Alejandro Huerta <alejandro.huerta@lacity.org>

Crossroads Project, 11-23-2015 comments in Initial Study

18 messages

Richard Abrams <abramsrl@gmail.com> Mon, Nov 23, 2015 at 1:12 PM
To: alejandro.huerta@lacity.org, Hollywoodians Encouraging Logical Planning <HwoodCA@gmail.com>, RSM <AbramsRL@gmail.com>

Dear Mr. Huerta:

Attached please find Hollywoodians Encouraging Logical Planning's [HELP] and Citizens Coalition Los Angeles' {CCLA] comments on the initial study for the Crossroad Project, 6665 Sunset Boulevard, Hollywood California.

As there are 18 enclosures - attachments, HELP's and CCLA's submission will require several emails. In addition to the initial comments, this email contains:

(1) 1915 Study of Street Traffic Conditions in the City of Los Angeles

2 attachments

Crossroards Project 11-23-15 HELP & CCLA Comments.pdf
320K

1915 Study Street Traffic Conditions in the City of LA.pdf
22744K

Richard Abrams <abramsrl@gmail.com> Mon, Nov 23, 2015 at 1:24 PM
To: alejandro.huerta@lacity.org, Hollywoodians Encouraging Logical Planning <HwoodCA@gmail.com>, RSM <AbramsRL@gmail.com>

Dear Mr. Huerta:

Please find HELP's and CCLA's attachments:

2. The Relation Between Transit Availability and Automobile Ownership: the Case of Los Angeles County, University of New Orleans, School of Urban and Public Affairs, by Devajyoti Deka, 1-1-1999

3. December 30, 2010, Streetblog, Density, Car Ownership, and What It Means for the Future of Los Angeles, by Damien Newton

4. FHWA NHTS BRIEF 2014, Mobility Challenges for Households in Poverty

5. March 2014, URBAN INSTITUTE, Driving to Opportunity: Understanding the Links among Transportation Access, Residential Outcomes, and Economic Opportunity for Housing Voucher Recipients.

6. August 22, 2013, NewGeography, Mobility for the Poor: Car-Sharing, Car Loans, and the Limits of Public Transit, by Joel Kotkin

7. January 3, 2013, LA Weekly, Hollywood's Urban Cleansing 12,878 Mostly Latinos Are Pushed Out by City Hall, High Rents and Hipsters, by Patrick Range McDonald

Hollywoodians Encouraging Logical Planning H.E.L.P.
1921 North Saint Andrews Place
Hollywood, California 90068
Citizen Coalition Los Angeles [CCLA]
Post Office Box 3354
Santa Monica, California 90408
323/957-9588 (phone) 323/464-7006 (fax)
HwoodCA@Gmail.com * AbramsRL@Gmail.com

Monday, November 23, 2015

Mr. Alejandro Huerta via email: alejandro.huerta@lacity.org
Environmental Analysis Section
Department of City Planning
200 North Spring Street. Room 750
Los Angeles, CA 90012

Re:	Case No.	ENV-2015-2026-EIR
	Project Name:	Crossroads Hollywood
	Applicant:	CRE-HAR Crossroads SPV, LLC
	Main Location:	6665 Sunset Boulevard, Hollywood, CA 90028
	Com Plan Area:	Hollywood
	Council District:	13
	Due Date:	November 23, 2015

Dear Mr. Huerta:

This letter and its enclosures are Hollywoodians Encouraging Logical Plan's [HELP] and Citizens Coalition Los Angeles' [CCLA] initial comments on the October 2015 Initial Study for the above-captioned project [The Project].

1. Preface

It is difficult people to cull out the various principles at work in city planning. If one excluded all the deliberate misinformation, one would still have trouble discerning what factors influence the planning for any particular project. One of the biggest challenges derives from the phenomenon that feed-back can stop a trend. People have the tendency to make straight line projections while ignoring the fact that almost all trends contain the seed of their own reversal. People do not continue to grow taller until their 90th birthday. If I accelerate my car with the pedal to the metal, it will not reach 500 mph.

Too many people made the mistake of thinking that because Hollywood had significant population growth in the 1970's and 1980's, that the population surge continues. While people know that whatever goes up has to come down, they have trouble applying that concept to population trends.

The reality for Hollywood is that starting around 1990, Hollywood began to lose population. It was in 1993 that Mayor Riordan made the mistake to bring the Community Redevelopment Agency [CRA/LA] to Hollywood to construct housing for the hordes of people who were allegedly coming. By 1993, however, Hollywood's population increase was becoming a population decline. The US Census data showed between 1990 and 2000, the population dropped from 213,912 people to 210,824.

Ignoring the fact that the population was declining, Councilman Garcetti, who took office in 2001, roared ahead with more CRA/LA mixed use projects. By 2010, Hollywood's population had dropped to only 199,228 people. When one delves into the population statistics, one discovers that the CRA/LA construction was a significant factor causing the exodus.

An analysis of Hollywood census tracts showed that the greatest decline occurred in the census tracts contiguous to the subway stations and the mixed-use projects. Garcetti's mixed-use projects had made his CD 13 portion of Hollywood so undesirable that his council district ceased to have enough people to constitute a legal council district. People were leaving only one particular part of Hollywood, i.e. the census tracts where the subway and mixed use projects were being constructed. The parts of Hollywood away from CD13 gained population. The analysis showed that the harm done to Hollywood in CD 13 was go great that it swamped the improvements in Council District 4, which had no CRA/LA project. When Judge Goodman saw the US census data, he rejected Garcetti's Update to the Hollywood Community Plan, ruling that it was based on fatally flawed data and wishful thinking. The same is true for the Crossroads Project. [*Judge Goodman's January 15, 2014 Statement of Decision* is submitted herewith]

The city planners and the developers did not want to admit the subway and the CRA/LA projects caused decline, and to this day, they refuse to admit that people dislike density and they dislike mass transit. HELP's and CCLA's comments attempt to introduce some accurate information into the planning process.

2. What's Wrong With Planning in the City of Los Angeles:

This mega-project showcases what is wrong with planning in the Hollywood. In rejecting the Hollywood Community Plan Update, Judge Allan Goodman explained the basic flaws, i.e The city uses fatally flawed data and wishful thinking to such a great extent it subverts the law. Judge Fruin and Judge Chalfant found a related problem with the City's planning, i.e. intentional violations of the law. Judge Fruin rejected the Target Store at the corner of Sunset and Western in Hollywood, because the city had deliberately violated the

Specific Plan, called SNAP. Judge Chalfant rejected the Millennium Towers just north of the Pantages Theater because the city ignored the law to follow the directions of CalTrans as the "responsible agency" on traffic studies.

The intentional use of false data combined with intentional breaking of the law is bringing a crisis upon the City of Los Angeles in general and upon Hollywood in particular. One group, SaveValleyVillage, has sued the city over its unlawful vote trading system which has been used to implement detrimental projects [*SaveValleyVillage v City of Los Angeles*, Case # BS 157989], and another group of citizens, Coalition to Preserve L.A., is promoting a ballot measure to create a moratorium on these fatally flawed projects.

The Crossroads Project incorporates everything that is wrong and unlawful with the City's planning process. All the city councilmembers need to realize that theory of Smart Planning with its Transit Oriented Planning is based on false data and that for two decades, the evidence of the harm which Smart Planning does to a city like Los Angeles has been accumulating. In fact, the harm which Smart Planning does to any large circular urban area was known 100 years ago. On page 38 of the 1915 *Study of Street Traffic Conditions in the City of Los Angeles*, our own civil engineers warned that TODs would only make a few landowners very wealthy while harming everyone else.

> Such a policy [TODs] would be nothing less than a deliberate exploitation of civic resources for the benefit of the limited number of property owners enjoying abnormal incomes from rental privileges. *Study of Street Traffic Conditions in the City of Los Angeles*, 1915, Bureau of Engineering, page 38

///

3. Propaganda Underlies All the Major Projects in Hollywood:

Because the Smart Planning ideology on which all the major projects in Hollywood are based is false, the City's Environmental Impact Reports [EIRs] for each project are not studies of the real impacts which the project will have upon Hollywood and its residents, but rather they are propaganda pieces whose purpose is to sell the project to the public by hyping non-existent benefits and concealing known harms.

4. The Health Benefit Trick:

One trick, which the city used in its Mobility Plan 2035, is to claim that TODs and the transportation plans to support them have significant health benefits. They "prove" this benefit by asserting that when people live in TODs there are fewer cars and overall that means less auto emissions. Thus, we are lead to believe hat TODs such as the Crossroads make the city more healthy.

The reality is different. As will be shown, TODs attract more cars and auto ownership increases in TODs. In addition, TODs create additional traffic congestion and by making traffic move more slowly, cars emit more toxic fumes. Thus, the toxicity of the main streets near TODs poses more health risks than before the TOD was constructed.

5. Transportation and Population Density:

Land Use requires a coordination of Transportation and Population Density. No place can make realistic plans for its future unless it has a scientific understanding of the transportation infrastructure which the proposed development will require. For Los Angeles, the landmark document for Los Angeles's transportation is the 1915 *Study of Street Traffic Conditions in the City of Los Angeles*, a copy which is submitted herewith.

The mathematics of transportation, Los Angeles' topography, and the finances of transportation have not changed over the prior century. In fact, each time the principles set forth in the 1915 Traffic Study are broken, Los Angeles suffers. Mathematics does not change from year to year and the relationship between transportation and Los Angeles's topography is based on math.

a. Subways Cannot Function as Mass Transit:

At the outset one needs to distinguish between **inter**-urban trains and **intra-**urban fixed-rail such as subways and trolleys. Sometimes, these concepts are confused. Is Metrolink inter-urban or intra-urban? For purposes of planning for the City of Los Angeles, HELP and CCLA include the entire Basin with all the cities along the "Shoe String" which extends down to San Pedro as well as the beach cities north of Orange County, plus all of the San Fernando Valley and the western parts of the San Gabriel Valley. We exclude Glendale, Pasadena, and those areas. Before any intra-urban fixed rail system can dispense with car ownership, it has to cover these basic areas of the urban Los Angeles.

The 1915 Traffic study shows the mathematical reason that fixed-rail systems whether they are subways or above-ground trolleys cannot provide a mass transit system for Los Angeles. Once we grasp this fact, we can realize that TOD resident cannot give up car ownership in favor of mass transit (subways, fixed-rail and buses).

The first thing people need to realize is that all transportation is held prisoner to an area's topography. Manhattan is only 2.5 miles wide and 11 miles long. As a narrow rectangle, tracks which start at one end and extend to the other end of the narrow island do not diverge. Thus, it is easy to construct a subway system where everyone on the island lives and works within ½ mile of a subway station. The 1915 Study of Street Traffic Conditions found that people will not use a subway if they have to walk more than ½ mile to or from the station. Metro uses the same measurement in 2015.

The area which subway has to serve in Los Angeles is a huge circular area, sometimes called a radiant city. The city's boundaries do not set the parameters of a subway system. As we said, West Hollywood, Beverly Hills, Inglewood, and a host of small towns between DTLA and San Pedro have to be part of any subway system.

The mathematics of a subway (and for an above ground rail system) make a fixed-rail system non-functional once the urban area has a radius greater than 5 miles. Each reader can confirm this fact for him/herself by drawing 5 concentric rings where each ring is one mile from the rings on either side. One sees that it is mathematically impossible to design fixed-rail system which will have a station within ½ mile of each resident. In other words, a fixed-rail system fails to be an urban transportation system before it extends to Hollywood.

Since the system breaks down at a radius of 5 miles from DTLA, one should realize that no fixed-rail system can function when the distance from DTLA to the ocean is about 15 miles. The outer ring of a fixed rail system with a radius of 15 miles would require 90 stations just on that ring alone. The number of subway stations and their cost is not the real problem. We need to face the fact that no fixed-rail system can serve an huge circular geographic area.

The mathematically reality is that a fixed-rail system cannot serve a huge circular urban area. It does not matter whether one lives on top of a subway station, the system will never come close to covering all the locations that people need to go on a daily basis. Once people grasp that it is mathematically impossible to have a fixed-rail system serve as our mode of transportation, then we can stop with the foolish claim that TODs reduce people's need to have cars.

For this reason, subways do not remove the need to have a car if one is to function in Los Angeles. There is no rational reason to create Transit Oriented Districts since they create areas of extra population density with many more vehicles per square mile. As a result, if a TOD were actually occupied at 100%, it would create gridlock within its area.

As we have seen, other forces come into play before gridlock is reached.

b. *The City Cannot Force People to Live in TODs*:

The 1915 Study of Street Traffic Conditions shows that cities where the topography forces the population to live within narrow confines, such as Manhattan, can profitably maintain a fixed-rail system. Cities, such as Los Angeles, which have no topographical barriers cannot support fixe-rail systems because the geography does not compel them to live in such dense proximity to each other. [1]

In what may be called an unfortunate synthesis of hubris and myopia, recent Los Angeles politicians and real estate developer were seized with the notion that they can artificially create a Manhattan in portions of Los Angeles.

---

[1] The other significant factor is that Eastern cities like Boston, Baltimore, and Philadelphia began in the pre-motorized age when walking was the mode of transportation. Thus, narrow lots with high population density were favored, but Los Angeles began after the motorized age. At the end of the 1800's and early 1900's, trolleys served the small Los Angeles. By 1915, however, it was clear that the combination of the lack of topographical barrier and the motorization of transportation meant that Los Angeles would become a huge, radiant city of primarily single-family homes. In other words, L.A. was growing in a manner which fixed-rail transit would not be a feasible mode of transportation.

They believed that by constructing extremely dense TODs, they could fashion with own idea of Manhattan running along Sunset and Hollywood Boulevard through Hollywood.

Since the extreme density of Manhattan made the subway and the skyscrapers financially viable, the Manhattanization of Sunset and Hollywood would bring similar benefits. They are wrong!

c. *The Folly of Manhattanization*:

Manhattanization requires more than building mega-dense mixed-use projects in Hollywood. As noted above, Manhattan is a narrow island 2.5 miles with Central Park running much of its length and with water on both sides. Thus, it is financially feasible to construct a subway system where everyone lives within ½ mile of the subway.

Since Hollywood has only one subway running beneath Hollywood Boulevard, it serves the area between Franklin Avenue on the north and Santa Monica on the south, both of which are .6 mile from Hollywood Boulevard.

In order to understand the folly of trying to Manhattanize Hollywood to make subway functional, one needs to look at what exists to its north and south. Manhattan is bounded by water – no one lives in the east River, but people do live in the Hollywood Hills, they do live in Hancock Park. Hollywood is not an island. The people who live in Hollywood want to go places and need to go places that are 2 miles south of the boulevard. Wilshire is almost 3 miles south of Hollywood Boulevard.

The topography of NYC makes the subway lines which feed into Manhattan function like inter-urban subways. All the boroughs are physically

separated from Manhattan. Manhattan is not in the middle of a huge, contiguous urban sprawl cover thousands of square miles. It is a extraordinarily narrow island. People comes to Manhattan daily to work, while their lives remain miles away from the island. Thus an inter-urban fixed-rail system can function for people to commute to and from work.

That is another crucial aspect of Manhattan – people flow in to Manhattan on a daily basis solely to work. Thus, a subways system which is designed to convey workers to and from Manhattan is financially feasible.

The reality is that people who live in Manhattan have no need to go to Queens on a daily basis and people from the Bronx do not go into Manhattan on a regular basis. If one lives in Hollywood, however, one goes to the San Fernando Valley all the time; Hollywoodians routinely go to West Hollywood, to Beverly Hills, to DTLA, to Inglewood, to East Los Angeles.

One does not replicate the topography of Manhattan by densifying Hollywood and Sunset Boulevards by lining them with skyscrapers. Because Manhattan is both so narrow, the places people need to go are within walking distance as augmented by subways on the west side and the east side. That situation is not replicable in Hollywood.

The attempted Manhattanization of Sunset and Hollywood Boulevard is an absurd folly because literally confuses a circle with a 15 mile radius with a one mile wide rectangle.

d. *Hollywood Proves that Manhattanization of Foolish*:

The demographic studies and the actual experience with council district 13 in Hollywood show that the City cannot force people to live in TODs.

Because people dislike being crowded, traffic congestion and inadequate parking are the primary complaints of Angelenos. Those who can afford to do so, move away. That leaves the TODs with Default Tenants, i.e. people who are too poor to move to more desirable places.

No matter how many skyscrapers are constructed along Sunset and Hollywood Boulevard, its residents do not live on an island and they will need cars in order to live in Los Angeles. That means no TOD in Hollywood will eliminate the need of its residents to own and drive cars. Each TOD will attract thousands of additional vehicles and those cars will make traffic congestion near the TODs unbearable.

The city, however, will not admit that people are leaving the TODs. During the Hollywood Community Plan litigation, Garcetti insisted that the City pretend that Hollywood's population had increased from 210,892 people in 2000 to 224,452 in 2005. In reality, the population had decreased to about 206,00 in 2005. The reason for the false claim of Hollywood's rapidly increasing population was to justify the construction of more mixed-use projects. Similar false data is being used to justify the Crossroads adding 870 additional housing units.

As we have shown, why the City was falsely representing that the subway and the CRA/LA projects were a huge success, they were an abysmal failure, driving so many people away from Hollywood that CD 13 ceased to qualify as a legal council district.

e. *In Pursuit of its Manhattanization of Hollywood*, *The City has Done Significant Harm*:

The city has the unfortunate habit of falsely stating that Hollywood has

been revitalized. If by revitalized, one means a form of ethnic cleansing in order to make room for single Millennials, then there is some truth to the revitalization claim. http://bit.ly/XjXmGk 2013-1-3, LA Weekly, *Hollywood's Urban Cleansing 12,878 Mostly Latinos Are Pushed Out by City Hall, High Rents and Hipsters*, by Patrick Range McDonald. The apparent theory behind the misrepresentations behind Hollywood's revitalization and its dramatically increasing population is to hasten gentrification.

In addition, the CRA/LA siphoned off billions of tax dollars which were used to subsidize the unwanted mixed-use projects in Hollywood. As a result, the city could not afford basic infrastructure. By diverting literally billions of dollars to developers to construct financial fiascos like Hollywood-Highland, The Metro Apartments, the Sunset-Gordon Project, LA lacked the funds to provide paramedics. In fact, the City took money away from paramedics so as to have enough money to give subsidies the to real estate developers.

Los Angeles knew for a decade that the sidewalks had deteriorated so badly that they were not ADA-compliant and that the City would be sued. Rather than repair sidewalks, Los Angeles gave more money to the TOD developers. Just this year, the city lost a $1.3 BILLION lawsuit and had to pay $15 Million in attorney fees due to its ADA non-compliant sidewalks.

f. *The Myth that The Millennials will Make the TODs Profitable*:

Leaving aside all the social debate about gentrification, the reality is that there are not enough new people to occupy these highly **un**desirable units. The Millennials are already transitioning into the family rearing generation and all the demographic studies confirm that older Millennials do not like TODs for raising families. In fact, LA itself is too crowded for them and they move to different states like North Carolina and Texas so they can have a single family

home with a large yard. November 3, 2015, FORBES, *So Much For The Death Of Sprawl: America's Exurbs Are Booming*, by Joel Kotkin

The idea that Millennials will move into The Crossroads approaches the delusional.

> Gen Yers might be young and idealistic, but they're not stupid. The closer they get to marriage and having children, the more they'll begin thinking about these things, just as previous generations did. Surely, some of them, likely the best paid (who can afford private schools), will stick around urban areas. But that's always been true, even during the 1970s and 1980s, when cities were rather dirty, dangerous places. April 1 , 2015, *Why Older Millennials Are Leaving the Urban Core and Younger Millennials Aren't Far Behind* by Ryan Servino.

Who will be willing to live in the Crossroads projects? No one has addressed this issue. With the project at 8150 Sunset , the Millennium Towers and the Palladium and in-fill projects, there are not enough people coming to Hollywood to live in these projects. Even assuming that the mixed-use apartments in the last few years have attracted some Millennials who are doubling up to pay the rents for the new places along La Brea, the claim that there has been a shift in long-term pro-urban housing among the Millennials is myth. Rather, they are fleeing place exactly like the Manhattanization of Hollywood of which The Crossroads is a significant part. July 23, 2015, Stateline, *Millennials: Living on the Edge of the Big City*, by Tim Henderson

Another significant factors which deter Millennials from moving into the mor dense urban projects are (1) bad schools and (2) bad infrastructure. The Los Angeles Unified School District is tied with Oakland as worst in California

and California is near the bottom of the 50 states and the United State ranks near th bottom of industrialized nations. Like other parents, Millennials do want good schools and decent infrastructure and Los Angeles has neither. July 16, 2015, Urbanism, *Millennials Will Live In Cities Unlike Anything We've Ever Seen Before* by Alissa Walker

People who are wealthy enough to afford private schools will not be moving into the crammed Crossroads Complexes in the center of one of the City's highest crime areas.

6. The Crossroads Project Has to Greatly Increase Traffic Congestion or Be an Economic Failure

Because the claim that residents of the Crossroads will use the subway is false, the Project cannot be a financial success until it attracts people and their cars. As discussed below, the only significant factor which correlates with not owning a car is poverty. Even then, many poor people own cars. The people who can afford to live at Crossroads are people who will own cars.

7. The Project Will Add 11 Linear Miles of Additional Living Units to on Square Block in Hollywood:

At the outset it is beneficial to grasp the number of additional homes which this project will be adding a huge population increase to roughly one square block of Hollywood. [2]

---

[2] The project is between Sunset and Selma and Highland and ½ block passed Las Palmas, but since it omits a large section of Sunset between Highland and ½ block passed McCadden, the effective area is one square block

Because it is difficult to visualize the increased population density of high rise which are 30 stories high, HELP & CCLA use the concept of Linear Miles. Linear miles take the total number of additional living units and multiples them by 60 feet, which is the average width of a R-1 lot. Then we divide that number of 5,280 which is the number of feet in a mile.

Thus, Linear Miles tells us how far all these new condos and apartments would stretch if they were modest single family homes sitting side by side.

This Project proposes to add the equivalent of over 11 Linear Miles of new homes within one square block.

8. How Long is 11 Linear Miles?

Just as it is helpful to translate, number of housing units into Linear Miles, one can more easily understand how much additional population density is being added by comparing the 11 Linear Miles to commonly known places in Los Angeles. For example, it is only 7 miles from the project at 6665 Sunset to City Hall at 200 S. Spring street. That means that if one drove, walked, or rode a bike from the Project to City Hall, he/she would have a house next to him/her the entire trip. By the time, they reached City Hall, they would still have 4 more miles of homes before they reached 11 Linear Miles.

If one went westward, 11 Linear Miles would take one through Beverly Hills and Jan and Dean's "Dead Man's Curve," past UCLA and to the intersection of the 405 Freeway.

When we take the time to visualize these distances, we can better comprehend the additional density which The Project will bring to one square block.

9. What will be the Impact of 11 Linear Miles of Additional Population in one Square Block?

People tend to look at the pretty pictures of the buildings and listen to the platitudes which accompany them. When one is concerned about the impact this population increase will have upon Hollywood, we have to take some time to get an understanding of how all these additional people will affect life in Hollywood.

10. The Increase in Automobiles Will be More Than Hollywood Can Handle

The claim that people who live in these Transit Oriented Districts will use the subway has been proven to be false. Almost every family who can afford a car who lives in a TOD will have a car. The subway cannot substitute for a car because the subway covers only 5% to 10% of the City. [3]

As the Metro's own data shows, when "illegals" were recently permitted to obtain drivers' licenses, subway ridership significantly declined.

///

///

---

[3]The 1915 Study of Street Traffic Conditions in the City of Los Angeles conducted by the City's Bureau of Engineering has been submitted to the City many times in the last decade. Nonetheless, the City persists in ignoring this landmark study and excludes it from the materials for the public record. Thus, once again HELP & CCLA are adding the 1915 Study to the public record for this Project.

11. Vehicle Ownership Does Not Decrease for People Who Live in Transit Oriented Districts

The rate of car ownership per household does not decrease for people who live in Transit Oriented Districts. Poverty correlates to lack of ownership. When one adjusts for more poor people living near transit hubs, one's wealth determines whether they are likely to own a car. This correlation was established for Los Angeles County back in 1999, but the City refuses to share this data, but instead it sets forth the false claim that people who live in Transit Oriented Districts will not own cars and they will use the subway and bus. A similarly false claim is made for this Project. [*The Relation Between Transit Availability and Automobile Ownership: the Case of Los Angeles* County, University of New Orleans, School of Urban and Public Affairs, by Devajyoti Deka, 1-1-1999]

12. How to Calculate the Number of Additional Vehicles in Hollywood from This One Project

The Project proposes to remove 80 Affordable Housing units and replace those 80 units with new affordable housing. That means the incident of car ownership for those 80 units should remain constant. As the rest of the 950 units will be for wealthier people, we can use the average number of cars per person. For Los Angeles that is .54 vehicles per person. [December 30, 2010, Streetblog, *Density, Car Ownership, and What It Means for the Future of Los Angeles*, by Damien Newton.] In other words, one car for every two people.

If we assume that there will be an average of two people per unit in the Project, that means a minimum of 870 additional cars in a one square block area. The average car is about 15 feet long. 870 cars x 15 feet equals 13,050 feet or about 2.5 miles of cars stretched end to end. That line of cars is twice are long as the distance from the Project to the freeway entrance at Sunset and Van Ness.

In order for anyone at 6665 Sunset to reach the Hollywood Freeway during rush hour traffic, they will have to pass the large Palladium Towers at Sunset and Argyle and the tower proposed for the north-east corner of Argyle and Selma, not mention the additional housing units planned for the portion of Bouelvard6200 south of Hollywood Boulevard.

HELP & CCLA do not suggest that every car from The Project will be trudging along Sunset Boulevard to the freeway on-ramps. Again, it is helpful to grasp the potential burden on the streets to translate the number of additional cars into scenarios with which we are familiar.

13. Only Poverty Reduces Vehicle Ownership

The only known way to reduce the number of cars per household in Los Angeles is to drastically reduce the income level. [*The Relation Between Transit Availability and Automobile Ownership: the Case of Los Angeles* County, University of New Orleans, School of Urban and Public Affairs, by Devajyoti Deka, 1-1-1999] While the rate of car ownership in Hollywood before the advent of its subway and its associated mixed-use projects by the Community Redevelopment Agency [CRA/LA] was lower in the transit areas, that relationship was broken by 2010. (See also http://1.usa.gov/1j4dNmP *FHWA NHTS BRIEF 2014, Mobility Challenges for Households in Poverty*. Poverty correlates with lack of car ownership.) [4]

---

[4]

Because the poor cannot afford cars and the cost of insurance, they tend to use mass transit, but mass transit imposes hidden costs on the poor. Because mass transit is slow and usually requires that the rider walk to the bus or subway stop, the time required to take the bus or subway is considerably longer than driving a car. Because time is money, the poor pay a significant unseen cost by using mass transit. The more congested a Project makes the surface streets, the slower the buses will travel and

Adding subways actually results in a higher incident of car ownership per household. After the Hollywood Subway was completed, vehicle ownership per car in Hollywood's CD 13 jumped by 30%.

One reasonable explanation for the increase in car ownership per household is that a lot of single Millennials started rooming together in the mixed-use apartment complexes in the TODs. Despite the claim that Millennials only use bicycle and subways, the reality is different. While a family is likely to own one car, a Millennial "household of 2 of 3 unattached persons" can have 2 or 3 cars. Unmarried Millennials without children have a higher disposable income than people with the same income but who also have children. Thus, poverty appears to be the main variable favoring car ownership.

In fact, not owning a car creates a vicious cycle which keeps people below the poverty line. http://urbn.is/20Vgyc3 March 2014, Urban Institute, *Driving to Opportunity: Understanding the Links among Transportation Access, Residential Outcomes, and Economic Opportunity for Housing Voucher Recipients*. To the extent social planners are interested in reducing poverty, they need to increase car ownership among the poor. It has been proven, that adding fixed-rail transit in poor areas does not result in enhanced job opportunities for the poor since the overwhelming majority of decent jobs are not reachable via fixed-rail transit.

In fact, relying on mass transit harms the poor. http://bit.ly/1NykAgs August 22, 2013, NewGeography, *Mobility for the Poor: Car-Sharing, Car Loans, and the Limits of Public Transit*, by Joel Kotkin. The idea that mass transit is an acceptable mode of transportation in a large geographic area is false.

---

thus indirectly, the projects for the wealthy cost the poor people more money just to go about their every day lives.

Whenever people can afford to use a car, they shun mass transit. When the area becomes too congested, a considerable number of people move away to less dense parts of the state or to other states. The idea that the City can force people to use mass transit projects like the Crossroads Project has been rebutted by all the evidence.

The idea that living close to a subway or a bus will compel middle class people to use mass transit is false. As has already been seen in the CD 13 portion of Hollywood, where this Project will be located, when the area becomes too dense, people who can afford to leave. http://bit.ly/XjXmGk January 3, 2013, LA Weekly, *Hollywood's Urban Cleansing 12,878 Mostly Latinos Are Pushed Out by City Hall, High Rents and Hipsters*, by Patrick Range McDonald.

HELP brought this fact to the City's attention in 2005 in its response to the Notice of Preparation for the Hollywood Community Plan Update. HELP explained that by increasing population density, traffic density would increase and that by not providing adequate off-street parking in the CRA projects, more cars would be competing for the on-street spaces. The result would be Default Tenants, i.e. people who cannot afford to live somewhere better. People do not like to search for 5 to 10 minutes to find a place to park and end up having to walk 3 blocks to their homes. The City could have constructed additional off-street parking in order to make life easier in these places, but Councilman Garcetti wanted to force people to give-up their cars and use the subway. Instead, people gave up on this part of Hollywood and moved away.

This Project is so outlandishly large that it will create its own mini-dead zone of traffic gridlock, lower socio-economic status, and it will increase crime rate as Hollywood has experienced when other TODs have been constructed.

Highland Avenue is already congested far beyond acceptable, especially during evening rush hour. The problem becomes much worse due to the frequent closings of Hollywood Boulevard for premiers, The Jimmy Kimmel Show, The Oscars, and other events. Each time Hollywood Boulevard closes, the east-west traffic tries to move down to Sunset Boulevard. As residents know, Sunset Boulevard is already slower than Hollywood Boulevard.

As was pointed out above, traffic and population density are simple math questions. It is easy to calculate that fixed-rail cannot serve Hollywood, it is also easy to figure that a significant addition of cars will push Hollywood beyond is Saturation Point.

The city will never tell anyone about the Saturation Point for traffic congestion. The city, however, is under an affirmative duty from CEQA to calculate the Saturation Point. Among other reasons, when an area reaches the Saturation Point, cars do not move, but they emit fumes.

14. The Impact of Office and Commercial Space:

The Project proposes 1,432,000 sq feet of space with 95,000 square feet of office space and 185,000 square feet for commercial use with 950 housing units and 2,500 parking spaces. If the Project follows the lead of the Metro Building at Hollywood and Western and lacks adequate parking for offices and commercial use, the financial viability of the entire project is questionable. After a decade, the Metro Building leases out about 1/4 of its space and that is to a US Bank training branch.

///

15. LOS for Nearby S Intersections

Because measuring the Level of Service [LOS] at intersections showed the additional traffic congestion which TODs bring to an urban area, California solved that problem by not using LOS any more. Everyone can see that the intersections along Highland from Santa Monica to the 170 Freeway operate at a Level F – the worst. Now, the State wants to use VMT for Vehicle Miles Traveled. That is a measure designed for fraud.

Rather than use a measurement which can be mathematically verified, e.g. how long it takes a car to clear an intersection, we now will have a mythical number. If there is a grocery store in the mixed-use project, they will assume that people will shop there and hence claim that few vehicle miles are being driven. Meanwhile, they will ignore an intersection which requires three changes of the signal in order for a car to clear the intersection. By assuming that people who live in TODs do not use cars, they will stop measuring how many cars are actually on the road. In other words, the TOD advocates have decided that when the data approves that their theory makes life worse, they stop collecting the data.

The reality will not change. A project which is a financial disaster as it can fill only 30% of its living units and 25% of its commercial space can still make the surrounding streets into gridlock hell. What happens is that people have a certain level of toleration of traffic congestion. When it becomes more effort than it is worth, they move away. When the parking is so restricted or the streets are too crowded, people do not shop at the stores. The same forces, which leave the Metro Apartments with only 1/4 of is retail in use and made Hollywood Highland the largest real estate write down in history, will befall this Project.

As we have seen, Hollywood Highland has made traffic in this portion of Hollywood a nightmare. It can take 10 minutes to drive from La Brea to Highland Ave along Franklin Avenue during rush hour. This Project is contiguous to the Hollywood-Highland fiasco.

16. An Inaccessible Project is a Failure

A Project which is essentially inaccessible is a failure – like Hollywood-Highland and like Metro Building. As explained above, this type of construction makes neighborhoods so undesirable that CD 13 lost so many people between 2000 and 2010, CD 13 ceased to qualify as a legal council district.

The above density and traffic analysis explains some of the main factors which excessive population density has brought and will bring to Hollywood.

17. The Initial Study is Repeating the Same Mistake Which The City Made with The Millennium Project

From reading the Initial Study, one sees that the City is repeating the mistake it made with The Millennium Project, i.e. to substitute its own ideas on traffic impacts for the mandates of CalTrans. On Page B-29, the City proposes to use CMP. As Judge Chalfant wrote in his decision rejecting The Millennium Project.

> In response to Caltrans, the City relied on the traffic analysis required by the CMP, which is the standard methodology for traffic studies in the County, and analyzed key freeway ramps as well as freeway mainline segments, finding a less than significant traffic impact. A supplemental traffic study using SCAG methodologies

> confirmed this conclusion. The City did not expect the ramps listed by Caltrans to be a capacity restraint issue. The City contended that Caltrans' allegation about its low trip estimates was unwarranted as the estimates were based on well accepted guidelines. Finally, the City preferred its congestion modeling to. Caltrans' HCM methodology which is inapplicable to planning issues. *Judge Chalfant Millennium Decision*, page 20

Judge Chalfant rejected the Millennium EIR due to the City's refusal to listen to the directives of CAlTrans, which was the Responsible Agency for this area of study. Judge Chalfant wrote:

> The City's choice of methodology did not comply with the substance of what Caltrans required, and the City was not free to ignore it. Even the CMP expressly states that Caltrans must be consulted to identify specific locations on the freeway system for analysis. AR 11863. The City relied on the CMP for thresholds of significance, but Caltrans told the City that the congested conditions of the 101 Freeway meant that even trips below the arbitrary CMP threshold of 150 could be significant and should be analyzed using its TISG. AR 11864. The CMP also states that at a minimum the geographic area examined in the traffic study must include mainline freeway monitoring locations where the project will add 150 or more trips, in either direction, during peak hours; it does not say that a 150 trip threshold is always sufficient. **The City was not free to reject Caltrans' instruction about threshholds**. See AR 56281. See *Mejia v. City of Los Angeles*, (2005) 130 Cal.App.4th 322, 342 ("A threshold of significance is not conclusive...and does not relieve a public agency of the duty to consider the evidence...."); *Berkeley Keep Jets Over the Bay Committee v. Board of Port*

> *Commissioners*, ("*Berkeley Keep Jets*") (2001) 91 Cal.App.4111 1344, 1380-82 (agency insufficiently considered site-specific characteristics of noise from airport in favor of standard for threshold of significance). The CMP also states that it chose ICU over HCM solely out of need for a consistent means of measuring congestion across the County. AR 56127-28. This justification — the need for a consistent measure of traffic on County streets -- is irrelevant to the evaluation of freeway traffic congestion and safety. Under these circumstances, there was no reason for the City to cling to the County's CMP to conduct its traffic analysis. The City wrongly used the CMP and its 150 trip threshold in the face of Caltrans' criticism and direction to the contrary. [**bold** added] *Chalfant Decision* page 24

The Project will be about 40% larger than The Millennium, and thus, one can anticipate about 40% more impacts. The City is already laying the foundation to disregard CalTrans. The reason for the City's course of action is easy to discern. The adverse impacts of this Project will be so severe that they will be beyond mitigation. Furthermore, the troubles with this Project, especially with the other projects in Hollywood, will be so dire that the Statement of Overriding Considerations will not allow the Project to proceed.

18. The 1988 Hollywood Community Plan has no Commerce Section

The Commerce Section of the 1988 Hollywood Community Plan expired by its own terms in 2010 and Judge Goodman did not revive it. Thus, the Initial Study's reference to the Hollywood Center (page HO-2) relies on a defunct document. Furthermore, the Community Redevelopment Agency which was integral to the Hollywood center was abolished effective February 1, 2012.

Government Code, §§ 65301(c), 65302 requires that the General Plan and each community plan has a Land Use element and each Land Use element which contains urban area must have a Commerce Section. The 1988 Hollywood Community Plan has no Commerce Section, thereby violating the City's General Plan and Government Code, §§ 65301(c), 65302.

The City has had sufficient time to produce a new Update to the Hollywood Community Plan, but has not done so. Judge Goodman could have addressed the issue of the Commerce Section's being defunct, but he chose not to so. Now, therefore, developers and the public are left in a legal no man's land.

For example, after the Hollywood Highland project provided to be the largest real estate write down in US history, the idea of more density in the prior Hollywood Center, appears to be an atrocious idea. As shown above, more density has resulted in a significant deterioration of Hollywood.

Community plans are to contain Regional Centers, and the 1988 Hollywood Community Plan has no Regional Center. If one were to say that in 1988 the Commerce Section was the forerunner of the Regional Center, there is no Commerce Section. In brief, the 1988 Hollywood Community Plan is so grossly outdated and inadequate that the entire planning process for Hollywood has fallen into an abyss.

Because the law requires that these planning tools exist and the City has chosen not to have them, all the commerce projects in Hollywood are unlawful.

///

///

19. A Very Foolish Developer Would Rely on the 1988 Hollywood Community Plan for His Project

The 1988 Hollywood Community Plan was based upon premises which have proven totally wrong. It was devised when people thought that California's, Los Angeles' and Hollywood's populations would continue to soar upwards. Why any educated person would not realize that there are feedback mechanisms and tends end and often reverse themselves is a mystery. The causes for the huge increases in Hollywood's population during the 1970's and 1980's were short term and very different factors are now in play.

Our economy was roaring and we needed people. That attracted people not only from the East but also from Mexico. The children of the Baby Boomers were on the move, but within a decade, the children would transition into the family, child rearing phase. Of great importance for Hollywood were the blocks and blocks of single family homes, which were under-priced and in need of renovation. Even the mansions in the hills were crumbling. When the city placed a cap on density in Hollywood and drew a line down Franklin Avenue above which no increased density would be permitted, money and families flowed back into Hollywood.

After they housing stock had been purchased and families were being raised, the huge attraction of a single-family home was gone. By 1990, the demographics had shifted. On May 10, 1990, the LA Times reported:

> Lockheed's decision this week to move almost all of its aircraft production to Georgia is the latest and most dramatic sign that Southern California's grip on the high-tech, high-wage aerospace industry is weakening.

> Aerospace companies have shifted operations from Southern California to small and medium-size cities in Alabama, Arizona, Utah and Georgia, where factories now produce missiles, helicopters, aircraft parts and defense electronics.
>
> The moves are prompted in part by cheaper wages, looser environmental regulations and the opportunity to pick up valuable political support in Congress by locating in more states with influential politicians.
>
> Contributing to the flight out of Southern California has been a widespread perception that the quality of life here has deteriorated amid unaffordable homes, congested highways, polluted air and rampant crime.

The Crossroads project aggravates each factor which has caused businesses and people to flee this area for over 25 years. The housing units in Crossroads are set higher than the average family can afford and they are not family-friendly places. Crossroads will make traffic congestion considerably worse. By attracting more cars into this small portion of Hollywood and by making traffic moving slower, Crossroads will increase air pollution and we have already seen the rampant crime which these types of projects have already brought to Hollywood.

The only way politicos justify mega-projects such as the Crossroads is by the propaganda contained in the EIRs which the courts have ruled was based on false data and wishful thinking.

After reading EIRs for many projects, for the Hollywood Community Plan, for Mobility Plan 2035, one sees that the city has no room for the quality

of life of its current residents. Yet, 25 years ago the LA Times made clear that deterioration in the quality of life was a major problem. As noted, the quality of life in Hollywood's council district #13 deteriorated so much between 2001 and 2010, that it ceased to qualify as a legal council district.

An EIR which cared about the quality of life for Hollywood would have addressed this fact. Instead, the city misleads people by calling the literal death of CD 13 a revitalization. CD 13 still exists for one reason. There is a 1925 law which requires Los Angeles to have 15 council districts. Due to this law, large sections of Koreatown were added to CD 13 and portions of CD 4 were moved into CD 13.

20. More Recent Data Show the Harmful Nature of TODs

Starting in 1999, data began to accumulate to show that the theory underlying Transit Oriented Districts [TODs] was materially false. *The Relation Between Transit Availability and Automobile Ownership*. TODs do not increase use of mass transit. The only sure correlation is poverty.

The 2001 Mineta Transportation Institute Study, *A New Planning Template for Transit Oriented Development*, showed that people who live in TODs do not necessarily use the mass transit and often own cars. Thus, the creation of TODs brings more cars and more toxic emissions into closer proximity thereby making the environment more toxic for the people who live in or near the TODS.

These findings present the city planner with an inherent contradiction: while the older plans call for TODs, they also call for less pollution. The situation is worse for TODs which require bike lanes on major thoroughfares

where the toxic fumes from traffic are most lethal. Thus, the planning documents calls for the multi-modal use of roads ways which place bikes at the greatest risk for lung disease by exposing them to maximum dosage of toxic fumes in the entire city.

As has been shown, this Project will attract thousands more vehicle trips into an area which is already experiencing near gridlock of much of the day. The Transportation Element of the General Plan on which the Project relies may be rejected just as the courts rejected the 2012 Update to the Hollywood Community Plan. When city planning is based upon theories which have been proven to be completely false, traffic congestion becomes worse, air pollution becomes worse, population density and crimes rates increase. We have seen the results of basing planning on false date and wishful thinking, people move away, leaving a council district without enough residents to be legal.

The plan which is being implemented in this portion of Hollywood is the same one Garcetti implemented when he was councilman and it took less than 10 years to decimate council district 13.

21. Alternatives Not Considered:

The Initial Study does not discuss Alternatives to the Project. The Project is hard pressed to present alternatives as there is no reason to increase the population density of this portion of Hollywood. A project that was 40% smaller at 1,000,000 sq feet would still be unduly harmful. In fact, the mixed-use construction which has already occurred has been so harmful to Hollywood, that the City should be considering "de-densifying" Hollywood.

The City has been catering to single Millennials, which are transient by nature. They are younger, they move more frequently, they change jobs more

often, and they move away from urban cores when they begin families. The Millennials are transitory into two senses: (1) They do not stay long term in the same place, preferring suburbs and exurbs to urban cores, and (2) as a generation, their time-span is limited, e.g. Baby Boomers, Gen X, etc.

Constructing a city for a generational group which already departing is myopic planning. Based upon the data which has accumulated since the 1990's, the main group of people who will "accept" living in cramped urban cores without cars are the very poor. This trend has already begun in Hollywood. As the difference between the 2000 and 2010 US census showed, the socio-economic status of residents in the census tracts contiguous to the subway station decreased. After the City was compelled to stop falsifying the crime data, we see a significant increase in crime in these same and adjacent neighbor-hoods.

In 2005, HELP termed these persons Default Tenants, i.e. people who cannot afford to move to a better location. The poor can also be called Urban Serfs, in that they are essentially tied to their small area of town as they cannot afford cars. Basing housing decisions on the creating of a permanent subclass of Default Tenants and Urban Serfs is not wise social policy.

The developer of this project should take the time to assess what the actual demographic patterns holds for the next 10 or 20 years, or does it have some get rich scam where it is flips the project for a quick buck leaving the investor, from perhaps China, to deal with the financial mess.

When one looks at the myopic planning which is going into Crossroads, The Millennium, and the Palladium, one is reminded of Cabrini-Green in Chicago and Pruit-Igoe and The Joseph Darst Apartment in St. Louis. The problem with the propaganda and hype use to promote these developer fiascoes

is that the laws of economics hold the trump cards. While the projects squander millions of dollars and needlessly destroy older neighborhoods rather than rehabilitating the homes, the deterioration process consumes decades. The only people who benefit are the developers who are paid to construct the projects.

22. There is No Demand for Apartments and Condos:

The likelihood that there is a real demand for additional housing in Los Angeles is slim. The city refuses to undertake any honest assessment of the housing market. Rather, the city misleads the public into believing that an increase in housing prices means a high demand for housing. Here are some factors which the city does not mention.

a. *Prices Rise in Deteriorating Neighborhoods*:

Counter-intuitive as it seems, housing values can increase in deteriorating neighborhoods when there is no real demand for additional units. When an over-sized mixed-use project is constructed, people who own homes realize that they can sell their homes for more than they are worth as a R-1 home. Developers will buy an R-1 home with the intent to tear it down and build condos. Until the time comes to tear down a home, it is either left vacant or rented out. In either case, very seldom is the property well maintained. That touches off the reverse of Chief Bratton Broken Windows approach. Repairing homes and removing graffiti reduces crime, but increasing the number of run-down properties increases crime and prompts more people to sell and move.

As a result, we see deteriorating neighborhoods with increasing housing prices.

///

b. *Bundling and Securitization of Rental Income*:

Another phenomenon is asserting itself in a few housing markets and Los Angeles is one of them. It is the bundling and securitization of residential rental income. This Wall Street scam is very similar to the bundling and securitization of subprime mortgages which crashed the economy in 2008. July 2014, *The Rise of the Corporate Landlord, The Institutionalization of the Single-Family Rental Market and Potential Impacts on Renters*, by Desiree Fields

Rather than sell single family homes and condos as fast as possible to put them back into the actual housing market for people who want to live in them, financial institutions have found extra value in residential properties by bundling and securitizing the rental income. This financial hanky pank means that any home has a value for Wall Street above the value as a place to live. Thus, financial institutions are buying single family homes and condos for above market value. The rise of housing prices due to bundling and securitization does not mean a higher demand for living space; it means Wall Street has invented another scam to fleece the investment world. We had Equity Funding in the 1970's, the Savings and Loans Scandals of the 1980's, the Dot Com frauds of the 1990's, and Subprime scams of the 2000's and now we are starting the Rental Securitization scam of the 2010's.

Developers, the public and city councilmember are mislead into believing that the increase in housing costs in Los Angeles has been caused by a significant increase in demand for housing. When one looks at the Sol Price School of Public Policy's studies of population growth for Los Angeles, one sees that there is no such demand. Rather housing prices are increasing due to the bundling and securitization of residential housing;

Affordability:
Tenants could face higher rental costs due to pressure for private equity funds to deliver returns to investors, particularly with the advent of rental bonds. Among Invitation Homes tenants we interviewed in Atlanta, Los Angeles, and Riverside, rents often exceeded the HUD Fair Market Rents for the area; lease renewals increased rents by 37 to 53 percent. The long distance nature of the tenant-landlord relationship and the practicalities of investment strategies may also increase corporate landlords' reliance on financial penalties, potentially limiting tenants' opportunities to seek recourse in cases of hardship. *The Rise of the Corporate Landlord* page 7

c. *The AirBnB Factor*:

It is not yet clear the extent to which the AirBnB phenomenon is increasing the costs of housing in Los Angeles. It seems reasonable that when people can purchase homes and condos and rent them out on a very short term basis for well above the mortgage and maintenance costs, that it will drive up housing prices. AirBnB should not be confused with a real demand for additional housing.

d. *Los Angeles' Population is not Increasing Enough to Explain the Increase in Housing Prices*

When one looks at the studies from the USC Sol Price School of Public Policy one realizes that Los Angeles is not growing very fast and the increased population is not due to factors which would significantly increase the demand for housing. *The Generational Future of Los Angeles: Projections to 2030 and Comparisons to Recent Decades*, March 2013, Sol Price School of Public Policy]

The immigration from Mexico to the United States has become a net loss with about 200,000 more people returning to Mexico than are coming to the United States.

The most reasonable explanation for the alleged increase in housing prices is not an increased demand for homes, but it is artificially hyped by various financial schemes. When these scams run their course, the market will fall. Just as there were no new home buyers to keep the subprime scam afloat, there will come a time when the income from bundled and securitized rental packages will plunge. The problem will be what to do with monster projects like Crossroads which were constructed on the basis of false data, propaganda and hype?

23. The Number One Problem Is Excessive Population Density:

The number one problem facing Los Angeles is excessive population density. The notion that the future requires Los Angeles to crowd more and more people in TODs and for these people to shun cars in favor of subways, buses and light-rail has already been proven false. The only people who gain from this coerced densification are the developers of the high rises and the contractors who construct subways and trolleys. Everyone else suffers.

24. The Data on Which this Project Is Based Is Fatally Flawed and it Wishful Thinking Contrary to the Known Facts of Population Density, Traffic Patterns, and Demographics

Not only does Hollywood not have an operational commerce portion of the Hollywood Community Plan, the Mobility Plan 2035, which is the Transportation Element of the City's General Plan, is similarly based on fatally flawed data and wishful thinking. Among other significant defects, Mobility Plan 2035 fails to consider alternatives to its solution of making traffic worse and trying to force people not to drive cars.

While the City was not under an duty to adopt any particular alternatives, it was under a CEQA duty to study alternatives such as the ones presented by Reason Foundation in its *Increasing Mobility in Southern California: A New Approach* Despite its title's including the words "a new approach," many of the suggestions in the report have been known for a long time. Under L.A.'s Mobility Plan 2035 (which may or may not be rescinded), the city has only one alternative with different variations on the same theme. There is no actual alternative except to promote fixed-rail transit and TODs. Intellectual dishonesty is integral to the planning process in Los Angeles

Also, the failure of TODs has been documented for over a decade. See also *The Myth of Rapid Mass Transit*, by Richard Lee Abrams, May 30, 2005 also submitted herewith.

While the Reason Foundation takes a very large geographic perspective of Southern California, the Abrams 2005 mass transit article discusses transportation on a smaller scale, i.e. TODs in this portion of Hollywood.

25. The Looming Disaster of the Hollywood Community Plan Update

As HELP and CCLA have shown above, America repetitively falls prey to the most myopic of financial scams. Politicians have no room for facts. Like much of Wall Street, they operate on a short term timetable which encourages them to do what benefits themselves in the short run. Term Limits aggravate this tendency since the politician know that there is no personal advantage to taking the long term health of the city into consideration. It takes time for disaster to hit home and when it does, the

politicians are on to a higher office. Although Eric Garcetti literally destroyed his council district in less than ten years, he suffered no political harm. He claimed that he had revitalized Hollywood, despite the fact he had destroyed Hollywood. The political fall-out hit Carolyn Ramsay, who had been Councilmember Tom La Bonge's chief of staff when she ran for council district CD 4. The dual endorsement of the L.A. Times and Mayor Eric Garcetti tipped the scales to new-comer David Ryu, who upon election fell into lock-step behind Garcetti.

As a result, the density hawks are still in full control at City Hall and it doesn't take a psychic to know why there has been no new Update to The Hollywood Community Plan. The city is pushing a multitude of mega-density projects in Hollywood such as 8150 Sunset at Crescent Height, The Palladium at 6201 Sunset, the Millennium north of the Pantages Theater, 7500 Sunset Boulevard, 6230 Yucca just north of The Millennium, The Paseo Plaza Project at the old Sears site (proposed 700 housing units), 7107 Hollywood Boulevard, as this Crossroads Project. The city still allows the developers to set the zoning laws and that is why the city is delaying the Update to the Hollywood Community Plan. It is waiting to see all the excesses which the developers desires and then the city will include each one into the new Update to the Hollywood Community Plan.

There are billions of development dollars at stake, and these billionaires have no intention of walking away from this extraordinarily lucrative market. They care naught that they are bringing economic disaster upon Hollywood. They are using LLC's and LLP's coupled with other short term financial instruments in order to loot the city treasury and stuff as much state and federal subsidies as possible into their pockets.

This ploy has been ineptly applied to the Target Store. Right now, the City foresees a legal loss on the Target Project in the appeals court. Thus, it is starting the approval process from scratch. The city believes that if it changes the law which invalidated The Target Project, then the construction can continue. The city, however, is following an unlawful procedure to change the law which will plunge The Target into another 8 to 10 years of litigation.

Nonetheless, we notice that the City is beginning to recognize the need to follow the law. Leaving aside the litigation which will follow from the new Update from the Hollywood Community Plan, if it were instituted, it will bring more disaster upon Hollywood. When Gail Goldberg remarked in 2006 that the City's practice of allowing developers to set zoning was leading to disaster, she was not referring to lawsuits. Her point was that there are various "laws of nature" which cannot be violated without bringing disaster upon the city. 2008-2-7 LA Weekly, *City Hall's "Density Hawks" Are Changing L.A.'s DNA*, By Steven Leigh Morris, http://bit.ly/1CxiGep

The new Update to the Hollywood Community Plan will set forth every mega-developers' wish-list making whatever they wish to construct completely legal. The City is apparently waiting for the developers to finish writing their various wish lists and when the developers' greed has run its course, then we will see the Update to the Hollywood Community Plan.

We have already seen where this type of corruptionism leads. How much is the stock in Equity Funding worth? Where is Lincoln Savings and

Loan? Who can remember the names of the Dot Com companies? Politicos have already forgotten about the Crash of 2008 and they are eagerly promoting the bundling and securitization of residential rental income – which is another Wall Street delusion justifying the re-newed Hollywood construction mania.

26. Conclusion:

Assessment of this Project cannot be separated from the problem of increasing urban densification in Hollywood and the gross inadequacy of mass transit to solve any of the problems which densification projects such as Crossroads will bring to Hollywood.

Disentangling the different factors can be difficult and the task is made impossible for councilmember themselves when they are presented with false data and when vital information is concealed from them. Rational planning is made much more difficult with the unlawful vote trading agreement with dominates City Council. Each councilmember is promised a free hand for all projects in his/her district and in return he/she shall not vote NO on any project in another district.

Thus, councilmembers have two hurdles: (1) The data is false, (2) they are not allowed to have an opinion other than "I approve."

Respectfully submitted,
Hollywoodians Encouraging Logical Planning [HELP
and
Citizens Coalition Los Angeles [CCLA]

LIST OF ARTICLE AND EXHIBITS SUBMITTED

1. 1915 Study of Street Traffic Conditions in the City of Los Angeles

2. *The Relation Between Transit Availability and Automobile Ownership: the Case of Los Angeles County*, University of New Orleans, School of Urban and Public Affairs, by Devajyoti Deka, 1-1-1999

3. December 30, 2010, Streetblog, *Density, Car Ownership, and What It Means for the Future of Los Angeles*, by Damien Newton

4. also http://1.usa.gov/1j4dNmP FHWA NHTS BRIEF 2014, Mobility Challenges for Households in Poverty

5. March 2014, URBAN INSTITUTE, *Driving to Opportunity: Understanding the Links among Transportation Access, Residential Outcomes, and Economic Opportunity for Housing Voucher Recipients*.

6. August 22, 2013, NewGeography, *Mobility for the Poor: Car-Sharing, Car Loans, and the Limits of Public Transit*, by Joel Kotkin

7. January 3, 2013, LA Weekly, *Hollywood's Urban Cleansing 12,878 Mostly Latinos Are Pushed Out by City Hall, High Rents and Hipsters*, by Patrick Range McDonald

8. Judge Chalfant *Statement of Decision* in the Millennium Project

9. Judge Allan Goodman's January 15, 2015 *Statement of Decision* in the Hollywood Community Plan litigation

10. 2001 Mineta Transportation Institute Study, *A New Planning Template for Transit Oriented Development*

11. November 2015, Reason Foundation in its *Increasing Mobility in Southern California: A New Approach*.

12. The Myth of Rapid Mass Transit, by Richard Lee Abrams, May 30, 2005

13. November 3, 2015, FORBES, *So Much For The Death Of Sprawl: America's Exurbs Are Booming*, by Joel Kotkin

14. *The Generational Future of Los Angeles: Projections to 2030 and Comparisons to Recent Decades*, March 2013, The Sol Price School of Public Policy by Myers and Pitkin

15. July 2014, *The Rise of the Corporate Landlord, The Institutionalization of the Single-Family Rental Market and Potential Impacts on Renters*, by Desiree Fields

16. 2008-2-7 LA Weekly, *City Hall's "Density Hawks" Are Changing L.A.'s DNA*, By Steven Leigh Morris, http://bit.ly/1CxiGep

17. April1 , 2015, *Why Older Millennials Are Leaving the Urban Core and Younger Millennials Aren't Far Behind* by Ryan Servino

18. July 16, 2015, Urbanism, *Millennials Will Live In Cities Unlike Anything We've Ever Seen Before* by Alissa Walker

6665;8865-1000-ver#3

STUDY OF STREET TRAFFIC CONDITIONS IN THE CITY OF LOS ANGELES

STUDY OF STREET TRAFFIC CONDITIONS

In The

CITY OF LOS ANGELES

and

THE PRACTICABILITY OF SUBSURFACE OR ELEVATED CONSTRUCTION

for

URBAN AND INTERURBAN TRANSIT FACILITIES.

E. W. Bannister,
Assistant Engineer.

October, 1915.

INDEX.

-0-

INDEX - continued.

One of the outcomes of modern civilization has been the collection of populations into large centers at situations of geographical importance, as regarded from a commercial, or, as in the case of Los Angeles, a climatic point of view. The massing of such populations has necessarily given rise to numerous civic problems, not the least of which are the providing of adequate urban and inter-urban transportation and the relief of congestion in crowded streets. While the former question can only be regarded as two distinct and separate problems, each with its own share of difficulties, yet such divisions are so co-related, so dependent upon each other for the complete development of any given territory, that consideration should be given them as a whole, and any remedial measures devised accordingly.

The relief of congestion in city streets is, moreover, somewhat dependent on the solution of transportation problems, inasmuch as the means of transit in principal use in any populated center are the cars of the transportation companies, necessarily occupying, during passage, through clearance requirements, a large proportion of the width of the ordinary thoroughfare, temporarily restricting and compressing into smaller areas the vehicular traffic used in the conduct of modern business. Enlargement of street area or expansion of business area form the only solutions of consequent congestion. If the first is impossible, then the second becomes imperative. Proper transportation facilities in congested districts can not be provided without either, (1) augmentation of territory and resultant diffusion of traffic, or

(2) additional operating areas, free from obstruction, secured either by placing all trackage above or below the surface of the ground.

It is proposed to discuss generally, in the following pages, the question of traffic congestion and its relief in Los Angeles streets, together with the influence of surface car lines on existing conditions and the practicability, cost and necessity, or otherwise, of sub-surface or elevated construction in the present congested and partially congested districts.

-0-

STREET CONGESTION

DISCUSSED GENERALLY AND LOCALLY.

CAUSES PRODUCING CONGESTION

and

PROBABLE METHOD OF RELIEF.

-0-0-

Congestion of traffic is a natural consequence of the congregating of population at certain strategic locations, considered from a commercial standpoint. As shipping facilities are essential to the development of commerce, it is only natural that such centers of business usually have their inception at the convergence of important waterways, at central points of inland travel, or on the shores of harbors providing safe and abundant anchorage and opportunity for interchange of raw or manufactured products. With the growth of business, the point of first settlement becomes a nucleus for further development and frequently remains the center of business activity even after it is demonstrated to be physically insufficient. People become accustomed to certain routes of travel and the transaction of affairs within certain territory, and will suffer serious inconvenience rather than accept any decided change. The streets and thoroughfares, originally laid out for a number of inhabitants, are, as a rule, narrow and inadequate to accommodate the constantly increasing volume of vehicles and pedestrians, causing blockades and impedance to traffic and transportation. Realty included within the favored sections assumes abnormal prices, rendering the construction of high buildings a necessity for the accommodation of those desirous of remaining in close touch with the commercial center, and the process continues until the limit of human endurance is reached and the original area is no longer able to provide business facilities. Expansion then gradually commences, controlled by geographical limitations, and proceeds along the line of least resistance.

The general plan of all cities is naturally regulated by the prevailing topography, and such plans may be roughly classed in the three following types:

(1) Peninsular, such as New York or San Francisco (See Plate #1), the city area being surrounded on three sides by water channels or natural barriers practically impregnable to civic growth.

(2) Valley, such as Pittsburg or Cincinnati, the first settlement and future congested area lying in the bottom of a natural depression, from which point business reluctantly ascends the surrounding elevations, and

(3) Circular, or radiating type, where natural boundaries are, practically speaking, non-existent, and the city is free to spread at will in all directions.

The growth of the peninsular type of city is naturally restricted to but one direction, i.e., toward the main land; forming, where the peninsular width is limited, as in New York, a long stretch of densely populated territory. With the valley type, actual congestion is confined to the usually limited business area, the demand for residence sites being satisfied by the partial utilization of the adjacent heights and the development of inter-urban transportation to more desirable locations. The radiating type of city, however, where the congested business area merely represents, approximately, the location of first settlement, is free to expand such area practically at will; and the fact that crowded conditions exist in this type of city only indicates that

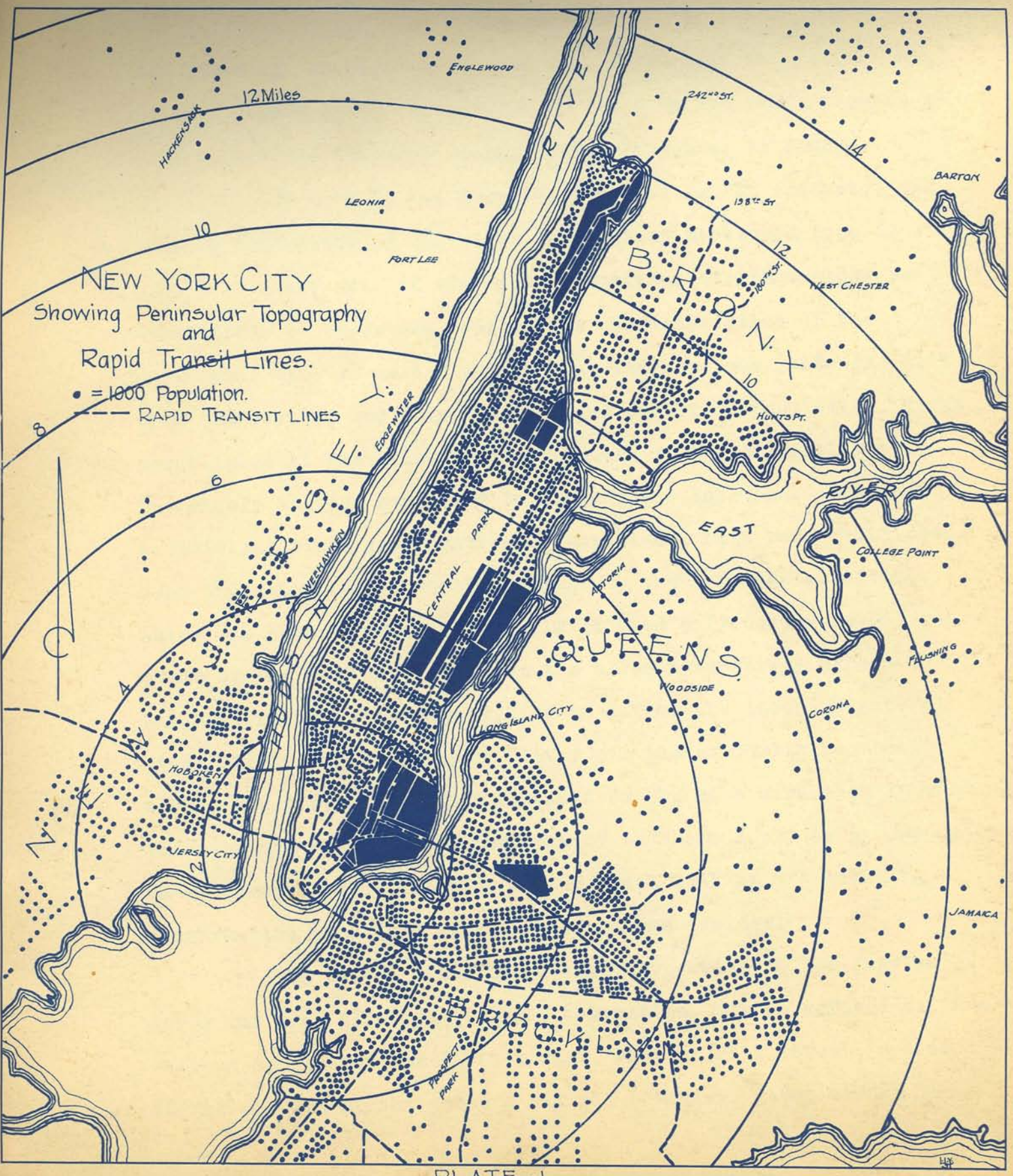

NEW YORK CITY
Showing Peninsular Topography
and
Rapid Transit Lines.
• = 1000 Population.
RAPID TRANSIT LINES
12 Miles
14
12
10
8
6
4
2
HACKENSACK
ENGLEWOOD
LEONIA
FORT LEE
EDGEWATER
WEEHAWKEN
HOBOKEN
JERSEY CITY
HUDSON
RIVER
CENTRAL PARK
PROSPECT PARK
BROOKLYN
LONG ISLAND CITY
ASTORIA
QUEENS
WOODSIDE
CORONA
FLUSHING
COLLEGE POINT
EAST RIVER
JAMAICA
HUNTS PT.
BRONX
WEST CHESTER
BARTON
242nd ST.
138th ST
180th ST.

PLATE 1.

the crowding, or congestion, has not yet reached the "saturation point," beyond which the removal of business and its customers to more commodious quarters becomes simply a matter of course.

The City of Los Angeles, regarded in its entirety, can only be considered as belonging to the last mentioned type of municipalities; yet, if the present business district alone be considered, it possesses some of the characteristics of the peninsular type as well. A glance at the map (see Plate #2) will show the reasons for this, and why the center of population, first established at the Plaza by the founders of the original pueblo, has slowly drifted southward to its present location. Business activities, first congregating at the Plaza, have been restricted from expansion to the north and east by the Los Angeles river, which has been somewhat adequately bridged only during recent years; while on the west and northwest the hills have barred egress to all but seekers of home sites willing to suffer the inconvenience of steep climbs for the sake of better air and proximity to their work. The south, then, has remained as the sole direction in which the constant and abnormal increase of business could be accommodated, as evidenced by the location of the great bulk of the building construction completed during the past two decades.

The retail district of the city, which in Los Angeles forms the area of street traffic congestion, may be defined as that section lying south of First street, east of Hill street, and west of Main. Hill street forms a natural boundary, First street the


MAP
OF
PRESENT AND FUTURE
BUSINESS DISTRICTS
TOGETHER WITH
PROPOSED REARRANGEMENT
OF
RAPID TRANSIT FACILITIES
SUBWAY
Scale 1" = 1000'
ELEVATED
RETAIL DISTRICT
WHOLESALE DISTRICT
RESIDENTIAL DISTRICT
CLEVELAND AVE
CASTELAR ST
BROADWAY
SAN FERNANDO
LYON ST
MACY
ALISO ST
MONROVIA
BROOKL
BUNKER HILL BLVD
TEMPLE
COURT AVE
ALAMEDA
ALISO
LOS ANGELES
BROADWAY
SPRING
MAIN
FIRST
CENTRE
RIVER
KEARNEY
CLARENCE
GLASS
MONO ST
LOS ANGELES
SAN PEDRO
CENTRAL AVE
ROSE
GAGE
STEVENSON AVE
SANTA FE AVE
CAROLINA ST
ALAMEDA
SEVEN
PALMETTO
6TH
INDUSTRIAL
7TH
SHEARER
8TH
OLIVE
HILL
3RD
4TH
5TH
6TH
7TH
8TH
9TH
10TH
12TH
14TH
15TH
16TH
PICO BLVD
SAN PEDRO
LOS ANGELES
SPRING
BROADWAY
SANTEE
MAPLE
WALL
JULIAN
SAN PEDRO
CROCKER
TOWNE
STANFORD
GLADYS
CERES
MERCHANT
CENTRAL
TOWNE
SHEARER

present location of a line fixed by public convenience, and Main street a boundary established more through custom than topographical limitations, forming as it does the western edge of the wholesale district and the eastern fringe of retail business. There is no physical reason why retail houses should not establish themselves east of Main street; yet experience has amply proven that it is useless to attempt to force shoppers to penetrate territory hitherto given over to less attractive occupations, and that a line thus fixed by custom or habit is as immutable as one caused by natural difficulties, provided that other and more attractive districts are available.

Retail commerce is thus confined to a narrow strip averaging little more than 1200 feet in width, served by four main thoroughfares running approximately north and south. The most westerly of these, however, Hill street, terminates at Temple street; and as Spring street merges with Main, but two north outlets or inlets are available. Such north and south streets average fifty-six (56) feet between curb lines, with sidewalks varying from twelve (12) to seventeen (17) feet. East and west streets vary from thirty-six (36) feet to forty (40) feet in width, with ten(10) to twelve (12) foot sidewalks. The street car tracks are laid on eleven (11) foot centers in the middle of the street; and as the ordinary P.A.Y.E. car measures 9' 1" in width, step to step, car operation, when two cars are moving in opposite directions, requires a trifle over twenty (20) feet of thoroughfare; or, allowing one

foot of clearance on each side, twenty-two (22) feet of the fifty-six (56) or forty (40) feet of street included between curb lines. Assuming that a sufficient number of cars are being operated to prevent the use of track area by vehicles, (which occasionally happens when cars are concentrated by blockades, or during the heaviest rush hours), and that the curbs are lined with standing automobiles or delivery wagons, as is usually the case, a narrow path only remains available for through traffic on either side, the width of which, allowing the smallest practicable clearance between standing and moving vehicles, cannot exceed ten (10) feet. Under such circumstances the course of traffic simply becomes a procession, the stoppage of which, more than momentarily, soon causes a complete blockade and consequent annoying delay.

This condition obtains from the entrance of traffic on the north to the end of topographical constriction on the south, which may be fairly placed at Sixth street, extending from Hill to Main. On and beyond Sixth street, vehicles are free to diverge to the west and relieve the situation, altho the larger percentage desiring a western or southwestern outlet proceeds to Seventh street, in order to take advantage of its greater width and opportunity for more rapidity of passage. South of Seventh street it is unusual for the traffic procession to assume unwieldy proportions, and beyond Ninth street all trace of congestion disappears. The reason for this, is of course, obvious. The great bulk of traffic, both street car and vehicular, plies to and from the south, west,

and southwest sections of the city; and, if traveling toward the residential section, as in the evening, is confined to the four north and south main arteries, without chance for expansion or different choice of route, until Sixth and the following side streets are reached. The connecting side streets north of Sixth are of no benefit to such through traffic, as each north and south thoroughfare is equally crowded between the stated limits and affords little choice as to conditions of congestion. Sixth, Seventh and the following side streets, however, each draw their quota from the traffic stream as it passes them, and either distribute their burden among north and south streets as far west as Figueroa, or act as through routes to residence districts; so that after passing Ninth street, practically no traffic remains on Main thoroughfares leading south save their proper loading of southbound vehicles and cars, which they are amply able to carry without crowding or inconvenience. If the preponderance of traffic is directed toward the business area, as in the morning, the converse of the proposition naturally obtains. Each side street adds its contribution to the legitimate north bound traffic, the curb lines rapidly fill with waiting vehicles, reducing the area available for passage one half, and congested conditions recommence.

As the congestion of any area is simply a physical demonstration of its inadequacy, it follows directly that the solution lies in the increase of such area, and, if natural or artificial boundaries prevent growth and symmetrical expansion, the remedy automatically lies in the removal of the main business

factors, or principal component parts, to a more suitable and commodious location. With the peninsular and valley types of city, such procedure is impossible, and congestion must be relieved, in part, at immense expense, by the removal, or partial removal, of transit facilities from the ground surface. With the radiating type of city, however, expansion in the most convenient direction or directions automatically affords such increase of territory, as is necessary for the accommodation of commercial needs.

The City of Los Angeles, while restricted by natural obstacles from expanding its present congested area symmetrically as has been already shown, has abundant opportunity to relieve inconvenient conditions through the occupation of a district immediately adjacent, which forms, as it were, a natural delta for the business stream. Inspection of a map (see Plate #2) of the central portion of the city can but convince that the territory lying south of Sixth and ~~east~~ west of Main streets is destined to become the location of important business interests and is the logical location for the convenient transaction of retail commerce. Its proximity to the main residential sections and consequent accessibility to shoppers, coupled with the fact that practically every car line either skirts its edges or traverses it from end to end renders it peculiarly suitable for such purpose; and the added advantages of broad sidewalks on all north and south streets and sufficient alleys to do away with the nuisance of frontage deliveries and sidewalk trap doors can but effect much needed relief over prevailing pedestrian traffic conditions. The greatest asset of

such district, however, lies in its flexibility, its power of indefinite expansion, rendering present congested conditions impossible of reproduction. Pico street on the south and Figueroa on the west would, in all probability serve as the limits for retail business during many years to come, including as they do, together with Sixth street, on the north, and Main street on the east, an area nearly four times the present retail area, with corresponding increase in available frontage. Yet, if the commercial volume attained unexpected proportions, there is no physical reason why such district should not expand so far to the south or west beyond these streets as the demand for business sites requires. There is no lack of evidence that this solution of present conditions has received abundant recognition; evidence so tangible that it presents itself in the erection of huge office and store buildings south and west of Sixth and Main streets, representing heavy investments and mature consideration of all probabilities. While a portion of such construction may be due to certain syndical realty operations, there is no doubt that the greater part has been dictated solely through recognition of the situation and realization of the inevitable. The establishment of the J. W. Robinson store and the Brockman building at Seventh and Grand has gone far to reassure the more timid of the permanency and desirability of such movement, as well as the practicability of lateral extension of the business area; and all the larger retail establishments, with the possible exception of one or two which have recently erected permanent

quarters on their old locations, may be expected to follow suit in due time. The smaller business houses will naturally be compelled to secure locations in fairly close proximity, dependent as they are on the crowds attracted by the department stores; but, having a greater frontage available in the vicinity of such stores, will not be restricted to any one street or subject to the exhorbitant rentals heretofore demanded. Such diffusion of business, added to the improvement in delivery facilities, will automatically prevent the massing of wheeled traffic in any particular spot or on any one thoroughfare; and although it is to be expected that passenger vehicles will congregate near favored establishments, it will no longer be necessary for them to follow any particular route to obtain egress to the residence section, as at present. Each street will carry its quota, instead of a few north and south streets carrying it all; and any congestion, momentarily formed, will as rapidly disappear.

The efforts of property owners in the northerly business area to detain the southerly march by the construction of cuts and tunnels west of Hill street will have no appreciable effect on the ultimate result. While rendering their holdings more accessible, such construction will be chiefly valuable in affording a more convenient entrance from the north and northwest sections of the city, resulting in the better development of the territory and in the relief of any traffic congestion north of First street. Providing no increase in business area, the benefit derived will be simply residential accessibility, and can affect but a small portion

quarters on their old locations, may be expected to follow suit in due time. The smaller business houses will naturally be compelled to secure locations in fairly close proximity, dependent as they are on the crowds attracted by the department stores; but, having a greater frontage available in the vicinity of such stores, will not be restricted to any one street or subject to the exhorbitant rentals heretofore demanded. Such diffusion of business, added to the improvement in delivery facilities, will automatically prevent the massing of wheeled traffic in any particular spot or on any one thoroughfare; and although it is to be expected that passenger vehicles will congregate near favored establishments, it will no longer be necessary for them to follow any particular route to obtain egress to the residence section, as at present. Each street will carry its quota, instead of a few north and south streets carrying it all; and any congestion, momentarily formed, will as rapidly disappear.

The efforts of property owners in the northerly business area to detain the southerly march by the construction of cuts and tunnels west of Hill street will have no appreciable effect on the ultimate result. While rendering their holdings more accessible, such construction will be chiefly valuable in affording a more convenient entrance from the north and northwest sections of the city, resulting in the better development of the territory and in the relief of any traffic congestion north of First street. Providing no increase in business area, the benefit derived will be simply residential accessibility, and can affect but a small portion

of the population. The paving of Vermont and Western avenues through to Sunset boulevard supplies a comfortable and direct route from Hollywood and vicinity to the newer business section without the trouble of passing through the upper part of town. Upper Hill, Broadway, Main and Spring streets will always be business streets, as the County, City, and Federal buildings, the Courts, etc., will always retain a certain percentage of business facilities in their neighborhood; but the larger stores, the centers of retail activity, will gravitate toward the area of greater convenience, their places will be filled with smaller and less important business units, and congestion, as it now obtains, will be definitely and finally relieved.

It is not to be expected that this will be accomplished immediately, or in any given period. All changes of this description shape themselves slowly, though none the less surely, and it is probable that nearly as much time will be required for the removal of the retail center to the more commodious location as it has taken to move from above First street to its present situation. The steadily increasing volume of business will constitute the most potent factor in hastening such removal, which, when complete will have the effect of locating the scene of greatest activity at the ideal point for a city of the circular, or radiating, type, namely; at its geographical center, with abundant opportunity to expand as required and prevent any return of congested conditions.

As a natural consequence, such opportunity for the relief

of congestion definitely eliminates any necessity for change of location of existing transportation facilities. Elevated roads and subways are only constructed when congestion can be relieved by no other method, or when thickly populated areas are located at considerable distances and create a demand for rapid transit. In a city of the radiating type such as Los Angeles, it will be readily seen that this is a function of interurban, not urban, transportation. With the lessening of congestion (always a consequence of territorial expansion), the investment necessary for the construction of an elevated or sub-surface road becomes less attractive, and the prospect of any financial return is decreased in proportion. The heavy cost of such construction means large fixed charges, and in order to make the expenditure profitable, there must be either higher rates of fare, dense traffic or many persons riding short distances. City ordinances prevent increase of fare, expansion of the business district scatters traffic, and the established city plan renders short rides the exception, and not the rule.

As a matter of fact, the popular estimate of the street space occupied by city surface cars is greatly exaggerated, and is probably due to the preponderance of size per unit, or car, as compared to the average vehicle, rather than to the number of cars operated on any street in any given period. A simple calculation will demonstrate this effectively, and show that street cars, even when operated to the limit of track capacity, are but a small factor

in causing street congestion.

The ordinary end entrance P. A. Y. E. car operated in Los Angeles is 9 feet and one inch in width (9' 1"), and forty six feet seven inches (46' 7") long. With clearance included, the area occupied by such a car is approximately eleven by fifty feet (11 x 50 ft) or five hundred and fifty (550) square feet, The greatest number of such cars passing any given point on a single track is 110 per hour, or a car every 33 seconds; and the average running time between two points such as First and Broadway and Seventh and Broadway, is seven minutes. If both north and south bound tracks are carrying the same number of cars, then a maximum of 220 cars per hour will pass the given point, or, approximately four cars per minute. As each car requires seven minutes to pass from First to Seventh streets, in any one minute there will be 7 x 4 - 28 cars occupying street space inside the above stated limits. If each car occupies 550 square feet then 28 cars will require 15,400 square feet. Broadway is 56 feet wide, and measures 3856 feet in length from the street center at First to the similar center at Seventh, giving a total street area, after deducting all cross streets, of 202,496 square feet. Simple division will demonstrate that, in any minute of time at the busiest time of day, street cars are only occupying eight per cent of the total available street area, or, conversely, vehicular traffic occupies eleven and one half (11½) times as much street area as the street cars.

Objection may be made to the above example that partial

blockades, emergencies, etc., may temporarily cause a large number of cars to be concentrated on a given street, or portion of a street. While dispatcher's records show this to be exceptional, the case may be assumed, as follows:

The largest number of cars which it is possible to operate on a single surface track is, admittedly, 180 per hour. This is equivalent to a car every 20 seconds, including stops, and is impracticable unless the tracks are free from obstruction and the "service stops" can be restricted to ten seconds or less. In cities with comparatively narrow streets, such as Los Angeles, stops will average several times ten seconds, as it is necessary for passengers to wait on the curb until their car arrives, instead of grouping on "Isles of Safety" or in the street, as is possible in Indianapolis or San Francisco. It is therefore probable that at no time has Los Angeles street car traffic ever approached such density for even an one-hour period.

One hundred and eighty cars per hour on a single track means three hundred and sixty cars per hour on double track, which, again, means 6 cars per minute passing any point, or a total of 42 cars occupying street space between First and Seventh streets in any minute of the hour. Forty-two cars, at 550 square feet per car, will occupy 23,100 square feet of street, which is only 11½ per cent of the total space available. In other words, with street car traffic operated to the maximum, vehicles are occupying nearly eight times as much area as are the cars.

Obviously, the remedy for congestion under such circumstances lies in the providing more vehicular area, rather than the relegation of transportation facilities to above or below the ground surface. The addition of one eighth (1/8), or a strip seven feet wide to the present street area would hardly compensate for the immense expenditure necessary for subway or elevated construction, especially when relief by natural expansion is simply a question of time.

SUB-SURFACE OPERATION

AS AFFECTED BY DENSITY OF POPULATION

and

CITY PLANS.

-O-

Since the financial success of the original New York subway has become so generally known, congestion of the streets of any American City has served as a signal for a public demand for removal of street car trackage to sub-grade, or elevated roadway. That such demand is made, generally speaking, without due consideration or knowledge of the conditions necessary for successful financial and physical operation is evident to anyone conversant with the underlying facts. The large investment necessary to accomplish such construction is fortunately, however, a sufficient deterrent to any hasty action, and sufficient reason for the reference of the problem to competent authority. Crowded traffic conditions should be mitigated or prevented wherever possible according to the best practice; but it does not always follow that the only remedy is track elevation or sub-surface construction.

As noted under "Congestion," it is the shape, or plan, of cities that forms the chief factor in determining the final character of its transportation facilities. Cities of the peninsular and valley types, being restricted as to available area for business purposes, cannot but become more congested with increased population. When all available space has been utilized, or at any time previous when realization of the ultimate outcome crystallizes into a popular desire for improved conditions, the existing means of transportation are either reinforced or supplanted by the building of elevated roads, or subways. Elevated roads, although noisy and unsightly, have heretofore, in America, in-

variably been the first means of relief on account of their lesser cost. With the better understanding, however, of the problems of construction and maintenance, and above all, the development of electric traction, subway construction has come into greater favor, and a combination of both systems apparently forms the proper solution in most cases. But a city of the radiating type, unless its business district is cut up by water ways or completely hemmed in by natural barriers, has an opportunity to solve its congestion problem simply by the gradual extension of its business area, thus avoiding extraordinary obligations for transit facilities and consequent increase in taxation.

This holds true until the populated area becomes so extensive that the inhabitants are unable to reach the business district from their places of residence by surface roads without undue loss of time, or, conversely, until the congested area surrounding the business district has become sufficiently extensive in any one direction to approximate the conditions of population obtaining in a city with restricted boundaries. More rapid transit then becomes a necessity and possible, on account of the intensive population, from the standpoint of the operator, although it is often difficult to meet the emergency satisfactorily and secure an equable return on the capital invested. London is a fair example of this, for while it contains the greatest number of possible passengers within its limits of any city in the world, its underground roads, with one or two exceptions, are not self

supporting. While this is partly due to lack of co-operation and faulty location of routes, the principal reason is that there is not sufficient available patronage along any one route. If theLondon underground system had been constructed according to modern methods, under a comprehensive plan which would allow opportunity for transfer, eliminate gauge differences, and carry its patrons directly to their destinations instead of by circuitous routes, it is probable that it would earn a fair rate of interest on the investment. It is doubtful, however, if it could ever approach the dividend ratio of the original New York subway, operating on Manhattan Island. The latter serves a district, which, through its topographical restrictions is congested from one end to the other, so that its total patronage is bounded only by its capacity. The London lines, on the other hand, while serving a greater population, would necessarily be obliged from the radial form of the city, to cover a far greater area with consequently larger mileage and less population per mile.

It may be readily seen, then, that congestion is a necessary factor to successful sub-surface operation. There is no doubt but that subways can be profitably operated under proper conditions, and at a lower operating ratio than can surface roads, While the first cost of surface roads is comparatively small, the platform expense and cost of conducting transportation is much higher; and the average speed being low on account of traffic obstruction and frequent stops, the capacity is proportionately

smaller. As the amount of annual gross receipts of any enterprise regulates the amount of capital expenditure it follows that the large investment required for subway construction may be justified only when the demands of traffic call for the running of multi-car high speed trains at frequent intervals. But, such traffic demands or requirements necessarily involve the presence of capacity patronage, and such patronage is not possible without congestion of population. The carrying of a sufficient number of passengers on any line of transportation will, perforce, insure its financial success, but the people desiring such facilities must be there to carry.

Density of population, then, is a prime necessity for profitable operation of sub-surface transit lines. A city area given over to private dwellings, each with its own premises, can not furnish a population sufficient to support a subway unless the ride is short and the rate of fare high. The ride is not apt to be short as realty values in the central part of any city are ordinarily so high that people must go some distance to have separate houses, and if the fare is high the great majority of the inhabitants cannot afford to pay it and are forced to live in crowded quarters and within walking distance. The great advantage possessed by Los Angeles, or any other city of the radial type, in being an aggregation of one-family houses, becomes a disadvantage when the development of a costly means of transportation is concerned.

In connection with this phase of the subject, it may be

worth while to compare Los Angeles with the larger eastern cities now possessing rapid transit systems. The following table shows their population density within corporate city limits.

POPULATION DENSITY IN CORPORATE CITY LIMITS.

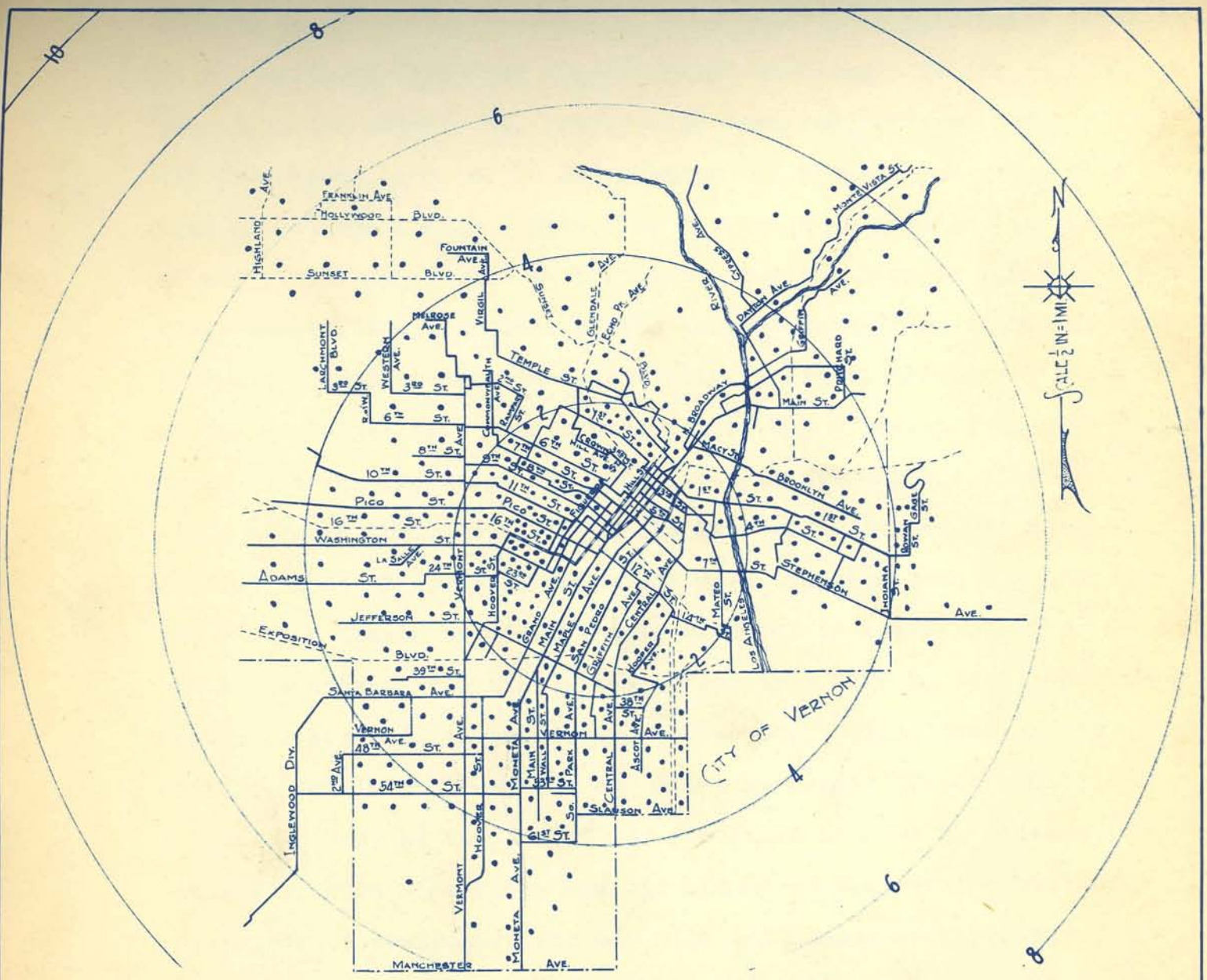
	Land area Sq. miles.	Population density per acre of land area. 1900.	1910.	1914.
New York (Manhattan & Bronx)	62.6	51.2	69.	
Brooklyn	77.6	23.4	32.9	
Chicago	179.6	14.8	19.	
Philadelphia	129.6	15.6	18.6	
Boston	87.3	15.7	19.0	
Los Angeles (1900)	43.3 *	3.7		
Los Angeles (1910)	77.3 *		6.3	
Los Angeles (1914)	84.2 *			9.3 *

* = North of Manchester avenue.

The population density of Los Angeles, as shown in above table, is only half that of Philadelphia or Boston, both of which cities and particularly the latter, are restricted from expanding in a natural manner by various waterways. Philadelphia, moreover, to a greater extent than any other American city, consists of individual communities built up around large manufacturing industries as centers, necessitating the use of rapid transit facilities in order to insure homogeneous growth. Los Angeles territory, south of

Manchester avenue has been neglected in this compilation, as its transportation service, from the length of ride, more properly falls under the classification of inter-urban traffic. The population of Los Angeles for the year 1914 has been taken as per the figures given by the Los Angeles directory, less the population of Wilmington and San Pedro. The table shows conclusively the difference in density of population between cities of the peninsular and radial or partly radial types, New York having over twice as many people per acre as Brooklyn, and nearly eight times as many as Los Angeles. It should be remembered that the figures shown are averages. Certain districts in New York house as many as 1000 persons per acre, while the apartment house sections average 250 to 400, and the better class of tenements 600 to 700 per acre. If the fact be considered that an acre of ground is contained within an area a trifle over 200 feet square, some idea of the population density and consequent resultant traffic may be obtained. Rapid transit in such case is vital to city existence, and must be operated either above or below the ground surface for the simple reason that there is no other place to put the tracks.

A good idea of the diffusion of the 1914 population of Los Angeles, and the relative population density of the several residential districts may be had by inspection of Plate #3 herewith appended. This plate has been made up from existing maps of city territory and the 1915 Los Angeles directory records of the number of householders in each precinct division; and while it does not



MAP OF CITY OF LOS ANGELES

SHOWING

TRANSPORTATION LINES AND COMPARATIVE DENSITY OF POPULATION IN DIFFERENT MILE ZONES

• 1000 POPULATION

——— LOS ANGELES RAILWAY

- - - - - - - - PACIFIC ELECTRIC RAILWAY

▬▬▬ JOINT TRACK

include the transient population, will serve as a sufficient index as to the relative growth of the different sections. It can be plainly seen that Los Angeles is, practically speaking, growing equally in all directions, and is, to all intents and purposes, a round city with an average 5 mile radius. No residence congestion, or massing of any considerable part of the resident population in any limited area, exists, due doubtless to the comprehensive plan of street car trackage affording equal accessibility to practically every portion of the municipality. Some conception of the effeciency of street car system and the large part it has played in symmetrical city expansions through the liberality of its extensions may be had when it is realized that it operates 100 miles more trackage than any city on the Pacific Coast, or about 1 mile of track to every 1300 people, while the average for the United States is 1 mile to 1800 population. More cars are run, in proportion to the population, than on any surface road in America, the car miles averaging 72 per capita, or 3 times as many as New York City, and twice as many as Chicago. Naturally, such liberality has its effect on the earning capacity, the number of passengers per car mile and annual earnings per track mile being only about one-half that of San Francisco and considerably less than either Portland or Seattle.

Statistics covering the number of dwellings contained within the boundaries of any city and the average number of persons inhabiting each dwelling, are most significant as indicating its population density. The term "dwelling," may be broadly defined as "a place in which one or more persons regularly sleep, having a separate

entrance from the street." Under this definition an apartment house or tenement, even if housing several hundred persons, is classed as one dwelling. The following tables show the number of dwellings within the corporate limits of Los Angeles, as compared with the larger Eastern cities previously mentioned:

TABLE #3 - NUMBER OF DWELLINGS WITHIN CORPORATE CITY LIMITS.

U.S. Census	New York (A)	Brooklyn	Chicago	Philadelphia	Boston	Los Angeles
1880	73864	62233	61069	146412		
1890	81828	82282	127871	187052	87985	10368
1900	100547	113972	193895	241589	119595	22531
1910	104143	147666	246744	295220	133516	69061

(A) Manhattan and Bronx.

TABLE #4 - POPULATION PER DWELLING WITHIN CORPORATE CITY LIMITS.

1880	16.4	9.1	8.2	5.8		
1890	18.5	9.8	8.6	5.6	7.6	4.9
1900	20.4	10.2	8.8	5.4	7.4	4.5
1910	26.5	11.1	8.9	5.2	7.9	4.6

Inspection of the above tables shows conclusively the difference in living conditions, and, consequently, the relative congestion, between cities of limited areas and the radial or semi-radial types which are free to expand. During the period 1900 - 1910

the entire number of dwellings, tenements, apartment houses and residences, constructed in New York City only totaled 3956, while the population per dwelling mounted to 26.5, an increase for the decade amounting to nearly 150% of the total population per house in Los Angeles. During the same period, the latter city built 46530 dwellings without increasing the population per dwelling but a fraction of one per cent. In like manner, the average number of families per dwelling increased from 4.3 to 5.6 in New York; while Los Angeles, with a proportionately greater increase in population, still preserved its ratio of one family to each home. Although this means that practically every inhabitant enjoys the benefits of abundant living space, it also marks the fact that the number of people who can conveniently patronize any given transportation line is comparatively limited. Experience has shown that possible passengers will not walk more than ten minutes to reach a car line, if any other means of transit are available. The average person walks at a pace not exceeding 3 miles per hour, and a 10 minute walk would therefore mean practically half a mile of distance. Patronage, therefore, would be confined to an area not exceeding one mile in width; and, supposing such line to extend to the city limits, five miles long; a total of five square miles, or less than one fifteenth of the territory to be served. A subway system adequately serving a city of the circular type, supposing such city to be equally inhabited in all sections, would resemble the spokes of a wheel, with the different lines radiating from the business

center; involving the necessity of a total mileage whose construction cost would be prohibitive.

SURFACE CAR DIVERSION

to

SUB-SURFACE TRACKAGE.

It may be urged that while Los Angeles, taken as a whole, cannot perhaps present such conditions of population as would justify the installation of extensive subway construction, that the congestion, or partial congestion, of certain portions of the present business district should be relieved by sub-surface trackage.

It is apparent that the matter is entirely a question of public welfare and convenience. The necessarily heavy expenditure either is, or is not, justifiable, according to whether the situation admits of no other remedy, or whether, by natural means, it will automatically adjust itself. No expenditure, however great, should be considered disproportionate when used in overcoming otherwise insuperable natural difficulties or hindrances to civic growth; but, on the other hand, no municipality is justified in adopting a policy which would tend to retard the removal of business centers to their natural geographical location. Such a policy would be nothing less than a deliberate exploitation of civic resources for the benefit of the limited number of property owners enjoying abnormal incomes from rental privileges; and at best, could only serve as a palliative, since the final location of the business center of any growing city is regulated entirely by its topography and is altogether beyond individual or corporate control. Such removal; or partial evacuation of territory, involves no municipal loss. Diminution of assessable values in the one case is offset by increase in the other; and individual loss on any particular

lot or parcel can only be regarded as the natural subsidence of inflation.

The inference may be drawn from the preceding paragraph that the indebtedness incurred in the construction of subways is, primarily, a civic obligation. This is true in the large majority of cases. A subway is a public improvement whose enormous initial cost renders the undertaking uninviting to private capital, unless the general topography concentrates a heavy traffic over a considerable length of route. This is only possible in rare instances. Cities with a wide spread radial system of track with only a congested or semi-congested center, can only hope for an underground diversion through their center, and that only if the traffic conditions are sufficiently vigorous. As such diversion not only creates no accession to the income of the transportation line, but increases its expenses by the added problems of ventilation, lighting and station operation; and as the responsibility for the adequate provision of thoroughfare for the needs of its inhabitants is inherent with the city, it naturally becomes the province of the municipality to provide any extraordinary methods of facilitating transit.

This principle has been generally recognized. With the exception of the Market street subway in Philadelphia, no underground construction has been undertaken by other than public funds. Contracts signed in 1913, however, for the construction of the so-called "Dual System" in New York and Brooklyn, provide for a nearly equal division of expense between the operating companies and the

City. This, though, is an extension and amplification of the rapid transit system, including both subway and elevated. Boston is the only city which has definitely committed itself to the policy of supplying sub-surface accommodations for surface lines, owing to the extreme congestion obtaining in its central business section, caused by narrow and irregular streets and restrictive waterways. The City undertakes and owns all underground construction, practically forcing the operating company to lease same on completion at a rental of from 4½ to 4-7/8 per cent of original cost, the rate being calculated to provide sinking funds as well as interest.

While the construction of underground transit facilities by a municipality for the operation of urban car lines, in cases where the traffic area is insufficient without possibility of expansion, or where removal from a certain advantageous commercial situation by enforced expansion may work permanent hardship and inconvenience, and is without doubt justified by the necessity of supplying a larger area for vehicular transport, it is difficult to see the equity of the rental exacted therefor.

It is true that passage, free from obstruction has been provided for car operation, but it is an improvement which the transportation company could, in most cases, well do without. It can be readily seen that all passengers using trolley systems, always supposing that no more rapid means of transit exist, will use them whether below ground or on the surface, as being the best and perhaps the sole means of reaching their residences or other destinations.

The running time may be lessened by the use of the subway through the crowded sections, but this is merely a convenience to passengers and does not materially benefit the operators. Practically all possible revenue will be secured as readily by surface as by subsurface operation, with considerably less expense. The City, however, through the possession of paramount authority within its boundaries, compels the adoption of the new facilities, reaping enormous benefits through increased taxable valuations and freer movement of traffic; and, altho retaining perpetual title to such facilities, forces the operating company to contribute a sufficient annual rental, or percentage of their cost, to cancel both principal and interest in a certain given period, thus increasing fixed charges and proportionately decreasing income without possibility of recourse. The railway company, then, is placed in the anomalous position of being obliged to occupy and pay for something which it does not want; and through its annual contributions to the amortization or sinking fund, defray the entire cost of something which it can never own.

It is admittedly the duty of the city to provide adequate streets. Why then, when the removal of any particular class of traffic essential for the transaction of business and the well being of its participants, is considered imperative, should a charge be made for the privilege of operation over what is nothing more than an extension of street area? If the expenditure incurred in subway construction had been employed in the demolition of existing surface

structures and the widening of the identical streets under which the subway runs, or the construction of tunnels, long or short, to connect adjacent sections of the city, one with the other, the users of such additional accommodations would ridicule the idea of payment for daily passage, considering the expense incurred as a necessary concomitant to civic existence and a legitimate addition to municipal bonded indebtedness. As a subway is simply an amplification of street area, a tunnel below the ordinary gradient, any payment for its use can but be regarded as a toll. Toll collections, with the progress of civilization, have been generally and definitely abolished; and the principle that streets and roads are free to the users thereof has become axiomatic.

Inasmuch as any city transportation company, contributing its share through general taxation to the common funds, is regarded in the eyes of the law, as an individual entity, no discrimination should be made between it and any other participant in city traffic. It may occasionally be necessary to remove the cars from existing streets to make more room for smaller vehicular units, but if so, other accommodations should be provided at a no further cost than that entailed by such removal. Congestion of thoroughfare is not caused by street cars, but by the influx of traffic following their installation. It should be remembered that transportation lines form the principal factor in city development and render business centers possible; and that no city or concentration of commercial activity can exist without cheap, efficient and convenient means of transit to adjoining territory.

to exact compensation for the use of subway construction designed for the operation of urban cars and the relief of congested streets by the removal of such cars, unless it can be clearly demonstrated that the operating company increases its revenues, over and above the normal increase, by the use of such facilities. In like manner, the amount of any compensation paid should bear a reasonable proportion to such increase of revenue only, without reference to the original cost of the work.

The case of Boston having been cited, the financial experience of the operating company prior to and since the construction of subways may be pertinent to this discussion. Owing to the use of the latter by both rapid transit and surface cars, one company operating all city lines with practically universal transfer privileges, it is impossible to segregate the single effect of the transfer of surface lines to underground trackage. The total result, however, is valuable in illustrating the truth of the statement that subway operation is unremunerative in all but abnormal cases; and a brief resume of conditions, etc., is therefore subjoined.

Boston, like New York, is a peninsular city, (See Plate #4). The original settlement being at the point of the peninsula in close proximity to shipping facilities, the growth of business has gradually caused the occupation of and filled to overflowing all available space. Unlike New York, the peninsula is comparatively short and the congested area consequently limited, the entire


BOSTON
Showing Original Peninsular
Settlement & Subsequent Radiation.
• 1000 Population.
Rapid Transit Lines.
WOBURN
STONEHAM
MELROSE
WINCHESTER
LYNN
FRANKLIN PARK
MEDFORD
MALDEN
REVERE
EVERETT
BELMONT
FRESH POND
SOMERVILLE
CAMBRIDGE
CHARLES
BRIGHTON
NEWTON
BOSTON
HARBOR
BROOKLINE
CHESTNUT HILL
NEPONSET
QUINCY
BAY
MATTAPAN
MILTON
HYDE PARK
QUINCY
DEDHAM

PLATE 4.

mainland being available for residence or other purposes as soon as the neck of the peninsula, or point of constriction, is passed. This naturally causes diffusion of population with more or less concentration at suburban centers and a change in city contour to the semi-radial form, so that the population density of the metropolitan district, or territory included within the 16 mile circle is only 4.1 per acre, or less than one quarter of that of the larger city. The opportunity for heavy patronage is therefore confined to a relatively small district, while New York, as represented by Manhattan Island, presents practically uniform conditions of congestion for nearly 13 miles.

With the consolidation of existing horse car lines in 1888, the transportation interests were in possession of a property yielding a gross revenue of $4,888,000.00. This represented an invested capital 2.39 times as great, which experience has shown to be a safe and conservative ratio of expenditure. The average half trip was 3.62 miles long, and the revenue passengers per half trip averaged 22.5, which insured a satisfactory return over and above operating expenses. The electrification of all lines, with consequent higher speed and extensions to other territory, brought the total revenues in 1898 to $9,257,000.00 and increased the number of passengers per half trip to 28.9. Absorption of surface lines by the Boston Elevated Railway Company then took place and subway operation commenced, first simply as an adjunct or extra facility for surface cars, later in connection with a complete rapid transit system of combined subway and elevated trackage,

the latter only being constructed by the company. In 1903, with ordinances compelling universal transfer, the half trips were so lengthened that the number of passengers per half trip was reduced to 23, while in 1912 it only averaged 25.5.

Meanwhile the total capital expenditure necessitated by the popular demand for rapid transit amounted to over 34 million, and the City, in the construction of subways, expended 17 million more, or a total of 51 million dollars. As the City expenditure can but be regarded as an addition to company expenditure, on account of the enforced liability of the latter to take care of interest and sinking fund charges, the company had increased its obligations over 200 per cent; while, even with a gain of 500,000 possible patrons through growth of city population, there were only 3 more revenue passengers per half trip than with the horse cars in 1888. Gross revenues had increased over 80%, but such gain was only normal. As voiced by a prominent official of the railway company, "Boston experience would seem to indicate that no addition to transit facilities accelerates the ordinary growth of business."

It is true, in the case of Boston, that without such additional facilities, the normal business increase could hardly have been realized through lack of physical space; but from the investment standpoint, the point of view of net financial results, the change was decidedly for the worse. Certainly three additional passengers per half trip do not begin to compensate for such an enormous increase in investment, practically forced upon the company

by municipal plans. Naturally, the number of half trips was increased many fold; but it must be remembered that any increase in operation brings a like increase in operating expense, in equal, or, as in the case in point, even larger ratio. And that the slight increase of income is not only burdened by the extra operating expense, but by the heavy augmentation of fixed charges, of which the city share, or subway rental, forms a lien prior to any other obligation.

There is no particular reason to believe that subway operation in Los Angeles with considerably less congestion, with only 1/8 as much congested area, and but 1/3 the city population, would produce any more favorable results. If, for the purpose of discussion, it is assumed that the present southward trend of business be abruptly checked and retail commerce, at least, be confined within its present limits, it is only necessary to estimate roughly the probable cost of sub-surface construction through such district to ascertain the amount of patronage necessary to justify the investment from the view-point of private capital, or its operation by the present company under a leasing arrangement similar to the system now obtaining in eastern cities.

Following the present routing with two-track tunnels on Main, Spring and Broadway, from 11th and Main to the Temple block junction, together with cross town tunnels on all east and west streets except Sixth, emerging through inclines between Olive and Hill streets on the west, and Main and Los Angeles streets on the

east, (see detail in "Cost of subways."), gives, approximately, a total of five and seven tenths (5.7) miles of structure. A system of this magnitude would serve to eliminate all surface trackage in the present retail area except on Sixth and on Hill streets. Sixth street, between Olive and Main, is used exclusively by the Pacific Electric. Hill street, while utilized as an outlet for both urban and inter-urban cars, is not deemed sufficiently congested to be included in this study. Both streets, however, together with Main street between First and Ninth, will be further considered under "Rapid transit."

The probable construction cost of two-track tunnel large enough to accommodate the present surface cars will average approximately, according to experience elsewhere, $1,500,000.00 per mile of structure. Neglecting the additional cost of station platforms and stairways, realty and easements, etc., 5.7 miles of such construction would represent an investment of $8,550,000.00. If it is assumed that the cost of surface and subway operation will cancel, an erroneous assumption, since the problems of station operation, ventilation and lighting are all foreign to surface maintenance, there must still be considered the payment of interest on the capital invested, plus sinking fund percentage. If money be secured at 4% on city credit, and the sinking fund, or amortization percentage placed at 1%, the usual figure, then 5% on $8,550,000.00, or $427,500.00 must be paid annually for the privilege of riding underground. Reduced to the fare basis, such

over 25,000 extra revenue passengers per working day. (340 working days are considered the working year by transportation companies, Sundays being taken as half days). The word "extra" is emphasized as it must be understood that the patronage represented by these 25,000 passengers is over and above the number ordinarily riding. In other words, the construction of such a sub-surface system must increase the riding habit of the entire population by 6.2 per cent, over and above the natural increase, in order to defray the interest charge and provide a sinking fund adequate to retire construction bonds in an hundred year period.

It is hard to see just how this could be accomplished, It is, of course a fact well borne out by the experience of all cities, that the providing of rapid transit facilities is followed by an increase in the general riding habit. Mattersdorf endeavors to prove that the relation of city traffic to its population varies as the square of such population; while the N. Y. Public Service Commission, in an analysis of New York City growth, arrives at the conclusion that traffic increases at a per cent rate of about twice that of the increase in population. The lack of similarity in regulating conditions makes it probable that no hard and fast rule can be laid down that will apply to all cases. It is in general the change from town to city, the change from walking to riding rendered necessary by the growth of the city, that causes an increase of traffic at a greater rate than population. The

individual does not make more trips from home or place of business than when he walked, but the greater distances involved by city growth render riding imperative to save time. One thing, however, is apparent, that such city growth and traffic increase, while the natural consequence of rapid transit, can never be effected by mere sub-surface diversion through limited territory. Increase of patronage, or the habit of using any means of transportation is mainly realized through the establishment of more comfortable riding conditions, the time saved by greater speed, or the removal of patrons beyond the limit of pedestrianism. Any one familiar with subway travel knows that it is not a particularly comfortable method of transit. The noise, heat, and lack of ventilation render it the reverse of popular when other means are available. The time gained by its use is the factor which contributes most largely to its prosperity in large cities, but this element is absent, or nearly so, when a subway is used for the operation of surface cars. When it is realized that the present running time of cars in the business district of Los Angeles is only, including stops, one minute per block, it will be readily seen that there can be but little change in schedule. Again, the fact that 20 or 25 feet of stairway must be negotiated on entering or leaving the structure is a distinct detriment to the comfort of the average individual. Stairways grow slippery with moisture and usage, and accidents are numerous. Escalators, or moving staircases, would be out of the question here, on account of the number required. It must be kept in mind

that a Subway for surface cars in no way reduces the number of necessary stops, and is not comparable to a rapid transit line whose shortest station interval, even for local work, is rarely less than one quarter mile.

There is, then, no particular time saving and a decided decrease in convenience. With the two factors most productive of business increase practically eliminated, from what source could the requisite income emanate? There is no credible reason for any belief that it would be produced. Transportation would be rendered no easier from the public standpoint. There would be no more cars, no shorter routes. While the obstruction to loading and unloading by other vehicles would no longer exist, the lessened danger to passengers would be more than offset by the risk of being pushed from a crowded platform in front of a moving car, and the discomfort of ascending and descending stairways made slippery by weather conditions and the tread of countless feet. That portion of the population who found it necessary to ride, would ride; but the total number would not exceed the number which would have been carried had the cars been operated on their former level. It is more than probable that the gross receipts, instead of increasing, would show a considerable decrease, as many people who had hitherto resisted the importunities of the motor buses would prefer crowded and uncomfortable riding conditions in the open air to transit and delivery beneath the surface of the ground.

If there is no reasonable expectation of any accession of income, it will be readily seen that private capital, as represented

by the transportation company, could not afford to shoulder the responsibility of meeting the annual interest and amortization charges caused by such construction. The margin remaining after the deduction of the operating expenses of an electric surface railroad is altogether too slight to carry other than its legitimate burden without additional compensation. Few patrons of the present system realize that 3-3/4 cents of their 5 cent fare is required to defray actual running expenses, leaving but 1¼ cents to cover rentals, sinking fund, and bond interest ~~and dividends~~, to say nothing of surplus. Inspection of recent balance sheets can but convince the most skeptical that this percentage is insufficient to insure even a moderate return on the investment and is entirely inadequate to meet any further demands.

If the railway company cannot afford to pay these charges, there only remains the city to defray them through additional taxation, recouping itself through possible increase in assessed valuations along the route. While such increase would undoubtedly occur if the business area served was restricted and immutable, it is improbable that there would be any lasting rise in realty values when such area is capable of indefinite expansion. With the latter condition and a constant increase of business and demand for convenient business locations, the center of activity at present obtaining could only be temporarily restrained from southerly movement. The subway system, then, as herein outlined, would be sooner or later entirely removed from the scene of any possible

congestion, repre. enting only an economic waste and an irreparable civic blunder.

congestion, representing only an economic waste and an irreparable civic blunder.

SUBWAY DESIGN

CONSTRUCTION REQUIREMENTS

AND DIFFICULTIES.

Sub-surface accommodations for transit facilities may be divided into two classifications; shallow and deep level construction. Both are sub-ways, but the modern interpretation of the word has come to signify a railway built as close to the ground surface as possible, with staircases affording ready access to stations. Deep level construction is principally exemplified by the London "Tubes," or tunnels driven through the thick bed of firm clay which underlies the entire city at an average depth of 70 feet, such tunnels being lined by cast iron segments bolted together to circular form. Stations are formed by enlargement of the section, and elevator systems, furnish transportation to and from the street.

While deep level tunnels have been definitely disapproved by the great majority of subway engineers, there were many good reasons for their adoption in London. English laws are far more drastic on the subject of property rights than are American, the custom of condemnation of private property and valuation by appraisement for the accommodation of public utilities being unheard of, and each property owner being the sole judge of the monetary value of right of way or easements. Cellars extend beyond the sidewalk lines and are protected by ordinance and custom; unlike New York City which held that house vaults (cellars extending beyond the property line) were not property, but were maintained only on a revocable license from the city. The streets are narrow, there being but three thoroughfares, even as late as 1908, 100 feet in width, while those as wide as Broadway in New York City (80 ft)

Sub-surface accommodations for transit facilities may be divided into two classifications; shallow and deep level construction. Both are sub-ways, but the modern interpretation of the word has come to signify a railway built as close to the ground surface as possible, with staircases affording ready access to stations. Deep level construction is principally exemplified by the London "Tubes," or tunnels driven through the thick bed of firm clay which underlies the entire city at an average depth of 70 feet, such tunnels being lined by cast iron segments bolted together to circular form. Stations are formed by enlargement of the section, and elevator systems, furnish transportation to and from the street.

While deep level tunnels have been definitely disapproved by the great majority of subway engineers, there were many good reasons for their adoption in London. English laws are far more drastic on the subject of property rights than are American, the custom of condemnation of private property and valuation by appraisement for the accommodation of public utilities being unheard of, and each property owner being the sole judge of the monetary value of right of way or easements. Cellars extend beyond the sidewalk lines and are protected by ordinance and custom; unlike New York City which held that house vaults (cellars extending beyond the property line) were not property, but were maintained only on a revocable license from the city. The streets are narrow, there being but three thoroughfares, even as late as 1908, 100 feet in width, while those as wide as Broadway in New York City (80 ft)

may be counted on the fingers of both hands. Such deficiency in construction area would necessitate the acquirement of private property for all station facilities, practically an impossibility. Again, London is built on what may be described as made ground, the material superposed on the underlying clay being the result of ages of deposition by adjacent waterways and possibly glacial action, forming a permeable and friable material which, under engineering practice then obtaining, seemed unsafe, unsuitable and less preferable than the clay below. However, the reason which probably formed the deciding factor was the knowledge of the immense difficulties certain to be encountered in persuading the occupants of business frontage to allow the even partial blocking of their streets, inevitable in the excavation and replacing or redisposition of gas and water mains, service conduits and sewers, to say nothing of the subway itself. No such liberty as is enjoyed by American contractors is tolerated in England. Public improvements are constructed with the minimum possible disturbance of existing conditions and the franchises granted to the present "tubes" contained provisions which practically debarred them from the use of any thoroughfare. Naturally, as such stringent regulations automatically forced the location to a lower level than would permit the use of staircases, the plan was adopted for the driving of the tunnels in the more permanent and less difficult material, at the greater depth. All spoil was handled through shafts on the river bank or points of least congestion, and the construction was completed without

traffic interference, or indeed, on the part of the average householders, any knowledge of its prosecution.

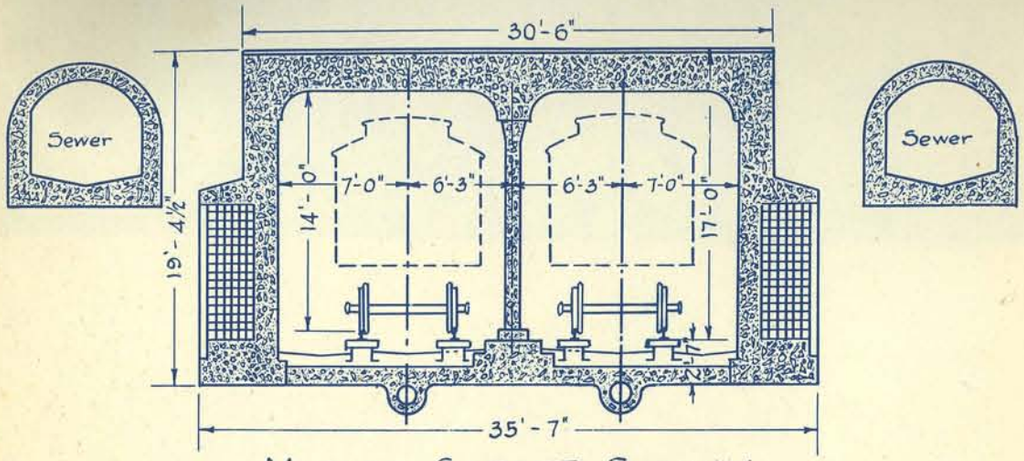
Buda Pesth was the first city to adopt the shallow subway section, a line being constructed from the center of the city to public gardens several miles distant in the center of a broad thoroughfare, with such distinct saving in construction expense that its example has been followed in practically all similar work since that time. Boston was the first American city to construct such transit facilities, demonstrating the fact that cut and cover work, even in soft and permeable soils can be sufcessfully carried on even in sections as congested as the London streets. Paris has built extensive subway lines of this type, Philadelphia a few miles of a proposed comprehensive sub-surface system, while Berlin, Hamburg and other European cities possess similar lines of moderate mileage. New York City, beginning in 1900, constructed approximately 73 track miles of shallow type rapid transit road, combining both subway and elevated forms of construction, and is now, under the present plan and in connection with the operating companies, expending $330,000,000.00 additional in the building of 260 additional miles of track. This, when complete, will have a capacity of three billion passengers per annum, or, expressed in another way, the ability to transport ten million passengers from the residence section to the community center and back again in a single day, affording practically everyone a seat. The mileage of the completed system will exceed the combined rapid transit mileage of all other

cities in the world, and is unique in being the only installation to combine express service with local traffic, a feature which has proved to be the deciding factor in its financial success.

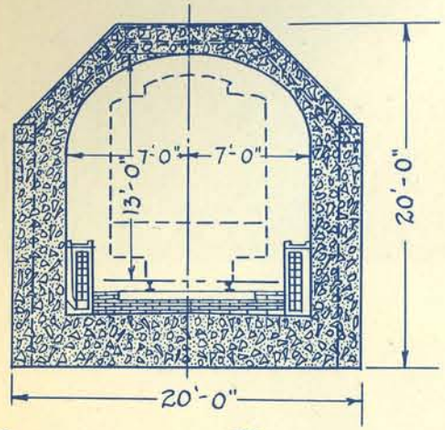
STRUCTURE:

The character of the section developed for the use of subways in different cities has naturally varied according to the sizes of rolling stock proposed to be employed, the topographical features encountered, and the plans of the designer. Plate # 5 shows typical sections employed in the several localities. It will be readily seen that arch construction, while probably affording better ventilation, is not possible in restricted rights of way or under narrow streets, being objectionable on account of the massive abutment walls required and the necessarily added distance from street to platform. The arched roof is applicable to tunnel construction, or in certain locations affording unlimited head room, and in such cases is more economical, on account of the saving in reinforcement, the quantities of excavation and lining being practically identical. The circular section is, of course, only applicable in the case of extraordinary hydrostatic pressures, such as are met with in underground river crossings in permeable soils. The flat or nearly flat roofed structure, reinforced sufficiently to withstand the expected loads, insures the least possible distance from street to platform level, reduces the construction quantities to the minimum, and affords the maximum of convenience.

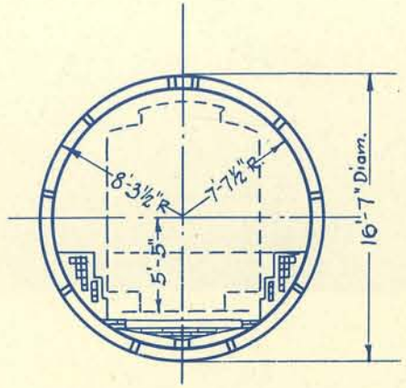
Live loads that may be imposed on a subway roof are of



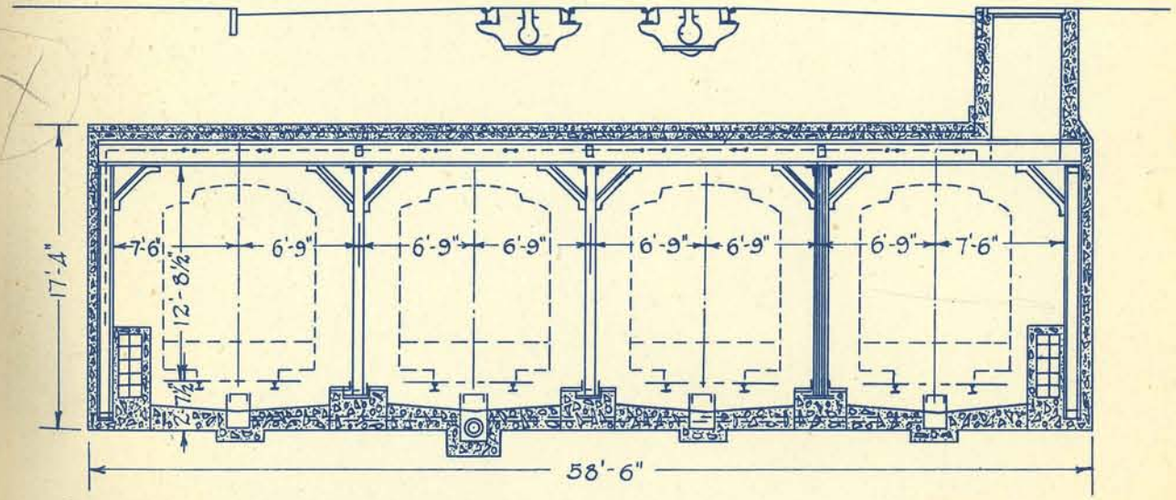
MARKET STREET SUBWAY
PHILADELPHIA, PA.



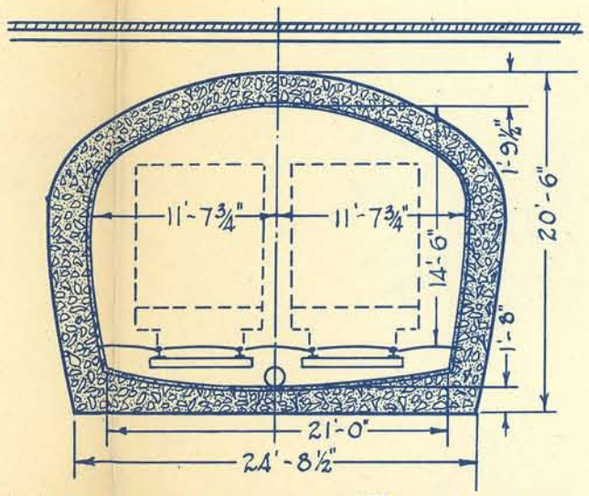
CONCRETE TUNNEL
HUDSON & MANHATTAN
NEW YORK.



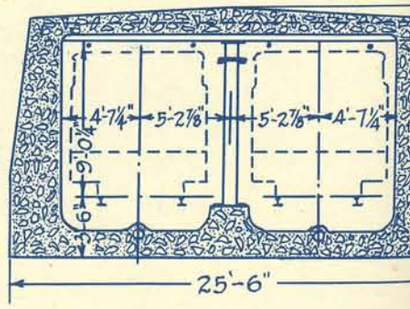
IRON TUNNEL
RAILROAD



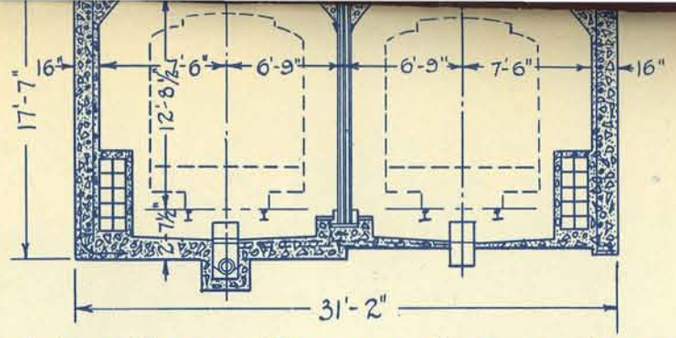
NEW YORK RAPID TRANSIT, SUBWAY SYSTEM.
TYPICAL 4 TRACK SECTION ABOVE WATER
CONTRACT No. 1.



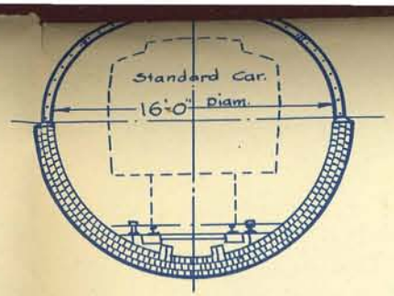
METROPOLITAN RAILWAY.
OF PARIS
FRANCE.



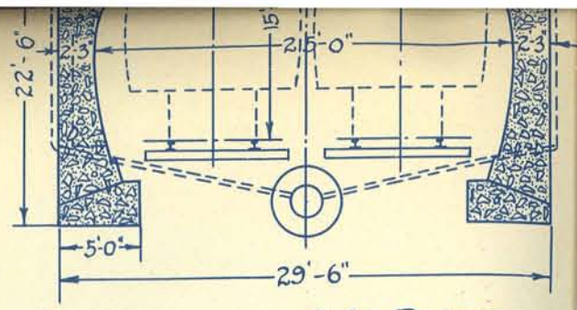
BUDA-PEST SUBW
BUDA-PEST
AUSTRIA.



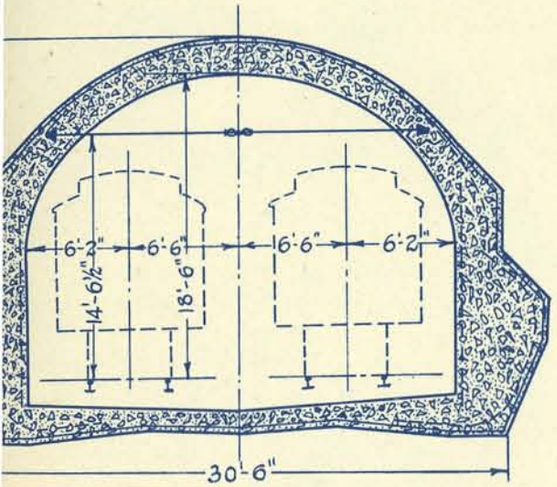
NEW YORK RAPID TRANSIT SUBWAY SYSTEM.
TYPICAL 2 TRACK SECTION – LEXINGTON AVE.



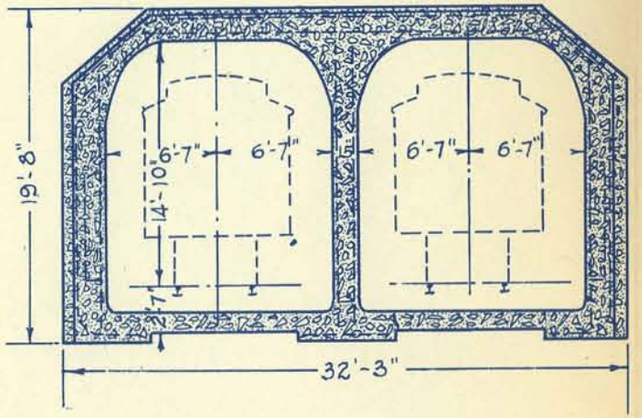
GREAT NORTHERN & CITY RAILWAY.
LONDON, ENGLAND.



METROPOLITAN & DISTRICT
RAILWAY OF LONDON.

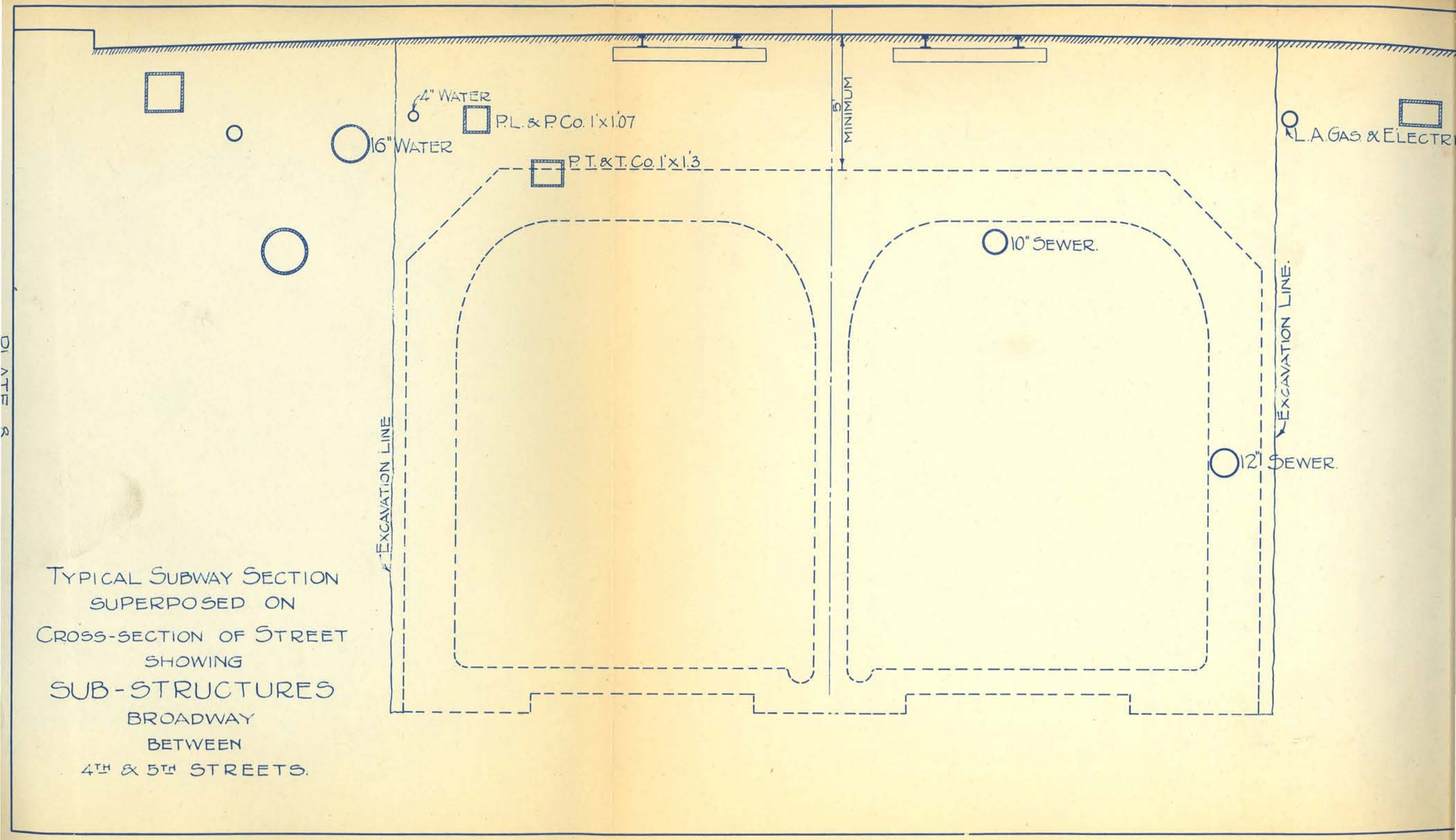


BOSTON SUBWAY.
WASHINGTON ST. TUNNEL.



BOSTON SUBWAY
CAMBRIDGE CONNECTION NEAR BRIDGE.

TYPICAL CROSS SECTIONS OF AMERICAN AND EUROPEA SUBWAYS



TYPICAL SUBWAY SECTION
SUPERPOSED ON
CROSS-SECTION OF STREET
SHOWING
SUB-STRUCTURES
BROADWAY
BETWEEN
4TH & 5TH STREETS.

PLATE 8

three kinds; rolling loads of heavy vehicles such as trucks or surface cars; the shocks due to falling walls as the result of fires; and piles of building or other materials. The depth of cover, from the street surface to the top of the roof, must be sufficient to distribute the concentrated loads over a wide enough area to make the effect upon the roof construction of the least possible intensity. It is also obvious that there will be a greater loading at the sides of streets than at the center, which must be kept open for traffic. Such loads may be assumed as follows:

	Center of street.	Side of street.
	Pounds per square foot.	
Heavily congested district	750	900
Medium congested district	500	650

It should be remembered, however, that the area of congestion in a new, or comparatively new, city, is subject to change unless absolutely restricted, so that maximum loads should be assumed in practically all such cases. Total roof loads naturally consist of live loads, plus the weight of cover, generally assumed to be 100 lbs per cubic foot.

Roof construction, as may be seen in the sketches of the Buda Pesth and first New York subways (See Plate #5) originally consisted in the superposing of steel beams transversely across the line of track, the end and central supports being built up columns

of standard angles and intermediate plates. Wall columns and roof beams were surrounded by poured concrete, such beams being stiffened laterally by short jack arches. Central columns or supports between tracks, were in some cases left exposed, but the more recent practice is to surround them with concrete to prevent corrosion. Modern subway plans call for reinforced concrete roofs, altho' structural members are used for girders in all conditions of heavy stress. The thickness of the roof naturally varies with the amount of cover. New York plans specified 18½ inches for 5 feet of cover, increasing to 21½ inches with a 10 foot depth. In the design of such roofs, from 500 to 600 lbs. per square inch is allowed in compression on the concrete, and 12,000 lbs. per square inch tension on the steel.

Walls are built according to the space available, the amount of cover, and the probable strains to be expected. Structural members are used in thin walls to make up any deficiency in strength of section, but the ordinary wall, where there is no lack of room, is the usual reinforced type, calculated to withstand the thrust of the earth backing, and, possibly, eccentric strains from contiguous future excavations for foundations or sewers. New York subway walls were made from 14 to 16 inches thick, increasing where deemed necessary. Inverts are built flat, or nearly so, of a thickness varying with the underlying material, heavily reinforced where the gradient carries the structure below ground water level and introduces hydrostatic pressures. I beams were used in the heavy ground encountered in New York, the beams extending from column to column,

and encased in 15 inches of concrete, instead of the usual 8 inch floor.

The following table illustrates the comparative cost of the two methods of construction, by giving the quantities of the principal items in a typical section with the same amount of cover.

TABLE #5.

	Beam Construction.			Reinforced concrete.		
	2 tracks	3 tracks	4 tracks	2 tracks	3 tracks	4 tracks
Excavation, Cu. Yd.	22.2	32.0	41.7	22.8	32.5	42.3
Concrete, Cu. Yd.	5.7	7.7	9.6	6.3	8.3	10.2
Steel, Tons (2000#)	0.38	0.56	0.74	0.74	0.46	0.62

The reinforced concrete method calls for a trifle more concrete but less metal, and the metal used costs less per pound.

WATERPROOFING:

Wherever the subway gradient drops below ground water level, means must be taken to render the structure impervious to moisture, or as nearly so as is humanly possible. Damp walls naturally increase the humidity and add to ventilation difficulties, besides providing ideal conditions for various species of foul smelling fungus growth, difficult to eradicate. Accepted practice, under ordinary conditions, consists of building into the invert, walls and

roof a continuous course of asphalted felt and asphalt. The former is generally the ordinary roofing felt paper, weighing 12 to 15 lbs. per square; while the asphalt is much purer than the usual commercial grade, and is mixed with either a flux of petroleum residuum or with powdered limestone or sand in the case of low or high temperatures in order to maintain the proper degree of fluidity.

As generally applied, a bed of concrete half the calculated invert thickness is laid in the bottom of the excavation, upon which a layer of hot asphalt is spread. While still hot, a layer of felt is placed, followed by alternate thicknesses of asphalt and paper to the extent required by the conditions obtaining. On top of the last course is laid the upper half of the subway floor. To waterproof the walls the same course if carried upward. A half wall of rough concrete, or hollow tile set vertically to serve as drain, is constructed, and the combination of paper and asphalt is carried to the roof line. The roof, or cover, is finished in the same manner, the waterproofing being applied after the roof concrete has thoroughly set, the final result being that a continuous envelope of waterproofing material surrounds the entire structure. In order to protect the roof waterproofing from damage by subsequent street excavation, a layer of concrete 3 to 4 inches thick is usually spread over it.

This method of keeping a subway dry has been demonstrated to be entirely satisfactory under moderate hydrostatic pressure. Where higher pressures are encountered, porous bricks are used,

being dipped in liquid asphalt and then laid inntwo or more layers, with broken joints. After laying, hot asphalt is poured over them, filling all spaces.

STATIONS: (~~See Plate #6~~)

The basis for the design of all stations serving subway traffic is the location of all platforms as close to the surface of the street as is possible, so as to give the minimum height of staircase from platform to sidewalk and avoid the use of mechanical means of ascent and descent. Subways with three, four or more tracks, used for express as well as local service, are necessarily obliged to depress the rail level at stations in order that overhead passageways may be constructed to the island, or intermediate platforms. Sub-passages below the tracks are rarely used and are seldom practicable, though the chief objection lies in the added length of stairway climb. The amount of earth covering, or distances from the top of the roof to the street surface, necessarily regulated by the design of the structure; the roof thickness, and the overall dimensions of the standard equipment are the controlling factors in fixing stairway heights. In a subway diversion of surface cars, through a business district, such as might be planned for Los Angeles, if the minimum cover be taken at five feet, this height would approximate 20 feet at the shallowest points, increasing wherever drainage crossings, etc., rendered a change of grade expedient. The cover on the New York subway averaged 6 feet, making the shallowest distance from sidewalk to top of rail, 17 feet.

Subway stations are simply sectional enlargements whose width varies with the number of tracks. Cast iron, built-up, or reinforced concrete columns, set back a sufficient distance from the platform edge, carry the necessary roof beams. Platforms are of such length and width as may be required to carry expected traffic, the edges projecting nearly to the line of car clearance. Eastern subways platforms intended for local traffic average 200 feet in length, the central 100 feet being 20 feet wide, narrowed to 10 feet at either end. Stairways for ingress and egress are usually five feet wide, leading from the sidewalks to the platform center. Stairway entrances are protected by Kiosks, constructed of steel and wire glass. The stairway treads are usually built of reinforced concrete, properly supported, any open sides being protected by wrought iron grills.

PERMANENT WAY:

Permanent way, on sub-surface trackage differs but little from ordinary street railway construction, with the exception that no paving is required. Ties and rock ballast are generally employed, although Philadelphia has adopted the plan of eliminating both, securing the rails to concrete blocks spaced at regular intervals, claiming that such construction prevents rail corrugation and its attendant noise. The general practice, however, is to use untreated ties, the odor arising from creosoted timber being objectionable in such confined quarters, with sufficient ballast to afford good bedding and a certain amount of elasticity. Drainage

is taken care of in the construction of the invert, All water being led to sumps provided with automatic ejectors connected with contiguous sewers. Special work at grade crossings, in the case of surface car diversion, is of course, identical with original surface layouts.

VENTILATION:

One of the most important factors in the successful operation of any sub-surface means of transit is the provision of adequate and satisfactory methods of ventilation. In a long or extensive system that is a prime consideration. In a simple diversion of surface cars it is probable that sufficient, or nearly sufficient ventilation will be accomplished by natural means; but any structural design should embody provisions for an abundant supply of outside air in order to offset the effect of possible future extensions.

All subways grow warm with age. The temperature is normal for the first few months, or even longer, depending on the service; but in time the walls and surrounding material become saturated with the heat generated by the consumption of electrical energy. It is evident that such heat must either pass through the walls and their backing, or else escape with the air. A structure on first use will be able to absorb any heat which is not carried away through ventilating passages; and, if surrounded with wet or moist material the conductivity will be considerable. If the backing be dry, however, and the ventilation insufficient, the heat will gradually accumulate, only partially relieved by any change in outside temperature

and uncomfortable riding conditions will result. In this connection, the importance of proper waterproofing will be readily seen. Any moisture penetrating walls, roof or invert is transformed into aqueous vapor, creating extraordinary conditions of humidity, and making for the discomfort of occupants of cars.

Increase of temperature, however, does not necessarily imply vitiation of atmosphere. The increase in the percentage of carbon dioxide (carbonic acid gas) in warm subway air is relatively small and not to be compared with conditions commonly obtaining in schools, theaters and other public places. Analysis made under the direction of the Boston Transit Commission showed as follows:

	Parts in 10,000 volumes.	
Boylston street station 5 ft. above platform	9.45	Samples taken between 5 and 5;30 P. M. on January week day.
Track between stations	6.54	
Park street station 5 ft. above platform	7.78	
Adams sq. station	6.62	
Haymarket station	9.13	
On street in central part of the city	4.5 to 5.9	Made at same time.
In center of car about to enter subway	24.97	Car contained 65 passengers Forward ventilator closed Rear ventilator open.
City Council chamber, 2/3 full	10.12 to 14.6 - Floor. 13.22 to 18.6 - Gallery.	

	Parts in 10,000 volumes.
Public Hall, near open door with in-draught	13.93
Public Hall, well filled	32.59 - Floor 36.43 - Gallery
Four theaters	16.16 to 48.7
Two churches	12.45 to 18.2
Twelve schools	7.1 to 23.5

In this connection, it may be remarked that people remain several hours in the rooms referred to, while a passenger ordinarily remains in a subway but a few minutes.

Possibly the most thorough investigation ever made of subway ventilation was undertaken by the officials of the New York subway, occasioned by complaints of patrons and unfavorable comment by the press. Heat became noticeable after five months service and caused a popular belief that the air was vitiated. The highest professional talent was engaged and a comprehensive program arranged, involving study of prevailing conditions in both America and Europe. Five thousand determinations were made of temperature and humidity, two thousand samples of air analysed for carbon dioxide, and 3,000 bacteriological examinations undertaken. Microscopic examinations were made of the atmospheric dust and studies effected of the force and direction of air currents set up by moving trains, the utility of fans and blowers, the results of cleaning processes, the efficiency of chemical disinfectants, and the longevity of bacteria under sub-

surface conditions.

The results of the investigation were, briefly, as follows: Temperature studies showed conclusively that the degree of heat within the structure, as compared with the outside air, was greatly exaggerated, the average difference being only four or five degrees Fahrenheit. The greatest difference was 15 degrees Fahrenheit, occurring during a sudden cold snap in November . Outside thermometers at this time showed an average reading of 50 degrees Fahrenheit, making the subway temperature the very comfortable figure of 65 degrees Fahrenheit. The heat was found to emanate almost entirely from the electrical equipment, the amount of bodily heat from passengers being negligible. The most objectionable feature of the heat was less the actual elevation of the temperature than the fact that the subway remained warm continually while the streets, during the summer nights, became relatively cool. It was at such times that the greatest inconvenience was experienced. In winter the heat given off was advantageous, since if low temperatures occurred, they would, with strong drafts, render riding conditions uncomfortable. During the hottest week of such investigation the street temperature averaged 78 degrees and two tenths, while subway temperature averaged 83.4 degrees, Fahrenheit. The relative humidity was slight, the actual weight of aqueous vapor being practically identical in subway and outside air. When the temperature was higher in the subway than in the street, the humidity was more noticeable within the structure, and vice versa.

Chemical analyses showed that the air was not deficient in oxygen and that carbon dioxide from the lungs of passengers was not present to an objectionable extent. The highest amount of CO_2 found was 8.89 parts per 10,000, the average being 4.81, while the average for street air was 3.67.

Bacterial analyses showed only one half as many bacteria in the subway as were present in the outside air.

The impurity most noticeable in microscopic examinations of the air was iron dust, caused by the wear of metallic surfaces, principally brake-shoes. Investigation developed the fact that the consumption of the latter amounted to one ton per month. This dust is found in all subways and the amount contained in the New York subway air was practically equal to that contained in the Paris subway air. Examinations of employes did not show that it caused any ill-health effects, though the time occupied in the investigation was not of sufficient length to render this conclusive.

It was found that the principal causes of the local subway odor were the oil drip and consumption of lubricants by hot wearing surfaces. A large number of disinfecting machines were installed at the inception of subway service, but were soon discontinued, as the results were found to be more objectionable than the conditions they were intended to correct. Washing down of stairways and platforms was also found to be the reverse of beneficial, the cooling effect of evaporation being negligible and the escaping water vapor adding to the humidity.

Actual ventilation was demonstrated to be principally accomplished by the action of trains upon the atmosphere, the latter moving freely through sufficiently large openings to the outside air. For a given volume of air space in any section it was found that a certain calculated area of opening was necessary; and that success in subway ventilation lay in arranging openings to the outside air so that they should be of proper area and location. Experience with conditions encountered in New York showed that, beside the amount of ventilation which took place in this way, the exchange of air which could be produced by means of mechanical blowing devices was immaterial.

In connection with the subject, it may be of interest to note that the average temperature in the London "Tubes" is 68 degrees Fahrenheit. Ventilators are provided wherever possible; and, in order to prevent any accumulation of carbon dioxide, the station doors are closed each night and approximately all air is exhausted, the process continuing until an amount equal in volume to three times the cubic contents of the tubes has passed the pumps.

SUBSTRUCTURES:

As may well be imagined, the problem of the disposal, temporary removal, or rearrangement of underground structures, contributes one of the most important items of the expense incurred in subway construction. The tangle of gas, water, steam and cold storage pipes, the various conduits carrying the wires of the

sanitary and storm sewers, occupy a large portion of the street area and form serious obstacles in the case of narrow thoroughfares. An additional difficulty lies in the fact that few cities possess accurate records of the structures underlying street surfaces, the necessity for such records not becoming apparent until proposed subway or similar underground construction renders the acquisition of such information imperative in order to estimate the probable cost. So called underground surveys are usually taken up at an advanced point in the City's maturity and all possible data collated from the available private company records. The result, however, is far from satisfactory, and a liberal allowance must be added to any preliminary estimate to cover the handling of unforseen contingencies. Generally speaking, the most serious limitation to rapidity of subway construction is the time required to readjust sub-surface structures.

As practically all these pipes and conduits are laid at an comparatively shallow depth, the simplest solution of such difficulties would seem to be the lowering of the gradient to a point so that the subway roof could be built below their level. This, however, would practically nullify the object attempted, namely; to construct transportation facilities at the minimum depth below the surface. Each foot of extra depth means just that much extra climb from delivery platform to the surface, besides materially adding to the quantity of excavation, thus increasing cost and decreasing conven-

ience. This is especially true in the case of a sub-surface trolley car diversion, as the necessary head room, or distance from top of rail to roof, must be, through equipment requirements, considerably in excess of a subway built for specially constructed cars. Thus, the New York and Philadelphia subways are operated with from 12' 8" to 14 feet of head room, power being obtained through a third rail, allowing the construction of passenger platforms at easy walking distance from the sidewalk level. An overhead trolley car, however, of the type generally operated in Los Angeles, measures 14' 5" from the top of rail to the top of the hooked, or unused trolley, necessitating a clearance of not less than 16 feet from trolley wire to rail for successful operation. If the minimum cover, say 5 ft, and 1½ ft of roof thickness be added, the vertical height of stairway from platform to street would be not less than 20 feet at any point.

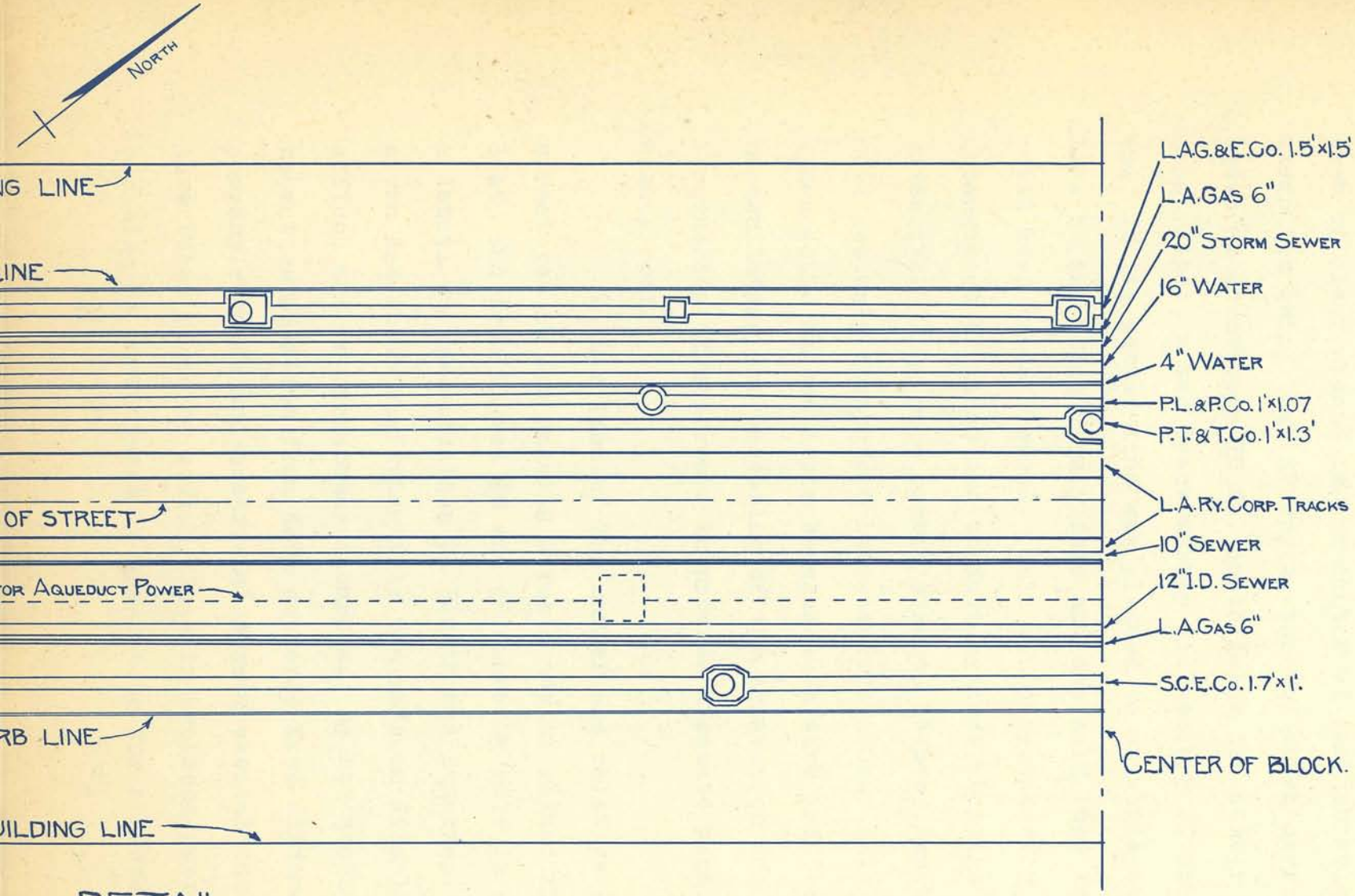
An additional objection to the lowering of a subway structure lies in its interference with drainage problems. While service conduits, gas and water pipes, may follow the natural gradient, sewer grades are practically fixed within certain limits by the topographical conditions. Reconstruction to suit subway convenience may entirely derange a well formulated civic plan; and, if the grade be slight, prove impossible. It is, however, entirely practicable to construct sewers of a limited size as an integral part of the subway walls, and such procedure has been followed in both New York and Boston. When drainage must be passed across the

line of subway and the clearance from roof to street surface is insufficient, the points of crossing are made as few as possible by constructing intercepting sewers on the upper side and conducting the drainage to a few chosen points. Manholes are built at such points, leading to chambers connected with pipes passing beneath the subway floor. In general, all longitudinal sewers along the line of subway are made as small as possible, being relieved of their contents at crossings by lateral drains. As an example of what sewer reconstruction may amount to, it may be interesting to note that in fourteen miles of cut and cover work on the New York subway, 17 miles of sewers, ranging in size from 15 feet to six inches, were entirely rebuilt.

Gas and water mains are easily handled and replaced. As they are seldom of large diameter, it is usually possible to carry or cross them above the subway roof level, either in their original form or by dividing them, in the case of a shallow crossing, into a number of smaller pipes whose aggregate capacity equals the required flow. Some cities specify that no water or gas mains shall be carried beneath the subway floor, although the plans for the New Philadelphia improvements provide for a pipe gallery directly beneath the tracks, large enough to carry a number of large diameter mains. During construction, especially in narrow streets, where it is not possible to replace them between the curb and subway wall, it is customary to suspend all mains on trestles at the side, thus maintaining temporary service. It is generally deemed unsafe to

permit the maintenance of gas mains beneath the wooden roof, or temporary street surface used during construction, as accidental breakage, injury or leakage might cause a severe explosion, heavy construction damage and serious loss of life. Service conduits containing the cables of different utility companies are not difficult to deal with, being either moved bodily to their new location, the cables being cut and respliced, or else supported temporarily above structural lines until subway completion, the cables being then drawn through ducts built in the subway walls. Steam pipes supplying live steam at high pressure from a central plant, are probably the most dangerous of all substructures to readjust, as a break would fill the excavated section beneath the temporary roof and result in the fatal injury of all those in the immediate vicinity.

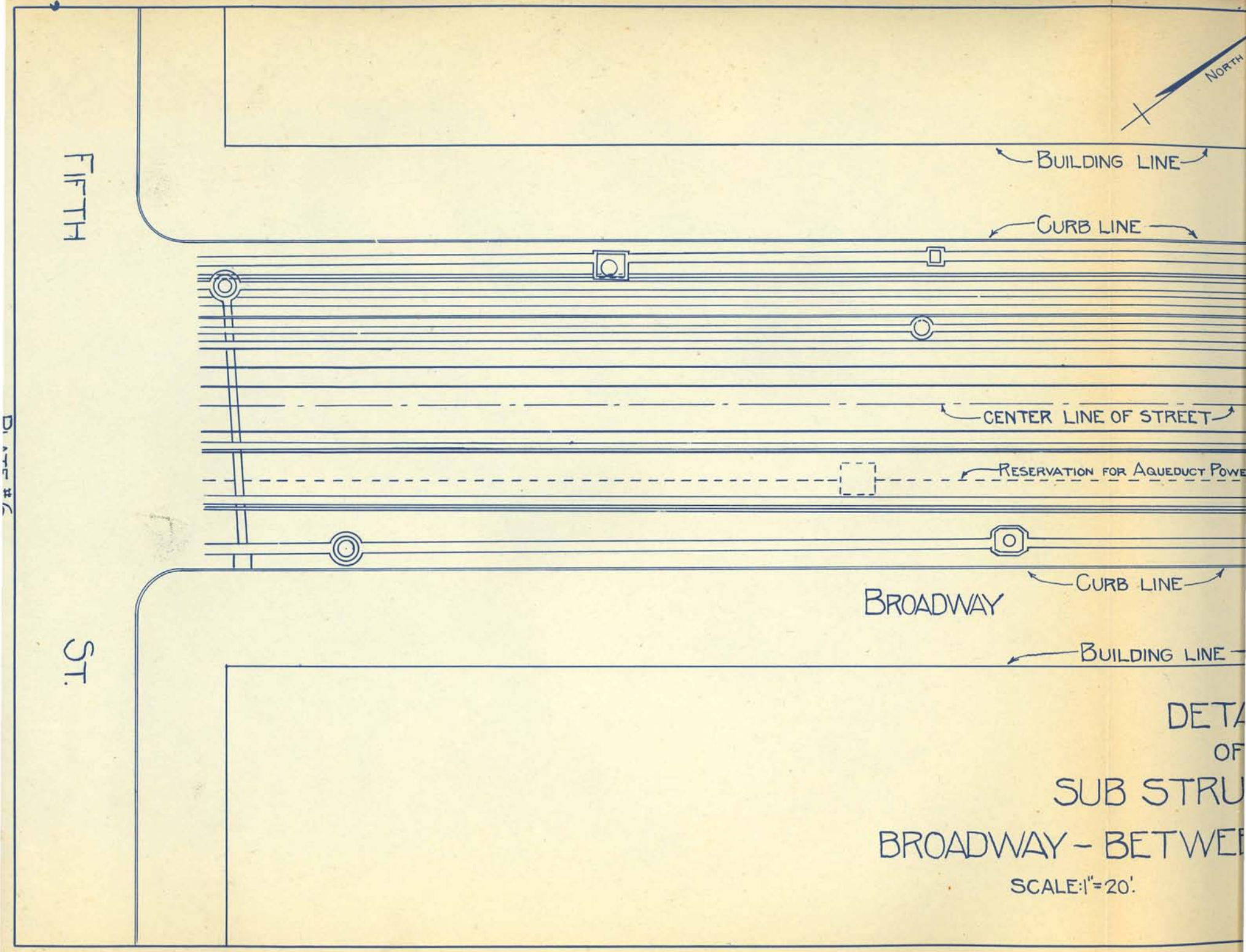
The streets of the business district of Los Angeles, on account of its relatively smaller population and comparatively recent growth, do not begin to be as thickly underlaid with subsurface structures as the streets of the older municipalities previously mentioned; yet, taking into consideration their lesser width, (Broadway, New York City, is 80 feet and Broadway Los Angeles is 56 feet between curbs), the percentage of occupied area is practically the same. A state law enacted for the protection of workmen provides that no excavation for the installation of subsurface utility conduits or manholes shall approach more closely than two feet from the outer edge of the outer rail of the street



DETAIL
OF
B STRUCTURES
BETWEEN 4TH AND 5TH STS.

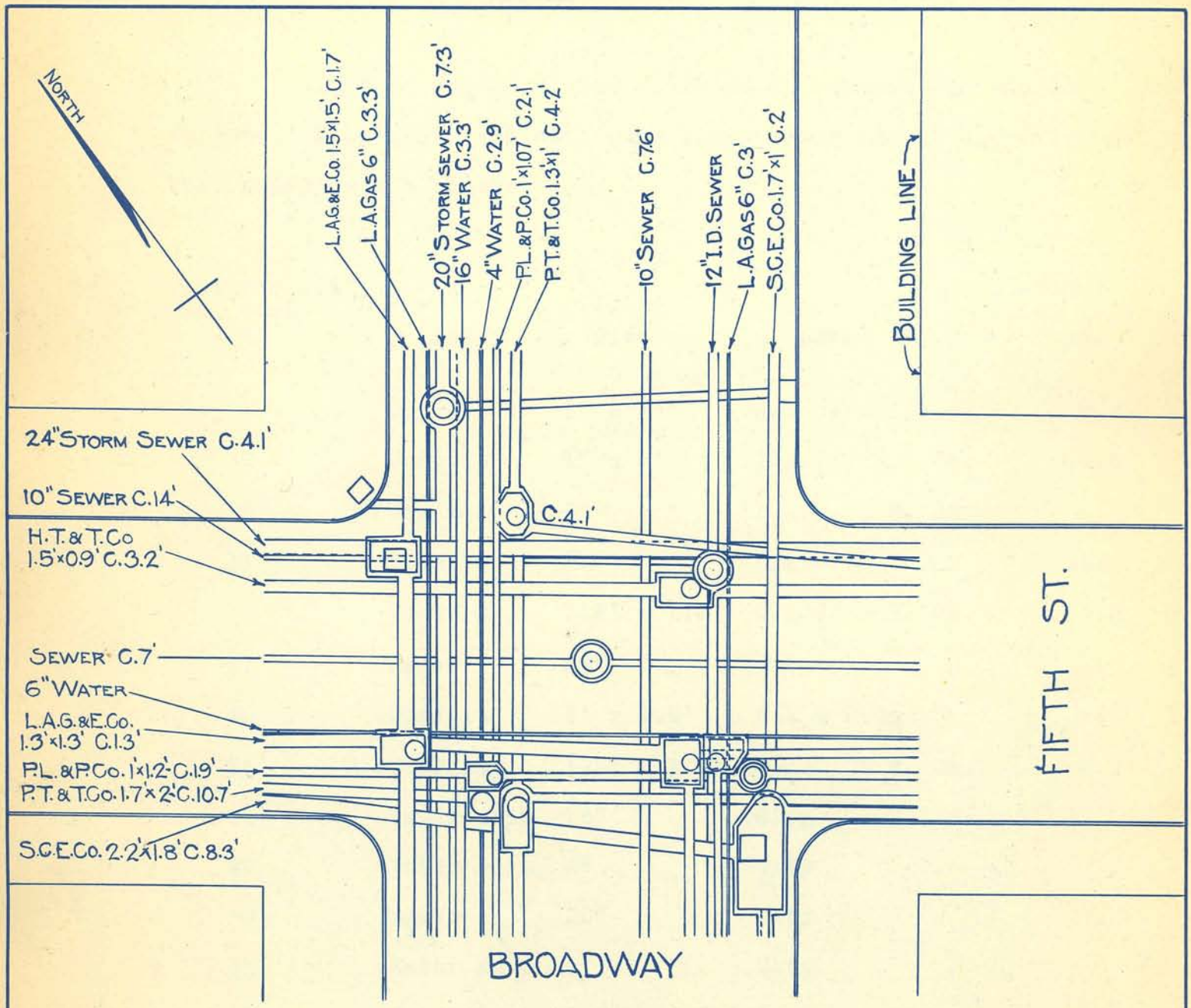
20'.

OCT. 19, 1915.


NORTH
BUILDING LINE
CURB LINE
FIFTH
CENTER LINE OF STREET
RESERVATION FOR AQUEDUCT POWE
CURB LINE
BROADWAY
BUILDING LINE
ST.
DETA
OF
SUB STRU
BROADWAY - BETWEE
SCALE: 1" = 20'.

car track, which has resulted in the preservation of practically 19 feet of clear ground in the center of each thoroughfare, the only exception being that of Spring street, which carries a 12" sanitary sewer at an average 10 ft. depth below the center line. As usually constructed, a two track subway will occupy 30 feet of street width; and, if its center line was planned to coincide with the center line of the street, only five and one half ($5\frac{1}{2}$) feet on either side would need to be cleared. This would necessarily involve some re-arrangement of pipes and conduit systems, but the cost would not be excessive. In a more narrow street, however, such as Fourth, which measures only forty feet between curb lines, only five (5) feet of space would be available between such curb and the subway wall, necessitating the deepening of the excavation and consequent lengthening of stairways to provide adequate pipe room above the subway roof.

A fair idea of the number and relative location of sub-structures in Los Angeles streets may be gained from the following list, and from Plates #8 and #9, showing same in plan, together with a detail of the situation at Fourth and Broadway. The information given and shown was taken from the maps on file in the City Engineer's office, and is presumably accurate. As the maps, however, are of recent compilation from data gathered from different utility company records and occasional street excavations, it is possible that other pipes or sewers, laid in previous years and unrecorded, may also be encountered if excavation for a subway is undertaken.



DETAIL

SHOWING PRESENT ARRANGEMENT OF SUB STRUCTURES FIFTH AND BROADWAY

C = VERTICAL DISTANCE BELOW SURFACE.

SCALE: 1" = 20'. OCT. 18, 1915.

List of substructures on Broadway between 4th and 5th streets. Distances from east curb line, beginning at approximately the center of the block:

Distance out from curb. Ft.	Kind.	Size	Owner	Distance Below surface Ft.
4	Conduit	1' x 2'	So. Cal.Ed. Co.	2.8
7	Conduit	1' x 1'	L.A.I.& C.S.Co.	4.3
8	Gas main	6"	L.A.G. & E. Co.	
11	Sewer	12"	City	15.6
14	Conduit	1.3' x 1.3'	L.A.G. & E. Co.	1.3
17	Sewer	12"	City	8.0
40	Conduit	1' x 1.5'	P L & P Co	1.8n
44	Conduit	1.5' x 1.5'	L.A.G. & E. Co.	2.3
46	Water main	16"	City	
49	Water main	4"	City	
50	Sewer	20"	City	7.0
51	Water main	6"	City	
53	Conduit	1.5' x 0.9		3.4
54	Conduit	1.5' x 0.9		3.4

In addition to these there are two tunnels carrying steam pipes crossing Broadway diagonally near Third street, and three small conduits crossing at right angles at different points.

Plate #~~10~~ 8 shows a section of the street with a typical two track subway section superposed with the top of roof five feet below the surface. This distance, or cover, will naturally be regulated by the amount of room required for the accommodation of pipes and conduits at street intersections.

A typical case, showing the difficulties occasionally encountered by subway constructors in large cities, was the situation at Fourth avenue and 23rd street, New York City, during the building of the original subway. Exclusive of sewers, there were found in Fourth avenue, north of 23rd, seventeen lines of pipe or conduit on the east, and eighteen lines on the west side of the street, with all the usual manholes, valve boxes, etc. Some of these ran through, some turned from one street to the other, but all were in service and had to be maintained. Owing to the laxity of the City officials, they were neither at a uniform level, being sometimes above and sometimes underneath adjoining mains, nor followed any given route, the constructors having crossed and recrossed the thoroughfare apparently at will to secure more convenient or economical conditions for excavation. The tangle was so complete that it was impossible to secure thorough identification until all pipes were exposed. The situation was further complicated by the fact that the subway grade had been raised to avoid a transverse sewer at 22nd street, bringing the roof to the minimum limit from the surface, such distance (30") being fixed by the depth of the tramway yokes which carry the underground trolley for surface cars. In

addition, nearly as many mains and conduits occupied space in 23rd street, and a double track surface car intersection carried, during the morning and evening rush periods, 800 cars per hour. A timber roof was erected, the ground excavated, and the pipes and conduits entirely re-laid on different planes, the crossings at the subway roof being either accomplished by pipe division, shallow box construction, or through utilization of the space between cross girders. Plates were laid on the bottom flange of such girders, the mains placed, and then solidly surrounded by concrete to the usual roof line. Another method employed was the carrying of mains far enough on either side of the proper intersection to a point where room was available to pass above the subway, then crossing and returning to a junction with the main in place.

The situation above described was not unusual, but was a fair example of the underground conditions discovered at many points in the older districts of the city.

SUBWAY COSTS

and

APPROXIMATE ESTIMATES.

While the unit costs of subway construction naturally vary with each separate enterprise, owing to differences in the size and character of the excavation and in the prices of the materials and labor used, a sufficient amount of shallow subway has been built in American cities to afford reliable data, on which estimates for similar work can be based. Absolute accuracy in such estimates is not to be expected as it is beyond any human power to foresee the various emergencies and difficulties contingent upon the driving of tunnels or the opening of heavy cuttings. A liberal percentage of the estimated cost should be added to cover any exigencies and prevent the inevitable, though often unjust, criticism attendant on requests for additional appropriations.

The size, or width, of subway; the breadth of the thoroughfares, beneath which the structure is to be built; the head room and side clearance required for the equipment intended to be used; and the number and character of sub-structures which must be moved and readjusted, are all important factors in the cost of subway construction. The larger the subway, the larger the necessary cutting and amount of construction quantities. The wider the street, the less necessity, if any, to plank over the excavation during the construction period, and the better opportunity to excavate, remove excess material and prosecute the work at all times without interference with existing traffic; and the fewer pipes, sewers or utility conduits that must be moved or relaid, the less the amount of auxiliary expenditure necessary to the successful completion of

While the unit costs of subway construction naturally vary with each separate enterprise, owing to differences in the size and character of the excavation and in the prices of the materials and labor used, a sufficient amount of shallow subway has been built in American cities to afford reliable data, on which estimates for similar work can be based. Absolute accuracy in such estimates is not to be expected as it is beyond any human power to foresee the various emergencies or difficulties contingent upon the driving of tunnels or the opening of heavy cuttings. A liberal percentage of the estimated cost should be added to cover any exigencies and prevent the inevitable, though often unjust, criticism attendant on requests for additional appropriations.

The size, or width, of subway; the breadth of the thoroughfares, beneath which the structure is to be built; the head room and side clearance required for the equipment intended to be used; and the number and character of sub-structures which must be moved and readjusted, are all important factors in the cost of subway construction. The larger the subway, the larger the necessary cutting and amount of construction quantities. The wider the street, the less necessity, if any, to plank over the excavation during the construction period, and the better opportunity to excavate, remove excess material and prosecute the work at all times without interference with existing traffic; and the fewer pipes, sewers or utility conduits that must be moved or relaid, the less the amount of auxiliary expenditure necessary to the successful completion of

Structural steel ----------	97,500 tons.
Rail steel ----------	12,600 tons.
Cast iron ----------	38,000 tons.

More recent costs achieved in subway construction in Boston show that the figures from the New York reports are not unusual. Experience in Boston seems to indicate that excavation for subways through streets carrying a fairly heavy traffic, including support of street railway trackage and the necessary trench sheeting or bracing, pumping, etc., will cost from $2.50 to $5.00 per cubic yard, possibly averaging $4.00. Concrete, including forms, but exclusive of steel or placing, has averaged $10.00 per cubic yard; and reinforcing steel, including bending, cutting and wiring in forms, has cost 2-3/4 cents per pound in place. Removal and care of gas and water pipes, utility conduits and sewers, has averaged $13.50 per lineal foot of trench for all subways. Such cost has, of course, been many times exceeded in the more narrow and congested streets, where the tangle of substructures presented as many complications as certain portions of New York, but the more orderly arrangement of the wider and more modern thoroughfares reduced the unit cost in proportion to the number and length of the latter.

Underpinning buildings along the route wherever the subway structure penetrated within property lines, has been most expensive, but such cost is difficult to reduce to a unit basis, on account of divergent conditions in nearly every case. The following examples will serve to give an approximate idea of such work.

Case #1 - Four story brick building, foundation 21 feet deep, underpinned along frontage only - $122.00 per lineal foot.

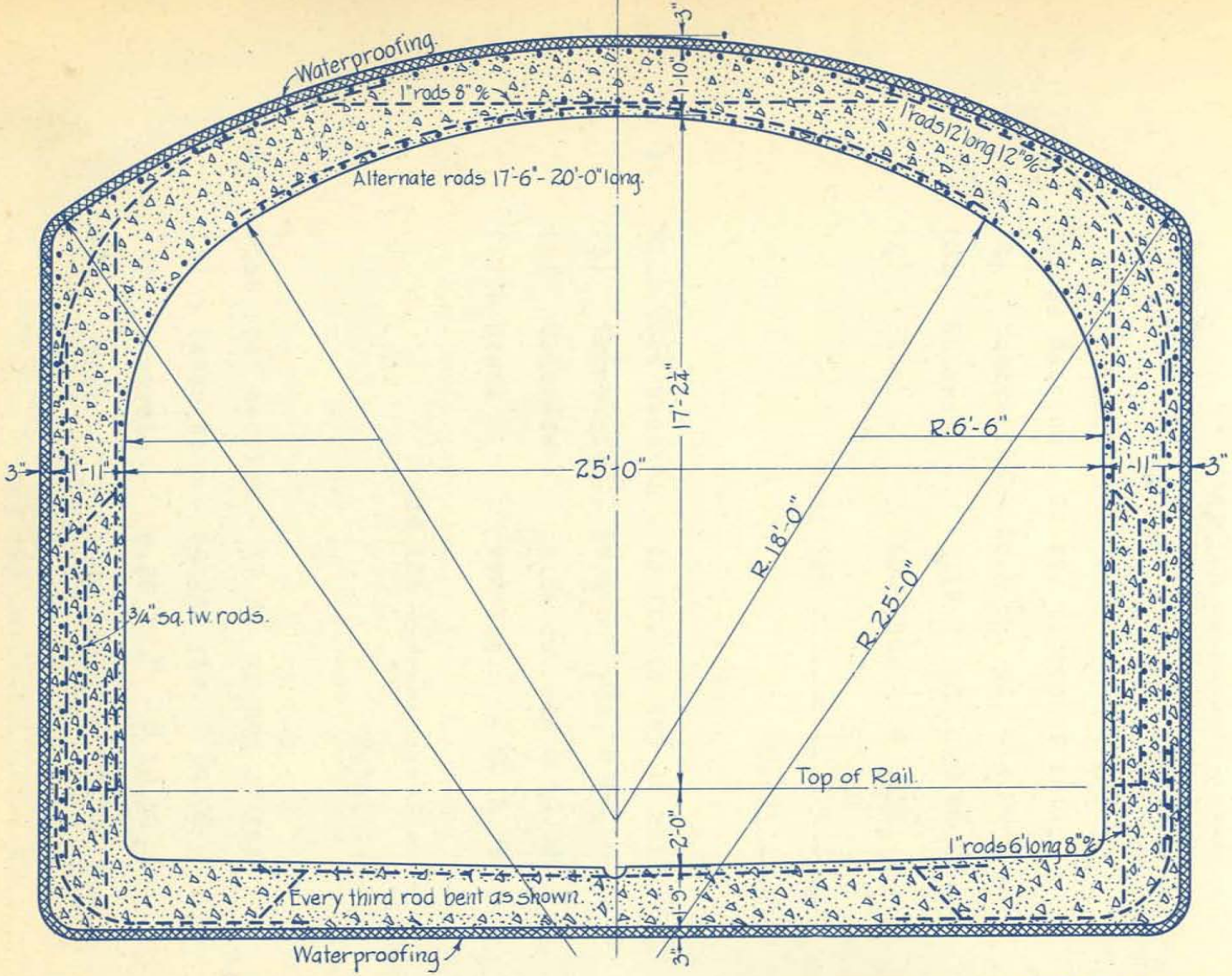
Case #2 - Four story brick building, foundation 11 ft. 6 in. deep, underpinned along frontage only-$120.00 per lineal foot.

Case #3 - Seven story brick building - stone front, foundation 20 feet deep, underpinned along frontage and part of side - $153.00 per lineal foot.

From the costs tabulated for the underpinning of all buildings since the commencement of subway work, it is now estimated that a six story brick building will cost $150.00 per lineal foot, and a two story brick building $90.00 for each lineal foot of underpinning under ordinary conditions.

The following tabulation of unit costs has been taken from the Boston bid streets of 1913, and shows the average prices which obtain for sub-surface work under favorable circumstances. The material to be excavated was a firm clay, with occasional sand pockets. All cement and reinforcing steel was furnished by the city, but was hauled by the contractor. Haul of excavated material averaged one mile, being dumped into scows and carried out to sea. The prices quoted, of course, include contractor's profit:-

1.	Earth excavation	open cut	Cu. Yd.	$4.00
2.	Earth excavation	tunnel	Cu. Yd.	4.75
3.	Concrete (Incl. forms)	Open cut	Cu. Yd.	10.00
4.	Concrete (Incl. forms)	Tunnel	Cu. Yd.	11.00
5.	Brick masonry	Tunnel	Cu. Yd.	17.00
6.	Placing steel (Bending, etc.)		Ton	15.00



DOUBLE TRACK CONSTRUCTION

ARCHED ROOF SECTION

BOSTON SUBWAY

SCALE ¼" = 1'

PLATE 14

	Brought forward ---	$219.60
	Add 15% ----------	32.94
	Total ----	$252.54

2. Arched Section - 27 ft. to top of rail,

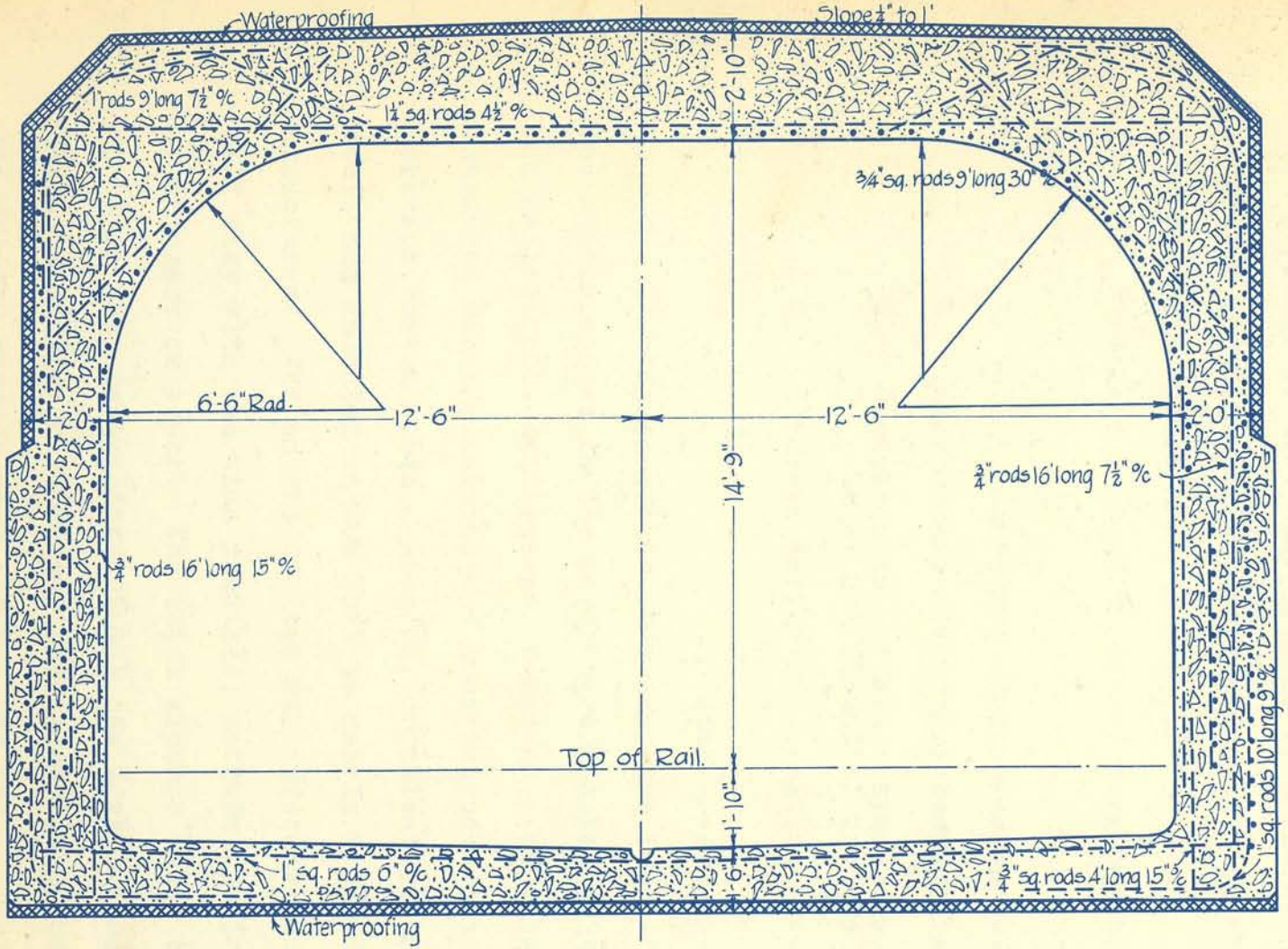
(A)	Excavation - 35.6 cu. yd. @ 4.00 ---	143.00
(B)	Concrete - 8.19 " " @10.00 ----	81.90
(C)	Steel - 850 lbs. @ 2.75 ----	23.35
		$248.25
	Add 15% ----------	37.24
	Total ----	$285.49

3. Flat roof section - 21 ft. to top of rail,

(A)	Excavation - 27.4 cu. yds. @ $4.00 --	109.50
(B)	Concrete - 8.36 cu. yds @ 10.00 --	83.60
(C)	Steel - 990 lbs. @ 2.75 --	27.20
		$220.30
	Add 15% ----------	33.04
	Total -----	$253.34

4. Flat roof section - 27 ft. to top of rail,

(A)	Excavation - 34 Cu. yds. @ $4.00 ----	136.00
(B)	Concrete - 8.36 " " @ 10.00 ----	83.60
(C)	Steel - 1075 Lbs. @ 2.75 ----	29.60
		$249.20
	Add 15% ----------	37.80
	Total -----	$286.58



DOUBLE TRACK CONSTRUCTION

FLAT ROOF SECTION

BOSTON SUBWAY

SCALE ¼" = 1'

PLATE 15.

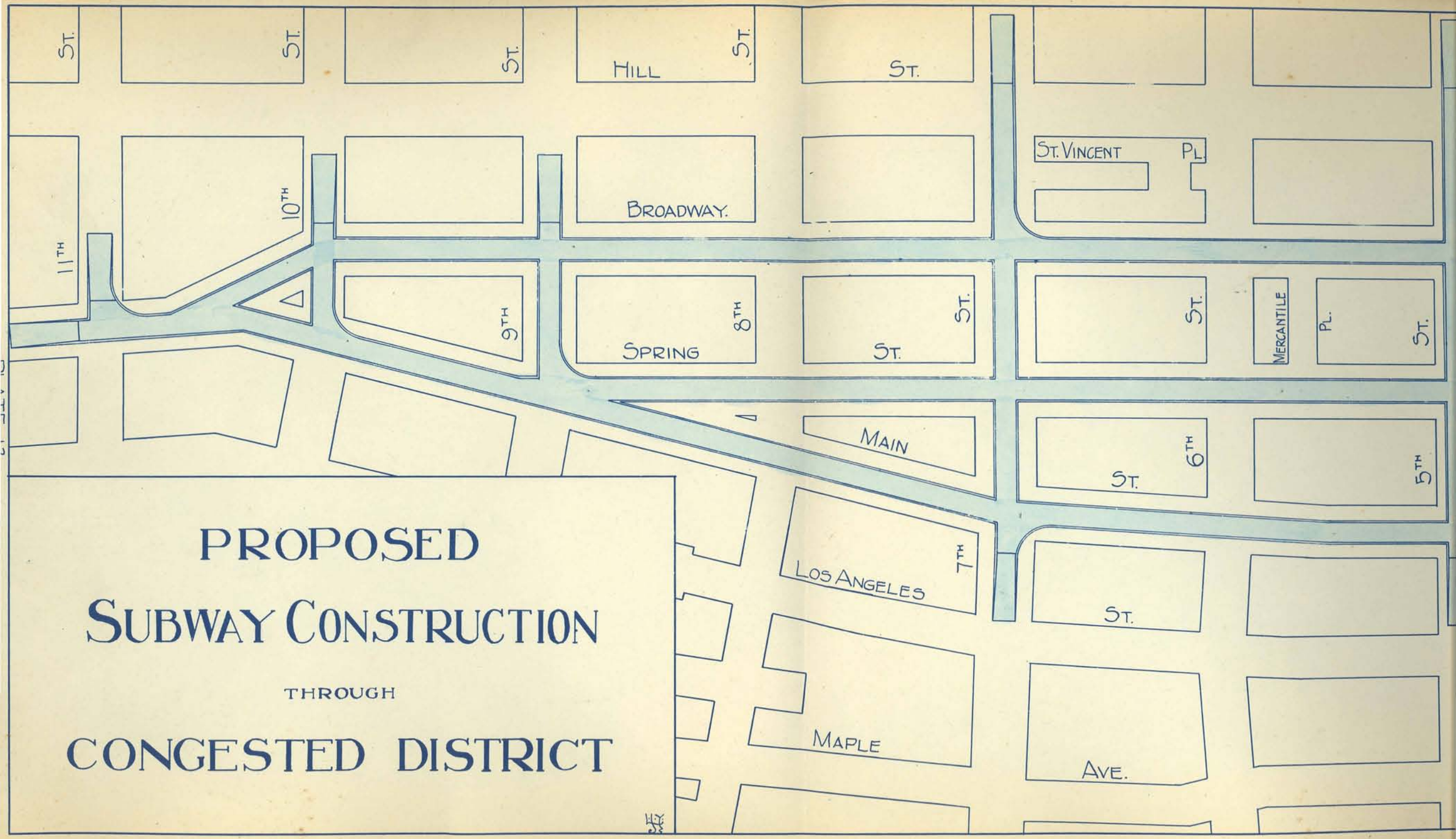
In addition, from $12.00 to $15.00 per lineal foot has been expended for the readjustment of substructures, and an average of $19.00 per foot for water-proofing and the placing of concrete over the water-proofing.

Overhead charges on subway work may be assumed as follows:

1.	Incidentals and contingencies ------	10%
2.	Engineering and superintendence ----	10%
3.	Organization and administraction, legal and financial expense ---	3%
4.	Interest during construction -------	7%
	Total ----------	30%

Taking each item in order, the 10% assumed for incidentals and contingencies is the percentage adopted by the New York Boston and Philadelphia commissions, based on past experience. The 10% estimated for engineering and superintendence is a mean of New York and Boston costs. Item #3, organization and administration, etc., has amounted in New York to nearly 2.5% of the cost of structures. The amount of Item #4, interest during construction, will vary with the time required, methods of financing and rate of interest on loans. The total expense under this item amounted to 8% in the construction of the New York Transit System, and to about 6% in Boston. — As any subway designed and constructed for the use of city surface cars through the present retail district of Los Angeles would be admittedly built simply as a measure tending

toward the supply of greater area for vehicular traffic, there is no particular reason why any one of the three main arteries should be favored over the others. The street widths are practically identical, all frontage is fully occupied, and the vehicular traffic while varying in quantity on different streets at different times, is practically the same in any 24 hour period. If any one thoroughfare requires the street area occupied during the passage of cars, then all three streets, Broadway, Spring and Main, should be supplied with sub-surface facilities. Topographical features, as well as business considerations, practically enforce such procedure, as otherwise cars entering the district from side streets must pass directly across town; or, if using a single subway, must follow each other in slow procession, forming a car blockade equally as objectionable as those now obtaining on the surface. No single subway could be operated to carry the cars now serving any two of the thoroughfares mentioned, as may be readily seen from data given in previous pages. The capacity of trackage for single cars is limited by the headway, or time interval between cars. This, again, is regulated entirely by the length of station stop; which, under the most favorable conditions, cannot average less than 20 seconds. Twenty second headway means 180 cars per hour per track; and as rush hour traffic on Los Angeles streets shows a peak of 110 cars hourly, it is clear that 40 of the cars now running on any two parallel streets must be retired from service for want of physical space to operate. It must be realized that sub-surface trackage will accommodate little, if any, more traffic than surface


PROPOSED
SUBWAY CONSTRUCTION
THROUGH
CONGESTED DISTRICT
ST.
HILL
ST.
BROADWAY.
ST. VINCENT
PL.
11TH
10TH
9TH
SPRING
8TH
ST.
MERCANTILE
PL.
MAIN
6TH
5TH
LOS ANGELES
7TH
MAPLE
AVE.

Buena Vista St.
St.
Temple
New High
St
Court
St.
Commercial St.
St
Market
San Pedro
St.
St.
St.
St.
1st St.
St.
Wilmington St.
Hill
Broadway
Spring St.
Main 2nd
Los Angeles
St.
3rd St.
St.
3rd

trackage when the latter is operated to capacity, as long as cars are run as single units. Trailer service, or multi-car trains, forms the only practicable method of increasing track capacity over the figures above stated.

In such case, it is evident that separate subways must be constructed on each individual street in order to accomplish the object proposed, with the necessary connections, inlets or inclines, and cross-town subways to allow exit and entrance for equipment. Plate #13, herewith attached, has been arranged to show graphically the extent of a possible arrangement of this description.

The cost of a system of subways covering the routes as designated in Plate #13 may be estimated accurately enough for the purpose of this report by the use of unit values accomplished in similar work in other localities; and the design of a typical section suitable for the operation of equipment now in use. (See Plate #16). Stations may be estimated as sectional enlargements of uniform length and breadth, with the necessary stairways and entrance kiosks. Right of way expense would be confined to the cost of easements for necessary curves, since the City owns its streets; and the cost of removal and relaying of substructures may be estimated from inspection of Plate #8, with a liberal percentage addition for more difficult construction. Such an estimate can naturally be little better than an approximation, but will serve to show the extent of expenditure required for sub-surface work.

Referring again to Plate #13, the following table shows

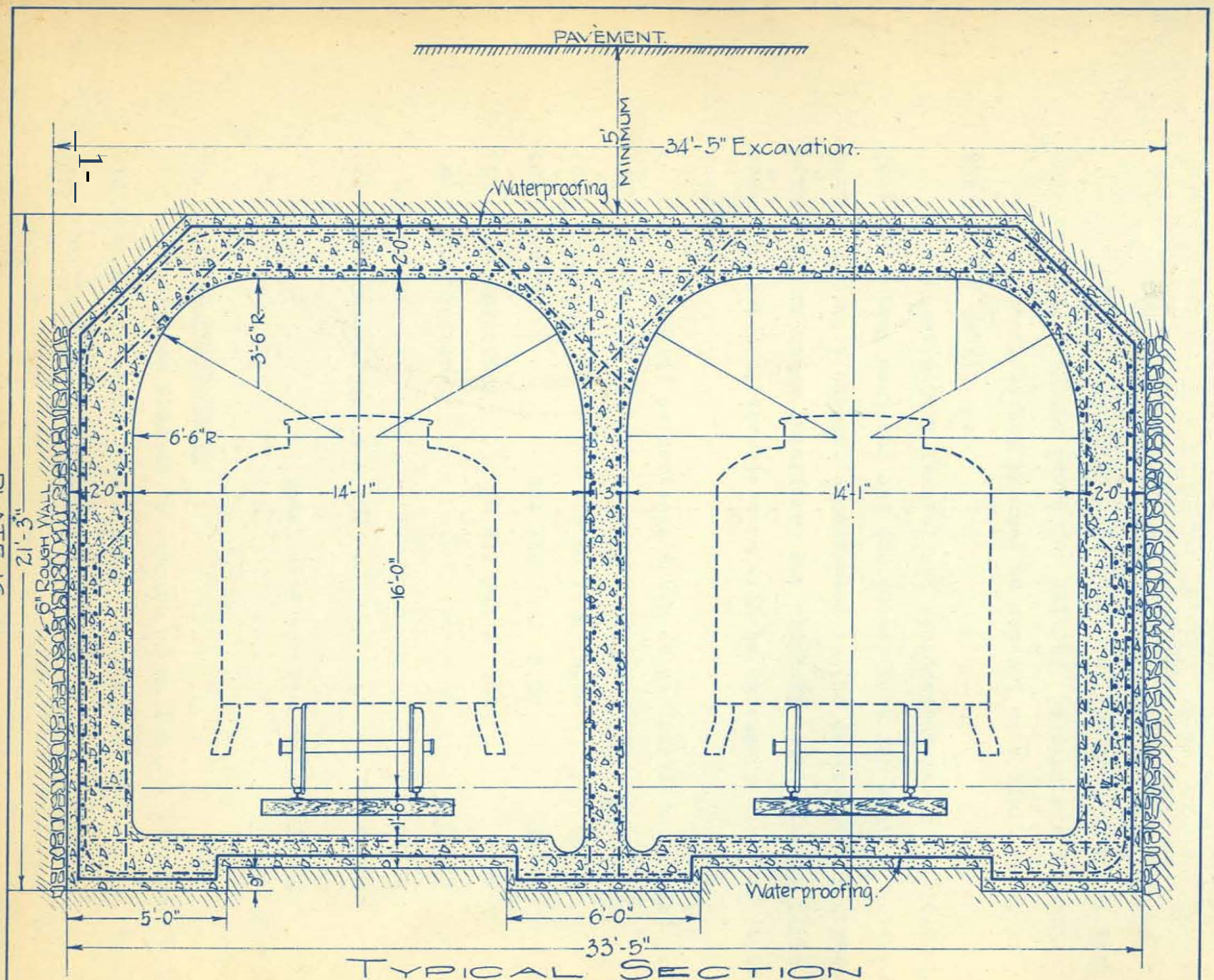
the lineal feet of double track subway section, together with the number of stations and entrance or exit inclines necessary to supplant the present system of surface cars:

	Street.	Lineal feet Subway Section.	Station Enlargements	Inclines.
1.	Broadway	5885.9	19	--
2.	Spring	6088.7	21	--
3.	Main	7587.3	22	2
4.	First	865.8	5	1
5.	Second	910.5	5	1
6.	Third	971.8	6	2
7.	Fifth	1375.0	8	2
8.	Seventh	1675.0	8	2
9.	Ninth	475.0	3	1
10.	Tenth	325.0	3	1
11.	Eleventh	50.0	1	1
		26210.0	101	13

Taking each item in order, without going into the smaller details, unit costs may be assumed as follows:

1. Subway Section - Double track:

Excavation taken to be earth and gravel with little, if any, surface water pumping . Price per cubic yard to include all trenching, sheeting and bracing, roofing of trench and support of car tracks during construction, haulage of spoil to nearest dump, backfill and street replacement after completion of structure.



TYPICAL SECTION
OF
TWO TRACK SUBWAY FOR SURFACE CARS.

Concrete price includes cost of materials and forms.

Steel assumed to cost $2.25 per 100 lbs. F. O. B. Los Angeles, plus 3/4¢ per pound for cutting, bending and placing.

Waterproofing assumed to consist of a light layer of asphalt and fabric.

Substructure removal and replacement taken at $10.00 per foot for subway section, and $20.00 per foot for station enlargements. The main subway, constructed in the center of the street with 5 ft. of cover interferes but slightly with existing pipes or conduits, but considerable work will be necessary wherever stations occur.

Overhead percentages taken as per previous tabulation.

(A)	Excavation -	33.5 C. Y. @ $4.00	$134.00
(B)	Concrete	7.5 C. Y. @ 10.00	75.00
(C)	Steel	824 lbs. @ 3.00	24.72
(D)	Waterproofing	12 sq. yds @ .50	6.00
(E)	Substructures		10.00
			$249.72
(F)	Overhead expenses - 30%		74.92
		Total cost per lin.ft. -	$324.64

2. Station enlargement:

Station assumed to consist of an 100 ft. platform, with stairway and entrance from street. Unit prices same as in Item #1.

(A)	Excavation -	1150 C. Y. @ $4.00	$4600.00

(B)	Concrete	159 C. Y.	@ $10.00	$1590.00
(C)	Steel (Reinf.)	13787 lbs.	@ 3.00	413.61
	Steel - Girder	100 ft.	@ 3.50	350.00
	Steel - columns	4	@ 50.00	200.00
(D)	Waterproofing	88 sq yd	@ .50	44.00
(E)	Entrance Kiosk			250.00
(F)	Substructures -	100 ft.	@ 20.00	2000.00
				$9447.61
(G)	Overhead expenses - 30%			2834.28
			Total -------	$12281.89

3. - Inclines:

Assumed to be 300 ft. in length, with reinforced concrete side walls, headwall and invert. Excavation, concrete and substructure costs reduced on account of better working facilities.

(A)	Excavation	6645 C. Y.	@ $ 2.00	$13290.00
(B)	Concrete	1031.8 " "	@ 8.00	8254.90
(C)	Steel	44488 lbs.	@ 3.00	1334.64
(D)	Substructures	300 feet	@ 5.00	1500.00
(E)	Railing	635 feet	@ ___	100.00
				$24479.54
(F)	Overhead expenses - 30% ----------			7343.71
				$31822.75

The following tabulation shows the cost of each street and total cost of the entire system as shown in Plate #13. Unit costs for each item taken at

1. Subway section - per lineal foot ----- $ 325.00

2. Station Section - each	----------	$ 12,280.00
3. Incline Section - each	----------	31,825.00

Broadway:

5886 lineal feet subway	@ $ 325.00 ------	1,912,950.00
19 stations	@ $12,280.00 ------	233,320.00

Spring:

6089 lineal feet subway	@ $ 325.00 ------	1,978,925.00
21 stations	@ $12,280.00 ------	257,880.00

Main:

7587 lineal feet subway	@ $ 325.00 ------	2,465,775.00
22 Stations	@ $12,280.00 ------	270,160.00
2 Inclines	@ $31,285.00 ------	63,650.00

First street:

866 Lineal feet subway	@ $ 325.00 ------	281,450.00
5 Stations	@ $12,280.00 ------	61,400.00
1 Incline	@ 31,825.00 ------	31,825.00

Second street:

910 Lineal feet subway	@ $ 325.00 ------	295,750.00
5 Stations	@ $12,280.00 ------	61,400.00
1 Incline	@ $31,825.00 ------	31,825.00

Third street:

972 Lineal feet subway	@ $ 325.00 ------	315,900.00
6 Stations	@ $12,280.00 ------	73,680.00
2 Inclines	@ $31,825.00 ------	63,650.00

Fifth street:

1375 Lineal feet subway	@ $ 325.00 ------	446,875.00
8 Stations	@ $12,280.00 ------	98,240.00
2 Inclines	@ $31,825.00 ------	63,650.00

Seventh street:

1675 Lineal feet subway	@ $ 325.00 ------	544,375.00
8 Stations	@ $12,280.00 ------	98,240.00
2 Inclines	@ $31,825.00 ------	63,650.00

Ninth street:

475 Lineal feet subway	@ $ 325.00 ------	$154,375.00
3 Stations	@ $12,280.00 ------	36,840.00
1 Incline	@ $31,825.00 ------	31,825.00

Tenth street:

325 Lineal feet subway	@ $ 325.00 ------	105,625.00
3 Stations	@ $12,280.00 ------	36,840.00
1 Incline	@ $31,825.00 ------	31,825.00

Eleventh street:

50 Lineal feet subway	@ $ 325.00 ------	16,250.00
1 Station	@ $12,280.00 ------	12,280.00
1 Incline	@ $31,825.00 ------	31,825.00
	Total cost ---	$10,172,255.00

The above total of $10,172,255.00 is exclusive of any easements required for curves or station entrances on private property, should it be deemed advisable to remove the entrance Kiosks from the sidewalk. No estimate can be given for such easements, as valuations would necessarily be fixed by appraisal and condemnation. The total figures simply show, approximately, the cost to the City of constructing a sufficient length of sub-surface roadway to relieve the present retail section of surface car traffic and provide equal transportation facilities to those now obtaining.

-0-

REARRANGEMENT
OF
RAPID TRANSIT FACILITIES.

Opinion may be divided as regards the retirement of urban cars to sub-surface accommodations, but there can be no reasonable doubt as to the advisability of removing interurban cars from surface trackage. This must be patent to the most casual observer, if notice be taken of conditions obtaining on Main street during the hours of the morning and evening rush. The entire traction right of way, and more, considering the overhang and necessary car clearance, is solidly occupied from crossing to crossing by the equipment of the city and interurban lines, movement being restricted to car lengths, resulting in disruption of surface car schedules and annoying delays to the patrons thereof. Relief is impossible until the 7th street junction is cleared by south bound traffic, and the 1st street corner passed by north bound traffic, such outlets allowing the interurban cars opportunity to reach their private right of way. While some measure of relief has been accomplished by the diversion of various inter-urban lines to San Pedro street and the Los Angeles street temporary terminal, the remaining interurban cars are sufficient in number to seriously hamper city street car service on Main street between the limits before mentioned. Their removal would mean the placing of the traffic problem of this thoroughfare on a parity with that of adjacent streets, and its solution by natural expansion.

In considering the transportation problem of any city, due regard must be paid to the fact that the area requiring such facilities is not alone that included within existing city boundaries

Opinion may be divided as regards the retirement of urban cars to sub-surface accommodations, but there can be no reasonable doubt as to the advisability of removing interurban cars from surface trackage. This must be patent to the most casual observer, if notice be taken of conditions obtaining on Main street during the hours of the morning and evening rush. The entire traction right of way, and more, considering the overhang and necessary car clearance, is solidly occupied from crossing to crossing by the equipment of the city and interurban lines, movement being restricted to car lengths, resulting in disruption of surface car schedules and annoying delays to the patrons thereof. Relief is impossible until the 7th street junction is cleared by south bound traffic, and the 1st street corner passed by north bound traffic, such outlets allowing the interurban cars opportunity to reach their private right of way. While some measure of relief has been accomplished by the diversion of various inter-urban lines to San Pedro street and the Los Angeles street temporary terminal, the remaining interurban cars are sufficient in number to seriously hamper city street car service on Main street between the limits before mentioned. Their removal would mean the placing of the traffic problem of this thoroughfare on a parity with that of adjacent streets, and its solution by natural expansion.

In considering the transportation problem of any city, due regard must be paid to the fact that the area requiring such facilities is not alone that included within existing city boundaries

but is all territory tributary to such city lying within the limits of commutation traffic. As the latter are regulated entirely by the speed of interurban cars, it follows directly that the minute and not the mile forms the controlling unit of service, and that the total metropolitan, or greater city, area is bounded only by a line whose radius is the greatest distance possible to be traversed within a reasonable riding period by rapid transit cars, operated under the highest conditions of safety and non-interference by surface obstructions. The avoidance of the latter automatically forces the placing of the tracks above or below the ground surface within the more densely populated area.

It has been well said that "The economic point of city expansion, as influenced by surface railway extension, and operation, is fixed by the time in which surface cars can reach such point, as compared with the time in which interurban cars can reach residential sections equally desirable." That this point has been reached, and even over-lapped, in the case of Los Angeles, is easily demonstrated by comparison of existing schedules. The following list gives the average running time of typical surface and interurban routes, showing that the surface lines, following a liberal development policy, have extended their trackage beyond the boundaries of profitable operation, and are serving territory properly belonging to interurban facilities.

TABLE #6.

WESTERLY LINES.

System.	Route.	Distance Miles.	Fare Cents	Running time Minutes.
Los Angeles Ry.	Rimpau Western terminus to 5th & Spring.	6.35	5	36
Los Angeles Ry.	West Adams Western terminus to 3rd and Main.	7.38	5	45
Los Angeles Ry.	Pico. Western terminus to 1st & Broadway.	6.00	5	33
Pacific Electric Railway.	Venice Short Line.	17.00	10*	35

SOUTHERLY LINES.

Los Angeles Ry.	Inglewood. Southern terminus to 6th and Main.	12.90	10	52
Los Angeles Ry.	Homeward avenue. Southern terminus to 4th & Spring	9.00	10	39
Los Angeles Ry.	Vermont Heights. Southern terminus to 4th & Spring	9.96	10	46
Pacific Electric Railway.	Long Beach	21.1	12*	45

* - Commutation ticket - 54 ride.

While it is impossible to increase the speed of surface cars operating in city streets on account of existing ordinances, vehicular obstructions and the numerous stops, without introducing the "skip stop" or similar system, it is perfectly feasible to formulate plans for interurban operation which will increase the capacity and scope of the present lines. This may be accomplished to a combination of re-routing and the elevation or depression, according to topographical conditions, of all interurban trackage, affording unobstructed entrance and exit to high speed trains. The latter condition is a sine qua non to the success of rapid transit operation.

Inspection of a map of the present interurban system shows a network of potentially high speed lines terminating at two points within the business center, the western lines using the old L. A. P. station on Hill street, while the southern and more easterly lines are divided between the Pacific Electric terminal at 6th and Main, and the temporary terminal at 6th and Los Angeles streets. All these terminals in their present condition, have one common characteristic, inadequacy, and each succeeding day makes the fact more apparent. This condition, however, while discreditable to the municipality and inefficient in its workings, should not be blamed on the present management, being due partly to the unprecedented growth of population and consequent outstripping of arrangements ordinarily sufficient;and partly to the annexation of lines previously operated as a separate and distinct system with little, if any, modern equipment. The Hill street terminal, even in its present state, is certainly an improvement over the old method of turning cars

on Fourth, between Hill and Broadway; but its inadequacy becomes daily more patent to all concerned, while the increasing number of cars, rendered necessary by the steady growth of patronage, bids fair in a short time, to create traffic blockades as serious as those on Main street.

Two principal facts must be taken into account when the problem of the rearrangement of Los Angeles rapid transit facilities is presented for consideration. First, the purchase or acquirement of real property of sufficient dimensions to accommodate such facilities in any more convenient location that the present Pacific Electric holdings on Sixth street, is impracticable, if not impossible from the enormous cost involved and the inevitable economic loss through destruction by demolition of existing modern structures. The block bounded by Sixth, Los Angeles, Seventh and Maple avenue, must on account of this fact, be the scene of future terminal improvements. The Pacific Electric building and present central station, is, and will be hereafter valuable only for offices and stores, its usefulness as a traffic terminal having passed with the growth of the city.

Second; no arrangement of building and trackage should be approved which is not planned with full recognition of the fact that terminals, in the strict sense of the word, located within civic boundaries, are objectionable and should not be tolerated where the topography allows the operation of interurban lines <u>through</u>, and not merely <u>to</u> a city. Any terminal, so-called, erected in Los Angeles for the accommodation of suburban passengers

and operation of interurban cars, should consist of nothing more than a central station of sufficient capacity to accommodate present and estimated future traffic, through which, trains or single cars may be operated from one suburb or one beach to another without turning except at the actual ends of lines, thus eliminating the use of expensive space for switching, repairing, etc., the major part of such operations being conducted at the real terminals and in less valuable situations. In this manner may be secured the maximum of capacity with the minimum of equipment, particularly at times of peak loads, together with the highest occupational efficiency of necessarily restricted station area.

That this is feasible and economically possible in the City of Los Angeles will be shown in the following paragraphs.

Rearrangement of the main east and south rapid transit lines (See Plate #2) in such a way that both may enter the City and delivery passengers at a central point without burdening main thoroughfares with their equipment, is, from the physical standpoint, a relatively simple matter. As any re-routing on the ground surface, while affording temporary relief, can but become a source of congestion with increased density of population, the proper and most economical solution would seem to be track elevation to a point of connection with existing trackage beyond the congested area. The elevated structure at the rear of the present terminal building should be extended due east to a junction at San Pedro street, continuing thence north on San Pedro to Aliso street, and east on Aliso street across the Los Angeles river and San Pedro, Los Angeles

and Salt Lake Railway tracks to a grade connection in that vicinity, while the trackage to serve Long Beach and related lines should turn south on San Pedro street to Seventh street, east on Seventh to Alameda and thence south to a grade connection with the private right of way. It is understood that the private property between Maple and San Pedro streets on this proposed route has been acquired by the corporate interests in anticipation of its ultimate necessity. A franchise for elevated railroad operation would be required from the city, which in view of the benefits to be derived from the more rapid passage of cars and evacuation of streets, should be granted on liberal terms.

The construction of this amount of elevated structure would practically eliminate the presence of inter-ruban cars from the eastern half of the business district, and would relieve Main, Seventh, Ninth and First streets from any present, or possibility of future, congestion from this source. There would need to be no suspension of service. Erection of the necessary columns and superstructure could be carried on without interfering with existing schedules; and, if built according to the more recent designs, would, when complete, afford unobstructed passage to cars with less noise than now obtains.

No diminution of property values traversed by, or adjacent to an elevated road need be feared, according to the general experience of other cities. While admittedly detrimental to residential sections, its presence, as a rapid transit line, has

always proved beneficial in increasing valuations when utilized through areas of a commercial character. Authoritative proof of this fact is shown in the subjoined table, compiled by the Director of the Rapid Transit Commission of Philadelphia, Mr. A. Merritt Taylor, demonstrating the effect of elevated railway operation on assessed valuations on Market street, upon which the road is located, and on Arch and Chestnut streets, which are parallel and one block distant.

Assessed valuation of real estate along Market, Arch and Chestnut streets prior and subsequent to the construction of the Market street Elevated Road:

TABLE #7.

	Property between 32nd street and the City Line, fronting on -		
	Market st.	Arch st.	Chestnut st.
Assessed valuation			
1900 (A)	$4,159,000	$2,015,000	$5,157,000
1906 (B)	4,916,000	2,095,000	6,291,000
1912 (B)	7,671,000	2,197,000	8,721,000
Increase (Amount			
1906 over 1900	757,000	80,000	1,134,000
1912 over 1906	2,755,000	102,000	2,430,000
1912 over 1900	3,512,000	182,000	3,564,000
Increase (Per cent)			
1906 over 1900	18.2	4.0	22.0
1912 over 1906	56.0	4.9	38.6
1912 over 1900	84.4	9.0	69.1

(A) Basis of assessment was 80% of value. Figures are adjusted to 100% to compare with 1906 and 1912.

(B) Basis of assessment 100% of value.

The total increase on Market street, from 1900 to 1912, was $3,512,000 or 84.4 per cent; while on Chestnut street, it was $3,564,000, or 69 per cent. Therefore, the construction of the elevated roadway not only caused no decrease of values, but stimulated the increase beyond that on neighboring streets.

The question of the elimination of the westerly beach lines and Glendale cars from Hill and Sixth streets, presents considerably greater difficulties, yet nothing insuperable if the exigencies of the situation seem to warrant the necessarily heavy expenditure. It may be assumed that Hollywood and Colegrove cars form nothing more than local service, and as such are entitled to surface trackage, running from Sunset boulevard down Hill street to 16th street; thence west to Vineyard station or similar terminus and return. Cars serving Van Nuys and Fernando Valley points, while constituting a definite interurban service, are too infrequent to add measurably to street congestion; and, until the demand for such service reaches a considerably higher point, may follow their present routing, turning back on upper Hill street, or other convenient location. Later, if the settlement of this particular district demands a better service and its installation results in the occupation of too much street area, a connection running south from Hollywood to the proposed western beach line may be constructed. The present Hill street terminal between Fourth and Fifth streets should be definitely abandoned, being both incapable of suitable enlargement and more valuable for building sites than for traffic operations.

The main problem, then, resolves itself into the feasibility of discovering a practicable route from existing trackage at the western boundary of the city to the proposed central station at Sixth and Los Angeles streets, always keeping in mind the necessity for the retirement of interurban equipment from the street surface, and the need for securing the most direct line possible in order to secure the utmost rapidity of passage.

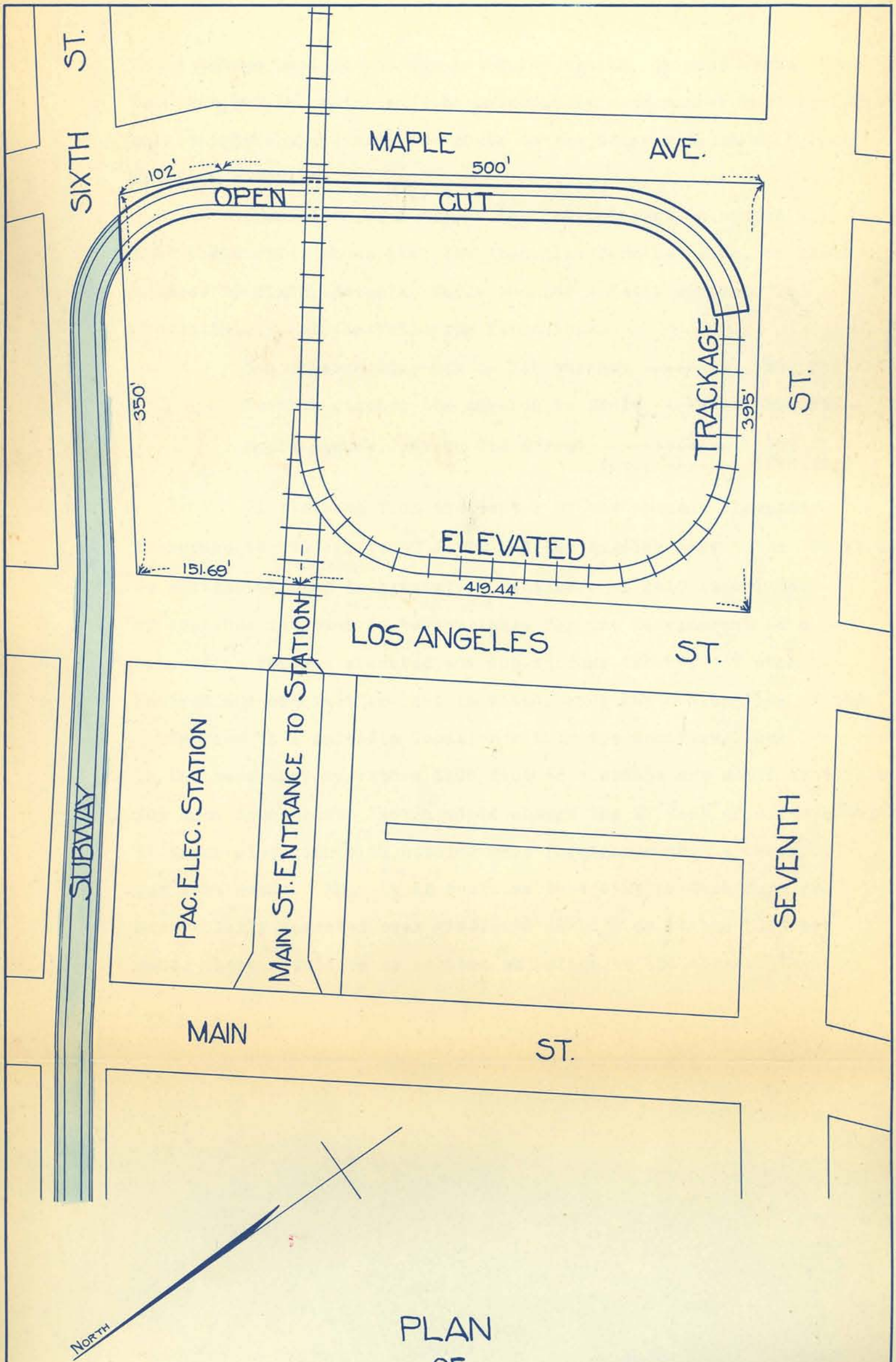
It is evident that track elevation, while, unobjectionable and even desirable in a wholesale business district, is unsuitable construction in high-class residence sections. Moreover, any route practicable for elevated construction and operation leading westerly from Sixth and Los Angeles streets must inevitably follow the present line along 16th street, or, if located on a parallel street, would injure still more valuable residence properties. It is true that an elevated structure might be built south from the proposed central station, along Los Angeles street, to the intersection of 16th street; thence turning west, and that such construction would improve Hill street conditions; but such a line would merely parallel present routing and would be deficient in the primary requirement for successful interurban service, namely; the shortest possible location, without which, even with unobstructed trackage, speed, or rapidity of passage cannot be obtained. Reduction of speed means less area possible to be served, thus vitiating the results properly accruing from the expenditure. The old adage that "A curved line for pleasure and a straight line for business" is best exemplified when applied to the question of transportation.

If surface tracks are a source of congestion and an elevated structure objectionable, then there remains but one measure of relief; sub-surface, or subway constructions. If southerly and easterly trackage is brought into the central station on an elevated structure, then, in order to afford continuous trackage and the operation of trains through the city and central station to actual terminals, a connection between subway and elevated structures must be perfectly feasible and satisfy all conditions of operating requirement. That this is practicable may be shown as follows:

Let the elevation of the floor, or platform, of the main concourse of the proposed central station be at the same elevation as the top of rail on the elevated structure now occupying a portion of the station site, or 19 feet above the ground surface. The elevation of the top of rail of any subway leading westerly from Sixth and Los Angeles streets may be taken as follows:

Clearance, top of subway rail to subway roof ------	15.0	ft.
Thickness of subway roof ----------	2.0	ft.
Top of roof to ground or pavement surface ---------	1.0	ft.
Total ---------	18.0	ft.
Add distance from top of rail on elevated structure to ground surface ----------	19.0	ft.
Total distance from top of elevated rail to top of subway rail ----------	37.0	ft.

The above tabulation shows a total difference in gradient of 37 feet between trackage to be used for elevated incoming trains



PLAN
OF
PROPOSED RAPID TRANSIT LOOP
ELEVATED - SUBWAY INTERCHANGE

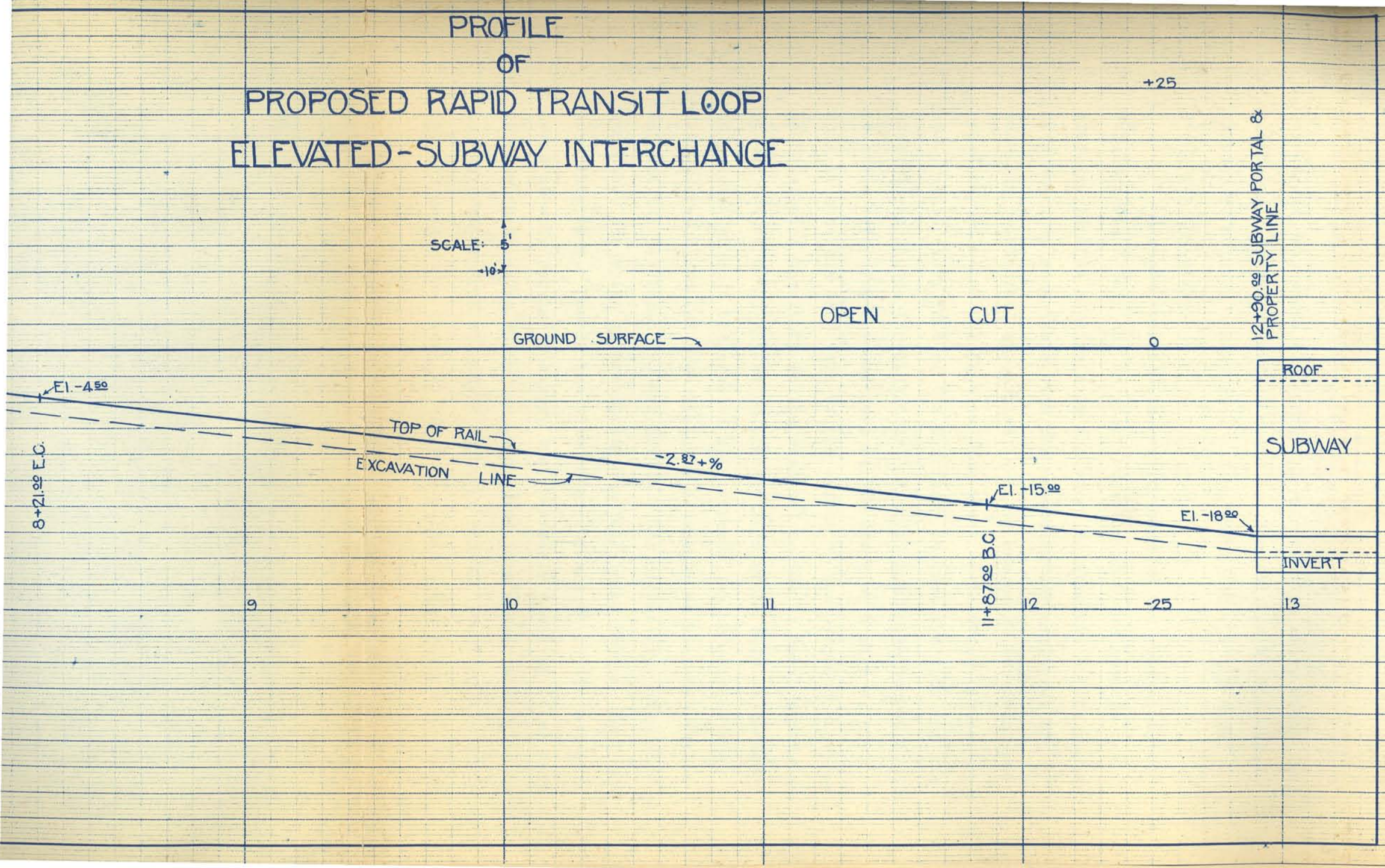
and trackage used for subway out-going trains, or vice versa, as the case may be, which must be overcome in such manner that equipment may be interchanged from one route to the other without switching or other hindrance.

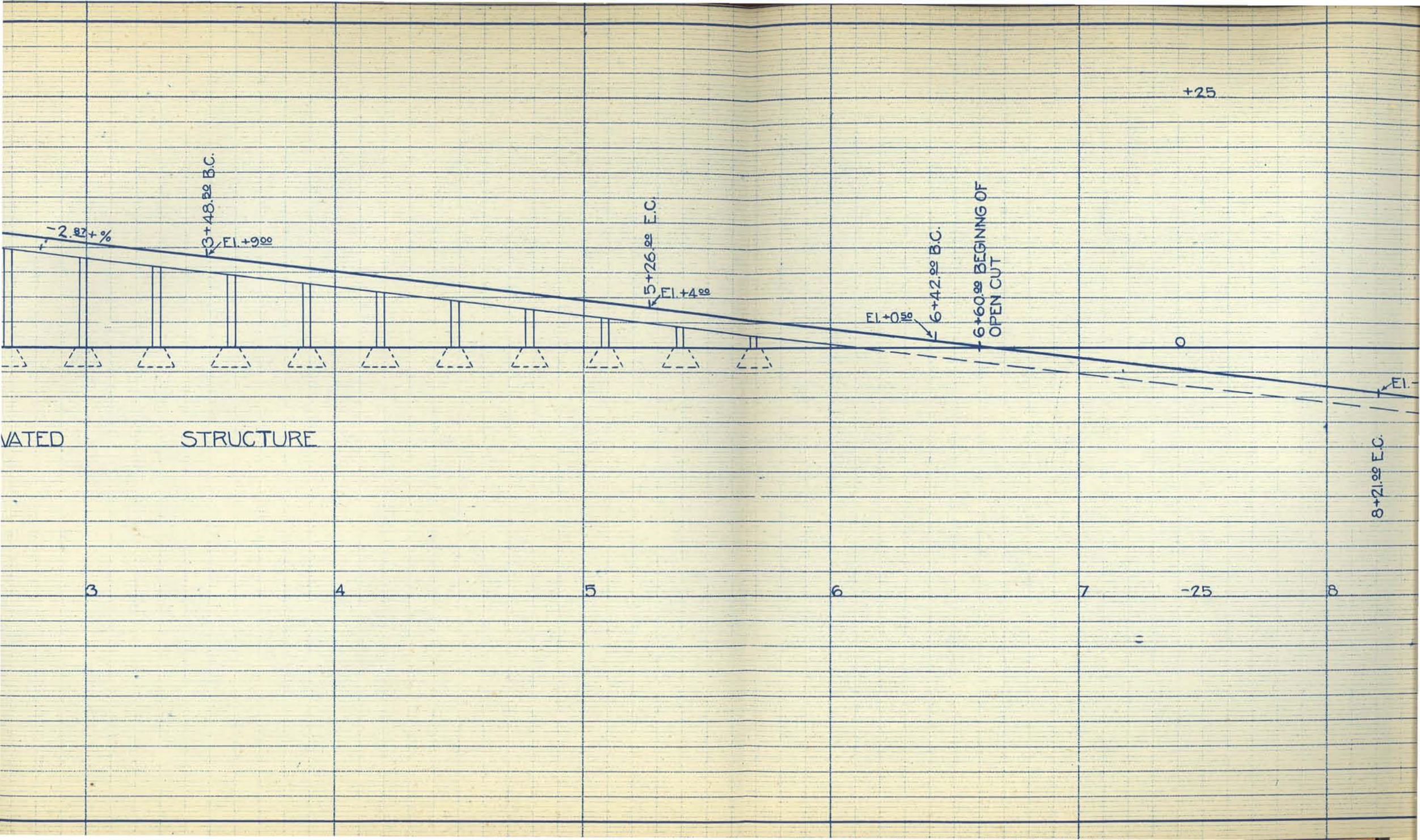
Inspection of a map of the central portion of the City, (See Plate #~~11~~ 9), shows that the so-called Terminal site, or block bounded by Sixth, Seventh, Maple and Los Angeles streets, is approximately, of the following dimensions:

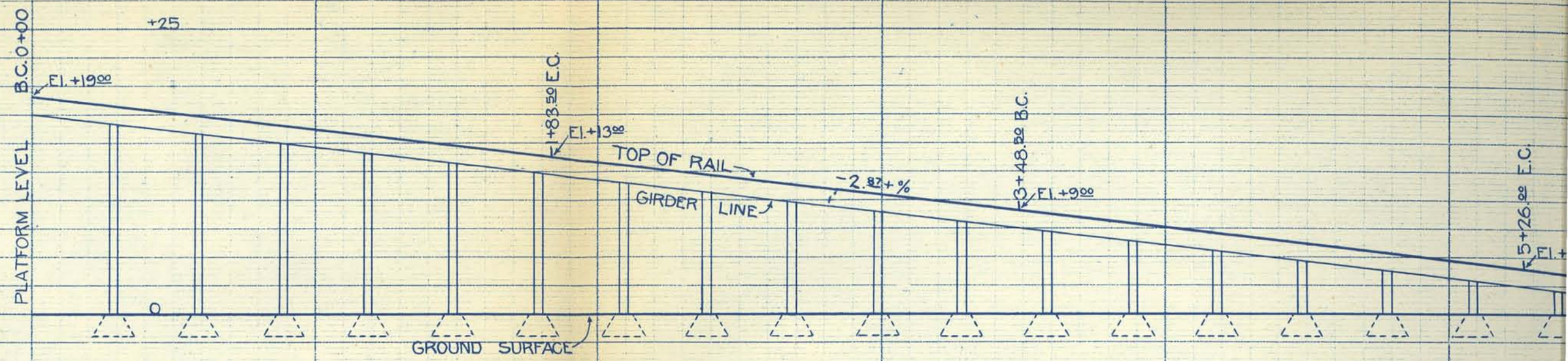
Los Angeles st., 6th to 7th streets --------	581 ft.
Seventh street, Los Angeles to Maple -------	390 ft.
Maple avenue, 6th to 7th street ----------	607 ft.
Total ------	1578 ft.

If the distance from the center of the present elevated structure to the corner of Sixth and Los Angeles street, or 162 ft., be subtracted from this total, a remainder of 1416 lineal feet of distance is found to be available for the development of a connection between elevated and sub-surface tracks. If even two hundred and odd feet be lost in withdrawing the center line of the connection to a suitable location within the boundary lines, and in the necessary curvature, 1200 feet of distance are still available for such development, which would absorb the 37 feet of difference in track elevation with nothing more formidable than a three (3) per cent grade. When it is realized that city surface cars are successfully operated over gradients as high as twelve (12) per cent, there should be no serious objection to the above. The

PROFILE
OF
PROPOSED RAPID TRANSIT LOOP
ELEVATED-SUBWAY INTERCHANGE




+25
-2.87+%
3+48.52 B.C.
El. +9.00
5+26.00 E.C.
El. +4.00
El. +0.50
6+42.00 B.C.
6+60.00 BEGINNING OF OPEN CUT
0
El.
8+21.00 E.C.
VATED
STRUCTURE
3
4
5
6
7
-25
8



ELEVATED STRUCTURE

0 -25 1 2 3 4 5

street and only small easements there to provide extra width for platforms. Transfer traffic could be accommodated by passenger crossovers between subway roof and pavement, or via the usual entrances and exits.

A rapid transit line constructed on the routing above outlined would form the shortest possible location between the proposed central station site and existing trackage at the western city boundary compatible with the necessity for avoidance of valuable residential properties; and, by reason of the increased speed possible through freedom from track obstruction, grade crossing etc., place every foot of the territory between the city and the ocean in as close, if not closer, physical communication as is now possible with city surface cars within the 4 or 5 mile circle. This is none the less true of the effect of the proposed elevated roads serving territory to the east and south. A heavy percentage of the actual running time of present interurban cars is consumed in passing through the crowded city streets, which reduces the commutation limit and area directly tributary to city activities in just the corresponding proportion. As cities grow and distances increase, the speed of transportation facilities becomes more and more important. Double the size of a city and there are not only twice as many people to carry, but, generally speaking, they must be carried twice as far. And as elapsed time rather than mileage controls the radius of modern suburban travel, doubling the distance means doubling the speed in order to maintain the same conditions

of convenience.

While the architectural features of a central station on the Sixth and Los Angeles site are beyond the province of this discussion, it is possibly advisable to designate the most important part of such construction, as regarded from the public point of view. All arrangements should be made subservient to the one idea of providing adequate floor space at track level for a main concourse sufficiently extensive to care for a patronage of at least twice the present passenger traffic, with enough reserve to accommodate the holiday crowds. It should be kept in mind that track elevation and depression will inevitably force practically all passengers to board cars at this point, instead of the present custom of waiting at street intersections. The floor of such concourse should be planned to carry the maximum live load and should be unobstructed by booths, cigar stands, or the like, all of which should be relegated to the walls of the room. Adequate elevator service should be provided from the Los Angeles street level to the concourse floor, and the present entrance for interurban cars into the Pacific Electric station should be turned into a grade entrance for foot passengers from Main street, abolishing the present system of allowing passengers to use the same doorways as building tenants. Sub-passage below the ~~passage~~ tracks should connect both sides of the concourse and afford means of exit to either street.

The area within the enclosure, or terminal block may be utilized for storage tracks, etc., connection being made with the

subway elevated incline at, or about, the intersection with the ground plane. Entrance to the enclosure for equipment may be provided on the Maple avenue side, near Sixth street, as the subway structure would be completely below the surface at that point. This would eliminate all difficulties as to the use of the present shops at 7th and Central.

The station building might be either constructed in toto, or in only such part as would be necessary for the housing of the concourse floor and passageways. Sufficient foundation provision should of course be made for the addition of upper stories, whenever the need for same becomes apparent. It is certain, however, that any office facilities thus provided would be in demand on account of their convenience and central location. Actual street frontage on the street level would retain its value for commercial purposes, as the proposed incline could be located so as to interfere but little with shallow stores.

HISTORY AND STATISTICS.

In considering any comprehensive plan for supplying the transportation needs of any metropolitan area, it is interesting and instructive to note the methods of other municipalities as shown by inspection of maps and compilations of expenditures and operating statistics. It is true that the few American cities which have installed other than surface facilities are far in advance of Los Angeles as regards the amount of population included within their metropolitan circles and afford no means of exact comparison on account of divergent topography. There is reason to believe, however, that all territory within an hour's ride of the city center will, in the course of a comparatively few years, through climatic and other advantages, be fully occupied if efficient means of transportation be supplied. Such occupation, if only of the usual suburban density, would afford a patronage which would amply compensate for the construction of a far more costly system than now obtains; but neither the occupation nor the system are possible nor can the city proper derive the full benefit from the tributary area unless free and convenient egress and ingress for transportation units through urban districts, with consequent rapidity of passage, be provided. If the first efforts to secure means of rapid transit are so planned as to form a convenient nucleus for future additions, even though the first cost seem disproportionately large to the results immediately secured, such additions may be made whenever requisite with a minimum of expense and inconvenience, and a total avoidance of any waste of resources, either territorial or financial.

Temporary expedients may afford transient relief and defer the period of construction; but such policy can only result in an increase of expenditure when the day of reckoning finally arrives, together with the practically total loss of capital thus employed.

Inspection of the following data can but convince that the cost of well designed and located primary units, constructed during the inception of city growth, is inconsiderable as compared with the enormous expense required for identical operations in after years.

The following brief statements cover the growth of rapid transit in the largest American cities. A rapid transit line is taken, for the purpose of this report, as consisting of a city passenger electric railway located in (1) a subway or tunnel, (2) on an elevated structure, or viaduct, or (3) on the surface of a private right of way, or, in minor instances, of a street operated by trains stopping at stations at intervals of at least several blocks and making delivery of passengers at one or more stations in the central business district. Suburban branches of steam railroads are therefore excluded.

NEW YORK (MANHATTAN AND BRONX BOROUGHS).

The necessity for high speed street transportation in New York City became acute after the Civil war by reason of the rapid growth of population, and also largely because of the narrow and confined limits of Manhattan Island. As underground operation was not feasible before the development of electric traction, this

necessity led to the construction of the elevated system, which was completed by 1880, substantially as it exists today, except that the motive power has been changed from steam to electricity. The construction of this elevated system permitted rapid and intensive development of the territory north of 59th street, and further had the effect of concentrating business near the southern end of the island. Ten years after its completion the congestion of traffic again became so great that relief was imperative. The north andsouth streets were so limited in number and width that it was practically out of the question to build more elevated lines south of Central Park; and, as subways had now become feasible, because of the great density of population and volume of traffic and because of the improvements in electric traction, a north and south subway line with two branches above the Park was projected in the early 90's and placed in operation in 1904. Six years after its completion it was carrying as many passengers as the four elevated lines and the congestion of traffic made a further development of the system necessary.

The existing system (elevated and subway) comprises a total of 11 north and south tracks opposite Central Park, where the island is about two miles wide. North of the Park four lines spread into Bronx Borough and the northern part of the Manhattan, reaching points from 11 to 13 miles distant from the city hall. With the new lines now authorized there will be a total of 15 tracks opposite Central Park and 6 branches to the northward, reaching points 12 to 15 miles from the city hall. Of the three elevated

lines at the Park, one has three tracks, the middle track being used for express service southward in the morning and northward in the afternoon, to a point about 7 miles north of the business center. Third tracks to be used in a similar manner are now authorized on the two other elevated lines. Of the four tracks in the present subway, two are used for express service, making only 3 stops between the down town district and 96th street, 5¾ miles north of the city hall.

The elevated system in New York was built entirely by private capital, but the subway system, with its elevated branches in the northern part of the city, was built by the city and leased to an operating corporation which furnished all equipment. A large part of the surface lines on Manhattan Island is now controlled and operated by the company which operates the high speed lines. Transfer privileges, however, are given at few points and to a very limited extent.

BROOKLYN:

The establishment of elevated railways on Manhattan Island led to their introduction in Brooklyn between 1885 and 1890. The Brooklyn lines, being projected by different companies and operating in comparatively thinly settled districts, did not attain the success of the New York system either financially or in point of utility. Since then, they have been brought under one management and have obtained direct delivery into Manhattan and have been a prime factor in the rapid growth of the population and the wide

extension of the settled area. The system, however, is far from homogeneous, and if designed at the present time a much more efficient and satisfactory track layout could be obtained. A large proportion of the mileage is devoted to Coney Island and resort business. Except on some of the latter lines the system is practically all two track, with local service only. In 1908 the Manhattan subway was extended into the Brooklyn business district. A subway line extending out 4th avenue in the direction of Staten Island is now nearly completed, and the authorized rapid transit extensions in Brooklyn comprise 20.3 miles of subway and 38.5 miles of elevated lines. Practically all of the rapid transit and surface transportation service in Brooklyn is under the control of one company, and transfer privileges between surface and elevated lines are given in many cases.

GREATER NEW YORK (See Plate #1):

The rapid transit extensions authorized in Greater New York cover the use of the Steinway tunnel leading from 42nd street under the East river to Long Island City, together with several lines in Queens Borough. The operation of the new lines in Greater New York is to be divided between the two principal transportation systems so that each company will have good delivery routes in the lower part of Manhattan Island. The Interborough Company, operating principally in Manhattan, will serve the boroughs of Manhattan and Bronx with lines into Brooklyn and Queens, while the Brooklyn Company will serve Brooklyn Borough with lines into Queens and delivery lines in Manhattan.

A summary of the rapid transit lines now in operation and authorized to be constructed within the Greater City is as follows. The cost, etc., may be found in related tables.

FOR OPERATION BY THE INTERBOROUGH RAPID TRANSIT COMPANY.

	Track miles.
Existing subway	73.0
Existing elevated lines	118.0
Subway and elevated lines for construction jointly by city and company	149.0
Elevated railroad extensions to be constructed by the company	10.4
Third tracks on elevated roads to be constructed by the company	10.5
Total	360.9

FOR OPERATION BY THE N. Y. MUNICIPAL RY. CO (Brooklyn).

	Track miles.
Existing elevated lines	105.0
Subway and elevated lines for construction jointly by city and company	110.41
Elevated extensions for construction by the company	35.29
Third tracking and reconstruction by company	9.30
Total	260.00

Grand total completed Dual system ------ 620.90

Within the past ten years, tunnels under the Hudson river, which had been long projected, were completed for use as part of an

independent rapid transit system, the special object of which was to connect the railroad passenger terminals on the New Jersey side of the river with the principal business districts of Manhattan Island and with the Grand Central station, or terminal for the New York Central, New York, New Haven and Hartford, and allied roads. This system, popularly known as the "McAdoo Tubes," is substantially completed and in operation, and consists of two sets of tunnels, those at the north running via 33rd and 6th avenue, to Christopher street; thence westward under the Hudson to Hoboken; thence south along the river to Jersey City. The south tunnel commences at Church street in Manhattan, runs west under the Hudson to a connection with the north tunnel at Jersey City, from which point both lines run as far as Newark, N. J., on surface tracks leased from the Pennsylvania Railroad. The system in Manhattan has 3.2 miles of road and 7.1 miles of single track, and is a distinct and separate enterprise from the City Rapid Transit improvement. The system carries entirely short haul traffic, having traffic agreements with the railroads whose termini it serves.

During the year ending June 30th, 1911, the period at which the Dual system was planned, the New York rapid transit lines carried 798, 281,850 passengers, divided as follows:

Interborough R. T. Co., subways & elevated -- 578,154,088

Brooklyn Elevated R. R. system ---------- 167,371,328

Hudson & Manhattan R. R. (McAdoo tubes) ----- 52,756,434.

During the year ending June 30th, 1913, the subways and elevated in Manhattan and Bronx alone, neglecting the McAdoo tubes,

carried 327,471,510 and 306,845,006 passengers respectively, or a total of 634,316,516. During the year ending June 30th, 1914, the subway alone averaged 1,001,215 passengers daily, Sundays being taken as half days; and the total number of passengers on all routes amounted to the stupendous total of 1,813,204,692. Such figures demonstrate conclusively the necessity for efficient transportation in the metropolis.

CHICAGO - (See plate No. 11):

The distinct features of the transportation problem in Chicago are the widely extended area, the numerous steam railroad lines and the shape of the city, which is one-sided, owing to the location of its central business district near the lake. The rapid transit system is entirely elevated and was built largely between 1890 and 1900. There is one principal line to the north, one to the northwest, three to the west and one to the south. All of these lines come into a loop about 2 miles in circumference, which encloses the central business district. There are adjacent to the loop four stub terminals, from which trains are despatched in the rush hours. The line to the north extends to Wilmette, a distance of 14 miles, where connection is made with a high speed electric line to Milwaukee. This line is four-tracked for about 7 miles. The lines to the northwest and west reach points from 5 to 9 miles from the loop, and the trains of a high speed interurban line from the west are brought up to the loop over one of these elevated lines. The south side line runs directly south with three tracks for four

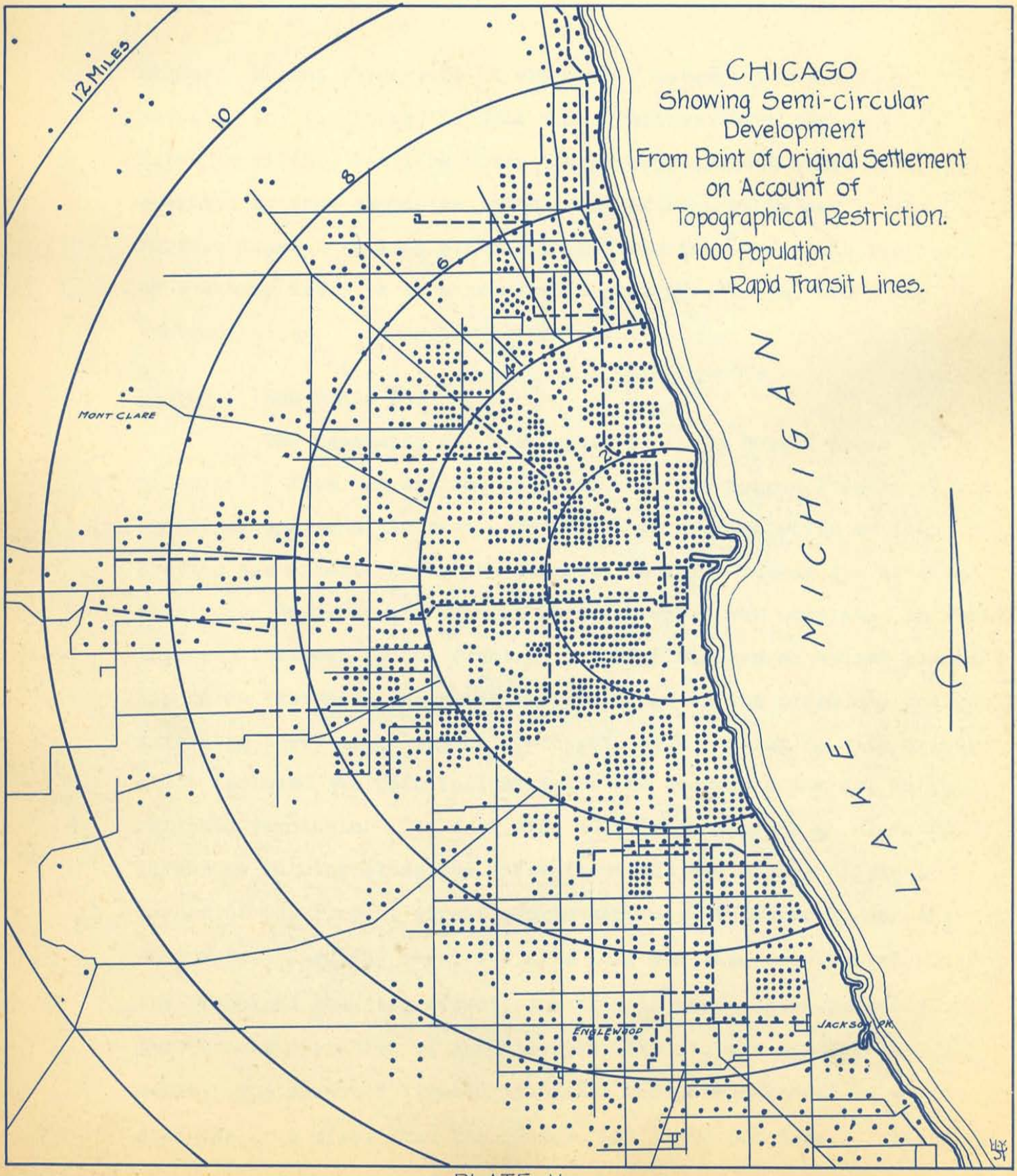

CHICAGO
Showing Semi-circular
Development
From Point of Original Settlement
on Account of
Topographical Restriction.
• 1000 Population
Rapid Transit Lines.
12 MILES
10
8
6
4
2
MONT CLARE
ENGLEWOOD
JACKSON PK.
LAKE MICHIGAN

PLATE II.

miles. Beyond this point it throws off several two track branches, covering the territory for four miles farther south and about 3½ miles in width. Until recently these rapid transit lines have been operated by four companies independent of each other and of the surface lines. Various plans for supplementing the present system by a subway loop, or by a complete system of subways, are under contemplation.

BOSTON - (See Plate #4):

The necessity for high speed lines in Boston arose principally from the extreme congestion in the narrow streets of the principal business district. In 1893 a partial solution of the problem was undertaken by the construction of a subway for surface cars under Boylston and Fremont streets, which was completed in 1898. This was followed by the construction of a high speed system consisting of an elevated line extending two miles to the north and another extending three miles to the southwest, both connecting with a loop which enclosed the principal district and connected the two large railroad terminals. The east side of this loop is on an elevated structure running along the water front and two of the original tracks of the Fremont street subway were used temporarily for the west side. A subway about one mile long was then constructed under the principal business street, and this is now used permanently for through operation of the elevated lines to the north and south. The elevated line to the south has been extended to a distance of 5 miles from the center, and it is proposed to extend

the northern arm to about the same distance.

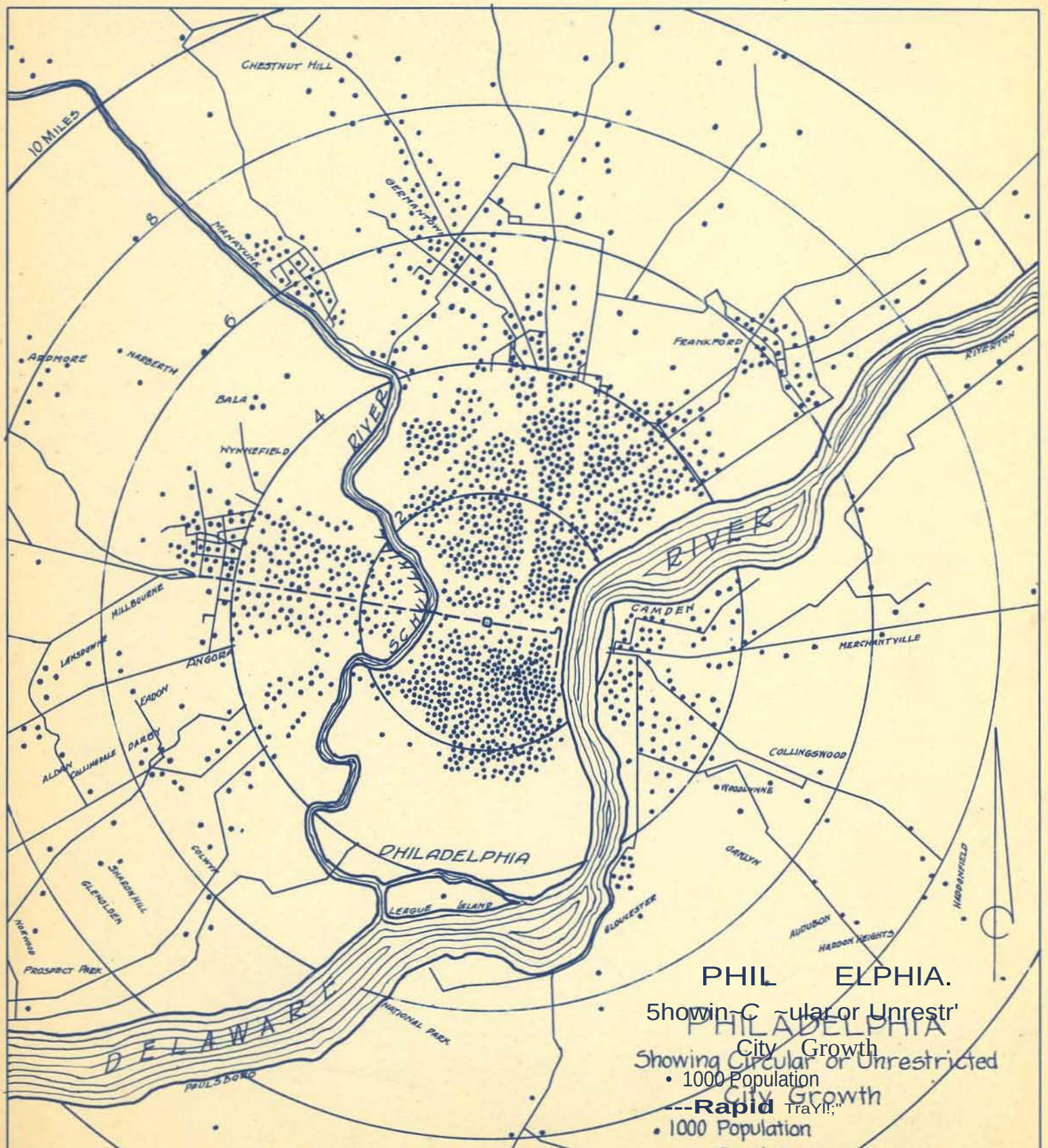
A tunnel has also been driven under the harbor to East Boston extending into the heart of the business district, where connection is made with the north and south line. Special type cars are operated singly in this tunnel and run out on the surface lines of East Boston.

Somewhat recently a subway line running about three miles westward to Cambridge has been placed in operation. Standard rapid transit service is maintained in this subway. An extension of this line eastward through the business district and thence southward for a distance of about two miles, has been authorized and is in process of construction. An elevated line for surface cars extends about a mile to the northwest and an extension of the subway for surface cars is being constructed to a point about two miles from the city hall.

All underground construction was undertaken by the city, while all of the elevated construction belongs to the operating company, which also owns and operates practically all of the surface system. All the high speed lines have elaborate terminals for the transfer of passengers to and from surface cars. This method of transfer is the most important feature of the Boston rapid transit system.

PHILADELPHIA - (See Plate #~~15~~ 12):

From a comparative standpoint, Philadelphia resembles Chicago in its wide area and in having its main business district



PHIL ELPHIA.

5howin~C ~ular or Unrestr'

City Growth

• 1000 Population

---**Rapid** TraYl!;"

located near its eastern limits, thus causing unsymmetrical development. To a greater extent, however, than any other American city, it consists of individual communities built up around manufacturing industries as centers. The proportion of traffic to the central delivery district is not as great as in the other large cities described. The central business district is not restricted topographically but as the streets are narrowand as there is so much crossing of traffic, the usual city congestion occurs. The transportation requirements of the important outlying districts have been fairly well supplied in the past by good steam railroad accommodations, the city terminals of the railroads being in the heart of the business district. The development of electric traction has had the usual effect of extending the building districts, but the area within the distance of a reasonable surface car ride is now well occupied. There is no congestion of population in Philadelphia comparable with that in parts of other large cities, and there has been but little development of tenements or apartment houses.

The existing Market street subway - elevated line is of the best and most highly developed design throughout, and is so located as to provide the east and west arm of a complete system, serving the entire city.

COMPARATIVE STATISTICS:

The following series of tables show the most important traffic and financial statistics of rapid transit service in the cities above mentioned. Information contained therein relates to the year ending June 30th, 1912, unless otherwise stated, as later

statistics for all cities are not available. It should be remembered that such data is principally valuable for the purpose of comparison. Construction of the various improvements outlined is being actively prosecuted in New York, Brooklyn and Boston. Philadelphia and Chicago have apparently deferred action until a more favorable financial period.

TABLE #8.

TRACK MILEAGE OF PASSENGER STREET TRANSPORTATION SYSTEMS.

City	Total	Surface	Rapid transit. Elevated.	Subway.	Total.	Ratio of Rap transit to Total track %
New York - (Manhattan and Bronx)	647.8	457.2	119.6	71.0	(A) 190.6	29.4
Brooklyn - (Including Queens)	820.7	698.8(b)	116.7	5.2	121.9	14.8
Total - Greater New York	1468.5	1156.0	236.3	76.2	312.5	21.3
Chicago	809.9	666.2	143.7		143.7	17.8
Philadelphia	579.4(c)	564.7	10.6	4.1	14.7	2.5
Boston	446.5(d)	420.0	17.7	8.8	26.5	5.9

(A) In New York 17.4 miles of elevated track belong to the subway system, but are here classed as "Elevated." All the McAdoo track is classed as "Subway," though 11.7 miles are in New Jersey.

(B) Only about 64.5 miles of the "Elevated" track in Brooklyn and Queens are on elevated structures.

(C) Philadelphia has included in "Surface" track 1.9 miles of subway track used for surface cars.

(D) Boston has 11.4 miles of subway and elevated track for surface cars, here included in surface track.

TABLE #9.

PASSENGER SYSTEM REVENUES.

City.	Total.	Surface.	Rapid Transit.	Ratio Rap.transit to total %
New York - (Manhattan and Bronx) (A)	$56,599,771	23,102,948	33,496,823	59.2
Brooklyn - (Incl. Queens)	26,438,850	18,440,209	7,998,641	30.3
Total - Greater New York	83,038,621	41,543,157	41,495,464	50.0
Chicago (B)	30,008,030	22,125,872	7,882,158	26.3
Philadelphia	21,697,703	19,950,920	1,746,783	8.1
Boston	15,491,052	(Not segregated)		

(A) Including Hudson and Manhattan R. R.

(B) Year to 6/30/10.

TABLE #10.

NUMBER OF REVENUE PASSENGERS CARRIED (C).

City	Total.	Surface.	Rapid Transit.	Ratio Rap.transit to total %
New York - (Manhattan and Bronx) (A)	1,128,254,194	463,075,271	665,178,923	59.0
Brooklyn - (Incl. Queens)	539,699,942	379,896,151	159,803,791	29.6
Total - Greater New York	1,667,954,136	842,971,422	824,982,714	49.5
Chicago (B)	606,770,027	445,562,120	161,207,907	26.6
Philadelphia	444,704,602	409,762,847	34,941,755	7.9
Boston	310,310,009	255,980,509	54,329,500	17.5

(A) Including Hudson and Manhattan R. R.
(B) Year to 6/30/10.
(C) In New York over one-half the passengers travel on the rapid transit system, while in Brooklyn one-third, in Chicago one-quarter, and in Philadelphia 8% use high speed lines.

TABLE #11.

CAR MILES OPERATED - (C)

City.	Total.	Surface.	Rapid Transit.	Ratio Rap.transit to total %
New York - (Manhattan & Bronx)	208,270,527	71,240,564	137,029,963	65.8
Brooklyn - (Incl.Queens)	97,832,490	67,244,944	30,587,546	31.3
Total - Greater New York	306,103,017	138,485,508	167,617,509	54.8
Chicago (A)	129,191,172	85,788,797	43,402,375	33.6
Philadelphia	82,868,950	76,745,454	6,123,496	7.4
Boston (B)	54,564,378	45,202,162	9,362,216	17.2

(A) Year to 6/30/10
(B) Boston Elevated Ry. Co. system only.

TABLE #12.

CAR MILES OPERATED PER MILE OF TRACK - (C)

City.	Surface.	Rapid Transit.	Ratio Rap.transit to surface %
New York - (Manhattan and Bronx)	155,800	699,800	4.5
Brooklyn - (Incl. Queens)	96,200	262,100	2.7
Average - Greater New York	119,800	536,400	4.5
Chicago (A)	128,800	302,000	2.5
Philadelphia	135,900	416,600	3.1
Boston (B)	107,600	353,300	3.3

(A) Year to 6/30/10.
(B) Boston Elevated Ry. Co. system only.
(C) Car miles operated per mile of track indicates density of traffic. Naturally, the traffic and car mileage over rapid transit track is much greater than over surface track. The relative number of car miles per track mile shows the relative efficiency of track layouts. In the case of

rapid transit lines, these comparative figures show roughly how near each city is to the limit of track capacity, as the number for New York represents a fair limit. On this basis, twice the present car mileage can be added in Chicago and Boston, and 70% more in Philadelphia.

TABLE #13.

REVENUE PASSENGERS PER MILE OF RAPID TRANSIT LINE (C).

New York - (Manhattan and Bronx)	9,124,500
Brooklyn - (Including Queens)	3,241,200
Average - Greater New York	6,751,000
Chicago - (A)	2,941,800
Philadelphia	4,786,500
Boston (B)	4,054,400

(A) Year to 6/30/10.
(B) Boston Elevated Ry. system only.
(C) Limit of capacity indicated to some extent by this table, but allowance must be made for the difference in length of haul, as with a shorter haul more passengers may be carried.

TABLE #14.

REVENUE PASSENGERS PER CAR MILE (C).

City.	Surface.	Rapid Transit.	Ratio Rapid transit To surface %
New York - (Manhattan and Bronx)	6.5	4.9	75
Brooklyn - (Incl. Queens)	5.6	5.2	93
Average - Greater New York	6.1	5.0	80
Chicago (A)	5.2	3.7	71
Philadelphia	5.3	5.7	108
Boston (B)	5.7	5.8	102

(A) Year to 6/30/10.
(B) Boston Elevated Ry. system only.
(C) Note that, except in Philadelphia and Boston, the revenue passengers per car mile are less on rapid transit than on surface lines, in spite of the fact that the former cars are larger. This is the result of the longer haul or greater number of passenger miles per passenger on rapid transit lines.

TABLE #15.

REVENUE RIDES PER YEAR PER CAPITA.

City.	Surface.	Rapid Transit.	Total.
New York - (Manhattan and Bronx)	159	229	388
Brooklyn - (Including Queens)	186	79	265
Average - Greater New York	171	167	338
Chicago (A)	204	74	278
Philadelphia	252	22	274
Boston (B)	234	50	284

(A) Year to 6/30/10
(B) Boston Elevated Ry. System only.

TABLE #16.

REVENUE RIDES PER CAPITA SINCE 1890 (C).

Year.	New York incl. Manhattan & Bronx	Brooklyn incl. Queens.	Greater New York	Chicago (A)	Phila-delphia.	Boston (B)
1890				159	158	172
1895				180	192	200
1900	276	208	249	200	220	229
1905	312	230	279	235	258	255
1910	376	251	325	278	258	274
1912	388	265	338		274	284

(A) Year to 6/30/10.
(B) Boston Elevated Ry. system only.
(C) The development of the habit of riding since the introduction of electric traction is shown by above table. Boston, Brooklyn and Philadelphia have followed about the same general rate. Chicago has increased more rapidly, while New York is in a class by itself. This is due to the distribution of population and to the large number of visitors continually in the city from distant or suburban points.

TABLE #17.

POPULATION PER MILE OF TRACK.

City.	Population	Rapid transit.		Surface.		Total.	
		Miles of Track	Pop per mile of track	Miles of Track	Pop per mile of track	Miles of Track	Pop per mile of track.
New York - (Manhattan and Bronx)	2,904,906	190.6	15241	457.2	6353	653.0	4449
Brooklyn - (Including Queens)	2,038,154	121.9	16720	698.8	2917	815.5	2499
Total - Greater New York (A)	4,943,060	312.5	15818	1156.0	4276	1468.5	3366
Chicago (B)	2,185,283	143.7	15207	666.2	3280	809.9	2698
Philadelphia (A)	1,623,200	14.7	110422	564.7	2874	579.4	2802
Boston (A)	1,094,831	26.5	41314	420.0	2607	446.5	2452
Total	9,846,374	497.4	19796	2806.9	3508	3304.3	2980

(A) Estimated for year 1912.

(B) United States Census - 1910.

TABLE #18.

MILEAGE OF PROPOSED EXTENSIONS TO RAPID TRANSIT SYSTEMS.

City.	Elevated Line	Elevated Track	Subway Line	Subway Track	Total Line	Total Track
New York - (Manhattan and Bronx)	18.7	63.0	27.9	89.4	46.6	152.4
Brooklyn - (Including Queens)	38.5	109.5	20.3	58.4	58.5	167.9
Total	57.2	172.5	48.2	147.8	105.4	320.3
Chicago			56.4	131.7	56.4	131.7
Philadelphia	16.9	33.9	8.6	25.4	25.5	59.3
Boston (A)	3.1	6.2	1.8	3.7	4.9	9.9
Total under construction	60.3	178.7	50.0	151.5	110.3	330.2
Total under construction and recommended	77.2	212.6	115.0	308.6	192.2	521.2

(A) Boston has also under construction 1.7 miles of lines, comprising 4.5 miles of subway track for surface cars.

TABLE #19.

MILEAGE OF RAPID TRANSIT SYSTEMS AFTER CONSTRUCTION OF PROPOSED EXTENSIONS.

City	Elevated Line	Elevated Track	Subway Line	Subway Track	Total Line	Total Track	Ratio to Total of all Cities - %. Line	Ratio to Total of all Cities - %. Track
New York - (Manhattan & Bronx)	62.5	182.6	55.3	160.4	117.8	343.0	30.2	33.8
Brooklyn - (Including Queens)	87.8	226.2	22.0	63.6	109.8	289.8	28.2	28.5
Total-Greater N.Y.	150.3	408.8	77.3	224.0	227.6	632.8	58.4	62.2
Chicago	54.8	143.7	56.4	131.7	111.2	275.4	28.5	26.9
Philadelphia	22.2	44.5	10.7	29.5	32.9	74.0	8.4	7.3
Boston	12.1	24.0	6.2	12.5	18.3	36.5	4.7	3.6
Total	239.4	621.0	150.6	397.7	390.0	1018.7	100.0	100.0

TABLE #20.

APPROXIMATE INVESTMENT IN RAPID TRANSIT SYSTEMS (H)

		City	Company	Total Investment
New York - (Manhattan and Bronx)	Subway	$40,000,000	$111,000,000(A)	151,000,000
	Elevated	10,000,000	110,000,000(B)	120,000,000
	Total	50,000,000	221,000,000	271,000,000
Brooklyn - (Incl. Queens)	Subway	5,000,000	4,000,000	9,000,000
	Elevated		51,000,000(C)	51,000,000
	Total	5,000,000	55,000,000	60,000,000
Total - Greater New York	Subway	45,000,000	115,000,000	160,000,000
	Elevated	10,000,000	161,000,000	171,000,000
	Total(D)	55,000,000	276,000,000	331,000,000
Chicago	Subway			
	Elevated		98,000,000(E)	98,000,000
	Total		98,000,000	98,000,000
Philadelphia	Subway			
	Elevated			
	Total(F)		17,000,000	17,000,000
Boston	Subway			
	Elevated			
	Total(G)	9,000,000	35,000,000	44,000,000
	Grand total -	$64,000,000	$426,000,000	$490,000,000

(A) Including investment in Hudson and Manhattan R. R., assumed at $74,000,000

(B) Including investment in Manhattan Ry., assumed at $101,000,000.

(C) Representing investment assumed at par value of bonds, notes and stock of Brooklyn Union Elevated R. R. and Sea Beach Ry. Co. Track is partly on the surface and power plant cost not included.

(D) Approximated from reports of Public Service Commission.

(E) Investment assumed at estimate of cost of reproduction of physical property.

(F) Approximate investment after deducting surface car subway.

(G) Approximate only, as it is impossible to separate the company's rapid transit and surface investments. City has additional investment of $8,000,000 in subways for surface cars and company has additional investment in subways and viaducts for surface cars.

(H) In New York all subways and elevated extensions of subways in outlying

TABLE #21

ESTIMATED PROPOSED INVESTMENT IN RAPID TRANSIT FACILITIES

RECOMMENDED FOR IMMEDIATE CONSTRUCTION.

		City.	Company.	Total Investment.	Status
New York - (Manhattan and Bronx)	Subway	$97,000,000	$70,000,000	$167,000,000	Under Constr-
	Elevated	7,000,000	38,000,000	45,000,000	uction.
	Total	104,000,000	108,000,000	212,000,000	
Brooklyn - (Including Queens)	Subway	45,000,000	30,000,000	75,000,000	Under
	Elevated	14,000,000	29,000,000	43,000,000	Constr-
	Total	59,000,000	59,000,000	118,000,000	uction.
Total Greater New York	Subway	142,000,000	100,000,000	242,000,000	
	Elevated	21,000,000	67,000,000	88,000,000	
	Total	163,000,000	167,000,000	330,000,000	(A)
Chicago	Subway	96,000,000	35,000,000	131,000,000	
	Elevated				
	Total	96,000,000	35,000,000	131,000,000	(B)
Philadelphia	Subway	31,000,000	7,000,000	38,000,000	
	Elevated	4,000,000	16,000,000	20,000,000	
	Total	35,000,000	23,000,000	58,000,000	
Boston	Subway	7,000,000	2,000,000	9,000,000	Under con
	Elevated		6,000,000	6,000,000	struction
	Total	7,000,000	8,000,000	15,000,000	(C)
Total	Subway	276,000,000	144,000,000	420,000,000	
	Elevated	25,000,000	89,000,000	114,000,000	
	Total	301,000,000	233,000,000	534,000,000	

(A) Comprises the "Dual System," to be owned by the City jointly with the two companies. Includes cost of equipment (about $47,000,000) and extensions of existing elevated lines (about $46,000,000) to be the property solely of the companies.

(B) Comprises a subway system to be owned by the city and leased to a company, which would own the equipment.

(C) Proposed subway is being built by the city and the elevated line is being built by the Boston Elevated Railway, which will own the entire equipment. Boston, also, has under way the construction of subways for surface cars to cost $8,300,000.00.

-0-

and that no one individual is entitled to more than his, or her, fair share.

The provision of adequate area for the operation of public transportation is vital to the growth of any city, since cheap and expeditious means of transit form the greatest factor in civic development. The character of such operating area, subway, elevated or surface, as the case may be, is economically determined by the topography of the city; but sub-surface construction as applied to urban traffic, should be looked upon as a measure of last resort, a necessity forced by conditions for which there is no other remedy. As an inlet for an extensive system of inter-urban lines, the construction of a subway occasionally becomes warranted, since there is no way by which a city can so effectively extend its sphere of influence as by the provision of unobstructed entrances and exits for high speed transportation.

-0-

SUMMARY.

It is possible that future years will bring an even greater growth of population to the City of Los Angeles and its environs than the product of the past amazing decade, and it is far from improbable that all territory contained within its metropolitan circle, will, in a comparatively brief period, be solidly built up with residential improvements of high class character, the homes of that proportion of the inhabitants who desire individual places of abode and less crowded conditions than inevitably obtain within a city's actual boundaries. Business activities will naturally increase in corresponding ratio, and the area required for the transaction of business must be capable of meeting the necessity of territorial expansion in exact proportion to the exigency, if the full measure of commercial prosperity is to be realized. Convenience of operation is a strong attraction and frequently the deciding factor in the location of commercial institutions, other things being equal, and inconvenience is only tolerated when natural remedies are incompetent to provide relief. A city is nothing more than an aggregation of population, and as such, is subject to the same natural laws as regulate each individual component. Cramped quarters can but produce cramped growth, and complete development can only be attained in adequate and suitable surroundings. A few cities, like a few individuals, have their inception under unfavorable circumstances, and labor, throughout their periods of existence, under conditions of physical disability.

Unable to achieve their proper growth in a normal manner, their development is only possible by the use of abnormal measures. A city, however, so located as to be free from topographical limitation, inherently possesses the ability to acquire symmetrical development with complete utilization of all possible tributary area, thus realizing the benefit of resources otherwise latent.

Los Angeles is fortunate in being so situated, and any measures employed to check or restrain its business area from expanding to its proper location can only be regarded as a subversion of natural forces fully able to provide their own solution of the congestion problem. As a matter of fact, the City is just passing from the adolescent stage; and the accommodations for the transaction of its business, together with its customs or ordinances for the conduct of its traffic, vehicular and pedestrian, are insufficient for a municipality containing possibly a million people. The problem of providing a larger area for commercial transactions will solve itself automatically by expansion or removal in the most convenient direction; and the passage of more stringent regulations governing the conduct of traffic will go far to relieve the present uncomfortable conditions. Rural customs are only permissible in rural communities. Frontage deliveries and the practice of standing vehicles on central thoroughfares can only be tolerated prior to civic growth and consequent population density. It should be realized that the vested right of any individual to the occupation of the common property, or streets, of any community, diminishes in direct proportion to the increase in the number of the inhabitants,

districts are owned by the City, and the subway equipment is owned entirely by the company, except in the case of the Hudson and Manhattan where the company owns both structure and equipment. The elevated system complete is owned by private corporations.

Chicago and Philadelphia systems were constructed entirely by private capital.

Boston subway structures within the city limits are owned by the City. All elevated structures, whether connected or not with the subways, all subway equipment, and the subway structure in Cambridge, are owned by the operating company.

Figures in this table taken to the nearest $1,000,000.

8. Judge Chalfant Statement of Decision in the Millennium Project

[Quoted text hidden]

7 attachments

- **The relation between transit availability and automobile ownershi-1.pdf**
  211K
- **Density, Car Ownership, and What It Means for the Future of Los Angeles _ Streetsblog Los Angeles.pdf**
  451K
- **FHWA NHTS BRIEF 2014, Mobility Challenges for Households in Poverty.pdf**
  1005K
- **Driving-to-Opportunity-Understanding-for-Housing-Voucher-Recipients.PDF**
  1669K
- **Mobility for the Poor_ Car-Sharing, Car Loans, and the Limits of Public Transit _ Newgeography.pdf**
  302K
- **LAWeekly – January 3, 2013 _ Hollywood's Urban Cleansing.pdf**
  55K
- **2015-4-30 Millennium Chalfant Decision.pdf**
  3835K

Alejandro Huerta <alejandro.huerta@lacity.org> Mon, Nov 23, 2015 at 1:33 PM
To: Richard Abrams <abramsrl@gmail.com>

Mr. Abrams, this batch received.

Alejandro A. Huerta
Environmental Analysis•Major Projects

On Mon, Nov 23, 2015 at 1:24 PM, Richard Abrams <abramsrl@gmail.com> wrote:

> Dear Mr. Huerta:
>
> Please find HELP's and CCLA's attachments:
>
> 2. The Relation Between Transit Availability and Automobile Ownership: the Case of Los Angeles County, University of New Orleans, School of Urban and Public Affairs, by Devajyoti Deka, 1-1-1999
>
> 3. December 30, 2010, Streetblog, Density, Car Ownership, and What It Means for the Future of Los Angeles, by Damien Newton
>
> 4. FHWA NHTS BRIEF 2014, Mobility Challenges for Households in Poverty
>
> 5. March 2014, URBAN INSTITUTE, Driving to Opportunity: Understanding the Links among Transportation Access, Residential Outcomes, and Economic Opportunity for Housing Voucher Recipients.
>
> 6. August 22, 2013, NewGeography, Mobility for the Poor: Car-Sharing, Car Loans, and the Limits of Public Transit, by Joel Kotkin

7. January 3, 2013, LA Weekly, Hollywood's Urban Cleansing 12,878 Mostly Latinos Are Pushed Out by City Hall, High Rents and Hipsters, by Patrick Range McDonald

8. Judge Chalfant Statement of Decision in the Millennium Project

On Mon, Nov 23, 2015 at 1:12 PM, Richard Abrams <abramsrl@gmail.com> wrote:

Dear Mr. Huerta:

Attached please find Hollywoodians Encouraging Logical Planning's [HELP] and Citizens Coalition Los Angeles' {CCLA] comments on the initial study for the Crossroad Project, 6665 Sunset Boulevard, Hollywood California.

As there are 18 enclosures - attachments, HELP's and CCLA's submission will require several emails. In addition to the initial comments, this email contains:

(1) 1915 Study of Street Traffic Conditions in the City of Los Angeles

---

Alejandro Huerta <alejandro.huerta@lacity.org> Mon, Nov 23, 2015 at 1:34 PM
To: Stephanie Eyestone-Jones <s.eyestone@eyestoneeir.com>, Heidi Mekkelson <h.mekkelson@eyestoneeir.com>

Alejandro A. Huerta
Environmental Analysis•Major Projects
213•978•1454

[Quoted text hidden]

7 attachments

- **The relation between transit availability and automobile ownershi-1.pdf**
  211K
- **Density, Car Ownership, and What It Means for the Future of Los Angeles _ Streetsblog Los Angeles.pdf**
  451K
- **FHWA NHTS BRIEF 2014, Mobility Challenges for Households in Poverty.pdf**
  1005K
- **Driving-to-Opportunity-Understanding-for-Housing-Voucher-Recipients.PDF**
  1669K
- **Mobility for the Poor_ Car-Sharing, Car Loans, and the Limits of Public Transit _ Newgeography.pdf**
  302K
- **LAWeekly – January 3, 2013 _ Hollywood's Urban Cleansing.pdf**
  55K
- **2015-4-30 Millennium Chalfant Decision.pdf**
  3835K

Richard Abrams <abramsrl@gmail.com> Mon, Nov 23, 2015 at 1:40 PM
To: alejandro.huerta@lacity.org, Hollywoodians Encouraging Logical Planning <HwoodCA@gmail.com>, RSM <AbramsRL@gmail.com>

Dear Mr. Huerta:

Attached please find additional attachments for HELP's and CCLA's comment on Initial Study for The Crossroads project:

9. Judge Allan Goodman's January 15, 2015 Statement of Decision in the Hollywood Community Plan litigation

10. 2001 Mineta Transportation Institute Study, A New Planning Template for Transit Oriented Development

11. November 2015, Reason Foundation in its Increasing Mobility in Southern California: A New Approach.

[Quoted text hidden]

3 attachments

HCP 2014-1-15 GOODMAN Statement of Decision.pdf
1754K

SanJoseTODStudy.pdf
1244K

Reasons Southern California Mobility Plan.pdf
11647K

Alejandro Huerta <alejandro.huerta@lacity.org> Mon, Nov 23, 2015 at 1:46 PM
To: Richard Abrams <abramsrl@gmail.com>

This batch received.

On Mon, Nov 23, 2015 at 1:40 PM, Richard Abrams <abramsrl@gmail.com> wrote:

> Dear Mr. Huerta:
>
> Attached please find additional attachments for HELP's and CCLA's comment on Initial Study for The Crossroads project:
>
> 9. Judge Allan Goodman's January 15, 2015 Statement of Decision in the Hollywood Community Plan litigation
>
> 10. 2001 Mineta Transportation Institute Study, A New Planning Template for Transit Oriented Development
>
> 11. November 2015, Reason Foundation in its Increasing Mobility in Southern California: A New Approach.
>
> On Mon, Nov 23, 2015 at 1:24 PM, Richard Abrams <abramsrl@gmail.com> wrote:
>
> > Dear Mr. Huerta:
> >
> > Please find HELP's and CCLA's attachments:
> >
> > 2. The Relation Between Transit Availability and Automobile Ownership: the Case of Los Angeles County, University of New Orleans, School of Urban and Public Affairs, by Devajyoti Deka, 1-1-1999
> >
> > 3. December 30, 2010, Streetblog, Density, Car Ownership, and What It Means for the Future of Los Angeles, by Damien Newton
> >
> > 4. FHWA NHTS BRIEF 2014, Mobility Challenges for Households in Poverty

5. March 2014, URBAN INSTITUTE, Driving to Opportunity: Understanding the Links among Transportation Access, Residential Outcomes, and Economic Opportunity for Housing Voucher Recipients.

6. August 22, 2013, NewGeography, Mobility for the Poor: Car-Sharing, Car Loans, and the Limits of Public Transit, by Joel Kotkin

7. January 3, 2013, LA Weekly, Hollywood's Urban Cleansing 12,878 Mostly Latinos Are Pushed Out by City Hall, High Rents and Hipsters, by Patrick Range McDonald

8. Judge Chalfant Statement of Decision in the Millennium Project

On Mon, Nov 23, 2015 at 1:12 PM, Richard Abrams <abramsrl@gmail.com> wrote:

Dear Mr. Huerta:

Attached please find Hollywoodians Encouraging Logical Planning's [HELP] and Citizens Coalition Los Angeles' {CCLA] comments on the initial study for the Crossroad Project, 6665 Sunset Boulevard, Hollywood California.

As there are 18 enclosures - attachments, HELP's and CCLA's submission will require several emails. In addition to the initial comments, this email contains:

(1) 1915 Study of Street Traffic Conditions in the City of Los Angeles

---

Alejandro Huerta <alejandro.huerta@lacity.org> Mon, Nov 23, 2015 at 1:52 PM
To: Stephanie Eyestone-Jones <s.eyestone@eyestoneeir.com>, Heidi Mekkelson <h.mekkelson@eyestoneeir.com>

---------- Forwarded message ----------
From: **Richard Abrams** <abramsrl@gmail.com>
Date: Mon, Nov 23, 2015 at 1:40 PM
Subject: Re: Crossroads Project, 11-23-2015 comments in Initial Study
To: alejandro.huerta@lacity.org, Hollywoodians Encouraging Logical Planning <HwoodCA@gmail.com>, RSM <AbramsRL@gmail.com>

[Quoted text hidden]

3 attachments

HCP 2014-1-15 GOODMAN Statement of Decision.pdf
1754K

SanJoseTODStudy.pdf
1244K

Reasons Southern California Mobility Plan.pdf
11647K

Richard Abrams <abramsrl@gmail.com> Mon, Nov 23, 2015 at 1:57 PM

To: alejandro.huerta@lacity.org, Hollywoodians Encouraging Logical Planning <HwoodCA@gmail.com>, RSM <AbramsRL@gmail.com>

Dear Mr. Huerta:

And here is another batch of HELP and CCLA attachments:

12. The Myth of Rapid Mass Transit, by Richard Lee Abrams, May 30, 2005

13. November 3, 2015, FORBES, So Much For The Death Of Sprawl: America's Exurbs Are Booming, by Joel Kotkin

14. The Generational Future of Los Angeles: Projections to 2030 and Comparisons to Recent Decades, March 2013, The Sol Price School of Public Policy by Myers and Pitkin

15. July 2014, The Rise of the Corporate Landlord, The Institutionalization of the Single-Family Rental Market and Potential Impacts on Renters, by Desiree Fields

I think we can include the balance of attachments with one more email.

[Quoted text hidden]

4 attachments

RMT-2005 article.pdf
7217K

So Much For The Death Of Sprawl - America's Exurbs Are Booming.pdf
379K

Sol Price 2013 Generational Future Los Angeles.pdf
2427K

2014 The Rise of The Corproate Landlord.pdf
4360K

Alejandro Huerta <alejandro.huerta@lacity.org> Mon, Nov 23, 2015 at 1:59 PM
To: Richard Abrams <abramsrl@gmail.com>

This batch received.
[Quoted text hidden]

Richard Abrams <abramsrl@gmail.com> Mon, Nov 23, 2015 at 2:03 PM
To: alejandro.huerta@lacity.org, Hollywoodians Encouraging Logical Planning <HwoodCA@gmail.com>, RSM <AbramsRL@gmail.com>

Dear Mr. Huerta:

This is our last email with attachments:

16. 2008-2-7 LA Weekly, City Hall's "Density Hawks" Are Changing L.A.'s DNA, By Steven Leigh Morris, http://bit.ly/1CxiGep

17. April1 , 2015, Why Older Millennials Are Leaving the Urban Core and Younger Millennials Aren't Far Behind by Ryan Servino

18. July 16, 2015, Urbanism, Millennials Will Live In Cities Unlike Anything We've Ever Seen Before by Alissa

Walker

This completes all of HELP's and CCLA's transmissions for today.

Thank you for your patience with this segmented submission on the Crossroads project.
[Quoted text hidden]

3 attachments

2008-2-27 LA Weekly LA's Density Hawks.pdf
165K

Why Millennials Are Leaving the Urban Core.pdf
1392K

Millennials Will Live In Cities Unlike Anything We've Ever Seen Before.pdf
1798K

Alejandro Huerta <alejandro.huerta@lacity.org> Mon, Nov 23, 2015 at 2:05 PM
To: Stephanie Eyestone-Jones <s.eyestone@eyestoneeir.com>, Heidi Mekkelson <h.mekkelson@eyestoneeir.com>

---------- Forwarded message ----------
From: **Richard Abrams** <abramsrl@gmail.com>
Date: Mon, Nov 23, 2015 at 1:57 PM
Subject: Re: Crossroads Project, 11-23-2015 comments in Initial Study
To: alejandro.huerta@lacity.org, Hollywoodians Encouraging Logical Planning <HwoodCA@gmail.com>, RSM <AbramsRL@gmail.com>

[Quoted text hidden]

4 attachments

RMT-2005 article.pdf
7217K

So Much For The Death Of Sprawl - America's Exurbs Are Booming.pdf
379K

Sol Price 2013 Generational Future Los Angeles.pdf
2427K

2014 The Rise of The Corproate Landlord.pdf
4360K

Alejandro Huerta <alejandro.huerta@lacity.org> Mon, Nov 23, 2015 at 2:06 PM
To: Richard Abrams <abramsrl@gmail.com>

Dear Mr. Abrams:

I received the last batch.

Sincerely,
Alejandro A. Huerta
Environmental Analysis•Major Projects

[Quoted text hidden]

Alejandro Huerta <alejandro.huerta@lacity.org> Mon, Nov 23, 2015 at 2:09 PM
To: Heidi Mekkelson <h.mekkelson@eyestoneeir.com>, Stephanie Eyestone-Jones <s.eyestone@eyestoneeir.com>

---------- Forwarded message ----------
From: **Richard Abrams** <abramsrl@gmail.com>
Date: Mon, Nov 23, 2015 at 2:03 PM
Subject: Re: Crossroads Project, 11-23-2015 comments in Initial Study
To: alejandro.huerta@lacity.org, Hollywoodians Encouraging Logical Planning <HwoodCA@gmail.com>, RSM <AbramsRL@gmail.com>

[Quoted text hidden]

3 attachments

2008-2-27 LA Weekly LA's Density Hawks.pdf
165K

Why Millennials Are Leaving the Urban Core.pdf
1392K

Millennials Will Live In Cities Unlike Anything We've Ever Seen Before.pdf
1798K

Richard Abrams <abramsrl@gmail.com> Mon, Nov 23, 2015 at 2:12 PM
To: Alejandro Huerta <alejandro.huerta@lacity.org>

Thank you for letting us know.
[Quoted text hidden]

Heidi Mekkelson <h.mekkelson@eyestoneeir.com> Mon, Nov 30, 2015 at 7:46 AM
To: Alejandro Huerta <alejandro.huerta@lacity.org>, Stephanie Eyestone-Jones <s.eyestone@eyestoneeir.com>

Received, thanks.

From: Alejandro Huerta [mailto:alejandro.huerta@lacity.org]
Sent: Monday, November 23, 2015 1:34 PM
To: Stephanie Eyestone-Jones; Heidi Mekkelson
Subject: Fwd: Crossroads Project, 11-23-2015 comments in Initial Study

[Quoted text hidden]

Heidi Mekkelson <h.mekkelson@eyestoneeir.com> Mon, Nov 30, 2015 at 7:46 AM
To: Alejandro Huerta <alejandro.huerta@lacity.org>, Stephanie Eyestone-Jones <s.eyestone@eyestoneeir.com>

Received, thanks.

From: Alejandro Huerta [mailto:alejandro.huerta@lacity.org]
Sent: Monday, November 23, 2015 1:52 PM
To: Stephanie Eyestone-Jones; Heidi Mekkelson
Subject: Fwd: Crossroads Project, 11-23-2015 comments in Initial Study

[Quoted text hidden]

Heidi Mekkelson <h.mekkelson@eyestoneeir.com> Mon, Nov 30, 2015 at 7:46 AM
To: Alejandro Huerta <alejandro.huerta@lacity.org>, Stephanie Eyestone-Jones <s.eyestone@eyestoneeir.com>

Received, thanks.

From: Alejandro Huerta [mailto:alejandro.huerta@lacity.org]
Sent: Monday, November 23, 2015 2:05 PM
To: Stephanie Eyestone-Jones; Heidi Mekkelson
Subject: Fwd: Crossroads Project, 11-23-2015 comments in Initial Study

[Quoted text hidden]

Heidi Mekkelson <h.mekkelson@eyestoneeir.com> Mon, Nov 30, 2015 at 7:46 AM
To: Alejandro Huerta <alejandro.huerta@lacity.org>, Stephanie Eyestone-Jones <s.eyestone@eyestoneeir.com>

Received, thanks.

From: Alejandro Huerta [mailto:alejandro.huerta@lacity.org]
Sent: Monday, November 23, 2015 2:09 PM
To: Heidi Mekkelson; Stephanie Eyestone-Jones
Subject: Fwd: Crossroads Project, 11-23-2015 comments in Initial Study

[Quoted text hidden]

1-1-1999

The relation between transit availability and automobile ownership: the case of Los Angeles County

Devajyoti Deka
University of New Orleans

The Relation Between Transit Availability and Automobile Ownership: The Case of Los Angeles County

Devajyoti Deka

1999

Introduction

The primary objective of this research is to examine the relationship between transit availability and automobile ownership of households, with special reference to the low-income population of Los Angeles. National data show that during the last few decades there has been a significant increase in automobile ownership among low-income households in general (Bureau of Transportation Statistics, 1990; Millar, Morrison, and Vyas, 1986). In fact, among all income groups, the increase in auto ownership has been the highest for the lowest income group (Millar, Morrison, and Vyas, 1986). Since low-income households have traditionally constituted a large segment of the transit market, the recent increases in their automobile ownership make one wonder whether, or to what extent, mass transit continues to serve the travel needs of these households.

The 1990 Nationwide Personal Transportation Survey reveals that approximately 61 percent of the households earning an annual income of less than

$10,000 had at least one vehicle at their disposal in 1983 (Bureau of Transportation Statistics, 1990). By 1990, however, this proportion increased to more than 65 percent, indicating a rapid increase in vehicle ownership among the poor during the intervening period.

Since a majority of the carless households in the country are poor, the changes in the proportion of carless households also indicate to some extent the changes in automobile ownership among the low-income households (Bureau of Transportation Statistics, 1990; Lave and Crepeau, 1994). The number of carless households in the country decreased from 11.4 million in 1960 to 10.6 million in 1990 in spite of a significant increase in the total number of households during this period (Pisarski, 1996). In terms of percentage change, the proportion of carless households decreased from 21 percent in 1960 to 11.5 percent in 1990. When New York City was excluded, the proportion of carless households in the country amounted to only about 9 percent (Lave and Crepeau, 1994). The proportion of carless households in certain urban areas is even smaller. For example, in Los Angeles County, the study area for this research, less than 5 percent of the households are currently carless.[1]

For empirical analysis, this research uses household-level data from the 1991 travel survey conducted by the Southern California Association Governments (SCAG). In addition to the household-level data from the 1991 travel survey, census tract-level data from various other sources have been used. The study area is restricted to Los Angeles County. The county was chosen as the study area because of several reasons. *First*, since the poverty population in the county is very large, transit policies are likely to affect a large number of the low-income households. The extent of poverty in the county is apparent from the fact that approximately 1.3 million of its inhabitants, or 15 percent of the total population, live below the poverty level. According to Wolch

(1998), about one in four of the county's residents received some form of welfare benefits in 1995. *Second*, mobility problems of low-income and minority populations in Los Angeles have historically attracted a lot of attention even at the national level, as evident from the federally organized reverse-commuting projects of the 1960s (Meyer and Gomez-Ibanez, 1981). *Third*, the economy of the region has been performing rather poorly in the 1990s (Lee, 1997). Since it is the poor who are most affected at times of economic distress (O'Sullivan, 1996), there is an increasing need to address the mobility problems of the region's low-income households, especially of the workers from these households. *Fourth*, there is a growing concern that mass transit in Los Angeles is becoming increasingly inequitable and detrimental to the travel needs of the low-income population (Rubin and Moore, 1996, 1997). *Finally*, there have been serious concerns in the recent past about environmental justice issues in the county in regards to provision of transportation infrastructure and services (Bullard and Johnson, 1997; Taylor et al., 1995). These issues led to litigation against the largest transit provider of the region.

Probit and logit analyses with instrumental variables were undertaken for empirical estimation of the model examining the relationship between transit availability and automobile ownership. The basic conclusion from the analyses is that automobile ownership is relatively low in areas with high transit level of service. However, the results indicate that the probability of automobile ownership decreases only slightly with increases in transit services. The analysis also shows that the low-income households in the study area have a low propensity to own automobiles, implying that transit availability may still have considerable importance fulfilling these households' mobility needs.

Income and Travel Mode

Household income is closely related to automobile ownership. For example, the 1990 Nationwide Personal Transportation Survey shows that the average number of automobiles for households with less that $10,000 annual income is merely 1.0, whereas the average for households with income $40,000 or over is 2.3 (Hu and Young, 1993, Table 3.18). One can also observe that 91 percent of the trips made by households with $40,000 or more annual income are made by automobile, whereas only 70 percent of the trips made by households with less than $10,000 are made by this mode (ibid., Table 4.33). The lower proportion of trips by automobile for the low-income households is matched by a higher proportion of trips by transit.

A similar relationship between income and mode can be observed in Los Angeles county also. Table 1 shows a cross-tabulation of household income and automobile ownership. It is evident from this cross-tabulation that the proportion of low-income households decreases drastically as the number of automobiles per household increases, indicating the possibility of a direct or positive relationship between income and automobile ownership. Table 2 shows the relationship between income and mode use. It is evident from the table that individuals from high-income households in the county have a far greater propensity to make trips by automobile than individuals from lower income households. The data also shows that individuals from lower-income households are more likely to use public transit than individuals from higher income households.

Table 1. Percent Distribution of Households by Household Income and Automobile Ownership in Los Angeles County (N= 5,626 Households)

Annual Household	Percentage Households with

Income (in $ '000)	0 Auto	1 Auto	2 Autos	3 Autos	4 or More Autos
Less than 7.5	28.67	43.01	17.83	5.59	4.90
7.5-15	18.23	54.51	19.74	5.08	2.44
15-20	7.94	47.89	32.01	7.94	4.22
20-30	3.62	48.94	34.08	9.11	4.24
30-40	2.03	34.82	48.54	10.29	4.32
40-50	0.83	26.14	52.01	15.08	5.95
50-75	0.46	13.00	56.92	20.15	9.47
75-100	1.04	9.88	53.38	21.14	14.56
100-150	0.31	5.96	50.78	26.02	16.93
150 or more	0.00	4.96	47.11	23.14	24.79
All Households	4.87	29.91	43.65	14.01	7.55

Source: Estimated from the SCAG travel survey,1991.

Table 2. Percent Distribution of Trips by Mode and Household Income of Trip Maker in Los Angeles County (N= 35,591 trips)

Annual Household Income ($)	Mode Used	
	Automobile	Local Bus
0-15,000	7.61	39.97
15,000-30,000	16.84	29.83
30,000-50,000	27.80	20.07
50,000-75,000	24.02	6.70
75,000-100,000	12.96	0.90
100,000 or more	10.77	2.53
Total	100.00	100.00

Source: Estimated from the SCAG travel survey, 1991.

The Increasing Rate of Automobile Ownership

Automobile ownership is an important factor determining individuals' mobility and accessibility because this mode is the fastest of all popular urban transportation modes. It is in fact quite common for researchers to heavily emphasize automobile ownership or use as one of the most important factors determining accessibility levels (Koening, 1980; Morris, Dumble, and Wigan, 1979). In addition to being the fastest

mode, an automobile also provides a level of comfort and convenience unparalleled by other modes of urban transportation.

One of the indicators of mobility of an individual or a group is the amount of travel undertaken (Hanson 1995; Bureau of Transportation Statistics, 1997). The faster speed of an automobile provides a greater mobility than other modes. Data from Los Angeles (Table 3) show that workers from households with larger number of automobiles on an average make longer commuting trips. These longer trips are indicative of a greater level of mobility. Due to its ability to provide a greater level of mobility, the automobile is attractive to all individuals, including the poor.

Table 3. Commuting Distance of Workers Belonging to Households with Different Automobile-Ownership Rates in Los Angeles County

Household Automobile Ownership Rate	Average Commuting Distance (Miles)
No Automobile	5.30
One Automobile	7.14
Two Automobiles	10.97
Three or More Automobiles	11.14

Source: Estimated from the SCAG travel survey, 1991.

The increase in automobile ownership among low-income households may be due to several reasons. One reason could be the externalities arising from the extensive use of automobiles by higher-income and middle-income households. Automobile ownership and activity decentralization have aided each other for decades, leading to a dispersed activity location pattern that causes a serious accessibility problem for those without an automobile. It is likely that many of the low-income households have sought a solution to this problem by acquiring an automobile. To understand the relationship of

auto use among low-income households vis-à-vis auto use by higher-income households and activity location pattern, one has to undertake an analysis with temporal data. This study, being conducted with cross-sectional data for a one time period, is unable to examine this relationship.

Another reason for the increase in automobile ownership among low-income households may be the decreasing real cost of automobile ownership and operation during the last few decades. National data indicate that the consumer price index for motor vehicles and parts has increased significantly slower than the price index for commodities as a whole, indicating a decline in the real cost of auto ownership (US Department of Commerce, 1997).[2] At the same time, the consumer price index for gasoline and oil has remained constant since the early 1980s, again indicating a favorable condition for consumers of these products.

Although the consumer price indices indicate that the ownership and maintenance costs of automobile have remained fairy low over the years, when one contrasts these costs with the household income of the poor, the costs may appear rather high. In 1991, the American Automobile Association (1991) estimated the annualized cost of an average compact automobile at $3,526. The Federal Highway Administration (1991) estimated the average annual cost of an intermediate-size automobile at $3,560 for the same year. In contrast, the income threshold for a four-member poverty household was only $13,359 in 1990 (Jennings, 1994). These figures indicate that in order to own an automobile, a four-member household in poverty would have to spend at least a quarter of its income. This may be quite burdensome for poor households. A 1993 Consumer Expenditure Survey by the Bureau of Labor Statistics (1996) indicates that the lowest-income quintile of households spends about 33 percent of their after-tax income on transportation while an average household spends only about 17 percent.

This also indicates that transportation costs impose a greater burden on the household budgets of the poor than the population at large.

Yet another reason for the increase in automobile ownership among low-income households may be the declining quality of transit services. In urban areas like Los Angeles, where mass transit has been accused of being apathetic to the travel needs of the poor, the high rate of automobile ownership among the low-income households may well be the result of inappropriate transit service provision.

Mass Transit for the Poor

The mode that receives the greatest attention as an alternative to the automobile is mass transit. This is in spite of the fact that mass transit carries only about 1.8 percent of all person trips and 5.3 percent of all commuting trips in urban areas of the country (Vincent et al., 1994). Although mass transit had historically been a self-sufficient industry, it has been heavily dependent on government subsidies since the 1960s. With declining fare box revenue and increasing reliance on subsidization, the welfare role of transit seems to have become more important since then.

Since a large section of transit riders belong to low-income and minority households, in certain quarters transit's primary objective is considered to be provision of welfare. According to the American Public Transit Association (1995), one of the major objectives of mass transit is to provide mobility to the transportation disadvantaged, of which the poor constitute the largest segment (Meyer and Gomez-Ibanez, 1981). Needless to say, one of the reasons for subsidization of transit is the expectation that it continues to perform this welfare function.

When society's expectations are growing about transit's role as a provider of welfare, there is also an increasing concern that much of the transit services are being

allocated in a manner that is detrimental, or at least apathetic, to the travel needs of the poor. For example, even though it has been pointed out that transit's most profitable routes are mainly in central cities, where low-income and minority households predominantly live (Cervero, 1990), there has been a growing tendency in the recent past to extend transit routes to suburban areas (Wachs, 1989). In addition, recent years have also seen substantial investments on rail transit projects, even though bus riders on an average have lower incomes than rail riders (Wachs, 1989; Pickrell, 1992; Rubin and Moore, 1996, 1997). The prevailing criticisms about transit's failure to perform its welfare functions provide an impetus to this study.

Location of Low-Income Households

Location of households may be an important consideration when estimating accessibility level of any particular group. The reason is that, all else being equal, if the location of homes is close to location of an activity, there is likely to exist a high accessibility for the population group in question for that particular activity. For example, when the location of a group of households is closer to jobs than another group of households, the former group is likely to have a higher job accessibility level than the latter.

In almost all metropolitan areas of the US, poverty is concentrated mainly in the central cities. The poor have concentrated in central cities for a variety of reasons, including availability of low-skilled jobs in nearby areas, their low wages, discrimination in the suburban housing market, and availability of smaller and low-quality housing units in central areas (Clark and Whiteman, 1981; Kain, 1968). Los Angeles is no exception in regards to concentration of poverty in central locations. In this county, the census tracts with extreme poverty concentration are located around the

downtown and along the Interstate-110 corridor in South-Central Los Angeles. Figure 1 shows the concentration of poverty in census tracts of Los Angeles County. The figure also shows a fair amount of poverty concentration in the City of Long Beach, a large regional center with port facilities.

Variations in Automobile Ownership Rate

A comparison of locational distribution of the poverty population with the locational distribution of automobile ownership rates provides an insight into the mobility of the low-income households in Los Angeles. Figure 2 shows the automobile ownership rates per individual 18 years or older in census tracts of Los Angeles county. It is evident that generally the tracts with central location have the lowest automobile ownership rates, while the suburban tracts have higher rates. Comparison of Figure 2 with Figure 1 shows that automobile ownership is generally the lowest in the areas with high poverty concentration, indicating a potential negative relationship between income and automobile ownership.

Variations in Transit Availability

A GIS-based transit availability index was developed to measure transit availability of census tracts in Los Angeles County.[3] The transit availability index for the census tracts was obtained by using route density and frequency of services on each route. In order to account for walking trips to transit stations/stops outside the census tract of residence, the boundary of each tract was increased by 0.6 miles on all sides for

estimating the index. Transit routes within this extended area was considered accessible to individuals within the census tract. The index was estimated as follows:

$$\left(\sum_{r=1}^{m} L_r F_r \right) \div A_i$$

Where L is the length (miles) of a transit route r within the extended area of the census tract i, F is the hourly service frequency on route r within that area in AM peak period, m is the number of routes within the extended census tract, and A_i is the extended area of the tract (square miles). For the estimation of this index, route maps and frequency of services were collected from all the major transit providers in the county, including Los Angeles County Metropolitan Transportation Authority, Santa Monica Municipal Bus Lines, Culver City Municipal Bus Lines, Long Beach Public Transportation Company, Foothill Transit, City of Torrance Transit System, City of Gardena Municipal Bus Lines, Montebello Municipal Bus Lines, Norwalk Transit System, and City of Commerce Municipal Bus Lines.

In spite of the recent tendency towards suburbanization of transit services, in Los Angeles County transit continues to be provided predominantly in central city areas. This is evident from Figure 3, where availability of transit services in census tracts within Los Angeles County is shown. It is evident that transit availability is significantly higher in the City of Los Angeles than the suburban jurisdictions. Transit availability is particularly high in the east-west corridor along Interstate-10 as well as the Interstate-110 corridor south of downtown Los Angeles. The transit availability index shown in Figure 3 can be compared with the location of low-income populations within the county, as shown in Figure 1. This comparison shows that transit availability index is fairly high in most areas with high concentration of low-income populations. The Interstate-10 corridor west of downtown seems to be the only exception, where

transit availability is high without having a high concentration of low-income populations. A comparison of Figure 3 with Figure 2 indicates that transit availability is fairly high in most areas with low automobile-ownership rates. However, transit availability is also fairly high in some areas with reasonably high automobile-ownership rates, such as the areas along the western half of the Interstate-10 corridor.

The Relationship Between Transit Availability and Automobile Ownership

The foregoing discussion provides an insight into the locational distribution of low-income households, as well as locational variations in automobile ownership rates and transit availability. Although the information provided above gives a general picture of the relationship between transit availability and automobile ownership, it does not provide any objective measure of this relationship. The following analysis is meant to obtain an understanding of the relationship in an objective manner.

The analysis begins with a statement of the conceptual relationship between transit availability and automobile ownership. This statement is followed by a brief review of literature addressing similar issues. Subsequently the relationship between the two variables is empirically estimated using data from Los Angeles County. Finally, the implications of the empirical estimation are discussed.

The Conceptual Model

The hypothesis to be tested here is that household automobile ownership varies according to availability of mass transit in areas where the households locate. Thus, the number of automobiles owned by households is the dependent variable while the

availability of mass transit in the residence zones is the key policy variable. Since automobile ownership is likely to depend not only on transit availability, but also on several other variables, these other variables are to be included as controls. These control variables pertain either to the households or the zones. The household characteristics considered for the purpose of testing this hypothesis were household income, dwelling type, number of licensed drivers, number of workers, and household size. The control variables for locational characteristics included job density and dwelling density of census tracts. It is expected that household income, household size, number of workers in household, number of licensed drivers in household, and residence in single family dwellings will have a positive relationship with automobile ownership. It is expected that job density and dwelling density in residence zones will have a negative relationship with automobile ownership of households. Finally, it is expected that automobile ownership will have a negative relationship with transit availability.

Previous Studies on Auto Ownership

There are numerous examples in the existing literature where researchers have estimated automobile ownership of households in terms of household characteristics and zonal characteristics (Golob and Van Wissen, 1989; Golob, 1990; Golob, 1996; Train, 1980; Lerman and Ben-Akiva, 1976; Burns et al., 1976).

In terms of methodologies, most studies use some form of logit or probit models for estimating automobile ownership. Although there has been a reasonable consistency in using probit and logit models to estimate auto ownership, there is no consistency in

the selection of independent variables in the various models. While Golob and Van Wissen (1989) use only income as an independent variable, other studies, such as Train (1980), Lerman and Ben-Akiva (1976), and Golob (1996) use several independent variables in their models. Characteristics of households and zones have been used as independent variables in these studies. Models have included income, household size, and number of licensed drivers as household characteristics. For zonal characteristics, models have considered density of activities, transit accessibility, and certain dummy variables indicating whether a household is located in an urban area or a rural area, or whether household is located near CBD or far from CBD. Aside from these household and zonal characteristics, variables such as housing type and tenure status of dwellings have been used as independent variables in some of the models.

Among the aforementioned studies, the two that were specifically interested in identifying the relationship between transit availability/accessibility and automobile ownership were Train (1980) and Lerman and Ben-Akiva (1976). Although Train included the transit variable as one of the independent variables in his model, Lerman and Ben-Akiva refrained from including the variable in spite of conceptual consideration. One of the potential flaws in Train's model was that he did not consider the possibility of an endogeneity problem between transit accessibility and auto ownership.

Empirical Estimation of the Model

Empirical estimation of the model was undertaken with data for Los Angeles County. One of the potential problems in estimating the conceptual model was that of

endogeneity or simultaneity between transit availability and auto ownership. Although it is crucial for the study to determine auto ownership of households on the basis of transit availability in the areas of their residence, the relationship between the two variables is not uni-directional. That is, while auto ownership of households may be affected by transit availability in their residence zones, transit availability in different zones may be affected by the auto-ownership rates of households within the zones. In other words, while households' auto ownership decisions may be affected by zonal transit availability, transit agencies may provide services on the basis of auto ownership rates of residents. This bi-directional relationship between transit availability and automobile ownership may cause an endogeneity problem in the model. An endogeneity problem results in biased and inconsistent estimation of a model. To overcome the potential endogeneity problem, the instrumental variables method was used for estimation of automobile ownership. The instrumental variables method produces estimates that are biased but consistent. The theoretical underpinnings for simultaneous categorical models of the type adopted here are to be found in Amemiya, 1978; Rivers and Vuong, 1988; Heckman, 1978; Maddala and Lee, 1976; Lee, Maddala and Trost, 1980.

Considering that transit agencies are likely to provide services on the basis of certain zonal characteristics, in the first step of this modeling exercise, transit availability of zones was predicted by a regression model. The independent variables used in this model are listed in Table 4. The parameter estimates and the test statistics are provided in Table 5. The regression model in Table 5 provided the predicted values

of transit availability index for census tracts. These constitute the instrumental variable for the subsequent probit and logit models.

Table 4. Description of Variables Used for Estimating Transit Availability in Census Tracts

CBD	Dummy variable indicating whether the census tract is in CBD, yes=1, no=0
POVERTY	Percent population below poverty in census tract
NWHITE	Proportion of nonwhite persons in tract
JOBDENS	Density of jobs per square mile in census tract
DWDENS	Density of dwellings per square mile in census tract
MEDAGEST	Median age of structures in census tract

Source: 1990 Census of Population and GIS map for census tracts.

Table 5. Regression Model Estimating Transit Availability in Census Tracts

Variable	Mean	Std. Devn.	Parameter Estimate		Stdzd. Parameter Estimate	Std. Error	Hetero-consist. Std. Error	Variance Inflation Factor
Intercept	18.77	33.91	- 23.3345	***	0.0000	2.04	1.79	0.00
CBD	0.01	0.11	105.9222	***	0.3261	6.13	42.54	1.28
POVERTY	0.14	0.12	21.5270	***	0.0749	6.78	7.00	2.01
NWHITE	0.41	0.27	11.1502	***	0.0886	2.81	2.54	1.79
JOBDENS	4696.00	10043.00	0.0008	***	0.2181	0.00	0.00	1.36
DWDENS	3758.00	3302.00	0.0039	***	0.3822	0.00	0.00	1.19
MEDAGEST	32.52	49.37	0.4733	***	0.1353	0.06	0.06	1.05
R^2	0.549							
Adj-R^2	0.547							
F-Stat	329.63							
Prob>F	0.0001							
N	1635							

*** Significant at 1% level.

The description of the variables used in the models estimating auto ownership of households is provided in Table 6. The empirical relationships obtained through the probit model are provided in Table 7.

Table 6. Description of Variables Used for Estimating Automobile Ownership of Households

I15	Dummy variable, if income below $15,000 then 1, else 0
I15-20	Dummy variable, if income between $15,000-20,000 then 1, else 0
I30-40	Dummy variable, if income between $30,000-40,000 then 1, else 0
I40-50	Dummy variable, if income between $40,000-50,000 then 1, else 0
I50-75	Dummy variable, if income between $50,000-75,000 then 1, else 0
I75-100	Dummy variable, if income between $75,000-100,000 then 1, else 0
I100-150	Dummy variable, if income between $100,000-150,000 then 1, else 0
I150PLUS	Dummy variable, if income $150,000 or more then 1, else 0
SFAMILY	Dummy variable, if single family then 1, else 0
DRIVERS	Number of licenses drivers in household
OWNER	Dummy variable, if lives in owned dwelling then 1, else 0
WORKERS	Number of workers in household
HHSIZE	Household size
TRANSIT	Predicted value of transit availability obtained from regression model in Table 5
DWDENS	Density of dwellings per sq. mile in tract
JOBDENS	Density of jobs per sq. mile in tract

Under the simple circumstances of the model, a probit and a logit model are likely to provide similar outcome. As Ghareib (1996) points out, logit is a superior model than probit from an analytical standpoint, although probit has a deeper theoretical basis. A logit model is also recommended over probit for the purpose of prediction

(ibid.). To maintain a balance between theory and predictability, both a probit and a logit model were used for examining the relationship between transit availability and auto ownership. An additional advantage of the logit model is that it produces the odds ratios for different explanatory variables. These ratios are simple and easy to understand.

Table 7. Probit Model Estimating Auto Ownership of Households (Dependent Variable: Number of Autos=0, 1, or 2 or more)

Variable	Mean	Std. Devn.	Parameter Estimate	χ^2	
I15	0.14	0.35	- 0.3985	38.11	***
I15-20	0.07	0.25	- 0.1128	2.15	
I30-40	0.14	0.35	0.2263	11.46	***
I40-50	0.13	0.33	0.3937	29.46	***
I50-75	0.19	0.39	0.7192	98.70	***
I75-100	0.10	0.30	0.7887	67.99	***
I100-150	0.06	0.23	1.0194	56.66	***
I150PLUS	0.02	0.14	1.1931	25.86	***
SFAMILY	0.62	0.49	0.3388	54.55	***
DRIVERS	1.67	0.83	0.8603	568.23	***
OWNER	0.49	0.50	0.1988	17.45	***
WORKERS	1.20	0.89	0.0147	0.23	
HHSIZE	2.86	1.53	0.1589	124.88	***
TRANSIT	11.89	29.71	- 0.0027	5.14	**
DWDENS	3129.66	3199.40	- 0.0000	2.69	
JOBDENS	4225.66	10961.00	0.0000	0.12	
Intercept for 2 Autos			0.1705	4.66	**
Intercept for 1 Auto			- 1.9858	-	
Prob>χ^2 = 0.0000					
Total households= 5505 (0-car households=260, 1-car households=1644, and 2 or more car households=3601)					

** Significant at 5% level *** Significant at 1% level

It can be observed from Table 7 that almost all the independent variables relating to households are highly significant with expected signs. The only exception is the number of workers in households, a variable found to have an insignificant relationship with auto ownership. A positive relationship exists between income and automobile ownership. The empirical relationship between the two indicates the influence of income on automobile ownership. The empirical estimates also indicate that households in single family homes, households with a larger number of licensed drivers, households living in owner-occupied homes, or households of larger size have a greater likelihood of auto ownership. Among the variables representing zonal characteristics, transit availability is the only variable that has a significant relationship with automobile ownership. As expected, this variable has a negative relationship with automobile ownership. The relationship indicates that households having greater access to transit have greater automobile ownership rate.

Another way to look at the relationship between transit availability and automobile ownership is through the odds ratios of the variables. The computer software used for this research allows calculation of the odds ratios of automobile ownership through a logit procedure. Table 8 provides these odds ratios together with other relevant test statistics.

The parameter estimates and test statistics from the logit model are consistent with those from the probit model. The last column of Table 8 provides the odds ratios of auto ownership. An odds ratio lower than one indicates a lower likelihood of automobile ownership while an odds ratio greater than one indicates a higher likelihood of automobile ownership. The odds ratios for automobile ownership increases with increases income. The ratios are greater than one for households in single family homes and households in owner-occupied dwellings. The ratio for household size is also

greater that one, indicating a positive relationship between household size and auto ownership. The odds ratio for the transit variable is only slightly smaller than one, indicating that although transit availability has a significant negative relationship with automobile ownership, the likelihood of auto ownership of households will decrease only slightly with increases in transit availability in their residence zones. This may be interpreted as good news and bad news for the transit industry. While it is good news that transit continues to have a significant negative relationship with automobile ownership even in a dispersed area like Los Angeles, it is bad news that significant improvements in transit services will be required for bringing forth even a moderate decrease in automobile ownership.

Table 8. Multinomial Logit Model for Household Automobile Ownership. Dependent Variable: Auto-Ownership per Household (Automobiles = 0, 1, 2 or more)

Variable	Parameter Estimate	Standard Error	Wald χ^2	Pr>χ^2	Odds Ratio
I15	-0.728	0.116	39.27	0.0001	0.483
I15-20	-0.203	0.138	2.16	0.1417	0.816
I30-40	0.384	0.120	10.25	0.0014	1.468
I40-50	0.663	0.131	25.74	0.0001	1.940
I50-75	1.254	0.132	89.78	0.0001	3.505
I75-100	1.326	0.177	56.34	0.0001	3.765
I100-150	1.830	0.266	47.47	0.0001	6.235
I150PLUS	2.056	0.457	20.25	0.0001	7.812
SFAMILY	0.608	0.083	54.41	0.0001	1.837
DRIVERS	1.685	0.068	614.51	0.0001	5.391
OWNER	0.335	0.086	15.08	0.0001	1.398
WORKERS	0.023	0.056	0.17	0.6778	1.024
HHSIZE	0.314	0.027	140.26	0.0001	1.368
TRANSIT	-0.004	0.002	3.950	0.0469	0.996
DWDENS	0.000	0.000	2.89	0.0890	1.00
JOBDENS	0.000	0.000	0.02	0.8923	1.00
Intercept for 2 Autos	-3.508	0.149	557.41	0.0001	-
Intercept for 1 Auto	0.140	0.145	0.92	0.3364	-
Testing Global Null Hypothesis Beta = 0:					

Criterion	Intercept Only	Intercept and Covariates	χ^2 for Covariates
-2 Log L	8617.90	15514.12	3103.78 with 16 DF (p=0.0001)

Association of Predicted Probabilities and Observed Responses:
Gamma = 0.769
Total households= 5505 (0-car households=260, 1-car households=1644, and 2 or more car households=3601)

Note: Descriptive statistics of variables identical with Table 7.

The odds ratio for the dummy variable representing the lowest income class (below $15,000 annual income) is less than 0.5. It indicates that the likelihood of automobile ownership is extremely low for low-income households, irrespective of the increase in auto ownership among the poor. This empirical observation may have serious implications for developing transit policies. The fact that the odds ratio for the transit variable is only slightly less than one implies that auto-ownership decisions of households in general are affected by availability of transit service in their residence zones only to a very small extent. On the other hand, the extremely small odds ratio of auto ownership for the lowest-income category indicates that transit may be extremely useful for the poor because of their inability to obtain an automobile.

Conclusion

In view of the increasing automobile-ownership among low-income households, this paper examined the relationship between transit availability and household automobile-ownership rates with empirical data from Los Angeles County. One of the basic conclusions from the analysis is that household automobile-ownership rates are inversely related to transit availability in the census tracts of residence. However, the likelihood of automobile ownership decreases only minimally with increases in transit availability. Another significant conclusion from this research is that the low-income

households in the study area have very low likelihood of owning automobiles, even though there has been an increase in automobile ownership among these households nationally. Because of their low propensity for owning automobiles, it seems that mass transit continues to be an important means for providing mobility to these households.

The fact that low-income households have a low propensity to own automobiles in Los Angeles may indicate that such households have a low propensity to own automobiles in other metropolitan areas also. This is particularly likely because Los Angeles is normally considered more automobile-oriented than most other metropolitan areas of the country.

Finally, it seems that in spite of an increase in automobile ownership among low-income households, their propensity for owning automobiles continues to be low. Given this low propensity, it is possible that such households in general have continued to be highly dependent on mass transit into the 1990s. If such is the case, it would seem reasonable that transit agencies make it a top priority to provide services to low-income neighborhoods rather than making plans for general extension of services.

Notes

1. Estimated from the travel survey of the Southern California Association of Governments, 1991.

2. Spenser (1996) shows that the real cost of new cars has increased slightly over the years between 1975 and 1996. However, since new cars also have improved technology and safety features, it may be more appropriate to look at the consumer price index for all cars rather than the price of new cars alone.

3. For a survey of transit availability indices, see Henk and Hubbard (1996).

References

Amemiya, Takeshi. 1978. The Estimation of a Simultaneous Equation Generalized Probit Model. Econometrica 46, 5: 1193-1205.

American Automobile Association. 1991. Your Driving costs: 1991 Edition. Heathrow, FL: American Automobile Association.

American Public Transit Association. 1995. Transit Fact Book. Washington, DC: Management Services Department, Statistics and Information Systems Division, American Public Transit Association.

Bullard, Robert D. and Glenn S. Johnson, eds. 1997. Just Transportation. Gabriola Island, BC, Canada: New Society Publishers.

Bureau of Labor Statistics. 1996. gopher://hopi2.bls.gov:70/11/Formatted%20Tables/Consumer%20Expenditure%20Survey/Cross%20Tabulations%20For%201986%20to%201993/1992%20%2093%20Tables/Age%20of%20Reference%20Person%20by%20Income%20Before%20Taxes [November 8, 1996]

Bureau of Transportation Statistics. 1990. Nationwide Personal Transportation Survey, 1983 and 1990. BTS-CD-09. Washington, DC: US Department of Transportation.

Bureau of Transportation Statistics. 1997. Transportation Statistics Annual Report 1997: Mobility and Accessibility. Washington, DC: US Department of Transportation.

Burns, Lawrence D., Thomas F. Golob, and Gregory C. Nicolaidis. 1976. "Theory of Urban-Household Automobile-Ownership Decisions." Transportation Research Record 569: 56-73.

Cervero, Robert. 1990. "Profiling Profitable Bust Routes." Transportation Quarterly 44: 183-201.

Clark, Gordon, L., and J. Whiteman. 1981. "Why Poor People Do Not Move: Job Search behavior and Disequilibrium Amongnst Local Labor Markets. Report No. D 81-3. Cambridge, MA: John F. Kennedy School of Government, Harvard University.

Federal Highway Administration. 1991. Cost of Owning and Operating Automobiles, Vans, and Light Trucks, 1991. Washington, DC: Office of Highway Information Management, Federal Highway Administration, US Department of Transportation.

Ghareib, Ahmed Hamdy. 1996. “Evaluation of Logit and Probit Models in Mode-Choice Situations. Journal of Transportation Engineering 122, 4: 282-290.

Golob, Thomas F. 1990. "The Dynamics of Household Travel Time Expenditures and Car Ownership Decisions." Transportation Research A 24A: 443-463.

Golob, Thomas F. 1996. "A Model of Household Demand for Activity Participation and Mobility." Paper presented at the Conference of Theoretical Foundations of Travel Choice Modeling, Stockholm, August 7-11.

Golob, Thomas F., and Leo Van Wissen. 1989. "A Joint Household Travel Distance Generation and Car Ownership Model." Transportation Research B 23B: 471-491.

Hanson, Susan. 1995. “Getting There: Urban Transportation in Context.” In Geography of Urban Transportation, ed. Susan Hanson, 3-25. New York: The Guilford Press.

Heckman, James J. 1978. Dummy Endogenous Variables in Simultaneous Equation System. Econometrica 46, 6: 931-959.

Henk, Russell H., and Sarah M. Hubbard. 1996. “Developing an Index of Transit Service Availability.” Transportation Research Record 1521: 12-19.

Hu, Patricia S., and Jennifer Young. 1993. 1990 NPTS Databook: Volume 1. Washington, DC: Office of Highway Information Management, Federal Highway Administration, US Department of Transportation.

Jennings, James. 1994. Understanding the Nature of Poverty in Urban America. Westport, CT: Praeger.

Kain, John F. 1968. "Housing Segregation, Negro Employment, and Metropolitan Decentralization." The Quarterly Journal of Economics 82, 2: 175-197.

Lave, Charles, and Richard Crepeau. 1994. “Travel By Households Without Vehicles.” In Travel Mode Special Report, 1:1-1:47. Washington, DC: Federal Highway Administration, US Department of Transportation.

Lee, Lung-Fei, G. S. Maddala, and R. P. Trost. 1980. Asymptotic Covariance Matrices of Two-Stage Probit and Two-Stage Tobit Methods for Simultaneous Equations Models with Selectivity. Econometrica 48, 2: 491-503.

Lee, W. 1997. “Poverty and Welfare Dependency: The Case of Los Angeles County in the 1980s. Environment and Planning A 29: 443-458.

Lerman, Steven R. and Moshe Ben-Akiva. 1976. "Disaggregate Behavioral Model of Automobile Ownership." Transportation Research Record 569: 34-55.

Maddala, G.S. and Lung-Fei Lee. 1976. "Recursive Models with Qualitative Endogenous Variables." Annals of Economic and Social Measurement 5/4: 515-545.

Meyer, John R. and Jose A. Gomez-Ibanez. 1981. Autos, Transit, and Cities. Cambridge, MA: Harvard University Press.

Millar, Marianne, Robert Morrison, and Anant Vyas. 1986. Minority and Poor Households: Patterns of Travel and Transportation Fuel Use. Argonne, IL: Argonne National Laboratory.

Morris, J. M., P. L. Dumble, and M. R. Wigan. 1979. "Accessibility Indicators for Transport Planning." Transportation Research A 13A, 2: 91-109.

O'Sullivan, Arthur. 1996. Urban Economics. Boston: Irwin McGraw-Hill.

Pickrell, Don H. 1992. "A Desire Named Streetcar." Journal of the American Planning Association 58: 158-176.

Pisarski, Alan, E. 1996. Commuting in America II. Landsdownes, VA: Eno Transportation Foundation.

Rivers, Douglas, and Quang H. Vuong. 1988. "Limited Information Estimators and Exogeneity Tests for Simultaneous Probit Models. Journal of Econometrics 39, 3: 347-366.

Rubin, Thomas, A. and James E. Moore. 1996. Why Rail will Fail: An Analysis of the Los Angeles County Metropolitan Authority's Long Range Plan. Los Angeles: Reason Public Policy Institute.

Rubin, Thomas, A. and James E. Moore. 1997. Better Transportation Alternatives for Los Angeles. Los Angeles: Reason Public Policy Institute.

Spencer, Peter. 1996. "Your Driving Costs." Consumers' Research Magazine 79, 6: 42.

Taylor, Bryan, D., Martin Wachs, and others. 1995. "Variations in Fare Payment and Public Subsidy by Race and Ethnicity: An Examination of the Los Angeles Metropolitan Transportation Authority." Working Paper, UCLA Institute of Transportation Studies, Los Angeles: University of California, Los Angeles.

Train, Kenneth. 1980. "A Structured Logit Model for Auto Ownership and Mode Choice." Review of Economic Studies 47: 357-370.

Vincent, Mary Jane, Mary Ann Keyes, and Marshall Reed. 1994. NPTS Urban travel Patterns: 1990 Nationwide Personal Transportation Survey. Washington, DC: Office of Highway Information Management, Federal Highway Administration, US Department of Transportation.

Wachs, Martin. 1989. "American Transit Subsidy Policy: In Need of Reform." Science 244: 1545-1549.

Wolch, Jennifer. 1998. "America's New Urban Policy: Welfare Reform and the Fate of American Cities." Journal of the American Planning Association 64, 1: 8-11.

Notes

1. Estimated from the travel survey of the Southern California Association of Governments, 1991.

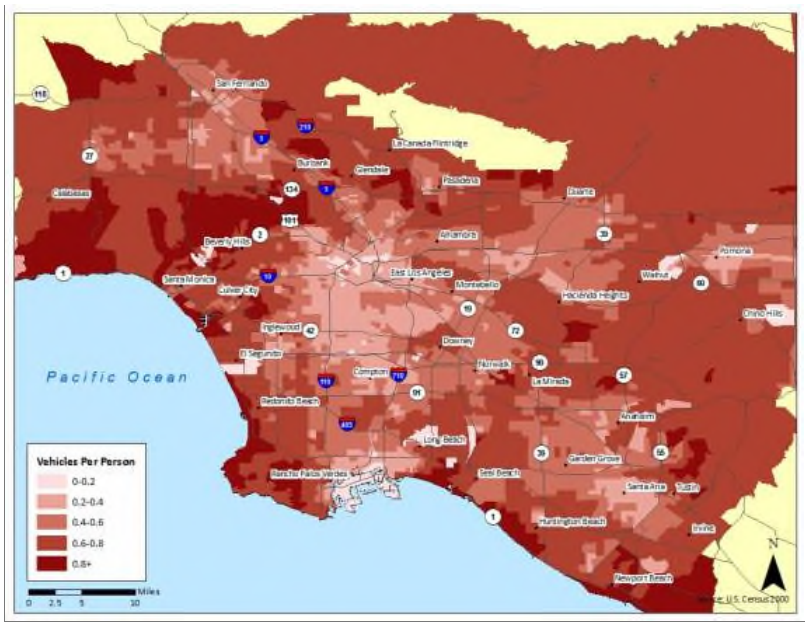
2. Spenser (1996) shows that the real cost of new cars has increased slightly over the years between 1975 and 1996. However, since new cars also have improved technology and safety features, it may be more appropriate to look at the consumer price index for all cars rather than the price of new cars alone.

3. For a survey of transit availability indices, see Henk and Hubbard (1996).

Monday, December 13, 2010 28 Comments

Density, Car Ownership, and What It Means for the Future of Los Angeles

by Damien Newton



The number of cars per person in Greater Los Angeles. For a full copy of the map, here.

Density. Vehicle Ownership. The number of cars packed into a small area.

These are concepts that we discuss often on Streetsblog. Thanks to a UCLA research project undertaken by Professors Mike Manville and Donald Shoup, we can get an idea of some of the challenges Los Angeles' planners face in trying to ween our city off the automobile.

This article will look at the population density, car ownership per person, and car ownership per mile maps and charts. At the top of each article will be a "Streetsblog sized" map for Los Angeles with links to maps for San Franscisco and New York for comparison purposes. All maps are based on information from the 2000 Census.

A huge hat tip to Katie Matchett, without whom this article wouldn't have been possible.

Population Density:

Click for population density maps of Los Angeles, New York and San Francisco.

RELATED ARTICLES

When It Comes to Successful Transit, Density Is Not Destiny
September 27, 2010 0

"Spatial Mismatch" and Why Density Alone Isn't Enough
August 4, 2009 15

Measuring the Shift Away From Car Ownership, City By City
July 31, 2013 3

Car Ownership May Be Down in the U.S., But It's Soaring Globally
July 8, 2013 0

Connecting Residential Density and Fuel Consumption
August 11, 2009 2

Filed under: Car Free, Transportation Policy, Urban Design

Print

FOLLOW STREETSBLOG

G+1 RSS

Subscribe to the daily email digest:

Your email Go

Our first set of maps show the population density for the region. The greater Los Angeles region is often portrayed as a giant suburb. When you look at the raw number for Los Angeles, as compared to New York and San Francisco, this characterization seems suspect. After all, Los Angeles exceeds New York when it comes to person per square mile.

	Population	Urbanized Area (sq. mile)	Population Density (person/sq. mile)
Los Angeles	11,874,000	2,980	3,990
New York	18,091,000	5,500	3,290
San Francisco	3,019,000	720	4,200

This table shows the total population, size of the urbanized area, and population density for each region. Note that while San Francisco has the highest population density, Los Angeles is more dense than New York. However, when you look at the maps you'll see that the population is spread relatively evenly throughout Los Angeles, while the other regions have dense centers with more sprawling suburbs.

In other words, when it comes to New York, our suburbs are denser than their suburbs; even though they have a much denser urban core.

It will be interesting to see in the 2010 census how much of a dense urban core has developed over the last ten years. I suspect those dark green areas will continue to grow, but that nobody is going to start mistaking the Downtown with those of San Francisco or New York.

Vehicles Per Person

Click for the vehicles per person maps for Los Angeles, New York and San Francisco

The number of cars per person in Greater Los Angeles

It's no surprise that New York had the lowest rate of car ownership per person, but I think that many people will be surprised to see that Los Angeles actually has a lower rate of car ownership than San Francisco. As with population density, vehicle density is more evenly distributed in LA than in the other two regions.

	Total Vehicles In Urbanized Area	Population	Urbanized Area (sq. mile)	Vehicles per Person
Los Angeles	6,433,000	11,874,000	2,980	0.54
New York	7,771,000	18,091,000	5,500	0.43
San Francisco	1,769,000	3,019,000	720	0.59

Matchett provides a couple of other facts about Greater Los Angeles, which further illustrates what does and doesn't determine car ownership

> The three tracts with the lowest vehicles per square mile and per person are located in Long Beach, downtown Los Angeles, and San Fernando. A closer examination of the demographics of each of these tracts reveals that while each has a fairly large population (between 300 and 1,000 residents), the tracts have hardly any workers or housing units. This suggests that they may contain institutional uses such as jails, where vehicle ownership rates would be very low. The downtown tract might also include homeless residents without vehicles.
>
> The three census tracts with the highest number of vehicles per person are located in the cities of Beverly Hills, Newport Beach, and Norwalk. The Norwalk tract also includes primarily commercial uses and has only nine residents, so the high vehicle ownership rate is likely due to the tract's low population. The two other census tracts with a high number of vehicles per person are located in some of the wealthiest communities in the Los Angeles region. Given the strong correlation between income and vehicle ownership, this should come as no surprise.

LISTEN TO THE LATEST TALKING HEADWAYS PODCAST

RECENTLY POSTED JOBS

Transportation Planner, 6 days ago

Active Transportation Planner, 2 weeks ago

Program Analyst, 2 weeks ago

Campaigns Director, 3 weeks ago

Transportation Policy Planner – 5278 Planner II, 3 weeks ago

Post a Job » See more Jobs »

WORD ON THE STREET

"I can't help but to read this and still feel utterly hopeless and pretty much confirm that there's no way these [L.A. City Council] people use the sidewalks and truely understand the problem."

– M

In response to "Muddled L.A. Sidewalk Repair Hearing

In other words, Los Angeles' surprising low rate of car ownership seems to have more to do with income than progressive transportation ideals.

Vehicles Per Square Mile:

Click for vehicle per square mile maps for Los Angeles, New York, and San Francisco

From a planning standpoint, this set of maps and statistics, combined with the first set of maps and statistics tells the most important story. What is the impact of population density on car ownership? As we try to provide alternatives to the automobile, it stands to logic that dense development is part of the key.

	Total Vehicles In Urbanized Area	Urbanized Area (sq. mile)	Vehicles per Square Mile
Los Angeles	6,433,000	2,980	2,161
New York	7,771,000	5,500	1,413
San Francisco	1,769,000	720	2,460

Oh, well this is embarrassing. Matchett explains.

> The pattern of vehicles per square mile in each region basically mirrors the population density: tracts with high population density also have a lot of vehicles. This is true even in New York, with its lower vehicle ownership rates.

Honestly, I was surprised by this result. I wasn't exactly stunned that this was true for Los Angeles, because our transit system still needs some development, but that car ownership in New York and San Francisco was still high in their dense, transit rich areas? I didn't have a great explanation for this, but fortunately Matchett supplied an explanation from Professor Manville.

> From a policy standpoint, this suggests that simply increasing density is likely to exacerbate rather than mitigate congestion–something we see borne out by most congestion data. (Increasing density and congestion can sometimes allow people to make more trips while avoiding congestion, but the congestion itself is still bad). So the trick for transportation and land use policy is to find ways to pull apart density and vehicle use. That's what pricing does, and that's what minimum parking requirements do the opposite of. Parking requirements make it very easy for increases in density to move in lockstep with increases in vehicles, because new dwelling units automatically include housing for cars.

So there's the challenge for our local planners and transportation engineers. As Los Angeles grows and becomes more transit diverse in the coming years, the city, county and Metro needs to get rid of parking minimums in dense, transit-rich areas and find other ways to encourage people to not feel the need to own cars. It sounds as though Metro ought to be urging cities to relax their parking requirements in the areas around their new rail lines or, at a minimum, get them relaxed for the developments on land that the agency owns.

Inconclusive On How To Proceed"

RECENT COMMENTS

0 comments so far today

Asher Of LA

I brought it up on a libertarian-ish urbanist facebook group (Market Urbanism), and the proposal...

Today's Headlines · 1 hour ago

tim1724

The Wikipedia article on the topic lists other places where they're used (Japan uses them...

Eyes On the Street: Scramble Crosswalks Debut At Hollywood And Highland · 3 hours ago

tim1724

Pasadena has had scramble crossings for many years on Colorado Blvd. It works great when there's...

Eyes On the Street: Scramble Crosswalks Debut At Hollywood And Highland · 3 hours ago

Thedialectic

The owner of these buildings is Geoff Anenberg. His grandfather owned property in Boyle Heights,...

Terms of Art: Boyle Heights Youth Rally against Being Columbused by the New York Times · 4 hours ago

Joe Linton

I wish - I certainly didn't give them the legitimacy of responding to them via full Streetsblog...

Today's Headlines · 5 hours ago

View all comments »

HOT TOPICS

Today's Headlines

3 comments · 1 hour ago

Today's Headlines

1 comment · 6 hours ago

Eyes On the Street: Scramble Crosswalks Debut At Hollywood And Highland

12 comments · 3 hours ago

Muddled L.A. Sidewalk Repair Hearing Inconclusive On How To Proceed

1 comment · 7 hours ago

Mobility Plan Re-Approval Passes Joint Council Committee Meeting

40 comments · 4 days ago

City Planning | Streetsblog Los Angeles

The 2014 Los Angeles River Kayak Season Is …

A Walkability Prescription For Downtown …

EYES ON THE STREET

A driver blocks the crosswalk and bike lane at the intersection of 4th and Spring

From: ubrayj02 February 24, 2012

Email tips@la.streetsblog.org or send them anonymously. Tag your photos, links, and videos with "streetsblog".

View all contributions »

ARCHIVED ARTICLES

Select Month

CATEGORIES

28 Comments StreetsblogLA SZwartz

Recommend 1 Share Sort by Newest

Join the discussion…

Matt • 4 months ago

Is there any way to access this data? I've been looking for vehicle ownership data in LA for a while, and all I've found from the census is the data that contains "0 cars per household" "one car per household" etc. I much prefer the "vehicles per person" and "vehicles per square mile" way of displaying the data.

• Reply • Share ›

ohnononononono → Matt • 20 days ago

I actually think vehicles per person is a weird metric if it includes children, which I assume it does. A single mom with 2 kids now has 0.33 cars per person in her household? That's a bit misleading. The Census Bureau usually refers to workers over 16 in its commuting data, so I think that'd be the better denominator.

• Reply • Share ›

Stephen Hemenway • 5 years ago

Great post. This is really fascinating in a lot ways. Another map that would be very helpful to have is how many miles are driven, or how many hours on the road per car. I own a car and live in Oakland, but after 8 1/2 years my car has 30,000 miles on it, since I don't need to drive very far for anything and I commute on Bart into SF. It's the driving I believe that adds the most to the pollution. Suburb x could have 30 cars that drive 3 miles a day. Suburb y could have a 5 cars that drive 30 a day. Which is worse environmentally?

• Reply • Share ›

Stephen Hemenway • 5 years ago

The borders of the San Francisco area do seem a little arbitrary.

@Carlton Glüb

"Likewise, but in reverse, if the City of San Francisco included the entire peninsula – Daly City, Atherton, M, and all the sprawling rest – it would probably look a lot more like LA."

The San Francisco map, and therefore the study I believe, does include Daly City and Atherton and even a little further south down to the borders of San Jose. I suppose San Jose could also be included in the map. It be interesting to see how this affects everything.

@ Katie M

The map of the Bay Area does seem somewhat arbitrary in that it doesn't include Marin, which has a HUGE degree of social and economic integration with San Francisco. Much more percentagewise than the southern end of the peninsula which borders directly on San Jose.

• Reply • Share ›

Drew Reed • 5 years ago

Awesome data, thanks for the post. Despite all the analysis suggesting that this might actually be a bad thing, I couldn't help but be a bit proud to see LB with one of the lowest rates of cars per person. Also, I wonder what a bikes per person map would look like?

• Reply • Share ›

Alex → Drew Reed • 3 years ago

don't get too excited- a huge portion of Long Beach is covered by POLB, which doesn't have many cars!

• Reply • Share ›

Author Login

A project of

FHWA NHTS BRIEF

2014

Mobility Challenges for Households in Poverty

2009 National Household Travel Survey

- **Households in poverty spend a higher proportion of their income on transportation expenses and are disproportionately represented by race/ethnicity with African-Americans and Hispanics experiencing the highest poverty rates. Limited vehicle availability and fewer affordable transportation options afflict this cost-sensitive group.**
- **Households in poverty are limited to a shorter radius of travel compared to higher income households. They have the lowest rates of single occupancy vehicle use and the highest usage of less costly travel modes: carpool, transit, bike and walk.**
- **Households in poverty have lower vehicle ownership rates, which has led to an increased use of alternative modes of transportation and higher vehicle occupancy rates.**
- **The 2009 National Household Travel Survey shows that in the metropolitan areas of Atlanta and Los Angeles, those in poverty have a smaller radius of travel than those in the highest income group. In New York City, however, the working poor tend to have a larger radius of travel than workers with the highest incomes, which is likely indicative of its very affluent urban core.**

Studies have shown that rising transportation costs have a disproportionate negative impact on lower income households. The Bureau of Labor Statistic's Consumer Expenditure Survey has shown that transportation is the second highest American household expenditure, only exceeded by housing costs[i]. The high sticker price of vehicles, increased prices at the pump, and transit fare hikes all pose a financial burden to the mobility of all households, especially those in poverty.

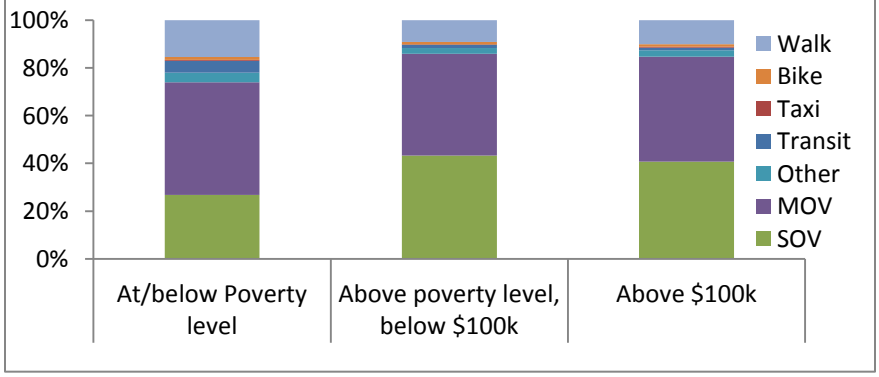
2009 Poverty Status of Selected Groups

	People in Poverty	*Percent in Poverty*
White	29,830,000	12.3
White, not Hispanic	18,530,000	9.4
Black	9,944,000	25.8
Asian	1,746,000	12.5
Hispanic origin	12,350,000	25.3

Data Source: www.census.gov

In 2009, the year of the most recent NHTS, the Census Bureau reported that the nation's official overall poverty rate was 14.3 percent whereas 25.8 percent of Blacks and 25.3 percent of Hispanics were in poverty. In 2012, the Census poverty numbers changed slightly with poverty rates of 27.2 percent and 25.6 for Blacks and Hispanics respectively.[ii] These vulnerable groups are in need of cost-effective transportation options that are affordable and provide them access to job opportunities.

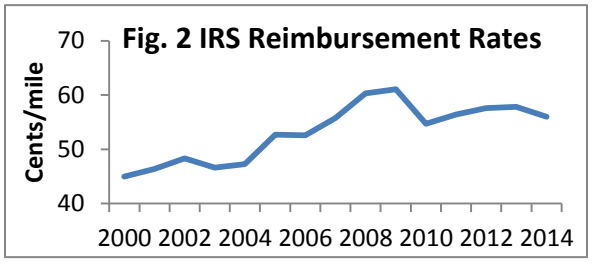
Fig. 1 Distribution of Trip Mode



Data Source: 2009 FHWA NHTS

Figure 1 shows that individuals in poverty take about three times as many transit trips as those in the higher income groups. They also have the greatest rate of bike trips and take walk trips about 50% more than their higher income counterparts. When using personal vehicles, individuals in poverty are about twice as likely to travel in a multi-occupant vehicle

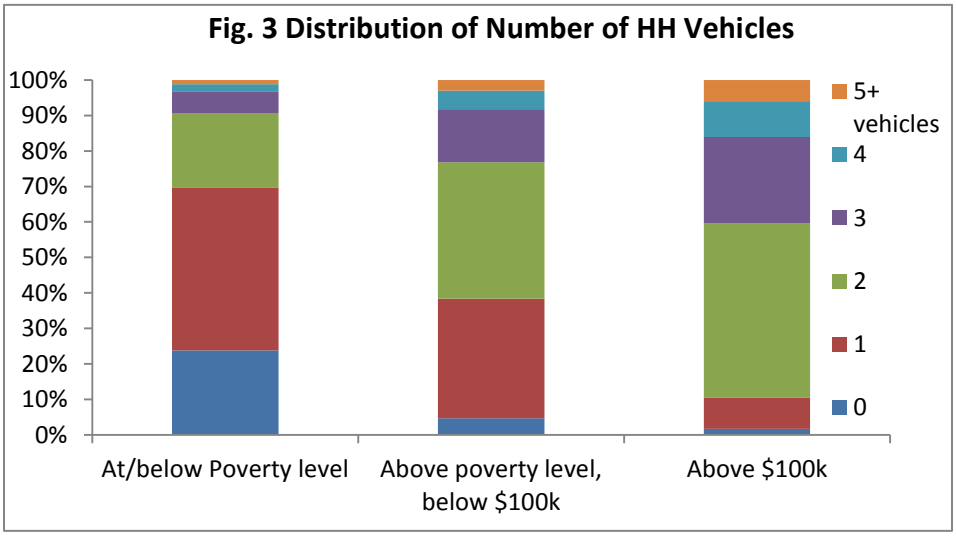
(MOV) than a single occupant vehicle (SOV). Average vehicle occupancy for those at or below poverty level is 2.37 persons per vehicle mile versus 2.07 for those with incomes above $100,000.



Data Source: www.irs.gov

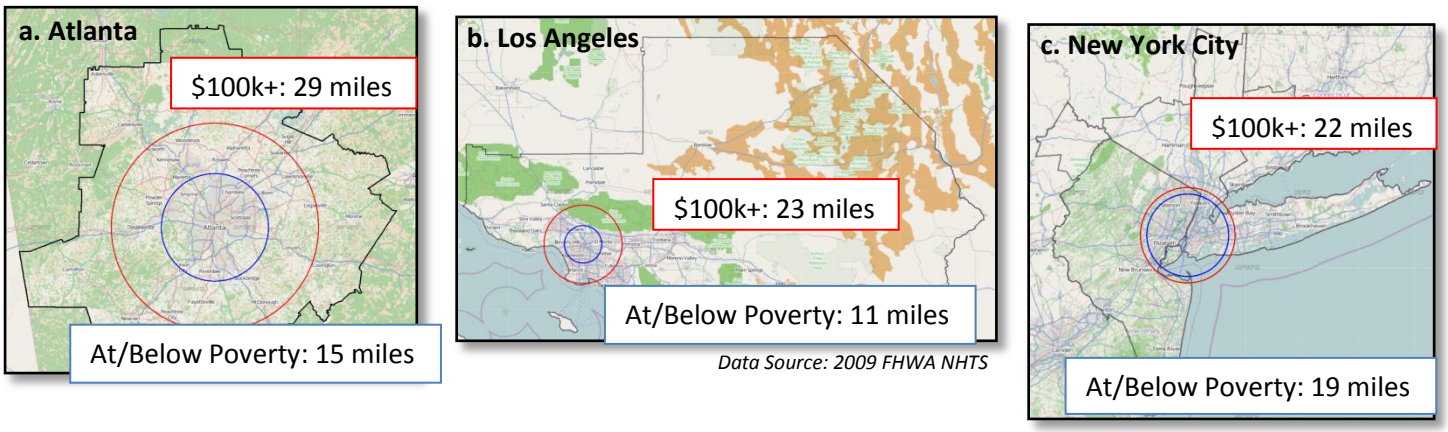
The Internal Revenue Service vehicle mileage reimbursement rates[iii] since 2000 display an overall increase in the per mile cost of driving (Figure 2 - indexed to 2014 dollars), which is indicative of one of the cost obstacles to personal vehicle ownership and maintenance. 2009 NHTS data shows vehicle ownership increasing with household income as shown in Figure 3. About 24 percent of households in poverty do not own a vehicle while over 98 percent of $100,000+ households own at least one vehicle.

Diversity-rich metropolitan areas can display even larger disparities in the travel trends between those in poverty and their higher income counterparts. In the cities of Atlanta, Los Angeles and New York City, individuals in the $100,000+ income group travel 14, 12.8, and 3.36 more daily miles respectively than those in poverty (Figures 4a-c). For those who are workers and drivers, (Figure 5) the person miles traveled told a different story. In New York City, wealthier worker-drivers traveled significantly fewer miles than those in poverty likely due to their ability to afford to live in the very expensive urban core. The greater sprawl in housing and employment in Atlanta and Los Angeles allowed for a smaller difference between income groups for worker-driver travel (Fig 5) and all person travel. (Fig. 4)



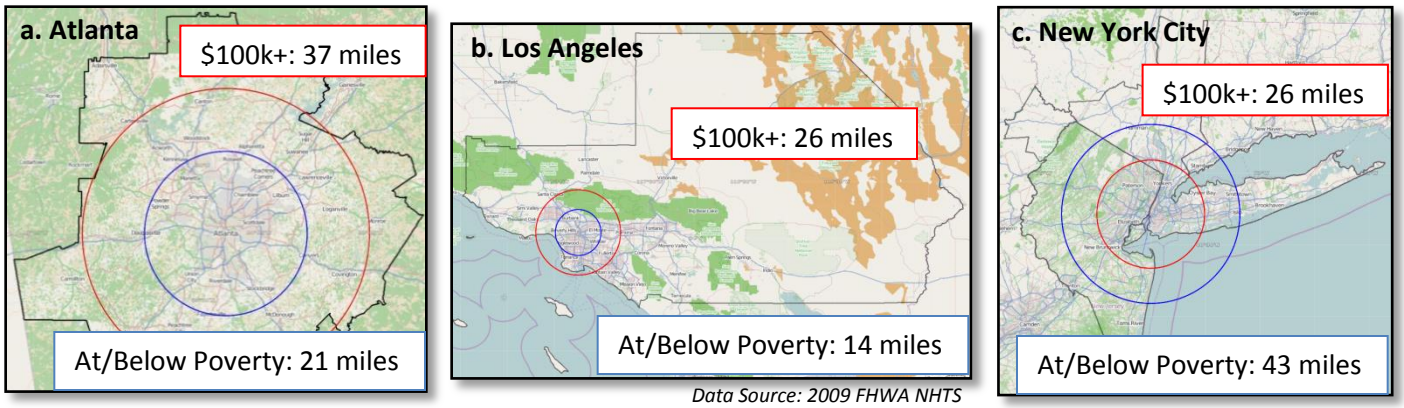
Data Source: 2009 FHWA NHTS

Fig. 4 Daily Travel Radius of all persons



Data Source: 2009 FHWA NHTS

Fig. 5 Daily Travel Radius of Workers who are licensed drivers



Data Source: 2009 FHWA NHTS

The geography of poverty is also changing. More U.S. households in poverty live in suburbs than in big cities or rural communities. The concentrated poverty rate is still highest in big cities, where almost one in four poor residents (23 percent) lived in a distressed neighborhood between 2008-2012, compared to 6.3 percent in suburbs. Suburban communities, however, experienced the largest change in the number of residents living in concentrated poverty. Between 2000 and 2012, the number of suburban poor living in distressed neighborhoods grew by 139 percent—almost three times the pace of growth in cities.[iv] These suburban poor neighborhoods face many challenges: Poor health, high crime, low-performing schools, and low job density, which make it especially difficult to climb out of poverty and allow the community to develop and grow in sustainable ways.[v] Transportation becomes an even greater problem since suburban neighborhoods have fewer transit options compared to more densely populated urban areas.

Fig. 6 Statistics on Poverty

- **Almost one out of sixteen people in the USA are living in deep poverty.**
- **Racial and ethnic minorities, women, children, and families headed by single women are particularly vulnerable to poverty and deep poverty.**
- **Blacks and Hispanics are more likely than whites to be poor, and to be in poverty and deep poverty. Poverty is a women's issue; female-headed families are more likely to be poor.**
- **Children represent more than one-third of the people living in poverty.**
- **Over one-fourth of adults with a disability live in poverty.**

The suburbs have also historically been a draw for families with children, which leads to concerns about childhood poverty and children's travel needs. National 2009 NHTS averages show that households with children tend to travel over twice as much as those without children. Trips to daycare, school, doctor's appointments, and social activities add a significant number of miles to family households. In New York City, however, households in poverty who live with children travel significantly less than their childless counterparts. Improving mobility and job accessibility are very important factors for households to escape poverty. As transportation costs continue to rise, poor households will have an increasing burden with expenses that are necessary to meet basic needs and improve quality of life.

For more information, please visit our Website: http://nhts.ornl.gov

Or Contact:

Adella Santos, Program Manager, FHWA, DOT
Phone: 202-366-5021
Email: adella.santos@dot.gov

Jasmy Methipara, Program Analyst
Phone: 202-366-4073
Email: jasmy.methipara.ctr@dot.gov

Susan Liss, Survey Strategist
Email: susan.liss.ctr@dot.gov

Tim Reuscher, Statistical Analyst
Email: reuschertr@ornl.gov

About the National Household Travel Survey

Conducted periodically by the USDOT FHWA since 1969, the survey collects travel data from a sample of U.S. households. The information has been used to understand trends in the nation's trip making and miles of travel by mode, purpose, and time-of-day for use in policy, planning and safety.

Data is collected for household members and for each day of the year, yielding a rich demographic profile linked to daily travel and vehicle characteristics.

---

[i] "CONSUMER EXPENDITURES--2012." BLS Economic News Release 10 Sept. 2013. Web. 4 Sept. 2014. <http://www.bls.gov/news.release/cesan.nr0.htm>.

[ii] DeNavas-Walt, Carmen, Bernadette D. Proctor, and Jessica C. Smith. "Income, Poverty, and Health Insurance Coverage in the United States: 2012 Current Population Reports." United States Census Bureau P60-245 (2013). Web. <http://www.census.gov/prod/2013pubs/p60-245.pdf>.

[iii] "Standard Mileage Rates." Http://www.irs.gov/Tax-Professionals/Standard-Mileage-Rates. 1 May 2014. Web. 4 Sept. 2014. <http://www.irs.gov/Tax-Professionals/Standard-Mileage-Rates>.

[iv] "Poverty in the United States: A Snapshot." National Center for Law and Economic Justice. 1 Sept. 2013. Web. 4 Sept. 2014. <http://www.nclej.org/poverty-in-the-us.php>.

[v] Kneebone, Elizabeth. "The Growth and Spread of Concentrated Poverty, 2000 to 2008-2012." Brookings. 31 July 2014. Web. 4 Sept. 2014. <http://www.brookings.edu/research/interactives/2014/concentrated-poverty#/M10420>.

URBAN INSTITUTE

Driving to Opportunity:

Understanding the Links among Transportation Access, Residential Outcomes, and Economic Opportunity for Housing Voucher Recipients

Rolf Pendall, Christopher Hayes, Arthur (Taz) George, Zach McDade
(The Urban Institute)

Casey Dawkins, Jae Sik Jeon, Eli Knaap
(National Center for Smart Growth, University of MD)

Evelyn Blumenberg, Gregory Pierce, Michael Smart
(Institute of Transportation Studies, UCLA)

March 2014

Driving to Opportunity: Understanding the Links among Transportation Access, Residential Outcomes, and Economic Opportunity for Housing Voucher Recipients

Rolf Pendall, Christopher Hayes, Arthur (Taz) George, Zach McDade
(The Urban Institute)

Casey Dawkins, Jae Sik Jeon, Eli Knaap
(National Center for Smart Growth, University of MD)

Evelyn Blumenberg, Gregory Pierce, Michael Smart
(Institute of Transportation Studies, UCLA)

March 2014

URBAN INSTITUTE

The Urban Institute is a nonprofit, nonpartisan policy research and educational organization that examines the social, economic, and governance problems facing the nation. The views expressed are those of the authors and should not be attributed to the Urban Institute, its trustees, or its funders.

Atlanta photo from Rob Hainer/Shutterstock.com.

Contents

Executive Summary

In the 1990s and early 2000s, the Department of Housing and Urban Development (HUD) sponsored two major experiments to test whether housing choice vouchers propelled low-income households into greater economic security. The first of these was the Moving to Opportunity (MTO) for Fair Housing program, which was designed to move low-income families from high- to lower-poverty neighborhoods. The other was a tenant-based housing voucher program, the Welfare to Work Voucher program (WTW), initiated in 1999 to help families currently receiving or eligible to receive welfare transition from public assistance into the labor market.

Although slightly different, the two voucher programs' purpose was to assess whether low-income families benefitted from living in lower-poverty neighborhoods—either through improved neighborhood conditions or better economic and health outcomes. Research shows that households receiving vouchers choose to live in a wider range of neighborhoods than public housing residents and unassisted renters. However, voucher users still face hurdles when trying to secure housing in high-opportunity neighborhoods.

There is growing evidence that transportation—particularly access to automobiles—plays an important role in shaping the residential location choices and economic outcomes of low-income households. Automobiles and high-quality public transit services can enable participants to better search for housing as well as provide access to potential employment, services, and other opportunities within a reasonable travel time. To date, however, transportation has not been a major focus of the research related to housing voucher participants.

This study fills this gap. We examine the relationship between transportation, residential location, and employment outcomes. More specifically, our research focuses on three areas: (1) the sorting of housing choice voucher recipients into different neighborhoods and variation in neighborhood sorting by automobile ownership, (2) the role of transportation in voucher users' residential choices, and (3) how transportation access and residential location choice influence economic opportunity.

Overall, the findings from this study underscore the positive role of automobiles in outcomes for housing voucher participants. The following bullet points list our key findings in the three research areas.

- Neighborhood sorting
    - Families with access to cars found housing in neighborhoods where environmental and social quality consistently and significantly exceeded that of the neighborhoods of households without cars. Especially noteworthy, families with car access felt safer in their neighborhoods and were less likely to live in neighborhoods with high crime rates than those without car access.
    - Low-income households did make trade-offs with respect to neighborhood conditions. MTO households with cars lived in neighborhoods that were more spread out—with lower density of aggregate income and housing and less diverse housing stock—and with worse measured school performance than transit-dependent households. (School performance measures improved, however, by the final survey, as noted below.)
    - While most neighborhoods are not distressed, practically none with housing prices affordable to most families offers mostly positive attributes and few disadvantages.
    - Only a small minority of tracts in US metropolitan areas have crushing crime rates, failing schools, high levels of environmental degradation, and deep poverty; these distressed tracts also number among the most conveniently situated places in a nation.

    - The two sets of metropolitan areas offer important contrasts with one another on one important dimension. The MTO metropolitan areas—Boston, Baltimore, Chicago, New York, and Los Angeles—offer many transit choices. The WTW metropolitan areas—Atlanta, Houston, Augusta, Spokane, and Fresno—have less-developed transit systems than the MTO areas.
- Transportation and residential location choice
    - Over time, households with automobiles experience less exposure to poverty and are less likely to return to high-poverty neighborhoods than those without car access.
    - Among those relocating from their baseline neighborhoods, program participants with access to automobiles moved to areas with lower concentrations of poverty, higher concentrations of employed adults, higher median rents, more owner-occupied housing, lower vacancy rates, greater access to open space, and lower levels of cancer risk.
    - When we control for other factors influencing residential mobility, program participants with access to automobiles move to neighborhoods with higher levels of school performance by the time of the final survey.
    - Access to vehicles positively influences neighborhood satisfaction, particularly in neighborhoods with low levels of transit.
    - Program participants with automobiles live in neighborhoods with lower levels of transit and in environments less conducive to walking.
- Effect of transportation access and residential location choice on economic opportunity
    - The neighborhoods where carless voucher users live offer access to larger numbers of jobs than those where driving voucher users live. However, voucher users with cars more than compensate for this by living in neighborhoods where fewer low-income people compete for available jobs.
    - Keeping or gaining access to automobiles is positively related to the likelihood of employment.
    - Improved access to public transit is positively associated with maintaining employment but not with transitions to employment.
    - On earnings, both cars and transit access have a positive effect, though the effect for auto ownership is considerably greater.

Our analyses point to many implications for future research and data collection efforts, voucher-enhanced mobility programs, and strategies for coordinating housing and transportation policies in ways that enhance economic opportunity for low-income households:

- All levels of government, philanthropy, and the private sector should continue to pursue efforts to strengthen coordination of transportation and housing programs.
- Policymakers should rethink vehicle asset limitations and state-level policies that limit the value of the cars that participants in safety-net programs may own.
- Combining rental vouchers with subsidies for automobile purchases may be one possible approach to expanding the location choices available to low-income households.
- Short-term car rental services such as ZipCar and Car2Go have the potential to address the travel needs of some low-income adults at a lower cost, because users pay only for the transportation that they use.
- Housing search services should be tailored to the transportation needs of households receiving assistance.
- Voucher recipients would benefit from greater coordination of housing voucher assistance and nonprofit car donation and rideshare services.
- HUD would be well-advised to collect data on assisted tenants and their access to working

automobiles.

- Because the importance of automobile access may also reflect the inadequacy of public transportation, policies to enable households to move to transit-rich neighborhoods can also help participants retain employment.

HUD's Sustainable Communities Initiative helps communities and regions improve their economic competitiveness by connecting housing with good jobs, quality schools, and transportation.[1] Given their numerous negative environmental externalities, automobiles tend to be ignored in these planning efforts. Yet, as our research shows, automobiles are important to achieving many elements of the sustainability agenda because they are associated with improved access to high-opportunity and more livable neighborhoods. In other words, pursuit of the broader sustainability agenda may require some difficult trade-offs in the types of neighborhoods in which families live and in the means (the travel mode) by which they access opportunities.

[1] "Sustainable Communities Initiative." US Department of Housing and Urban Development, accessed February 10, 2014, http://portal.hud.gov/hudportal/HUD?src=/hudprograms/sci.

Introduction and Overview

In the 1990s and early 2000s the Department of Housing and Urban Development (HUD) sponsored two major experiments to test whether housing choice vouchers propelled low-income households into greater economic security. The first of these was the Moving to Opportunity (MTO) for Fair Housing program. Authorized by Congress in 1992, MTO was a tenant-based housing voucher program that, coupled with housing and counseling services, was designed to move low-income families from high- to lower-poverty neighborhoods, neighborhoods with poverty rates under 10 percent in 1990. The other was a tenant-based housing voucher program, the Welfare to Work Voucher program, (WTW) initiated in 1999 to help families currently receiving or eligible to receive welfare transition from public assistance into the labor market. Combined, these two programs produced experimental data (treatment and control) for voucher participants in 10 major US metropolitan areas: New York, Los Angeles, Chicago, Boston and Baltimore (from MTO); and Atlanta, Spokane, Augusta, Houston and Fresno (from WTW).[2]

Although slightly different, the two voucher programs' purpose was to assess whether low-income families benefitted from living in lower-poverty neighborhoods—either through improved neighborhood conditions or better economic and health outcomes.[3] Research on the linkages between tenant-based housing assistance and residential outcomes suggests that households receiving vouchers choose to live in a wider range of neighborhoods than public housing residents and unassisted renters (Schwartz, 2010). However, over the long term, they still face hurdles when trying to secure housing in high-opportunity neighborhoods (Turner et al. 2011). Among other characteristics, high-opportunity neighborhoods have low poverty and high labor force participation rates, quality public services (schools, public transit, and other services), access to employment opportunities within a reasonable travel time, and are safe and healthy environments in which to live.

There is growing evidence that transportation—particularly access to automobiles—plays an important role in shaping the residential location choices and economic outcomes of low-income households. Automobiles and high-quality public transit services can enable participants to better search for housing as well as provide access to potential employment, services, and other opportunities within a reasonable travel time. Participants in both voucher experiments were asked questions about their transportation resources and use. Depending on the survey, they reported whether they had a driver's license, their access to automobiles, their commute mode, and their proximity to public transit. To date, however, transportation has not been a major focus of the research related to housing voucher participants.

This study aims to fill this gap. In a series of papers currently under consideration or in preparation for peer review, we have examined the following three general topics: (1) the sorting of housing choice voucher recipients into different neighborhoods and variation in neighborhood sorting by automobile ownership, (2) the role of transportation in voucher users' residential choices, and (3) how transportation access and residential location choice influence economic opportunity. (In this report, we summarize our findings from this body of research.)

Our findings underscore the positive role of automobiles in outcomes for housing voucher participants. Automobiles increase the likelihood that voucher participants will live and remain in high-

---

[2] While Los Angeles also hosted a WTW demonstration, there were no follow-up data collected there, so we exclude it from our experimental sample.

[3] For more information on both programs, see Briggs et al. (2010), Orr et al. (2003), Patterson et al. (2004), and Sanbonmatsu et al. (2011).

opportunity neighborhoods—neighborhoods with lower poverty rates, higher social status, stronger housing markets, and lower health risks than neighborhoods in which those without cars live. Cars are also associated with improved neighborhood satisfaction and better employment outcomes. The importance of automobiles arises not because of the inherent superiority of the mode, but because public transit systems in most metropolitan areas are slow, inconvenient, and lack sufficient metropolitan-wide coverage to rival the automobile.

HUD's Sustainable Communities Initiative intends to help communities and regions improve their economic competitiveness by connecting housing with good jobs, quality schools, and transportation.[4] Given their many negative environmental externalities, automobiles tend to be ignored in these planning efforts. For example, the listing of FY2011 Sustainable Communities Grantees includes many references to transportation, particularly efforts to improve the linkage between affordable housing and public transit.[5] Not a single grantee lists efforts to increase low-income households' access to automobiles. Yet, as our research shows, automobiles are important to achieving many elements of the sustainability agenda because they are associated with improved access to high-opportunity, more livable neighborhoods. In other words, pursuit of a sustainability agenda may require some difficult trade-offs.

Background

In this section, we briefly discuss the academic literature relevant to our study. We emphasize two major strands of literature: (1) theoretical and empirical works that examine the linkages among transportation, residential location decisions, and economic outcomes for low-income households, and (2) studies that focus specifically on those receiving federal housing assistance, emphasizing the role that HUD subsidies play in helping households secure housing in neighborhoods that provide access to social and economic opportunities.

Residential Location, Transportation, and the Poor

It is widely acknowledged that transportation plays an important role in shaping the residential location and economic outcomes of low-income households. Muth (1969) and Alonso (1964) were the first to examine the role that transportation costs play in household location decisions. These authors argue that utility-maximizing households will make trade-offs between housing costs and intra-regional accessibility, with more centrally located locations offering higher accessibility to employment and more suburban locations offering lower housing prices, all things else equal. If the income elasticity of demand for housing exceeds the income elasticity of demand for savings in commuting costs, higher-income households will choose more distant locations to consume a larger housing bundle, while lower-income households will choose smaller housing in more accessible central-city locations. LeRoy and Sonstelie (1983) expand upon this model to argue that the availability of a public transportation system may also induce centralization of low-income populations, if the costs of owning and operating an automobile are prohibitively high and public transportation is only accessible within more centrally located areas.

While subsequent research offers only mixed support for these initial models, many studies still find a relationship between transportation, housing search, and residential location choice (Abraham and Hunt

---

[4] "Sustainable Communities Initiative," US Department of Housing and Urban Development, accessed February 14, 2014, http://portal.hud.gov/hudportal/HUD?src=/hudprograms/sci.

[5] "HUD FY2011 Sustainable Communities Grantees" US Department of Housing and Urban Development, accessed February 14, 2014, http://portal.hud.gov/hudportal/documents/huddoc?id=FY2011RegGrantees_noDist.pdf.

1997; Levine 1998; Rodriguez et al. 2011). The literature on residential satisfaction also finds that various transportation-related factors, including measures of walkability and land use mix (Yang 2008), proximity to public transportation (Baum et al. 2009), access to walking and biking paths (Kearney 2006; Chapman and Lombard 2006), and more general measures of accessibility to jobs and social services (St. John and Clark 1984) are significant determinants of one's satisfaction with his or her residential environment. Schwanen and Mokhtarian (2004) find that automobile access interacts with geographic location in influencing the disparity between households' preferred and actual neighborhood choices.

Transportation also is a significant determinant of the economic outcomes of low-income families. Low-income, inner-city residents suffer from a "modal" mismatch, a drastic divergence in the relative advantage between those who have access to automobiles and those who do not (Blumenberg and Hess 2003; Blumenberg and Ong 2001; Grengs 2010; Kawabata 2003; Ong and Miller 2005; Shen 1998; Taylor and Ong 1995; Wyly 1998). In almost all metropolitan areas, individuals without reliable access to automobiles can reach far fewer opportunities within a reasonable travel time compared with those who travel by automobile (Benenson et al. 2010; Blumenberg and Ong 2001; Grengs 2010; Kawabata 2009; Kawabata and Shen 2006, 2007; Ong and Miller 2005; Shen 2001, 1998).

Given this access advantage, it is unsurprising that private automobiles are positively associated with employment outcomes for low-income and minority adults. Cars facilitate searching for and commuting to jobs and therefore increase the likelihood of finding and retaining employment. Conversely, employment can provide households with the necessary resources to purchase automobiles; income is one of the strongest correlates of automobile ownership (Blumenberg and Pierce 2012; Giuliano and Dargay 2006; Schimek 1996). The importance of automobiles to employment persists even in studies that control for the simultaneity of car ownership and employment decisions. In general, automobile ownership is associated with higher employment rates, weekly hours worked, and hourly earnings (Raphael and Rice 2002). Automobile ownership also reduces racial disparities in employment rates (Raphael and Stoll 2001) and unemployment duration (Dawkins et al. 2005).

Automobiles can be particularly important for low-income women who often juggle paid work with household-serving responsibilities and would benefit greatly from the flexibility offered by driving (Blumenberg 2004). Many studies have examined the effect of automobile ownership on outcomes for welfare participants—largely poor, female-headed households. These studies produce similar results: a positive association between household automobiles and employment rates, the likelihood of leaving welfare, and an increase in earned income (Baum 2009; Cervero et al. 2002; Gurley and Bruce 2005; Lucas and Nicholson 2003; Ong 2002; Sandoval et al. 2011).

For low-income households without access to automobiles, public transit is essential (Garrett and Taylor 1999), which is why many of them choose to live in dense, transit-rich urban neighborhoods (Glaeser et al. 2008). However, despite transit's importance, findings on the relationship between public transit and employment outcomes are mixed, likely because employment access by public transit—even in the transit-richest of urban areas—still pales in comparison to access by automobile. In their study of welfare recipients in six major US metropolitan areas, Sanchez and colleagues (2004) conclude that access to fixed-route transit and employment concentrations had virtually no association with welfare recipients' employment outcomes. Transit access appears to make a difference among households without cars. For this subset of the poor, transit-based employment accessibility can positively affect the probability of employment (Kawabata 2003; Yi 2006) and of working 30 hours or more per week (Kawabata 2003). Similarly, studies of welfare recipients show that higher levels of transit service increase the likelihood of finding jobs (Ong and Houston 2002) and reduce time on welfare (Alam 2009).

Residential Location, Transportation, and Subsidized Housing Residents

Despite this body of literature, few studies focus on the relationship among transportation resources, residential location, and employment outcomes of subsidized housing residents. Yet overcoming transportation barriers and improving access to employment were two of the underlying objectives of the voucher experiments. In part, vouchers were intended to facilitate families' moves to transit-rich neighborhoods in close proximity to employment and other destinations. For example, in early text about the WTW program, the authors wrote: "Search assistance can be an effective technique for educating families about and encouraging them to rent near high-employment areas, day care centers, public transportation, etc." (US Housing and Urban Development, 2000: 1-7.)

There are a few exceptions, largely using data from the MTO program. Both the interim and final MTO evaluations examine the effect of voucher access and living in a low-poverty neighborhood on "transportation access" (Orr et al. 2003 Sanbonmatsu et al. 2011). In these evaluations, transportation access is defined as the share of adults with a working car or the share that lives less than a 15-minute walk to public transit. Using this measure, almost everyone in both samples—95 percent of the interim sample and 94 percent of the final sample—had access to transportation. The combined measure conflates modes with very different characteristics. Thus, it is not surprising that the program at either point in time did not have a statistically significant effect on transportation access, perhaps because the measure was too broadly defined.

Transportation does not appear to factor into a family's decision to move. In the interim evaluation, participants were asked to state their most important reason for moving (Orr et al. 2003). Less than one percent (0.2%) of participants cited a desire to move to obtain "better transportation." Clampet-Lundquist and Massey (2008) find that access to automobiles did not influence the likelihood of using a voucher to move.

Once households decide to move, transportation can positively influence their successful use of a housing voucher. Shroder (2002) finds that access to a car or a driver's license increases the likelihood that MTO program participants successfully found and secured a lease using their housing voucher.

Transportation also affects the types of neighborhoods that participants considered and to which they moved. For example, Clampet-Lundquist (2004) studied households relocated from the DuBois HOPE VI project in Philadelphia and found that many were constrained in their housing search because of their lack of access to an automobile and their perception that suburban public transportation opportunities were limited (reviewed in Varady et al. 2010). Varady and Walker (2007) find that a major factor determining the location of moves is proximity to friends and relatives and the availability of public transportation. De Souza Briggs and colleagues (2010) find that families who relocated were also more likely to successfully lease up in a low-poverty neighborhood if, among other factors, they had consistent access to a car. Clampet-Lundquist and Massey (2008) find that households with automobiles were less likely to move to racially-integrated neighborhoods compared to households without cars.

Finally, two qualitative studies examined the relationship between lease-up locations and transit access. De Souza Briggs and colleagues (2010) used mixed research methods—interviews, ethnographic fieldwork and analysis of survey data—to produce the most extensive findings on the relationship between transportation resources and key outcomes for MTO participants. In Boston, New York, and Los Angeles, MTO participants who relocated tended to move from transit-rich inner cities to suburbs, which require the use of a car to take advantage of jobs and services. Moreover, about 15 percent of mothers interviewed by the authors identified giving up convenient access to transit as a price they had paid to live in safer neighborhoods. The lack of transit options in their new neighborhoods subsequently presented a major obstacle to those who had moved and did not have cars.

In their interviews with 67 MTO families in Baltimore, Turney and colleagues (2006) find similar results. MTO participants who relocated often lived further away from their jobs and in neighborhoods with less dense transportation networks. Turney's (2006) study also provides evidence suggestive of the importance of car ownership for capitalizing on economic opportunities. Half of those who were employed among those assigned to the experimental group—those obligated to move to a lower-poverty neighborhood in order to lease up—owned a car, as opposed to only one unemployed respondent in this subgroup. Still, the links between transportation assets and employment are few and indirect in studies utilizing MTO data.

Data

In this section, we describe the primary databases used to perform the analyses outlined in this report. In the 1990s and early 2000s HUD sponsored two major experiments to test whether housing choice vouchers propelled low-income households into greater economic security. These programs, Moving to Opportunity for Fair Housing (MTO) and Welfare to Work Vouchers (WTW), each produced a rich dataset describing households with housing vouchers. While both studies were experimental in nature—providing some households with a housing voucher while keeping others in a nonvoucher control group—there were key differences between the experiments and therefore the nature of the data they produced. This section provides a brief background on these two experiments and describes the datasets used to complete our analyses.

The purpose of MTO was explicitly to test whether poor public housing households with children benefitted from living in low-poverty neighborhoods. (For more information about MTO, see Sanbonmatsu et al. 2011; Orr et al. 2003; and Briggs et al. 2010.) At the outset of the experiment, project guidelines stipulated that all households have at least one child present. In particular, HUD hypothesized that relieving part of a household's housing burden and requiring lease-up in a neighborhood with a poverty rate below 10 percent as of 1990 would improve many of the household's social and economic outcomes. Between 1994 and 1998, eligible (and willing) households in five metropolitan areas were randomly assigned into three groups. The MTO Treatment Group received Section 8 housing vouchers only useable in areas of less than 10 percent poverty as measured by the 1990 census. The Section 8 Comparison Group received identical Section 8 vouchers, but faced no geographic restrictions. The Control Group remained in project-based public housing. The use of three groups allowed causal analysis of the effect of vouchers versus no vouchers—that is, mobility choice versus no mobility choice—as well as the effect of moving into low-poverty neighborhoods.

Three MTO surveys were conducted. Between 1994 and 1998, baseline data were collected on 4,604 families when they were randomized into one of the three groups. An interim survey was conducted in 2002 including 4,252 of these households; the survey excluded 356 families in Los Angeles whose randomization occurred between December 1997 and the end of randomization in July 1998. A third and final survey was conducted in 2008, 10 to 15 years after randomization, on all the families randomly assigned in the MTO demonstration. Our analyses make use of data from the baseline survey, interim survey, and final surveys, along with a "residential spell file" that provides geocoded information linking each household to their residential location at baseline and following each residential relocation.

The WTW experiment targeted low-income households to learn the effect of receiving housing assistance on households' neighborhood locations, obtaining and retaining employment, and welfare dependency. (For more information on WTW, see Patterson et al. 2004.) All the recipients of WTW vouchers had already applied for housing vouchers from local public housing agencies but had been placed on the waiting list. The use of mobility vouchers was appealing because in theory, families could

choose to move into neighborhoods that optimized their ability to find or maintain employment. Another distinction between the experiments was that WTW households were not required to use their vouchers in low-poverty neighborhoods. For the most part, the housing agencies that implemented WTW did not provide counseling on mobility, housing search, or employment to experimental households beyond the level normally provided to their tenants (Patterson et al. 2004, 33).

Baseline WTW data were gathered in 2000 and 2001 at the time of the randomization in which 7,684 households were assigned to one of two groups: the treatment group that received housing vouchers and the control group that did not. Like MTO, WTW treatment and control group households came from five (non-MTO) metropolitan areas. The random assignment allows researchers to analyze WTW data to infer the effects of receiving a voucher on location choice, employment, and welfare dependency.

Together, there are voucher treatment and control data for people who began the experiments in 10 major US metropolitan areas: New York, Los Angeles, Chicago, Boston, and Baltimore (from MTO); and Atlanta, Spokane, Augusta, Houston, and Fresno (from WTW). While Los Angeles also hosted a WTW demonstration, there were no follow-up data collected there, so we exclude it from our analyses. (Participants in these experiments could move to other metropolitan areas; we did not include any households in our analysis that moved to locations outside the 10 case study regions.)

We also use Form HUD-50058 data describing housing choice voucher tenants as a comparison point to the voucher data. The housing choice voucher tenant data are gathered by housing agencies who report on households participating in public housing or Section 8 rental subsidy programs. Housing agencies collect and electronically submit information to provide HUD with a picture of people who participate in subsidized rental housing. We obtained an extract of 50058 data from HUD's Office of Policy Development and Research. This data concerned households with tenant-based vouchers for 2000 and 2002 for all the counties in all 10 of the metropolitan areas in which the MTO and WTW experiments took place. This allows us to describe the location of all voucher holders in these 10 metropolitan areas in relation to the households involved in the experiments.

The housing choice voucher tenant data provide basic demographic variables: age, race, household composition, and income. They also include a "project-based" flag, indicating that the household's subsidy is tied to a particular location. We exclude these from our sample in order to compare only voucher-eligible (mobile) households across the datasets. Throughout, we compare housing choice voucher tenant data and experimental data only from the same metropolitan areas.

In addition to these data sources, we rely on publicly available data provided for census tracts from many sources to characterize the sustainability dimensions of neighborhoods. We describe these data in more detail in a subsequent section of the report.

Research Questions

Using the data described above, we examine three primary research questions. Each question is informed by many separate analyses.

- *How do Housing Choice Voucher recipients sort into different neighborhoods?* Answers to this question extend work by Pendall (2000), Been and colleagues (2010), and Galvez (2010), identifying (1) the array of neighborhood social and built environments that HUD voucher recipients inhabit, (2) how the neighborhood characteristics of HUD voucher recipients compare to those of other HUD-assisted households, and (3) differences among HUD voucher recipients in their neighborhood environments. Information about current residential choices across a range of

metropolitan contexts (small to large, weak to strong economies, transit-rich to auto-dependent) provide valuable baseline information for ongoing and future Sustainable Communities research, planning, and policy efforts. To address this question, we (1) characterize the neighborhoods inhabited by MTO and WTW participants in terms of their sustainability dimensions, and (2) examine patterns of sorting across each of these dimensions, paying particular attention to the differences in sorting patterns between those with and without access to vehicles.

- *What role does transportation play in voucher users' residential choices?* Answers to this question identify the effect of transportation assets on the residential location decisions of HUD households, and for which households transportation appears to be most important. This research also contributes to Sustainable Communities efforts by enhancing our understanding of housing and transportation connections and how they vary across metropolitan areas. It also contributes to HUD's responsibility to affirmatively further fair housing by identifying transportation-related barriers to the integration of minority voucher users. To answer this question, we examine the influence of transportation access on three dimensions of location choice: (1) locational attainment, (2) neighborhood satisfaction, and (3) dynamic patterns of residential mobility. Each analysis, with the exception of the neighborhood satisfaction analysis, is conducted for a sample of MTO and WTW households.
- *How do transportation access and residential location choice influence economic opportunity?* As part of the Sustainable Communities agenda, HUD has funded initiatives intended to "enrich the social and economic health" of communities.[6] Thus, it is important to understand not only the residential location choices of program participants, but also the effect of these choices on specific outcome measures. To address the above question, we examine the influence of transportation access on employment and earnings. For MTO participants, we examine the exposure of households to "access opportunity neighborhoods," which we define as census tracts in the top quartile of their metropolitan area for employment and public transit availability. Then we examine the influence of transportation access on employment transitions for those in the MTO and WTW program. We conclude with an analysis of the joint relationships among automobile ownership, residential location in transit-rich neighborhoods, and earnings for MTO participants.

The next several sections provide summaries of our findings, organized according to the three research questions posed above.

How Do Housing Choice Voucher Recipients Sort into Different Neighborhoods?

To answer the first research question we undertook two operations. First, we created a new multidimensional definition of neighborhood sustainability, applying it to the 10 metropolitan areas in the two experiments. Second, we analyzed the differences in neighborhood attainment between the experimental households that had access to cars and those who did not.

Defining Neighborhood Sustainability

In this section, we operationalize neighborhood sustainability with reference to six major dimensions: natural environment, functional environment, social environment, economic vitality, security, and access

[6] See the announcement of the Sustainable Communities Research Grant program, "Transformation Initiative: Sustainable Communities Research Grant program," Grants.gov, accessed February 14, 2014, http://www.grants.gov/web/grants/view-opportunity.html?oppId=230694.

to opportunity. We assemble relevant indicators from available local and national data and construct measures that reflect key conceptual components of our dimensions, which we refer to as subdimensions. We then apply these dimensions to the 10 metropolitan areas in which the MTO and WTW experiments were carried out, showing important variations within and among metropolitan areas in desirable neighborhood characteristics.

Dimensions and Subdimensions of Neighborhood Sustainability

The task of measuring and classifying neighborhood sustainability began with defining six major dimensions of sustainability: natural environment, functional environment, social environment, economic vitality, security, and access to opportunity. We identified these dimensions based on a review of the neighborhood opportunity, livability, and sustainability indicator literature, grouping these into sets of characteristics that provide for a series of basic needs. Using these dimensions, we built a comprehensive database of neighborhood indicators, which we created by assembling a range of measures related to each dimension. We were able to develop indicators related to five of the six dimensions using national data; for the sixth, security, we collected data from local sources, but were able to obtain data only for central cities of most of the 10 metropolitan areas in our study area. The data sources included the 2000 US census, the National Land Cover Database, and indices produced by other organizations. Table 1 summarizes the various dimensions around which we assembled the data.

Table 1. Dimensions and Subdimensions of Neighborhood Sustainability

Dimension	Subdimension
Natural environment	• urbanization • highway proximity • health outcomes • environmental hazards
Functional environment	• housing market strength • housing diversity • transit access
Social environment	• level of household distress • socioeconomic status of residents
Economic vitality	• level of household distress • housing market strength • presence of neighborhood work opportunities • density of income
Security	• incidence of violent and property crime • public perceptions of safety
Access to opportunity	• access to high-quality elementary schools • job access

Source: Authors' data.

To reduce the list to a more manageable number for analysis and to assess underlying concepts, we followed two procedures. First, we produced correlation matrices of the indicators within each dimension. Where multiple indicators were clearly important for capturing the dimension and appeared largely independent of one another, we created subdimensions. Some sets of indicators were highly correlated and could be replaced by a single representative indicator. For others that were strongly related but not easily represented by a single measure, we used principal components factor analysis to produce a single factor score from all the component indicators within a subdimension. Each dimension includes between

two and four subdimensions.

In some instances, subdimensions can be a component of more than one dimension. The calculation of these subdimensions is the same across dimensions. Categorizing a subdimension within more than one dimension does not mean that a set of indicators is weighted more heavily in our analysis, but that we interpret any findings related to that subdimension through the lens of more than one broader dimension. For example, we do not weight our index for housing market strength more heavily than the other subdimension measures, but we consider what its relationship to other neighborhood characteristics and voucher household patterns suggests about functional environment and economic vitality.

Each neighborhood consists of a mix of these six dimensions, each of which will have different importance for different residents. Neighborhoods differ from one another in part because different kinds of households want and need different things from their residential environments. Young singles often want to live in lively places where they can meet each other and get easy access to work and nightlife. Families with kids usually value parks, playgrounds, good-quality schools, and convenient shopping. Everyone wants "security," but people's thresholds for what feels secure vary by age, gender, and other characteristics, and there is sometimes a trade-off between safety and liveliness. For these reasons, a single scale for neighborhood sustainability, livability, or opportunity may not apply to all households. Instead, it makes sense to develop scales for the different dimensions of neighborhood characteristics that people balance in different ways when they decide where to live.

We describe the indicators used to capture each of these dimensions below:

Natural Environment

Here, we consider both the amenity aspects of a neighborhood's natural environment—access to nature and open space, most importantly—and the threats posed by the neighborhood environment from pollution and noise. We divided the natural environment dimension into four subdimensions. Three measures reflect environmental hazards of different kinds that are not well correlated with one another: percent of the tract's area within one mile of a facility listed on the EPA's 2000 Toxic Release Inventory (TRI);[7] an index of cancer risk from the 2002 National-Scale Air Toxics Assessment;[8] and proximity to major highways, calculated as the percent of land in a census tract lying within 200 meters of major highways as georeferenced in the 2000 Census TIGER files.[9] The weak empirical relationship among these hazards was expected, given the many factors that may be associated with neighborhoods' elevated cancer risk, proximity to highways, and proximity to registered toxic facilities. We include all of them in our analysis because there is a clear conceptual relationship among them, and each can have serious implications for a neighborhood's livability and sustainability. In all three cases, a higher score indicates a living environment most people would consider lower-quality. While access to highways may represent opportunity for some households, exposure to a major highway within 200 meters has noise and air pollution impacts that can impair health, especially for children.

For the urbanization subdimension, the key indicators were percent of census tract that is open space,

---

[7] Environmental Protection Agency. "2000 Toxics Release Inventory (TRI) Public Data Release Report: Executive Summary," Environmental Protection Agency, last modified February 17, 2014, http://www2.epa.gov/toxics-release-inventory-tri-program/2000-toxics-release-inventory-tri-public-data-release-report.

[8] Environmental Protection Agency. "2002 National-Scale Air Toxics Assessment (NATA)," EPA, accessed March 10, 2014, http://www.epa.gov/nata2002/.

[9] US Census Bureau. "Census 2000 Tiger/Line Shapefiles," US Department of Commerce, accessed March 10, 2014, http://www.census.gov/geo/maps-data/data/tiger-line.html.

percent of tract that is water, and percent of tract that is developed for urban uses, calculated from the 2001 National Land Cover Database.[10] Percent of urban developed land was strongly correlated with the other indicators, and most fully represents the concept of urbanization, so we use that indicator alone as our measure of urbanization. We do not infer a clear relationship between level of urbanization and quality of life, though a higher score would indicate a more urbanized environment and a lower score a more suburban or rural one.

Functional Environment

This set of characteristics conveys those features of the neighborhood's built environment that make it livable for residents, even if they have financial, mobility, and other limitations. We consider three subdimensions of functional environment: housing market strength, housing diversity, and transit access. Our initial list also included a walkability subdimension, but we dropped walkability due to data availability constraints.

We group together vacancy rate, percent owner-occupied housing units, and median gross rent as indicators of neighborhood housing market strength. All three measures are from the 2000 decennial census summary file 3.[11] To control for variation in the rental market across our sites, we standardized median gross rent by metropolitan area and used the resulting z-score as the indicator. The standardization process means that the resulting indicator reflects a given neighborhood's median rent relative to other neighborhoods in that metropolitan area. Each indicator reflects a unique aspect of housing market strength and we thus relied on factor analysis to construct that subdimension. As expected, vacancy rate had a negative coefficient (meaning higher vacancy rates suggest lower sustainability), while the other two indicators had positive coefficients. Thus, a higher score on the housing market strength dimension indicates a stronger housing market and usually a more attractive or appealing neighborhood. See appendix A for more details on the factor analysis.

We used a similar process to create a single measure of housing diversity, composed of diversity of residential structure type, average of residential density, and percent of very old and very new housing. We again relied on factor analysis, and the resulting score serves as our measure (see appendix A for more details on the factor analysis). A higher score on the housing diversity dimension indicates a more diverse housing stock. As discussed in the background chapter, housing diversity is valued strongly by some contemporary urban designers and city planners. Individual satisfaction levels are somewhat higher, however, in exclusively single-family neighborhoods than in neighborhoods with diverse housing stock even after adjusting for individual and housing-unit characteristics. We thus do not associate this dimension with either a more or a less desirable outcome.

We examined transit access as a unique subdimension of functional environment. Our single indicator of transit access is the FHEA (Fair Housing Equity Assessment) transit access index created by HUD.[12] This index used data from public transit agencies to assess relative accessibility to amenities

---

[10] Multi-Resolution Land Characteristics Consortium. "National Land Cover Database 2001 (NLCD2001)," Multi-Resolution Land Characteristics Consortium, accessed March 10, 2014, http://www.mrlc.gov/nlcd2001.php.

[11] US Census 2000, "Summary File 3," US Census Bureau, last modified October 13, 2011, http://www.census.gov/census2000/sumfile3.html.

[12] In 2012, HUD created a database to support grantees of the Sustainable Communities Regional Planning Grant program in the preparation of their FHEAs. The data file included indicators for a wide array of neighborhood conditions at the block-group level, using 2010 census tract boundaries. HUD provided a readable version of the national file to the research team for use in this project. We imputed

within metropolitan areas. Higher values indicate greater access to transit; values of one indicate no transit availability. Because of uniformly low index values for almost all tracts in three of the five WTW metropolitan areas (Atlanta, Augusta, and Spokane), we chose not to use this indicator for the neighborhood analysis for the WTW group.

Social Environment

These characteristics express important aspects of the social and demographic makeup of the neighborhood, including the level of household distress and the socioeconomic status of residents. Our measures for this dimension all came from the 2000 decennial census summary file 3.[13]

Our conception of social environment includes two subdimensions: household distress and social status. We selected four measures to indicate household distress: labor market participation rate, number of households on public assistance, poverty rate, and median household income (converted to z-scores within each metropolitan area to account for variation among metropolitan areas). These were all highly correlated with one another. We chose poverty rate as a single measure of this subdimension because it has the strongest relationship with the other indicators and is most clearly associated with household distress in the literature.

We considered social status a conceptually separate subdimension of the social environment. We collected three indicators of social status. The first is a single variable meant to encapsulate the variation of racial composition: the percent of white households, standardized by metropolitan area to control for variations in racial composition across our sites. The second indicator is the percent of population age 25 and over with a high school diploma. The third is the percent of female-headed households. We performed a factor analysis because we believed each was relevant to social status. All three indicators were positively associated with the resulting factor score, in which higher values associate with higher levels of social status. See appendix A for more details on the factor analysis.

We placed racial composition in this social status subdimension rather than the household distress subdimension because although mostly black and mostly Latino neighborhoods continue to have high levels of household distress, the correspondence between race and distress is complex. Neighborhoods with higher percentages of whites, college-educated residents, and two-parent households usually have low levels of household distress. Conversely, however, neighborhoods with low socioeconomic status are not always seriously distressed. We decided not to consider racial composition separately so as to highlight the aspects of racial composition that associate with social status and to separate it from those that correlate with household distress.

Economic Vitality

A neighborhood's economic vitality comes from a composite of characteristics that include both the presence of work opportunities in the neighborhood and the density of population and income in that area. Our best available measures for this dimension come from the 2000 decennial census Summary File 3.[14]

For the dimension of economic vitality, we include two previously considered subdimensions, household distress and housing market strength, as well as economic activity and income density. The additional subdimensions are each represented by a single indicator. For economic activity, we calculated

---

these values to 2000 Census Tract boundaries.

[13] US Census 2000, "Summary File 3."

[14] Ibid.

job density as total jobs per square mile, as reported in the 2000 Census Transportation Planning Package.[15] We also included aggregate income density, computed using the estimated aggregate income from Summary File 3 of the 2000 census,[16] and then standardized the results by metropolitan area to control for differences among sites.

Security

A neighborhood's sense of security is measured by the incidence of violent and property crime and public perceptions of safety in the neighborhood. Reported crime data are unavailable for full metropolitan areas, because each county or city individually decides whether or not to make data available to the public. Where data are available, they may not be available for the time periods needed. Finally, jurisdictions that do report data apply different standards for the crime records to be included, the information to be reported, and how the crimes are reported, making aggregation and comparison difficult.

We collected crime data in various ways in each of the case-study areas. For Atlanta, Baltimore, and Chicago, we utilized publicly available point-level crime records for varying years. Each crime incident contained address or coordinates that we then mapped to 2000 census tract boundaries. We calculated the number of violent crime incidents in a given year for each census tract and divided by the estimated population of the tract in the year the crime data was collected, using a linear interpolation between 2000 and 2010 census population figures to create a measure of number of violent crimes per 100,000 inhabitants on the census tract level. Finally, within each metropolitan statistical area, we ranked the census tracts by violent crime rate and categorized them by quartile to establish low, low to moderate, moderate to high, and high crime neighborhoods. For three other sites of our study (Boston, Houston, Los Angeles), we used data from the National Neighborhood Crime Study (Peterson and Krivo 2010). The study provided census tract-level statistics for these three sites, including the sum of violent crimes over 1999–2001. We used this figure and 2000 census population statistics to create a violent crime rank and quartile categories consistent with the assignments for the sites with public crime records. We were unable to secure reliable crime data for the central cities of the other four metropolitan areas or for suburban areas of these six metropolitan areas.

To gauge perceptions of neighborhood safety, we used questions from the interim and final surveys for MTO and WTW, respectively. Like the crime data, the survey data were available for only some of the tracts in the metropolitan area; unlike the crime data, however, survey responses were available beyond the central cities and in all 10 metropolitan areas.

Access to Opportunity

The neighborhood's access to opportunity, unlike the other dimensions, is a function mainly of what the neighborhood is close to rather than what it contains. The availability of jobs is important here, as is access to high-quality elementary schools. Access to opportunity is characterized by the availability, proximity, and quality of educational and employment opportunities and critical public service functions. We include only one subdimension for this dimension, school quality, as represented by HUD's FHEA school quality index. The school quality index uses elementary school data on the performance of students in state exams to produce a score for each tract, based on the closest elementary schools. Job access is a second critically important measure of access to opportunity. We were unable to obtain reliable data on this measure for all metropolitan areas and therefore do not include it in this report.

---

[15] Federal Highway Administration. "Census Transportation Planning Products 2000 Data Products," US Department of Transportation, accessed March 10, 2014, http://www.fhwa.dot.gov/planning/census_issues/ctpp/data_products/2000dataprod.cfm.

[16] US Census 2000, "Summary File 3."

Neighborhood Sustainability Dimensions for MTO and WTW Metropolitan Areas

The MTO and WTW metropolitan areas differ in a series of important ways that stand out when reviewing the sustainability dimensions (table 2). First, the MTO metros have many more tracts than the WTW metropolitans. Three of the MTO metropolitan areas—Chicago, LA, and New York—each have more tracts than the 1,893 tracts in all five WTW metros combined. The diversity within these large metropolitan areas is also substantial, but a full review of that diversity is beyond the scope of this report. The smallest WTW metropolitan areas, Augusta and Spokane, have only 95 and 104 tracts respectively, and the largest, Houston, has fewer tracts than all but the smallest MTO metropolitan area, Baltimore.

Table 2. Mean Levels of Sustainability Subdimensions and Their Factor-Score Contributors, Moving to Opportunity and Welfare to Work, 2000–2001

	MTO					WTW				
	Baltimore	**Boston**	**Chicago**	**LA**	**NYC**	**Atlanta**	**Augusta**	**Fresno**	**Houston**	**Spokane**
Number of tracts	601	832	1,958	2,564	4,307	675	94	154	864	104
Natural environment										
Land within buffer of TRI site (%)	16.6%	64.6%	65.5%	24.2%	57.3%	28.9%	24.9%	26.2%	38.4%	37.2%
Log of cancer risk score	3.8	3.8	3.8	4.1	4	3.8	3.4	3.5	3.7	3.5
Land within 200m of major highway (%)	27.5%	24.0%	17.5%	13.4%	22.7%	17.30%	16.9%	10.30%	11.0%	10.2%
Land developed as urban uses (%)	68.6%	72.4%	87.7%	93.2%	87.5%	57.20%	45.9%	66.90%	75.3%	71.4%
Functional environment										
Housing market strength factor	0.1	0.1	0.1	0	-0.1	0.1	-0.1	0	-0.1	0.1
Vacancy rate (%)	7.9	4	6.4	4	5.4	5.9	10.2	6.1	7.9	6.6
Owner-occupied housing units (%)	66.8%	59.9%	61.6%	52.7%	51.2%	66.1%	69.1%	57.7%	62.5%	67.7%
Median gross rent ($)	669	803	700	857	836	727	505	572	637	582
Housing diversity factor	-0.3	0.2	-0.1	-0.3	0.2	-0.1	-0.2	0.1	0.1	0.2
Diversity index of structure type	0.5	0.6	0.6	0.6	0.6	0.4	0.4	0.5	0.4	0.4
Housing density (dwellings/acre)	7.9	8.8	9.3	8.2	21.2	3	2.3	3.3	3.9	3.4
Housing 50+ years old (%)	12.4	7.6	10.2	7.9	6.3	25.5	20.3	17.5	17.5	16.9
Housing <11 years old (%)	30.6	45.5	36.3	21.5	42.8	10.4	13.6	15.2	10.5	27.4
FHEA transit index	45.4	41.2	52.6	49.4	32.8	1.8	1.0	1.0	36.2	44.2
Social environment										
Poverty rate	12	10	13.5	16.2	14.5	12.1	17.9	22.5	14.9	13.1
Social status factor	0.02	0.09	0.02	-0.05	-0.01	0.02	-0.06	-0.11	-0.01	0.15
Non-Hispanic white (%)	63.4	78.4	52.9	36.6	50.8	56.3	58.2	41.1	46.9	89.4
Female-headed households (%)	34.5	31.7	32.9	28.4	33.4	31.4	33.7	28.2	27.5	28.9
Adults with college degree (%)	25.9	36.1	26.3	24.7	27.6	28.6	19.3	16.9	23.9	24.4
Economic vitality										
Aggregate income/square mile (in millions of dollars)	113	194.6	218	195.7	629.3	51.1	21.8	52.9	75.1	50.2
Nat log of job density/sq mi	6.65	7.19	7.25	7.5	7.9	5.84	4.99	6.1	6.25	5.98
Job density per square mile	2,570	4,179	4,188	3,521	12,403	1,754	951	1,460	1,726	1,631
Access to opportunity										
FHEA school performance index	48.6	50.2	44.2	49.7	49.1	50.3	43.8	39.6	51.4	54

Source: Authors' calculations. For details on variable construction, see appendix A.

Notes: TRI is Toxic Release Inventory. FHEA is Fair Housing Equity Assessment.

Of the natural environment indicators, the WTW metropolitan areas stand out for being generally less urban than the MTO metropolitan areas. Boston, Chicago, and New York also have high exposure to TRI sites, while Los Angeles has a level closer to that of the WTW metropolitan areas, and Houston has a relatively high level of exposure to TRI sites (a function of its large oil and gas sector). MTO metropolitan areas also have higher cancer-risk scores, average shares of their tracts within 200 meters of a major highway, and average shares of their tracts developed with urban uses.

The functional environment indicators also show important differences between the MTO and WTW metropolitan areas. Two of the three subdimensions we developed for this dimension—housing market strength and housing diversity—are factor scores, each of which is the product of three variables. (Because the factor scores were developed separately for the two datasets, once for MTO and once for WTW, the scores can be usefully compared among metropolitan areas in the same dataset but not across the two datasets.) The MTO metropolitan areas generally have lower vacancy rates and homeownership rates and higher gross rents than the WTW metropolitan areas, with the exception of Baltimore. The MTO metropolitan areas also score higher on average housing diversity and density in their tracts. While New York stands out for density, it resembles Los Angeles and Boston in its level of structure-type diversity and Boston in its median housing age. The oldest average housing stock in the WTW metropolitan areas, about 47 years in Spokane, is younger than any of the MTO metropolitan areas. Finally, the FHEA transit index—which shows relative accessibility to amenities through public transit—also generally is higher in the MTO metropolitan areas than in the WTW areas. Atlanta, Augusta, and Fresno all have average scores around 1.0 because the vast majority of tracts within these sites were deemed inaccessible by HUD's definition of the FHEA transit index. New York's average FHEA transit index of only 32.8 is lower than we expected, and is similarly attributable to its many outlying census tracts receiving a value of one.

The metropolitan areas do not fall as cleanly into MTO versus WTW groups in their average social environments. The poverty rate, which we use as a proxy for overall neighborhood distress, is highest on average in Fresno (22.5 percent average across tracts) and Augusta (17.9 percent), but Atlanta and Spokane have poverty rates at the low end of the range (12.1 percent and 13.1 percent, respectively). Boston's 10.0 percent average poverty rate is less than half of Fresno's. The social status factor does not vary much across the metropolitan areas because we constructed it as two separate factor scores (one for each dataset), the exceptions being Spokane, with an average of 0.153, and Fresno, where the average was -0.11. The components of social status do vary substantially among the metropolitan areas, but again not in ways that distinguish MTO and WTW systematically. The California metropolitan areas and Houston all have average percent white non-Hispanic populations below 50 percent; Spokane's tracts are predominantly white, with an average of almost 90 percent. Among the other metropolitan areas, only Boston is more than 70 percent white on average. The range of female headed households is more restricted, from Houston's 27.5 percent to Baltimore's 34.5 percent average. But the share of college graduates is more varied, with as few as 16.9 percent in Fresno on average and as many as 36.1 percent in Boston. (The MTO metropolitan areas uniformly have higher levels of college completion than the WTW metropolitan areas.)

We express the economic vitality of the tracts (i.e., what is happening inside the neighborhood rather than near it) through density of income of residents and of jobs (which can be held by people outside or inside the tract). Here again, the MTO metropolitan areas stand out because they are larger, older, and denser than the WTW metropolitans, starting with New York—the clear outlier, with an average of nearly $630 million in household income per square mile in 1999 and over 12,400 jobs per square mile in 2000. Even excluding New York, however, the income density and job density in the MTO metropolitan areas is consistently higher than in the WTW metropolitan areas. Augusta's average income density of only $21 million per square mile, and its average job density of fewer than 1,000 jobs per square mile, identify it as a different place than most of the other metropolitan areas even in the WTW dataset (where Atlanta, Spokane, and Fresno have roughly comparable averages on both income and job density).

The sole access to opportunity metric we consider here is the FHEA school index. This index was computed such that it has an average score of 50. It is unclear why Fresno's average FHEA school index would be less than 40. Clarification of HUD's methods for constructing this index is pending. Other important considerations of accessibility are discussed in a subsequent chapter of this report, as are considerations of exposure to crime.

Neighborhood Typology

Our final analytic step was to develop a neighborhood typology incorporating all of the subdimensions we created except crime rates, which were available only for the central cities. For this step, we used cluster analysis to group tracts into sets based on their relative similarity to one another as measured by the indicators. We use a hierarchical cluster analysis using average linkage between groups based on squared Euclidean distances, which produces a series of potential clusters in stages, dividing previous clusters into new clusters at each stage. A measure of the average distance between cluster members serves as an indicator of the relative strength of each cluster solution. Choosing the optimal number of clusters is an experimental process in which we look for the strongest cluster solutions and examine the average values of the component indicators for each cluster both for plausibility of the solution (i.e., the analysis has produced neighborhood types with recognizable features) and for usefulness (e.g., a solution that does not lump all the tracts that are likely voucher destinations into a single cluster). Subdimensions which appear under more than one dimension enter the cluster analysis only once.

Because of the extreme range of values in two of our selected indicators, job density and aggregate income density, we performed two variable transformations. For job density, we use the natural log of the indicator, and for aggregate income density we use the natural log standardized by metropolitan area (i.e., the measure used is the z-score of the natural log). These changes caused distributions in the variables that more closely approximated a normal curve, eliminating dramatic skewing effects of extreme values on the construction of clusters.

Analysis of the MTO sites produced 4, 6, 8, 10, 12, and 15 cluster solutions. Comparing the cluster averages for our indicators and the distribution of tracts and MTO households across the clusters, we decided that the 15-member cluster solution provided the most convincing and useful grouping of neighborhood types. This solution consisted of a mix of identifiable neighborhood types, with poverty and relative affluence being important sorting factors but demonstrating variations based on our other dimensions. An initial analysis of the WTW sites revealed that over 70 percent of census tracts in Atlanta, Augusta, and Fresno had an FHEA transit index value of one, which is assigned to tracts located more than three quarters of a mile from either a bus or transit stop. We elected to omit this transit indicator from the WTW cluster analysis to avoid disproportionately weighting the tracts in these sites to group together because of their identical values. With this slightly reduced set of indicators for WTW sites, we identified solutions of 5, 6, 10 and 13 members. We concentrate our analysis on the 13-cluster solution, which performed the best in allocating tracts into recognizable groupings with members in each metropolitan area.

To simplify the interpretation of the large number of clusters produced, we divided the census tracts into groups based on the average poverty rate of the cluster to which they are assigned, creating low-, medium- and high-poverty bands. This method also addresses the problem that cluster analysis produces several clusters with very low tract counts, which can be analyzed more efficiently in combination with broadly similar clusters.

In broad terms, the clusters with the lowest average poverty levels rate favorably on other factors, while those with the highest average poverty levels have many other deficits. The poor neighborhoods are densely developed areas with little open space, weak economic activity, and occupied mainly by highly distressed households; the low-poverty neighborhoods are less dense spaces with stronger commercial

and economic growth and better-performing schools.

For the WTW sites, there are two low-poverty, four medium-poverty, and seven high-poverty clusters. Tables 3 and 4 display the clusters and average dimension values for clusters in the WTW and MTO sites. The two low-poverty clusters include a total of 893 tracts in which, compared with tracts in other clusters, less of the neighborhood's land area is urban, less is within 200 meters of a highway, schools have higher test scores, and social status is higher than in the average neighborhood. The great majority of the land area of the WTW metropolitan areas is in low-poverty tracts, but they account for about 47 percent of the tracts we classified into clusters. In all five WTW metropolitan areas, the low-poverty tracts cluster at the "macro" level (i.e., a level that is evident when viewing a map of the entire metropolitan area). In Atlanta, the large majority of tracts north of Interstate 20 are low-poverty tracts, especially those outside the I-285 beltway. Augusta's low-poverty tracts occupy a band running from northwest to southeast, with more disadvantaged tracts lying at the northeast and southwest fringes of the CBSA and on Augusta city's south side. Almost all of Fresno's low-poverty tracts occupy land northwest of SH 99, the main thoroughfare of the Central Valley. In Houston, I-45 is an important dividing line, with most low-poverty tracts sitting west of this main route between Galveston, Houston, and Dallas; this is true inside the city's two beltways as well, with a significant number of low-poverty tracts occupying a wedge on the city's west side. In Spokane, smallest of the five WTW metro areas, most of the low-poverty areas are south of I-90 or north of the city limits.

Table 3. Cluster-Factor Average Values, WTW Clusters

WTW Cluster	**L1**	**L2**	**M1**	**M2**	**M3**	**M4**	**H1**	**H2**	**H3**	**H4**	**H5**	**H6**	**H7**	**Total**
Number of tracts	**443**	**450**	**183**	**328**	**228**	**11**	**71**	**109**	**40**	**3**	**15**	**6**	**4**	**1891**
Buffer of Toxics Release Inventory facilities (%)	.18	.25	.26	.35	.47	.66	.71	.57	.64	.91	.65	.72	.71	.33
Nat log of cancer risk	3.62	3.63	3.69	3.64	3.71	3.88	3.97	3.79	4.07	4.16	4.01	3.82	4.17	3.68
Buffer of major highways (%)	.09	.12	.16	.13	.14	.16	.23	.19	.24	.16	.37	.40	.13	.13
Land area that is developed as urban uses (%)	.59	.58	.68	.65	.73	.95	.91	.84	.92	.99	.88	.81	.92	.66
Housing market strength factor	.55	.19	-.14	-.06	-.35	-.50	-.64	-.77	-1.01	-1.25	-1.12	-1.32	-1.39	.00
Housing diversity factor	-.46	-.22	.18	.06	.30	.36	.66	.69	.82	1.00	.85	1.04	1.38	.00
Poverty rate	5.47	8.50	13.40	13.46	21.46	22.27	29.75	35.68	42.47	46.04	54.29	65.05	71.20	14.58
Social status factor	.84	.42	-.45	-.12	-.53	-.43	-1.12	-1.16	-1.41	-1.78	-1.65	-1.70	-1.90	.00
FHEA school performance index	83.49	57.71	12.36	28.95	42.62	90.22	67.65	13.09	40.05	97.00	24.62	7.92	46.77	49.79
Z-score of the natural log of aggregate income density, by MSA	.11	-.10	.16	-.14	-.11	.24	.27	.09	.20	.57	.09	.00	.15	.00
Nat log of job density per sq. mi.	5.73	5.69	6.01	5.79	6.26	7.69	7.29	6.74	7.66	7.44	7.31	6.53	7.36	6.01

Source: Authors' calculations using data from sources detailed in appendix A

Note: MSA is metropolitan statistical area. FHEA is Fair Housing Equity Assessment.

Table 4. Cluster-Factor Average Values, MTO Clusters

MTO Cluster	L1	L2	M1	M2	M3	M4	M5	H1	H2	H3	H4	H5	H6	H7	H8	Total
Number of tracts	**2,403**	**622**	**1,663**	**1,014**	**710**	**2,125**	**1,494**	**19**	**32**	**97**	**8**	**7**	**65**	**2**	**1**	**10,262**
Buffer of Toxics Release Inventory facilities (%)	.28	.29	.58	.50	.46	.59	.63	.50	.51	.84	.78	.08	.73	1.00	1.00	.49
Nat log of cancer risk	3.72	3.92	4.11	4.01	4.08	3.96	4.08	4.30	4.34	4.33	4.23	4.01	4.10	4.22	4.44	3.96
Buffer of major highways (%)	.15	.17	.23	.20	.23	.21	.21	.18	.17	.25	.49	.10	.20	.25	.95	.20
Land area that is developed as urban uses (%)	.66	.90	.96	.93	.97	.86	.98	.94	.96	.98	.98	.95	.99	1.00	.98	.87
Housing market strength factor	.55	.57	-.08	-.06	-.06	-.19	-.50	-.92	-1.10	-1.16	-1.31	-.45	-1.41	-.96	-.94	.00
Housing diversity factor	-.58	-.40	.37	-.08	.36	.11	.41	.31	.37	.24	.42	-.38	.22	.18	.71	.00
FHEA transit access index	4.65	46.47	82.08	46.22	86.59	3.00	87.50	54.31	68.74	2.53	35.84	77.67	92.64	1.00	1.00	42.13
Poverty rate	5.03	5.47	12.48	14.96	15.06	16.90	24.45	41.10	42.41	44.57	52.73	61.53	62.67	93.97	100.00	14.25
Social status factor	.79	.76	-.04	-.31	.08	-.22	-.89	-.93	-1.31	-1.40	-1.44	.18	-1.43	-2.02	-1.65	.00
FHEA school performance index	75.99	79.05	45.38	28.29	77.35	31.66	17.35	79.47	45.81	78.00	20.27	96.50	11.47	29.97	69.90	48.36
Z-score of the natural log of aggregate income density, by MSA	-.65	.08	.57	-.01	.61	-.16	.40	.12	.03	.33	.01	-.36	-.43	-3.08	-5.24	.01
Nat log of job density per sq. mi.	6.37	7.30	8.39	7.50	8.45	7.54	8.03	8.78	8.28	9.17	7.73	8.99	8.27	8.98	7.59	7.55

Source: Authors' calculations using data from sources detailed in appendix A.
Note: MSA is metropolitan statistical area. FHEA is Fair Housing Equity Assessment.

The high-poverty WTW clusters differ from the low-poverty clusters in several ways. They tend to have a higher than average share of urban developed land, very weak housing markets, much lower than average expected social status, and school performance that ranges from average to very poor. In Atlanta and Houston, most high-poverty tracts are close to the center of the region; metropolitan Atlanta's high-poverty neighborhoods are concentrated inside the I-285 beltway, and Houston's lie inside Beltway 8, its second loop road. Both metropolitan areas also have smaller cities (Marietta and Galveston, respectively) with a few tracts in high-poverty clusters. Spokane's high-poverty tracts also cluster in the center of the region. In Augusta and Fresno, by contrast, tracts in high-poverty clusters take two patterns: some line up along major highways while a few others are in outlying rural areas.

The middle-poverty group of WTW clusters includes a variety of environments that sorted into four main groups. The two largest clusters are M2 (328 tracts) and M3 (228 tracts). Compared with M3, M2 has lower poverty (13 percent versus 21 percent), exposure to TRI facilities, cancer risk, income density, job density, developed land, and housing diversity, as well as having lower average FHEA school performance scores. The average poverty rate of M1, with 183 tracts, is about the same as that of M2, but its social status is lower, its housing market is weaker and more diverse, its income and job density are higher, and its school performance is much worse. Cluster M4, the average poverty rate of which is highest in the group at 22 percent, includes only 11 tracts, all of them in either Atlanta or Houston. It is the most urban of these four clusters, with the highest exposure to TRI facilities, cancer risk, percent of land developed with urban uses, housing diversity, income density, and job density, as well as the lowest average housing market strength. Its social status factor, however, is not as low as those of either cluster M1 or cluster M3.

Anomalously, the average FHEA school performance index in this cluster is higher than that of any other cluster in the low- or medium-poverty band. Visual inspection of metropolitan-level maps does not readily resolve patterns of clustering of these neighborhoods other than that they often are interspersed in patches of medium-poverty areas surrounded by low-poverty neighborhoods and surrounding high-poverty tracts.

Out of fifteen clusters of the 10,262 MTO-metropolitan census tracts we analyzed, two clusters are low-poverty, five are medium-poverty, and eight are high-poverty, though half of the high-poverty clusters contain fewer than 10 tracts. The two low-poverty clusters account for 2,822 of the tracts we analyzed, 30 percent of the total. Like those in WTW, these tracts have high social status, strong housing markets, and above average school performance. They differ in their portion of urban developed land and in income and job density, however, suggesting that cluster L1 represents suburban and exurban wealthy neighborhoods, while cluster L2 represents wealthy urban areas. Like the low-poverty tracts in the WTW metropolitan areas, these neighborhoods cluster at the macro level. In Baltimore, the main macro-level dividing line is clearly the I-695 beltway; a small number of tracts in the low-poverty clusters lie at the northern and southernmost extents of the area inside the beltway, but the vast majority is beyond the beltway (many of them immediately outside I-695). Boston's Route 128 does not form this kind of dividing line; rather, low-poverty neighborhoods line either side of the beltway with fewer low-poverty tracts occurring inside a tier of neighborhoods two to three tracts deep. The Route 128 corridor's identity as a high-tech hub likely protects nearby neighborhoods from the decline that has reached Baltimore's beltway. Chicago, too, has few low-poverty neighborhoods close to its center, with even the relatively well-off north shore neighborhoods inside the central city limits classified into the medium-poverty tracts; broad expanses of the metropolitan area's suburban and exurban hinterland are in the low-poverty band, and Chicago's close-in northern suburbs (e.g., Evanston, Winnetka, and Highland Park) are low-poverty enclaves. Los Angeles and New York present patterns of low-poverty neighborhoods too complex to discern through visual inspection.

The high-poverty clusters include a total of 231 tracts, just 2.3 percent of the total. Contrasting sharply with the low-poverty clusters, these tracts are almost exclusively composed of dense, highly developed neighborhoods with weak housing markets and low social status. Four of the five medium-poverty MTO clusters have over 1,000 tracts, and M4 has over 2,000.

The fifth cluster, M3, has 710 tracts. Differences within these clusters could undoubtedly be discerned with further rounds of analysis, but for our purposes these main groupings present interesting contrasts. Their average level of urban developed land ranges from 86 percent to 96 percent, and all of them have job density near or above the average for all tracts. All of them have about the same average exposure to highways (20 to 23 percent of the land area, on average, is within 200 meters of a highway). M1, M2, M3, and M4 have very small differences in average poverty rates, ranging from 12.5 percent to 16.9 percent; M5 has average poverty of about 24 percent. M5 shares some traits with most of the high-poverty clusters, such as very low social status, poor school performance, a high portion of urban developed land, and weak housing markets. However, the lowest average poverty rate among the high-poverty clusters is 41.1 percent, well above that of M5, whose comparatively high income density and transit access also make it different from most of the high-poverty neighborhood clusters. The average income and job density of M5 are lower than those of either M1 or M3; its relatively high FHEA transit score is, however, comparable to those of M1 and M3. Few indices distinguish M1 and M3 from one another; these relatively densely developed (urban) neighborhoods have similar levels of social status, poverty, and job density, but M1 has lower FHEA school performance scores, higher TRI exposure, and slightly higher cancer risk. M2 and M4, meanwhile, are less urban medium-poverty clusters with low school performance indices, social status, and income and job density, with M4 distinguished from M2 mainly by its very low average score (3.0) on the FHEA transit index.

These medium-poverty clusters do appear in some unsurprising geographic patterns, with New York City constituting an exception. In the other four metropolitan areas, M5 tends to dominate the central cities, while M4 is located in more peripheral locations and M1, M2, and M3 are located in neighborhoods at the edges of the central city, in inner suburbs, and in outlying small cities (e.g., Columbia, Maryland; Quincy and Brockton, MA; Aurora, Elgin, and Joliet, IL). The patterns in metropolitan New York are too complex to describe here and contain a few anomalies that may be a consequence of the use of HUD's FHEA data that may not apply as well to New York as to some of the other metropolitan areas.

Crime and Neighborhood Clusters

In an additional step, we calculated the share of MTO or WTW households in each cluster that reported high perceived safety in their neighborhoods in the interim survey. Households in lower-poverty clusters tended to report feeling safer on their streets at night, not surprisingly. Among all WTW households, just under 50 percent felt safe at night. But in the lowest-poverty cluster, 70 percent felt safe, and in the highest-poverty cluster, only 27 percent felt safe. The relationship was similar, though less consistent, among MTO clusters. In particular, high-poverty MTO clusters varied substantially in their share of households that felt safe at night. Over half felt safe in clusters H2 and H6, but in clusters H1 and H3, only 41 and 32 percent, respectively, felt safe. Furthermore, the lowest-poverty MTO cluster had only a slightly higher share of households reporting feeling safe at night than did two of the medium-poverty clusters.

Car Ownership and Residential Sorting

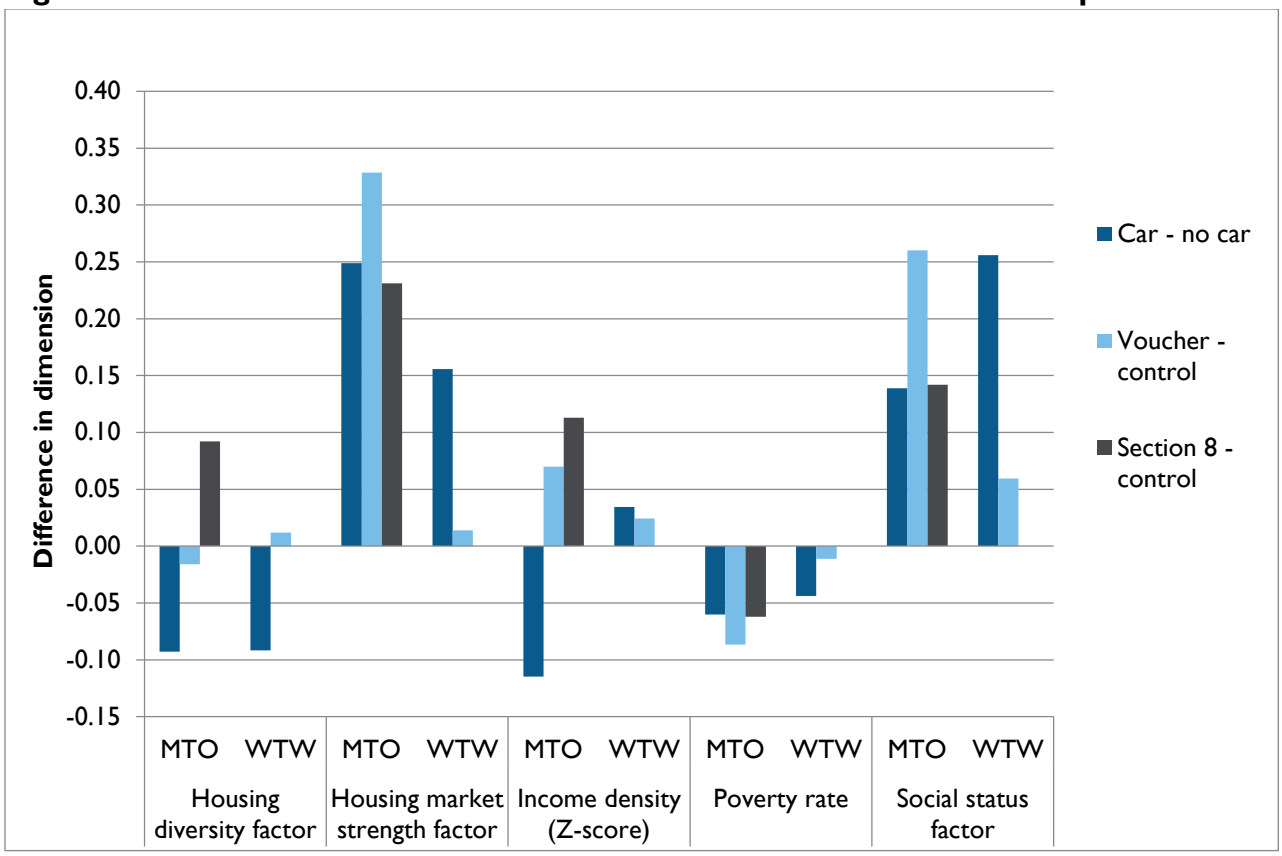
This section documents the attainment of sustainable neighborhoods by tenants who participated in the MTO and WTW programs. Its principal question is: How do households differ in their neighborhood attainment based on whether or not they own a car?

In this section, we define households in which at least one member is both a licensed driver and has access to a running car as a "driving household." The questions about car access in the MTO surveys

changed from the baseline to the interim survey to account for car ownership among household members other than the survey participant, from "Do you have a car that runs?" at baseline, to "Does anyone in your household own a car, van, or truck that runs?" in the interim survey. All WTW households were asked at baseline, "Do you have a car that runs?" Regrettably, the follow-up survey included a skip pattern in which only employed household heads were asked about cars and driver licenses. It is therefore impossible to ascertain precisely how access to cars changed between the baseline and follow-up surveys in WTW.

Figure 1 displays measures of the social environment, emphasizing comparisons between those with and without car access in addition to the experimental versus control group and Section 8 comparison versus control group. Access to a car clearly associates with access to better neighborhoods on most dimensions to which normative values can be ascribed. In both experiments, households with cars lived in neighborhoods with significantly lower poverty, higher social status, and stronger housing markets than those without cars. The relationship between driving and income density differs between MTO (in which the neighborhoods had generally higher population densities), where access to a car associated with lower income density, and WTW, where the reverse was true. These neighborhoods also had less-diverse housing stock than the neighborhoods of nondriving households. Combined with other information about neighborhood quality, this result reinforces the idea that while diverse housing stock may be favored by urban designers and planners, the neighborhoods with the most diverse housing in these 10 metropolitan areas may also have counterbalancing negative aspects that will need to be addressed before they work well for families.

Figure 1. Cars and Controls: Social Dimension Differences within the Experiments

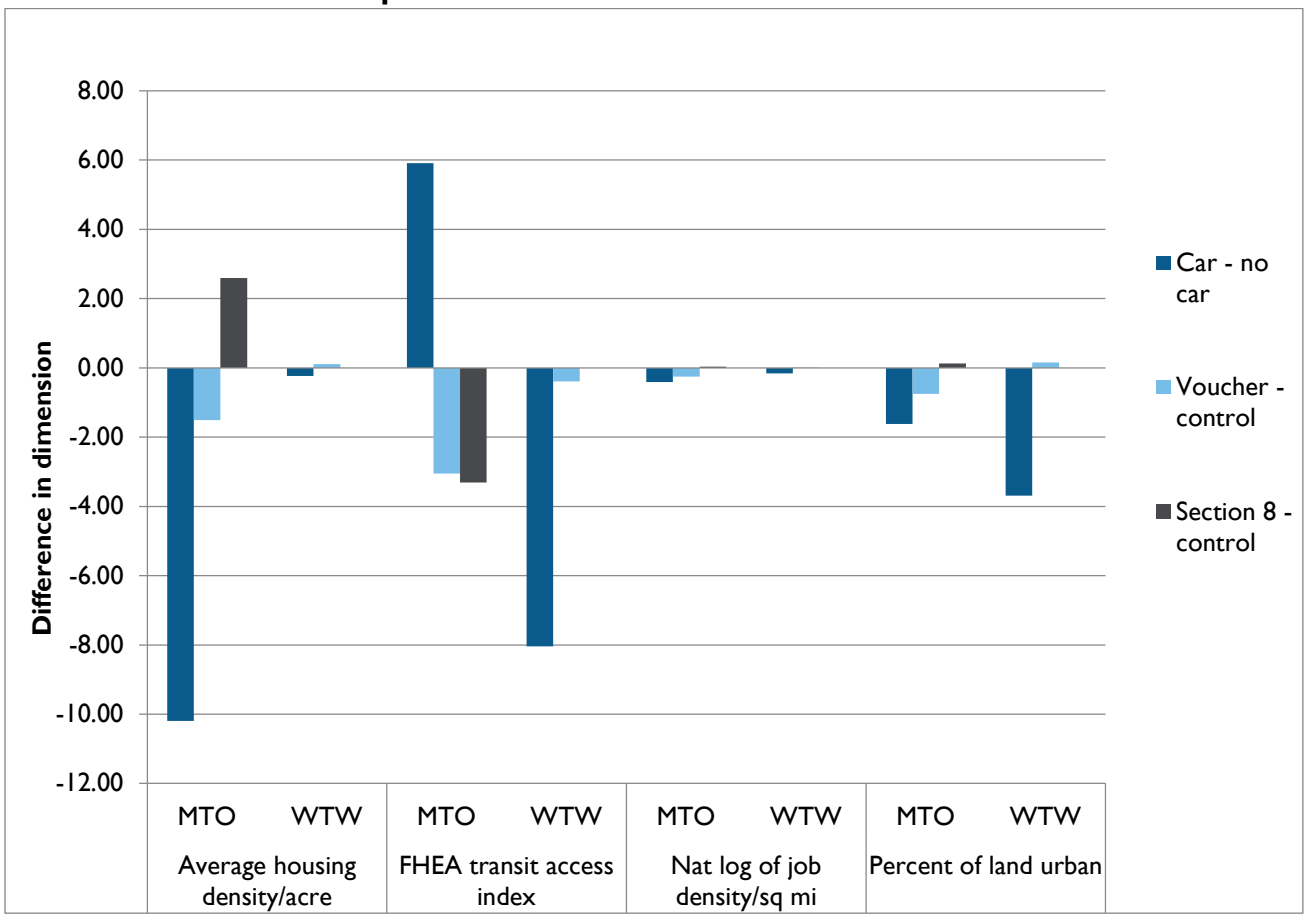


Source: Authors' data.

Figures 2 and 3 present the same comparisons for measures of the functional environment, natural

environment, and school performance. Driving households in MTO lived in neighborhoods with much lower housing density than nondriving households, whereas the difference for WTW households was smaller (but still statistically significant) (figure 2). Neighborhood job density and percent urban land were also significantly lower for driving than for nondriving households. Curiously, driving households in MTO had better access to transit than nondriving households, opposite the result of the WTW experiment. The MTO metro areas have much better transit generally than the WTW metropolitan areas; it would be intriguing to learn that MTO households with cars could find neighborhoods that were more convenient for both their transit users and their drivers. Having a car also associated fairly consistently with lower exposure to neighborhood harms and hazards (figure 3). In both experiments, the average cancer risk was lower for driving households than for nondriving households, and in WTW driving households lived in neighborhoods that had less exposure to TRI facilities and highways.

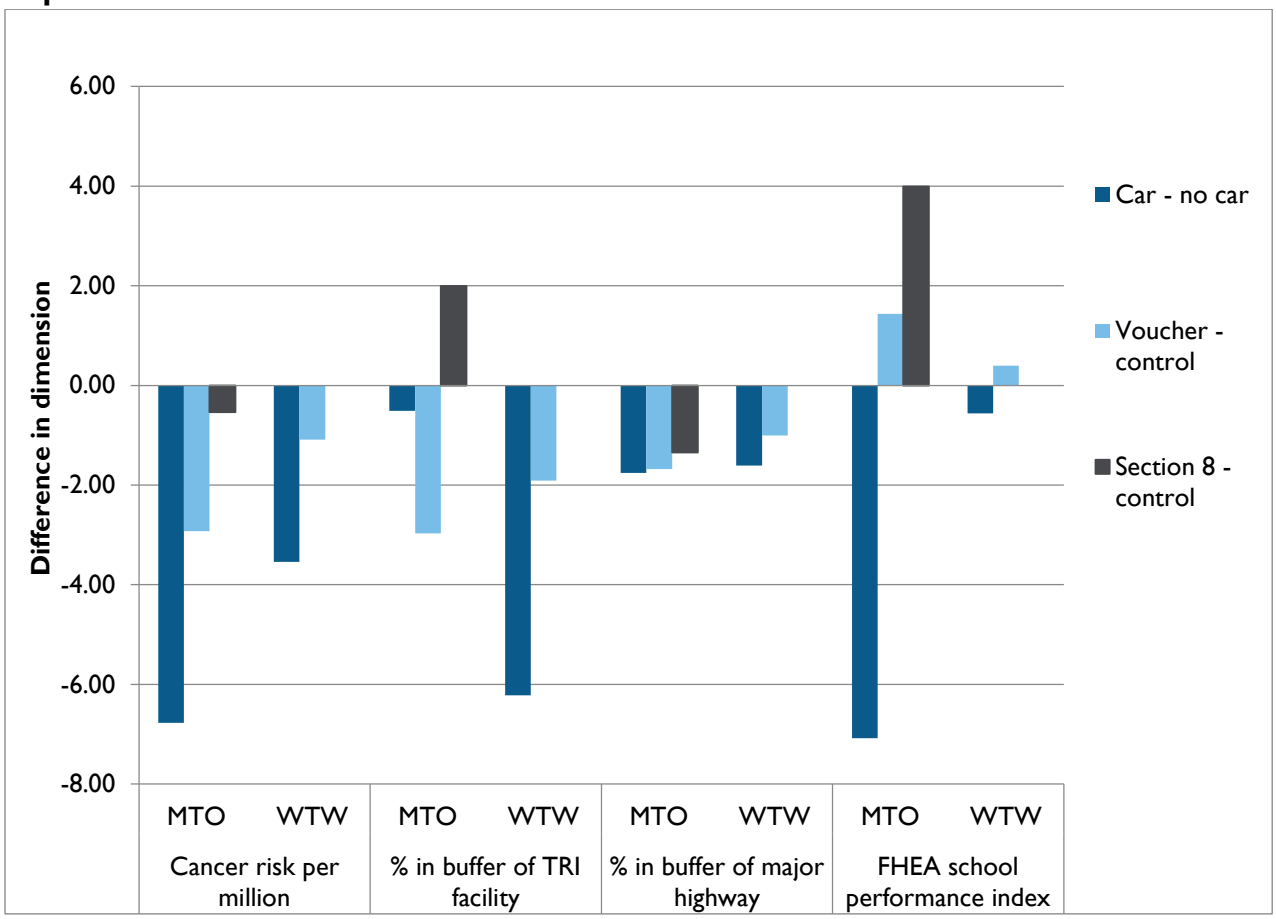
Figure 2. Cars and Controls: Built Environment and Functional Dimension Differences within the Experiments



Source: Authors' data.

Note: FHEA is Fair Housing Equity Assessment.

Figure 3. Cars and Controls: Exposure and School Access Differences within the Experiments



Source: Authors' data.
Notes: TRI is Toxics Release Inventory. FHEA is Fair Housing Equity Assessment.

The neighborhoods of nondriving households outperformed those of driving households on only one dimension: nondriving households lived in neighborhoods with significantly better school quality than driving households. This result was statistically significant and large in the MTO experiment, but not large enough to be significant at conventional levels in WTW.

Neighborhood Sorting Among Clusters: MTO

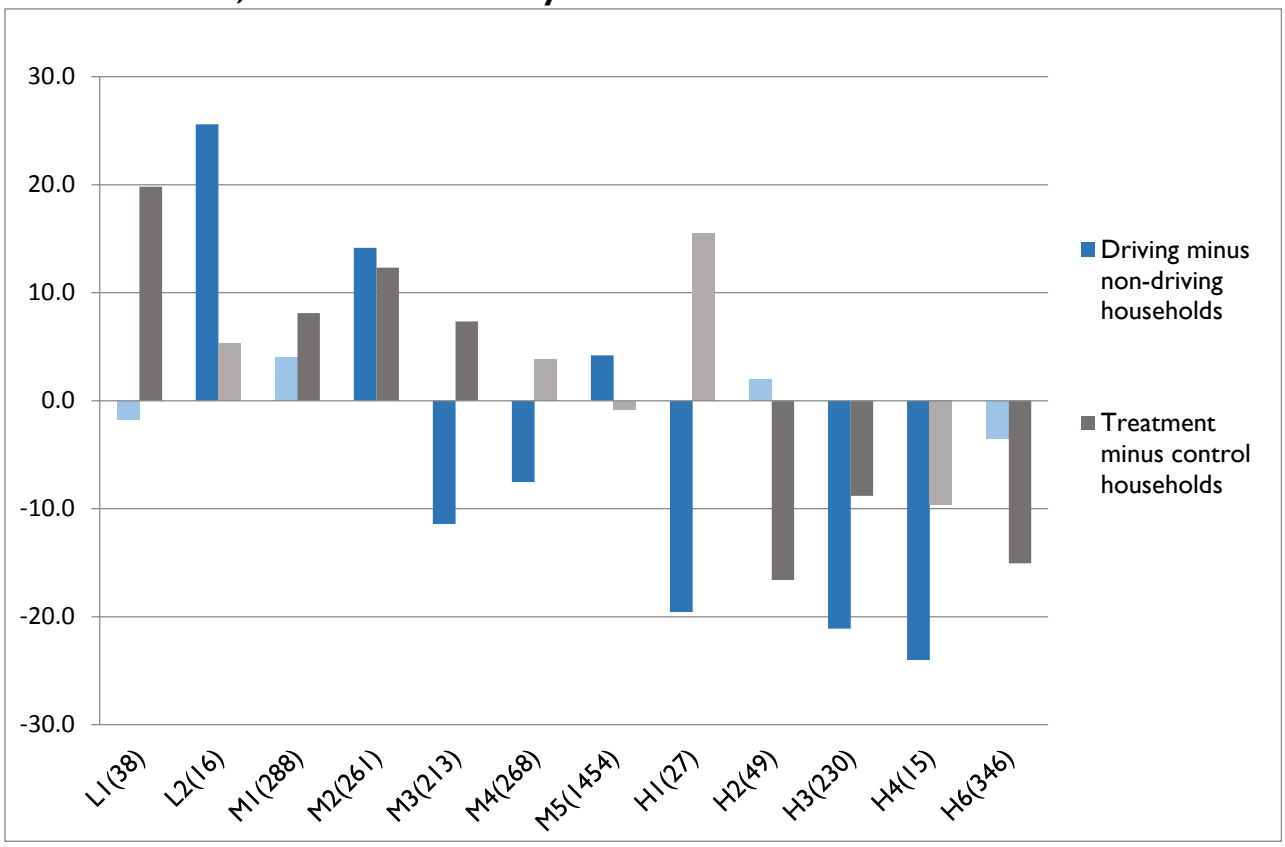
The cluster analysis procedure yielded 15 distinct clusters of neighborhoods (tracts) across MTO sites. Of those, 12 clusters contained tracts with experimental households in them. The three clusters in which there were no MTO households (from any of the three design groups) were all in the high-poverty band, and two of those clusters were the highest-poverty clusters (including a cluster with an average poverty rate of 100 percent). They also had extremely unfavorable ratings on several other factors including social status, proximity to highway and income density. Like many clusters, though, the picture was not uniformly negative; in two of those three clusters the schools had high FHEA indices, and they all had high job density.

Five of the 12 MTO-populated clusters had fewer than 50 households, but each of the remaining seven had more than 200. Of these, the majority—four clusters representing two-thirds of households—were in the medium-poverty band. Nearly 20 percent of households were also in high-poverty clusters.

Analysis of the sorting of MTO households across these clusters reinforces the conclusion that driving households and treatment households were significantly more likely to be located in low-poverty tracts (See figure 4). And, the difference between driving and nondriving households exceeded that between treatment and control households when it came to avoiding several of the highest-poverty clusters. But there were some important differences among the clusters that merit further discussion.

One medium-poverty band cluster, M5, had 1,454 MTO households, nearly half of the total. This cluster contains 1,494 tracts across the MTO sites and falls in the upper range of the medium-poverty band, with an average tract poverty rate of 24 percent. It is characterized by high-density urban tracts, with high average shares of land developed for urban uses, at 98 percent. M5 has relatively poorly performing schools and low social status factors. It has an average of 21 percent of its neighborhood area within 200 meters of a highway, near the middle of the range. M5 also has relatively high density of jobs and aggregate income, along with a mediocre housing market score. In other words, nearly half of MTO experimental households lived in dense, urban environments, with a range of socioeconomic statuses and access to opportunities. Some were likely better off than others, but on average these neighborhoods were at neither end of the spectrum with respect to sustainability and quality.

Figure 4. Percentage-Point Differences in Neighborhood Choice by Driving and Voucher Status, MTO Households by Cluster



Source: Authors' data.

Notes: Values represent the percentage-point difference from average in the household type's presence in the cluster. Dark colors represent differences that are statistically significant at the 5 percent or greater level. Light colors are not statistically significant. Horizontal axis labels are the cluster name and the number of MTO households in the cluster. For ease of representation, Treatment refers to Section 8 and Voucher households together, compared to Control households.

In general, the distribution of MTO households in this populous, medium-poverty cluster did not vary based on experimental voucher, Section 8 or control status of households. Voucher households were somewhat less likely to live in this cluster than control households, but those differences are statistically significant only at the 10 percent level. In contrast, driving households were more likely than nondriving households to live in this relatively high-quality cluster. That difference is statistically significant at the 1.0 percent level.

Nearly 600 MTO households lived in one of two high-poverty clusters, H3 and H6, with average neighborhood poverty rates of 45 and 63 percent, respectively. These clusters, containing a combined 162 tracts, comprised high-density neighborhoods with low social status factors. H6, with average poverty of 63 percent, had very poorly performing schools but high access to public transit and low proximity to highways. In contrast, H3 had comparatively good schools but poor transit access and high proximity to highways. That cluster also had the highest aggregate income density of the tracts. As with the households in M5, these 576 households lived in neighborhoods with a range of qualities, but tended to be more distressed.

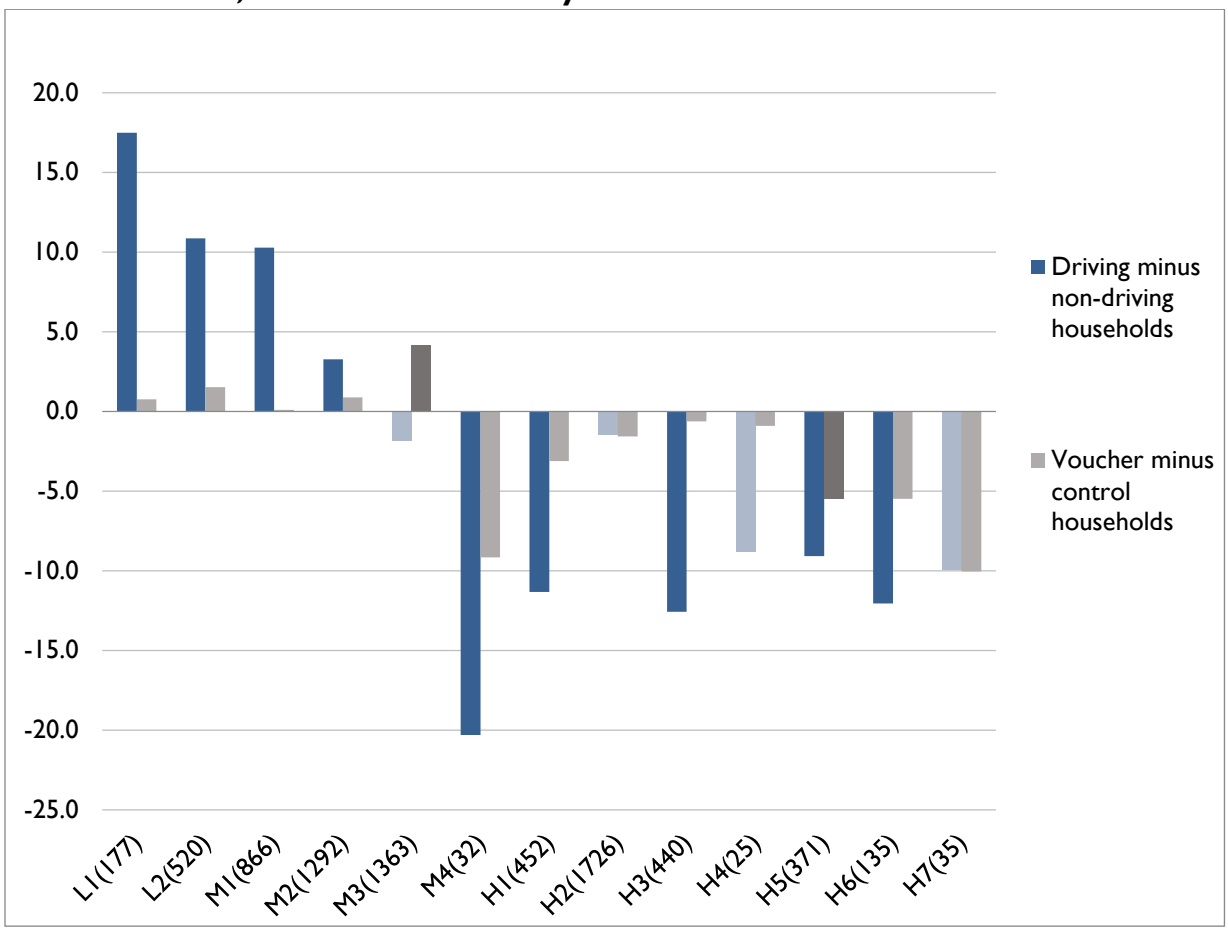
MTO experimental households with vouchers were less likely to live in these high-poverty clusters. The differences are especially pronounced in the higher-poverty cluster, with just half as many vouchers as a share of the cluster population as an even distribution would expect. Those differences are statistically significant at the 1.0 percent level. In contrast, control-group households were more likely to live in these neighborhoods, while there was not a clear pattern with Section 8 households. Similarly, driving households were much less likely than average to live in these clusters.

The remaining four clusters with more than 50 MTO households were characterized by neighborhood characteristics near the middle across the dimensions, with the exception of school quality; they tended to have poorly performing schools. The quality of schools emerged as a largely noncorrelated indicator; the highest-ranking tracts with respect to school quality were often in lower-quality neighborhoods. This is perhaps because of the temporal incongruity of that indicator, which was collected nearly a decade after randomization. There is therefore some evidence that “better-off” households—those with mobility in the form of housing choice vouchers and car access—lived in more sustainable neighborhoods, but the pattern was not universal across households or dimension of sustainability.

Neighborhood Sorting Among Clusters: WTW

The differences between driving and nondriving WTW households in attainment of low-poverty and higher-quality neighborhoods are even more consistent and pronounced than those in the MTO experiment. Whereas there are only two clusters in which voucher and control households had significant differences in sorting, there are nine in which driving and nondriving households had significant differences (figure 5). Again, important differences among the clusters merit further discussion.

Figure 5. Percentage-Point Differences in Neighborhood Choice by Driving and Voucher Status, WTW Households by Cluster



Source: Authors' data.
Notes: Values represent the percentage point difference from average in the household type's presence in the cluster. Dark colors represent differences that are statistically significant at the 5 percent or greater level. Light colors are not statistically significant. Horizontal axis labels are the cluster name and the number of WTW households in the cluster.

Compared to the MTO households, WTW households were more uniformly distributed across neighborhood types. Each neighborhood cluster had some WTW households, and only three had fewer than 50. Seven clusters had more than 400 households and three had more than 1,000. The cluster with the most WTW households contained 23 percent of the total, compared with the MTO cluster that contained nearly 50 percent of all MTO households. Further, 36 percent of WTW households—in three clusters representing nearly 1,000 tracts—were in clusters near the sustainable end of the neighborhood quality spectrum. These clusters are characterized by low to medium poverty levels—from 8 percent to 13 percent—relatively low shares of land developed for urban uses, low exposure to highways, and relatively high social status. In contrast, however, these clusters also had relatively poor schools and low density of jobs and aggregate income. In other words, neighborhoods in these clusters could be described as outside of the city center with low poverty and minor neighborhood streets.

These relatively sustainable neighborhoods were more heavily populated by WTW households that had cars at the baseline (See figure 5). In the three clusters, driving households were 3 to 10 percentage

points more likely to live in these neighborhoods six quarters after randomization than nondriving households. These differences are statistically significant at the 1.0 percent level. In contrast, voucher-holding households were not more likely than control-group households to live in these clusters. Similarly, households with children were equally likely as households with no children or households with seniors to live in these clusters. These findings suggest that access to a car is a better predictor of whether a family will live in a high-quality neighborhood than either having access to a voucher or having children at home.

Another 18 percent of WTW households live in a cluster that closely represents the middle of the sustainability spectrum. This cluster of 228 tracts, M3, has medium to high average poverty, medium-quality schools, high share of land developed for urban uses, and low average social status. In other words, the 1,400 households in this cluster tend to live in fairly dense, urban neighborhoods with high poverty, decent schools and low average social status. These are not inner-city neighborhoods, but are likely found within the urban core. As with the more sustainable clusters, baseline driving-households were more likely to live in this cluster—with statistically significant differences at the 1.0 percent level—but treatment status and presence of children did not affect the likelihood of living in these neighborhoods after randomization.

The bad news for WTW households is that nearly a quarter—over 1,700 households—lived in a cluster with high-poverty, high-density, low social status neighborhoods, H2. These 109 tracts have poor schools and low income and job density. It is these neighborhoods that most closely represent traditionally understood inner-city, unsustainable neighborhoods. Voucher households and those with access to cars were marginally less likely to live in these neighborhoods after randomization. The differences are only a percentage point away from the expected distribution however, and do not represent meaningful sorting. The 5 percent level of statistical significance is likely because of the high explanatory power of the significance test resulting from a large number of households in this cluster.

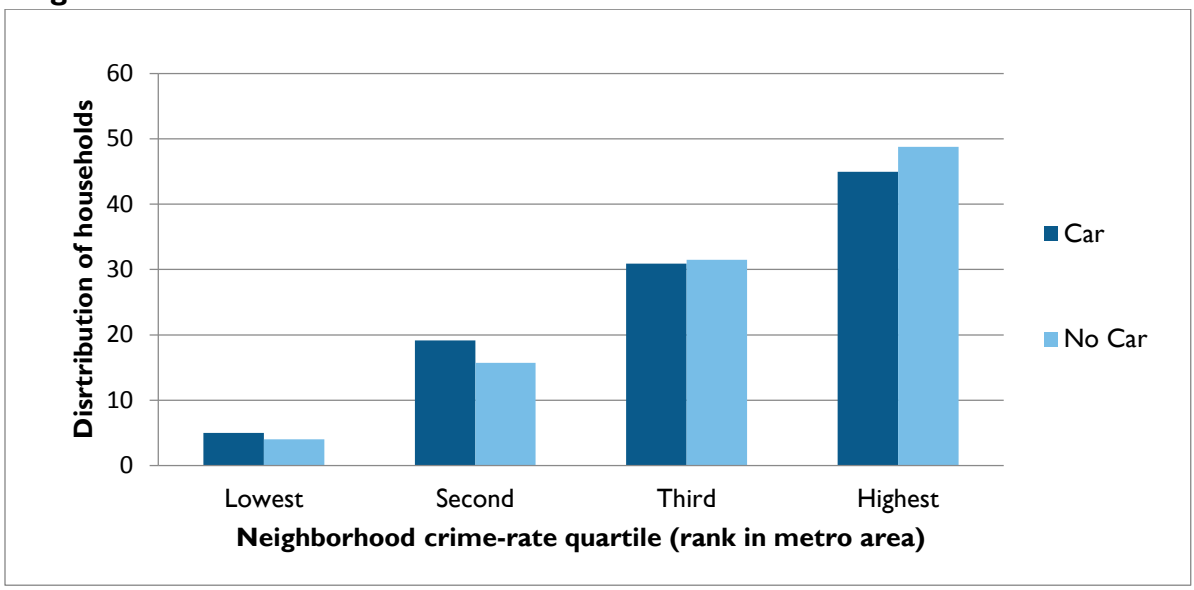
The remaining 20 percent of households—about 1,400 in total—lived in a range of clusters across the spectrum of neighborhood types. Unsurprisingly, households that had access to a car at baseline were more likely to live in the lowest-poverty cluster. In contrast, those without cars were more likely to live in the higher-poverty clusters.

Car Access, Crime, and Perceptions of Neighborhood Safety

As discussed above, we did not have complete information about crime rates for all our neighborhoods. However, we do have data on crime rates in six of the central cities of these 10 metropolitan areas and data from the MTO and WTW surveys on how participants perceived their neighborhoods' safety.

We examined the relationship between public safety and car access utilizing available crime data for six metropolitan areas in our study: Baltimore, Boston, Chicago, Los Angeles, Atlanta, and Houston. We tabulated the percent of households in each quartile (calculated individually for each site) of neighborhood violent crime rates, for those with car access and those without. The plurality of households—with or without cars—lived in the highest-crime neighborhood quartile; very few lived in the lowest-crime quartile (figure 6). Yet driving households were significantly less likely ($p<.05$) to live in the highest-crime quartile; whereas 49 percent of nondriving households lived in this quartile, 45 percent of driving households lived there. Driving households were also somewhat less likely to live in the second-highest quartile (but this was not statistically significant) and about 3 percentage points more likely than nondriving households to live in the second-lowest crime quartile.

Figure 6. Driving Households Less Likely than Nondrivers to Live in Highest-Crime Neighborhoods



Source: Authors' data.

In every site for which there was available crime data, the share of households with no car access that lived in the highest-crime quartile was higher than the share of households with car access that lived in the highest crime quartile. If we look at the top two crime quartiles together rather than only the one highest crime quartile, we see that the pattern persists. In each site, households with no car were more likely to fall in the top half of neighborhoods ranked by crime rate than households with car access. Finally, in three of the sites—Baltimore, Chicago, and Houston—there were large differences in the shares of car and noncar households in the lowest crime quartile, representing the safest neighborhoods in each site. In each of these sites, households with car access were about twice as likely to live in the lowest crime quartile compared to households without car access. In the other three sites, the shares between car and noncar households were about the same. Overall, these patterns suggest that the distribution of households with car access is shifted more towards relatively lower-crime neighborhoods compared with the distribution of households without car access.

We also examined perceptions of crime using the MTO and WTW survey responses, emphasizing the percent of heads of household who felt safe at night, out of those with car access and those without car access, by metropolitan area. We then performed chi-squared tests to determine whether, for each site, the percent of respondents who felt safe on the streets at night varied by car access status. The results of the tabulation are shown in table 5. For all sites except Los Angeles, chi-squared tests indicated a significant difference between the groups.

Table 5. Share of Households Reporting High Neighborhood Safety, by Car Access

	With Car		Without car	
	Percent	*N*	Percent	*N*
Baltimore	78	108	61	243
Boston	69	234	61	251
Chicago	77	183	66	360
LA[a]	56	140	52	136
NYC	72	73	54	374
All MTO	**69**	**738**	**59**	**1,364**
Atlanta	46	153	29	233
Augusta	66	231	52	212
Fresno	49	472	43	713
Houston	44	171	39	644
Spokane	65	330	59	380
All WTW	**53**	**1,357**	**42**	**2,182**
All sites	**58**	**2,095**	**48**	**3,546**

Source: MTO and WTW surveys.
[a] Los Angeles is the only site in which a chi-squared test found no statistically significant difference between groups.

For all WTW and MTO sites, a higher percentage of households with car access reported feeling safe than did households without car access, a difference that was statistically significant in all sites except Los Angeles. MTO households were more likely to feel safe than WTW households, but the perceived safety gap of about 10 percentage points was persistent across both groups. The gap was especially large, over 15 percentage points, for households in Baltimore, New York, Atlanta, and Spokane. For Houston, Fresno, and Los Angeles, the gap was only about 5 percentage points— small, but still consistent with the broader trend.

Summary of Neighborhood Characteristics and Residential Sorting Patterns

Our analysis of neighborhood clusters and residential sorting patterns advances the measurement of neighborhood quality, especially as it relates to the residential environments of low-income residents of metropolitan America, by identifying factors that matter in different ways for household outcomes. Our analysis of neighborhood sustainability dimensions has several implications.

First, despite the attention lavished on distressed neighborhoods, only a small minority of tracts in US metropolitan areas have crushing crime rates, failing schools, high levels of environmental degradation, and deep poverty. These distressed tracts also number among the most conveniently situated places in a nation whose metropolitan areas are undergoing a “Great Inversion” (Ehrenhalt 2013). Well-off households are rediscovering central cities, crime rates are falling, tax bases are stabilizing, new investments in all kinds of urban infrastructure are underway, and school districts are showing signs of improvement. Low-income residents, meanwhile, are finding it necessary to move farther away from the central city to neighborhoods where infrastructure is more dispersed and sparse and they must rely more heavily on cars to get around.

With their low land values and disempowered populations, the neighborhoods in the "H" clusters are ripe for reinvention as places for relatively well-off singles, couples without kids, and even young married people with kids. The retention of publicly owned land, affordable housing, and services for low-income people in these distressed neighborhoods is therefore much more important than was the case in the early 1990s; many of them have the potential to become mixed-income neighborhoods if public and private investment can be coordinated to accomplish that objective. The relatively small percentage of truly distressed neighborhoods and the prospect of adding another 100 million Americans by 2060 suggest that the nation could improve many of these neighborhoods if the incentives were aligned.

Second, while most neighborhoods are not distressed, practically none with housing prices affordable to most families offers mostly positive attributes and few disadvantages. Instead, households must balance neighborhood pros and cons as they decide where to live. In particular, neighborhoods whose poverty rates range between 10 and 30 percent—which in most metropolitan areas in this study account for at least the plurality, if not the majority, of tracts— have important differences in other characteristics. It therefore appears limited to characterize neighborhoods as offering either opportunity or environmental quality but not both, as found by Been and colleagues (2010). We found little or no relationship between poverty and income density, for example, meaning that while some high-poverty neighborhoods also have little economic vitality, others have enough income circulating per square mile to justify greater investment by the public and private sectors. The correlation between poverty and measures of exposure to hazardous conditions, while troubling, generally did not exceed 0.50. And on average, high-poverty neighborhoods had higher job density and better transit service (in the MTO metropolitan areas) than lower-poverty neighborhoods. These differences are important enough to yield a mosaic of choices among medium-poverty neighborhoods, as our cluster analysis showed.

Third, our two sets of metropolitan areas offer important contrasts with one another on one important dimension. The MTO metropolitan areas—Boston, Baltimore, Chicago, New York, and Los Angeles—offer many choices with respect to transit richness. Neighborhoods ranging from highly desirable to acceptable to miserable all have decent transit. The WTW metropolitan areas—Atlanta, Houston, Augusta, Spokane, and Fresno—contrast markedly with this picture. They have (collectively) so little good transit that we were forced to drop the transit measure when we constructed the neighborhood cluster analysis. While this finding partly reflects the incompleteness of the FHEA data on transit for some neighborhoods that do have bus routes, it also reflects the underlying reality of underfunded, sparse, and inconvenient transit in many large US metropolitan areas. For transit-dependent people—kids, people with mobility limitations, and those who prefer not to drive—this lack of transit is isolating and disempowering. Even for families who usually have access to a car, access to transit can provide an important safety net when the car is unavailable.

Regarding the patterns of household sorting across different dimensions of sustainability, our research shows that families with access to cars found housing in neighborhoods where environmental and social quality consistently and significantly exceeded the neighborhoods of households without cars. In both experiments, households with cars lived in neighborhoods with significantly lower poverty, higher social status, stronger housing markets, and lower cancer risk than those without cars. WTW households with car access also lived in neighborhoods with less exposure to TRI facilities and major highways than those without cars. And unexpectedly, MTO households with cars lived in neighborhoods with better transit access than those without cars.

Low-income households did make trade-offs, however. MTO households with cars lived in neighborhoods that were more spread out—with a lower density of aggregate income and housing and less diverse housing stock—and with worse measured school performance than transit-dependent households. While this result may be unexpected, it is consistent with findings that when they receive vouchers,

families must think first about how to find an acceptable housing unit, and that they first look for safety when weighing neighborhoods against one another. Getting away from harmful relationships motivated some MTO households to move far from the housing projects where they lived, a decision made much more straightforward for families with cars (Briggs et al. 2010). But when they made these moves, they probably were finding neighborhoods with schools about which they lacked complete information. Interestingly, there was no school performance difference in the neighborhoods of WTW households according to their car access.

What Role Does Transportation Play in Voucher Users' Residential Choices?

In this section, we examine the influence of transportation access on three dimensions of location choice: (1) locational attainment, (2) neighborhood satisfaction, and (3) the dynamics of residential mobility. Each analysis, with the exception of the neighborhood satisfaction analysis, is conducted for a sample of MTO households and WTW households.

Locational Attainment

We begin with an investigation of the determinants of observed neighborhood opportunity outcomes. Specifically, we address the question, "Does vehicle access enable voucher recipients to move to neighborhoods exhibiting characteristics that are more sustainable, are more livable, and/or provide access to opportunity?" To investigate this question, we estimate several "locational attainment" models. In models of this sort, the dependent variable is a census tract characteristic associated with a household's chosen neighborhood, and independent variables include household-level determinants of location choice. A few examples of studies employing versions of this type of empirical approach include Alba and Logan (1992), Bayer et al. (2002), Dawkins (2005), Freeman (2008), and Woldoff (2008).

The dependent variables in our locational attainment models include a wide range of variables capturing the various dimensions of neighborhood opportunity outlined in the previous section, including the neighborhood functional environment, social environment, natural environment, economic vitality, and access to opportunity. Functional environment indicators, which capture the quality of available housing, transportation, and other physical neighborhood infrastructure, include median gross rent, vacancy rates, percent of housing that is owner-occupied, percent of rental housing occupied by voucher-recipients, and the FHEA transit access index. The neighborhood social environment refers to both the demographic makeup of residents and the strength and quality of the social networks present in a neighborhood. Indicators of this dimension include poverty rates, median household income, labor force participation rates, the percent of the population from a racial or ethnic minority group, the percent of households headed by females, and the percent of the adult population with a high school degree or GED.

The natural environment dimension captures the exposure to environmental hazards and presence of natural and built environment characteristics that may affect both residents' health and a neighborhood's desirability. Natural environment indicators include the percent of land that is in open space, population density, cancer risk per million persons, and the percent of a tract that is covered by 200 meter buffers surrounding major highways (a proxy for automobile emissions). A final natural environment indicator is average block length, which captures the average length of streets within a census tract. Tracts with longer average block lengths are assumed to exhibit more suburban street patterns.

The final two neighborhood dimensions examined are the neighborhood's level of economic vitality and access to opportunity. Indicators of economic vitality include job density and aggregate income

density. Access to opportunity is quantified using a measure of the number of jobs accessible within 30 minutes of the census tract centroid and the FHEA school performance index.

The independent variables in each model include several household-level factors discussed in the literature that have been shown to be associated with neighborhood choice. To capture various policy effects, we include measures of the randomly-assigned "treatment" group for each sample, interacted with whether the household was still relying on voucher assistance at the time of the final survey. For the WTW final sample, the "voucher status" variable is defined in terms of those who used the voucher to lease-up in their current location. In the MTO final sample, including voucher lease-up information substantially reduced the sample size because of the large number of missing values on that variable in the final sample. Instead, our measure of voucher status captures not whether the household has leased-up in their current location using a voucher, but whether the household is receiving voucher assistance in their current location, regardless of whether they were awarded their voucher for use in the final survey location or previously in some other location. We also include indicators of the household's metropolitan location, with Boston omitted as the reference category for the MTO sample and Augusta omitted as the reference category in the WTW sample. Households living in Los Angeles were excluded from the WTW sample, because the program was ultimately not implemented within this metropolitan area.

Other household characteristics include income, income squared, and number of children in the household. Income is defined slightly differently for the two samples. In the MTO sample, income is defined as the total household income earned during the previous year, whereas in the WTW sample, income is defined simply using a dummy variable indicating whether the household's income is above or below the poverty threshold. We experimented with a measure of income based on annualized earnings for the WTW sample, but because of the number of missing values for particular quarters on this variable, it proved to not be very reliable. The only other available measure with sufficient coverage for the entire WTW sample was the household's income relative to the poverty threshold.

Characteristics of the household head include age, age squared, race and ethnicity, marital status, gender, education, and employment status. We include three measures of auto access. The first is an indicator variable equal to 1 if anyone in the household owned a car, van, or truck that runs or has access to a valid driver's license at the time of the interim survey (for MTO households) or at the time of the baseline survey (for WTW households). For the MTO sample, we also include two indicator variables that measure whether the household gained or lost access to cars or licensing since the interim survey. Change in auto access could not be calculated for the WTW sample, due to a change in the wording of the question between the baseline and follow-up survey which limited the variable's coverage to only those who were employed at the time of the follow-up survey. We include access to a driver's license in our definition of auto access, because even if a household does not own a car, access to a driver's license may enable a household member to rent a car or borrow one from a friend or family member. All of these variables, with the exception of the auto access variables, were measured contemporaneously with the date of the final survey. Additionally, in each regression model we include the lagged measure (as of the baseline surveys) of the same neighborhood characteristic used to construct the dependent variable. All models are restricted to those who moved from their baseline neighborhood to a new census tract by the final survey.

Table 6 provides a summary of the regression coefficients for automobile access across all locational attainment regressions. These tables report the sign for all coefficients significant at the .05 level. We find that auto access has significant impacts across a variety of locational outcomes, whether access is measured in terms of having a car or license at an earlier period or gaining access during the survey period. Those with access to cars or licenses gain access to neighborhoods with a more highly-valued housing stock, higher school performance, lower poverty rates and unemployment rates, and among MTO households, a more educated adult population.

Table 6. Summary of Vehicle Access Regression Coefficients from Locational Attainment Models

	MTO Sample			WTW Sample
Variable description	Car access at interim	Car access gained	Car access lost	Car access at baseline
Functional environment				
Median gross rent	+	+	-	+
Vacancy rate	-	NS	+	-
Owner occupied (%)	+	+	-	+
Vouchers (% of rental housing)	NS	NS	NS	NS
FHEA transit access index	NS	NS	+	-
Social environment				
Poverty rate	-	-	+	-
Median household income	+	+	-	+
Labor force participation rate	+	+	-	+
Unemployment rate	-	-	+	-
Minority population (%)	-	-	+	NS
Female-headed households (%)	-	-	+	-
25+ with high school diploma or GED (%)	+	+	-	NS
Natural environment				
Open space (%)	+	+	-	NS
Average block length	+	+	-	+
Population density	NS	-	+	-
Buffer of major highways (%)	NS	NS	NS	NS
Cancer risk per million	NS	NS	NS	-
Buffer of TRI facilities (%)	NS	NS	NS	NS
Economic vitality				
Job density	NS	NS	+	NS
Aggregate income density	NS	NS	NS	-
Access to opportunity				
FHEA school performance index	+	NS	NS	+
Number of jobs within 30 minutes	NS	NS	NS	NS

Source: Authors' data.

Notes: NS = not significant at .05 level; + = positive and significant at .05 level, - = negative and significant at .05 level.

We also find that when it comes to environmental conditions, economic vitality, and outcomes associated with access to opportunity, there are trade-offs associated with having access to a vehicle. While households with vehicles live in areas with more desirable environmental amenities, including more access to open space and less exposure to cancer risk (WTW households only), having a vehicle or license also encourages moves to neighborhoods that are less accessible to transit (among WTW households) and less conducive to walking. Thus, when it comes to measuring "opportunity," one must recognize that the spatial distribution of opportunities is heterogeneous. When faced with an uneven distribution of

opportunity structures, households must often make trade-offs and choose those which are valued most highly. Although our approach does not allow us to distinguish between the effect of household preferences versus spatial supply constraints as they influence the residential outcomes observed, we find that auto access has fairly consistent effects across a range of housing market, social, economic, and environmental outcomes, and that accessing one particular dimension of neighborhood opportunity often comes at the expense of other dimensions of opportunity.

For the influence of voucher status and program treatment effects, we find that voucher status has more significant effects on locational attainment than being assigned to either the experimental or Section 8 group for MTO participants. Part of the explanation for these findings may be attributable to the length of time between the initial random assignment and the final survey, which was 10 to 15 years later in many cases. Even with this length of time, however, initial assignment to the experimental group has effects on locational attainment which persist across a variety of outcomes. This suggests that the initial exposure to low-poverty neighborhoods has impacts on long-term locational attainment, particularly when combined with voucher assistance.

Being randomly assigned to receive a voucher and using the voucher to lease up has less significant impacts on the range of locational attainment for those in the WTW program. This latter finding is consistent with Mills and colleagues (2006), who find evidence of only modest differences in the locational outcomes between the WTW voucher treatment group and the control group. Two findings are worth noting from the WTW results. First, leasing with a voucher, and in some cases being randomly assigned to the voucher treatment group, has an impact on a number of positive housing and labor market conditions. Second, random assignment to the voucher treatment group is associated with living in neighborhoods with higher levels of school performance.

A final finding worthy of note is the observation that having a voucher in the MTO program and leasing-up with a voucher in the WTW program is positively associated with moving to a neighborhood with a higher percentage of voucher holders. We interpret this as evidence of possible supply constraints limiting the locations where vouchers can be utilized. This finding is consistent with Pendall (2000), who finds that renters receiving housing assistance tend to live in distressed neighborhoods primarily due to the larger supply of rental housing in those neighborhoods.

Neighborhood Satisfaction

Access to adequate transportation is an important constraint influencing housing search and residential satisfaction, particularly among low-income households. In metropolitan areas lacking adequate public transportation service, households without access to an automobile may limit their housing search to nearby homes that are easily accessible by transit. Because public transit tends to be a slower travel mode than automobile-based travel, transit-dependent households may inspect fewer homes before making a residential location decision. Even if low-income households gain access to housing in areas with limited transit options, the neighborhoods chosen may fail to satisfy household needs if work and nonwork destinations are not easily accessible. Therefore, low-income households often must “satisfice” in their location choice decisions, selecting housing in transit-rich neighborhoods even if such neighborhoods do not necessarily provide other desirable amenities and economic opportunities.

This section examines the linkages between transportation access (defined in terms of access to a vehicle or public transportation) and neighborhood satisfaction using data from the MTO program’s final survey. Our models of neighborhood satisfaction are based on the ordered probit specification. The dependent variable is an ordinal measure of the household head’s response to the survey question, “Which of the following statements best describes how satisfied you are with your neighborhood? Would you say you are .... (1) very satisfied, (2) somewhat satisfied, (3) in the middle, (4) somewhat dissatisfied,

(5) very dissatisfied?" These responses were recoded so that answer five corresponds to the highest neighborhood rating and answer one corresponds to the lowest rating. Following Boehm and Ihlanfeldt (1991), we assume that this index is a proxy for the households' unobserved level of utility attained from their neighborhood environment.

The covariates in the models include a variety of factors discussed in the literature that have been shown to be associated with neighborhood satisfaction. To capture various policy effects, we include indicator variables for each MTO treatment group, interacted with whether the household was receiving voucher assistance at the time the survey was conducted. We also include indicators of the household's metropolitan location and whether the household lived in the suburbs at the time of the final survey. An indicator of mobility (number of moves) and its squared term is included to capture nonlinear impacts of mobility. Household characteristics include household income, household income squared, number of children in the household, and a measure of the household's reported housing satisfaction, measured on a four-point scale. Characteristics of the household head include age, age squared, race and ethnicity, marital status, gender, education, and employment status.

We include two measures of transportation access from the MTO survey. The first is an indicator variable equal to 1 if anyone in the household owns a car, van, or truck that runs or has a valid driver's license. We include access to a driver's license in our definition, because even if the household does not own a car, access to a driver's license may enable a household member to rent a car or borrow one from a friend or family member. The second measure of transportation access is an ordinal variable that measures the household's assessment of how long it takes to reach the nearest bus or train stop. Higher values indicate that public transportation is more accessible, with the levels of access measured in 15-minute increments.

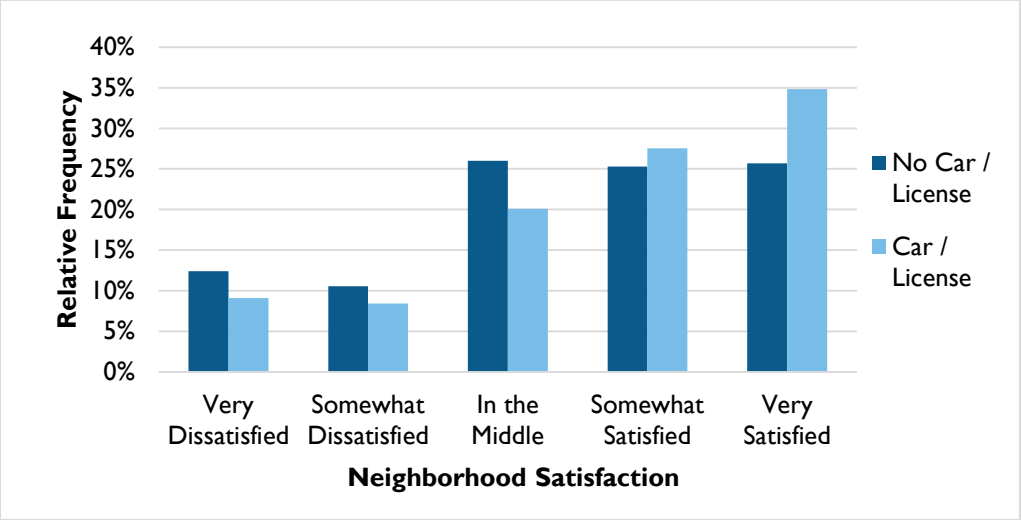
Consistent with previous studies, we include two types of neighborhood characteristics in our models: (1) the household head's self-reported evaluation of whether particular conditions are problematic in their neighborhood, and (2) observable neighborhood characteristics measured at the census tract level. Regarding the former, we include measures of the degree to which respondents viewed the following issues as problematic in their neighborhoods: trash, graffiti, public drinking, abandoned buildings, loitering, police activity, drug use, and safety on the streets. We also include two measures of social networks with friends and neighbors in the neighborhood. Regarding the observable neighborhood characteristics, we include various measures from the 2000 census, along with a variety of derived measures to capture various neighborhood amenities and built environment characteristics, including the percent of voucher holders in rental units, housing structure diversity, housing market strength factor, the FHEA job access index, FHEA environmental hazards index, FHEA school performance index, unemployment rate, poverty rate, female-headed household percentage, and racial and ethnic composition.

Figures 7 and 8 provide a descriptive look at the connection between neighborhood satisfaction and transportation access. As shown in Figure 7, those with access to a car or a license tend to report higher levels of neighborhood satisfaction. Specifically, 35 percent of those with access to a car or license report being very satisfied with their neighborhoods, compared with 26 percent among those without access to a car or license. Similarly, 12 percent of those without access to a car or license report being very dissatisfied with their neighborhoods, compared to 9 percent among those with access to a car or license. Responses vary more by level of proximity to public transit. The largest percentage of those who are very satisfied with their neighborhoods live more than 60 minutes from the nearest transit stop. Since these households are more likely to rely on automobiles to reach destinations, this finding complements the information displayed in Figure 7.

In the ordered probit models explaining household neighborhood satisfaction scores, we find that

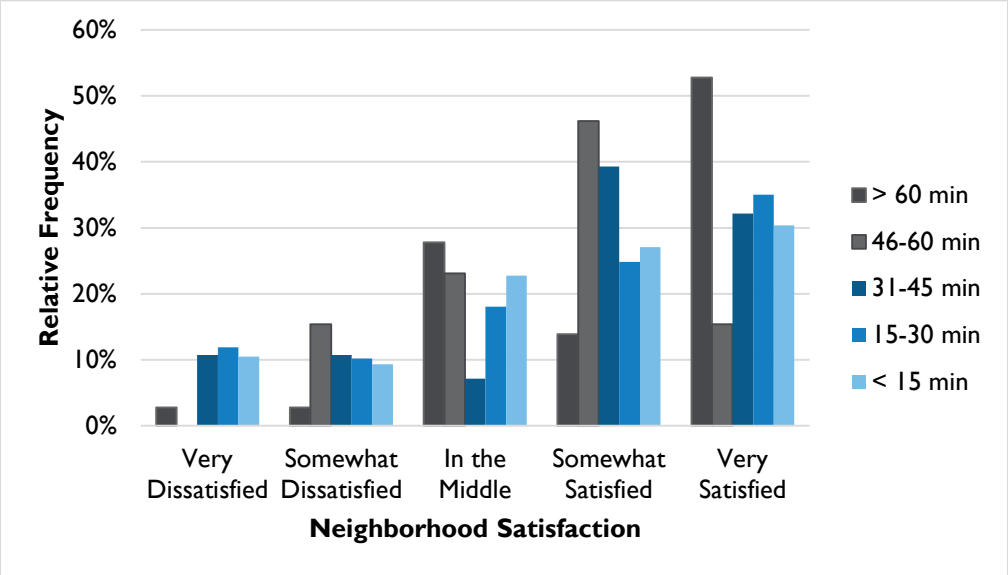
access to cars or licenses and transit each positively influence neighborhood satisfaction. The significance of the interactive effect of cars and transit suggests that the importance of automobile access varies by proximity to transit. Estimates from the full model suggest that automobile ownership matters most in neighborhoods with low transit accessibility. At relatively low levels of transit access (more than an hour to the nearest public transit stop), the marginal change in neighborhood satisfaction is much higher for car owners (1.67) than for households without a car (.20). However, in areas with high transit accessibility (less than 15 minutes to the nearest public transit stop), the marginal change in neighborhood satisfaction is slightly lower for car owners (.92) than for households without a car (1.02).

Figure 7. Neighborhood Satisfaction by Car or License Access



Source: Authors' data.

Figure 8. Neighborhood Satisfaction by Time to Nearest Transit Stop

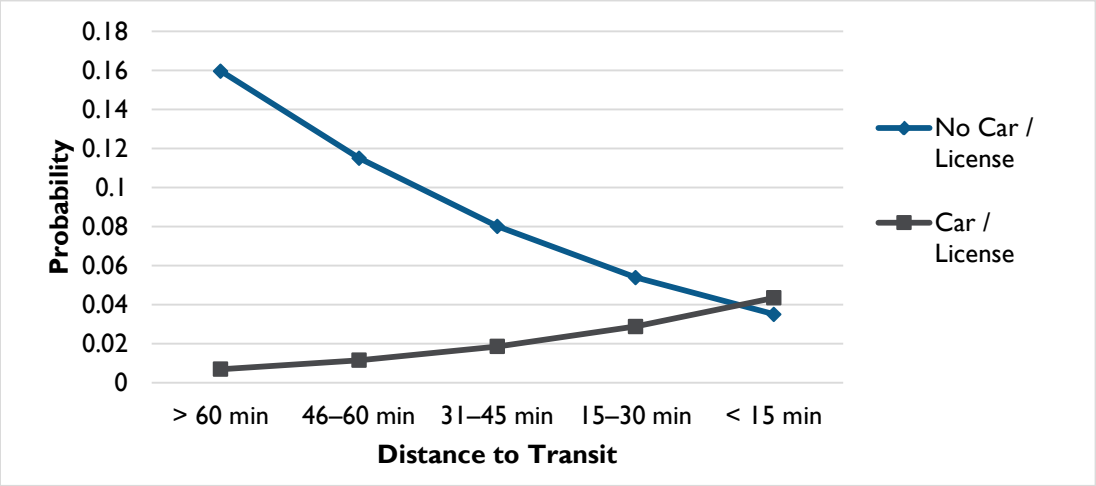


Source: Authors' data.

Figures 9 and 10 display the predicted probability that households will cite the lowest and highest neighborhood satisfaction ranking for different levels of access to transit and cars or licensing. The predicted probabilities hold values of nontransportation covariates at their respective means for the

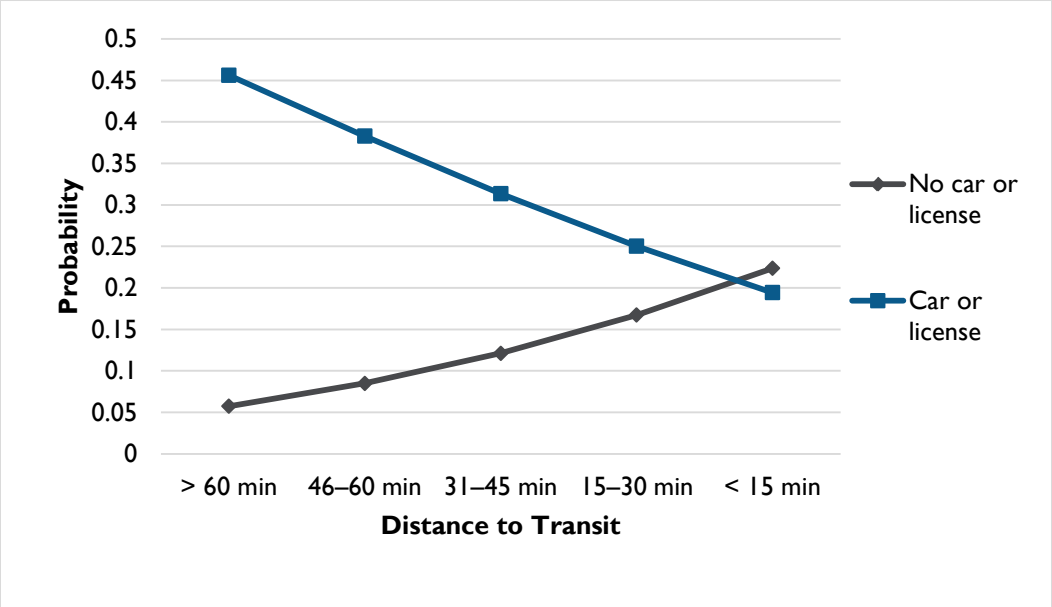
sample. Among those living within 15 minutes of a transit stop, those without access to cars or licenses report slightly higher levels of neighborhood satisfaction. Beyond this distance, the probability of being very satisfied with one's neighborhood decreases with distance from transit for those without access to cars or licenses and increases for those with access to cars. The reverse relationship holds in models predicting the probability of a household being "very dissatisfied" with their neighborhood.

Figure 9. Predicted Probability of "Very Dissatisfied" Neighborhood Satisfaction Score by Accessibility to Public Transportation and Cars or Licensing



Source: Authors' data.

Figure 10. Predicted Probability of "Very Satisfied" Neighborhood Satisfaction Score by Accessibility to Public Transportation and Cars or Licensing



Source: Authors' data.

Table 7 displays the predicted neighborhood satisfaction scores for different levels of car, license, and public transit access using coefficients from the full model and the models estimated for the experimental and control groups. Values of car access and public transit access are allowed to vary, while the other variables are held at their respective means. Table 7 suggests that in areas with the highest levels of transit

access (less than 15 minutes to the nearest bus or transit stop), households without access to cars or licenses are slightly more satisfied with their neighborhoods. The disparity in neighborhood satisfaction between those with and without access to cars or licenses increases with distance from transit. In areas with the lowest levels of transit access, those with access to cars or licenses are about 1.5 times more satisfied with their neighborhoods than those without access to cars or licenses. Across all values of transportation access, car owners living in areas with the least-accessible public transit exhibit the highest levels of neighborhood satisfaction.

Table 7. Predicted Neighborhood Satisfaction by Transit and Car or License Access

Sample	Car or license access	Minutes to nearest transit stop				
		> 60	46–60	31–45	15–30	< 15
Full model	No car or license	2.83	3.05	3.26	3.47	3.67
	Car or license	4.23	4.08	3.92	3.75	3.57
Experimental group	No car or license	3.25	3.39	3.53	3.66	3.79
	Car or license	4.47	4.32	4.14	3.95	3.74
Control group	No car or license	2.39	2.67	2.96	3.24	3.51
	Car or license	4.10	3.91	3.71	3.50	3.29

Source: Authors' data.

Comparing the predicted probabilities for different treatment groups, we find similar differences between those with and without access to automobiles or licenses. The differential in neighborhood satisfaction between those with and without access to cars or licenses is largest for the control group. Among control group households with the lowest levels of transit access, those with access to cars or licenses are about 1.7 times more satisfied with their neighborhoods than those without access to cars or licenses. These group-level differences possibly reflect the differences in location choices between experimental and control group households. If those in the control group reside in locations with greater transit accessibility, we would expect to find a larger differential between the neighborhood satisfaction rankings of those with access to cars relative to those without access.

Duration of Exposure to High-Poverty Neighborhoods

While much has been written about the locational outcomes of MTO and WTW participants, we know less about the range of factors affecting low-income households' exposure to neighborhood poverty over time. Households that temporarily move into poor neighborhoods because of a temporary change in housing needs often face a different set of constraints than households that remain exposed to poverty over longer periods. Research from the MTO program suggests that while the program enabled many households to move to low-poverty neighborhoods that offered greater accessibility to different social and economic opportunities, many of those randomly-assigned to low-poverty neighborhoods subsequently moved back to high-poverty neighborhoods. Furthermore, few households that did not initially gain access to low-poverty neighborhoods subsequently moved to low-poverty neighborhoods at a later date (Turner et al. 2011). Some have pointed to these facts as possible explanations for the insignificant impacts of the MTO program on short-term employment outcomes.

This section examines the dynamics of exposure to neighborhood poverty for a sample of households from the WTW and MTO programs. We conduct descriptive analyses of the length and incidence of exposure to different neighborhood poverty conditions for the participants within each of these programs, emphasizing differences in outcomes by program treatment group and level of vehicle access, defining vehicle access as having access to either an automobile or a license. To be consistent with the MTO poverty threshold definition, we define high-poverty neighborhoods as those with poverty rates greater

than or equal to 10 percent. Unlike MTO, which defines poverty rates using 1990 census data, we rely on 2000 census data, because the majority of the residential spells for those in both the MTO and WTW programs occurred during the 2000s.

Tables 8 and 9 examine several measures of residential mobility for the entire sample in each program, and separately for each treatment group and for different levels of vehicle access. For each of these metrics, it is important to note the differences in average duration between the two samples (shown in the first row of tables 8 and 9). The length of time between the baseline and final MTO survey is on average about 13.8 years, whereas the length of time between the baseline and end-of-the-period "follow-up" WTW survey is on average about 4.5 years. The following two rows display the average length of exposure to high- and low-poverty neighborhoods over the analysis period, using the 10 percent poverty threshold defined above. The fourth and fifth rows express the duration of exposure to high- and low-poverty neighborhoods as a percentage of each household's total duration.

Table 8. Descriptive Analysis of Neighborhood Mobility, MTO Participants

		Treatment Group			Vehicle Access	
	Total households	Exp.	Section 8	Control	Vehicle access	No vehicle access
Average total duration (days)	5,050.8	5,119.6	4,950.8	5,057.9	5,011.3	5,073.6
Average duration in high-poverty neighborhood (days)	4,566.3	4,369.6	4,587.7	4,795.3	4,371.4	4,677.5
Average duration in low-poverty neighborhood (days)	485.4	751.4	363.8	262.6	639.2	397.8
Total duration in high-poverty neighborhood (%)	90.5	85.4	92.7	94.8	87.4	92.3
Total duration in low-poverty neighborhood (%)	9.5	14.6	7.3	5.2	12.6	7.7
High-poverty neighborhood at least once (%)	100.0	99.9	100.0	100.0	100.0	99.9
High-poverty neighborhood at beginning and end of survey (%)	85.6	82.9	85.7	89.1	81.8	87.8
High-poverty neighborhood consecutively during the survey (%)	74.5	65.1	77.2	83.9	70.0	77.0
Who exit a high-poverty neighborhood (%)	23.5	33.1	20.6	14.0	28.4	20.8
Who re-enter a high-poverty neighborhood after exit (%)	12.7	20.8	9.6	5.4	13.8	12.1
Sample Size	**4,594**	**1,812**	**1,348**	**1,434**	**1,679**	**2,904**

Source: Authors' analysis.

Rows 6 through 10 in the tables display different poverty transition measures for the households in the sample. Row six displays the percent of households, by group, who lived in a high-poverty neighborhood at least once during the analysis period. Next, we display the percent of households that began and ended their spells in a high-poverty neighborhood, ignoring whether they possibly moved to a low-poverty neighborhood at some time during the analysis period. Row eight considers the percentage of households in each group who lived in high poverty neighborhoods continuously throughout the analysis period. For all measures in rows six through eight, we include all households in each analysis, regardless of whether the household moved or not. For example, the continuous exposure to poverty for some households may have been due to never having moved from a high-poverty neighborhood, whereas for others, it may have been due to moves between two or more high-poverty neighborhoods.

Table 9. Descriptive Analysis of Neighborhood Mobility, WTW Participants

		Treatment Group		Vehicle Access	
	Total households	Voucher	control	Vehicle access	No vehicle access
Average total duration (quarters)	18.0	18.0	18.0	18.0	18.0
Average duration in high-poverty neighborhood (quarters)	16.4	16.5	16.4	16.1	17.1
Average duration in low-poverty neighborhood (quarters)	1.6	1.5	1.6	1.9	0.9
Total duration in high-poverty neighborhood (%)	91.4%	91.6%	91.1%	89.4%	95.1%
Total duration in low-poverty neighborhood (%)	8.6%	8.4%	8.9%	10.6%	4.9%
In high-poverty neighborhood at least once (%)	96.3%	96.5%	96.2%	95.4%	98.2%
In high-poverty neighborhood at beginning and end of survey (%)	86.8%	86.8%	86.7%	83.7%	92.3%
In high-poverty neighborhood consecutively during the survey (%)	85.6%	85.5%	85.7%	82.3%	91.5%
Who exit a high-poverty neighborhood (%)	8.2%	8.2%	8.1%	9.9%	5.1%
Who re-enter a high-poverty neighborhood after exit (%)	1.4%	1.6%	1.3%	1.6%	1.1%
Sample Size	**8,657**	**4,645**	**4,012**	**5,517**	**2,937**

Source: Authors' analysis.

The final two measures shown in tables 8 and 9 display information regarding transitions into and out of high-poverty neighborhoods. Row nine displays the percent of households that exited a high-poverty

neighborhood at least once during the analysis period, and row 10 displays the percent of households that initially lived in a high-poverty neighborhood at least once, exited to a low-poverty neighborhood at least once, and subsequently returned to a high-poverty neighborhood after an initial exposure to a low-poverty one. We now turn to a discussion of these various measures and their implications.

We find that the exposure to high-poverty neighborhoods, whether measured in terms of the total exposure or percent of total duration, is lowest for those in the MTO experimental group. This is expected, given that this group was required by the program to reside in a low-poverty neighborhood for at least one year. We find that on average, MTO households resided in low-poverty neighborhoods for slightly more than two years, compared to those in the Section 8 and control group, whose average spells in low-poverty neighborhoods were each less than one year. On average, those in the WTW program stayed in low-poverty neighborhoods for a much shorter period of time, regardless of whether they were assigned to the treatment or control group. As a percent of the total duration time, WTW participants, regardless of treatment group, spent a larger proportion of the analysis period in low-poverty neighborhoods than those in either the MTO Section 8 or control group, but the MTO experimental group spent the largest proportion of their time in low-poverty neighborhoods. These findings are expected, given the geographic focus on the MTO program. While these findings offer promise to those advocating the use of geographically targeted residential mobility programs for the purposes of reducing exposure to poverty, it is important to note that the average exposure to low-poverty neighborhoods was only slightly longer than the required minimum of one year. Furthermore, even those in the MTO treatment group spent a large proportion of their time (85.4%) in neighborhoods with poverty rates greater than 10 percent.

The effect of vehicle access on exposure to poverty is evident from the first five rows of tables 8 and 9. For both samples, those with access to vehicles spent a larger proportion of their time in low-poverty neighborhoods and a smaller proportion of their time in high-poverty neighborhoods. In the WTW program, the effects of having access to a vehicle were greater than the effects of being assigned to the voucher treatment group, with vehicle owners spending 10.6% of their spells in low-poverty neighborhoods compared with 8.4% for those in the WTW treatment group. The differences between poverty exposure for those with and without access to cars in the MTO sample are similarly large, although vehicle owners spend a slightly lower proportion of their time in low-poverty neighborhoods than do those assigned to the MTO treatment group. These findings suggest that combining auto assistance with geographically-targeted housing assistance could go a long way toward reducing the length of exposure to poverty.

We now turn to the various transition measures displayed in rows 6 through 10 of tables 8 and 9. First note the large proportion of households that lived in a high-poverty neighborhood at least once, particularly for MTO participants. This is expected given the initial locations of the subsidized units for those recruited for participation in the MTO program. A similarly large proportion of households in each program began and ended their spells in high-poverty neighborhoods or remained in high-poverty neighborhoods throughout the entire analysis period. For these two transition types, we note similarly large differences among MTO treatment groups and by vehicle access, with little difference observed between those in the WTW treatment and control group.

The last two transitions displayed in tables 8 and 9 provide a different perspective on the influence of mobility on exposure to poverty. Unlike the other dynamic patterns displayed in these tables, the last two focus exclusively on neighborhood mobility, through exits from and eventual returns to neighborhood poverty. Focusing on exits, we see similar patterns to those displayed in previous analyses, with the MTO treatment group assignment and vehicle status having a significant influence on a household's likelihood of exiting poverty. Again, we see little difference between the WTW treatment and control group in rates of exit. These findings are expected, since MTO treatment group assignment and vehicle access should

influence exposure to poverty primarily through its influence on the propensity to move.

When we examine the last column in tables 8 and 9, we find that fostering residential mobility, through geographically-targeted policies or enhanced vehicle access, also increases the likelihood of eventually returning to a high-poverty neighborhood. More than 20 percent of those in the MTO experimental group eventually returned to a high-poverty neighborhood after their initial exposure to low-poverty neighborhoods, compared with only 9.6 percent for those in the Section 8 group and 5.4 percent in the control group. Interestingly, while those with access to vehicles were more likely than those without access to return to poverty after an initial exposure to low-poverty neighborhoods, those with vehicle access were much less likely to return than those in the MTO experimental group. Taken together, these findings suggest that vehicle access has effects on exposure to poverty that are comparable to those of geographically-restricted mobility programs.

Summary of the Influence of Transportation on Residential Choices

While much has been written about the effects of neighborhoods on the social and economic outcomes of households participating in the experimental MTO and WTW programs, less is known about the types of neighborhoods chosen and the factors influencing these choices. Even less is known about the effect of car accessibility on the types of neighborhoods chosen. This section fills this gap in the literature, examining the impact of various household characteristics along with voucher assistance and auto access on the locational outcomes of low-income households.

In several locational attainment models, we find that car and license access, whether measured in terms of initially having access to a vehicle or subsequently gaining access to one, has statistically significant effects across a range of locational outcomes. This suggests that vehicles influence housing search and the types of neighborhoods considered when making a location decision. Generally speaking, having access to a vehicle has effects that are much stronger and more consistent than any other household characteristic, including income. Regarding whether the neighborhoods chosen by vehicle-owners are more desirable, it depends on how neighborhood opportunity is defined. Those with access to cars are able to locate housing in areas with lower concentrations of poverty and higher concentrations of households that are employed or participating in the workforce. These areas also tend to have higher median rents, more owner-occupied housing, lower vacancy rates, and higher-performing schools. There are trade-offs when it comes to environmental features. While vehicle owners are shown to live in areas with more access to open space and less exposure to cancer risk and toxic facilities, this comes at the expense of lower levels of transit access and urban environments that are potentially less conducive to walking. We also find that those who lose access to cars compensate by choosing neighborhoods that have higher levels of job accessibility.

We also find that access to vehicles influences neighborhood satisfaction interactively with transit access. Estimates from an ordered probit model suggest that access to automobiles or a driver's license matters most in neighborhoods with low transit accessibility. In areas with the highest levels of transit access, those with and without access to cars or licenses are each moderately satisfied with their neighborhoods, although predicted neighborhood satisfaction levels are slightly higher for those without access to cars or licenses. In areas with the lowest levels of transit access, car owners are about 1.5 times more satisfied with their neighborhoods. Considering different levels of car and transit access together, those living in areas with the least-accessible public transit and who lack access to cars or licenses exhibit the highest levels of neighborhood satisfaction.

Comparing the predicted levels of neighborhood satisfaction across MTO treatment groups, we find evidence of similar differences between those with and without access to automobiles or licenses, although the differential in neighborhood satisfaction between those with and without access to cars or

licenses is largest for the control group. Among control group households with the lowest levels of transit access, those with access to cars or licenses are about 1.7 times more satisfied with their neighborhoods than those without access to cars or licenses. These group-level differences suggest that the effect of housing mobility programs on neighborhood satisfaction is likely to be influenced by the availability of transportation options in destination neighborhoods. We also find that these effects vary by metropolitan area, likely because of differences in transportation networks across metropolitan areas.

Our descriptive analysis of the dynamics of exposure to poverty provides evidence of significant differences between those with and those without access to vehicles. The total length of exposure to low poverty was slightly lower than for those in the MTO experimental group, but vehicle-owners were also less likely than MTO experimental group members to return to high-poverty neighborhoods. Those with vehicle access exhibited high rates of exit from poverty, suggesting that mobility is the primary channel through which vehicle access influences poverty exposure. Vehicles arguably facilitate housing search and increase the accessibility of destinations following moves to low-poverty neighborhoods.

Taken together, these findings suggest that having access to vehicles facilitates mobility to low-poverty neighborhoods over time and eventual satisfaction with the neighborhood chosen. Geographically-targeted housing assistance also has measurable effects that persist over time, but the magnitude and significance of the effect varies once the geographic requirement is lifted.

How Do Transportation Access and Residential Location Choice Influence Economic Opportunity?

In this section, we examine the influence of transportation access on employment and earnings. For MTO participants, we examine the exposure of households to access opportunity neighborhoods, which we define as census tracts in the top quartile of their metropolitan area in terms of employment and public transit availability. Then we proceed to examine the influence of transportation access on employment transitions for those in the MTO and WTW program. We conclude with an analysis of the joint relationship between automobile ownership, residential location in transit-rich neighborhoods, and earnings for MTO participants.

Access Opportunity Neighborhoods: Public Transit and Employment Availability

In this section, we examine whether the MTO program provided participants with greater access to opportunities—by improving either their access to employment or their ability to use public transit to travel to opportunities. We focus on access opportunity neighborhoods, which we define as census tracts in the top quartile of their metropolitan area in terms of employment availability and public transit availability. Particularly, we examine these two areas of opportunity in the neighborhoods to which individuals moved at first lease-up, how much time they spent in high-access neighborhoods during the course of the experiment, and access at their final reported neighborhood location. The purpose of this analysis is to (1) assess whether households in the MTO experimental group have greater access to jobs and public transit than households in the Section 8 and control groups, (2) examine how these relationships are mediated by access to automobiles, and (3) determine how closely these measures of access are correlated with other dimensions of opportunity. A secondary goal of this section is to assess the reliability of different census tract-level public transit and jobs access measures, which have only recently become available with full national coverage. Because low-income individuals face complicated trade-offs among relevant dimensions of opportunity in any neighborhood, from a research perspective, there are many ways to measure neighborhood quality and accessibility (Handy and Niemeier 1997).

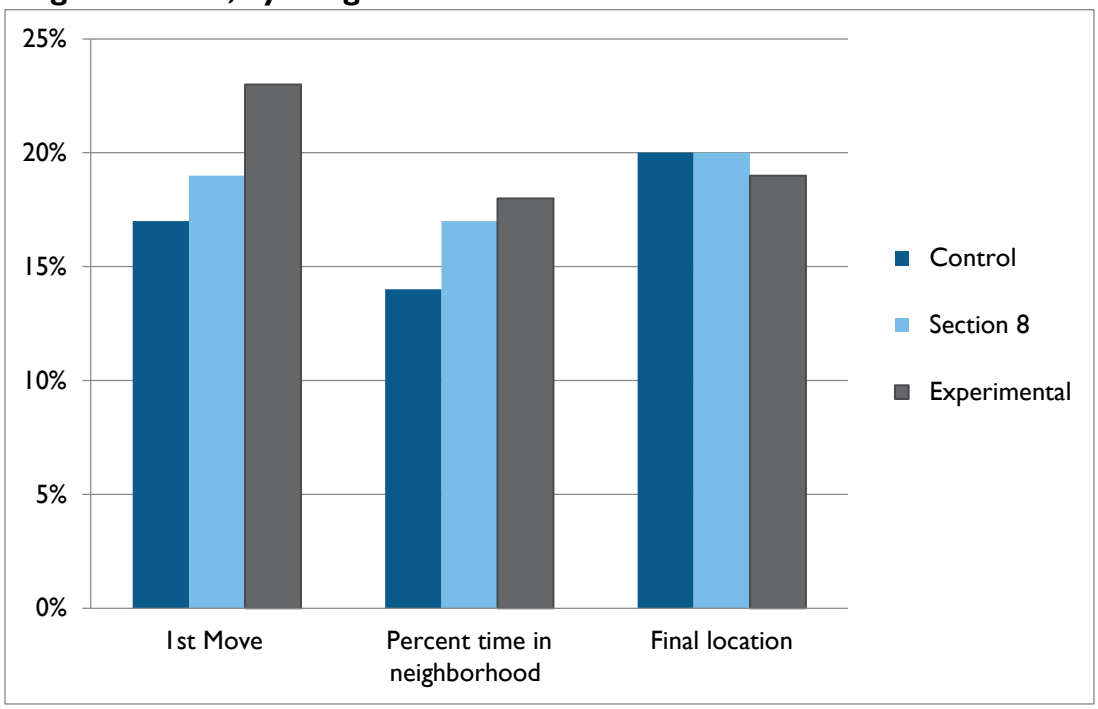
Our analysis reveals findings in a number of important areas for participants in the MTO program, which may be applicable to urban, low-income adults more broadly. Our findings can be broadly summarized in three categories: the spatial location of jobs, the residential location of program participants relative to both employment opportunities and transit, and the measures by which we calculate both of these important measures of opportunity.

Spatial Location of Program Participants Relative to Jobs

Households in the control group live in neighborhoods in closer proximity to jobs than households in either the Section 8 or the experimental (MTO) groups. Public housing tends to be located in central-city areas in close proximity to downtown (Crump 2002; Wilson 2012). Although jobs have decentralized, central-city neighborhoods typically remain the largest areas of concentrated employment within metropolitan areas (Shen 2001).

While control-group households live in close proximity to jobs, many of these positions are practically very difficult to obtain because there tends to be intense competition for job openings in dense central-city neighborhoods. Therefore, an improved measure of "job access" controls for the relative competition for jobs. Using this measure, we find that a higher percentage of households in the experimental group initially find employment in high job-access neighborhoods compared to households in the control and Section 8 groups. Further, households in the experimental and Section 8 groups spent more time in high job-access neighborhoods than households in the control group. However, as figure 11 shows, by the end of the program, the differences narrow when approximately one fifth of households in all three groups live in high job-access neighborhoods. Finally, by the end of the program, fewer households in the experimental group live in high job-rich neighborhoods compared with their neighborhoods at lease-up. This finding suggests that the effects of the MTO program on moving adults to areas of better job opportunity were short-term, at best.

Figure 11. Percent of MTO Program Participants in High Job-Access Neighborhoods, by Program Status



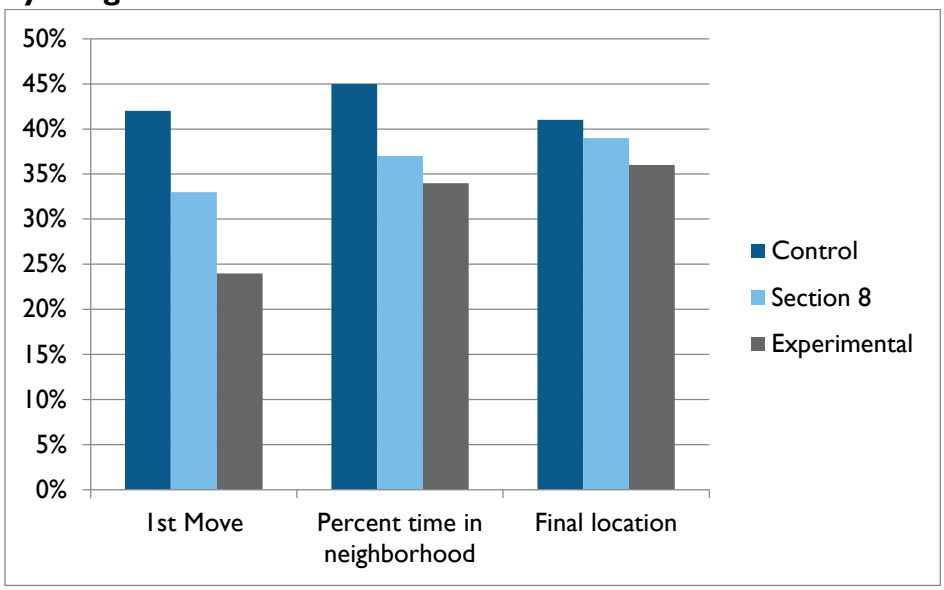
Sources: HUD and Google.

Spatial Location of Participants Relative to Public Transit

We use three measures to examine the transit characteristics of the neighborhoods in which program participants live—walk times to transit, service frequency, and jobs accessible by public transit. To summarize our findings we focus on the last measure, because—at least in theory—job access by public transit incorporates both the time it takes to walk to a transit stop or station as well as how quickly transit users can board a bus or train.

As depicted in figure 12, our analysis shows that residents in the control group are much more likely to live and remain in transit-rich neighborhoods. This finding holds true for all three measures—at lease-up, percent of time in transit-rich neighborhood, and at the close of the program. As mentioned previously, both jobs and transit networks are highly concentrated in central-city neighborhoods, where, as discussed, public housing tends to be located. Over time, households in the experimental group are more likely to live in neighborhoods that are transit rich. Since our transit data do not change over time and, therefore, do not incorporate changes in levels of transit service over time, this finding likely reflects the relocation decisions of families in the experimental group.

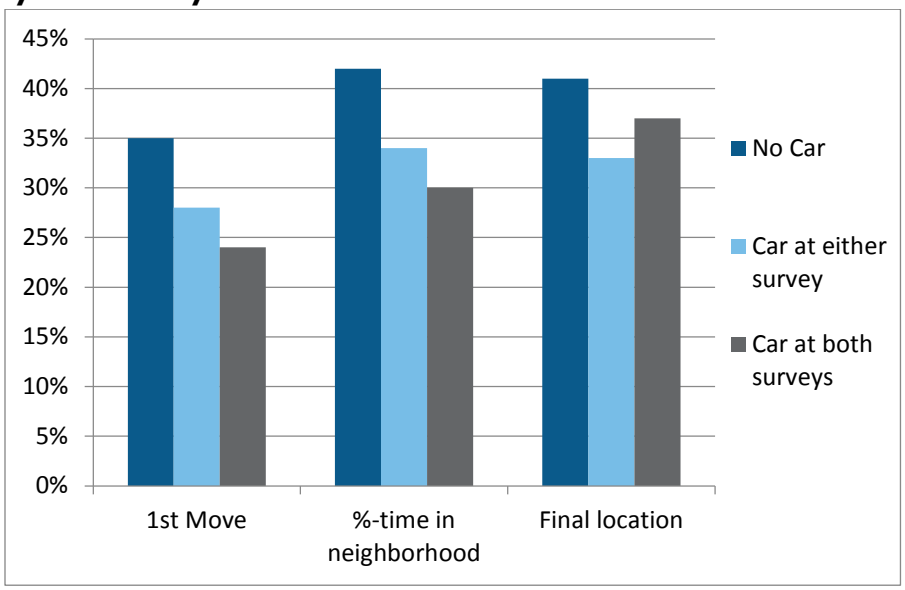
Figure 12. Percent of MTO Program Participants in Transit-Rich Neighborhoods, by Program Status



Sources: HUD and Brookings Institution.

There is a strong relationship between automobile ownership and residential location that runs in both directions (Pinjari et al. 2007; Schwanen and Mokhtarian 2005). As figure 13 shows, households without automobiles are more likely to reside and stay in transit-rich neighborhoods since they tend to be reliant on the transit network for their mobility, a finding consistent with the broader literature (Glaeser et al. 2008). However, by the end of the program, households in all three groups are more likely to live in transit-rich neighborhoods than they were at lease-up.

Figure 13. Percent of MTO Program Participants in Transit- Rich Neighborhoods, by Availability of Automobile



Sources: HUD and Brookings Institution.

Measurement Issues

There are many measurement issues that ought to be the subject of additional data collection and research. First, our findings are only as good as the data on which they are based. The evidence suggests that transportation—particularly access to automobiles—can play an important role in residential location decisions and economic outcomes. Yet the data available to analyze participants' access to transportation (both automobiles and public transit) are quite limited. MTO participants were asked a simple yes or no question regarding their access to automobiles. At baseline they were asked whether "they had a car that runs" and in the final survey they were asked whether they "own a car or truck, or other motor vehicle that runs and can be driven on the road." The exact question differed slightly over time. However, more importantly, automobile ownership is not a simple yes or no dynamic. A much better measure would have been the relationship between the number of working automobiles in the household and household drivers. Many low-income adults live in auto-deficit households, households in which there is less than a one-to-one ratio between vehicles and drivers. Adults in these households may not have reliable access to vehicles.

The job access and transit measures also are limited. Historical data on both jobs and transit service are scarce. Due to limitations with the census travel data, we used data from Google to calculate job richness and job access. However, these data are from 2013, and therefore do not match the years in which we have MTO survey data. Further, our calculations depend on Google drive times for the MTO areas and census data on employment; they could be enhanced by incorporating better estimates of employment competition (which would require data from areas well outside our metropolitan areas of interest) as well as travel by transit. We calculate a competition-based measure of jobs accessibility by car by employing the Google drive time data and the 2000 Census Transportation Planning Package's estimates of job locations by census tract. We calculate the number of jobs that an individual living in a given census tract could access within 30 minutes' drive time, but divide the number of jobs in each tract by the number of workers who could reach those same jobs in 30 minutes' drive time. We borrow this methodology from Shen (1998) and others. While we improve on standard methods of calculating this metric by including competition from outside the metropolitan area, in some cases (particularly in the Baltimore's metropolitan area, which overlaps considerably with Washington, DC, and Philadelphia), we

expect some error on the urban fringe.

Our analysis of transit supply rests on relatively current data from the Brookings Institution which, again, does not match the years in which we have MTO survey data. Also, while very useful, cross-sectional data do not allow us to examine changes in the transit network over time. However, many metropolitan areas expanded their transit systems over the course of the MTO program (American Public Transit Association 2013). From the beginning of the MTO program in 1994 to the end of the program (sometime between 2008 and 2010), transit agencies increased the number of vehicle miles operated by over 50 percent.

Access to public transit is an important factor in the residential location decisions of families without automobiles (Glaeser et al. 2008). However, there is relatively little research on the qualities of public transit that residents believe are important. Handy and Niemeier (1997, 1176) state that "a practical definition of accessibility must come from the residents themselves, rather than from researchers, and reflect those elements that most matter to residents." Yet we do not know how low-income travelers evaluate the various characteristics of the transit network and how much these public transit characteristics differ even within a single neighborhood. For example, some low-income residents may live in neighborhoods close to transit stops, but where service frequencies are low or travel times to employment are lengthy.

Finally, residents' perceptions of the transit system may also be quite different from the actual characteristics of the transit system. The MTO survey includes a question on self-reported walk time to a bus stop. This variable is only loosely correlated to the Brookings data on walk time to transit (.10). This weak relationship suggests that individuals do not necessarily experience neighborhoods in the same way that aggregate, tract-level statistics would lead us to believe in isolation. Moreover, the relationship may also be skewed by respondents who have little experience using public transit, and therefore have little basis for assessing the walk time to the stop.

Opportunity Neighborhoods

Finally, there is an important caveat to any analysis of opportunity based on our findings. Neighborhoods are complex and even seemingly clear notions of opportunity along one dimension (e.g., job opportunities) may be offset by other neighborhood characteristics that limit the opportunities available to program participants and other low-income families. Future programs need to consider a range of opportunity indicators. Moreover, additional attention should be given to facilitating households' interest in remaining in neighborhoods with a rich variety of opportunities, the cumulative effects of which may only accrue after a lengthy duration rather than a short spell.

Transportation and Employment Outcomes

In this section, we examine the influence of transportation assets on the employment outcomes of MTO and WTW participants. We supplement the survey data with information on the characteristics of the neighborhoods in which program participants live, including their access to public transit. Combined, these data provide a rich array of individual, household, and neighborhood characteristics allowing us to control for the many factors that influence employment. Specifically, we use multinomial logistic regression models to examine the relationship between automobiles and public transit availability on employment transitions between baseline and interim surveys, controlling for other potential determinants of employment, including experimental group status.

The employment models are similar in many respects. However, there are a few differences, one of which is the way in which "automobile access" is specified. The MTO data allow us to examine transitions in automobile access between baseline and interim surveys. Therefore, our models include the following

variables: no car at both time periods, gained a car between baseline and follow-up survey, lost a car between baseline and follow up, and the presence of a car at both time periods. In contrast, as we mention previously, in the WTW follow-up survey, the automobile question was asked only of respondents who indicated that they were employed. Because we did not have follow-up automobile data for all participants, we were unable to capture transitions in automobile access. Instead, the WTW employment model includes access to an automobile at the time of the baseline survey.

MTO Results

Table 10 presents the results of a regression model predicting discrete change in employment for all adults in the sample. We report the relative risk ratios and robust standard errors. The relative risk ratio is the probability of choosing one outcome category over the probability of choosing the base category for a unit change in the predictor variable. Our model specifications explain a moderate amount of the variation in employment outcomes, in comparison to similar auto-employment models and our own analysis of the WTW voucher dataset. Low levels of prediction for individual outcomes, particularly among vulnerable population groups, are common for other similar studies reported in the literature. In our primary model specification, exactly half of the predictions are correct. We predict consistent unemployment and job gain best, and loss of a job very poorly.

Table 10. Employment Model (Base = Not Employed → Not Employed)

Independent variables	Not employed→ employed	Employed→ not employed	Not employed→ employed
Individual characteristics			
Age	+	NS	+
Age^2	-	NS	-
Male	NS	NS	NS
Black	NS	NS	+
Hispanic	-	NS	NS
Other race	NS	NS	NS
High school graduate	+	NS	+
Household characteristics			
Household size	NS	NS	NS
Aid to families with dependent children	NS	-	-
Supplemental Security Income	-	-	-
Moved between baseline and interim	NS	NS	NS
Program Status [excluding control group]			
Section 8	NS	NS	NS
Experimental	NS	NS	NS
Transit access			
Improved public transit between baseline and interim	NS	NS	+
Live < 15 minute walk to transit (self-	NS	NS	+

reported)			
Automobile access [excluding no car]			
Gained car between baseline and interim	+	NS	+
Lost car between baseline and interim	NS	NS	+
Had car at baseline and interim	+	NS	+
Neighborhood Characteristics			
Job access (relative to metropolitan statistical area)	NS	NS	NS
Poverty rate	NS	NS	NS
Population density	NS	NS	+
Metropolitan Area [excluding Los Angeles]			
Baltimore	+	NS	+
Boston	NS	NS	NS
Chicago	+	NS	+
NYC	+	NS	NS

Source: Authors' analysis.
Notes: NS = not significant at .05 level; + = positive and significant at .05 level, - = negative and significant at .05 level. *N*=3,199. R^2=.17. Significance: < .10.

For the independent variables of interest, gaining a car between baseline and interim and maintaining access to a car at both time points are positively and strongly correlated with finding employment and being employed at baseline and interim. The effect of the presence of a car raises the probability of finding a job by a factor of two and the probability of being employed at both time points by a factor of four. While improved transit access is not a significant factor in finding employment, it appears to be the most important factor associated with being employed at both time points. Having moved to a neighborhood with better transit between baseline and interim and living within 15 minutes of a bus stop both raise the probability of having consistent employment by a factor of 14. As other studies have shown, experimental group status has no discernible effect on participants' ability to find or keep work.

Neighborhood characteristics also appear to be weakly correlated with employment outcomes, after we control for individual and household attributes. With one exception, the presence of a high number of jobs near the census tract, the poverty rate of the census tract, and the residential density of the tract are not associated with employment. Higher density is correlated with having employment at both time periods. Metropolitan-level effects are stronger than neighborhood associations, but mixed. Compared with participants in Los Angeles (the excluded group) participants in Baltimore and Chicago were more likely to both obtain a job and retain a job over the survey period, although the significance of the relationship in Chicago was weaker. The variable New York (participants living in New York) also exhibited a relationship to gaining employment (which was statistically significant at the .10 level).

We also estimated similar employment models only for those adults living in households without cars. The sample size in these models is reduced by less than one-fifth, because there were few households with cars at baseline, and as a result, the model's fit is slightly lower, correctly predicting 44 percent of the cases. Similar to the full model, transit— as measured by both self-reported bus access and households moving to neighborhoods with better service between baseline and interim— has a large positive effect on retaining employment. Both of these measures raise the likelihood of being employed at both time points

by a factor of 10. Improved public transit also has a negative but nonsignificant effect on gaining employment. Individual and household-level characteristics largely operate as in the full model, but with some demonstrating attenuated correlation to employment. Experimental group status is not correlated with work outcomes in any significant manner. At both the neighborhood and metropolitan scale, access to jobs and the surrounding poverty level have no effect on employment, while density continues to play a positive role in individuals' retention of work at both time points. Living in Baltimore continues to have a positive relationship with gaining and keeping employment, but there are no other discernible metropolitan impacts on participants' work status.

WTW Results

Table 11 presents the results of a model predicting the discrete change in employment for all adults in the WTW sample. As in table 9 above, we report the relative risk ratios and standard errors, along with a measure of model fit.

In comparison with those who are not fully employed at the baseline and follow-up surveys, access to an automobile has a significant, positive effect on the likelihood of adults going from unemployment to employment and the likelihood of adults remaining employed at the two time points. For adults employed at both time points, relative risk ratios indicate that automobile access is the most important determinant. Improved transit between baseline and follow-up surveys is not significantly related to employment outcomes. Public transit may not effectively connect low-income workers to jobs. However, it may also be true that public transit—particularly in the WTW metropolitan areas—does not provide enough service to adequately connect voucher recipients to employment opportunities. Finally, it is possible that households with characteristics that make it more difficult for them to find employment are more likely to move to and live in transit-rich neighborhoods.

In response to the levels of transit service hypothesis, we explored whether there was a relationship—or interaction—between our public transit measure and metropolitan area. In other words, might there be a positive effect of public transit on employment outcomes in metropolitan areas that provide more extensive transit service? Indeed, we find some variation by metropolitan area. Relative to program participants in Atlanta, moving to transit-richer neighborhoods has a negative effect on employment. Although tentative, this finding suggests that public transit may be more effective in connecting low-wage workers to employment opportunities in some metropolitan areas than others. These results should be interpreted with caution as the sample sizes for participants who moved to transit-richer neighborhoods in some of the metropolitan areas, particularly Spokane, are quite small. Moreover, relative to Augusta, Fresno, and Spokane, Houston also has a more developed transit network, yet the interaction term is negative.

In terms of neighborhood characteristics, job access is significantly and positively related to unemployment. Unexpected, this finding may suggest the presence of high job turnover among low-income adults, or may simply show the positive role that job access plays in an adult having had a job at any point in time, as opposed to never having had a job. Jobs access is not significantly related to employment at baseline and follow-up, whereas poverty rates are negatively related and population density is positively related to steady employment. Finally, there is significant variation in employment outcomes across metropolitan areas. In comparison with adults living in Atlanta, adults in Fresno, Houston and Spokane were less likely to find employment. Moreover, adults in Augusta, Houston and Spokane were less likely to be employed at both time points, though with varying degrees of significance.

Table 11. Model 1—Aggregate Employment Model (Base = Not Employed→ Not Employed)

Independent variables	Not employed→ employed	Employed→ not employed	Employed → employed
Individual characteristics			
Age	NS	NS	+
Age^2	NS	NS	-
Male	+	NS	+
Black	NS	NS	NS
Hispanic	NS	NS	NS
Other race	NS	NS	NS
High school graduate	+	NS	+
Household characteristics			
Household size	NS	NS	NS
Public housing	NS	NS	NS
Welfare	NS	-	-
Supplemental Security Income	-	-	-
Moved between baseline and follow-up	NS	NS	NS
Improved public transit at final	NS	NS	NS
Experimental group	NS	NS	NS
Automobile access	+	+	+
Job access relative to metropolitan statistical area	NS	+	NS
Neighborhood Characteristics (by tract)			
Poverty rate	NS	-	-
Population density	NS	NS	+
Metropolitan Areas [excluded=Atlanta]			
Augusta	NS	NS	-
Houston	-	-	-
Fresno	-	NS	NS
Spokane	NS	NS	-

Source: Authors' analysis.
Notes: NS = not significant at .05 level; + = positive and significant at .05 level, - = negative and significant at .05 level. *N*=3,199. R^2=.17. Significance: < .10.

We also estimated a separate model that replicates the aggregate model but includes only those program participants in households without access to automobiles. The independent variables operate very similar to the full specification, but in this model there is a positive relationship between being employed at both time points and jobs access. In other words, among adults without automobiles in the household, the likelihood of employment at any point in time is higher among those with access to more local jobs. Transit access, however, still does not appear to play a significant role in improving employment outcomes. Although the models control for a number of individual and household characteristics, it is likely that the transit variable reflects other characteristics of carless individuals that make it more difficult for them to find and retain employment.

Finally, we considered the determinants of employment for participants in two of the metropolitan areas in our sample, Fresno and Houston, by running separate, metropolitan-level models. Descriptive evidence from the sample suggests that there are major demographic differences across these two areas. Namely, adults in Fresno are much more likely to be Hispanic, have access to automobiles, and be

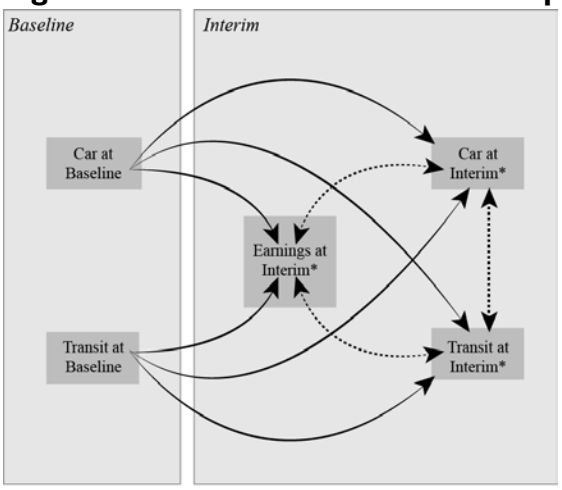
employed at baseline than adults in Houston. Among the adults living in the Fresno sample, there is a positive relationship between automobiles and both gaining employment and staying employed. In Houston, however, there is no apparent relationship between automobiles and transitions to employment. There is, however, a positive relationship between automobile access and maintaining employment at both time points. For public transit, this variable is not significant in either metropolitan area.

Automobile Ownership, Transit Accessibility, and Earnings

In this section, we take advantage of longitudinal data from the MTO program to examine the role of transportation in improving outcomes for MTO households. In particular, we examine the relationship between automobile ownership, residential location in transit-rich neighborhoods, and earnings. We are also interested in the effect of program status (being in the experimental group) itself on all three out of these outcomes. Because we expect that the relationships between these outcomes are themselves interrelated, we employ structural equation modeling, which allows the researcher to posit more complex, interrelated pathways of causation than other modeling approaches.

We depict our structural equation modeling approach in figure 14. Our conceptual model rests on the assumption that access to transportation resources—cars and high-quality public transportation—can increase an individual's probability of employment and enhance earnings by expanding the geographic scope of the individual's job search and improving punctuality and reliability. However, in the US context, the two transportation options we examine—cars and transit—are typically substitute goods for the journey to work. Therefore, we expect that individuals—particularly low-income individuals looking to economize—would make trade-offs in selecting between the two. We therefore expect car ownership and transit richness to both be positively associated with earnings, but negatively associated with one another. We further expect car ownership to be more strongly associated with earnings than transit access, as previous studies have found (Cervero et al. 2002; Gurley and Bruce 2005; Sandoval et al. 2011).

Figure 14. Overview of Structural Equation Modeling Approach



Source: Authors' analysis.
Note: Dashed lines indicate modeled covariance of error term.
*Also controlled for randomization group, race/ethnicity, age, sex, and employment at baseline. The earnings submodel includes additional controls: years of education and having not moved residences by interim.

As depicted on the left side of the diagram, we use characteristics of the individual at the time of the baseline MTO interview (roughly 1994 to 1998), as well as a series of time-invariant variables such as race or ethnicity, gender, and randomization group to predict our three outcomes of interest at the time of the

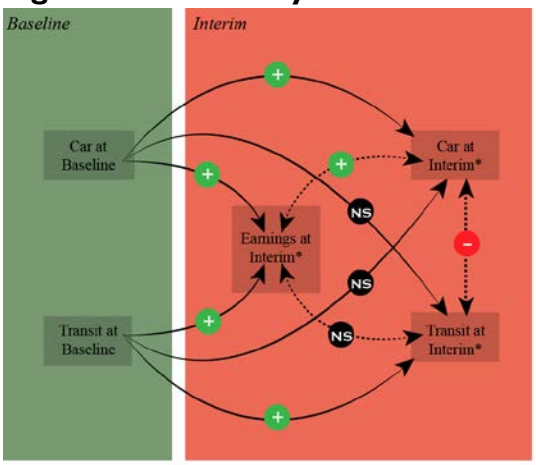
MTO interim interview. These outcomes are: automobile ownership, the transit richness of the respondent's home census tract, and the respondent's self-reported earnings. Most of these data are derived directly from the MTO baseline and interim surveys. For example in the baseline and interim surveys, households were asked whether they had a car that ran. We use administrative records attached to the interim dataset to determine whether the household had not moved by the interim survey.

We supplement the information on individuals and their households with data on public transit service in the neighborhoods in which program participants live. A census tract identifier allowed us to match the survey data to census tract-level data on public transit from the Brookings Institution. Between May 2009 and February 2011, researchers at the Brookings Institution collected data on the routes, schedules, and stops for 371 agencies located in the 100 largest metropolitan areas. They combined these data with employment data to develop a number of different measures of transit access including the number of jobs available in a 30-minute transit trip from a given census tract. We use these data measuring transit richness as a Z-score using the regional mean of jobs accessible by transit in thirty minutes; thus, a one-unit increase in our "transit richness" metric indicates a (region-specific) standard deviation increase in jobs accessible by transit in thirty minutes.

We also relate the three outcomes measures to one another in the overall modeling approach. We estimate a covariance parameter for the error covariance of each of the submodels. This approach assumes that the unobserved variables that help to explain car ownership, choice of residence in a transit-rich neighborhood, and earnings co-vary in meaningful ways. For instance, those who have a preference for owning a car also choose to live in a neighborhood with ample parking and lower levels of transit access.

Figure 15 summarizes the results of our model, focusing on the variables of interest. Having owned a car at the time of the baseline interview is a strong predictor of owning a car at the interim interview, perhaps reflecting both the likelihood of retaining a valuable asset such as an automobile as well as individuals' preferences for automobile ownership. Similarly, having a job at baseline is a strong predictor of automobile ownership several years later, reflecting the need for employment to cover the financial costs of car ownership.

Figure 15. Summary of Model Results



Source: Authors' analysis.
Note: Dashed lines indicate modeled covariance of error term.
*Also controlled for randomization group, race/ethnicity, age, sex, and employment at baseline. The earnings submodel includes additional controls: years of education and having not moved residences by interim.

Only two variables are statistically significant predictors of living in a transit-rich neighborhood. Being a member of the control group for random assignment has a strong positive association with transit richness at the time of the interim survey. The control group in the MTO experiment did not receive Section 8 vouchers, and thus most participants remained in traditional public housing, which is often located in transit-rich, inner-city areas, or left housing assistance altogether for one reason or another. The only other significant predictor of transit richness at interim is transit richness at baseline. This relationship may reflect individuals' transit preferences and the "lumpiness" of transitioning to transit's main competitor, the automobile (through vehicle purchases and licensing). It also may be because of the high financial and social costs of moving to a new neighborhood. With respect to this last point, voucher households can experience difficulty moving out of their current neighborhoods because of limited resources, landlord practices, and institutional obstacles associated with the voucher program (DeLuca et al. 2012).

Access to transportation at baseline appears to make a difference in earnings several years later. Both automobile access and transit richness in the home census tract at the time of the baseline interview are statistically significant predictors of higher earnings. However, the earnings effect for owning a car is considerably greater than the effect of transit richness. Our results suggest that one would have to live in a neighborhood nearly eight standard deviations above the mean regional transit richness to achieve the same estimated effect on earnings as owning a car. Our model further suggests that the effect of living in a transit-rich neighborhood is similar for those individuals with and without cars.

Finally, we find that the error terms of our earnings and transit richness models are both correlated with that of the car ownership submodel. This suggests that omitted variables that are associated with higher earnings but difficult to measure (such as perseverance, intelligence, a highly developed social network, or other factors) are also associated with automobile ownership. Similarly, the model results suggest that there are clear trade-offs between the choice to own a car and the choice to live in a transit-rich neighborhood. Controlling for a host of other factors, those who are more likely to choose one of these transportation options (for instance, buying a car) are considerably less likely to choose the other (for instance, living in a very transit-accessible neighborhood). This relationship likely reflects both attributes of the person (preference for one mode over the other) as well as a host of unobserved factors associated with living in a particular neighborhood. For instance, if a person lives in a transit-poor neighborhood in order to be close to friends and family, that person may be more likely to purchase a car as well.

Summary: Influence of Transportation and Location Choice on Economic Opportunity

In this section, we analyzed the relationships among various transit measures, and using robust measures of transit access and vehicle access, we examined the relationship between transportation access and transitions into and out of employment. We also considered the relationships among transportation access, residential location choice, and earnings. Here we summarize the primary findings from these analyses.

In our analysis of access opportunity neighborhoods, we find that transit and job opportunity metrics are largely incongruent, even when data for these metrics are collected contemporaneously by the same organization. Discernible trends in the data include better job richness but worse job access among the control group and those without cars, although this disparity appears to attenuate by the time of the final survey. We are surprised to find that access to public transit is not notably better among those without cars or among the control group, and in fact service frequency sometimes appears discernibly worse.

We also used several multinomial logistic regression models to investigate the relationship between

public transit and automobile access on transitions into and out of employment. In models estimated for MTO households, we find that keeping or gaining access to automobiles is positively associated with the likelihood of employment. Improved access to public transit is positively associated with maintaining employment but not with transitions to employment. Consistent with previous MTO program evaluations, we find that experimental group-status is not statistically significant.

In models examining the influence of baseline access to automobiles and public transit on follow-up employment for WTW households, we find that baseline access to automobiles has a strong positive relationship to follow-up employment, but transit access does not. While there are substantial differences in employment rates across metropolitan areas, the determinants of employment outcomes are largely consistent across the metropolitan-specific models. These findings suggest that enhancing car access will notably improve the likelihood of employment among very low income adults, but investments in transit in areas with concentrated poverty will only have, at best, marginal effects.

Finally, we examine the effect of transportation resources on earnings outcomes for MTO participants using a structural equation modeling approach to examine the interrelationships among automobile ownership, residential location in transit-rich neighborhoods, and earnings. We find evidence that both cars and transit access have a positive effect on earnings, though the effect for auto ownership is considerably greater. We also find evidence that low-income households make trade-offs between owning a car and living in a transit-rich neighborhood. We find little evidence that participation in the MTO experimental group influenced transportation decisions or earnings.

Taken together, these findings show that automobile access importantly influences employment outcomes and earnings for low-income households. The effects of public transportation are mixed, likely because of the substantial variability in transit coverage among the metropolitan areas included in the study. Moreover, we find that access to automobiles is more important that assignment to the MTO or WTW experimental group. In the next section, we discuss the implications of these findings and those discussed above for expanding low-income households' access to economic opportunities.

Conclusion and Policy Implications

In this study, we examined the interrelationships among transportation assets, residential location choice decisions, and economic outcomes for housing choice voucher recipients broadly and for those participating in the MTO and WTW experimental programs. Our analyses point to several implications for future research and data collection efforts, voucher-enhanced mobility programs, and strategies for coordinating housing and transportation policies in ways that enhance economic opportunity for low-income households.

Several findings presented above suggest that HUD would be well advised to learn more about whether all their assisted tenants have access to working cars. Collection of such information would be possible, though potentially controversial, annually as part of the income verification process. Tenants might have concerns that housing agencies would disqualify them for assistance if they revealed that they own a car. But car ownership provides both access to better neighborhoods and a way to get to work and better schools. If HUD knew which of its households had cars, it could develop new programs and partnerships to help able families become economically self-sufficient. Information about car access could also be helpful for identifying neighborhoods where assisted families with cars are living so that new economic development efforts could concentrate there, including affordable options for car maintenance, and educational opportunities for courses in auto mechanics, for example. It is clear that even in high-density, transit-rich cities, voucher users—like many other low-income people—make huge sacrifices to get and maintain car access. Housing and community development policies and programs can be shaped

so that the needs of assisted households with and without cars are accounted for individually.

Our findings also have implications for policies designed to enhance "access to opportunity" for low-income households. Our results imply that housing search services should be tailored to the transportation needs of households receiving assistance. Transporting those without access to a car to prospective residential locations along with providing information about the public transportation options available in different neighborhoods may help to improve the number and quality of units inspected prior to a housing search. This policy recommendation is echoed by Shroder (2002), who finds that car ownership and the intensity of housing counseling services both increase the likelihood of lease-up among MTO program participants. He goes on to argue that while providing long-term transportation services may be expensive, combining such assistance with other educational programs may go a long way towards increasing the rate at which mobility program participants successfully lease-up in desirable neighborhoods.

Currently, the provision of transportation-based services is an integral component of the WTW program but has been less of a focus for the MTO program. HUD provides guidance to public housing agencies participating in the WTW program regarding ways in which to tailor services to the transportation needs of households receiving assistance. The HUD website also provides information about how to coordinate housing assistance with the various local transportation programs sponsored by nonprofits, transit agencies, and the business community.[17] But HUD's role in this effort is primarily advisory, with local public housing agencies playing the lead role in designing such programs.

An implication of our findings is that combining rental vouchers with subsidies for automobile purchases may be one possible approach to expanding the location choices available to low-income households. Alternatively, short-term car rental services such as ZipCar and Car2Go have the potential to address the travel needs of some low-income adults at a lower cost. (See, for example, McCarthy [2012] and Ortega [n.d.]). These services may be particularly useful to households with at least one licensed driver but who do not have sufficient assets to own and maintain a car. Coordination of housing voucher assistance with nonprofit car donation services and rideshare services is a third possibility[18]. Of course, the trade-offs of such policies are that additional car-based travel will exacerbate the negative externalities associated with auto use, including congestion and air quality degradation. Furthermore, car ownership itself entails costs that accrue directly to owners, which may place undue burdens on low-income families. These trade-offs should be considered with any auto-based mobility strategy.

The importance of automobile access may also reflect the inadequacy of public transportation service in meeting the needs of many low-income households. Our research examining the link between transportation assets and employment transitions for MTO households suggests that while automobile access has the largest impact on transitions to employment, policies to enable households to move to transit-rich neighborhoods can also help participants' retain employment.

Despite these findings, there are few federal programs aimed at helping low-income families gain access to automobiles and some programs actually act as barriers to gaining such access. Post–welfare reform, policymakers turned to transportation as a strategy for rapidly moving welfare recipients and other low-income adults into the labor market. In 1998, Congress passed the Job Access and Reverse

---

[17] "Supportive Services Resources – Welfare to Work Vouchers," US Department of Housing and Urban Development, accessed February 14, 2014, http://www.hud.gov/offices/pih/programs/hcv/wtw/resources/bs10/transportation.cfm#1.

[18] See National Economic Development Law Center (2007) and "Working Cars for Working Families," accessed February 14, 2014, http://www.workingcarsforworkingfamilies.org/.

Commute program, one component of the Transportation Equity Act of the 21st Century (Stommes et al. 2002). Additionally, other federal agencies—US Departments of Health and Human Services, Housing and Urban Development, and Labor—made resources available to provide transportation for welfare recipients and other low-wage workers. However, these efforts focused on public transit and, in particular, strengthening transit connections from center cities to suburbs. In the absence of building extensive transit networks which are fiscally impracticable in all but the densest US metropolitan areas, our study suggests that cars present a more viable means of connecting low-income workers to jobs. To be effective, federal strategies should be coordinated with local and state approaches. While most states have lifted or eased vehicle asset limitation rules that previously had limited welfare recipients' ability to own (reliable) automobiles, some states still maintain asset limits (Kassabian et al. 2012).

As new transportation legislation is being debated, and social equity concerns are playing a more prominent role in the design of federal transportation policy, perhaps it is time to better coordinate federal housing and transportation programs in ways that enhance the upward mobility of low-income households. The Sustainable Communities Partnership between HUD, the Department of Environmental Protection, and the Department of Transportation is one example of such coordination. Our findings lend support for additional programs such as these that consider social mobility more broadly, emphasizing the role of transportation access as it affects both residential mobility and economic mobility.

Finally, our findings call for a more nuanced reframing of the geography of opportunity debates. In our descriptive sorting analysis, locational attainment models, and descriptive characterization of access opportunity neighborhoods, we find that low income HUD-assisted households make trade-offs among different neighborhood characteristics. Areas with high-performing schools, access to open space, and a lower risk of environmental contamination may have inadequate transportation systems, have less accessibility to jobs, and have an increased risk of exposure to automobile emissions. Furthermore, households at different life-cycle stages and with different levels of access to transportation value each of these amenities differently. Given the spatial heterogeneity of preferences and opportunity structures, our findings call for an expansion of housing assistance services that are tailored to the particular needs of individual households. Thus, the goal of "moving to opportunity" may be more usefully phrased as "moving to opportunities."

As promising as these findings about car ownership may be, more research is needed on the relationship between cars and other outcomes. A full accounting of the effects of car ownership on neighborhood choices would require a methodological approach accounting as fully for self-selection into car ownership as MTO tried to do for self-selection into low-poverty neighborhoods. Undoubtedly, families with access to cars differ in unmeasured ways from those without access to cars. Neither experiment "treated" voucher-assisted households with auto access, denying access in an experiment to a control group. Many of the factors that would lead a household to secure access to a car could also motivate moves to good neighborhoods and to get and keep jobs. For the present, therefore, our results on car access must be treated as preliminary and promising.

References

Abraham, John E., and John D. Hunt. 1997. "Specification and Estimation of a Nested Logit Model of Home, Workplaces, and Commuter Mode Choice by Multiple Worker Households." *Transportation Research Record* 1606: 17–24.

Alam, Bhuiyan Monwar. 2009. "Transit Accessibility to Jobs and Employment Prospects of Welfare Recipients without Cars. A Study of Broward County, Florida, Using Geographic Information Systems and an Econometric Model." *Journal of the Transportation Research Board* 2110: 78–86.

Alba, Richard D., and John R. Logan. 1992. "Analyzing Locational Attainments: Constructing Individual-Level Regression Models Using Aggregate Data." *Sociological Methods and Research* 20: 367–97.

Alonso, William. 1964. *Location and Land Use*. Cambridge, MA: Harvard University Press.

Baum, Charles L. 2009. "The Effects of Vehicle Ownership on Employment." *Journal of Urban Economics* 66(3): 151–63.

Baum, Scott, Kathryn Arthurson, and Kara Rickson. 2009. "Happy People in Mixed Up Places: The Association between the Degree and Type of Local Socioeconomic Mix and Expressions of Neighborhood Satisfaction." *Urban Studies* 47(3): 467–85.

Bayer, Patrick, Robert McMillan, and Kim Rueben. 2002. "What drives Racial Segregation? New Evidence Using Census Microdata." Working paper. New Haven, CT: Yale University.

Been, Vicki, Mary Cunningham, Ingrid Gould Ellen, Adam Gordon, Joe Parilla, Margery Austin Turner, Sheryl Verlaine Whitney, Aaron Yowell, and Ken Zimmerman. 2010. "Building Environmentally Sustainable Communities: A Framework for Inclusivity." Washington, DC: What Works Collaborative. http://www.urban.org/UploadedPDF/412088-environmentally-sustainable-communities.pdf.

Benenson, Itzhak, Karel Martens, Yodan Rofé, and Ariela Kwartler. 2010. "Public Transport Versus Private Car GIS-Based Estimation of Accessibility Applied to the Tel Aviv Metropolitan Area." *Annals of Regional Science* 47: 499–515.

Blumenberg, Evelyn. 2004. "En-gendering Effective Planning: Spatial Mismatch, Low-Income Women, and Transportation Policy." *Journal of the American Planning Association* 70(3): 269–281.

Blumenberg, Evelyn, and Daniel Hess. 2003. "Measuring the Role of Transportation in Facilitating the Welfare-to-Work Transition: Evidence from Three California Counties." *Journal of the Transportation Research Record* 1859: 124–32.

Blumenberg, Evelyn, and Gregory Pierce. 2012. "Automobile Ownership and Travel by the Poor." *Transportation Research Record* 2320: 28–36.

Blumenberg, Evelyn, and Paul Ong. 2001. "Cars, Buses, and Jobs: Welfare Participants and Employment Access in Los Angeles." *Transportation Research Record* 1756: 22–31.

Boehm, Thomas P., and Keith R. Ihlanfeldt. 1991. "The Revelation of Neighborhood Preferences: An N-Chotomous Multivariate Probit Approach." *Journal of Housing Economics* 1: 33–59.

Briggs, Xavier de Souza, Sue Popkin, and John Goering. 2010. *Moving to Opportunity: The Story of an American Experiment to Fight Ghetto Poverty*. New York: Oxford University Press.

Cervero, Robert, Onésimo Sandoval, and John Landis. 2002. "Transportation as a Stimulus of Welfare-to-Work Private versus Public Mobility." *Journal of Planning Education and Research* 22(1): 50–63.

Chapman, David W., and John R. Lombard. 2006. "Determinants of Neighborhood Satisfaction in Fee-Based Gated and Nongated Communities." *Urban Affairs Review* 41(6): 769–99.

Clampet-Lundquist, Susan, and Douglas Massey. 2008. "Neighborhood Effects on Economic Self-Sufficiency: A Reconsideration of the Moving to Opportunity Experiment." *American Journal of Sociology* 114(1): 107–43.

Crump, Jeff. 2002. "Deconcentration by Demolition: Public Housing, Poverty, and Urban Policy." *Environment and Planning D: Society and Space* 20(5): 581–96.

Dawkins, Casey J. 2005. "Evidence on the Intergenerational Persistence of Residential Segregation by Race." *Urban Studies* 42(3): 545–55.

Dawkins, Casey J., Qing Shen, and Thomas W. Sanchez. 2005. "Race, Space, and Unemployment Duration." *Journal of Urban Economics* 58(1): 91–113.

DeLuca, Stefanie, Greg J. Duncan, Micere Keels, and Ruby Mendenhall. 2012. "The Notable and the Null: Using Mixed Methods to Understand the Diverse Impacts of Residential Mobility Programs." In *Neighbourhood Effects Research: New Perspectives*, eds. Maarten Van Ham, David Manley, Nick Bailey, Ludi Simpson, and Duncan MacClennan, 195–223. Dordrecht, Netherlands: Springer.

de Souza Briggs, Xavier, Susan J. Popkin, and John Goering. 2010. *Moving to Opportunity. The Story of an American Experiment to Fight Ghetto Poverty*. Oxford: Oxford University Press.

Ehrenhalt, Alan. 2013. *The Great Inversion and the Future of the American City*. New York: Vintage Books.

Freeman, Lance. 2008. "Is Class Becoming a More Important Determinant of Neighborhood Attainment for African-Americans?" *Urban Affairs Review* 44(1): 3–26.

Galvez, Martha M. 2010. "What Do We Know About Housing Choice Voucher Program Location Outcomes? A Review of Recent Literature." Washington, DC: What Works Collaborative. http://www.urban.org/uploadedpdf/412218-housing-choice-voucher.pdf.

Glaeser, Edward L., Matthew E. Kahn, and Jordan Rappaport. 2008. "Why Do the Poor Live in Cities? The Role of Public Transportation." *Journal of Urban Economics* 63(1): 1–24.

Grengs, Joe. 2010. "Job Accessibility and the Modal Mismatch in Detroit." *Journal of Transport Geography* 18(1): 42–54.

Giuliano, Genevieve, and Joyce Dargay. 2006. "Car Ownership, Travel and Land Use: A Comparison of the US and Great Britain." *Transportation Research Part A* 40: 106–24.

Gurley, Tami, and Donald Bruce. 2005. "The Effects of Car Access on Employment Outcomes for Welfare Recipients." *Journal of Urban Economics* 58(2): 250–72.

Handy, Susan, and Debbie Niemeier. 1997. "Measuring Accessibility: An Exploration of Issues and Alternatives." *Environment and Planning A* 29: 1175–94.

Kassabian, David, Anne Whitesell, and Erika Huber. 2012. *Welfare Rules Databook: State TANF Policies as of July 2011*. Washington, DC: Urban Institute.

Kawabata, Mizuki. 2003. "Job Access and Employment among Low-Skilled Autoless Workers in US Metropolitan Areas." *Environment and Planning A*, 35: 1651–68.

Kawabata, Mizuki. 2009. "Spatiotemporal Dimensions of Modal Accessibility Disparity in Boston and San Francisco." *Environment and Planning A* 41: 183–98.

Kawabata, Mizuki, and Qing Shen. 2006. "Job Accessibility as an Indicator of Auto-Oriented Urban Structure: A Comparison of Boston and Los Angeles with Tokyo." *Environment and Planning B: Planning and Design* 33: 115–30.

Kawabata, Mizuki, and Qing Shen. 2007. "Commuting Inequality between Cars and Public Transit: The Case of the San Francisco Bay Area, 1990-2000." *Urban Studies* 44: 1759–80.

Kearney, Anne R. 2006. "Residential Development Patterns and Neighborhood Satisfaction: Impacts of Density and Nearby Nature." *Environment and Behavior* 38(1): 112–139.

LeRoy, Stephen F., and Jon Sonstelie. 1983. "Paradise Lost and Regained: Transportation Innovation, Income, and Residential Location." *Journal of Urban Economics* 13: 67–89.

Levine, Jonathan C. 1998. "Land Use Solutions to Transportation Problems? Rethinking Accessibility and Jobs-Housing Balancing." *Journal of the American Planning Association* 64(2): 133–49.

Lucas, Marilyn T., and Charles F. Nicholson. 2003. Subsidized Vehicle Acquisition and Earned Income in the Transition from Welfare to Work. *Transportation* 30: 483–501.

McCarthy, Ryan. 2012. *How Buffalo Car Share Fights Poverty*. Buffalo, NY: Partnership for the Public Good.

Mills, Gregory, Daniel Gubits, Larry Orr, David Long, Judie Feins, Balbul Kaul, and Michelle Wood. 2006. "Effects of Housing Vouchers on Welfare Families." Washington DC: US Department of Housing and Urban Development. http://www.huduser.org/publications/commdevl/hsgvouchers.html.

Muth, Richard. 1969. *Cities and Housing*. Chicago: University of Chicago Press.

National Economic Development Law Center. 2007. "Low-Income Car Ownership Programs: 2006 Survey." Oakland, CA: National Economic Development and Law Center. http://www.insightcced.org/uploads/publications/assets/LICO2006surveyreport.pdf.

Ong, Paul. 2002. "Car Ownership and Welfare-to-Work." *Journal of Policy Analysis and Management* 21(2): 239–52.

Ong, Paul M., and Douglas Houston. 2002. "Transit, Employment and Women on Welfare." *Urban Geography* 23(4): 344–64.

Ong, Paul M., and Douglas Miller. 2005. "Spatial and Transportation Mismatch in Los Angeles." *Journal of Planning Education and Research* 25: 43–56.

Orr, Larry, Judith D. Feins, Robin Jacob, Erik Beecroft, Lisa Sanbonmatsu, Lawrence F. Katz, Jeffrey B. Liebman, and Jeffrey R. Kling. 2003. "Moving to Opportunity Interim Impacts Evaluation." Washington, DC: US Department of Housing and Urban Development, Office of Policy Development and Research.

Ortega, Juan. n.d. Car Sharing in the United States. Helping People Transition from Welfare to Work and Improving the Quality of Life of Low-Income Families. Washington DC: Community Transportation Association of America. http://web1.ctaa.org/webmodules/webarticles/articlefiles/carsharing_report_final.pdf.

Patterson, Rhiannon, Michelle Wood, Ken Lam, Satyendra Patrabansh, Gregory Mills, Steven Sullivan, Hiwotte Amare, and Lily Zandiapour. 2004. "Evaluation of the Welfare to Work Voucher Program: Report to Congress." US Department of Housing and Urban Development, Office of Policy Development and Research.

Pendall, Rolf. 2000. "Why Voucher And Certificate Users Live in Distressed Neighborhoods." *Housing Policy Debate* 11(4): 881–909.

Peterson, Ruth D., and Lauren J. Krivo. 2010. National Neighborhood Crime Study (NNCS), 2000. ICPSR27501-v1. Ann Arbor, MI: Inter-university Consortium for Political and Social Research [distributor], 2010-05-05. doi:10.3886/ICPSR27501.v1

Pinjari, Abdul Rawoof, Ram M. Pendyala, Chandra R. Bhat, and Paul A. Waddell. 2007. "Modeling Residential Sorting Effects to Understand the Impact of the Built Environment on Commute Mode Choice." *Transportation* 34(5): 557–73.

Raphael, Steven, and Lorien Rice. 2002. "Car Ownership, Employment, and Earnings." *Journal of Urban Economics* 52: 109–130.

Raphael, Steven, and Michael A. Stoll. 2001. "Can Boosting Minority Car-Ownership Rates Narrow Inter-racial Employment Gaps?" *Brookings-Wharton Papers on Urban Affairs* 2001: 99–145.

Rodriguez, Daniel A., Jonathan Levine, Asha Weinstein Agrawal, and Jumin Song. 2011. "Can Information Promote Transportation-Friendly Location Decisions? A Simulation Experiment." *Journal of Transport Geography* 19: 304–12.

Sanbonmatsu, Lisa, Jens Ludwig, Lawrence F. Katz, Lisa A. Gennetian, Greg J. Duncan, Ronald C. Kessler, Emma Adam, Thomas W. McDade, and Stacy Tessler Lindau. 2011. "Moving to Opportunity for Fair Housing Demonstration Program - Final Impacts Evaluation." Washington, DC: US Department of Housing and Urban Development, Office of Policy Development and Research.

Sanchez, Thomas, Qing Shen and Zhong-Ren Peng. 2004. "Transit Mobility, Jobs Access and Low-Income Labour Participation in US Metropolitan Areas." *Urban Studies* 41(7): 1313–31.

Sandoval, J.S. Onésimo, Robert Cervero, and John Landis. 2011. "The Transition from Welfare-to-Work: How Cars and Human Capital Facilitate Employment for Welfare Recipients." *Applied Geography* 31(1): 352–362.

Schimek, Paul. 1996. "Household Motor Vehicle Ownership and Use: How Much Does Residential Density Matter?" *Journal of the Transportation Research Board* 155: 120–25.

Schwanen, Tim, and Patricia L. Mokhtarian. 2004. "The Extent and Determinants of Dissonance between Actual and Preferred Neighborhood Type." *Environment and Planning B: Planning and Design* 31: 759–84.

Schwanen, Tim, and Patricia L. Mokhtarian. 2005. "What Affects Commute Mode Choice: Neighborhood Physical Structure or Preferences toward Neighborhoods?" *Journal of Transport Geography* 13(1): 83–99.

Schwartz, Alex F. 2010. *Housing Policy in the United States: An Introduction*, 2nd ed. New York: Routledge.

Shen, Q. 1998. "Location Characteristics of Inner-City Neighborhoods and Employment Accessibility of Low-Wage Workers." *Environment and Planning B: Planning and Design* 25(3): 345–65.

Shen, Qing. 2001. "A Spatial Analysis of Job Openings and Access in a U.S. Metropolitan Area." *Journal of the American Planning Association* 67(1): 53–68.

Shroder, Mark. 2002. "Locational Constraint, Housing Counseling, and Successful Lease-Up in a Randomized Housing Voucher Experiment." *Journal of Urban Economics* 51: 315–338.

St. John, Craig and Frieda Clark. 1984. "Racial Differences in Dimensions of Neighborhood Satisfaction." *Social Indicators Research* 15: 43–60.

Stommes, Eileen S., Dennis M. Brown, and Capree M. Houston. 2002. "Moving Rural Residents to Work: Lessons Learned from Implementation of Eight Job Access and Reverse Commute Projects." Washington, DC: Transportation Research Board.

Taylor, Brian, and Paul Ong. 1995. "Spatial Mismatch or Automobile Mismatch? An Examination of Race, Residence, and Commuting in U.S. Metropolitan Areas." *Urban Studies* 32(9): 1453–73.

Turner, Margery Austin, Jennifer Comey, Daniel Kuehn, and Austin Nichols. 2011. "Helping Poor Families Gain and Sustain Access to High-Opportunity Neighborhoods." Washington, DC: Urban Institute.

Turney, Kristin, Susan Clampet-Lundquist, Kathryn Edin, Jeffrey R. Kling, and Greg J. Duncan. 2006. "Neighborhood Effects on Barriers to Employment: Results from a Randomized Housing Mobility Experiment in Baltimore [with Comments]." *Brookings-Wharton Papers on Urban Affairs* 2006: 137–87.

US Housing and Urban Development. 2000. "Welfare to Work Voucher Program: The Basics: Program Rules, Guidelines, Opportunities and Challenges." Washington, DC: Quadel Consulting Corporation.

Varady, David P., Xinhao Wang, Yimei Wang, and Patrick Duhaney. 2010. "The Geographic Concentration of Housing Vouchers, Blacks, and Poverty over Time: A Study of Cincinnati, Ohio, USA." *Urban Research & Practice* 3(1): 39–62.

Varady, David P., and Carole Walker. 2007. *Neighborhood Choices: Section 8 Housing Vouchers and Residential Mobility*. New Brunswick, NJ: Rutgers University Center for Urban Policy Research.

Wilson, William Julius. 2012. *The Truly Disadvantaged: The Inner City, the Underclass, and Public Policy*. Chicago: University of Chicago Press.

Woldoff, Rachael A. 2008. "Wealth, Human Capital and Family Across Racial/Ethnic Groups: Integrating Models of Wealth and Locational Attainment." *Urban Studies* 45(3): 527–51.

Wyly, Elvin K. 1998. Containment and Mismatch: Gender Differences in Commuting in Metropolitan Labor Markets. *Urban Geography*, 19(5): 395–430.

Yang, Yizhao. 2008. "A Tale of Two Cities: Physical Form and Neighborhood Satisfaction in Metropolitan Portland and Charlotte." *Journal of the American Planning Association* 74(3): 307–23.

Yi, Chang. 2006. "Impact of Public Transit on Employment Status: Disaggregate Analysis of Houston, Texas." *Journal of the Transportation Research Board* 1986: 137–44.

Appendix A. Indicators, Labels, Descriptions, and Sources

Table A.1. Indicators, Descriptions, and Sources

Indicator	Description	Source
Natural environment		
Land within buffer of TRI site (%)	Total buffer area of TRI facilities within 1 mile in a given census tract divided by area of the census tract	EPA Toxic Release Inventory 2000
Log of cancer risk score	The sum of all carcinogens in assessment and individual pollutant contributions to total risk, multiplied by 1 million	2002 National-Scale Air Toxics Assessment
Land within 200m of major highway (%)	Total buffer area of major highways within 200 meters in a given census tract divided by area of the census tract	Authors' analysis using 2000 US census TIGER files,
Land developed as urban uses (%)	Total developed areas with low, medium, and high intensity including open space in a given census tract divided by area of the census tract	National Land Cover Database 2001
Functional environment		
Housing market strength factor	The first factor score resulting from authors' varimax rotation of vacancy rate, percent owner-occupied units, and median gross rent	2000 US census, SF3
Vacancy rate	Vacant units, except those held for seasonal or occasional use or for farmworkers, divided by total housing units in the census tract	2000 US census, SF3
Owner-occupied housing units (%)	Number of owner-occupied units divided by total number of housing units in 2000	2000 US census, SF3
Median gross rent ($)	Median gross rent in 2000	2000 US census, SF3
Housing diversity factor	The first factor score resulting from authors' varimax rotation of diversity index of structure type, housing density, and median housing age	2000 US census, SF3
Diversity index of structure type	See table description below	2000 US census, SF3
Housing density (units/acre)	Average number of housing units per acre on blocks in a given census tract, excluding blocks with no housing units	2000 US census, SF3
Housing 50+ years old	Percent of year-2000 housing units built before 1950	2000 US census, SF3
Housing <11 years old	Percent of year-2000 housing units built in 1990 or later	2000 US census, SF3

FHEA transit access index	Score on a 1–100 index of the accessibility by bus or rail of retail, entertainment, recreation, food, and accommodations. For more information, see table description below.	HUD FHEA 2012 data
Social environment		
Poverty rate	Percent of persons in census tract with incomes below the poverty line	2000 US census, SF3
Social status factor	The first factor score resulting from authors' varimax rotation of percent non-Hispanic white, percent of households consisting of a single female with at least one child under 18, and percent of persons over 25 with at least four-year college degree in 2000	2000 US census, SF3
Non-Hispanic white (%)	Percent of population non-Hispanic white 2000	2000 US census, SF3
Female-headed households (%)	Percent of households that consist of an unmarried woman with at least one child under 18	2000 US census, SF3
Adults with college degree (%)	Percent of persons at least 25 years old with a four-year college degree or greater	2000 US census, SF3
Economic vitality		
Aggregate income per square mile	Aggregate household income (in 1999) divided by tract land area	2000 US census, SF3
Job density per square mile	Jobs as reported in the Census Transportation Planning Package part 2, divided by tract land area	2000 US Census Transportation Planning Package
Access to opportunity		
FHEA school performance index	Score on a 1–100 index of the average test scores of schools in or closest to the census tract. For more information, table description.	HUD FHEA 2012 data

Notes: TRI is Toxics Release Inventory; FHEA is Fair Housing Equity Assessment.

In table A.1, the diversity index is computed as

$$H_1 = -\sum_{i=1}^{s} \{(p_i)\ln(p_i)\,/\ln(s)\}$$

where H_1 is diversity, P_i is proportions of each of the eight housing structure types, and s is the number of structure types; in this case, s = 8. High values indicate high diversity of structure types.

As explained in the documentation to the August 2012 vintage Fair Housing Equity Assessment Database, which was distributed by HUD to its Sustainable Communities program grantees:

> HUD has constructed a transit access index where available data exists to support local analysis. HUD uses data on over 200 transit agencies that provide data through GTFS Exchange (http://www.gtfs-data-exchange.com/) to assess relative accessibility within metro areas (or balance of state). The appendix

contains a list of metropolitan areas where GTFS data was available and used. The GTFS- based accessibility index is designed to model relative accessibility to amenities via bus or trains within a metro. Because standardized data on the location of amenities is not uniformly available at a granular level, HUD uses the number of jobs in retail (NAICS 44-45), arts entertainment & recreation (NAICS 71), and food & accommodations (NAICS 72) as proxies for the magnitude of amenities at the block- group level from the Local Employment Dynamics dataset published by the census bureau. (For states without Work Area Characteristics les in the LED data, population was used as a proxy.) First, HUD identified the number of jobs in these sectors within 1=2 mile of each bus stop and 3=4 mile of each rail transit stop and summed them. Then for each trip in the transit system, HUD calculated a stop-specific measure of the additional amenities accessed in each ensuing stop on that route, which it then divided (deflated) by the additional travel time to each ensuing stop. Mathematically, this can be expressed in several terms.

Let (s_{ij}) represent the accessibility of stop i on trip j, a is the amenity radius of a stop (the total jobs mentioned above), and T is the marginal travel time with each stop. Each stop of each trip takes on a value equal to the sum of the amenity radius of each ensuing stop divided be the time to that next stop for all stops on a trip.

$$s_{ij} = \sum_{i}^{N} \frac{a_{i+1}}{T_{t+1}}$$

These stop-journey specific (s_{ij}) values are then summed over all journeys j (where a journeys in opposite direction are counted as two trips) made in 24-hours to create a single aggregate accessibility value for each stop in the system (where k is the total stops in the system).

$$A_i = \sum_{j}^{k} s_{ij}$$

To translate these stop accessibility values (A_i) to block-groups, HUD then calculates the distance between each stop and the population-weighted centroid of each block-group. The three highest accessibility stops within 3/4 of a mile are summed to generate a block-group value for accessibility. Finally, these values are placed into deciles (10-percentile) buckets within-metro or balance of state, and are scaled up by a factor of 10 to align with the other indices. Block-groups that are not within 3/4 of a mile of either a bus or transit stop are normalized to a value of 1, the lowest accessibility score. For communities with fixed rail, but no available GTFS data, HUD calculates a simple access measure as the distance of the block-group centroid to the nearest fixed-rail.

As explained in the documentation to the August 2012 vintage Fair Housing Equity Assessment Database, which was distributed by HUD to its Sustainable Communities program grantees:

The neighborhood school proficiency index uses school-level data on the performance of students on state exams to describe which neighborhoods have high-performing elementary schools and which have lower performing elementary schools. The proficiency index is a function of the percent of elementary school students proficient in read (r) and math (m) on state test scores for the *ith* school associated with the neighborhood (i = 1; 2; ... n)where N is the maximum number of schools in any block-group in the state-distribution, and school enrollment *s*:

$$School_i = \sum_{i}^{N} \left(\frac{s_i}{\sum^n s_i} \right) * \left[\frac{1}{2} * r_i + \frac{1}{2} * m_i \right]$$

Elementary schools are linked with block-groups based on a geographic mapping of attendance area zones from School Attendance Boundary Information System (SABINS), where available, or within-district proximity matches of up to the four-closest schools within a mile. In cases with multiple school matches, an enrollment-weighted score is calculated following the equation above.

Factor Analysis Results

We used factor analysis to develop three indices: housing market strength, housing diversity, and neighborhood socioeconomic status. We used common factor analysis, which creates a composite index from a selective series of measures predetermined to be related in a certain way; that is, we had already

decided what the first "factor" represents. Therefore, we know that certain variables measure the concept of housing market strength, housing diversity and neighborhood socioeconomic status, and we use this method because we want to extract an index capturing where these variables intersect. We conducted the factor analysis separately for the MTO and WTW subsets (i.e., each factor analysis used five metropolitan areas). Factor patterns for each of these variables appear in table A.2.

The housing market strength factor extracts a single index from the vacancy rate, homeownership rate, and the standardized gross rent (i.e., contract rent plus utilities converted to a z-score within each metropolitan area to account for inter-metropolitan area differences). The first factor extracted by this common factor analysis explained 51 percent of the variance across the MTO cases and 50 percent across the WTW cases. Higher scores on the housing market strength indicate lower vacancy rates, higher homeownership rates, and higher median gross rent.

The housing diversity factor is a single index created by the first factor extracted from the structure diversity index described above; the housing density in the tract net of blocks without housing units; the percent of housing over 50 years old (i.e., built before 1950); and the percent of housing less than 10 years old (i.e., built since 1990). High scores indicate more diverse, denser, and older housing stock. The MTO housing diversity factor explained 55 percent of the variance across cases, and the WTW factor explained 58 percent of the variance.

The social status factor extracts a single index from the percent of the population that is white non-Hispanic, standardized within the metropolitan area using a z-score; the percent of persons with at least a high school diploma or GED; and the percent of families and subfamilies composed of an unmarried mother with at least one child under age 18. High scores indicate high levels on all these indicators, meaning that "low" social status is indicated by high scores on this factor. The MTO social status factor accounted for 80 percent of the variation across cases, and the WTW factor accounted for 76 percent of the variation.

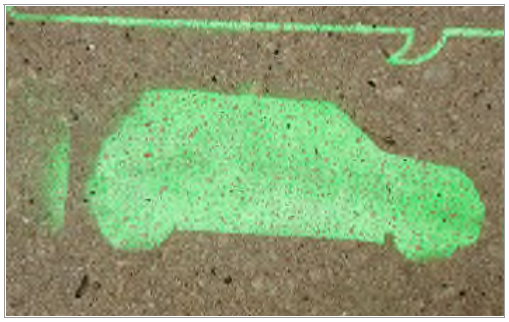
Table A.2 Factor Patterns, Housing Market Strength, Housing Diversity, and Social Status Factors

	MTO	WTW
Housing market strength		
Vacancy rate	-0.285	-0.493
Owner-occupied housing units (%)	0.608	0.543
Z-score of median gross rent, by metropolitan statistical area	0.601	0.549
Housing diversity		
Diversity index of structure type	0.406	0.601
Average number of housing units per acre on blocks	0.386	0.522
Housing 50+ years old (%)	0.652	0.406
Housing less than 10 years old (%)	-0.471	-0.524
Social status		
Z-score of percent white alone, by metropolitan statistical area	0.871	0.847
Persons age 25+ high school diploma or GED (or greater) (%)	0.744	0.636
Female-headed families	0.572	0.612

Source: Authors' calculations using data from 2002 US census.

MOBILITY FOR THE POOR: CAR-SHARING, CAR LOANS, AND THE LIMITS OF PUBLIC TRANSIT

by Jeff Khau 08/22/2013



Public transit systems intend to enhance local economies by linking people to their occupations. This presents problems for many low-income families dependent on transit for commuting. With rising prices at the gas pump, much hope has been placed on an influx of investment into public transit to help low-income households. But does public transit really help the poor? While the effect of transit access on job attainment is murky, several alternatives such as car loans and car-sharing programs have seen real results in closing the income gap. For Christina Hubbert, emancipation from public transit has been a change for the better. NBC News reports:

> *A car means Hubbert no longer spends two hours each way to and from work in suburban Atlanta. It means spending more time with her 3-year-old daughter — and no longer having to wake her up at 5 every morning so she can be in the office by 8. It also means saving hundreds of dollars each week in day care late fees she incurred when she couldn't get to the center before its 6:30 p.m. closing time.*

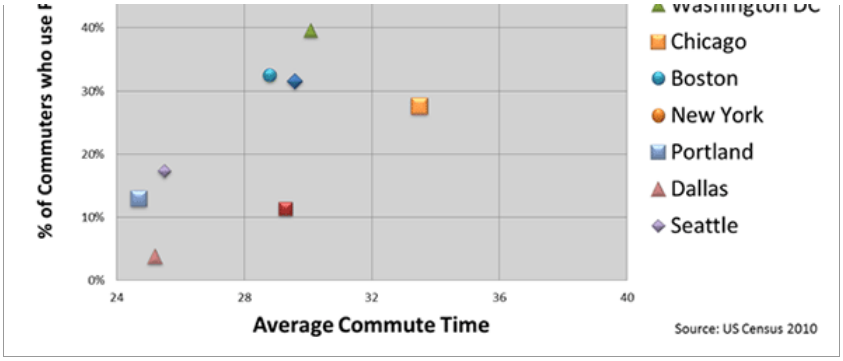
Research finds that car-ownership is positively correlated with job opportunities while no such relationship exists with access to transit stations. Furthermore, increased transit mobility has been proven to have no effect on employment outcomes for welfare recipients. The notion that newer and nearer public transit creates benefits for all is inaccurate; it only creates opportunities for those who live near the transit stations, and those opportunities are limited. A study by the Brookings Institute finds that, among the ten leading metropolitan areas in the US, less than 10% of jobs in a metropolitan area are within 45 minutes of travel by transit modes. Moreover, 36% of the entry-level jobs are *completely* inaccessible by public transit. This is not surprising given the fact that suburbia houses two-thirds of all new jobs.

The mismatch between people and jobs can be reconciled in two ways: car loans and car-sharing services. Basic car-sharing involves several people using the same car or a fleet of cars, as with the ZipCar. The concept has branched out to on-demand car sharing services, such as Lyft, mobile apps which link riders with drivers.

Car loans on the other hand have been around for a while and offer affordable financing for a car without a required down payment. Ways to Work, one of the largest loan providers in the U.S., includes courses on personal finance and credit counseling. By making vehicle travel more attractive, these two disruptive innovations threaten the expansion of public transit – and its powerful associated lobbies – in three ways:

1. It's more cost-efficient and time-efficient.

To improve the way we move people, transit developments must save both time and money. Sadly, transit lines are notorious for their extraordinary costs and long delays. Data from the 2010 Census reveals that people living in central cities with a higher proportion of transit riders experience longer commutes. And since transit riders have more cumbersome commutes, they are much more likely to be tardy or absent from work.



The hefty price tag of transit projects also triggers concern. For example, the cost per new passenger of the Washington Metro line to Dulles Airport was estimated at $15,000 annually. That's about the same as the current poverty threshold for a household of two.

Car-loan programs on the other hand are largely cost-efficient, producing real fiscal benefits to borrowers, employers, and taxpayers. A survey of 4,771 borrowers and their employers finds that borrowers have greater job security as a result of access to vehicles. With access to credit, borrowers increase their purchasing power by an average of $2,900 each year and save about $250 by avoiding payday loans and checks-for-cash outlets. Employers gain as well through cost savings due to increase retention and reduced absenteeism and tardiness, which amount to $817 and $1130 per borrower respectively. In large part, providing vehicle financing is a smart investment since it reduces the number of low-income families on social welfare – an annual cost savings of $2,900 for each borrower coming off public assistance.

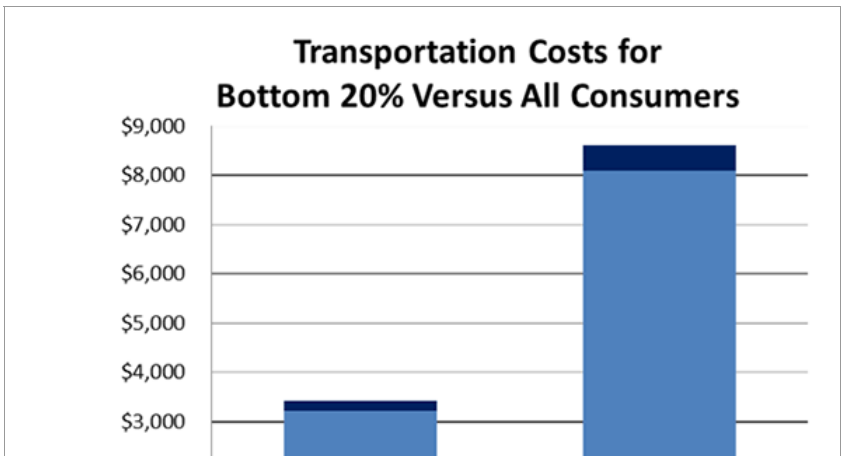
Given its clear advantages, car sharing is increasing. Recent reports find that shared-use vehicle organizations have been lucrative. Between August 2012 and July 2013, car-sharing ridership grew by 112 percent and the number of vehicles increased by 52 percent. And although car-sharing is not typically used to transport the poor, having on-demand car service makes it so that door-to-door access is more available and affordable. If car-sharing continues to grow at its current rate, it's reasonable then to assume that these pseudo-taxi services will be eventually be affordable enough so that people would choose to be chauffeured rather than drive their own vehicles.

2. Vehicle ownership provides greater access to jobs and economic opportunities.

Instead of being limited to a few areas that are transit-oriented, families with cars have access to more jobs and economic opportunities. Public transit lines are limited in their geographical coverage and take time to make often numerous stops. Transfers are inefficient and time-consuming, making much of that coverage impractical. Also regular transit riders have limited employment options since they're only able to consider jobs in the vicinity of transit stops and stations.

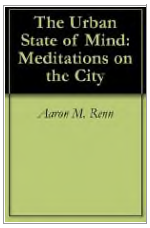
3. Travel by car is responsive to current travel patterns

A common misperception is that low-income people do not have cars. In reality, 86% of the poor have cars, compared to 95% of the entire population. The high percentage of poor families with cars reveals how automobile culture has become fixed into American ideals of economic well-being and prosperity. And contrary to stereotypes, the poor and the rich similarly spend about 94% of their transportation costs on vehicle travel versus public transit, challenging the notion that low-income travel behavior is unlike that of the rest of the population. As such, providing the poor with cars dramatically levels the playing field as they are the ones who would gain the most from increased access to employment destinations and education facilities.

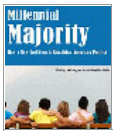


Inequality: Virtually All in Housing?
California Dreamin' or California Nightmare?
Lobbying Pays Off 500-to-1
Short Film: Emigrate
A Lifetime of Financial Advice for 2015
more

BOOKS



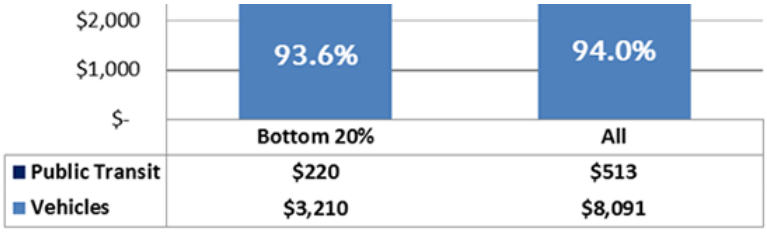
Authored by Aaron Renn, *The Urban State of Mind: Meditations on the City* is the first Urbanophile e-book, featuring provocative essays on the key issues facing our cities, including innovation, talent attraction and brain drain, global soft power, sustainability, economic development, and localism.



Download *Millennial Majority*, the new book from Morley Winograd and Michael D. Hais.

RECENT POPULAR CONTENT
Largest World Cities: 2014
Largest 1,000 Cities on Earth: World Urban Areas: 2015 Edition
China's Demographics at a Turning Point
Too Many Places Will Have too Few People
World Urban Areas Population and Density: A 2012 Update
12 Ways to Map the Midwest
California Companies Head for Greatness – Outside of California
What Is a Global City?
more

MORE FROM THIS AUTHOR
The Rise of Telework and What it Means
Mobility for the Poor: Car-Sharing, Car Loans, and the Limits of Public Transit
Will Driverless Cars Help us Drive Less?



	Bottom 20%	All
Public Transit	$220	$513
Vehicles	$3,210	$8,091

Sources: U.S. Bureau of Labor Statistics, Consumer Expenditure Survey 2008; U.S. Bureau of Labor Statistics, Consumer Expenditure Survey, Table 1: Quintile of Income Before Taxes, 1988.

A strong argument posited by public transit advocates is that as more cars use the road, congestion and pollution will intensify. And to be sure, public transit is more environmentally friendly than motor vehicles. The Amalgamated Transit Union (ATU), the largest union representing transit workers in North America, reports that one full bus eases the road of thirty-five cars, and that existing transit usage cuts national gasoline consumption by 1.4 billion gallons annually. Yet, on average, this result can only be achieved if buses were always full, which they are not – authorities from the Los Angeles Metro estimate that their buses run at an average of 42% capacity.

But is it equitable to ask the poor to forgo mobility and economic gain for the environment? Considering that most Americans experience some degree of social mobility via vehicle ownership, it's far more reasonable to allow low-income families greater access to opportunity. In addition, new fuel efficiency standards for cars set by the Obama administration will decrease overall GHG emissions substantially; according to forecasts by the Department of Energy, carbon emissions from light-duty vehicles will drop 21% between 2010 and 2040 in spite of a 40% increase in driving. This shows that, even with more cars on the road, environmental goals can be accomplished.

Although the eligibility requirements are stricter in some areas than others, every state in the U.S. has a program for low-income residents to have access to car loans. Car-sharing is also rapidly expanding, but marketing now is geared towards millennials on a budget rather than low-income families. Both innovations, however, respond to new demands faced by future workers, who are likely to find employment in dispersed locations and may make more trips per workday since many may have multiple part-time jobs. With more efficient ways of getting people to work, it's time to challenge the assumption that the expansion of public transit is the best way to meet the needs of America's hard-pressed working class.

Jeff Khau graduated from Chapman University with a degree in business entrepreneurship. Currently, he resides in Los Angeles where he is pursuing his dual-masters in urban planning and public policy at the University of Southern California.

Photo by Romana Klee, #113 zipcar.

» Email this Story | ShareThis

Subjects: Urban Issues | Middle Class | Demographics | Economics | Planning | Suburbs | Transportation | Policy

RECOMMENDED BOOKS

- The Next Hundred Million: America in 2050 By Joel Kotkin - Available Now
- The City: A Global History by Joel Kotkin
- Why is construction so backward? Co-authored by Ian Abley
- Millennial Momentum: How a New Generation Is Remaking America by Morley Winograd and Michael D. Hais
- War on the Dream: How Anti-Sprawl Policy Threatens the Quality of Life by Wendell Cox
- Remembering the Twentieth Century Limited by Matthew Stevenson
- An April Across America By Matthew Stevenson

BLOGROLL AND PARTNER SITES

- Burgh Diaspora
- Center for Economic Research and Forecasting
- China Urban Development Blog
- Chris Bradford - Austin Contrarian
- Houston Strategies
- LA Observed

- Labor Lou Siegel
- Multiplier Effect: Levy Economics Institute
- NDN
- Newsalert
- Second Shelters
- Technology and the City
- The Cost of Energy
- The Electoral Map
- The Rural Blog
- The Urbanophile
- Patrick.net - Housing Crash
- Joel Kotkin
- Praxis Strategy Group
- American Association of Retirement Communities

more

USER LOGIN

Username: *

ScottZwartz

Password: *

●●●●●●●●●●

Log in

- Request new password

LAWeekly — January 3, 2013

Change Language: Choose

Hollywood's Urban Cleansing

Patrick Range Mcdonald

12,878 MOSTLY LATINO RESIDENTS VANISH, PUSHED OUT BY CITY HALL, HIGH RENTS AND HIPSTERS

In the 1960s, Mercedes Cortes arrived in Hollywood after fleeing her homeland of Guatemala, which was roiled by bloody unrest. After moving around a bit, she and her husband and their three sons settled in a twobedroom apartment on Eleanor Avenue, a community of run-down apartment buildings and old Craftsmanstyle houses, which is a short walk from Paramount Pictures and Hollywood Forever Cemetery, where many stars are buried.

A decade later, Cortes' world was shattered again — when gang violence and drug dealing hit her beloved neighborhood. This time, the affable, soft-spoken housekeeper bravely stood her ground as Hollywood was engulfed in the wave of bloodletting that gripped Los Angeles from the mid-1980s to the mid-1990s. A small, unimposing woman, she became a visible member of Neighborhood Watch, walking the dark streets in candlelight vigils to confront the thugs.

And it worked. Cortes and her neighbors slowly won back Eleanor Avenue. She never dreamed that she'd be evicted — for being too poor to live in her improved, more livable community.

But in 2002 her apartment building changed hands during the real estate bubble, a particularly frenzied phenomenon in Hollywood, where the taxpayer-subsidized, nearly $1 billion Hollywood Redevelopment Project Area helped fueled a Wild West of land speculation, building flipping, profit-seeking — and skyrocketing rents. In 2003, projects such as the stylish face-lift of the Cinerama Dome were completed. In 2004, Cortes' new landlord told her she had to go.

"I was working and doing good things for my neighborhood and they treated me like that," Cortes says. "For what? They wanted more money."

A gracious, churchgoing woman, Cortes represents a Latino diaspora of working families priced out of Hollywood and East Hollywood, a mass departure that has fueled an unexpected — and, for City Hall, increasingly embarrassing — net population plunge of 12,878 people in those two neighborhoods between 2000 and 2010.

Hollywood, defined here as the huge flatlands roughly bounded by La Brea, Melrose, Western and Franklin avenues, has lost one in every 12 of its residents.Latinos are streaming out, as a much smaller number of higher-income whites takes their place. The Latino population plummeted 17 percent, about 6,000 adults and children gone.

East Hollywood, roughly bounded by Western, Beverly, Hollywood and Hoover, has seen a net loss of more than 5,000 Latinos.

Hollywood-area City Councilman Eric Garcetti, who is running for mayor in the March 5 primary and has for 12 years avidly led the urban renewal in Hollywood, won't discuss the census data, the outflow of Latinos or the area's net population loss, none of which were foreseen by his office. But Larry Gross, executive director of the Coalition for Economic Survival, a tenants' rights advocacy group, says, "It was an economic tsunami that pushed low-income people out. There was massive displacement." Representing more than 8 percent of Hollywood and East Hollywood's population, the exodus of nearly 13,000 mostly Latinos is believed to be the largest mass departure from an L.A. neighborhood since "black flight," between 1980 and 1990. In that demographic upheaval, 50,000 residents fled the violence and shattered neighborhoods of South Central and South Los Angeles.

Garcetti and other L.A. politicians have insisted that growth is as inevitable as summer tourists, and that City Hall is merely facilitating Hollywood's unavoidable, denser future with smart planning.But census data and the stories of those who have fled suggest that city planners and political leaders are facilitating what some criticize as the urban cleansing of Hollywood.

Father Michael Mandala, who was pastor at the landmark Blessed Sacrament Catholic Church on Sunset Boulevard from 1998 to 2011, repeatedly saw landlords drive out Latino families of three or four in order to rent the same space to one or two white tenants. "I'm wondering if the policymakers are on the mark with fixing Hollywood," Mandala says, "or are they clearing out what they don't want?"

In mid-July, the Los Angeles City Council approved a new Hollywood Community Plan championed by Garcetti, which wipes out height limits in parts of Hollywood to allow skyscrapers, some of which would obscure the Hollywood Sign. At tense public hearings, hundreds of residents decried the plans for a Century City skyline in their community.Business owners, led by the Hollywood Chamber of Commerce, were among those who cheered the City Council's decision.

Three neighborhoods group have sued the city over the new skyscraper zoning. Brad Torgan, lead attorney for those groups, describes the Hollywood Community Plan as Garcetti's personal "vision for Hollywood — good and bad." But, Torgan says, "There's a perception that the plan was created for the development community at the expense of the residents."

Garcetti, the brainy, Ivy League–educated mayoral hopeful, revealed some of his thinking in a 2010 interview with Hollywood Patch: "We staged seminars in which we brought the New York banks to Hollywood and showed them the opportunities Garcetti said. "Whatever the project's size, my philosophy is to let the creative entrepreneurs in." He added that "what we did was to use the nightlife to bring back the day life" — restaurants such as Beso, 25 Degrees, Cleo and Katsuya and night spots such as the Sayers Club, Drai's, My Studio and Eden.

Garcetti's chief of staff , Yusef Robb, waves off the flight of Latino families and individuals as a sign of their own good fortune, arguing that Hollywood's Latinos did so well during the past decade that they bought homes in "the suburbs."

"We looked into the population shift in Hollywood," Robb says, "and the situation tended to be people making choices to their own advantage."

Robb could not provide L.A. Weekly any data to back up his claim. In fact, it appears that Garcetti and his sizable Staff — about 20 full-time personal aides — are unprepared to explain what is unfolding.

Th e hollowing out of Latinos in Hollywood is particularly dramatic in the dense, L-shaped chunk of six U.S. census tracts at the heart of Hollywood — tracts 1908. 01, 1908.02, 1909.01, 1909.02,1918. 10 and 1918.20 — bordered by Western Avenue on the east, Seward Street on the west, Melrose Boulevard on the south and Sunset on the north.

Tracts 1909.01 and 1909.02 between Western, Gower, Sunset and Santa Monica Boulevard saw a net loss of 664 Latinos. Far fewer Latinos moved into than out of the neighborhood's increasingly costly apartments, condos and bungalows, resulting in a steep population decline. The same thing occurred in tracts 1908.01 and 1908.02 between Gower, Seward, Sunset and Santa Monica, where a net loss of 896 Latinos created a sharp overall population drop.

Just south of there, in tracts 1918.10 and 1918.20 bordered by Gower, Seward, Santa Monica and Melrose, a net 1,402 Latinos took off . Having lost 2,962 Latinos, the historically affordable housing in these six flatland census tracts is now a thing of the past, creating ground zero in Hollywood's working-class diaspora.

In 2000, about 80,000 people lived in Hollywood, and L.A.'s Department of Planning announced that 85,489 would live there by 2008. By 2010, only 72,000 did.

What's going on is clear enough to USC demographer Jared Sanchez. He says the data show "significant" gentrification, with wealthier households moving in — which inevitably contain fewer people than working-class households — while others get squeezed out.

Many will cheer this turn of events.Hollywood, the neighborhood, is richer, flashier and more attractive than at any time since its golden era. Hollywood Chamber of Commerce president Leron Gubler says, "We've made significant strides in cleaning up Hollywood, restoring community pride and creating a vibrant economy here in Hollywood."

Longtime Hollywood resident and Garcetti ally Ferris Wehbe says, "There has been big change in the area. Hollywood is going to soar."

The L.A. City Council in 1986 approved a 1,100-acre "redevelopment project area" with the aim of remaking Hollywood into a livable community. The nearly $1 billion Hollywood Redevelopment Plan was one of the most heavily subsidized projects in California, with taxpayers underwriting such items as a $32 million parking garage at the pricey Cinerama Dome and ArcLight Theaters and $98 million for Hollywood & Highland.Los Angeles County transportation officials broke ground in 1986 on the Red Line subway with stops along Hollywood Boulevard, at that time the haunt of heroin dealers and prostitutes.

In 1992, Leron Gubler, a soft-spoken, determined power broker, became president of the Hollywood Chamber of Commerce, which supervises the Walk of Fame and is one of the most influential champions of redevelopment. Politicians rarely run afoul of the Chamber, which counts among its members top executives from Paramount Pictures, Walt Disney Studios, real estate developer Millennium Partners, The CW television network, the Renaissance Hollywood Hotel and Hollywood & Highland.

At first, Gubler says, "We had a lot of homeless. The sidewalks were dirty.Businesses were closing left and right. … People had given up on Hollywood."

In 1993, Jackie Goldberg was elected to represent Hollywood on the City Council, and she pushed hard for redevelopment. Gubler told her that first they should focus on "nuts-andbolts" issues, which Gubler narrowed down to "crime and grime." The Chamber and Goldberg's office launched much-publicized efforts to make Hollywood's streets cleaner and safer.

But beyond the headlines, Mercedes Cortes and her neighbors were already on the job, creating a successful Neighborhood Watch that teamed up with the Los Angeles Police Department. So were many other Spanish-speaking residents, including Manny Romero, who worked as a youth organizer in unstable El Salvador, escaped that country's violent civil war, which took the lives of his family and friends in the 1980s, and moved to Los Angeles.

Romero eventually became the popular and well-respected groundskeeper at Blessed Sacrament Catholic Church, built in 1928, an important community center for Hollywood's Latino population.

In 1978, Romero moved with his wife and two children into a cheap bungalow on Las Palmas Avenue just south of Sunset. It was a few blocks west of De Longpre Park, which became a notorious cesspool of drug dealers and junkies in the late '80s and early '90s.

Romero suddenly faced a new kind of war. He went to incredible lengths to save his community, joining a neighborhood patrol group called the Hollywood Sentinels, whose members put their lives on the line by running drug dealers and gang members off of street corners.

Criminals threatened to kill Romero and his family.

"I was scared of the gang members," Romero recalls, "but it didn't stop me from doing my citizen's duties."

The Chamber's Gubler and many journalists credit the 2001 opening of the concrete elephant–bedecked Hollywood & Highland mall, where the Academy Awards are held, for initiating Hollywood's turnaround. But low-income working folks like Cortes and Romero were key figures in first steadying the community's foundation.

Romero was treated like anything but a hero. In 1996, his landlord sold the cluster of bungalows on Las Palmas Avenue, and the new owner doubled Romero's rent from $600 a month to $1,200. Romero was forced to abandon his dramatic but unsung quest to create a livable community. He and his family moved to then-affordable North Hollywood.

Five years later, in 2001, Garcetti took over from Goldberg on the City Council.He was 30, fresh-faced and eager to move forward with a new kind of politics that would put residents, not big-moneyed special interests, first.

Community activist Ferris Wehbe, who spearheaded the unsuccessful Hollywood secession movement in the early 2000s, supported Garcetti then and backs him today. "Eric played a big role" in turning around Hollywood, Wehbe says. "He saw that good changes took place. You need good leaders to make decisions and not try to please everyone."

By the mid-2000s, land speculation in Hollywood turned into a frenzy. In 2003, Ralph Horowitz and developer Larry Worchell bought historic Columbia Square on Sunset Boulevard, the West Coast home of CBS, for a reported $15 million. Three years later, Horowitz and his partner sold the property to Las Vegas–based developer Molasky Pacific for $66 million. That land flipping, and the breathtaking $51 million profit for Horowitz and Worchell, were fed by the widely held belief that Garcetti, now the powerful arbiter of what could and couldn't be built, would let developers ignore the neighborhood's longtime height limit of a few stories to build a skyscraper.

About the same time, Mercedes Cortes' landlord sold her building to Prime West Management chief executive officer Mercedes Anaya. In 2004, when the eviction notice arrived, Cortes was paying $450 a month. Although she had divorced, her three adult sons still lived with her and she enjoyed a vibrant social life as an active member of Blessed Sacrament Catholic Church.

She drove each day to clean houses in West Hollywood or Beverly Hills. At 61, she fought eviction. She eventually won a settlement that paid her some "relocation" expenses, and she and two of her sons found a place far from home, in North Hollywood.

About 20 of her Latino friends and acquaintances were similarly pushed out of Hollywood, she says. A neighbor still living in the flatlands recently told Cortes that her old $450 rental now goes for $1,200.

In the legal battle that ensued, Anaya claimed in 2004 that Cortes' sons were heavy-drinking gang members and nuisances. When that didn't work, says Cortes' lawyer Marty O'Toole, Anaya's lawyers claimed that Cortes didn't respond to a three-day notice that demanded she pay her rent or vacate.The landlord did not respond to emails requesting comment.

During the six-month legal battle to keep her apartment, Cortes formed a prayer group with her friends at Blessed Sacrament. "I was asking for justice," she recalls. "Because if I lost the case, I would've been in the streets."

Her prayers were partly answered. Just before the trial, Anaya's lawyers offered Cortes five months of free rent and several thousand dollars if she moved out.Emotionally drained, she took the deal.

Not long after her battle, several blocks away, Roy Maule and his Latino neighbors faced their own war against eviction on tree-lined Camerford Avenue in a quaint bungalow complex built in 1912 for actors working at Paramount Pictures.

Many of Maule's neighbors — mostly Latino families — had lived on the quiet block, near tony Larchmont Village, for decades. "It was great," says Maule."Everyone knew each other."

They traditionally closed the street to celebrate Fourth of July, with adults lighting fireworks and kids running around. One day, a young man walked up to Maule's mailbox and snatched a package sticking out of it. Maule's neighbors, he recalls, "gave chase, got the package and beat up the guy. … The poor guy didn't know he was in a neighborhood like that."

But the property was sold, and around 2006, the landlord made clear he wanted the families gone. Neighbors from Mexico and Central America told Maule that the landlord had threatened to make calls to federal immigration officials.Other tenants were offered money to leave.

But Maule hired a lawyer to fight his eviction and wrote to Garcetti's office for help. He did his own homework, finding in a title search that Santa Monica-based developer Watt Genton Associates owned the property.

Maule says Garcetti "did nothing," and at least 150 people were displaced from the bungalows and adjacent apartment units. In 2007, Maule was paid relocation money to leave, and the city put its political weight behind the developer, with the City Planning Commission and Garcetti backing his demolition of the historic bungalows and newer apartment buildings to create luxury condos for affluent professionals.

Today, the corner property stands barren, a victim of the economic disaster that struck the nation, and the historic bungalows are long destroyed. A new plan calls for a luxury apartment complex with ground-floor retail. Developer Jonathan Genton and Watt Commercial Properties executives declined to take questions from the Weekly.

"Here it is five years later," Maule says.
"There's nothing."

Manny Romero says it's a maddening scenario he has seen over and over In Hollywood: "There are many, many people like us."

At 41, having served as Hollywood's councilman and the area's chief landuse visionary and community policymaker for nearly 12 years of his life, Eric Garcetti wants to become the 42nd mayor of Los Angeles. He is clearly proud of Hollywood's turnaround and its bustling nightlife scene. In fact, Garcetti has publicly said that he wants to replicate Hollywood's style of urban renewal across communities in Los Angeles.

Driving out thousands of Latino working and poor families in favor of affluent residents and high-end restaurants is not

part of his pitch.

"L.A. is full of bad planning," Garcetti said at a recent mayoral debate in Hollywood with rival candidates Wendy Greuel, Jan Perry and Kevin James."You look at places where there are four jobs for every one unit of housing, and wonder why they're stuck in traffic. Hollywood has become a template for a new Los Angeles."

Except Hollywood's traffic is immeasurably worse than when Garcetti was elected to represent the area, even though one-twelfth of the population has left. For all their planning, the City Council, Los Angeles Planning Department and Garcetti have brought mass congestion to a residential community that is shrinking, not growing.

Gary Slossberg, a public-interest attorney who represents low-income clients and who ran for City Council against Garcetti in 2009, says, "A lot of his policies don't match what's best for the people in Los Angeles, but a lot of people are getting rich." Garcetti has raised nearly $3 million for his mayoral bid by promising "bold, new ideas" and calling for the need to create more jobs for working families.

Now a well-known whistleblower who tracks the sweetheart deals often granted to developers, Kruse sees Garcetti as a cold figure who is in denial about the high-end development he embraces.

There's palpable resentment among Kruse and other activists toward Garcetti, who was raised in an upperclass household in Encino and whose life has been eased by a bequest of property that provided him thousands of dollars in annual income starting when he was a young man.

Kruse says Garcetti "has gone more times against the community than with the community," backing zoning variances and other exceptions that let developers ignore protective zoning laws, and supporting what Kruse sees as too-generous taxpayer subsidies. "The only time he goes with the community," she says, "is when it's a politically smart move."

Now, Garcetti is wooing Latinos to elect him as mayor, even controversially claiming that he is a Latino candidate.

Garcetti has no Latino ancestry. His great-grandfather was Italian; he moved the family from Europe to Mexico, where Garcetti's paternal grandparents were born and raised before the family emigrated again, to Los Angeles.

Romero, the groundskeeper at Blessed Sacrament Catholic Church, has found the councilman to be "a nice person to talk to but different when you want to solve a problem."

Such sentiments could pose a problem for Garcetti in the mayoral race. But he still has a deep well of voter support in Hollywood, having been easily re-elected more than once.

Many people welcome the changes Garcetti has pushed through.

"Development has been great for Hollywood," says Laurie Goldman, president of Friends of the Hollywood Central Park, a nonprofit that's pushing an effort to build a park over the 101 Freeway. The neighborhood has improved so much, Goldman says, that she wants to move back to where she once lived, but "it's too expensive. My rent is cheaper in Beverly Hills."

Wehbe, a longtime resident who walked the streets with the Hollywood Sentinels in the early 1990s, is more than happy with Garcetti's policies. Of Hollywood's transformation, he says, "It's day and night. It's amazing. You can walk around at any given time. Back then, you couldn't get out of your house."

Manny Romero chuckles when he hears such talk, repeating an old saying: "El saluda con sombrero ajeno." The church groundskeeper, who faced down violent gang members on Hollywood street corners before Garcetti's time, says the phrase essentially means that "someone else does the job and the person who's the opportunist takes the credit."

Hollywood historian Greg Williams also gives voice to residents who are not pleased with Garcetti's sleek vision. "It's really bad development," says Williams, who was born and raised in the community."There's no variety. It's the same mixed-use with retail on the bottom floor and condos on top." He's come to see Garcetti as "totally in the developers' pockets. He's not for the preservation of old Hollywood."

Robb, the aide speaking on behalf of the unavailable Garcetti, strongly disputes that notion. "What developers tell us is that community activists have too much of a say" in Garcetti's decision making. Robb says his boss completely supports preserving old Hollywood, while looking to the future. "It's always been about taking what Hollywood offers," Robb says, "and enhancing it."

But when asked by the Weekly, Garcetti's staff could not provide basic figures that might shed light on what their enhancement efforts have produced.Garcetti's team does not know how many "affordable" housing units have been built in Hollywood, or the total amount of housing built or lost, since 2001. Nor could Garcetti's aides, whose salaries and overhead cost L.A. taxpayers about $1.5 million a year, provide the Weekly even a ballpark figure for how much taxpayer money has subsidized Hollywood's makeover since 2001.

Robb says one of Garcetti's top priorities has always been affordable housing.Yet Barbara Schultz, the directing attorney of the housing unit at the Legal Aid Foundation of Los Angeles, which helps working-class and poor people in disputes involving housing rights and landlord-tenant disagreements, says Garcetti hasn't stood out. In fact, Schultz says, "There's not any top council member whose top priority is affordable housing."

Dennis Frenchman, a well-regarded professor of urban design and planning at the Massachusetts Institute of Technology, says smart policymakers always know how their planning strategies are playing out in communities. "They should have a sense of demographic changes and what's been happening," says Frenchman, one of the world's leading experts on building and maintaining a sustainable city. "They should know if people have been pushed out.

Father Mandala knows what is happening at the neighborhood level. He has seen his mostly Latino parishioners leave

Hollywood, while the Latino population grew in the rest of the city. He has seen parents take their kids out of Blessed Sacrament Elementary School.Between 2000 and 2010, student enrollment at that grade school plummeted from 250 to 100.

Contrary to Yusef Robb's claim, Mandala says these people did not want to leave. "If they could have bought a home in Hollywood," says the priest, "they would have. … It's bad for Hollywood because if your goal is to have a mixedincome community, you're losing taxpaying citizens. These are the teachers, the contractors, the furniture makers of the community."

Wehbe argues that Garcetti is very connected to what's happening, declaring, "I bet you anything there isn't a single councilmember who walks the neighborhoods every month and knocks on doors like Eric. To me, that's saying something."

But Dowell Myers, a demographer and urban planning professor at the USC Sol Price School of Public Policy, who researched Los Angeles County's shrinking youth population, predicts that Hollywood's schools will drop in enrollment and Hollywood will become less family-oriented, with more of an emphasis on nightlife. That means fewer families will be around to keep an eye on the neighborhood. "They help to keep streets safer," Myers says.

Garcetti aide Robb said in a recent L.A. Weekly story reporting on the rise of Koreatown that Garcetti is not necessarily interested in duplicating Hollywood's urban-renewal template in Koreatown.Robb warned, "A robust nightlife is good for the economy, but too many night spots in a neighborhood can create dead spots during the day" and community "balance" is needed.

Myers says L.A. political leaders and planners have already gone too far to draw a high-end crowd to Hollywood."We don't need more condos," he says."We need more rentals. Rentals are where you house lower-income and poor people."

Frenchman has a similar message for Los Angeles' leaders: "Diversity is the key to long-term sustainability. … Density without diversity makes things worse."

Mercedes Cortes sits in a back room of Blessed Sacrament Catholic Church on Sunset while trumpets in a mariachi band sound off for a mass celebrating the feast day of Our Lady of Guadalupe.Like some parishioners, Cortes still drives in from the Valley to Hollywood to worship, and the church is jammed with Latino parents and children.

But not everyone returns to Hollywood."That's why we lost so many members of the church," Cortes says. "They moved to Palmdale, North Hollywood and Burbank" — but not because they were better off . Instead, many doubled up with relatives as the recession bore down.

Hollywood's business community often says that the catalyst that really set off development in Hollywood was Councilwoman Jackie Goldberg's pet project, the Hollywood & Highland mall, which houses the Kodak Theatre (now Dolby Theater), home to the Academy Awards show.

But Cortes says the glitzy, architecturally unloved mall has had a more complex long-term effect on the bigger neighborhood around it: "Once the Kodak Theatre was built," Cortes says, "we started seeing the rents going higher and higher."

Cortes generally likes Eric Garcetti, but she noticed a difference between him and his predecessor, Goldberg. Goldberg at least got involved in the community without prodding or protest, she recalls.

Garcetti, according to Cortes, did not seek out members of her activist group but waited for them to complain.

As if talking directly to Garcetti, the grandmother and retired house cleaner delivers up one of their complaints, still unanswered after all these years: "When they start to build something, why does the middle class have to suffer for that?"

Reach the writer at pmcdonald@laweekly.Com.

VIEW ALL ARTICLES

LA WEEKLY

CITY HALL'S "DENSITY HAWKS" ARE CHANGING L.A.'S DNA

Bitter homes & gardens?

BY STEVEN LEIGH MORRIS, Wednesday, February 27, 2008

http://www.laweekly.com/index3.php?option=com_content&task=view&id=18410&Itemid=2&pop=1&page=0

Soon after taking the job of director of the Los Angeles Department of City Planning in 2006, Gail Goldberg made a declaration that let slip how City Hall is allowing developers to pursue a building frenzy straight out of the storied tale *Chinatown*.

"What have you done? The whole thing's a fraud." —County Supervisor Zev Yaroslavsky, on City Hall's claim that high-rises create affordable housing

"There's really no secret plan here." —City planner Jane Blumenfeld

“All I ask is, don’t scare people into paralysis.” —City Planning Director Gail Goldberg, about media coverage of her office’s activities

Said Goldberg, newly arrived here from a similar post in San Diego:

"In every city in this country, the zone on the land establishes the value of the land. In Los Angeles, that's not true.

"The value of the land is not based on what the zone says ... It's based on what [the] developer believes he can change the zone to.

"This is disastrous for the city.

"Disastrous.

"Zoning has to mean something in this city."

Goldberg probably wishes she hadn't said that, not necessarily because she got reprimanded by L.A.'s famously vindictive Mayor Antonio Villaraigosa, but because Los Angeles County Supervisor Zev Yaroslavksy has repeated her words in public, over and over. Yaroslavsky, who represented the city's affluent Westside District 5 as a councilman until 1994, has been staging a one-man campaign to slow City Hall's feverish promotion of density — a quiet war on the large swaths of suburbia and few hunks of countryside remaining inside the city limits.

With little debate, a trio of new "density enabling" ordinances (a real mouthful, known as the Downtown Ordinance, the Parking Reduction Ordinance and the Senate Bill 1818 Implementation Ordinance) has rolled through Goldberg's Planning Department and ended up in the ornate council chambers on City Hall's second floor.

The first two were easily approved, and the SB 1818 Implementation Ordinance passed on February 20, with only council members Dennis Zine, Janice Hahn, Bill Rosendahl and Tom LaBonge opposed. On paper, the three ordinances will let developers bypass the city's fundamental zoning protections — and profoundly alter the livability, look and essence of L.A.

This is no small thing. The rules for how Angelenos wanted to fashion their city were arduously, sometimes bitterly, negotiated among homeowners, developers, environmentalists and politicians in the mid-'80s, led by then city councilmen Joel Wachs, Marvin Braude and Yaroslavsky. Those core rules today hold tremendous power, creating a blueprint that dictates which Los Angeles neighborhoods should be preserved — and which should be dramatically built up.

Yet in contrast to the boisterous civic debate launched by city and community leaders in the 1980s, the Villaraigosa administration has grown accustomed to only tepid public interference and awareness. Through aide Gil Duran, the mayor has for five months ducked *L.A. Weekly*'s routine questions about his agenda's potential consequences citywide — much taller and fatter residential buildings than zoning law allows, significantly less green space, obliteration of residential parking in some complexes and removal of older, less expensive housing. (Hours before the *Weekly* went to press, Deputy Mayor Helmi Hisserich finally responded, lashing out at "heads in the sand" sentiments and warning that "the city is not going to stop growing.")

On the City Council itself, the likes of Wachs and Braude are long gone, replaced by avidly prodensity council members such as Jan Perry, Council President Eric Garcetti and Wendy Gruel, who rarely say no to grand construction plans and work in tandem with obscure

regional planning commissions that routinely override zoning rules in favor of developers and property owners.

Yaroslavsky, silent for the first two years of Villaraigosa's reign, now snaps, "These density hawks at City Hall are trying to undo 20 years of our work."

The constant overriding of zoning protections has indeed been relentless — a binge of "zoning variances" and "zone changes" granted by longtime Zoning Administrator Michael LoGrande, a little-known official who is the rear admiral of a prodensity flotilla inside City Hall that long predates Villaraigosa's administration.

The variances and zone changes — quite simply, permissions to skirt existing rules — are granted on a case-by-case basis, and LoGrande hands them out like candy. LoGrande did not return numerous phone calls from the *Weekly*. Four biweekly Planning Department reports, randomly selected by the *Weekly* from March, June, September and December 2007, show that requests to increase housing density or square footage rolled in at about 260 annually, slowing only as the mortgage crisis hit. Retired Zoning Administrator Jon Perica explains that while the sought-after density increases are subjected to design, environmental and compatibility review, "the Planning Department historically approves about 90 percent."

For anyone paying attention, and very few people are, LoGrande's decisions — buttressed by the rulings of seven area planning commissions populated with Villaraigosa's appointees — are why some corners of the city are taller and more congested than 10 years ago, even neighborhoods whose legally binding zoning plans were supposed to achieve the opposite.

In the 1960s, a city growth cap of 4.2 million was established as the peak load for Los Angeles' infrastructure and services. This allowed for urban centers like Century City, Warner Center and downtown, while protecting single-family neighborhoods. Three years ago, Perica warned, "growth beyond 4.2 million people would require that existing single-family neighborhoods and lower-density residential areas would have to be 'up-zoned' in the future for more intense multistory density." He added pointedly, "Residents didn't want Los Angeles to look like other higher-density Eastern cities, like Chicago and New York."

Nonetheless, the agendas of builders, land speculators, the chambers of commerce, the Planning Department and elected leaders have produced a virtually nondebated tectonic shift since the residential real estate turnaround of 2002, much increased under Villaraigosa. The shift is pushing L.A. from its suburban model of single-family homes with gardens or pools — the reason many come here — toward an urban template of shrinking green patches and multistory buildings of mostly renters.

To be sure, not everyone sees this in the negative light that people such as *The New Geography* author and social critic Joel Kotkin ("We remain an increasingly suburban nation") and Yaroslavsky do. Downtown developer Tom Gilmore scoffs that Kotkin and other defenders of suburbia and single-family dwellings "take that notion of urbanism and say, 'Oh my god, they're going to do that to your neighborhood too! They're going to make everything a "heat island"!'"

To Gilmore, the attitude in Ventura County and cities such as Santa Barbara, Rohnert Park, Sonoma, Healdsburg, Tracy and Dublin, all of which have enacted residential-growth limits to stop urbanization, denies the inevitable.

“Oh my god, they’re going to do that to your neighborhood!” —Developer Tom Gilmore, mocking those who are worried

"Growth is not an option," says Gilmore. "We can grow with care, with thought and creativity, or we can grow the way we've grown for 150 years. I don't think the Planning Department has got it all right, but I'm happy they've got a template we can argue about."

But his notion of a grand civic debate under way is a facade. The public have little idea what is being allowed even in their immediate area. Downtown insiders such as Ed Reyes — a city councilman and chairman of the powerful Planning and Land Use Management Committee — working with Villaraigosa's handpicked department heads like Goldberg and mayoral appointees like former Councilman Mike Woo (on the Planning Commission) aren't engaging Angelenos in any serious discussion of their "template." And the mayor is assiduously avoiding a public debate in which he might be forced to justify his vision.

Their template could force urbanism onto all but the most protected enclaves of Los Angeles. The truly protected spots are "R1-zoned" — or single-family-residential only — 318,602 of the city's roughly 1.4 million housing units. The other 75-plus percent of housing units in Los Angeles — including thousands of homes in single-family neighborhoods that residents assume are R1 when they are not — could potentially be "up-zoned" for apartment towers and condos. Some of the most vulnerable areas are the eastern and western ends of the San Fernando Valley — the last quadrants containing some open space.

Of 16,874 housing units built the year after Villaraigosa was elected, 86 percent were multifamily — the vast majority of those rentals. Established homeowner neighborhoods — the glue that historian and former California State Librarian Kevin Starr once noted helped hold L.A. together, even in bad times — are an afterthought; the Brookings Institute reports that L.A. is suffering a middle-class decline more pronounced than in any other urban area in America.

To be fair, some of the mayor's focus has been on truly "underutilized" areas — nearly 100 developments of 100,000 square feet or larger are proposed or approved on sites like the old Sears warehouse in Boyle Heights, land in Marlton Square in South Los Angeles, and the aging Valley Plaza in North Hollywood. Councilwoman Gruel and Council President Garcetti tout this "proactive lead from the mayor."

But there's another side: Around Vanowen and Balboa in the San Fernando Valley over the past decade, ranch homes on spacious lots have made way for apartments, condos or McMansions. Hillsides from Hollywood to Mount Washington are so overbuilt that cars are ordered off the streets on "red-flag days." Along Miracle Mile, beautiful Spanish Colonial duplexes that since the 1920s have housed middle-class families sit unprotected from the urbanization steamroller.

Zev Yaroslavsky is a shrewd, politically left-of-center politician and a "slow growth" advocate with two adult children. Now 59, he's been married to health-care and child-care activist Barbara Yaroslavsky for 36 years. Born in Boyle Heights, then home to Jewish immigrants, Yaroslavsky grew up in the Fairfax District, ran track at Fairfax High, and put himself through UCLA (he has a master's in British imperial history) by teaching Hebrew in Long Beach — and playing professional poker.

He knew the gambling had to stop when he was elected to the City Council in 1975. Before he was sworn in, he paid a last visit to his favorite Gardena casino, the Normandie, sidling up to a group of Jewish matrons who said, "Zev, we know you're going to be an honest politician because you never bluff." He remembers thinking, "No, I just look like I never bluff."

Today, he says Los Angeles desperately needs a subway to the sea. But 23 years ago, he and others raised safety concerns about tunneling under the Westside after a 1985 explosion of naturally occurring methane gas ripped through the Ross Dress for Less near Fairfax. Although Yaroslavsky is sometimes blamed for halting federal funds for the line, he called for further safety studies, while Westside Congressman Henry Waxman led the fight to stop federal funds.*

For his part, Yaroslavsky in 1998 led a successful ballot effort that stopped local sales taxes from being used on the increasingly pricey subway being built under Hollywood. He instead pushed to use those funds for non-subway transit projects.*

Longtime Westsiders remember it was Yaroslavsky who ushered through the huge expansion of the Westside Pavilion in 1986, despite community outrage over gridlock. Developer Gilmore is one of many pro-growthers who blame "Zev" for so disrupting the old mass-transit scheme that today the Westside is "incredibly dense" and has "the worst traffic in the city," but Yaroslavsky tires of getting blamed for inevitable development pressures in his former Council District 5.

It is, after all, some of the city's priciest and most sought-after housing real estate, running from Palms to Encino and including Westwood and UCLA. It's something of a City Hall tradition to blame Yaroslavsky: Even back in 1987, Mayor Tom Bradley's spokesman Fred MacFarlane, in *The New York Times*, blamed the congestion on him. In the same story, an L.A. businessman noted, "Right now, any slow-growth candidate who does not get arrested for molesting children can get elected." But how times have changed.

Yaroslavsky counters today's dominant voice of pro-growthers in City Hall by saying that had he not halted the $300-million-per-mile subway, Los Angeles could never have afforded to create the popular Orange Line bus lanes in the Valley or the Gold Line light rail from downtown to Pasadena. Sounding like the old Yaroslavsky, he tells the *Weekly*, "In all corners of the city, a revolution is brewing against the pack mentality at City Hall."

One of the issues that most sticks in his craw is the aforementioned SB 1818 Implementation Ordinance. Not exactly a household phrase, the ordinance lets developers build new apartment buildings 35 percent larger than the protective local zoning allows — if developers agree to include some below-market "affordable" units in these buildings.

But does it actually produce cheaper housing — its main aim? Yaroslavsky points to a development on Sepulveda in Westwood where a developer wiped out 31 apartments rented mostly to UCLA students for $1,500, erecting 59 condos with mortgages of about $3,000 a month. He recalls scornfully, "The developer says to me, 'Those [$1,500-a-month] units weren't affordable anyway.'" Yaroslavsky retorted, "How many of those students can afford your condos after they graduate?" And the trend is spreading. In Miracle Mile, he says, "On

Ridgeley and Sixth, there's four parcels of rent-controlled units. One day I'm jogging there, and they're gone!"

Under the SB 1818 Implementation Ordinance, the now-destroyed lower-cost apartments on Ridgeley and Sixth can be replaced with a luxury tower that ignores low-growth zoning — as long as the owner agrees to rent 10 to 20 percent of the apartments at "affordable" prices. The developer can now charge the current market rate (of about $2,300 a month for a two-bedroom apartment) for the rest of the units he builds at Ridgeley and Sixth — far higher than the rents in the now-destroyed building, and enough for a mortgage in most cities.

Fumes Yaroslavsky of this "affordable" housing, "The whole thing's a fraud. It's a wolf in sheep's clothing."

Yaroslavky's passion dates from the mid-'80s, when homeowners associations howled at a wave of construction from Hauser Boulevard to La Brea Avenue on both sides of Sixth Street in Miracle Mile that destroyed beloved, picturesque Spanish Colonial rentals boasting wrought-iron staircases, cozy alcoves and tile work from the 1920s.

The Bradley administration's urbanization frenzy ushered in shoddy, higher-density, four- and five-story apartment blocks with quickly decaying stucco veneers that looked like they'd been airlifted from Beirut. Indignation generated a wave of grassroots activism. Groups such as the Detroit Street Coalition and Not Yet New York pressured avidly pro-growth City Council President John Ferraro, and Bradley, to protect neighborhoods.

Angry citizens won a huge victory with approval of 35 legally binding land-use plans citywide, now known as "Community Plans." Largely shaped by residents, Community Plans made it harder for developers to roll through medium-density neighborhoods such as Miracle Mile. Community Plans protected the suburban character of low-density areas being eyed by developers near big streets like Florence, Reseda, Vanowen, La Brea and South Broadway.

But here's the clincher: SB 1818 trumps restrictions built into the Community Plans because it's state law. Each Community Plan is slowly being revisited by the Planning Department in negotiations among homeowners, renters, business owners and city planners, so that neighborhoods conform to projected growth. Right now, 12 city planners (plus support staff) are redoing a big batch of Community Plans including Boyle Heights, Central City, Granada Hills, Hollywood, San Pedro, South Central (redubbed Southeast), South L.A., Sunland-Tujunga, Sylmar, West Adams, West L.A. and Westlake.

In this top-down process, the Planning Department contacts each affected neighborhood council (after notifying the City Council member who oversees that neighborhood) that changes are in the wind — usually to densify the neighborhood.

Some areas face unusually dramatic growth, not because their Community Plan calls for it, but because city planners got $1 million from the prodevelopment Southern California Association of Governments, combined with Proposition A transportation funds and property taxes, to research and plan extremely dense new neighborhoods near train stations in mostly poor areas along Exposition Boulevard in South Los Angeles, along Soto and Indiana streets on the Eastside, and near Gold Line stations in Chinatown, Lincoln Heights and Cypress Park.

Wes Joe, of the Silver Lake Neighborhood Council, says that his Community Plan was rewritten in 2004, just before Goldberg got here from San Diego, so Silver Lake won't be up for review for some time. Joe says city officials contacted one in five Silver Lake households that year to help redo the Community Plan, and those meetings drew the "usual array of Anglo homeowners" in a neighborhood that's also heavily Latino. Steve Leffert, the president

of Lake Balboa Neighborhood Council in the Valley, says that Lake Balboa's two adjacent Community Plans were rewritten in 1993 and 1994, and he's heard nothing from the Planning Department — yet.

The ostensible purpose of Community Plans is to manage the growth that is now officially capped at 4.2 million before city services — like sewerage and local roads — are strained beyond capacity. Perica points out that the current population of 3.9 million doesn't include the 300,000 to 400,000 undocumented residents who make up 10 percent of the city, some living in 50,000 to 70,000 illegally adapted garages and storage spaces, according to the Department of Building and Safety. "Keep that in mind the next time you're stuck in traffic," Perica says. And the planning that exists for that shadow population doesn't begin to address the scale of the problem.

Some residents are stunned by the way the city is trying to circumvent the intent of the Yaroslavksy-sponsored slow-growth measure known as Proposition U, embraced in a landslide vote in 1986, which cut in half the size of buildings allowed on commercial strips adjacent to residential areas.

Voters ushered in Prop. U after then Mayor Bradley, Council President Ferraro and prodeveloper council members like Pat Russell embraced wildly inappropriate projects. Westwood Village was targeted for massive growth, and a huge trash-burning facility, Lancer, was pushed in South L.A. One flash point came with the $43 million, six-story Encino Terrace Center office tower, which now looms over an attractive Encino neighborhood, wiping out privacy below and casting a permanent shadow.

Prop. U aside, North Hollywood and Hollywood are now targeted for 20-to-35-story skyscrapers that include a mix of residential on the upper floors and commercial on the bottom. The 35-story Columbia Square building will tower over Sunset Boulevard at Gower Street. Such skyscrapers represent dramatic — and virtually undebated — departures for Hollywood and the Valley. Neither skyscraper site is protected by Prop. U, which doesn't apply to Hollywood, downtown or the Metro Rail site in North Hollywood.

Beyond what's in store for Hollywood and the Valley, Yaroslavsky also believes that the SB 1818 Implementation Ordinance places treasured, low-slung neighborhoods such as the Fairfax District's historic rental corridor at risk. But since the mayor is ducking public discussion, Yaroslavsky, a powerful elected official, finds himself instead debating two little-known, if influential, city employees who serve at Villaraigosa's pleasure — Goldberg and Senior City Planner Jane Blumenfeld.

"This is where Gail Goldberg is missing the boat," Yaroslavsky explains of the threats to established, steady neighborhoods. For example, in the Fairfax District, where SB 1818's incentives allow developers to blow past existing zoning, "You've just increased the chance of demolition and redevelopment from impossible to probable."

Though Goldberg counters that the new law doesn't threaten the Fairfax District, in a moment of candor she agrees that SB 1818 is an unavoidable state law that's "a terrible fit for Los Angeles." Blumenfeld, too, concedes that it's "draconian ... but we're trying to make it work."

But Yaroslavsky says it was Blumenfeld, not the state, who pushed the new densities well beyond the state requirements to "35 percent more density," and Blumenfeld then "laid out all the 'findings' to approve it."

Villaraigosa isn't part of this growing rancor. His own views are unknown, aside from his repetitive claim that the "construction crane is the official bird" for Los Angeles.

Meet Jane Blumenfeld, the object of Yaroslavsky's scorn and senior planner for the city of Los Angeles. After receiving her bachelor's in history from the University of Wisconsin, and then a master's in city planning from the University of Pennsylvania, she came here in 1978, working as a planning adviser for Mayor Bradley, just as young Councilman Yaroslavsky was ushering through Prop. U to halt commercial high-rises near homes.

After spending some years in the real estate business, Blumenfeld worked as chief of staff to former Councilman Mike Feuer, then rejoined the Planning Department in 2001. A small woman with a quick wit propelled by spurts of sarcasm, Blumenfeld appears a bit stunned by the charges Yaroslavsky lodges against her, like an elf reacting to the roar of a bear.

"All right ... all right," she says calmly. "Let's just take a look at *his* work."

Blumenfeld leads me through a maze of hallways in City Hall, to an inner office where she points to a color-coded map. "See that?" she says, pointing out that 83 percent of the commercial parcels in the city are marked — indicating Prop. U is in force. "It's not physically possible to build growth there, because Zev has blocked it with Proposition U."

But that's not true. In 2002, under Mayor James Hahn and with virtually no public scrutiny, the City Council watered down Prop. U, creating a new land zone confusingly dubbed "Residential Accessory Services." In such zones, projects can be doubled in size if the developer merely agrees to mix housing units with businesses. In another nod to developers, and calling it "smart growth," the council decided that projects with "affordable" housing can be one-third bigger than permitted if they are within 1,500 feet of a bus stop. Together with SB 1818, much of L.A. is now open to multistory construction. (Click here to download PDF of the map.)

To Blumenfeld, those neighborhoods are underutilized "transit corridors." She also denies Yaroslavsky's charge that Fairfax — as well as other stable villages that make up L.A. — is threatened by SB 1818. Developers still find that "land is expensive, lumber is expensive. The [state] law's been in effect for almost three years, but we've not seen any projects on Fairfax."

"So why write these incentives into the new law?" Yaroslavsky retorts. "The city can't keep talking out of both sides of its mouth."

City leaders first learned of plans to mandate denser California cities in a 1996 memo from the State Department of Housing and Community Development. But Yaroslavsky insists he didn't hear about SB 1818 until last summer, when a mole from the city's Planning Department leaked him a draft of the plan for apartment buildings 35 percent bigger than allowed.

"We were appalled," Yaroslavsky says. So the county supervisor again became the town crier. Prodensity groups begrudgingly credit him for pressuring the council to ban these higher buildings next to or across alleys from R1 (single family) homes. But other neighborhood protections, such as a lengthy appeals process, were stripped away.

"This all comes from the stupidity of doing these things behind closed doors," Yaroslavsky says. "Now everybody's weighing in. They didn't know what was going on. Now the Silver Lake Neighborhood Council is picking this all apart, and rightly so."

On hearing Yaroslavsky's version, Blumenfeld rolls her eyes.

"There's really no secret plans here," she says. "We don't do anything in this department that's not superpublic and transparent, and nobody knows better than Zev the steps we go through to adopt an ordinance. There were many, many public hearings."

She cites a series of committee meetings, describing them as poorly attended: "'Wow! A plan to implement SB 1818! Let me give up my Saturday to go to this!'"

In fact, Angelenos don't have a clue what's been happening, or what's coming. In the 32 months since Villaraigosa was elected, for example, the *Los Angeles Times* and the *Daily News* have written only four stories about a plan to allow apartments without parking in order to squeeze in more units. The phrase "SB 1818" has appeared in just 14 articles. The mayor's czar of zoning variances, Michael LoGrande, is virtually unknown — mentioned just six times in Los Angeles print media in the past two years. And the "superpublic" hearings cited by Blumenfeld were attended almost exclusively by lobbyists, a few activists and the occasional curious neighbor.

"There should be a debate!" Yaroslavsky wheezes, a victim of allergies, dabbing his nose with a handkerchief.

"The proponents of the density hawks, including the director of the Planning Department, and the real estate industry, and the L.A. Area Chamber of Commerce — they had the audacity to say that they negotiated the plan [with homeowners]. Not true, there wasn't one neighborhood group that knew about it!"

Now meet Gail Goldberg, Blumenfeld's boss and philosophical cousin, and the other object of Yaroslavsky's discontent. On a Friday at 8:20 a.m., I step out of a City Hall elevator on the fifth floor, walking down an imposing corridor. There stand the double doors to the offices of the director of the Planning Department, Goldberg.

More than 30 feet back from the unattended public counter sits Goldberg's assistant, Lily Quan, the only person in the vast reception area at that hour. She looks up. "May I help you?"

"I'm with the *L.A. Weekly*, and I just got stood up by the planning director for an 8 a.m. meeting at Starbucks."

Quan offers an expression of withering condescension. "I think you're confused," she says slowly, as if to a mentally impaired person. "Your meeting is scheduled for next Friday."

"I have a copy of the e-mail, sent by you, confirming the meeting for this morning."

Quan consults her computer, tapping buttons.

"Looks like we made a mistake," she concedes. "Sorry ... She's got a 9 a.m. appointment, so you'd only have half an hour."

"That," I say, "would be a good start," pondering how the Planning Department could have so much trouble planning a cup of coffee.

At 8:35, Quan ushers me down a small hallway. Goldberg graciously rises from the seat behind her desk to apologize, greeting me in a manner that is both warm and — since we are in City Hall — imperious.

"So what have I read of yours lately?" she asks.

"You would probably have a better idea of that than me."

"What I mean is, what have you written that might have annoyed me?"

In fact, I had recently authored a piece on the city's "Parking Reduction Ordinance," which lets developers of apartments and condos near train stations and bus stops get a waiver from the city's minimum parking-space requirements. In a radical departure, the city could allow big apartments to be constructed without parking spaces. The developer need only prove he is providing a vaguely imagined "alternative means" of transportation — potentially, anything from carpool programs to bicycle racks to walking canes and foot balm — that a local city-zoning administrator feels is a "viable alternative" to driving.

The "public-transit promoting" Parking Reduction Ordinance is not going over well with some of the very few Los Angeles residents who have heard of it.

The Silver Lake Neighborhood Council says that, among other things, the reduced-parking ordinance will eventually punish the working poor (who actually use public transit), helping to prod them out of neighborhoods where hipster, "transit-oriented" projects lacking parking would almost inevitably be paired with luxury rentals.

Developer Gilmore insists the parking-reduction waiver isn't aimed at "what's happening in Silver Lake today, but what it will look like in 20 to 30 years." Yaroslavsky responds, "I don't think Gail [Goldberg] has a clue as to the impact of what these 'incentives' will be."

When residents of Los Angeles hammered out 35 Community Plans to direct what should happen in the city's loosely connected villages, those plans did not include luxury apartments without parking or skyscraper apartments looming over neighborhoods.

"Good planning has to lead, not follow," Goldberg explains, of City Hall's quiet push to amend those Community Plans, a process she insists will emphasize the need to work together. "We need to get in front of the process with Community Plans, which we're creating right now."

Twenty years ago, Robin Kramer, then chief of staff to Eastside City Councilman Richard Alatorre, told *The New York Times*, in an almost identical comment, that the key question was how City Hall could "best manage the growth and lead it." Now Kramer is back, again as a chief of staff — but this time to Villaraigosa.

At 9 a.m., as Goldberg is preparing to greet members of the Downtown Planning Commission, she advises me of my civic responsibility as a journalist regarding the density debate:

"All I ask is that you don't scare people into paralysis."

The apartment-construction binge began in 2002 but dates to 1993, when the Planning Department, under newly elected Mayor Richard Riordan, rolled out the new-housing component of its General Plan. Although dozens of Community Plans attempted to mute its more dire effects, the General Plan claimed that two-thirds of the city — already the fourth most densely populated in the nation — was "underutilized."

Many found the General Plan laughable and unlikely to ever unfold. But then demographers from California's State Department of Finance and the Southern California Association of Governments (SCAG) prophesied that an inevitable county population increase of 2.5 million people by 2025 had to be met in Los Angeles by the building of far more housing.

That's when city planners started redesigning the very DNA of Los Angeles.

Goldberg says that SCAG bureaucrats want to see 16,000 new housing units per year — in a city many residents view as already overbuilt and grossly congested. (City Hall listens to SCAG, but some cities are sick of SCAG's density drumbeat. Irvine is involved in a bitter lawsuit against SCAG; Palmdale and La Mirada tried to stop SCAG and lost in court.)

SCAG "population projections" of massive, inevitable growth in L.A. are notoriously unreliable, says demographer James Allen, professor emeritus of geography at California State University Northridge.

"I personally don't put any stake in the accuracy of projections from SCAG or anyone else," Allen says. In his college classes, Allen assigns his students to make such projections — showing them how easy it is to manipulate theoretical circumstances to get whatever "population growth" results they desire.

It's a game, Allen explains, with outcomes "all based on assumptions that can't be known." A crash in the local economy, the subprime mortgage debacle, a flood or earthquake, major job growth in the U.S. South — all can send hundreds of thousands of people to other regions.

"But let's say they're accurate," Yaroslavsky conjectures. "Are we being told that we need to rebuild the entire city to facilitate another 2.5 million people in the next 17 years? Good luck. It's not going to happen — economically or politically ... It's preposterous. The deal is that there are a number of developers who see an opportunity here to make a killing."

The actual growth statistics fly in the face of the luxury-apartment future envisioned by the Villaraigosa administration. The U.S. Census says that between 1990 and 2000, 400,000 more residents fled Los Angeles County than moved in from other states and California counties. And significantly, the people who moved here earn an average of $3,000 less per year than the 400,000 who fled.

Yet the population is expanding, and the two key causes are illegal immigration and the high birth rate among the poor and working poor. Local Latino birth rates are driving it, and in Los Angeles, that means families with a median annual income circling $25,000.

Who is going to snap up thousands of luxury apartments on the drawing boards, at $2,500 a month? A few foreign nationals from Stuttgart and London, Dubai and Moscow? Even if Villaraigosa's team comes up with 16,000 new units per year in order to please land speculators, developers and bureaucrats at SCAG, it's highly unlikely that L.A.'s new residents — not hipsters but low-income families — could afford them.

"There's never been the market to support what they've been building," says Joel Kotkin, who notes that L.A. planners mistakenly believe they are creating the next New York or Chicago, when, Kotkin believes, it's more likely they are erecting a dense new Third World city.

There are, to be sure, arguments supporting high-density cities. Peter Gleick, director of Pacific Institute, an ecology-research foundation in San Francisco, says, "In single-family suburban homes, more than half the tap-water supply is spent on lawns and gardens. ... With

the expected radical decline in the Sierra Nevada snowpacks, cities like Los Angeles and Las Vegas cannot continue to grow in the 21st century the way they did in the 20th."

But density also breeds much more crime — something "density hawks" never mention. A report by the National Center for Policy Analysis says crime rates in dense cities outpace by up to 20 percent the crime in more sprawling, spacious cities. So-called "smart growth" Portland and Seattle lead the pack in property crime.

These colliding issues — of water usage, crime peaks, birth rates, developer greed (or hardship, according to Gilmore), statistical manipulation and City Hall transparency — could and should be the subject of public debate in Los Angeles.

But they're not.

Think of the current process as the urban-planning equivalent of termites gnawing away at the city's crossbeams. Each time a zoning-change application is considered, it must be heard in public in front of a volunteer committee of a regional Planning Commission — all political appointees of Villaraigosa.

The Planning Department is supposed to send notifications to the relevant "certified neighborhood council," and to all neighbors within 500 feet of the property at issue, or to post a notice in any local newspaper. And in addition, the agenda for all such hearings is posted at www.cityplanning.lacity.org.

That's how the Planning Department claims to be engaging the public. But a wall of silence between the public and the city is built into the incremental nature of the process.

Few residents know what to make of the strangely worded notifications they suddenly receive in the mail — just 10 days before a hearing. (Some notices, as in the Lake Balboa district in the Valley, arrived after a key hearing had occurred.) There's very rarely media interest, and in a city where few residents know the name of their city-council member (Los Angeles City Council districts contain about 280,000 people, the largest such districts — and many say the least responsive — in the U.S.), fighting City Hall is daunting.

Planning Commission hearings are held during business hours, handy for developers but not for residents. When no residents appear to oppose a developer's plan, the regional commissioners — often local residents, theoretically more invested in the area's welfare than downtown planners — usually go along with the developer. Usually, after the developer completes an environmental report and addresses a few problems, the zoning change or variance is granted.

The Woodland Hills-Warner Neighborhood Council's chairperson, Joyce Pearson, wrote this warning in a recent newsletter to her Valley area: "The public often waits until it's too late to do anything to enhance major developments or to impact any potential problems that may be caused."

Yet the public isn't "waiting," as Pearson puts it. The public is out of the loop — often until the demolition fence is already up.

That seems fine with City Hall. With a few pockets of 1980s-style activism developing at the feistier monthly neighborhood-council meetings in Los Angeles, City Hall has begun responding — by attacking the locals.

For example, the often-clamoring North Hills West Neighborhood Council, in a far-flung Valley area that was a hotbed of secession-movement sentiment, is so distrustful of City Hall that its members attend city Planning Commission hearings en masse. The North Hills group has defeated a series of high-density housing proposals on its rustic fields and meadows.

For their trouble, City Hall came down hard on these citizens. According to homeowner Peggy Burgess, the Neighborhood Council was subjected to an official barrage of blistering, trumped-up charges — even including racism — that originated from a cadre of pro-growthers. The accusers were allowed to file complaints anonymously with the city's somewhat ironically named Department of Neighborhood Empowerment (DONE).

Burgess says that, during a vitriolic December meeting, Manuel Durazo, a city project coordinator for DONE, conceded that he simply forwarded the ugly charges to the Board of Neighborhood Commissioners, and official "decertification" proceedings of the Neighborhood Council got under way - with no city official bothering to investigate the accusations, or allowing the neighborhood council to refute them.

Durazo finally admitted the charges were unsubstantiated. He sent out a letter congratulating the Neighborhood Council on its victory - adding that he'd requested that the city transfer him to a different district.

Since 2005, Villaraigosa has been tirelessly cheerleading for a taller city. He has often pointed to the frenzied construction of mixed-use buildings (apartments, shops and offices) as proof that he is probusiness.

In fact, some counter that L.A. is antibusiness, a city that drives big and small companies to neighboring Pasadena, Calabasas, Glendale, Culver City and elsewhere, earning itself special attention each year in the Kosmont Report on urban areas with backward business policies.

Villaraigosa appears to believe that edifices equate with business, and that the buildings themselves will lure in an educated work force and quality companies. "If we're not creating wealth, if we're not bringing in investment, if the official bird of Los Angeles isn't the crane, then we won't be able to do all the good things we would like to do for our people," Villaraigosa told the *Los Angeles Business Journal* in 2006.

His narrow emphasis on high-density housing construction might cost L.A. if a recession has really arrived. "The burst housing bubble has hit us pretty hard," says Joseph Linton, policy associate for Livable Spaces, a nonprofit developer that's completed mixed-income, transit-oriented residences in Long Beach and Lincoln Heights. The affordable units are selling, "but our market-rate units are going very slowly." Adds Gary Toebben, president of the L.A. Area Chamber of Commerce, "New market-rate housing is just not moving."

Nonetheless, Blumenfeld imagines dense urban villages built around subway stations, populated by the young and old, neighbors who shop on the ground floor and use rail or buses to get about.

Gail Goldberg looks out across the city and imagines residents and developers working side by side, with her department's firm leadership dedicated to the integrity of neighborhoods.

But from his County Hall of Administration office just a few blocks away, Yaroslavsky, his voice rumbling in a basso profundo, waves off Blumenfeld's and Goldberg's utopian plans: "I watched the demolition derby in this town 20 years ago ... I have a platform. I have some credibility. I have something to say. [But] I shouldn't be the one to say it."

Also read Julia Cooke's article on urban similarities between L.A. and Mexico City.

And What's Smart About Smart Growth? by David Zahniser

***Editor's Note:** This story incorrectly stated that Los Angeles County Supervisor Zev Yaroslavsky fought federal funding for subways after a methane explosion in 1985. In fact, Yaroslavsky called for more study of methane gas dangers while Congressman Henry Waxman championed the federal ban. Later, Yaroslavsky led a ballot effort that prevented local sales taxes from being used on the subway being tunneled under Hollywood, allowing that tax money to go to other transit projects. This story was corrected Feb. 29.

StopTheMilleniumHollywood.com, et al. v. City of Los Angeles, et al.
BS 144606

Tentative Decision on Petition for Writ of Mandamus: granted in part

Petitioners StopTheMillenniumHollywood.com, Communities United for Reasonable Development, Beachwood Canyon Neighborhood Association, and George Abrahams seek a writ of administrative mandamus setting aside the actions of Respondent City of Los Angeles ("City") in approving a large, mixed-use development in Hollywood ("Project"), its supporting Environmental Impact Report ("EIR"), and its land-use entitlements.[1]

The court has read and considered the moving papers, opposition, and reply, and renders the following tentative decision.

A. Statement of the Case

Petitioners StopTheMillenniumHollywood.com ("STMH"), Communities United for Reasonable Development ("CURD"), Beachwood Canyon Neighborhood Association ("BCNA"), and George Abrahams ("Abrahams") commenced the instant proceeding on August 28, 2013 alleging claims for mandamus, declaratory relief, and injunction.

On September 5, 2014, Petitioners filed a First Amended Petition for Writ of Mandamus and Complaint for Declaratory and Injunctive Relief ("FAP"), which is the operative pleading. The FAP alleges in pertinent part as follows.

1. Petitioners and Real Party-in-Interest

Petitioner StopTheMillenniumHollywood.com ("STMH") is an unincorporated association comprised of community organizations and individuals who participated in the administrative proceedings before the City. FAP, ¶7. Petitioner CURD is another unincorporated association of community organizations and individuals who jointly filed land use appeals during the administrative hearing process before the City Planning Commission and the City Council. Id., ¶8. Petitioner BCNA is a corporation representing property owners and residents living in the areas near Beachwood Canyon in or immediately adjacent to Hollywood and the site of the Project. Id., ¶9. BCNA is the parent organization of STMH and CURD. Id. Petitioner Abrahams is a director of BCNA. Id., ¶1 0.

Real Party-in-Interest Millennium Hollywood, LLC ("Millennium") is the business entity seeking to construct the Project.

2. Procedural Summary

A Draft EIR for the Project was released on October 25, 2012 and circulated for 45 days. FAP ¶25. A joint public hearing on the Project was held before a Deputy Advisory Agency and Hearing Officer (sometimes "DAA") on February 19, 2013. Id., ¶26. On February 22, 2013, the DAA approved the vesting tentative tract map ("VTTM") for the Project. Id., ¶27. The DAA also adopted a Statement of Overriding Considerations at the hearing. Id. On March 4, BCNA, represented by Abrahams, appealed the VTTM and Final EIR ("FEIR") approvals as to the City

[1]The court has separately ruled on the parties' several motions to augment the Administrative Record.

Planning Commission ("Planning Commission"). Id., ¶28. The hearing on BCNA's appeal of the VTTM and FEIR, as well as consideration of the entitlements and development agreement took place on March 28, 2013. Id., ¶30. On April 27, 2013, the Planning Commission issued a determination approving the entitlements and EIR, and recommending a zone change and a height district ordinance change. Id., ¶35. The same day the Planning Commission issued another determination letter denying BCNA's appeal of the DAA determinations. Id., ¶36.

On May 7, 2013, CURD filed an appeal of the Planning Commission's approval of a zone change, height district change and associated actions. Id., ¶37. CURD also appealed the Planning Commission's decision from its appeal of the VTTM approval. Id., ¶38.

On May 24, 2013, the City issued a notice of land use appeal public hearing before the City Council's Planning and Land Use Management Committee ("PLUM"). Id., ¶43. The hearing was initially set for June 4, 2013. Id. CURD was among the organizations whose appeal was to be heard at this hearing. Id., ¶44. At the scheduled PLUM hearing on June 4, it was announced that the matter was being postponed June 18, 2013 at Millennium's request. Id., ¶44. It was also announced that the matter would be heard by the full City Council on June 19, 2013. Id.

At the June 18, 2013 PLUM hearing, it was announced that the City Council hearing scheduled for the following day was postponed to July 24, 2013. Id., ¶ 53. PLUM also voted to (1) approve the Project, subject modified conditions, (2) deny all appeals, and (3) adopt the Final EIR and "Statement of Overriding Considerations." Id., ¶56.

Prior to the July 24, 2013 City Council hearing, PLUM released a "Recommendation Report" relating the actions that it had taken on June 18, 2013. Id., ¶62. Petitioners allege that this report misrepresented the June 18, 2013 actions. Id. Specifically, the report referred to a different ordinance than the one discussed at the hearing. Id. PLUM essentially set their initial proposed ordinance aside and adopted a new one instead. Id., ¶64.

The City Council's hearing was held on July 24, 2013. ¶ 71. The day before the hearing, Millennium submitted a last-minute 311-page report attacking Petitioners' arguments. Id., ¶68. Petitioners were deprived of an opportunity to rebut Millennium's evidence. Id. At the conclusion of the City Council's hearing, the councilmembers voted unanimously to approve the Project. Id., ¶85.

3. The Causes of Action

The FAP's first three causes of action are for violation of CEQA. The First Cause of Action alleges that the City violated CEQA and the CEQA Guidelines by abusing its discretion in: (1) failing to provide an accurate, stable and finite project description; (2) failing to address comments raising significant environmental issue in good faith, with reasoned responses; (3) failing to adequately disclose, analyze, mitigate or avoid the Project's significant impacts on the environment, including emergency service response times, seismic risks and traffic impacts; (4) failing to re-circulate the Draft EIR when significant new (seismic) information was added late or was requested to be added even after FEIR certification; (5) failing to adequately disclose, analyze, mitigate or avoid the Project's land use impacts associated with each Los Angeles Municipal Code ("LAMC") provision overridden in favor of development regulations and/or land use equivalency programs; and (6) failing to adequately analyze the impact of the invalidation of the 2012 Hollywood Community Plan Update. Id., ¶123. Petitioners further allege that the City abused its discretion by concluding that certain impacts would be less than significant without substantial evidence in support thereof. Id., ¶128.

The Second Cause of Action alleges that in disregarding the concerns of Caltrans, a responsible agency under CEQA, the City violated Pub. Res. Code sections 21080.4(a) and 21092.4, and Guidelines section 15096(b)(2). Id., ¶144.

The Third Cause of Action alleges that by failing to notify and consult with the California Geologic Survey ("CGS"), a responsible agency under CEQA, the City violated Pub. Res. Code section 21153 and Guidelines section 15086(a)(1). Id., ¶151. Millennium and the City "colluded to suppress critical information regarding seismic hazards at the Millennium Project Site, including information indicating that traces of the active Hollywood Earthquake Fault bisect the property, and further including suppression from the EIR of the California Department of Conservation, California Geological Survey's 2010 Fault Activity Map, which indicates the presence of the active Hollywood Earthquake Fault running directly through the Millennium Property." Id., ¶153.

The Fourth Cause of Action is for violation of due process rights and deprivation of a fair hearing under the United States Constitution, the California Constitution, and CCP section 1094.5(b). Petitioners allege that the City's failure to attach the precise versions of the Millennium Hollywood Development Regulations and Millennium Hollywood Land Use Equivalency Program ("LUEP") deprived them of the ability to know from the four corners of the letters of determination precisely what the Planning Commission decided. Id., ¶158. When confronted with this deficiency, the City refused to cure the defect, making it impossible for Petitioners to track changes made by the City during the City Council hearing process because Petitioners could not verify what the operative versions of these zoning documents were. Id. The City Council's failure to develop and publish procedural rules to assure fair and consistent hearings violates Govt. Code section 65804. Id.

The Fifth Cause of Action is for declaratory and injunctive relief based on deprivation of fair hearings in land use appeals. Petitioners allege that the City is presently engaged in a pattern of violating Govt. Code section 65804. Id., ¶174.

The Sixth Cause of Action is for violation of City Charter (sometimes "Charter") section 562 and LAMC section 12.27(D). Petitioners generally allege that the City has granted variances without making the legally mandated findings under the Charter and LAMC. Id., ¶¶ 177-78.

The Seventh Cause of Action is for violation of Charter section 562, LAMC sections 12.04 and 12.32, as well for an unconstitutional impairment of the City's police powers. Petitioners allege that the City is attempting to elevate development regulations into the position of a municipal ordinance, per LAMC section 12.04 and 12.32, in irreconcilable conflict with Charter section 562. Id., ¶181. In doing so, the City is attempting to override stricter LAMC provisions. Id., ¶182. The LUEP and development regulations are a grant of carte blanche authority which is *ultra vires* and *void ab initio* because they amount to the City's unconstitutional surrender of its police power to regulate land use. Id., ¶ 183.

Finally, the Eighth Cause of Action is for violation of an existing peremptory writ of mandate issued in La Mirada Avenue Neighborhood Association of Hollywood v. City of Los Angeles, et al., ("La Mirada") BS138369 invalidating the Hollywood Community Plan Update ("HCPU"). Id., ¶¶ 191-98. Per the writ, the City rescinded the HCPU and decertified its EIR. Id., ¶201. Accordingly, the FEIR's reliance on the invalidated HCPU warrants the FEIR's invalidation. Id., ¶203-04.

4. Relief Sought

On the First, Second, Third and Eighth Causes of Action, Petitioners seek: (1) a peremptory writ of mandamus directing the City and City Council to vacate and set aside the actions approving the FEIR, Project approvals, and all land use entitlements; (2) an injunction enjoining the City from granting any authority, permits, certificate of occupancy, or entitlements as part of the Project pursuant to the City's prior actions; and (3) an injunction enjoining Millennium from undertaking construction on the Project. Id., p. 62.

On the Fourth Cause of Action, Petitioners seek a declaration that their due process and fair hearing rights were violated. Id. They request mandamus directing the City to (1) vacate and set aside its actions in approving the FEIR, Project approvals, and entitlements, and (2) provide new and fair hearings that comply in all respects with due process of law. Id.

On the Fifth Cause of Action, Petitioners seek a judicial declaration that the City violated Govt. Code section 65804, as well as mandamus directing the City to develop proper fair hearing policies and procedures during land use appeals. Id., pp. 62-63.

Finally, on the Sixth, Seventh and Eighth Causes of Action, Petitioners seek a writ of mandamus directing the City vacate and set aside its actions approving the Project's land use entitlements. Id., p. 63. They further seek to have the City enjoined from granting any authority, permits, certificate of occupancy, or entitlements pursuant to the City's prior land use entitlement approvals. Id. Petitioners also seek to have Millenium enjoined from undertaking construction on the Project pursuant to the approved land use entitlements. Id.

B. Standard of Review

A party may seek to set aside an agency decision for failure to comply with CEQA by petitioning for either a writ of administrative mandamus (CCP §1094.5) or of traditional mandamus. CCP §1085.

CEQA review of quasi-adjudicatory agency actions in which a hearing is required, evidence taken, and the agency determines factual issues are governed by administrative mandamus under CCP section 1094.5, in which the court determines whether the agency's decision is supported by substantial evidence. Pub. Res. Code §21168. Examples of such actions include issuance of use permits (Neighborhood Action Group v. County of Calaveras, (1984) 156 Cal.App.3d 1176, 1186), planned use development permits (City of Fairfield v. Superior Court, (1975) 14 Cal.3d 768, 773), and zoning variances. Topanga Assn. For a Scenic Community v. County of Los Angeles, (1974) 11 Cal.3d 506, 517.

CEQA review of quasi-legislative agency actions is governed by traditional mandamus per CCP section 1085, in which the court determines whether the agency prejudicially abused its discretion by not proceeding in a manner required by law or by making a decision not supported by substantial evidence. Pub.Res. Code §21168.5. Examples of such actions include adoption of a general plan or rezoning property. O'Loane v. O'Rourke, (1965) 231 Cal.App.2d 774, 784-85 (general plan); San Diego Building Contractors Assn. v. City Council, (1974) 13 Cal.3d 205, 212-13).

There is no practical difference between the standards of review applied under traditional or administrative mandamus in CEQA cases. Friends of the Old Trees v. Dept. Of Forestry & Fire Protection, (1997) 52 Cal.App.4th 1383, 1389. Public entities abuse their discretion if their actions or decisions do not substantially comply with the requirements of CEQA. Sierra Club v. West Side Irrigation District, (2005) 128 Cal.App.4th 690, 698. Whether an agency abused its discretion requires "scrutiny of the alleged defect" depending on whether the claim is

predominately "improper procedure or dispute over the facts." Vineyard Area Citizens for Responsible Growth v. City of Rancho Cordova, ("Vineyard") (2007) 40 Cal.4th 412, 435. Abuse of discretion is established if the agency has not proceeded in a manner required by law or if the determination or decision is not supported by substantial evidence. Western States Petroleum Assn. v. Superior Court, (1995) 9 Cal.4th 559, 568.

Petitioners' first, second, and third causes of action alleges violation of CEQA in failing to proceed in the manner required by law, and to some extent the first cause of action challenges the sufficiency of the FEIR. Where an EIR fails to provide certain required information and/or was misleading is failing "to proceed in a manner required by CEQA" and an issue of law. Vineyard, *supra*, 40 Cal.4th at 435. Such issues require "a critical consideration, in a factual context, of legal principles and their underlying values." Harustak v. Wilkins, (2000) 84 Cal.App.4th 208, 212. However, the omission of information in an EIR is not presumed prejudicial, and will rise to the level of a failure to proceed in the manner required by law only if the analysis is clearly inadequate or unsupported. Citizens for a Sustainable Treasure Island v. City and County of San Francisco, ("Treasure Island) (2014) 227 Cal.App.4th 1036, 1046-47.

Whether an agency abused its discretion in an EIR's findings must be answered with reference to the existence of substantial evidence in the administrative record. "Substantial evidence," is defined as "enough relevant information and reasonable inferences from this information that a fair argument can be made to support a conclusion, even though other conclusions might also be reached." Guidelines[2] §15384(a). The substantial evidence standard requires deference to the agency's factual and environmental conclusions based on conflicting evidence, but not to issues of law. Laurel Heights Improvement Assn. v. Regents of University of California, ("Laurel Heights") (1988) 47 Cal.3d 376, 393, 409. Argument, speculation, and unsubstantiated opinion or narrative will not suffice. Guidelines §15384(a), (b). Whether substantial evidence exists is a question of law. *See* California School Employees Association v. DMV, (1988) 203 Cal.App.3d 634, 644.

The challenges to violation of the LAMC and City Charter (sixth and seventh causes of action) are traditional mandamus claims. The City is entitled to great deference in interpreting its own ordinances, and the court evaluates as an issue of law whether development regulations are an unlawful delegation of police power. *See* County Mobilehome Positive Action Committtee, Inc. v. County of San Diego, (1998) 62 Cal.App.4th 727, 733. Petitioners have the burden of showing that the agency decision is unreasonable or invalid as a matter of law. City of Arcadia v. State Water Resources Control Board, (2006) 135 Cal.App.4th 1392, 1409. The court must uphold the agency's action unless it is "arbitrary and capricious, lacking in evidentiary support, or made without due regard for the petitioner's rights." Citizens for Improved Sorrento Access, Inc. v. City of San Diego, (2004) 118 Cal.App.4th 808, 814; Sequoia Union High School District v. Aurora Charter High School, (2003) 112 Cal.App.4th 185, 195.

---

[2]As an aid to carrying out the statute, the State Resources Agency has issued regulations called "Guidelines for the California Environmental Quality Act" ("Guidelines"), contained in Code of Regulations, Title 14, Division 6, Chapter 3, beginning at section 15000.

For the constitutional challenges based on due process and fair hearing (fourth and fifth causes of action), the court independently reviews the proceedings to decide whether a party's rights were compromised. Sinaiko v. Superior Court, (2004) 122 Cal.App.4th 1133, 1140.

Finally, the challenge for a violation of the La Mirada judgment (eighth cause of action) is a traditional mandamus claim for abuse of discretion based on a failure to proceed in the manner required by law and/or based on a lack of substantial evidence. The underlying judgment is interpreted as an issue of law. Dow v. Lassen Irrigation Co., (2013) 216 Cal.App.4th 766, 780-81.

C. Statutory Framework

1. California Environmental Quality Act (CEQA)

The purpose of CEQA, (Pub. Res. Code §21000 *et seq.*,) is to maintain a quality environment for the people of California both now and in the future. Pub. Res. Code § 21000(a). "[T]he overriding purpose of CEQA is to ensure that agencies regulating activities that may affect the quality of the environment give primary consideration to preventing environmental damage." Save Our Peninsula Committee v. Monterey County Board of Supervisors, (2001) 87 Cal.App.4th 99, 117. CEQA must be interpreted "so as to afford the fullest, broadest protection to the environment within reasonable scope of the statutory language." Friends of Mammoth v. Board of Supervisors, (1972) 8 Cal.3d 247, 259.

The Legislature chose to accomplish its environmental goals through public environmental review processes designed to assist agencies in identifying and disclosing both environmental effects and feasible alternatives and mitigations. Pub. Res. Code §21002. Public agencies must regulate both public and private projects so that "major consideration is given to preventing environmental damage, while providing a decent home and satisfying living environment for every Californian." Pub. Res. Code §21000(g).

Under CEQA, a "project" is defined as any activity which may cause either a direct physical change in the environment, or a reasonably foreseeable indirect physical change in the environment (1) undertaken directly by any public agency, (2) supported through contracts, grants, subsidies, loans or other public assistance, or (3) involving the issuance of a lease, permit, license, certificate, or other entitlement for use by a public agency. Pub. Res. Code §21065. The word "may" in this context means a reasonable possibility. Citizen Action to Serve All Students v. Thornley, (1990) 222 Cal.App.3d 748, 753. "Environment" means the physical conditions which exist within the area which will be affected by a proposed project, including land, air, water, minerals, flora, fauna, noise, objects of historic or aesthetic significance. Guidelines §21060.5.

The "project" is the whole of the action, not simply its constituent parts, which has the potential for resulting in either direct or reasonably foreseeable indirect physical change in the environment. Guidelines §15378. An indirect physical change must be considered if that change is a reasonably foreseeable impact which may be caused by the project. On the other hand, a change that is "speculative or unlikely to occur is not reasonably foreseeable." Guidelines §15064(d)(3). The term "project" may include several discretionary approvals by government agencies; it does not mean each separate government approval. Guidelines §15378(c).

An EIR must be prepared for a project if the agency concludes that "there is substantial evidence, in light of the whole record... that the project may have a significant effect on the environment." Pub. Res. Code §21080(d). The EIR is the "heart" of CEQA, providing agencies with in-depth review of projects with potentially significant environmental effects. Laurel

Heights, *supra*, 6 Cal.4th at 1123. An EIR describes the project and its environmental setting, identifies the potential environmental impacts of the project, and identifies and analyzes mitigation measures and alternatives that may reduce significant environmental impacts. Id. Using the EIR's objective analysis, agencies "shall mitigate or avoid the significant effects on the environment... whenever it is feasible to do so. Pub. Res. Code §21002.1. The EIR serves to "demonstrate to an apprehensive citizenry that the agency has in fact analyzed and considered the ecological implications of its actions." No Oil, Inc. v. City of Los Angeles, (1974) 13 Cal.3d 68, 86. It is not required to be perfect, merely that it be a good faith effort at full disclosure. Kings County Farm Bureau v. City of Hanford, (1990) 221 Cal.App.3d 692, 711-12. A reviewing court passes only on its sufficiency as an informational document and not the correctness of its environmental conclusions. Laurel Heights, *supra*, 47 Cal.3d at 392.

All EIRs must cover the same general content. Guidelines §§ 15120-32. An EIR should be prepared with a sufficient degree of analysis to provide decision-makers with information which enables them to make a decision which intelligently takes account of environmental consequences. The environmental effects need not be exhaustively reviewed, but the EIR's sufficiency is viewed in the light of what is reasonably feasible. Guidelines §15151. The level of specificity of an EIR is determined by the nature of the project and the "rule of reason." Al Larson Boat Shop, Inc. v. Board of Harbor Commissioners, (1993) 18 Cal.App.4th 729, 741-42. The degree of specificity "will correspond to the degree of specificity involved in the underlying activity which is described in the EIR." Guidelines §15146. The ultimate decision whether to approve a project is a nullity if based upon an EIR that does not provide decision-makers, and the public, with the information about the project required by CEQA. Santiago County Water District v. County of Orange, (1981) 118 Cal.App.3d 818, 829.

2. Alquist-Priolo Earthquake Fault Zoning Act

The Alquist-Priolo Earthquake Fault Zoning Act ("Alquist-Priolo"), (Pub. Res. Code §2621 *et seq.*,) was enacted to prohibit the construction of buildings for human occupancy across the trace of active faults. California Oak Found. v. Regents of Univ. of California, (2010) 188 Cal.App.4th 227, 247; Better Alternatives for Neighborhoods v. Heyman, (1989) 212 Cal.App.3d 663, 670. Alquist-Priolo's purpose is in part to "provide policies and criteria to assist cities, counties, and state agencies in the exercise of their responsibility to prohibit the location of developments and structures for human occupancy across the trace of active faults." Pub. Res. Code § 2621.5. It is also meant to "provide the citizens of the state with increased safety and to minimize the loss of life during and immediately following earthquakes by facilitating seismic retrofitting to strengthen buildings, including historical buildings, against ground shaking." Id.

Among other things, Alquist-Priolo requires the State Geologist to publish maps delineating appropriately wide earthquake fault zones, as well active and well-defined fault traces. Pub. Res. Code §2622(a). The State Geologist must "continually review new geologic and seismic data and... revise the earthquake fault zones or delineate additional earthquake fault zones when warranted by new information." Id., §2622(c). Prior to publication, the State Geologist revised maps must be submitted to the State Mining and Geology Board for review and comment. *See* id.; 14 CCR §3602(a).

3. LAMC and City Charter Provisions

a. Adoption of Land Use Ordinances

Govt. Code section 65804(a) requires all city and county zoning agencies (including charter cities) to "develop and publish procedural rules for conduct of their hearings so that all interested parties shall have advance knowledge of procedures to be followed." Zoning agencies are required to create and preserve a record of their hearings, which must be made available (at a cost). Govt. Code §65804(b).

City Charter section 558 governs the adoption, amendment, and repeal of ordinances, orders and resolutions by the City Council which concern, among other things, land-use zones or districts, zoning or land-use regulations. City Charter §558(a).

LAMC section 12.32 governs the City's adoption of land use ordinances in accordance with Govt. Code section 65804 and City Charter section 558. The City Council, Planning Commission, or Director of Planning may initiate consideration of a proposed land use ordinance, the first two by a simple majority vote. LAMC §12.32(A). An owner of property may also apply for a land use ordinance for matters governed by subdivisions F through S. LAMC §12.32(B).

The Planning Commission is authorized to make an initial recommendation regarding the approval or disapproval of a proposed land use ordinance, which will then considered by the City Council. LAMC §12.32(C)(1). The City is required to provide at least 24 days' advance notice of the time, place and the public hearing on the proposed land use ordinance. LAMC §12.32(c)(4). Notice must either be in the form of publication, or in the form of mailings to owners within 500 feet of the affected property. Id. The applicant, if any, must also post notice in a conspicuous place at the affected property. Id.

Where the proposed land use ordinance concerns an amendment to zoning regulations, the Planning Commission is not required to comply with these strict notice requirements, nor must the matter be set for public hearing. *See* LAMC §12.32(E). Similarly, where the proposed land use ordinance involves a change in zone or height district, the Planning Commission may, without additional notice or hearing, recommend minor increases in affected areas or boundaries, provided that it determines that doing so is required by public necessity, convenience, general welfare or good zoning practice. LAMC §12.32(F)(1).

The Planning Commission hearing must be recorded or summarized. LAMC §12.32(C)(5)(a). If proceedings are recorded, the must be transcribed with copies made available to interested parties in exchange for a fee. Id. A copy of the transcript must be furnished to the Planning Commission and placed on file. Id. Additionally, after the hearing's conclusion, the Planning Commission's Director must submit a report setting forth his or her conclusions and recommendations, and the reasoning for them. LAMC §12.32(c)(5)(b).

Following the Planning Commission's decision to recommend approval or disapproval of a proposed land use ordinance, the City Council may approve or disapprove the ordinance. LAMC §12.32(c)(7). The City Council's decision must occur within 90 days of the recommendation. Id. If the proposed ordinance is approved by the City Council, it must make findings that its action is consistent with the General Plan and is in conformity with public necessity, convenience, general welfare and good zoning practice. Id.

The applicant may appeal the Planning Commission's recommendation to disapprove a proposed land use ordinance by filing an appeal with the City Clerk within 20 days of the decision. LAMC § 12.32(D)(1). If no appeal is filed, the Planning Commission's recommendation will be considered final. Id. At any time prior to the City Council's decision on the appeal, the Planning Department must submit any pertinent supplemental information that the City Council or its PLUM requests. LAMC §12.32(D)(2).

b. Q Qualified Classification

LAMC section 12.32(G) provides a series of possible special zoning classifications, one of which is a "Q Qualified" classification. *See* LAMC §12.32(G)(2). Ordinarily, rezoning a property allows the occupant to maintain it for any use permitted by-right therein. *See, e.g.*, LAMC 12.14 (listing uses allowed by right in "C2" commercial zones). A Q Qualified classification allows the City Council to rezone a property to restrict its use from the full range of uses in that zone. *See* LAMC §12.32(G)(2)(a). The classification can also be used to impose certain standards (or conditions) on the intended redevelopment. Id. The express purpose of such classifications is to (1) protect a neighborhood's best interests and assure compatible development therein, (2) secure appropriate development in harmony with the objectives of the applicable General Plan, or (3) prevent or mitigate the potential environmental impact of a zone change. LAMC §12.32(G)(2)(a)(1)-(3).

Q Qualified classifications may be either permanent or temporary. *See* LAMC §12.32(G)(2)(a). If made on a temporary basis, the classification lasts for up to six years. *See* LAMC §12.32(G)(2)(b)(1), (f). Once a certificate of occupancy is issued for a development, the temporary Q Qualified classification becomes permanent. LAMC §12.32(G)(2)(e). Until that point, the six-year time limit can be extended if there is "substantial physical development" of the property for the classification's permitted uses. LAMC §12.32(G)(2)(f). Otherwise, the classification becomes null and void if the time limit expires. Id.

c. Variance Procedure

City Charter section 562 sets forth the minimum standards and procedures for the granting a zoning variance. All initial determinations on variances are made by the Zoning Administrator ("ZA"). Charter §562(a). ZA determinations are appealable to the appropriate Area Planning Commission, and then the City Planning Commission or City Council (as prescribed by ordinance). Charter §562(b). Even if an ordinance requires that the appeal be made to the City Planning Commission, the decision is nevertheless subject to the City Council's discretionary review pursuant to City Charter section 245. Id. In any event, variances may not be granted without the following findings being made:

(1) that the strict application of the provisions of the zoning ordinance would result in practical difficulties or unnecessary hardships inconsistent with the general purposes and intent of the zoning regulations;

(2) that there are special circumstances applicable to the subject property such as size, shape, topography, location or surroundings that do not apply generally to other property in the same zone and vicinity;

(3) that the variance is necessary for the preservation and enjoyment of a substantial property right or use generally possessed by other property in the same zone and vicinity but which, because of the special circumstances and practical difficulties or unnecessary hardships, is denied to the property in question;

(4) that the granting of the variance will not be materially detrimental to the public welfare, or injurious to the property or improvements in the same zone or vicinity in which the property is located; and

(5) that the granting of the variance will not adversely affect any element of the General Plan. Charter §562(c).

LAMC section 12.27 generally implements City Charter section 562, and governs the adoption of ordinances. Consistent with Charter section 562(c), LAMC section 12.27(D) requires that the ZA make the same five findings in writing. The ZA's decision to approve or deny a variance is appealable to the appropriate Area Planning Commission, and then in turn to the City Council directly. *See* LAMC §12.27(G)-(O).

D. The Requests for Judicial Notice

Petitioners ask the court to judicially notice 13 documents (Exs. A-M). Exhibits B-M consist of LAMC and Charter provisions (Exs. B, I, J, K), court records from La Mirada, BS 138369 and South Central Farmers v. City of Los Angeles, BS117561 (Exs. E-G, L), a City Council action (Ex. H), and a State Attorney General opinion (Ex. M). These requests are unopposed and are granted. Ev. Code §452(b), (c), (d).

Exhibit A is a City printout from the City's Ethics Commission website showing payments made by Millenium to various entities. The joint Opposition argues that Exhibit A is not part of the Administrative Record, it is immaterial that Petitioners seek to add it via judicial notice rather than a motion to augment, and it should not be judicially noticed because it is irrelevant. The Opposition explains that the payments were made by Millenium to its lawyers, engineers and consultants working on this Project; they were not made to City officials. The payments were disclosed only because the City's broadly worded lobbying ordinance requires payments for providing advice or strategy to a client be disclosed as "lobbying activities." Opp. at 6-7. Petitioners respond that the payments are not offered under CEQA, but rather to show due process violations. Reply at 1.

Exhibit A is an official act subject to judicial notice. Ev. Code §452(c). It also is relevant to Petitioners' due process claim. The request is granted.

Exhibit C is a map released by CGS on November 6, 2014 depicting the location of Alquist-Priolo Earthquake Zones and Seismic Hazard Zones within the Hollywood Quadrange. Exhibit D is a Supplement to a Fault Investigation Report issued by CGS on November 5, 2014 to support its adoption of Exhibit C. CGS prepared Exhibits C and D to assist cities and counties in planning development. After the State adopts a map that delineates an Earthquake Fault Zone, the affected cities and counties regulated development within the Zone, including requiring the preparation of a geologic report discussing any hazard of surface fault rupture. Pub. Res. Code §2623(a).

The joint Opposition argues that the City did not have Exhibits C and D when it approved the Project, and they are irrelevant. In any event, the City treated the Project site as if it was within a Fault Zone. The mitigation conditions imposed on Millenium require it to conduct the same investigation and geologic report that would be required by placement in the Earthquake Fault Zone. Opp. at 8.

Petitioners contend that the City may have treated the Project Site as within an Earthquake Fault Zone, but that fact is insufficient for purposes of public information. The City

knew that CGS was studying the area, yet never changed the statements in the DEIR that the Project site was not in an Alquist-Priolo zone. The public should have been informed of this fact, and CGS's subsequent action reinforces that conclusion. Reply at 3.

Exhibits C and D did not exist at the time of approval, and they corroborate Petitioners' position. Nonetheless, they are inadmissible to challenge the City's approval of the FEIR and the Project entitlements. To the extent that Petitioners' CEQA challenge is quasi-legislative, extra-record evidence is completely inadmissible for the determination of whether the decision is supported by substantial evidence or the agency proceeded in the manner required by law. Western States Petroleum Assn. v. Superior Court, ((95) 9 Cal.4th 559, 573, 574-76. To the extent the challenge is quasi-adjudicative, the admission of extra-record evidence is governed by CCP section 1094.5(e). Petitioners do not discuss the requirements for the admission of extra-record evidence. The requests are denied.

In a "Second Supplemental Request for Judicial Notice" filed on April 14, 2015, Petitioners ask the court to judicially notice excerpts from an EIR dated November 2010 for the NBC/Universal Evolution Plan and the City Council's action approving and certifying the Plan (Ex. N). Petitioners argue that the excerpts are relevant to whether the Millenium FEIR adequately addressed cumulative impacts. Mot. at 2. While this may be true, Petitioners make no showing that the evidence was presented to the City before approval of the Project, or that the evidence meets the test for extra-record evidence. Petitioners also provide no reason why they waited to file the request with their reply, or give any indication that the evidence is properly responsive to a new issue raised by the Opposition. The City and Millenium have had no opportunity to object to the request, and it is denied.

The City and Real Party ask the court to judicially notice five documents (Exs A-E), including LAMC provisions (Exs. A, B, D), a Charter provision (Ex. E), and a court filing in La Mirada (Ex.C). The unopposed requests are granted. Ev. Code §452(b), (d).

E. Statement of Facts

1. The Project

The instant proceeding concerns a proposed 4.4 acre mix-use redevelopment project, spanning on two lots on the east and west sides of Vine Street south of Yucca in Hollywood ("Project"). AR 4211, 4215. The site is accessible from the Hollywood Freeway (US-101), with freeway on and off-ramps approximately one block north at Franklin and Vine, and Franklin and Argyle, respectively. AR 4217. In concept, the Project will include a mix of residential units, offices, a hotel, a health club, and retail spaces totally a developed floor area of approximately 1, 166,970 square feet, yielding a floor area ratio ("FAR") -- the total square footage of a building divided by the total square feet of the building's lot -- of 6:1. AR 4233.

2. Millennium's Initial Application

On August 18, 2008, Real Party Millennium filed a Master Land Use Permit Application with the City's Planning Department ("City Planning"). AR 21309-11. The Project was described as a mixed-use development consisting of approximately 492 residential units, a 200-unit luxury hotel, 100,000 feet of office space, an approximately 34,000 square foot sports club and spa, more than 11,000 square feet of commercial uses and approximately 34,000 square feet of food and beverage uses. AR 21321. The historic Capital Records Tower and Gogerty Buidling are located within the Project Site, and would be preserved as office and music recording buildings. Id. Thereafter, the City's Department of Building & Safety ("LADBS")

informed Millennium's attorney that the Project's enclosed balconies would render the building in excess of the maximum 6:1 FAR allowable under the City's General Plan, thus requiring a variance. AR 68250.

Millennium took time to review its plans and no further substantive progress occurred until 2011. *See* AR 68255-56.

3. <u>The NOP and Caltrans' Concern</u>

Millennium submitted another Master Land Use Permit Application with the City's Planning Department in April 2011. AR 10987-90. As part of its application, Millenium proposed (1) custom "Development Regulations" for the Project that would be incorporated in the Project approvals and contain standards for the Project's development that would prevail over zoning or land use regulations in the LAMC (AR 845-904, 853), and (2) a "Land Use Equivalency Program" ("LUEP") that would provide flexibility to Millenium to adjust the type and density of land uses for the Project, allowing Millennium to request and obtain a transfer of land uses before development of any Project phase so long as it stayed within the FAR and trip cap of 1498 new peak hour vehicle trips per day set forth in the EIR (AR 13789-90). AR 10987-90.

As the lead agency, the City issued a CEQA Notice of Preparation and Public Scoping Meeting for an EIR ("NOP") on April 28, 2011. AR 6225-31. The City's project description was for a maximum 1,166,970 square foot of floor space (6:1 FAR), preserving and maintaining the existing Capitol Records and Gogerty Building, a mix of residential, hotel, office, restaurant, health and fitness club, and retail uses, using the LUEP to provide development flexibility for future demands of the market and economy by allowing adjustment between land uses from several development scenarios, and Development Standards as embodied in a Development Agreement. AR 6226.

The Project would require entitlements of (1) a Development Agreement, (2) Vesting Tentative Tract Map ("VTTM") for the mixed use development, (3) zone change from C4 to C2, (4) height district change, (5) conditional use permit ("CUP") for alcohol and live entertainment, (6) Vesting CUP for hotel, (7) variance for sports club parking and for restaurants with outdoor eating areas above ground floor, (8) demolition and grading permits, (9) haul route approval, and (10) design review and approval to permit FAR above 4.5:1. AR 6227.

An Initial Study, also prepared on April 28, 2011, noted that the Project would develop a mix of land uses, including residential, luxury hotel, office, restaurant, health and fitness club, and retail. AR 30569. The LUEP would define a framework for permitted land uses and square footages which could be exchanged so long as the 1,166,970 square footage and 6:1 FAR were not exceeded and no additional environmental impacts occurred. <u>Id</u>. The Initial Study noted, *inter* alia, that the Project Site was not within a State-designated Alquist-Priolo Zone or other designated fault zone. However, a portion of the western portion of the Site is adjacent to the boundary of a City fault rupture study zone. The City zoning map (ZIMAS) shows the closest fault with a potential for rupture is the Santa Monica/Hollywood Fault which is 0.4 miles away. AR 30577. The Initial Study concluded that an EIR was required because the Project may have a significant environmental effect. AR 30570. The (now defunct) City of Los Angeles Community Redevelopment Agency ("CRA-LA"), South Coast Air Quality Management District ("SCAQMD") and Los Angeles Regional Water Quality Control Board ("LARWQCB") were designated as the "Responsible Agencies" under CEQA. AR 30569.

After the public scoping meeting was held, the California Department of Transportation ("Caltrans") expressed concern in a May 18, 2011 letter over the Project's traffic impact on the 101 Freeway. AR 31506. Caltrans had a specific concern about the possibility of vehicle queuing at the 101 Freeway on-ramps and off-ramps nearest to the Project. Id. Caltrans recommended that the City prepare a traffic study to determine whether the Project-related traffic, plus the cumulative traffic, would cause such issues. Id. Caltrans reminded the City that as a responsible agency under CEQA, it had the authority to determine the required freeway analysis for the Project and was responsible for off-setting Project vehicle trip generations that worsen the 101 Freeway. AR 31507. Caltrans noted that even the County's Congestion Management Plan ("CMP") standards provide that Caltrans should be consulted for the analysis of State facilities. AR 31507. Caltrans stated that trip generation, trip distribution, choice of travel mode, and assignments of trips to the 101 Freeway should be analyzed for all on/off ramps within five miles of the Project site, preferably using the Caltrans Traffic Impact Study Guide ("TISG"). AR 31506-07.

4. The DEIR

In October 2012, the City prepared a Draft Environmental Impact Report ("DEIR"). *See generally* AR 4082-5331. Per the DEIR, the Project was anticipated to encompass 492 residential units, 200 hotel units, 300 square feet of office, retail, restaurant, and fitness center/sports club space. AR 4234. The DEIR listed Caltrans as a responsible agency for its review of traffic impacts upon state highways and enforcement of any highway mitigation measures. AR 4260.

In analyzing potential traffic impacts, the DEIR applied the County's standard CMP methodology which requires that an EIR analyze traffic conditions at all CMP monitoring arterial intersections where the project would add 50 or more trips during the weekday peak hours, and at all mainline freeway monitoring locations where the project would add 150 or more trips during weekday peak hours. AR 4955, 4975. The DEIR analyzed 37 arterial intersections, including those directly adjacent to nearby 101 freeway ramps. AR 4927. The DEIR also studied cumulative traffic impacts applying both a 1% annual ambient growth factor for the Hollywood area and a list of 58 related projects. *See* AR 4317-20, 4980. The DEIR concluded that the Project would result in a less-than-significant impact in terms of trip generation, including trips using freeway segments. AR 4975.

The DEIR addressed the Project Site's subsurface geology, including seismic and fault rupture issues. AR 4589-602. The DEIR noted that the Project was not located within a designated Alquist-Priolo Earthquake Fault Zone. AR 4591. However, the Project's eastern portion was adjacent to the boundary of a fault rupture study zone included as part of the Safety Element of the City's 1996 General Plan. Id. The DEIR also noted that, according to CGS and ZIMAS, the closest earthquate fault with the potential for fault rupture was the Santa Monica Hollywood Fault (the "Hollywood Fault"), which was approximately 0.4 miles away. Id. The DEIR further included a Preliminary Geotechnical Study that analyzed subsurface borings performed on the property (*see* AR 8211-59), and seismic-geology mitigation measures, including a mitigation measure requiring substantial additional subsurface testing and monitoring prior to issuance of building or grading permits. AR 4136-37.

The DEIR addressed the Project's impact on fire protection services. AR 4804-24. The DEIR stated that response time relates directly to distance, and the preferred response time of the Los Angeles Fire Department ("LAFD") is to arrive at the scene of a call-out for all emergencies

within five minutes 90% of the time. AR 4800. The DEIR acknowledged that a City Controller audit of LAFD in May 2012 concluded that there has been an increase in response times for medical first responders, but not the time standard for fires and non-medical incidents. The DFEIR stated that the Controller's audit was presented for informational purposes only, and relied on LAFD-supplied response times. AR 4800.

The DEIR noted that CEQA Guidelines, Appendix G, provides that a project could have a significant environmental impact if new government facilities are necessary in order to maintain acceptable response times for fire protection and the construction of the new facilities could cause significant environmental impacts. AR 4804. The City's CEQA Thresholds Guide also provides that, if a project requires the addition of a new fire station or expanded facility to maintain service, the determination of whether the new construction could cause a significant environmental impact will be determined through a case-by-case evaluation. AR 4804-05. The DEIR noted that the Project Site is only 0.7 miles from a LAFD fire station housing a truck company and 0.8 miles from a fire station housing an engine company. AR 4807. Both the truck and engine companies are within the 1.5 mile maximum response distance required by Fire Code section 57.09.06 and applicable response times. Average response times for those two stations are less than five minutes, and the environmental impact was deemed less than significant. AR 4808.

The DEIR was circulated for 45 days, with a public hearing being held on February 19, 2013. *See* AR 21084-85.

5. <u>Millennium's Fault Investigation Report</u>

Pursuant to LAMC section 17.05(U), Millenium prepared and the City approved a preliminary soils report. AR 29810-11; Opp. RJN Ex.A.

Because a 2010 CGS map showed the Hollywood Fault as active, and it "appears to exist in the vicinity of the subject site," the City required a fault investigation report pursuant to Los Angeles Building Code section 1803.5.11. *See* AR 29813.

A Fault Investigation Report dated November 30, 2012 ("Fault Report") was prepared by Millenium's consultant, Langan Engineering. AR 29864-79 (without exhibits). The Fault Report stated that the Hollywood fault is active and has the potential for rupture. According to CGS and the City's ZIMAS mapping system, the Hollywood fault is located approximately 0.4 miles from the Project Site. AR 29870. The Fault Report explained that, although the Project Site is not located in a current State or City-mandated fault investigation zone, the City required a fault investigation anyway since the Project Site is within 500 feet of the Hollywood fault trace as mapped by CGS. AR 29867. The Fault Report concluded that "active faulting is not present within the limits of our investigation within the Site...." AR 29875.

6. <u>Caltrans' DEIR Comment Letter</u>

In a December 10, 2012 letter, Caltrans expressed a series of "major concerns" with the DEIR's traffic analysis, referencing its May 18, 2011 letter in response to the NOP. AR 31785-88. Caltrans' primary concern was that the City's June 2012 Traffic Impact Study ("Traffic Study") for the DEIR did not follow the procedures outlined in the TISG, and did not analyze impacts to the state highway system. AR 31785. Specifically, the Traffic Study only applied the CMP criteria and failed to provide adequate information for direct traffic impacts to the 101 Freeway's mainline segments and ramps. AR 31786. Additionally, the DEIR and Traffic Study omitted a cumulative traffic analysis for the 101 Freeway which would consider the impact of 58

related projects, the proposed NBC-Universal project, and anticipated growth from the Hollywood Community Plan. Id.

Caltrans also took issue with the DEIR's conclusion that the Project (without mitigation) would not generate significant trip generation impacts at CMP locations and on 101 Freeway segments. Caltrans asserted that this conclusion was "not based on any credible analysis that could be found anywhere in the DEIR." To the contrary, Caltrans opined that the Project would *significantly impact* the state highway system. Id. The Traffic Study's projected trip generation figures appeared to be "unreasonably low," and Caltrans requested that the City verify them. AR 31786-87. Particularly questionable was the Traffic Study's high number of trip-reduction credits. AR 31867.

The Traffic Study also did not include a series of nearby 101 Freeway on-ramps and off-ramps (*e.g.*, the Vine Street off-ramp), the inclusion of which was necessary to show projected queuing and upstream buildup, which is a safety issue. Id. In order prevent queuing and backup, City intersections adjacent to the Project needed to be able to adequately absorb increased off-ramp volumes at the same time as serving local circulation. *See* id. A Highway Capacity Manual ("HCM") weaving analysis also needed to be performed. Id.

In sum, Caltrans was "concerned that the project impacts may result in unsafe conditions due to additional traffic congestion, unsafe queuing, and difficult maneuvering" for the 101 Freeway, where the Level of Service (sometimes "LOS") is "F". AR 31867, 31786. If the City did not address these concerns, Caltrans refused to "recognize the [Traffic Study] and DEIR as adequately identifying and mitigating the project's impact to the State highway facilities." AR 31867.

7. The FEIR

The FEIR was published on February 8, 2013. The FEIR included over 500 pages of responses to comments. *See* AR 151-661.[3]

In response to Caltrans' comments, the City stated that it consulted Caltrans and considered its concerns. AR 181. The City disputed Caltrans' concern that it did not analyze the Project's impact on the state highway system. Id. The DEIR's Traffic Study analyzed "key freeway ramps" using the City's own "level of service" methodology, and of freeway mainline segments using the County's CMP-recommended methodology. Id. Caltrans' TSIG was consulted, but it did not provide thresholds of significance which CMP, a state-mandated program, did. Id. The City neither confirmed nor denied Caltrans' status as a CEQA responsible agency. *See* id.

As for freeway segment analyses, the City asserted that the Traffic Study concluded that Project impacts to the 101 Freeway would be less than significant so no further analysis was necessary. AR 181. Support for that conclusion was provided by the recently certified EIR for the Hollywood Community Plan Update ("HCPU"). Id.

The City added that it performed a supplemental traffic study using methodologies developed by the Southern California Association of Governments ("SCAG"). Id. The supplemental traffic analysis verified the City's initial conclusions that the Project will not result in the addition of 150 trips or more to any freeway segment, and therefore traffic impacts on the freeway system will be less than significant. Id.

---

[3] The City received only a few seismic comments that generally did not address the FEIR's sufficiency or methodology. AR 23892, 23995, 24019. *But* see AR 23924.

With respect to Caltrans' criticism of the Traffic Study's failure to include a cumulative traffic analysis for the 101 Freeway -- including from the 58-related projects in the DFEIR, the NBC-Universal project, and Hollywood Community Plan growth -- the City did not directly address the proposed NBC-Universal project. *See* id. However, the City referred to its extensive transit system in the Project's vicinity, stating that the Project would provide "in-fill uses" that would reduce regional trip demand. Id. The City's reliance on transit solutions was also consistent with the City's traffic study guidelines and the HCPU's objectives. Id.

As for the on-ramp/off-ramp issues, the City responded that its own procedures were selected as the most appropriate for use in the Traffic Study, and the ramps chosen were where impacts were expected to be the most significant and substantial. AR 183. The ramps listed by Caltrans were not expected to be a capacity restraint issue. Instead, the signalized intersections and mainline 101 Freeway sections present the capacity restraints, and the queues from those constraints determine the ramp conditions. AR 184. The queuing issue will depend on under-signaling at the intersections. Id.

The City's trip generation estimates -- 19,486 trips per day with 1064/1888 trips during the AM/PM peak hours -- were based on well-accepted guidelines. AR 184. Additionally, it is a common practice to reduce trips for transit trips, pass-by trips, and internal trips associated with mixed-use projects. Id.

The City stood by its use of the critical movement analysis ("CMA") methodology for congestion modeling as per the City's Department of Transportation ("LADOT") manual instead of Caltrans' preferred HCM methodology. AR 186. The CMA is a planning methodology, whereas HCM is an operations methodology. Id. The HCM also assumes *constant signal timing*, which is problematic given that the City employs instantaneous, computer-controlled signaling, the timing of which varies depending on traffic. Id.

8. Caltrans' Supplemental Comment Letter

On February 13, 2013, Caltrans submitted a supplemental comment letter after reviewing the FEIR. AR 22840-44. Caltrans stood by its assertion that the City's use of the CMP methodology did not adequately study impacts to the freeway system. AR 22840. According to Caltrans, the City's Traffic Study analysis improperly focused on the Project's impact on the local CMP, rather than impacts to the existing state highway system, particularly for safety issues. AR 22840-41. The Traffic Study also did not provide sufficient traffic analysis for the reader to review its assumptions, analysis, and conclusions. AR 22841.

Caltrans asserted that the CMP does not capture the same data for analysis that the HCM does. AR 22841. For example, the CMP does not analyze off-ramps or freeway impacts with fewer than 150 trip assignments, even where the existing LOS is F. Id. It also uses a "flawed percentage ratio to determine the significance of impacts," and incorrectly analyzes cumulative traffic impacts. Id. Caltrans again faulted the City for failing to undertake a queuing analysis. Id.

After receiving no response from the City, Caltrans sent a fourth letter dated May 7, 2013 to then-Councilmember Eric Garcetti. *See* AR 11853-54. In the May 7 letter, Caltrans generally repeated its grievances about why it felt the FEIR was inadequate. *See* id.

9. The Initial Hearing on the Vesting Tentative Tract Map and FEIR

Under the Subdivision Map Act, Millenium processed a VTTM for a 41-lot subdivision of the property. On February 19, 2013, 11 days after the FEIR's release, an initial hearing was

held by the City's Deputy Advisory Agency on the proposed VTTM and the FEIR. AR 21084-85. Although the parties do not cite to the decision, the DAA apparently approved the Project's VTTM and supporting FEIR.

10. The Planning Commission Hearing

On March 28, 2013, the Planning Commission heard the appeals from the Deputy Advisory Agency's approval of the VTTM and FEIR. AR 2. At the outset of the hearing, Deputy City Attorney Adrienne Khorasanee (the "City Attorney") announced that due to a financial conflict of interest by one of its commissioners, the Planning Commission was disqualified from considering approval of the Development Agreement for the Project. AR 74812. As a result, Millenium decided to withdraw the Development Agreement, which was removed from the agenda. AR 74812. The City Attorney advised the Planning Commission that it could nevertheless consider the other items concerning the Project. Id.

The Project opponents were given 30 minutes to speak at the Planning Commission hearing. *See* AR 74882. Petitioners' attorney, Daniel Wright, Esq., spoke on behalf of Mr. and Mrs. Jim Geoghan, who represented the neighborhood associations appealing the initial determination. *See* AR 74883-95. Mr. Wright argued that the commissioner's conflict of interest meant that the entire Planning Commission should be disqualified from the matter and that the hearing should be terminated. AR 74885-86. Mr. Wright also made a due process objection based on his belief that the exhibits he filed were neither accepted nor considered. AR 74886. Commissioner Perlman responded that the Planning Commission had received the exhibits, which were in the record, as was Mr. Wright's last minute two-page letter. AR 74886-87.

After the appellants spoke, several prepared statements were read by City representatives. *See* AR 74918-19. Next was a 90 minute public comment period, with time split evenly between supporters and opponents. See AR 74927.

At the conclusion of the hearing, the commissioners voted to deny the appeals from the approval of the VTTM and FEIR. AR 21149. Thereafter, the commissioners voted to adopt the Planning Commission staff's recommended actions, including approval of various CUPs, variances, and changes to the Development Regulations. *See* AR 4-7, 21149, 75168-72. The Planning Commission also voted to recommend that the City Council (1) adopt an ordinance authorizing the execution of a Development Agreement; (2) adopt a zone change and height district change; and (3) certify the FEIR and Statement of Overriding Considerations. Id.

11. The PLUM Hearing

On June 18, 2013, the matter was heard before the City Council's Planning and Land Use Management Committee ("PLUM"). AR 29-33, 75300-79. Petitioners' attorney, Robert Silverstein, Esq., spoke on behalf of appellant CURD. *See* AR 75178. He requested at least ten minutes to make his objections. AR 75177-78. The Chairperson responded; "Well, why don't you start, and let's see how far you get?" AR 75178. Mr. Silverstein offered a letter with 27 exhibits for PLUM's consideration. *See* AR 75178. In addition to arguing about the dangers posed by the Hollywood Fault (AR 75178-90,) Mr. Silverstein argued that the Planning

Commissioner's disqualifying conflict of interest should have resulted in the withdrawal of all items concerning the Project. AR 75190-92.[4]

After a presentation by Millennium, the PLUM gave 20 minutes of general public comment to each side. AR 75224. Anne Geoghan, a member of CURD, was one of the speakers during this period. AR 75251-52. At the conclusion of the hearing, the PLUM voted to take all actions recommended by the staff report. *See* AR 29-33, 75295-97. The changes to the Development Regulations and Q conditions requested by Millennium and the Planning Department were adopted by reference. AR 31. Therefore, the PLUM implicitly denied the appeal. *See* id.

12. The State Geologist's Letter

On July 20, 2013, State Geologist John Parrish sent Councilmember Wesson a letter indicating that CGS was commencing a study of the Hollywood Fault, pursuant to Alquist-Priolo for possible zoning as "Active." AR 19063-64. The State Geologist mentioned the Project, which he stated may fall within an Earthquake Zone. Id. He advised that the study's outcome would provide the City with new information for its consideration of current and future developments along the Hollywood Fault, and indicated that the investigation and resultant maps were scheduled for completion by late 2013 or early 2014. Id.[5]

13. The City Council Hearing

The City Council's hearing for the Project took place on July 24, 2013. AR 105, 113-16. The day before the hearing, Millennium submitted a 311-page letter and supporting evidence responding to CURD's arguments and evidence on appeal. AR 19086-393.[6]

Mr. Silverstein again represented CURD and other Project appellants. See AR 75331. At the outset of the hearing, the Chairman gave ten minutes for each of the two appellants, ten minutes for the applicant, and ten minutes each for all supporters and opponents. AR 75301. Mr. Silverstein requested more time to make his case, but the Chairman refused to give him the other appellant's ten minutes. AR 75330-31.

Mr. Silverstein objected to Millenium's last-minute letter as an attempt to sneak in new studies and data, and a violation of due process. AR 75332-33. He addressed the letter written by the State Geologist on the Hollywood Fault issue, and argued that the Project Site is within an earthquake fault zone. AR 75336.

---

[4] Prior to the PLUM hearing, Millennium sent a May 31, 2013 letter requesting a series of changes to the Q Conditions for approval and to the Development Regulations. *See* AR 18466-70. The City's Planning Department also made a recommended modification to Q Condition No. 2 and corrections to the Development Regulations. *See* AR 19038-42. These requested changes were not addressed by Mr. Silverstein at the PLUM hearing. *See* AR 75178-92.

[5] Petitioners attempt to present the results of this study showing that the Project is in fact within the Hollywood fault zone (RJN Exs C, D), but the court has denied this request.

[6] In a letter to the City Council dated the day of the hearing, LADBS noted the State Geologist's July 23, 2013 letter stating that investigation may show that the Project lies within an Earthquake Zone, and responded that LADBS already treats the Project Site as if it is located in an Earthquake Zone. It was for this reason that Millenium was required to prepare the Fault Report. AR 13791-92.

A typed amending motion was announced as circulated by the City Clerk, which was unanimously approved by the City Council. AR 75301, 75378-79. The City Council then denied all appeals and approved the Project in full. AR 125, 133-37. Thus, the City Council: (1) certified the FEIR; (2) adopted the Statement of Overriding Considerations; and (3) granted a series of land use entitlements, including a vesting CUP for a hotel within 500 feet of a residential zone, a master CUP to sell an dispense alcohol for on and off-site consumption and live entertainment, zone variances for outdoor eating above the ground floor and to permit reduced parking for a sports club facility, reduced on-site parking, and the VTTM. *See* AR 11643 (Council Amending Motion), 125-50, (City Council Action).

The Project's vested land use entitlements include Ordinance No. 182636 (the "Ordinance"), which effectuates for the Project property a zone change from a C4 zone with a 3:1 FAR and no height limitation to a C2 zone with height limitation and 6:1 FAR. AR 11644-95. The Ordinance also includes the Development Regulations, (AR 18574-635) and the LUEP (AR 13789-90), which define and restrict the Project's mix of uses, design, height, scale, and massing, and any future change in the mix of uses. AR 13789, 18586. The Ordinance further contains a Mitigation Monitoring and Reporting Plan ("MMRP"), which contains all of the mitigation measures listed in the EIR. These entitlements and conditions thereto were recorded with the County Recorder's Office. *See* AR 11656.

14. Invalidation of the Hollywood Community Plan Update

On February 11, 2014, the Honorable Ann J. Jones rendered judgment in La Mirada, LASC Case No. BS 138580. *See* Pet. Pet. RJN Ex. F. Pursuant to the court's judgment, a peremptory writ of mandate was issued invalidating and setting aside the HPCU and the EIR certified for the HCPU. Id., p. 1. The La Mirada judgment also set aside and vacated the related approvals issued in furtherance of the HCPU. Id., pp. 1-2. The judgment stated that its provisions were not intended to order the City to rescind "those adjudicatory approvals not challenged which the City may have made under the HCPU after its adoption by the City." Id., p. 2.

The City accepted the La Mirada judgment without appeal, and it is now final. The original 1988 Hollywood Community Plan ("HCP") became operative again after the City rescinded the HCPU. *See* AR 24045.

F. Analysis

Petitioners argue that the City violated CEQA by (1) refusing Caltrans' direction as a responsible agency to study impacts to the 101 Freeway, (2) failing to notify and consult with CGS as an agency with jurisdiction, (3) failing to provide a fixed and stable Project description, (4) failing to advise the public of seismic issues, (5) failing to properly analyze traffic impacts, (6) failing to properly analyze fire/safety service impacts and (7) relying on the HCPU which was later set aside by the La Mirada judgment. In their non-CEQA claims, Petitioners argue that (1) the La Mirada judgment requires rescission of all HCPU-related approvals such as the Project, (2) the City's approval of the Development Regulations and elevation of them over all other LAMC provisions was illegal, and (3) the City Council's unfair hearings violated due process.

1. The City Was Required to Follow Caltrans' Preferred Traffic Study Methodology

Caltrans contended that the City's traffic figures for the Project of 20,000 vehicle trips and 1064/1888 peak period AM/PM vehicle trips – which Caltrans described as low and not based on credible analysis (AR 11859) -- required a Traffic Impact Study using Caltrans' TISG. Concerned about queuing and upstream freeway buildup, Caltrans wanted a study of 101 Freeway on/off ramps near the Project. Caltrans also wanted a weaving analysis pursuant to its Highway Capacity Manual ("HCM"). Caltrans further stated that the FEIR omitted a cumulative traffic analysis for the 101 Freeway which included the NBC-Universal project, which was necessary whether or not the City was correct about only 150 additional trips generated. Thus, Caltrans concluded that the FEIR did not adequately analyze the Project's impact to the state highway system. Mot. at 6-8.

In response to Caltrans, the City relied on the traffic analysis required by the CMP, which is the standard methodology for traffic studies in the County, and analyzed key freeway ramps as well as freeway mainline segments, finding a less than significant traffic impact. A supplemental traffic study using SCAG methodologies confirmed this conclusion. The City did not expect the ramps listed by Caltrans to be a capacity restraint issue. The City contended that Caltrans' allegation about its low trip estimates was unwarranted as the estimates were based on well-accepted guidelines. Finally, the City preferred its congestion modeling to Caltrans' HCM methodology which is inapplicable to planning issues.

Thus, there was a clear dispute between the City and Caltrans over the adequacy of the FEIR's Traffic Study analysis for impacts to the 101 Freeway.

The lead agency under CEQA is the agency that carries out a project or has primary authority for approving a project. Pub. Res. Code 121067; Guidelines §15051. Where the project is local, such as land use decisions, the agency that has general governmental power over a project is almost always the lead agency. *See* Guidelines §15051(a).

If the lead agency determines that an EIR is required, it must send notice to each responsible agency. Pub. Res. Code §21080.4(a). A "responsible agency" means an agency which has some discretionary responsibility for carrying out or approving a project. Pub. Res. Code §21069; Guidelines §15381. Upon receipt of the notice, each responsible agency "shall specify to the lead agency the scope and content of the environmental information that is germane to the statutory responsibilities of that responsible agency...and which, pursuant to the requirements of this division, shall be included in the environmental impact report." Pub. Res. Code §21080.4(a); Guidelines §15082(b) (responsible agency shall provide detail about the scope and content of environmental information that "must be included in the draft EIR").

The lead agency shall include the responsible agency's information in the EIR. Guidelines §15096(b)(2). The lead agency may begin work on the draft EIR without waiting for responses, but the draft "may need to be revised or expanded to conform to" the responsible agency responses. Guidelines §15082(a)(4). *See* Save San Francisco Bay Association v. San Francisco Bay Conservation and Development Commission, (1992) 10 Cal.App.4th 908 (city as lead agency complied with its duty to produce comprehensive document which responsible agency could rely upon in its discretionary approval).

A responsible agency complies with CEQA by reaching its own conclusions on whether and how to approve the project. Guidelines §15096(a). The responsible agency consults with the lead agency and comments on draft EIRs for projects which the responsible agency would later be asked to approve. Guidelines §15096(b), (d). If the responsible agency deems the lead agency's final EIR to be inadequate for use by the responsible agency, it must either sue, be

deemed to have waived objection, prepare a subsequent EIR if permissible, or assume the lead agency role. Guidelines §15096(e).

The City is the lead agency for the Project. If Caltrans is a responsible agency, then the City was required to include in the FEIR the information required by Caltrans. The joint Opposition argues otherwise, contending that Pub. Res. Code section 21080.4(a) and Guidelines section 15096(b)(2) provide only that the lead agency shall include "this information" in the EIR, and "this information" means the comments of responsible agencies. According to the Opposition, the City was not required to follow Caltrans' direction as a responsible agency if it included the comments in the FEIR. Opp. at 11.

This position is incorrect. As Petitioners argue (Reply at 7), Pub. Res. Code section 21080.4(a)'s plain language requires that the responsible agency "specify" to the lead agency the "scope and content of the environmental information" within the responsible agency's purview, and that is the information which "shall be included" in the EIR. There is no reason for the statute to use the word "specify" if a lead agency could ignore it. This conclusion is underscored by the remedies available to the responsible agency should the lead agency fails to follow the responsible agency's direction, which include a lawsuit, preparation of a subsequent EIR if permissible, or assumption of the lead agency role. Guidelines §15096(e). There would be no need for the responsible agency to have this list of remedies – particularly the remedy of taking over as lead agency -- if it only had a right to comment on a draft EIR. Thus, a lead agency fails to follow a responsible agency's direction at its own peril. *See* Remy, Thomas, Moose, & Manley, Guide to CEQA: California Environmental Quality Act, (11th ed. 2007) p. 45 ("[L]ead agencies *must* include in their EIRs information related to the environmental impacts that are anticipated by responsible agencies and trustee agencies as to matters within their expertise or jurisdiction.").[7]

The issue becomes whether Caltrans is a responsible agency under CEQA whose direction the City was required to follow for analysis of the Project's impact on the state freeway system. Petitioners argue that Caltrans is a responsible agency for the Project, pointing out that the City identified Caltrans as a responsible agency in the draft EIR. Mot. at 6. Specifically, the DEIR stated that Caltrans had authority to review traffic impacts on the 101 Freeway and enforce any Project mitigation measures. AR 4260.

The Opposition admits that the City treated Caltrans as a responsible agency, but contends that treatment does not make it so. The Opposition argues that the definition of a "responsible agency" requires that the agency have some discretionary responsibility for carrying out or approving a project, and Caltrans has no approval authority over the Project. *See* Pub. Res. Code §21069; Guidelines §15381. Even if Caltrans has a role in implementing mitigation measures for the Project, that does not make it a responsible agency. *See* Rominger v. County of Colusa, (2014) 229 Cal.App.4th 690, 700-01 (county's environmental review did not bar it from contending that the project was exempt from CEQA because court decides whether agency required with procedure required by law). Opp. at 11-12.

---

[7] The Opposition cites to Citizens for East Shore Parks v. State Lands Commission, (2011) 202 Cal.App. 4th 549, 567-68. Opp. at 11. That case holds only that a lead agency may rely on a responsible agency's failure to provide comments after receiving notice to mean that the responsible agency had no comments to make. It does not hold that a lead agency may ignore a responsible agency's direction.

Contrary to Petitioners' position (Pet. Reply for Supp. Mot. To Augment, pp. 5-7), the City is not judicially estopped from contending that Caltrans is not a responsible agency simply because it said so in the DEIR, or in a September 9, 2013 email from Deputy City Attorney Siegmund Shyu providing Petitioners with notice of the responsible agencies so that Petitioners could notify them about their lawsuit. *See* Pub. Res. Code §21167.6.5(b), (c). Judicial estoppel is an equitable doctrine that prevents "the use of intentional self-contradiction as a means of obtaining unfair advantage in a forum provided for suitors seeking justice." The primary purpose of the doctrine is not to protect the litigants, but to protect the integrity of the judiciary. Thomas v. Gordon, (2000) 85 Cal.App.4th 113 (citations omitted). The focus is on whether a party has taken totally inconsistent positions in judicial proceedings where the prior position was successfully asserted, and the inconsistency is not the result of ignorance, fraud or mistake. Aguilar v. Lerner, (2004) 32 Cal.4th 974, 986-97. The doctrine should apply when: (1) the same party has taken two positions; (2) the positions were taken in judicial or *quasi*-judicial administrative proceedings; (3) the party was successful in asserting the first position (i.e., the tribunal adopted the position or accepted it as true); (4) the two positions are totally inconsistent; and (5) the first position was not taken as a result of ignorance, fraud or mistake. International Engine Parts, Inc. v. Feddersen & Co. (1998) 64 Cal.App.4th 345, 350-351. The City was not "successful" in asserting that Caltrans is a responsible agency in the DFEIR or other documents, and judicial estoppel does not apply.[8]

Moreover, Caltrans does not become a responsible agency simply because it will enforce mitigation measures created by the City. *See* Lexington Hills Assn. v. State, (1988) 200 Cal.App.3d 415, 433 (issuance by Caltrans of "encroachment permits" was not integral to timber harvesting project, merely occurred during performance of mitigation measure, and Caltrans did not have authority or duty to approve project under CEQA). *Compare* Citizens Assn. for Sensible Development of Bishop Area v. County of Inyo, (1985) 172 Cal.App.3d 151, 174-75 (Caltrans was responsible agency because it must issue encroachment permit for construction of the project, and permit was discretionary because Caltrans can control the location and manner of encroachment).

However, there is more to Caltrans' involvement than mere enforcement of mitigations. Caltrans contended that it is a responsible agency for the Project, and the City agreed with that contention in the DFEIR through the outset of this lawsuit. This is not an issue of judicial estoppel or admission, but rather that the City agreed upon a legal framework which included Caltrans as a responsible agency for purposes of CEQA. The City cannot now deny Caltrans the role of responsible agency after extensive colloquy between the two agencies in which Caltrans played that very role. At some point in the CEQA process, the City becomes bound by the CEQA framework it adopts. *See* Genry v. City of Murrieta, (1995) 36 Cal.App.4th 1359, 1404-05 (city never considered whether to prepare supplemental EIR and consequently was bound by election to prepare only mitigated negative declaration). To conclude otherwise would impermissibly enable the City to manipulate the Project's design so as to avoid allocating discretionary decisions to Caltrans and its demands for freeway and on/off ramp traffic study.

---

[8] Nor does the City Attorney's September 9 email that Caltrans is a responsible agency constitute a judicial admission. Judicial admissions apply to facts, not conclusions of law. Stroud v. Tunzi, (2008) 160 Cal.App.4th 377, 384.

Apart from the fact that the City is bound by the CEQA framework it adopted, Caltrans is a responsible agency because it does perform a discretionary function for the Project. Both the DEIR and the Project Conditions of Approval state that Caltrans and LADOT will jointly design and approve the mitigations measures for the intersection at Argyle/Franklin Avenue and the northbound onramp to the 101 Freeway. AR 4194-95, 11685; *see* AR 22879. This design feature makes Caltrans an agency with discretionary authority for approval of an integral part of the Project (design of an onramp mitigation measure), not just the implementation of mitigation measures. Caltrans is a responsible agency for the Project.[9] [10]

The Opposition contends that the City, as lead agency, was entitled to consider and reject criticism by Caltrans so long as its reasons are supported by substantial evidence. North Coast Rivers Alliance v. Marin Municipal Water District, (2013) 216 Cal.App.4th 614, 627, 642 (lead agency could reject other agency recommendations so long as lead agency decision was supported by substantial evidence). According to the Opposition, the City considered and fully responded to Caltrans' comments, including the preparation of a second traffic impact analysis using SCAG's traffic model. This second study is substantial evidence supporting the FEIR's conclusions. Unlike the City's threshold of 150 peak-hour trips in one direction, the SCAG analysis used a more conservative threshold of 150 trips during peak hours in both directions and it still found no significant impact on freeway segments. Opp. at 9-10.

The Opposition defends the City's use of CMP rather than the HCM level of service methodology preferred by Caltrans, which measures level of service based on travel speed and duration of congestion. AR 56127. The CMP chose a LOS methodology called Intersection Capacity Utilization ("ICU") due to the need for a consistent means of measuring congestion across the County. ICU has been determined to be consistent with HCM for this purpose, and CMP does not preclude the use of different methodologies for a purpose outside the CMP. AR 56127-28. The City did not use Caltrans' TISG because it does not include thresholds of significance, and the absence of significance thresholds is an appropriate basis to evaluate environmental impacts. *See* Sierra Club v. City of Orange, (2008) 163 Cal.App.4th 523, 541 (level of service standard used in EIR). Opp. at 10. The City also studied system constraints for freeway ramps by studying the immediately adjacent intersections to numerous 101 Freeway on/off ramps. The City used LADOT methodology for this purpose, and there is no evidence that this methodology was inaccurate. Id.

The City's choice of methodology did not comply with the substance of what Caltrans required, and the City was not free to ignore it. Even the CMP expressly states that Caltrans must be consulted to identify specific locations on the freeway system for analysis. AR 11863. The City relied on the CMP for thresholds of significance, but Caltrans told the City that the congested conditions of the 101 Freeway meant that even trips below the arbitrary CMP threshold of 150 could be significant and should be analyzed using its TISG. AR 11864. The CMP also states that at a minimum the geographic area examined in the traffic study must

---

[9] Petitioners also argue that Caltrans has authority for enforcing a stormwater runoff management permit that protects water quality in Ballona Creek (AR 4284), but this enforcement authority does not make Caltrans a responsible agency for traffic impacts on the Project. *See* Reply at 2.

[10] The Opposition does not argue the scope of Caltrans' authority as responsible agency, and the court need not decide whether the traffic study sought by Caltrans is outside the scope of its discretionary authority.

include mainline freeway monitoring locations where the project will add 150 or more trips, in either direction, during peak hours; it does not say that a 150 trip threshold is always sufficient. The City was not free to reject Caltrans' instruction about threshholds. *See* AR 56281. *See* Mejia v. City of Los Angeles, (2005) 130 Cal.App.4th 322, 342 ("A threshold of significance is not conclusive...and does not relieve a public agency of the duty to consider the evidence...."); Berkeley Keep Jets Over the Bay Committee v. Board of Port Commissioners, ("Berkeley Keep Jets") (2001) 91 Cal.App.4th 1344, 1380-82 (agency insufficiently considered site-specific characteristics of noise from airport in favor of standard for threshold of significance). The CMP also states that it chose ICU over HCM solely out of need for a consistent means of measuring congestion across the County. AR 56127-28. This justification – the need for a consistent measure of traffic on County streets -- is irrelevant to the evaluation of freeway traffic congestion and safety. Under these circumstances, there was no reason for the City to cling to the County's CMP to conduct its traffic analysis. The City wrongly used the CMP and its 150 trip threshold in the face of Caltrans' criticism and direction to the contrary.

Caltrans also wanted the City to use its HCM methodology to address safety issues, including queuing on off-ramps between Vermont and Highland where vehicles could back up into intersections, as well as performing a weaving analysis. Caltrans further wanted a cumulative analysis of the 101 Freeway traffic impacts from the Project, the 58 related projects in the DFEIR, and the NBC-Universal project. A freeway has three types of segments: (1) a merge/diverge segment, whether a stream of traffic combines or divides, (2) a weave segment, in which traffic streams travelling in the same direction cross paths, and (3) a basic freeway segment. AR 73441. Caltrans' HCM addresses safety issues with respect to all three types of segments (AR 22841, 11290), whereas the CMP addresses only traffic congestion. AR 56114 (CMP tracks and analyzes regional transit performance), 31503 (CMP evaluates "demand-to-capacity" for freeway impacts). The CMP has only one monitoring station between downtown and Coldwater Canyon (AR 56210) which is incapable of evaluating queuing and weaving. The City did not perform the requested analyses, merely finding that the 101 Freeway was exempt because the CMP's 150 trip threshold had not been met.[11]

The FEIR fails to analyze traffic impacts to the 101 Freeway as Caltrans directed in its role as responsible agency. As Petitioners contend (Reply at 3-4), the City's disagreement with Caltrans is a failure to proceed in the manner required by law. The City was not entitled to disagree with Caltrans, perform a study more limited than sought by Caltrans, and then rely on substantial evidence of what it did. Rather, the City was obligated to provide the information and analysis which Caltrans specified as a responsible agency should be performed. Compliance with the requirements of CEQA is "scrupulously enforced.' Citizens of Goleta Valley v. Board of Supervisors, (1990) 52 Cal.3d 553, 564.

2. The FEIR's Assessment of Traffic Impacts Was Inadequate

Apart from its failure to follow Caltrans' direction for methodology and 101 Freeway impacts analysis, the City did not adequately analysis traffic impacts. As stated *ante*, the City relied on the CMP to conclude that the Project would not generate more than 150 additional trips

[11] Finally, the Opposition contends that Caltrans waived its objections to the FEIR when it failed to file suit under Guidelines §15096(e). Opp. at 12. True, but Petitioners did not waive their right to assert the City's failure. *See* Citizens for Open Government v. City of Lodik, (2006) 144 Cal.App.4th 865, 875.

per day for the 101 Freeway, and this was not a significant traffic impact. AR 182. The FEIR also concluded that the freeway ramps, including the meters and weave sections on the ramps, are not the limiting factor for the roadway in the Hollywood area. AR 184.

The FEIR's mere conclusion that the ramps -- and the weaving sections on the ramps -- are not a limiting factor in Hollywood is not substantial evidence. Caltrans pointed out that ramp queuing can lead to safety issues and "without a queuing analysis neither Caltrans nor the City can determine whether traffic from the off-ramps will back up, creating an unsafe condition. AR 22843. Similarly, without a weaving analysis for both the northbound and southbound mainline segments between the nearby on/off ramps the difficulty of drivers in maneuvering could not be assessed. AR 22844. The City's only response was that its standard CMA analysis did not require these analyses. AR 186. This response did not meet CEQA's requirement of a good faith reasoned analysis in response to comment. *See* Berkely Keep Jets, *supra*, 91 Cal.App.4th at 1367; Guidelines §15151. The omission of a freeway weaving and queuing analysis was an abuse of discretion.

When Caltrans contended that the 101 Freeway's mainline segments should be analyzed, the City responded that its CMP analysis showed a less than significant 150 Freeway trips per day, and no further analysis was necessary. AR 181-82, 31791. As discussed *ante*, the use of a threshold of 150 daily trips failed to recognize Caltrans' concern that the greater the congestion, the lower the threshold of traffic needed to create an impact. AR 22848. According to Caltrans' TISG, fewer than 50 trips may have a significant impact on a freeway which operates at LOS E or F, and a full traffic study or some lesser analysis is required in that situation. AR 55811. *See* AR 22848. The 101 Freeway operates at level of service F during peak hours and the City's 150 trip threshold does not take into account this congested LOS. The additional traffic volume of 150 vehicles on the freeway is particularly important in light of weaving, queuing, and diverging movements, issues which Petitioners' consultant said can be addressed by Caltrans' HCM and not CMP. AR 11290. The City did not have substantial evidence to support its mainline freeway segment analysis.

The FEIR also did not perform an analysis of the Project's cumulative traffic impact with other projects on the ramps and mainline. Caltrans noted that the 58 projects identified in the FEIR will also add peak hour trips to the 101 Freeway, and a cumulative impact analysis was required. AR 22848. The City's sole response for not doing so was that the direct impact on the Freeway of the Project's 150 trips per day was not significant. AR 181-82. But, as Petitioners point out (Mot. at 24), this response misses the point of a cumulative impacts analysis which is to evaluate the cumulative impact of projects whose incremental impact is small. Environmental damage often occurs incrementally from a variety of small sources, and the assessment of a project's cumulative impact on the environment is a critical feature of the EIR. Los Angeles Unified School District v. City of Los Angeles, (1997) 58 Cal.App.4th 1019, 1025. Understated cumulative impacts analysis impedes meaningful public discussion and skews the decision-maker's perspective. Citizens to Preserve the Ojai v. County of Ventura, (1994) 27 Cal.App.4th 713, 729-35.

The Opposition argues that the FEIR did perform a cumulative impacts analysis because the Guidelines expressly permit a cumulative impacts discussion through a list of projects producing related impacts or a summary of projections from an adopted general plan or planning document. The Opposition contends (Opp. at 12-13) that the City conservatively did both, using a 1% growth factor (AR 2732) and discussing 58 related projects within 1.5 mile radius. AR 2733-39.

There are several problems with the Opposition's argument. First, the FEIR did not conservatively wear a belt and suspenders as the Opposition implies. The Guidelines provide that as part of the cumulative impacts analysis the EIR may provide a list of "past, present, and future project producing related or cumulative impacts," or "a summary of projections contained in an adopted general plan or related planning document...." Guidelines §15130(b)(1). The FEIR listed 58 related existing projects for cumulative impacts analysis, and then used a growth factor of 1% to cover future unknown projects. AR 4980. Thus, the two did not overlap. Second, the 1% growth figure is not a projection in an adopted general plan or planning document; LADOT created it out of whole cloth. *See* id. This is not permissible under Guidelines section 15130(b)(1).[12] Third, the FEIR did not use the projections for a reasonable discussion of cumulative traffic impacts. *See* Guidelines §15130(b)(5).

The FEIR also did not include the NBC-Universal project in its list of related projects, even though Caltrans expressly noted that the NBC-Universal project itself will add traffic to the 101 Freeway. AR 22848. The City's sole response was that the CMP did not show more than 150 trips generated by the Project, which was below the threshold of significance. AR 181-82. This *non-sequitur* is woefully inadequate to constitute a good faith reasoned response to comment. *See* Berkely Keep Jets, *supra*, 91 Cal.App.4th at 1367.

The Opposition now argues that the FEIR was not required to include NBC-Universal as it is located 3.5 miles away from the Project, outside the 1.5 mile radius designated by the City. AR 2733. Opp. at 13.

Other projects must be included in an EIR's cumulative impacts analysis if it is "reasonable and practical" to do so. San Franciscans for Reasonable Growth v. City and County of San Francisco, (1984) 151 Cal.App.3d 61, 77. The agency may draw a geographical line for its cumulative impacts analysis if it provides a reasonable explanation for doing so. *See* Guidelines §15130(b)(3). The City provided no justification for its arbitrary 1.5 mile radius that excludes a major project from cumulative impact analysis. There appears to be no legitimate reason why the large NBC-Universal project should not have been included in a cumulative impacts analysis.[13] Exclusion of the NBC-Universal project solely because it is 3.5 miles away is unreasonable where it apparently is quite large and lies directly downstream from the Millennium Project with few on/off ramps in between.

The FEIR did not have substantial evidence to support its cumulative impacts analysis. The FEIR's traffic impacts analysis was inadequate and an abuse of discretion.

3. The City Was Not Required to Notify and Consult with CGS Prior to Circulating the DEIR

The lead agency "shall consult with, and obtain comments from, each responsible agency, trustee agency, any public agency that has jurisdiction by law with respect to the project...." Pub. Res. Code §21153(a).

Petitioners argue that CGS is a commenting agency under CEQA. Despite knowing that there was a real prospect that the Hollywood Fault crossed Project Site, the City did not notify

---

[12] The DFEIR stated that the summary of projections was validated by the HCPU, but the HCPU was invalided in La Mirada and cannot be relied upon. *See* AR 2732.

[13] Petitioners are, of course, correct in arguing that the mitigations proposed in the FEIR to alleviate traffic congestion are no substitute for analysis of the traffic impacts from the Project. *See* AR 182. Mot. at 26.

the Department of Conservation or its CGS as either a responsible agency or an agency that has jurisdiction over the Project. The State Geologist is required to delineate active earthquake fault zones, which are identified on maps. Pub. Res. Code §§ 2621.5(b), 2622. The CGS's 2010 Fault Activity map showed the Hollywood Fault across the Project site. AR 49493. The City knew seven months before the DEIR was circulated that a Hollywood Fault trace mapped by the CGS might cross the Project Site. AR 68319. When a State Geologist found out that the City Council was considering the Project, he called to express concern and wrote to explain that CGS was mapping the Hollywood Fault and its maps and reports would be completed by year-end 2013 or early 2014. AR 68408, 11885. Yet, CGS was not named as a responsible agency. Mot. at 9.

CGS is not a responsible agency because it has no discretionary authority to approve or carry out the Project. *See* Guidelines §15831. Nor is it a trustee agency over natural resources held in trust for the People. *See* Guidelines §15386. Although Petitioners principally contend that CGS is an agency with jurisdiction by law for the Project, CGS in fact has no jurisdiction over the Project. CGS has no permitting or approval authority for the Project. Instead, CGS has jurisdiction over a fact that is relevant to the Project – the investigation and mapping of earthquake zones. But jurisdiction over a relevant fact does not make CGS an agency which must be notified under CEQA. To hold otherwise would, as the Opposition points out, give CGS jurisdiction over every project in the State. Opp. at 21.

Nor do Petitioners point to any specific prejudice from the City's failure to notify CGS. The agency's environmental decision must be set aside only if the manner in which the agency failed to follow the law is prejudicial. Sierra Club v. State Board of Forestry, (1994) 7 Cal.4th 1215, 1236. While the failure to give notice to a responsible or trustee agency is presumed to be prejudicial, if a department appears at the hearing and voices no concerns there would be no prejudice. Fall River Wild Trout Foundation v. County of Shasta, (1999) 70 Cal.App.4th 482, 492. In this case, CGS did not appear at the City Council hearing, but its State Geologist did explain that CGS' forthcoming determination of the Hollywood Fault could bear on the Project. It is not clear what more CGS would have said.

The City was not required to give notice to CGS.

4. The Ambiguity of the FEIR's Project Description

a. Governing Law

The EIR must describe the project, including (a) a map of the project's precise location and boundaries, (b) a statement of objections sought by the proposed project (c) a general description of its technical, economic, and environmental characteristics, (d) a statement of the intended uses of the EIR. Guidelines §15124.

Only the four listed items are mandatory. California Oak Foundation v. Regents of the University of California, ("California Oak") (2010) 188 Cal.App.4th 227, 269-70. The project description should not "supply extensive detail beyond that needed for evaluation and review of the [project's] environmental impact." Guidelines 15124; California Oak, *supra*, 188 Cal.App.4th at 269-70. The critical inquiry is whether the EIR' s project description "contains sufficient detail to permit reasonable and meaningful environmental review...." California Oak, *supra*, at 272. CEQA also does not require the project description to properly assess environmental impacts -- only generally to describe the project's own environmental characteristics. *See* Dray Creek Citizens v. County of Tulare, ("Dray Creek") (1999) 70 Cal.App. 4th 20, 28 ("general" means only the main features and not details or particulars).

An accurate, stable, and consistent project description is the *sina qua non* of an informative and legally sufficient EIR." County of Inyo v. City of Los Angeles, (1977) 71 Cal.App.3d 185, 193. A shifting project description may confuse the public and agency decision-makers, vitiating the EIR's usefulness as a vehicle for intelligent public participation. County of Inyo, *supra*, 71 Cal.App.3d at 197. The description should be sufficiently detailed to provide a foundation for a complete analysis of environmental impacts. Id. at 192-3. The description should include all project components. *See* Santiago County Water District v. County of Orange, (1981) 118 Cal.App.3d 818, 829-30 (EIR for mining operation should have included extension of waterlines to serve the mine). It must apprise the parties of the true scope of the project. *See* San Joaquin Raptor/Wildlife Rescue Center v. County of Stanislaus, (1994) 27 Cal.App.4th 713, 731-32 (EIR's project description failed to include sewer expansion which the EIR acknowledged would be required as part of the development); San Joaquin Raptor Rescue Center v. County of Merced, (2007) 149 Cal.App.4th 645, 672-83 (EIR's project description of a mining expansion project was inadequate because it inconsistently stated that no increase in mine production was being sought, yet also stated that the real party would be permitted to increase production).

An "EIR cannot be faulted for not providing detail that, due to the nature of the project, simply does not now exist.. .Nor have the courts required resolution of all hypothetical details prior to approval of an EIR." Citizens for a Sustainable Treasure Island v. City and County of San Francisco, ("Treasure Island") (2014) 227 Cal.App.4th 1036, 1054.

In Treasure Island, the court rejected claims that the EIR for the redevelopment of a former Naval base in the San Francisco Bay lacked sufficient detail about the project and should have been a program EIR, not a project-level EIR. 227 Cal.App.4th at 1043. The project description was for a mixed-use community with up to 8,000 residential units, 140,000 square feet of commercial and retail space, 100,000 square feet of office space, 500 hotel rooms, 300 acres of parks, playground and open space, and a school. The construction and build out would be phased over a 20-year period. Id. at 1044. The court noted that the level of detail required for an EIR is driven by the nature of the project and what is reasonably feasible; an EIR on a construction project will necessarily be more detailed in the specifics of the project than adoption of a local general plan. Id. at 1051 (citing Guidelines §15146).

The court held that the project description was accurate and stable, and not merely a "conceptual land use map" as argued by the petitioners. The EIR made an extensive effort to provide meaningful information about the project while providing flexibility to deal with changing conditions affecting final design over a 20 year period. Id. at 1053. The project provided for new zoning that identified permitted uses and development standards within each district and also a set of binding design standards that included both fixed elements, such as street layouts, and conceptual elements, such as shapes of new buildings or specific landscape designs. Id. The court noted that many project features necessarily would be subject to future revision and quite likely would be the subjects of supplemental environmental review before the final project design was implemented. Id. at 1054. The petitioners claimed that "because the EIR does not anticipate every permutation or analyze every possibility, the project description is misleading, inaccurate and vague." Id. The court rejected this claim, finding that the basic characteristics of the project remained, accurate, stable, and finite throughout the EIR process.

Id. at 1055. As an informational document, the project description provided sufficient information for the public and reviewing agencies to evaluate the project's environmental impacts and also provided the required "main features" of the project. Id.

b. The Project Description

The City's FEIR is modeled after the EIR in Treasure Island. The Project Description states that the Project is for a mix of land uses, including "some combination" of residential units, hotel rooms, offices, restaurants, a health and fitness club, and retail. AR 4082. The DEIR describes a LUEP that would provide flexibility to Millenium to adjust the type and density of land uses for the Project, allowing Millennium to request and obtain a transfer of land uses before development of any Project phase so long as it stays within the FAR and trip cap of 1498 new peak hour vehicle trips per day stated in the EIR (AR 13789-90). AR 10987-90.

The DEIR provides for Development Regulations for the Project that are incorporated in the Project approvals with contain standards for the Project's development that would prevail over zoning or land use regulations in the LAMC. AR 845-904, 853. The Development Regulations require that final Project design meet mandatory standards for building heights (AR 859), towers (AR 879), density (FAR) (AR 858), building massing (AR 861), grade level (AR 875), storefronts (AR 877), yards (AR 873), open space (AR 884-86), street walls (871), passageways (AR 887-89), landscaping (AR 892-94), lighting (AR 895-96), parking (AR 897-98), bicycle parking (AR 899-900), and signage (AR 901). Conceptual design drawings depict maximum allowed development envelopes. AR 863-70.

The DEIR identifies three potential development scenarios: the Concept Plan, a Commercial Scenario, and a Residential Scenario. The Concept Plan represents one possible scenario in which Millennium would build approximately 492 residential units (700,000 square feet of floor area), 200 luxury hotel rooms (167,870 square feet), 215,000 square feet of office space (including the existing 114,303 square-foot Capitol Records), 34,000 square feet of food and beverage use, 35,100 square feet of fitness center/sports club, and 15,000 square feet of retail. AR 4106.

The Commercial Scenario describes the most environmental impactful development scenario possible for those resource areas where commercial uses dictate the severity of impacts: air quality, greenhouse gases, noise, water demand, wastewater flow, energy demand, police and fire services, and traffic. AR 4237. The Residential Scenario describes the most impactful development scenario possible for those resource areas where residential uses dictate the severity of impacts: population and housing, schools, parks, libraries, parking, and solid waste generation. AR 4238-39. The DEIR uses these two scenarios in determining the maximum environmental impacts in each area. The total amount of specific development – residential, hotel, office, retail/food and beverage, and fitness center/sports club -- may increase or decrease as long as long as the maximum impacts in each issue area are not exceeded and the total 6:1 FAR is not exceeded. AR 4239-41. *See also* Opp. at 26-27.

c. Merits

Petitioners contend that the Project Description is neither stable nor finite because the actual mix of features for the Project Site is unknown, precluding an accurate identification and analysis of all environmental impacts from the Project actually built. Mot. at 10-11. Petitioners

describe the Project as an "amorphous envelope" of development parameters limited by a set of maximum environmental impacts. Nothing in CEQA permits the substitution of an impacts envelope for an actual project description, and a Project that does not provide an actual project but only "illustrative scenarios" pushes the flexibility permitted by CEQA for project descriptions beyond reasonable. Reply at 11-12.

The court agrees. An EIR should be prepared with sufficient information for the public and decision-makers to make an intelligent decision taking into account environmental consequences. The EIR's sufficiency depends on what is reasonably feasible. Guidelines §15151. The level of specificity of an EIR is determined by the nature of the project and the "rule of reason." Al Larson Boat Shop, Inc. v. Board of Harbor Commissioners, (1993) 18 Cal.App.4th 729, 741-42. That degree of specificity "will correspond to the degree of specificity involved in the underlying activity which is described in the EIR." Guidelines §15146. The ultimate decision whether to approve a project is a nullity if based upon an EIR that does not provide decision-makers, and the public, with the information about the project required by CEQA. Santiago County Water District v. County of Orange, ("Santiago County Water") (1981) 118 Cal.App.3d 818, 829.

The degree of specificity required in an EIR will correspond to the degree of specificity in the underlying project. Guidelines §15146. A construction project will necessarily have a more detailed EIR than that for a general plan or zoning ordinance because the effects of a construction project can be predicted with greater accuracy. Guidelines §15146(a). The use of new zoning that identifies permitted uses and also a set of binding design standards that includes both fixed elements and conceptual elements, such as shapes of new buildings or specific landscape designs, is permissible where necessary. Treasure Island. But an EIR serves both an informative and substantive purpose, and a developer must present an accurate and stable picture of the project so that the public and decision-makers can decide whether its environmental consequences are outweighed by its public benefits. City of Santee v. County of San Diego, (1989) 214 Cal.App.3d 1438, 1454.

The FEIR provides a blurred view of the Project, not the definite and stable view required under CEQA. The LUEP, Development Regulations, and Q Condition No. 1 collectively approve an envelope of potential residential, commercial, retail, and office projects which will not have more than a maximum design mass and height and that will create no more than maximum levels of air pollution and traffic impacts. CEQA requires the project description to describe the project's characteristics so that its environmental impacts may be assessed. Dray Creek, *supra*, 70 Cal.App. 4th at 28. Analyzing a set of environmental impact limits instead of analyzing the environmental impacts for a defined project is not consistent with CEQA, which demands that "the defined project and not some different project must be the EIR's bona fide subject." Burbank-Glendale-Pasadena Airport Authority v. Hensler, (1991) 233 Cal.App.3d 577, 592.

There are times when a project description setting forth only a project's physical parameters and setting out maximum permissible environmental impacts can be reasonable – most particularly where other conditions make specificity impossible. Thus, in Treasure Island, the developer had plans to build over a 20-year period a large-scale development on an island. The island was contaminated by hazardous material which required cleanup, and the developer

could not be sure when the island would be available for development. The Treasure Island court expressly cited Guidelines section 15146 for the proposition that the specificity required depends on the underlying project, and concluded that the existing conditions and long-term nature of the project prevented disclosure of detail that does not now exist. 227 Cal.App.4th at 1054. The court permitted an EIR based on new zoning that identified permitted uses and development standards that included both fixed elements, such as street layouts, and conceptual elements, such as shapes of new buildings or specific landscape designs. The court described the EIR as making an extensive effort to provide meaningful information about the project while providing flexibility. The court further noted that many of the project's features would be likely subjects of supplemental review before a final design was implemented. Id.

These circumstances have no application to Millennium's Project. There is no 20-year build out of a site containing hazardous substances or other external variables that makes the nature and timing of development unknown and unknowable. Nor is there any planned supplemental environmental review for the Project. Where a construction project is not limited by external conditions that create great uncertainty, there is no reason for a project developer not to be specific about project details. The public and decision-makers should know whether the project will contain any housing, any retail, any commercial, any restaurant, any health club, and if so, how much. They should also know whether it will have multiple tall buildings and the building footprint, all for purposes of environmental analysis. *See* Guidelines §15146(a).

The Millennium FEIR does not rely on an external condition -- such as a hazardous cleanup or a long-term development plan with many unknown variables outside Millennium's control -- to provide an ambiguous Project Description. Nor does the FEIR justify the ambiguity by anticipating further environmental review upon final Project design. Instead, the Opposition's sole excuse for not providing a clear and unambiguous Project Description are the "changing conditions and unforeseen events" that could possibly impact the Project. Opp. at 25. While CEQA does not require a project to be defined down to the last detail, Millennium's uncertainty about market conditions or the timing of its build-out is an insufficient ground for the ambiguous and blurred Project Description. The public and decision-makers for the Project are entitled to know what the Project will look like after Millennium makes that decision so that the Project's description can form the foundation of the environmental analysis. The EIR's project description must provide sufficient information about the project for the public and reviewing agencies to evaluate the project's environmental impacts. Treasure Island, *supra*, 227 Cal.App.4th at 1055. An EIR that does not provide decision-makers, and the public, with adequate information about the project fails as an informational document. Santiago County Water, *supra*, 118 Cal.App.3d at 829

Additionally, the Project essentially defers a portion of the environmental impacts analysis. The environmental assessment of the defined project must be performed at the earliest possible stage, and certainly in the EIR. *See* Sundstrom v. County of Mendicino, (1988) 202 Cal.App.3d 296, 306-08. As Petitioners argue, when a project faces uncertainty over several specific project alternatives, the EIR typically evaluates the environmental impacts of each specific project alternative. Deferred environmental evaluation generally is permitted only for mitigation measures, and even there only where obtaining more detailed useful information on the topic is meaningfully impossible at the time of the EIR, and the information is not of

overriding importance to determining whether to proceed with the project. Riverwatch v County of San Diego, (1999) 76 Cal.App.4th 1428, 1448 (deferral of precise detail of mitigation measure dependent on yet-to-be performed Caltrans study did not undermine EIR's conclusion that the impact could be mitigated).

Although the FEIR limits the Project to a maximum environmental impact in each issue area, it does not explain how it will be determined that the maximum impacts will not be exceeded when the Project is finally designed and built. The LUEP permits Millennium to obtain a transfer or change of uses within the Project, and the Planning Director may approve that request if the submission reasonably demonstrates that the change is consistent with the trip cap and does not exceed the maximum environmental impacts identified in the EIR. AR 13789. But how will the Planning Director make that determination for changing the Project and using what criteria?[14] Since no additional CEQA review will be required to ensure that a change sought by Millennium is within maximum environmental issue limits, and no public input will be permitted, the FEIR essentially defers the environmental assessment of the Project and substantively fails to ensure that the finally designed Project will not be approved without all necessary mitigations of environmental harm.

Petitioners admit that a LUEP may be acceptable where it permits a developer to choose among specifically defined scenarios, each of which is fully analyzed in the EIR, the Millennium LUEP makes this impossible. Petitioners give an example of the FEIR's reliance on a reduction in traffic because some residents will enjoy Project facilities internally and defer making a trip outside (AR 4939-41, 3263-64), but there is no assurance that the facilities will be constructed in a manner that would result in the anticipated internal trip captures. *See* AR 31600. Petitioners provide a second example that the driveway locations are merely hypothetical since the Development Regulations permit "parking, open space, and related development" to be located anywhere within the Project Site. AR 858. As a consequence, traffic analysis of driveway locations and their impact is impossible. Mot. at 12.

The Opposition tries to rebut Petitioners' argument that the driveway locations are merely hypothetical, noting that the FEIR provides that the driveways specifically will be located along Ivar and Vine and placed pursuant to LADOT standards. AR 2724-25. The Opposition argues that the traffic study contains the specificity to assess traffic impacts of these locations. Opp. at 27. This fact does not undermine Petitioners' point that the driveway locations are subject to change.[15]

The CEQA process is intended to provide the fullest information reasonably available on which the decision-makers and the public can rely in determining whether to start a project.

---

[14] Although Petitioners raised this issue (Mot. at 11, n.6), the Opposition does not address it.

[15] The Opposition also contends that Petitioners are mistaken about internal trip captures. The FEIR addresses trip capture and "pass-by" trip reductions based on the most traffic-intensive development scenario, meaning that fewer trips will be permitted than otherwise. The FEIR translates use-specific trip generation into general trip generation rates based on any use. Regardless of the final design, these general rates will apply to ensure the total trips remain below the cap. Opp. at 27-28. Petitioners do not reply to this confusing point.

Natural Resources Defense Council v. City of Los Angeles, (2002) 103 Cal .App.4th 268, 271. An EIR furnishes both the road map and the environmental price tag for the project so that the decision maker and the public both know how much they and the environment will have to give up in order to take that journey. Id. By approving an EIR with an ambiguous Project description which defers some portion of the environmental analysis, the City failed to act in accordance with law. CEQA's informational and substantive requirements have been violated and the EIR and the entitlements it purports to support must therefore be vacated.

d. The Q Condition

Petitioners argue that the Project's Q Condition of Approval No. 1 provides Millennium even more latitude to redesign and reconfigure the development than yielded by the ambiguous Project Description.

Q Condition No. 1 provides:

> "The use of the subject property shall be limited to those uses permitted in the Land Use Equivalency Program, attached as Exhibit D **or** as permitted in the C2 Zone as defined in Section 12.16.A of the LAMC." AR 11651 (Emphasis added.)

Petitioners argue that, on its face, Q Condition No. 1 permits Millennium to choose from any of the long list of land uses expressly permitted in the C2 zone. None of these uses or their environmental impacts were disclosed and analyzed in the FEIR, and none had appropriate mitigation imposed. Petitioners specifically objected to this Q Condition on the grounds that Q Conditions are supposed to restrict uses on a project beyond those required by a particular zoning law and were created to address the situation where a developer obtains a zoning change and then switch plans to build a project also authorized by that zone. Yet, Q Condition No. 1 expands Millennium's right to develop for uses that have not been disclosed. AR 11168-69. Mot.at 13.

The Opposition explains that the Project's central entitlement is the Ordinance, which rezoned the property from C4 to C2 commercial – a zone change that was necessary for the health club -- and imposed the Development Regulations. The Project is governed by the Development Regulations and the LUEP, both of which are incorporated into the Ordinance. The Q Conditions, which are zoning provisions enacted through the Ordinance, were added to restrict Millennium's use of the property within the C2 zone. *See* LAMC §12.32.G(2)(a). Opp. at 29.

The Opposition acknowledges the plain language of Q Condition No. 1, but argues that the City's intent in imposing Q Condition No. 1 was not to permit any use listed in the C2 zone. Instead, the LUEP defines the uses which Millennium is permitted to develop, if otherwise permitted on the C2 zone. Those uses must stay within the identified environmental maximum impacts and the Development Standards and Millenium's compliance will be verified and enforced by City Planning. Q Condition No. 1 must be read as a whole with the LUEP use restrictions and environmental impact caps (the LUEP is incorporated into Condition No. 1), and the requirements of the Development Regulations. Opp. at 29-31. Under familiar principles of statutory construction, Q Condition No. 1 must be interpreted with the LUEP and the

Development Regulations to "impose use and development limitations on the Project." Opp. at 32.

The construction of ordinances is subject to the same standards applied to the judicial review of statutory enactments. Department of Health Services of County of Los Angeles v. Civil Service Commission, (1993) 17 Cal.App.4th 487, 494. In construing a legislative enactment, a court must ascertain the intent of the legislative body which enacted it so as to effectuate the purpose of the law. Brown v. Kelly Broadcasting Co., (1989) 48 Cal.3d 711, 724; Orange County Employees Assn. v. County of Orange, ("Orange County") (1991) 234 Cal.App.3d 833, 841. The court first looks to the language of the statute, attempting to give effect to the usual, ordinary import of the language. Brown v. Kelly Broadcasting Co., (1989) 48 Cal 3d 711, 724. Significance, if possible, is attributed to every word, phrase, sentence and part of an act in pursuance of the legislative purpose. Orange County, *supra*, 234 Cal.App.3d at 841. The various parts of a statute must be harmonized by considering each particular clause or section in the context of the statutory framework as a whole. Lungren v. Deukmejian, (1988) 45 Cal.3d 727, 735. If a statute is ambiguous, the construction given it by the agency charged with its enforcement is entitled to consideration if such construction has a reasonable basis. Ontario Community Foundations, Inc. v. State Bd. of Equalization, (1984) 35 Cal.3d 811, 816.

In effect, the Opposition contends that the language of Q Condition No. 1 should be interpreted to limit the uses of the property to those uses permitted by the LUEP **and** by C2 zone. If a use is not permitted by both, Millennium may not put the property to that use. The problem with the Opposition's interpretation is that it runs contrary to the plain meaning of the word "or" in Q Condition No. 1, which in context means "either A or B". There is no ambiguity on which the court can rely to justify the City's interpretation.

Even if *arguendo* Condition No. 1, the LUEP, and the Development Standards collectively constitute a statutory scheme which should be collectively harmonized, that harmonization is easily done. Q Condition No. 1 addresses property use. The Development Standards concern building design, and do not address the use to which the property is placed. The LUEP contains use limitations, but Condition No. 1 places those use limitations in the alternative with uses in the C2 zone. Thus, the three elements are easily harmonized.

Petitioners objected to the language of Q Condition No. 1, and the City ignored their objection. The court cannot rewrite the Q Condition No. 1 now. It means what it says, and it provides Millennium greater latitude to redesign and reconfigure the Project in areas that have not been subjected to environmental analysis. This is a failure to act in accordance with the requirements of law.

5. Seismic Review

a. Petitioners' Argument

Petitioners acknowledge that the FEIR adequately analyzed seismic issues, and argue that the City failed to disclose pertinent environmental information, failing to meet CEQA's mandate that the public be equally informed as the agency. *See* Laurel Heights, *supra*, 47 Cal.3d at 404. Mot. at 14; Reply at 18.

Petitioners point out that the Hollywood Fault is considered active, and therefore a potential hazard for catastrophic rupture. Petitioners' consulting geologists identified, and the 2010 CGS Map showed, the Hollywood Fault crossing through both sides of the Project Site.

AR 11542-43; RL 33497-98. Although the City's ZIMAS mapping did not show the Hollywood Fault as crossing the Project Site, LADBS staff noted that a City geologist met with Millennium and discussed the fact that the Fault potentially crossed the property. AR 68257. In recommending a Fault Report, the City geologist stated that the Hollywood Fault "appears to exist in the vicinity of the subject site." AR 65566-68.

The City's Initial Study noted the potential of a significant impact from rupture of a known earthquake fault, and stated that the EIR will provide additional analysis. AR 680-81. A November 2011 report was prepared as a technical appendix to the EIR (AR 29824), but was never included in the FEIR. The report claimed that the Project Site is not located in a Fault Rupture Study Area ("FRSA"), and site-specific fault studies were not performed or required. AR 29829. But Petitioners contend that Exhibit 4 to the November 2011 report shows the Project's eastern portion crossing through the red footprint of the FRSA. Wright Decl., Ex.1.

Petitioners note that in March 2012 LADBS acknowledged the need for a limited fault investigation based on a CGS Hollywood Fault trace map. AR 29988. LADBS and Millennium representatives agreed that this limited investigation would include only the Project's western portion, not the eastern portion identified in Exhibit 4, and would be deferred until the buildings were designed. RL 6677-78.

The Planning Department reviewed a proposed DEIR which did not have the November 2011 report, and instead included a May 2012 report prepared by Millennium's expert. The May 2012 report was identical to the November 2011 report except that Figure 4 now showed the entire Project Site outside the FRSA boundary and a bolded sentence was deleted. AR 1385. Petitioners conclude that the May 2012 report was deliberately rigged to avoid disclosure of the Project Site within the FRSA. Mot. at 18.

The May 2012 report was attached as a technical appendix to the DFEIR which was released by City Planning staff on October 25, 2012 without waiting for, or without knowing about, the limited Fault Report that Millennium's expert was preparing. As a result, the DFEIR stated that the Hollywood Fault was 0.4 miles away from the Project Site and included little seismic analysis.

Not until the November 2012 Fault Report did Millennium or the City change its position. The Fault Report repeated the statement that the Hollywood Fault was 0.4 miles away, but acknowledged that the City had required a limited investigation because the 2010 CGS map showed the Hollywood Fault to be within 500 feet of the Project Site. The Fault Report was never included in the FEIR and never released to the public. Although the City's information potentially showed that the Project Site crosses the Hollywood Fault, the FEIR does not disclose or discuss the 2010 CGS Map. Mot. at 15. The City should have recirculated the DEIR with the Fault Report because it constituted significant new information. Pub. Res. Code §21005(a); Guidelines §§ 15088.5, 15144.

Petitioners conclude that the failure to ensure that the public knew about the seismic issue was an abuse of discretion and the DFEIR's reliance on Figure 4 to show the Project as outside the FRSA was clearly erroneous. Mot. at 19-20.

b. <u>Merits</u>

The Opposition seeks to debunk Petitioners' conspiracy theory that the City and Millennium worked to suppress the fact that the Project is located in a state-designated fault zone and in a City-designated FRSA. Opp. at 18-20.

Even if the Opposition does not successfully do so, the court agrees that no further disclosure about the location of the Project Site's proximity to the Hollywood Fault was required. Petitioner's theory of non-disclosure is based upon (1) the FEIR's failure to include the Fault Report, which stated that the Hollywood Fault was 0.4 miles away from the Project Site, but acknowledged that the 2010 CGS map showed the Hollywood Fault to be within 500 feet, and (2) the fact that the May 2012 report, which was included in the DEIR, attached a Figure 4 which showed the entire Project Site outside the FRSA boundary and deleted a bolded sentence.

Figure 4, the 2010 CGS map on which Petitioners rely to show the Hollywood Fault traversing the Project Site, is not a reliable document. *Compare* Wright Decl., Ex.1 *and* AR 1385. First, it is not an official CGS fault map. The 2010 map is a "Fault Activity Map" prepared for CGS's 150th anniversary and expressly states that it is "not intended to replace or supersede the Official Maps of Earthquake Fault Zones -- the location of fault traces shown should not be substituted for site-specific fault rupture investigations[.]" AR 49493. Second, a cursory review of the 2010 CGS map reveals that it is a low-resolution, non-scalable, map of the entire state of California. Id. It is not something anyone can rely upon to show fault boundaries.[16]

As for the contention that the May 2012 report was deliberately rigged to avoid disclosure that the Project Site was within the FRSA, the Opposition contends that the exhibit in the May 2012 report differs from that in the November 2011 report only because of a cut and paste from a graphic in the City's 1996 Safety Element. AR 47303. Opp. at 20. Whether or not the accusation of a doctored exhibit is true, it is irrelevant. The Initial Study clearly states that the Project Site is adjacent to, but not within, a City-designated FRSA. The DEIR said that the Hollywood Fault is 0.4 miles away. AR 4591, 4595. A not-to-scale exhibit showing differently is immaterial. AR 680.

Petitioners nonetheless contend that the May 2012 report attached to the DEIR is misleading because at all times the public was told that the Hollywood Fault trace was 0.4 miles away when LADBS actually regarded it as within 500 feet. If LADBS required a fault investigation because of the 2010 CGS map, the public was entitled to know about this same information. The Fault Report continued the City's position that the Hollywood Fault was 0.4 miles away from the Project Site, but at least acknowledged that the 2010 CGS map showed the Hollywood Fault to be within 500 feet. This should have been disclosed. Mot. at 19.

The Opposition argues that the Fault Report was prepared by Millennium's consultant for purposes of the VTTM under LAMC section 17.05U. LADBS acted with care by requiring a limited fault investigation despite the fact that the Project Site was not in a fault zone or FRSA, and did so because the Hollywood fault trace was less than 500 feet away. AR 29876. The Fault Report concluded that "active faulting is not present within the limits of our investigation within the Site...." AR 29875. The Fault Report was approved by LADBS for purposes of the VTTM. AR 29810-11. Opp. at 15-16.

As Petitioners reply, the VTTM process cannot be separated from the CEQA process, and the City's approval of the VTTM by itself required CEQA compliance. Pub. Res. Code

---

[16] Although the court has declined to judicially notice Petitioners' Exhibits C and D, which purport to show the Project Site within the Hollywood Fault, the Opposition correctly argues that if CGS released for the first time in November 2014 a map showing the Project Site in the Hollywood Fault Zone, how is it possible that CGS's 2010 map already placed the Project in a fault zone? Opp. at 19.

§21080(a); Govt. Code §66474.01. CEQA is essentially an environmental full disclosure statute and the City cannot silo information about seismic issues from the EIR. See Rural Landowners Assn. v. City Council, (1983) 143 Cal.App.3d 1013, 1020. Reply at 15-16.

Nonetheless, the FEIR adequately addressed seismic issues. The Opposition shows, and Petitioners do not dispute, that the City treated the Project as if it were in an earthquake zone. The DEIR included an adequate discussion of potential impacts from fault rupture (AR 4589-4602) and a 48-page Preliminary Geotechnical Engineering study which showed no evidence of faulting. AR 8212-59. Despite the fact that the Hollywood Fault was only proximate, the City adopted mitigation measures to ensure seismic safety, including construction of the Project in accordance with seismic standards and a requirement for final geotechnical engineering report prior to issuance of building or grading permits. *See* Oakland Heritage Alliance v. City of Oakland, (2011) 195 Cal.App.4th 884, 904 (upholding similar mitigation measures); California Oak, *supra*, 188 Cal.App.4th at 264 (upholding EIR for project in earthquake zone that required further testing before development of site).

Nothing in the Fault Report supports Petitioners' argument that it should have been included in the FEIR. As the Opposition argues, the DEIR already contained a May 2012 preliminary geotechnical study prepared by Millennium's expert claiming that the Project Site is not located in a FRSA, and that site-specific fault studies were not required. AR 29829. The Fault Report concluded that active faulting is not present at the Project Site, and this conclusion is consistent with the May 2012 report. The City treated the Site as if it was in a FRSA, and the FEIR contained a discussion of seismic issues, a preliminary geotechnical report, and mitigation measures. It did not have to include the Fault Report prepared for LADBS and the VTTM showing no active faulting. *See* California Oak, *supra*, 188 Cal.App.4th at 265 (seismic study prepared for compliance with Alquist-Priolo was not required to be included in EIR).

Petitioners argue that case law supports the exclusion of a particular document from the record where the discussion of an environmental impact is present in the EIR, but not where a crucial area of environmental impact has been omitted. Reply at 18.

Perhaps so, but the FEIR did not omit a crucial area of environmental impact. The City performed the proper environmental analysis, consistently stating that the Hollywood Fault was 0.4 miles away. The mere fact that the Fault Report acknowledged that the City required a limited investigation because the 2010 CGS map showed the Hollywood Fault to be within 500 feet of the Project Site, not 0.4 miles (2112 feet), does not mean the FEIR fails as an informational document. As the Opposition contends, the 2010 CGS map is unreliable and unofficial. The City required the Fault Report in order to be cautious and treat the Project Site as if it were in a FRSA, and the Fault Report confirmed a lack of active faulting. The mere fact that the FEIR did not disclose the reason why the City required a Fault Report is insufficient to cause the FEIR to fail as an informational document.

Because the Fault Report did not contain significant new information showing new or substantially more severe impacts, recirculation was not required. *See* Guidelines §15088.5(a).[17] Recirculation is not required where the new information merely clarifies or amplifies information

[17] Petitioners argue that the Opposition does not cite to any finding or evidence that recirculation is not required, but they bear the burden of showing that it was. *See* Mot. at 19.

in the EIR. Guidelines §15088.5(b). *See* Treasure Island, *supra*, 227 Cal.App.4th at 1063-64 (court must defer to decision not to circulate where it is supported by substantial evidence).[18]

6. Fire and Protective Services

Petitioners contend that the FEIR relied on inaccurate data concerning the Project's impacts on fire safety and services. The FEIR acknowledged that under CEQA Guidelines Appendix G a significant environmental impact occurs where a project causes substantial adverse physical impacts associated with new or improved government facilities in order to maintain acceptable service rations, response times, or other performance objectives for fire protection. AR 4804. The Millennium Project's impacts would be significant "if the project requires the addition of a new fire station or the expansion, consolidation, or relocation of an existing facility to maintain service." AR 4805. The FEIR concluded that the Project would not require the addition or expansion of a fire station to maintain service, and therefore no significant impacts on this issue area. AR 4806.

LAFD's preferred response time threshold for emergencies is five minutes or better 90% of the time. AR 4800. The FEIR noted that Fire Station 27, which houses a truck company, is 0.7 miles from the Project Site and Fire Station 82, which houses an engine company, is 0.8 miles from the Project Site. AR 4807. Consistent with Fire Code section 57.09.06, this proximity was sufficient to meet the response time requirement. Additionally, the average response times for Fire Stations 27 and 82 are less than five minutes based on data supplied by LAFD for July 5, 2011-December 14, 2011. AR 4807-08.

Petitioners criticize this conclusion as repudiated by another City official. The City Controller's May 2012 audit revealed that over 1/3 of the 1.9 million reported emergency incidents either coded unclearly as either emergency or non-emergency at the discretion of dispatchers. Therefore, the audit was unable to verify that LAFD had met its 90% goal for emergency response times. Pet. Mot. to Augment, Ex. 2. The DEIR acknowledged the Controller's audit, mentioning it "for information purposes only." AR 4800. LAFD subsequently stated that its prior reporting data should not be relied upon until properly recalculated and verified. AR 11187. Consequently, Petitioners argue that the City wrongly relied on the inaccurate data. Reply at 20.

Petitioners ignore the proximity of Fire Stations 27 and 82 to the Project Site. Fire Code section 57.09.07 requires response distances in compliance with Table 9-C, which in turn permits a maximum response distance of 1 ½ miles for engine and truck companies in high density resident and commercial neighborhoods. Fire Stations 27 and 82 are within those distances. The FEIR also noted five other stations nearby, the Project would generate revenue that could be applied to new fire facilities, emergency access would be adequate, and LAFD has experience navigating these streets. AR 313, 4808. Under these circumstances, the Controller's audit discrediting LAFD community-wide response time data does not undermine the FEIR's

[18] The City Council clearly understood that LADBS treated the Project as if it was in an earthquake zone, and the City Council approved an amending motion which imposed a condition of a comprehensive geotechnical report prior to issuance of any grading or building permit. AR 13791-92, 11643.

conclusion that response times to the Project area will meet the standard of five minutes or less 90% of the time.[19]

It is also true, as the Opposition argues and Petitioners admit, that Appendix G only requires analysis of whether new or modified facilities will be required, not response times.[20] The City concluded that no new facility will be required. AR 4806. Its decision that there is no significant impact from this environmental issue is supported by substantial evidence.

7. The Invalidated Hollywood Community Plan Update

a. The FEIR's Reliance on the HCPU

The HCPU governed the Project Site at the time of the City Council's approval. Like the City's other community plans, the HCPU was an integral part of the General Plan, and formed the General Plan's state law-mandated land use element for the Project area. Govt. Code §§ 65300, 65302(a). The City thus had to make, and did make, findings in the DEIR that the Project was consistent with the HCPU. AR 4689-4700. The FEIR's mitigations also relied on the HCPU.

Following the City Council's approval of the Project, the superior court in La Mirada invalidated the entire HCPU. Pet. RJN, Ex. G. The City elected not to appeal the decision, and rescinded its adoption of the HCPU. Pet. RJN, Ex. H. Since consistency with a general plan or one of its elements is required for any portion of local government land use, the absence of a valid general plan or its valid relevant elements precludes enactment of actions, including approval of entitlements. Neighborhood Action Group v. County of Calaveras, (1984) 156 Cal.App.3d 1176, 1184.

Petitioners argue that the City's land use consistency findings for the Project collapsed when the HCPU was invalidated and rescinded. Mot. at 29-30. The HCPU promoted high-intensity, mixed use development near transit stops, and had goals and policies custom-tailored for the Project. Because the Project approvals cannot be consistent with an invalid HCPU, the Project approvals are null and void. Mot. at 31.

This argument may be dealt with summarily. The FEIR acknowledged that the HCPU was subject to legal challenge, and therefore it analyzed the Project's consistency with both the HCPU and the original 1988 Hollywood Community Plan ("1988 HCP"), which became operative after the City rescinded the HCPU. *See* AR 24045, 24069-70. The Land Use Planning Section of the DEIR clearly states that the Project does not depend on the HCPU. AR 28213-78. This section provides the separate, parallel consistency analysis for both the 1988 HCP and the HCPU. Table 1V.G-3, analyzes the Project's consistency with the 1988 HCP. AR 28248. Table 1V.G-4 then analyzes the Project's consistency with the HCPU. AR 28249-60. The DEIR concludes that the Project is "consistent with the goal and policies of the 1988 Community Plan and the Community Plan Update and thus would not result in conflicts with local plans and policies." AR 28260. Because the Project is consistent with both plans, the FEIR finds land use consistency impacts to be less-than-significant under either plan. AR 28273.

---

[19] Petitioners also argue that the FEIR's response time analysis does not include the additional 19,000 daily trips generated by the Project. Mot. at 28. Not so. This issue was addressed in the FEIR's discussion of cumulative impacts of increased residents, households, and employees on fire protection services in the Project area. AR 4813.

[20] Petitioners state that the issue of whether emergency response times are themselves an impact which must be assessed is currently before the California Supreme Court. Reply at 19.

A city council's determination that the project is consistent with its general plan carries a strong presumption of regularity. Sequoyah Hills Homeowners Assn. v. City of Oakland, (1993) 23 Cal. App. 4th 704, 717. The foregoing evidence satisfies CEQA's land use consistency requirement and state law.

Moreover, the court agrees with the Opposition (Opp. at 36) that Petitioners waived their land use consistency argument by failing to discuss the FEIR's reliance on the 1988 HCP. When a petitioner challenges an administrative decision as unsupported by substantial evidence, it is the petitioner's burden to demonstrate that the record does not contain sufficient evidence to support the agency's decision. State Water Resources Control Board Cases, (2006) 136 Cal.App.4th 674, 749. A recitation of only the part of the evidence that supports the petitioner's position is not the "demonstration" contemplated by this rule. If a petitioner contends that some issue of fact is not sustained, the failure to set forth in his brief all the material evidence on the point and note merely his own evidence constitutes a waiver. Id. (quoting Foreman & Clark Corp. v. Fallon, (1971) 3 Cal.3d 875, 881.

Petitioners have not met their heavy burden of proving that the City's land use consistency findings for HCP were arbitrary and capricious.

b. Compliance with the La Mirada Judgment

Petitioners further argue that the La Mirada judgment required the City to rescind not only all actions approving the HCPU, but also "all related approvals issued in furtherance of the HCPU", with the exception of "adjudicatory approvals not challenged which the City may have made under the HCPU after its adoption by the City." Pet. RJN, Ex. G. Petitioners contend that this final judgment and supporting writ created a mandatory duty to rescind all approvals for development projects in the Hollywood planning area that were made while the HCPU was in effect, except where no lawsuit was filed against the project. According to Petitioners, the Millennium Project is within the scope of the La Mirada judgment and writ and the City has a mandatory duty to rescind its approvals. Mot. at 31-32.

This argument requires interpretation of the La Mirada judgment. The rules for interpreting a court order or judgment are the same as in ascertaining the meaning of any other writing. Dow v. Lassen Irrigation Co. , (2013) 216 Cal.App.4th 766, 780; Los Angeles Local Board of Culinary Workers, etc. v. Stan's Drive-Ins, Inc., (1955) 136 Cal.App.2d 89, 94. Individual clauses or provisions are not considered separately but rather the entire document must be considered on its four corners and construed as a whole to effectuate its intentions. Id.

The Opposition is most certainly correct that the Project approvals are not "related approvals" under the La Mirada judgment. That judgment expressly states that related approvals "refers only to those quasi-legislative actions necessary to carry out the HCPU...." Pet. RJN, Ex. G (Emphasis added.) The Project approvals are independent of, and not necessary to carry out, the HCPU. The La Mirada judgment gives examples of what related approvals are, including the HCPU text and maps, the Resolution amending the 1988 HCP, the actions necessary to effect the HCPU, amendments to the General Plan made to reflect changes in the HCPU, and CEQA findings for the PCPU. The Project is not a related approval, and Petitioners are simply wrong arguing that any project that relied upon the HCPU is a related approval. Reply at 20-21.

Petitioners have not met their burden to show that the City is obligated to rescind the land use consistency findings as related approvals under La Mirada.

8. Violation of the City Charter

Petitioners argue that the Development Regulations and Q Conditions are an unlawful blanket variance and/or an improper delegation of the City's police power. The Sixth Cause of Action alleges that the City granted variances for the Project without making the legally mandated findings under Charter section 562 and LAMC section 12.27(D), and the Seventh Cause of Action contends that the City has unconstitutionally impaired its police powers. Petitioners allege that the City is attempting to elevate the Development Regulations into the position of a municipal ordinance, per LAMC section 12.04 and 12.32, in irreconcilable conflict with Charter section 562. Id., ¶181. In doing so, the City is attempting to override other LAMC provisions. Id., ¶182. The LUEP and development regulations are a grant of carte blanche authority which is *ultra vires* and *void ab initio* because they amount to the City unconstitutionally surrendering its police power to regulate land use. Id., ¶183.

Petitioners present a history in which the City created the Development Regulations and LUEP to be adopted in conjunction with the Development Agreement. AR 4105-06. The Development Regulations would prevail over zoning or land use regulations in the LAMC. AR 4105, 18581. At the Planning Commission hearing, Millennium withdrew the Development Agreement when it was determined that the Commission would be disqualified from hearing it. AR 74811-12.[21] Instead of using the Development Agreement, the City claimed it had the authority to impose the Development Regulations and LUEP as Q Conditions of Approval. AR 74826. *See* LAMC §12.32(G).

Petitioner CURD then submitted evidence to the PLUM on appeal that Q Conditions authorized under LAMC section 12.32(G) must restrict a project, not increase a developer's rights to use property. AR 11169-1172. Implicitly accepting this argument, the City substituted the draft Ordinance for the original ordinance adopted by the Planning Commission. AR 11949-952. The draft Ordinance purported to enact the Development Regulations as Exhibit C. *See* AR 11644-95.

According to Petitioners, the substitution of the Ordinance for the original ordinance was accomplished through the creation of a false PLUM recommendation report that claimed PLUM had voted to recommend substituting the Ordinance for the original ordinance. This report recommended that the City Council "7. PRESENT and ADOPT the accompanying NEW ORDINANCE.... 8. NOT PRESENT and ORDER FILED the Ordinance approved by the [Planning Commission] on March 28, 2013." AR 11950. No such event ever happened, as reflected by the transcript of the PLUM hearing and the two documents approved by the PLUM. *See* AR 75174-299, 18466-470, 19738-42. The PLUM, or the City Clerk, created a false public record in violation of Charter section 281(c). CURD objected to this false record prior to the City Council hearing. AR 11731. Mot. at 35.

Petitioners argue that the Charter is the City's constitution and Charter section 562 protects the rights of residents by mandating that any variance from strict application of the zoning code proceed through a zoning administrator, who must make five affirmative findings. The City's attempt to enshrine the Development Regulations -- whether as the withdrawn Development Agreement, an *ultra vires* Q Condition, or a frantic enactment of City ordinance through a false public record -- cannot override Charter section 562 and is a void effort to grant

---

[21] The parties dispute whether the conflict was due to a conflict of interest by Planning Commission President William Roschen as a paid consultant to Millennium and that a City ethics investigation led to his rapid resignation. *Compare* Mot. at 34 *with* Opp. at 34, n.16.

undisclosed variances. *See* Trancas Property Owners Assn. v. City of Malibu, (2006_ 138 Cal.App.4th 172, 181-82 (contract exempting development from zoning law is unenforceable as violation of public policy). Mot. at 35-36. The City cannot adopt a Q Condition that is more permissive than that permitted in the City's zoning code. LAMC section 12.32(G) authorizes the City to approve projects and restrict the land uses to those specified in the Q Condition, not expand a developer's right to override the zoning code. Mot. at 36.[22] Additionally, the combined effect of the Ordinance and the agreement signed by Millennium to make the Q Conditions enforceable against it (AR 11656) constitute an unconstitutional contracting away of the City's police power. Mot. at 36-37.

The creation of the Ordinance demonstrates unpalatable eagerness by the City. The Opposition defends the PLUM recommendation report claiming the PLUM had voted to recommend substituting the Ordinance for the original ordinance. AR 11950. The Opposition argues that the report is not false, as the PLUM did modify the original ordinance by adopting a City Planning memo of technical corrections and a letter from Millennium's counsel concerning the Conditions of Approval. AR 75294-95. Opp. at 34. However, the technical changes and changes to the Conditions of Approval submitted by Millennium's counsel and City Planning, they were not the new Ordinance described in the PLUM recommendation report. The PLUM report is false.

Although the brief history of the Ordinance is troublesome, the Opposition correctly argues that the Q Conditions are not a blanket variance. Opp. at 33. A "variance" is a "permit to build a structure or engage in an activity that would not otherwise be allowed under the zoning code." Neighbors in Support of Appropriate Land Use. v. City of Tuolumne, (2007) 157 Cal.App.4th 997, 1007. The City did not grant Millennium a variance to deviate from zoning requirements, although it tried to do so in the Development Agreement. Rather, the City made a legislative policy choice in the Ordinance to favorably zone the Project Site, and this zoning rests on equal footing with the other zoning in the City.[23] Charter section 562 does not prevent the adoption of the Ordinance and the Q Conditions in it.

The false trail concerning adoption of the Ordinance does not necessarily invalidate it, and Petitioners do not argue that it does. Instead, they contend that the Ordinance adopts the Development Regulations (Exhibit C), which expressly provide that they shall prevail over any more restriction zoning provision in the LAMC. AR 18581. According to Petitioners, this prevents the City from enacting in the future any zoning provision inconsistent with the Development Regulations and, as such, is an unconstitutional delegation of police power. Since Millennium has potentially 12 years to begin the Project (AR 75052), this is no small consideration. Reply at 22. On this point, Petitioners rely on Cotta v. City and County of San

---

[22] The court agrees with this argument, which however is mooted by enactment of the Ordinance.

[23] This appears to be the converse of "spot zoning", which is a legislative zoning of a specific property in a discriminatory fashion such that it has lesser rights than surrounding properties. *See* Consaul v. City of San Diego, (1992) 6 Cal.App.4th 1781, 1801. Illegal spot zoning involving the unreasonable and arbitrary regulation of uses of property is an unconstitutional violation of due process. Echevarrieta v. City of Rancho Palos Verdes, (2001) 86 Cal.App.4th 472, 483. The City provided Millennium with favorable zoning, not more restrictive zoning.

Francisco, ("Cotta") 157 Cal.App.4th 1550, 1557-59 and 108 Holdings, Ltd. v. City of Rohert Park, ("108 Holdings") (2006) 136 Cal.App.4th 186, 194. Reply at 22.

A municipality may not contract away its legislative and governmental functions. 108 Holdings, 136 Cal.App.4th at 194. Such power may not be surrendered or impaired either by contract or ordinance. Id. The controlling consideration is whether the local entity has bargained away its police power or municipal function. Id. at 195.

In 108 Holdings, the city entered into a stipulated judgment that bound it to interpret and apply its general plan in the manner set forth. Id. at 191. The petitioner claimed that this was an unlawful surrender of police power, and the court disagreed. Nowhere in the stipulated judgment did the city agree to refrain from legislating in the future on matters that were subject to the stipulated judgment; the city could amend its general plan as it saw fit and future circumstances dictated. Id. at 195. The court distinguished County Mobilehome Positive Action Com., Inc. v. County of San Diego, (1998) 62 Cal.App.4th 727, in which a county had imposed a 15-year moratorium on the enactment of rent control legislation for mobilehome park owners who entered into an agreement with the county. The agreement specified that its provisions would prevail over any county action, and the county agreed not to adopt any ordinance that would regulate mobilehome rent the owner could charge. This action prevented the county from exercising its police power out of fear that a subsequent enactment would expose the count to a breach of contract action. Id. at 195-96. In contrast, the 108 Holdings stipulated judgment did not limit the city's ability to amend its general plan in the future. Reservation of police power is implicit in all government contracts and private parties take their rights subject to that reservation. Id. at 196.

In Cotta, the court addressed an exercise of police power after an airport commission entered into a contract granting certain benefits to taxi drivers of clean air taxis providing service at San Francisco Airport. The plaintiffs purchased compressed natural gas taxis and operated them. Then the commission adopted a new resolution that conferred fewer benefits. 157 Cal.App.4th at 1553. The court held that the commission's earlier resolution did not create a contract and was in fact a regulatory framework which involved no vested right. If construed as a contract, it would be unenforceable as an unlawful delegation of police power. Id. at 1563-64.

Petitioners point to nothing in the Ordinance and the Development Regulations which prevents the City from adopting a future ordinance changing the Project's zoning. To the contrary, Millennium had to sign an agreement that it is bound by the Conditions of Approval, which restrict its use of the property. AR 11656. The Development Regulations, which are part of the Ordinance, do state that they trump inconsistent zoning provisions. AR 18581. But this is merely one ordinance controlling the application of another existing ordinance of equal dignity. Petitioners point to no provision of the Ordinance or Development Regulations which prevents the City from changing the zoning at the Project Site, either before Millennium begins development or afterwards (when vested rights may occur).

It is worth noting that the now withdrawn Development Agreement expressly stated that the City accepted the Development Agreement's restrictions on its police powers only to the extent required to achieve the parties' mutual objectives and to obtain public benefits which go beyond those obtained by traditional city controls on projects. AR 23437. Otherwise, the City reserved all remaining police powers to itself. AR 23436. Presumably, the Ordinance, which was created to substitute for the Development Agreement, was intended to effectuate the same result.

The Ordinance is not an unconstitutional delegation of police power.

9. Violation of Due Process and Recirculation

Petitioners argue that the PLUM and City Council hearings violated due process and their right to a fair hearing.

Specifically, at the PLUM hearing Millennium's attorney was permitted to make new substantive claims that CURD was not permitted to rebut (AR 11735-39), and major changes were made to the Development Regulations as set forth in a May 31, 2013 letter from Millennium's counsel and in a June 18, 2013 Planning staff memo without providing a copy to the public (AR 18466079), 19038-42).

At the City Council hearing, (1) Millennium's attorney submitted a 311-page letter and supporting evidence, including a 120-page geological report, less than 18 hours before the hearing and the City Council provided no opportunity to refute these arguments, (2) the City Council required CURD and the public to testify before calling City staff to give new presentations and evidence, and (3) the City Clerk announced at the hearing that an amending motion had been circulated when in fact it had not.

Finally, persons who attended the PLUM and City Council hearings either had no opportunity to speak or were given an impossible one minute to present evidence. Petitioners argue that each of the 131 persons who asked and were denied the opportunity to be heard at the public hearing should have been heard. *See* Manufactured Home Communities, Inc. v. County of San Luis Obispo, (2008) 167 Cal.App.4th 705 (mobilehome park owner denied fair hearing where rent control board exercised judicial-like powers in deciding the parties' rights in their leases and relied on uncross-examined testimony of tenants). Mot. at 39-40. Petitioners contend that they were deprived of an opportunity to refute and explain as a result. Mot. At 38-39.

Due process is flexible and does not require any particular procedure, so long as there is notice and a reasonable opportunity to be heard. Horn v. County of Ventura, (1979) 24 Cal.3d 605, 612. Rather, these requirements vary according to the competing interests of the government and the citizen. Skelly v. State Personnel Board, (1975) 15 Cal.3d 194, 208. At a minimum, due process requires notice and an opportunity for a hearing. Id. When an agency conducts adjudicatory proceedings, the hearing must comply with principles of due process. Morongo Band of Mission Indians v. State Water Resources Control Board, (2009) 45 Cal.4th 731, 737. The tribunal must be free of bias, and an adjudicator is presumed impartial unless he or she has a financial interest in the outcome. Id. Where city council has authority to make final adjudications of fact, it may not rely on information of which the parties were not apprised and of which they had no opportunity to controvert. Clark v. City of Hermosa Beach, (1996) 48 Cal.App.4th 1152, 1171 (property owner was denied fair hearing on application to construct two-unit condominium).

Petitioners have not shown they have a due process right. Some of the City's actions (*e.g.*, the Ordinance) were legislative in nature. No person has a due process right for a body's legislative approvals; only governmental decisions which are adjudicative in nature are subject to procedural due process principles. Horn, *supra*, 24 Cal.3d at 612. For that portion of the City's approvals that were quasi-adjudicative, Petitioners must show that they a property right supporting a due process violation. Horn, *supra*, 24 Cal.3d at 615. This requires a protected property interest, which must be more than an abstract need or desire for an outcome. Smith v. Board of Quality Medical Assurance, (1988) 202 Cal.App.3d 316, 326. While Petitioners have shown they are property owners or community members, they have not shown that their property

rights are protected because they are adversely affected by the Project. *See* Abrahams Decl., ¶'s 3-4, 8; Dodge Decl., ¶3-4; Schwartz Decl., ¶3-4.

Aware of this fact, Petitioners rely on a dignitary interest – which is an interest in being informed of government action and in being able to present his or her side. Reply at 24. But this is putting the cart before the horse. A dignitary interest in due process only applies once it is determined that the plaintiff has a constitutionally protected property interest; Petitioners cannot use a dignity interest to create a property interest. *See* Mohilef v. Janovici, ("Mohilef") (1996) 51 Cal.App.4th 285-87 (deciding existence of protected property interest before using dignitary interest to decide what process was due).[24]

Assuming that Petitioners have a due process interest, the hearings provided the notice and opportunity to be heard that are the basics of due process. It is undisputed that the City provided notice. The City also provided an opportunity to be heard, fairly dividing the presentation time. At the PLUM hearing, Petitioners were given ten minutes to present its case. Members of the public opposing and supporting the Project were given 20 minutes, respectively. At the City Council hearing, Petitioners' side (including another appellant) was given 20 minutes, twice as much time as Millennium. Members of the public were given ten minutes each. Petitioners individually and through their counsel also submitted many letters, reports, opinions, and emails to the City. Consequently, Petitioners certainly had an opportunity to be heard. As for the public at large, Petitioners cite no case holding that every person who attends a public hearing must be given a chance to speak; local government could never perform the people's business if that were true. The City Council was entitled to limit the number and time of speakers to avoid cumulative information.

There were aspects of the hearing process which appear unfair, including the PLUM's acceptance of changes to Q Conditions and the Development Regulations through a May 31, 2013 letter from Millennium's counsel and through a Planning staff memo without providing either to the public, the submission by Millennium's attorney of a 311-page letter rebutting Petitioners' arguments less than 18 hours before the City Council hearing, requiring CURD and the public testify before City staff gave its presentation, and the City Clerk's announcement at the City Council hearing that an amending motion had been circulated when one had not been circulated.

The court need not decide whether these errors individually or cumulatively denied a fair hearing because Petitioners have not discussed prejudice: why the City's procedural due process errors require a new hearing. Prejudice is required for public agency decisions on land use matters. Govt. Code §65010; Rialto Citizens for Responsible Growth v. City of Rialto, (2012)

---

[24] Petitioners' reliance on American Tower Corp. v. City of San Diego, (9th Cir. 2014) 763 F.3d 1035, 1050-51 is not to the contrary. In that case, the Ninth Circuit interpreted Horn as relying on the broader due process principles of the California Constitution in holding that reasonable notice and an opportunity to be heard is required before an agency makes a land use decision that is a substantial deprivation of landowner property rights. Id. at 1051. Thus, American Tower concluded that adjacent and nearby property owners could make a due process objection to a city decision to permit dozens of antennas perched on hundred foot towers alongside sizable equipment shelters. Id. Whatever the correctness of American Tower's interpretation of Horn, Petitioners have made no such showing of significant impact from the Project. *See* Mohilef, *supra*, 51 Cal.4th at 285, n.16 (equating scope of federal and state due process for purposes of nuisance abatement case).

208 Cal.App.4th 899, 920-22. Petitioners argue that they are relying on constitutional, not statutory principles (Reply at 25), but due process does not mandate that all governmental decision-making comply with standards that assure perfect, error-free determinations. Machado v. State Water Resources Control Board, (2001) 90 Cal.App.4th 720, 725-26.[25]

The due process and fair hearing claims are denied.

G. Conclusion

The Petition is granted in part. The First and Second causes of action under CEQA are granted. The Third Cause of Action under CEQA is denied. The Sixth, Seventh, and Eighth causes of action (violation of City Charter, delegation of police power, and violation of La Mirada are denied, as are the Fourth and Fifth causes of action (due process and fair hearing). A writ of mandamus shall issue directing the City and City Council to vacate and set aside the actions approving the FEIR, Project approvals, and all land use entitlements. An injunction shall issue enjoining the City from granting any authority, permits, certificate of occupancy, or entitlements for the Project pursuant to the City's prior actions, and enjoining Millennium from undertaking construction on the Project pursuant to the set aside approvals.

Petitioners' counsel is ordered to prepare a proposed judgment and writ of mandate, serve them on counsel for the opposing parties for approval as to form, wait 10 days after service for any objections, meet and confer if there are objections, and then submit the proposed judgment and writ along with a declaration stating the existence/non-existence of any unresolved objections. An OSC re: judgment is set for June 11, 2015 at 9:30 a.m.

---

[25] Petitioners also argue that recirculation of the DEIR was required under Guidelines section 15088.5, which provides for recirculation is required where significant new information is added after public notice is given for review of the DEIR. New information is not significant unless the EIR is changed in a way that deprives the public of a meaningful opportunity to comment. Id. Petitioners point to nearly 400 pages of new or revised tables and analysis, much of it related to traffic and noise analysis (AR 5824-6222) and to Millennium's 120-page geology report and other materials submitted 18 hours prior to the City Council hearing. Petitioners argue that disclosure of this information and analysis was mandatory in the DEIR, not later when the public could no longer officially comment on it. Mot. at 33. The Opposition does not respond to this issue which is mooted by the fact that a new EIR is required.

SUPERIOR COURT OF THE STATE OF CALIFORNIA
COUNTY OF LOS ANGELES
WEST DISTRICT

FIX THE CITY, etc., **Petitioner and Plaintiff,** vs. **CITY OF LOS ANGELES; LOS ANGELES CITY COUNCIL; LOS ANGELES DEPT. OF CITY PLANNING; and DOES 1 through 100, inclusive,** **Respondents and Defendants.** **HOLLYWOOD CHAMBER OF COMMERCE,** **Intervenor.**	CASE NO. **BS138580** **STATEMENT OF DECISION**
LA MIRADA AVENUE NEIGHBORHOOD ASSN. OF HOLLYWOOD, etc., **Petitioner and Plaintiff,** vs. **CITY OF LOS ANGELES; CITY COUNCIL OF THE CITY OF LOS ANGELES; and DOES 1 through 100, inclusive,** **Respondents and Defendants.**	CASE NO. **BS138369** **STATEMENT OF DECISION**

HOLLYWOOD CHAMBER OF COMMERCE,
Intervenor.

SAVE HOLLYWOOD.ORG, aka PEOPLE FOR LIVABLE COMMUNITIES, etc., HOLLYWOODIANS ENCOURAGING LOGICAL PLANNING, etc.,

Petitioners/Plaintiffs,

vs.

THE CITY OF LOS ANGELES, CITY COUNCIL OF THE CITY OF LOS ANGELES, CITY ATTORNEY OFFICE OF CITY OF LOS ANGELES, HERB WESSON PRESIDENT OF CITY COUNCIL, CARMEN TRUTANICH CITY ATTORNEY, DOES 1 through 100, inclusive,

Respondents/Defendants.

HOLLYWOOD CHAMBER OF COMMERCE,

Intervenor.

CASE NO. **BS138370**

STATEMENT OF DECISION

These matters having been tried on September 16 and 17, 2013, and having been submitted for decision; the Court having issued its Tentative Decision and Proposed Statement of Decision; the parties having filed comments thereon; and those comments having been considered; the Court now issues this final Statement of Decision.

/ / /

INTRODUCTION

The Hollywood Community Plan Update (HCPU) (and its corollary environmental impact report [EIR]), which is a principal subject of this litigation, is a comprehensive, visionary and voluminous planning document which thoughtfully analyzes the potential for the geographic area commonly referred to as Hollywood (as defined in its several hundred pages). The HCPU includes scores of pages of text, detailed maps and tables which together express the finest thoughts of dedicated city planners. The HCPU is intended to be *the* essential component of the General Plan Framework (the Framework) for the City of Los Angeles (the City) as the General Plan for the City (in all of its elements) is applicable to planning and potential growth in Hollywood.

This otherwise well-conceived plan is also fundamentally flawed, and fatally so in its present iteration. As petitioners have articulated, and as will be discussed below, the HCPU, and its accompanying EIR, contain errors of fact and of law that compel granting relief to the community groups which challenge adoption of the HCPU and its EIR in their present forms.

While one can appreciate the goal of finalizing adoption of the HCPU, its accompanying EIR and related documents, and doing so as close to "on schedule" as possible given the many years since the City began its staged revisions to its General Plan planning documents (culminating in adoption of the Framework),[1] forging ahead in the processing of the HCPU, EIR and related documents in this case based on fundamentally flawed factual premises has resulted in a failure to proceed in the manner required by law. This and other bases for the rulings now made are set out below.

---

[1] The first draft of the Framework was circulated to the public almost twenty years ago, in July 1994. It was not finalized until eleven years later when review of the decision of the Court of Appeal of late 2004 upholding a revised version of the Framework was denied review by the California Supreme Court in February 2005. The attenuated history of adoption of the Framework is described in *Federation of Hillside and Canyon Associations v. City of Los Angeles* (2000) 83 Cal.App.4th 1252 [*Federation I*] and *Federation of Hillside and Canyon Associations v. City of Los Angeles* (2005) 126 Cal.App.4th 1180 [*Federation II*].

TRIAL PROCEEDINGS

The matter was tried to the Court on September 16 and 17, 2013. Prior thereto the parties filed extensive briefs, followed by their arguments at length at trial. Following the trial, the parties have filed requests for statement of decision (in addition to that provided for in Public Resources Code section 21005 (c) [requiring that a court specify all grounds on which a public agency has acted not in compliance with CEQA if it so finds]). While those statements have been filed, a controversy over the requests has been created. It is resolved in the accompanying footnote.[2]

Pursuant to Public Resources Code section 21005(c), Code of Civil Procedure section 632 and California Rules of Court 3.1590, this Tentative Decision is also the proposed Statement of Decision in these matters. If any party now renews its request for a statement of decision, it must timely and fully comply with Rule 3.1590. If not, then this document is also the Statement of Decision in these matters, and prevailing parties are to timely prepare, serve and lodge the appropriate peremptory writs and judgments.

Evidence

The Court admitted the Administrative Record in each case. (It is identical.)

Each party has sought judicial notice of certain items. With the consent of the parties, those items which are determined properly the subject of judicial notice in one case are admitted as to all cases.

Request for Judicial Notice by Fix the City

Fix the City (by Request for Judicial Notice filed August 21, 2013) seeks judicial

---

[2] In addition to filing in each case a list of issues which it contends should be addressed in the statement of decision in each, City and intervenor filed in each case a lengthy set of objections and arguments as to why many of the requests made by each petitioner/plaintiff were erroneous. As no authority to support their editorial comments on the requests made by their adversaries was provided, and the Court is not aware of any authority to challenge another party's *request* for inclusion of any matter or issue in the statement of decision, the *objections* will not be considered *qua* objections: The Court is the final arbiter of the contents of its own statement of decision and does consider the parties' views with respect to its contents in connection with the Court's final document.

notice of sections 2.10 through 2.10.6 and 2.11 through 2.11.6 of the City's General Plan Framework EIR (addressing Fire and Emergency Medical Services and Police Services, respectively. These requests are granted pursuant to Evidence Code section 452(c).

Request for Judicial Notice by La Mirada

La Mirada seeks judicial notice of the meaning of the word "range" according to a particular dictionary and of Los Angeles City Charter sections 554, 556 and 558. The Court grants the second request in full and the first subject to the Court's own ability to discern the appropriate and applicable meanings of words when used in particular contexts.

La Mirada also sought to "supplement" the Administrative Record by its August 21, 2013 Notice of Lodging, to which City objected. The items are Chapter 2 of the City's General Plan Framework and the text of a particular hyperlinked document. The latter is already part of the record pursuant to the correct reading of *Consolidated Irrigation District v. Superior Court* (2010) 205 Cal.App.4th 697, 724-725. City's reading of this case is crabbed. City's objection to the Framework is frivolous as City itself both seeks judicial notice of the document and cites it in its Opposition (City's Op. at 11:17-21). La Mirada requests are granted, as is City's request for judicial notice of the Framework.

Request for Judicial Notice by SaveHollywood.org et al.

There is no objection to Item 1, which is an opinion in a federal court case; granted.

Nor is there any objection to item 2, which is a print out of a web page relating to the census, but the Court sees nothing other than the printed page. That is not sufficient basis for granting a request for judicial notice; this request is denied.

City objects to item 3, a SCAG document, but it is in the record at AR 21168. And, under the authority of *Consolidated Irrigation District v. Superior Court, supra*, the report at the hyperlinked cite was already also part of the record. The copy of that report

at that link (Exhibit 3 to the Cheng declaration, filed with the Request for Judicial Notice) is merely another copy of the document which is already in the record. This request is granted.

Request number 4 is not a part of the record and its contents indicate it is only raw data in any event. It is neither timely nor appropriate for judicial notice; City's objections to this item are sustained.

City's Request for Judicial Notice

The requests of City, et al. that the Court take judicial notice of several items (identical in each case) are resolved as follows:

Granted as to Sections 555, 556 and 558 of the City Charter. (Exhibits F, G and H.)

Granted as to the extracts of the City of Los Angeles General Plan Framework attached to the Request for Judicial Notice as Exhibit B.

Granted as to the official opinion of the Court of Appeal in *Saunders v. City of Los Angeles,* reserving determination as to the relevance and application of that opinion to the circumstances of this action.

As no adverse party objected, the Court also grants the requests as to the existence and filing of each of the Petitions for Writ of Mandate in *Federation of Hillside Canyon Associations v. City of Los Angeles* (two cases) and *Saunders v. City of Los Angeles*; and as to the excerpts of the EIR in the *Saunders v. City of Los Angeles* (Exhibits C, D and E).

Without additional explanation, which was never provided, the Court finds insufficient the proffer with respect to a single page of the 2013 update of the U.S. Census. (Exhibit A.) Although the population of the HCPU area is a point of considerable interest in and importance to this case, the document attached as Exhibit A to this RJN, was apparently updated in 2013 -- in some unexplained manner — and the particular document attached has no indication of any particular relevance itself.

Nor will the Court accept City's apparently implied offer that the Court search the

U.S. Census itself. That would be both improper and inordinately time-consuming. City had the obligation to explain the relevance of the document, and in this case to be clear about the particular parts of the document to which it seeks the Court's attention.

Declarations

The declarations of MacNaughton and Kruse are not proper subjects of judicial notice; nor is Exhibit 1 to the Reply Brief to which it is attached. City's objections to these matters are sustained.

Other evidence

All other evidence, which is in the Administrative Record, is admitted.

Status of the three cases

With the stipulation that all evidence admitted in one case is admitted in all, and based on the congruence of the subject matter of the cases, the Court issues this single decision to address the issues presented in each of the three cases.

Background; the Framework Element

City has sought, and the Court has granted, City's request for judicial notice of a portion of "The Citywide General Plan Framework - An Element of the City of Los Angeles General Plan" ("the Framework Element" [the same document the Court referenced *ante* and which was the subject of the cases cited in footnote 1, *ante*).

There is no explanation why this document was not originally included in the Administrative Record in this case as it sets forth "a citywide comprehensive long-range growth strategy" for the city and describes the role of community plans such as the Hollywood Community Plan Update (HCPU) at issue in these proceedings.[3] (City's RJN, Exh. B, page 2) Thus: "While the Framework Element incorporates a diagram that depicts the generalized distribution of centers, districts, and mixed-use boulevards throughout the City, it does not convey or affect entitlements for any property. **Specific**

---

[3] The Court also granted Petitioner Fix the City's request that the Court take judicial notice of segments of Chapter 2 of the same document.

land use designations are determined by the community plans." [Par.] In fulfilment of the State's [planning] requirements [for general plans (Govt. Code secs. 65300, et seq.]), the City's general plan contains citywide elements for all topics listed except Land Use for which community plans establish policy and standards for each of the 35 geographic areas." (*id.*, emphasis added.) The HCPU is or will be such a plan for Hollywood.

The Framework also contains a statement of relevance with respect to the significance of population data:

> "In planning for the future, the City of Los Angeles is using population forecasts provided by the Southern California Association of Governments (SCAG). The Framework Element does not mandate or encourage growth. Because population forecasts are estimates about the future and not an exact science, it is possible that population growth as estimated may not occur; it may be less or it may be more. The City could be at the beginning of a long decline in population or at the beginning of a sharp increase." [Par.] The Element is based on the population forecasts provided by SCAG. Should the City continue to grow, the Element provides a means for accommodating new population in a manner which enhances rather than degrades the environment. The City does not have the option of stopping growth and sending it elsewhere. It must prepare for it, should growth occur. In preparing the General Plan Framework Element, the City has answered the question "What would the City do if it had to accommodate this many more people?" In answer to that question there are two possibilities: 1) prepare a Plan to accommodate density equally among all City neighborhoods, or 2) prepare a plan to preserve the single-family neighborhoods and focus density — should it occur — in limited areas linked to infrastructure." (*Id.*)

The HCPU is thus the updated, basic planning document for the Hollywood community which "establish[es] policy and standards for [the Hollywood] geographic area[]. (*Id.*)

As will be discussed, the HCPU, includes, *inter alia*, a plan to focus growth along transit corridors and in specific areas of Hollywood. Whether the final environmental impact report for the HCPU withstands scrutiny at this time is the focus of the differences between these petitioners, on the one hand, and City and Intervenor, the Hollywood Chamber of Commerce, on the other.

The fundamental dilemma is why and how "specific land use designations" are properly determined based on population estimates which, it is argued and clearly established, are substantially inaccurate.

PRELIMINARY PROCEDURAL ARGUMENTS

Waiver?

City and Intervenor contend that certain petitioners waived critical arguments by not asserting them in the administrative proceedings or in the petition for writ of mandate. This contention is an inaccurate statement of what occurred in the administrative proceedings below. Contrary to the claims of City and of Intervenor, it is well-established that whether a particular petitioner made a contention below is not the test for asserting that claim in CEQA proceedings. The question is: Was the subject matter of the claim made *by anyone* below with sufficient specificity?

As but two examples of the facts: (1) SaveHollywood raised the issue of the mis-use of the 2005 SCAG population estimate multiple times in the administrative proceeding, and (2) when the 2010 Census data was first incorporated into an official document just days prior to the final action by the City Council, La Mirada wrote to the body before which the issue was then being considered, the City Council, setting out in more than ample detail its objections. *Cf., Endangered Habitats League v. State Water Resources Control Board* (1999) 70 Cal.App.4th 482, 489-491 [exhaustion not required when no opportunity to challenge provided]. Public Resource Code section 21177 is simply not applied in the crabbed manner that City and Intervenor contend. Multiple additional examples of timely stated objections to the points now adjudicated appear in the record. Thus, on the facts, the issues now presented were all timely presented

below.

Next, there was considerable specificity in the objections made by petitioners (and others) at the several stages of the administrative process, specificity that meets the applicable test, even as discussed in the cases cited by Intervenor (*e.g.*, *Resources Defense Fund v. Local Agency Formation Commission* (1987) 191 Cal.App.3d 886, 894). Moreover, better reasoned cases such as *Citizens Assn. for Sensible Development of Bishop Area v. County of Inyo* (1985) 172 Cal.App.3d 151, 163, make clear that the specificity prong of the Public Resources Code section 21177 requirement was amply met -- and for all of the issues raised in this proceeding. As the *Sensible Development* court states: " ... less specificity is required to preserve an issue for appeal in an administrative proceeding than in a judicial proceeding. This is because "'[i]n administrative proceedings, [parties] generally are not represented by counsel. To hold such parties to knowledge of the technical rules of evidence and to the penalty of waiver for failure to make a timely and specific objection would be unfair to them.' (Note (1964) Hastings L.J. 369, 371.) It is no hardship, however, to require a layman to make known what facts are contested." (*Kirby v. Alcoholic Bev. etc. Appeals Bd.* (1970) 8 Cal.App.3d 1009, 1020 [87 Cal.Rptr. 908].)" *Id.,* at 163.[4]

Claim Preclusion as to Fix the City?

City and Intervenor advance two arguments as to claim preclusion of certain contentions by petitioner Fix the City; neither is meritorious.

First, City mistakenly asserts (City's Op. at 28-29) that Fix the City's arguments about mitigation measures are barred because it is "in privity with" with a party to *Federation II* (*id.* at 23:12-27). City cites as its legal authority *Frommhagen v. Board of Supervisors* (1987) 197 Cal.App.3d 1292, 1301. That case does not support the

---

[4] This last waiver contention is resolved based on the circumstance that the claims which City claims to have been waived are simply elements of petitioner Fix the City's Fourth Cause of Action. The cases City cites are inapposite. *See* Fix the City's Reply at 25:1-15.

argument made. At the cited page that court is addressing claims made by the same party, not which party is in privity with whom. It is clear that in this case we have multiple petitioning parties and that there is no sufficient evidence presented that Fix the City is in legal privity with any other party to the earlier case. City's claim is without support. *See, e.g.*, *Planning & Conservation League v. Castaic Lake Water Agency* (2009) 180 Cal.App.4th 210, 229-231.

Nor does Fix the City's participation in *Saunders v. City of Los Angeles* (September 25, 2012) (2012 WL 4357444) support City's claim preclusion arguments. As Fix the City points out, the issue presented in *Saunders* was whether City breached a mandatory duty by failing to prepare annual reports on the City's infrastructure (Fix the City's Reply at 22:19-27); it involved the Framework and not either this EIR or the HCPU. It appears that City relies solely upon the circumstance that Fix the City was a party to *Saunders* as barring its contentions here. That argument ignores the material differences in the issues presented in the two cases. Nor were this HCPU and its EIR considered in any respect in *Saunders*; indeed, there is no way either could then have been subject to anyone's consideration as they had only been adopted and approved *after* the *Saunders* trial court had issued its decision.[5]

PRINCIPAL ARGUMENTS AND ANALYSIS

Petitioners' contentions

Petitioners advance several arguments in support of their contentions that the

---

[5] The Court, *sua sponte*, takes judicial notice of the entry of judgment in the trial court in *Saunders* -- on March 2, 2011 — a date *prior* to the public dissemination of the draft EIR in the present case, making City's argument -- that of a party to *Saunders* and with detailed knowledge of its proceedings -- more than difficult: There is no way in which the claims now made concerning this, later issued EIR (and plan), could have been raised or litigated in that case. *See, Planning & Conservation League v. Castaic Lake Water Agency* (2009) 180 Cal.App.4th 210, 225-229 *and e.g., Federation II* at 1202.

HCPU and its EIR were not prepared in the manner required by law, etc.[6]

Population base

A fundamental contention of all petitioners is that the population data upon which the EIR for the HCPU is formulated is fatally flawed, with the result that the EIR must be revised and then recirculated with appropriate analysis of the corrected basic data.

Applicable facts

The first set of relevant facts is the timeline of significant actions for the items, now listed.

- April 28, 2005 * Notice of Preparation of Draft EIR published
- March 3, 2011 * Draft EIR released
- May 2011 * 2010 U.S. Census data released[7]
- October 2011 * Final EIR released
- December 11, 2011 * Planing Commission submits HCPU with recommendation of approval of HCPU
- May 8, 2012 * City Council Planning and Land Use Management Committee (PLUM Com.) submits HCPU to Council without recommendation
- May 18, 2012 * First Revisions to EIR [contains response to SCAQMD]
- June 14, 2012 * Second Revisions to EIR - [33 pages; contains references to 2010 US Census data released in May 2011]
- June 19, 2012 * City Council meeting at which EIR adopted
- June 21, 2012 * Notice of Determination filed

The principal factual and legal dispute concerns City's reliance on population

---

[6] Certain petitioners also address claimed general plan defects. Because they are analyzed according to a different standard, the Court addresses them separately, *post*.

[7] City cited a web address at which census data could be viewed. The Court declines this entirely non-specific invitation as vague, overbroad and therefore insufficient.

data, which City obtained from the Southern California Association of Governments (SCAG), as the base for analysis in the HCPU and its EIR. There is agreement that the base used for analysis was the SCAG estimate of population in 2005 in the HCPU defined area, and that this number was 224,426 persons. The EIR describes this estimate as having been derived from the 2004 SCAG Regional Transport Plan. Neither this 2004 Plan nor any other source data with respect to the 2005 population number appear in the Administrative Record. (Limited background memoranda relevant to the population statistics do appear in the Reference Library, but they do not provide the missing data.) The Draft EIR (DEIR) uses a forecast of population for 2030 for the HCPU area of 244,302; this was derived from the same 2004 study. The DEIR also sets out a "revised" population estimate of 245,833.

Using these various data points, the DEIR analyzed what it referred to as a "reasonable expected level of development for 249,062 people.

Petitioners argue that the fact that the results of the 2010 Census became available just after the DEIR was released compelled revision of the DEIR to utilize that data and that failure to do so was prejudicial error requiring preparation and recirculation of a new DEIR which properly incorporates the 2010 Census population data. (While the exact date of release of this data is a point of dispute among the parties, it is clear that the official United States Government census data became available by May, 2011 — within 60 days of the release of the DEIR.)

This U.S. Census data is relevant to this litigation because it differs so significantly from that used in the EIR process here. The 2010 Census shows that the population of the HCP area was approximately 198,228 persons. The reason why this is given as an approximation is that the relevant census tracts cover an area slightly different than the boundaries of the HCPU area. This difference is known, however, to City's Planing Department, and City did make some adjustments to its own data in its Second Addition to Final EIR, dated June 14, 2012, five days before the City Council took final action on the HCPU and its EIR, confirming its knowledge in this respect.

The following table summarizes key data and illustrates the petitioners' contention that the base used by City in its planning constitutes error.[8]

1990 U.S. CENSUS	2000 U.S. CENSUS	**2004/2005 SCAG pop. est.**	**2010 U.S. CENSUS**	2030 Forecast in DEIR	2030 CITY est.
213,912	210,824	**224,426**	**198,228**	244,302	249,062

Reference to this table produces some obvious questions including the following:

(1) Why was the population base which City used for analysis in the DEIR the SCAG estimate of 224,426 when the Official Census data became available within 60 days of release of the DEIR — and when that data shows a significantly lower population (even in a somewhat larger geographic area)?[9]; and

(2) why was the 2030 population number used not further adjusted once the 2010 U.S. Census data was available?

The 2005 SCAG population estimate was a principal key to the analytical foundation for the DEIR. From it flowed not only the 2030 population estimate used in the DEIR, but, combined with other factors, estimates for water consumption, waste

---

[8] While City argues that it was not possible to estimate the population in the HCPU area because of incongruity of census tracts with the HCPU area, the Administrative Record reveals that petitioner La Mirada was able to estimate the population in the HCPU area at 197,085 persons, and City itself made revisions to the EIR just 5 days prior to its approval by the City Council to incorporate some of the data from the 2010 Census, as noted in the text.

[9] It is clear that City's Planning Department had the ability to adjust for the slight differences between the HCP boundaries and the census tract data as the latter was discussed in the 33 page June 14, 2012 Second Revision to EIR released just 5 days prior to the City Council voting to approve the EIR -- and the census tracts themselves had been extant for a considerable period of time. City advanced several contentions based on the argued differences, claims that appear fully refuted by the actions taken by its own Planning Department.

water, solid waste, and energy demand,[10] as well as other elements of the EIR.

As Fix the City aptly describes the function of the EIR: "At the heart of the [DEIR for the HCPU] and indeed the defining purpose of the Plan Update itself, is the accommodation of projected population growth in the Plan area. The purpose of the EIR is to evaluate the environmental impacts of accommodating this growth in the manner and locations set forth in the Plan Update. In this regard, the magnitude of the population increase accommodated by the Plan Update is a critical component of the environmental analysis and [is] relied upon in numerous instances throughout the EIR." (Fix the City's Opening Memo. at 6:5-21). Thus, it is critical to the EIR that the population base be appropriate to the actual circumstances which exist in the area of the HCPU and its EIR. In this case, it was not.

Standard of Review

The standard for review of the sufficiency of any EIR is prejudicial abuse of discretion. Public Resources Code sections 21168 and 21168.5. "Abuse of discretion is established if the agency has not proceeded in a manner required by law or if the determination or decision is not supported by substantial evidence. *Laurel Heights* [*Impr. Asn. v. Regents* (1988) 47 Cal.3d 376,] at 392. A prejudicial abuse of discretion occurs if the failure to include relevant information precludes informed decision-making and informed public participation, thereby thwarting the goals of the EIR process." *San Joaquin Raptor Rescue Center v. County of Merced* (2007) 149 Cal.App.4th 645, 653. "... the existence of substantial evidence supporting the agency's ultimate decision on a disputed issue is not relevant when one is assessing a violation of the information disclosure provisions of CEQA. " *Association of Irrigated Residents v. County of Madera* (2003) 107 Cal.App.4th 1383. 1392.[11] A clearly inadequate or unsupported study is

---

[10] The estimates for public safety services will be discussed, *post*.

[11] The need to be alert for agency misconduct in CEQA matters is especially strong where, as here, the agency is the project proponent. *Deltakepper v. Oakdale Irrigation*

entitled to no judicial deference. *Berkeley Keep Jets Over the Bay v. Board of Port Commissioners* (2001) 91 Cal.App.4th 1344, 1355.

Here, a case cited by respondents also supports petitioners' contention.[12] In *Californians for Alternatives to Toxics v. Department of Food & Agriculture* (2005) 136 Cal.App.4th 1, the court held that a lead agency cannot forego its own analysis of base data and rely instead on such data provided by another agency. In the present matter, one of City's principal counter-arguments is that it was entitled by law to rely on the SCAG 2005 population estimate. That contention must be and is rejected upon the authority of *Californians for Alternatives, supra. See also, Ebbits Pass Forest Watch v. Calif. Department of Forestry* (2008) 43 Cal.4th 936, 956.

There are additional reasons why use of the SCAG population estimate is improper in the context of this EIR. As petitioners explain, this EIR does not contain the "analytical route" by which the lead agency reached the conclusions set out in such a document. This requirement, that fundamental information be disclosed in the planning documents, has been the law for decades. *E.g.*, *Topanga Assn. for a Scenic Community v. County of Los Angeles* (1974) 11 Cal.3d 506:

> "We further conclude that implicit in section 1094.5 is a requirement that the agency which renders the challenged decision must set forth findings to bridge the analytic gap between the raw evidence and ultimate decision or order. If the Legislature had desired otherwise, it could have declared as a possible basis for issuing mandamus the absence of substantial evidence to support the administrative agency's action. By focusing, instead, upon the relationships between evidence and findings and between findings and ultimate action, the

---

Distr. (2001) 94 Cal.App.4th 1092, 1109.

[12] Petitioner La Mirada clearly makes the argument that City did not proceed in the manner required by law. Petitioner Fix the City appears to rely on the other basis to set aside an EIR, viz., that there is no substantial evidence in its support — a claim joined by SaveHollywood, as well as by La Mirada.

Legislature sought to direct the reviewing court's attention to the analytic route the administrative agency traveled from evidence to action. In so doing, we believe that the Legislature must have contemplated that the agency would reveal this route. Reference, in section 1094.5, to the reviewing court's duty to compare the evidence and ultimate decision to 'the findings' (emphasis added) we believe leaves no room for the conclusion that the Legislature would have been content to have a reviewing court speculate as to the administrative agency's basis for decision." *Id.*, at 515.

City and Intervenor contend that City fully complied with EIR requirements, citing Guidelines section 15125(a), which provides:

"An EIR must include a description of the physical environmental conditions in the vicinity of the project, as they exist at the time the notice of preparation is published .... This environmental setting will normally constitute the baseline physical conditions by which a lead agency determines whether an impact is significant."

In addition to using the SCAG 2005 estimate of a population of 224,426, the DEIR forecast a population of 244,302 residents in 2030 for planning purposes. This data, as noted previously, was derived from the 2004 SCAG transportation report.[13] The EIR then estimated the "reasonable expected level of development" utilizing a further estimate of the population in the HCPU area in 2030 of 249,062.

Considering the *actual* population in 2010 as evidenced by the 2010 Census data, the real population increase essential to analysis in the DEIR was 50,744 rather than the 24,636 persons number which was utilized by City. Thus, the analysis in the DEIR was

---

[13] As Petitioner SaveHollywood points out, the 2004 RPT was not included in the Administrative Record; this is "a fatal error" as it is "a key rationale" for the HCPU and "[b]y omitting purported relevant information from the record, the City deprived the public of the ability to independently verify [City's] population assumptions and its environmental assessments predicated thereon." SaveHollywod.org Opening Memo. at 8:16-21.

predicated upon a population increase — *well under half* — of what would occur if the 2030 estimate were to remain. And, if the population estimate for 2030 were to be adjusted based on what the 2010 Census data had shown, then all of the several analyses which are based on population would need to be adjusted, such as housing, commercial building, traffic, water demand, waste produced — as well as all other factors analyzed in these key planning documents.[14]

City's reliance on what is "normally" permissible as what is required is misplaced. The very fact that Guideline section 15125(a) uses the word "normally" suggests that there are circumstances in which such reliance is not appropriate. It is well-established that, "[i]n some cases, conditions closer to the date the project is approved are more relevant to a determination of whether the project's impacts will be significant. *Save Our Peninsula Com. v. Monterey County Board of Supervisors* (2001) 87 Cal.App.4th 99, 125. Thus, the Guideline in which City and Intervenor seek refuge instead recognizes, and the cases support, the petitioners' contention that there are substantial reasons to use a different (up-to-date) baseline when the circumstances warrant, as the circumstance did, and do, in this case:

> "Administrative agencies not only can, but should, make appropriate adjustments, including to the baseline, as the environmental review process unfolds. *No purpose would be served, for example, if an agency was required to remain wedded to an erroneous course and could only make a correction on remand after reversal on appeal.*" *Citizens for East Shore Parks v. California State Lands*

---

[14] As La Mirada points out in its Opening Brief at 7:19-22, just before the City Council voted to approve the several documents in June 2012, City added its conclusion that it was still reasonable to rely on the 2005 SCAG population base even with the 2010 Census data. That clearly is a post-hoc rationalization of City's failure to recognize that the HCPU was unsupported by anything other than wishful thinking — and a demonstration of an effort to avoid further analysis in key planning documents. Nor is an agency's determination marked by changes such as those in evidence here, entitled to any deference. *Yamaha Corp. v. State Board of Equalization* (2001) 19 Cal.4th 1, 14.

Comsn. (2011) 202 Cal.App.4th 549, 563. (Emphasis added.)

Even when the surrounding conditions are recognized close in time to the final certification of the EIR, the baseline must be updated to reflect that new knowledge. *E.g.*, *Mira Monte Homeowners Assn. v. County of Ventura* (1985) 165 Cal.App.3d 357 (identification of additional wetlands made just prior to proposed certification of FEIR). Here, the significant factual predicate for the critical analytical issues explicated in the EIR was known far earlier in the EIR process than that in *Mira Monte*; here, just two months after release of the initial DEIR and over a year prior to final action on the EIR — yet no material adjustments were made. Multiple objections to the continued use of these demonstrably incorrect SCAG population estimates repeatedly were made "for the record" by several groups — and ignored by City until their limited [and inadequate] use, just 5 days before final approvals in the Second Addition to Final EIR. This conduct was itself a failure to proceed in the manner required by law. Public Resources Code section 21166; *Mira Monte, supra*, at 365-366.

When the new facts became known shortly after issuance of the DEIR, the baseline used for analysis should have been adjusted -- in the summer of 2011 rather than proceeding with a fundamentally flawed baseline. The failure to use accurate and then-current data was a failure to proceed in the manner required by law . This is made clear by cases such as *Save our Peninsula Committee v. Monterey County Board of Supervisors* (2001) 87 Cal.App.4th 99: "If an EIR fails to include relevant information and precludes informed decisionmaking and public participation, the goals of CEQA are thwarted and a prejudicial abuse of discretion has occurred. (*Sierra Club v. State Bd. of Forestry* (1994) 7 Cal.4th 1215, 1236 []; *Fall River Wild Trout Foundation v. County of Shasta* (1999) 70 Cal.App.4th 482, 492 []; *County of Amador v. El Dorado County Water Agency, supra,* 76 Cal.App.4th at p. 954; Pub. Resources Code, § 21005, subd. (a).)" *Id.*, at 128.

While CEQA gives the lead agency flexibility in establishing baseline conditions, as Fix the City argues, "that flexibility must be cabined by the rule that all CEQA

determinations must be supported by substantial evidence. (Fix the City, Opening Memo. at 8:17-19). Citing Guideline 15384, which defines substantial evidence, Fix the City points out (*id*, at 9:5 et seq.) that substantial evidence must have a factual basis which is "a serious deficiency of the 2005 estimate." Decision makers cannot arrive at the required reasoned judgment without it. *Concerned Citizens of Costa Mesa v. 32nd Agricultural Assn.* (1986) 42 Cal.3d 929, 935.

Intervenor errs in its claim that use of the incorrect baseline was not prejudicial. (Intervenor's Opposing Memo. at 17-18) Rather, as Fix the City argues, use of the flawed baseline "fundamentally distorted the EIR." (Fix the City's Opening Memo. at 8:20). Also, the attempted remedy to the prior utilization of the wrong baseline data in the DEIR resulted in City inserting an abbreviated analysis of the 2010 census data in its June 2012 Second Addition to the EIR, which contained a merely truncated — and insufficient — discussion of alternatives. As Fix the City notes: "Clearly, if one goal of the plan is to accommodate projected population growth — setting aside entirely the accuracy of the projection — and the City is advised that there is more capacity in the current plan than it realized, its analysis of necessary future actions to accommodate a projected increase would change." (Fix the City's Reply. at 9:1-4)

What is particularly flawed about the Second Addendum to the EIR is the failure to adjust for the 50,744 new residents that are a direct consequence of City's original error (use of the 2005 overstatement of population by SCAG rather than the actual number available from the 2010 Census). The Second Addendum is flawed because it is premised on the unsupportable notion that accommodating 50,744 new residents will have less impact than accommodating 24,636 new residents. The utilities, wastewater and public safety discussions of this EIR are all without support and City has not explained the "analytical route the ... agency traveled from evidence to action," thus rendering invalid its literally last minute attempt (viz., 5 days prior to final approval) to remedy its prior failures and refusals to accept as valid the many objections made to the mistaken use of outdated and substantially wrong SCAG data. *See, Laurel Heights*

Improvement Assn. v. Regents, *supra*, (1988) 47 Cal.3d 376, 404. [15] [16]

---

[15]

No party makes any note of the discussion in *Federation II* of a discussion of projections based on SCAG and census data which appears at 126 Cal.App.4th at 1206-1207. That discussion is not applicable in any event to this case; as may be inferred by the parties omission of any reference to it.

At page 11 of its opening memorandum, City claims that a single sentence in the Framework precludes use of up to date population figures, especially the 2010 Census data. As La Mirada argues (Reply at 7:9-11) "Blind adherence to data [City] knows is wrong is not the 'good faith effort at full disclosure' mandated by CEQA. Guideline section 15151." See, *Citizens for East Shore Parks v. California State Lands Comsn.* (2011) 202 Cal.App.4th 549, in which the State Lands Commission as lead agency revisited its baseline during the environmental review process *and modified it as needed*. This practice was specifically approved by the reviewing court of appeal:

> "To begin with, plaintiffs cite no authority supporting the implied premise of their argument—that the Lands Commission could not revisit the baseline during the environmental review process and modify it as the Commission deemed appropriate or necessary.[fn omitted] Moreover, such a suggestion is unsound. Administrative agencies not only can, but should, make appropriate adjustments, including to the baseline, as the environmental review process unfolds. No purpose would be served, for example, if an agency was required to remain wedded to an erroneous course and could only make a correction on remand after reversal on appeal. [Par.] The record also reveals a sound basis for the Lands Commission's adjustment of the baseline. Chevron presented the Commission with information about other baseline determinations being made for proposed San Francisco Bay Area projects, and urged it to take the same approach so there would be uniformity in the environmental review process. In addition, the case law in the area was being developed through decisions such as *Fat,* 97 Cal.App.4th at pages 1277–1281, 119 Cal.Rptr.2d 402, which endorsed and followed *Riverwatch, supra,* 76 Cal.App.4th 1428, 91 Cal.Rptr.2d 322. Thus, as the Lands Commission explained, its view of the appropriate baseline evolved over time, ultimately leading to modification of the baseline in the 2003–2004 timeframe, some four years before it completed the environmental review process. [Par.] in sum, the Lands Commission did not abuse its discretion in defining the baseline used to assess environmental impacts of the proposed marine terminal lease renewal. The baseline was not contrary to the law, and it was based on substantial evidence." *Id.* at 563-564.

[16]

The claims that the petitioners were too late with their objections is devoid of merit. As City only applied the 2010 Census data in the document dated June 14, 2012, five days prior to the City Council vote on the project component documents, and as the record is clear that some of the petitioners made their objections known even in that short time frame, that was all any citizen might (or need) do — and it fully complies with the standing requirements of CEQA under such a tight time frame. Public Resources Code section 21167; *e.g.*, *Endangered Habitats League v. State Water Resources Control Board* (1997) 63 Cal.App.4th 227, 238-240.

Alternatives Analysis

Alternatives analysis is a core element of each EIR. *In re Bay-Delta Programmatic Environmental Impact Report Coordinated Proceedings* (2008) 43 Cal.4th 1143, 1162.[17] An EIR must contain and analyze in depth a "range of reasonable alternatives." *Citizens of Goleta Valley v. Board of Supervisors* [*Goleta II*] (1990) 52 Cal.3d 533, 566; Guidelines section 15126.6(c). The range must be sufficient "to permit a reasonable choice of alternatives so far as environmental aspects are concerned. *San Bernardino Valley Audubon Society v. County of San Bernardino* (1984) 155 Cal.App.3d 738, 750-751. Each case must be evaluated on its own facts. *Goleta II, supra*, at p. 566. Among the usually included alternatives is one for "reduced density." *Watsonville Pilots Assn. V. City of Watsonville* (2010) 183 Cal.App.4th 1059. The EIR must always include analysis of the No Project Alternative (Guidelines section 15126.6(e); *County of Inyo v. City of Los Angeles* (1977) 71 Cal.App.3d 185, 203) which must discuss what would reasonably be expected to occur in the foreseeable future if the project were not approved, based on current plans and consistent with available infrastructure and community services. Guidelines section 15216.6(e). This alternative is not always the same as the baseline environmental setting, and the EIR's analysis of the No Project Alternative should identify the practical consequences of disapproving the project when the environmental status quo will not necessarily be maintained. *Planning & Conservation League v. Dept. Of Water Resources* (2000) 83 Cal.App.4th 892.

In determining what constitutes a reasonable range of alternatives, there must be a set or group of such alternatives which would feasiblely attain most of the basic objectives of the project but would avoid or substantially lessen any of the significant effects of the project. Guidelines section 15126.6(a). The term feasible is defined in Public Resources Code section 21061.1 as "capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic,

---

[17] The other core element is that of mitigation. *Id.*

environmental, social, and technological factors. See Guidelines section 15126.6(f)(1). "The key issue is whether the range of alternatives discussed fosters informed decision making and public participation. *Laurel Heights Improvement Assn. v. Regents*, supra, 47 Cal.3d 376, 404-405.

The EIR must identify the alternatives considered in, and those excluded from, EIR analysis and should provide the reasons for their rejection. *Goleta II, supra*, at 569; Guidelines section 15126.6(b). A brief explanation of such excluded alternatives is sufficient; the entire administrative record may be considered in determining whether a reasonable range of alternatives has been discussed. I*d.*, at 569.

"The selection of alternatives discussed will be upheld, unless the challenger demonstrates that the alternatives are manifestly unreasonable and they do not contribute to a reasonable range of alternatives." *Calif. Native Plant Society v. City of Santa Cruz* (2009) 177 Cal.App.4th 957, 988.

The EIR in this case contains analysis of three "alternatives": (1) the current (preexisting, 1988) plan, considered as the No Project Alternative, (2) the current/proposed project, and (3) a plan based on the SCAG 2030 population forecast (which is based on a one percent reduction in population from the proposed project). However, under applicable regulations, there are only two alternatives — Public Resources Code section 21100(b)(4) provides that the project itself cannot be an alternative to itself, as La Mirada points out. La Mirada Opening Brief at 16:17-20.

There is a further problem in "counting" the alternatives analyzed: La Mirada points out that Guidelines section 15126.6(e)(3)(A) when read in conjunction with *Planning and Conservation League v. Dept. Of Water Resources* (2000) 83 Cal.App.4th 892, 917-918 suggests that the "No Project Alternative" is not an alternative for purposes of CEQA. Instead, it is simply the continuation of the existing plan, policy or operation into the future....[T]he projected impacts of the proposed plan or alternative plans would be compared to the impacts that would occur under the existing plan." La Mirada Opening Memo. at 16:21-17:7.

However one counts the "alternatives," the flawed environmental setting presented in these EIR documents makes the analysis insufficient and inaccurate. *Friends of the Eel River v. Sonoma County Water Agency* (1994) 27 Cal.App.4th 713, 738-739. "[W]ithout [an adequate baseline] description, analysis of impacts, mitigation measures and alternatives becomes impossible." *County of Amador v. El Dorado County Water Agency* (1999) 76 Cal.App.4th 931, 953.

SaveHollywod and HELP contend that consideration of a down-sizing/down-zoning (DS-DZ) alternative was both feasible and required based on the actual population statistics and trends. These petitioners argue that notwithstanding multi-year and multi-million dollar investments in infrastructure in the Hollywood community, there has been a net outflow of population and an increase in vacancy rates in both commercial and residential properties. Interestingly, they argue that, based on the SCAG 2005 population estimate, the HCP area has lost over 26,100 people in the five year period 2005-2010 (basing the 2010 population on the U.S. Census data) and there have been massive financial losses connected to construction projects — the key example being the difference between the construction cost and eventual sale price of the Hollywood-Highland Project, of over $420 million. SaveHollywod Opening Memo. at 14-19.

Fix the City argues that the EIR's 10 page discussion of the three selected alternatives is perfunctory and "[a]s a result of the deficient alternatives analysis, the EIR fails to provide decision makers and the public with a genuine comparison of the environmental consequences of different levels of development in Hollywood." Fix the City Opening Memo. at 15:9-11. Nor, in Fix the City's view does the Second Addition to the EIR (June 14, 2012) sufficiently address the otherwise insufficient range of alternatives in the manner required by law. This petitioner points out that (1) these environmental documents ignore the requirement that other alternatives be identified or, consequentially, the reasons they were rejected be stated, and (2) that this defect was raised throughout the environmental review process in numerous comment letters.

Instead, "The FEIR states that City Planning 'considered and rejected as infeasible an alternative that would place a blanket moratorium on demolition permits and project development.' ... Like the DEIR, the FEIR also fails to meet CEQA's disclosure requirements...." Fix the City Opening Memo. at 16-17.

Focusing on the Second Addition document, Fix the City argues that the discussion there of the no-growth and DS-DZ alternatives are infeasible, but neither the EIR nor the Second Addition document contains "sufficient information ... to enable the public or decision makers to adequately evaluate the City's conclusory statements regarding the infeasibility of a downsizing alternative." *Id.* at 17

This argument has particular force when one considers the material discrepancy in the population statistics discussed, *ante*, and the short 5 day window between the release of the Second Addition and the vote by the City Council approving the several documents at issue. The evidence in this record strongly supports petitioners' contention that there has been an insufficiently-reasoned rush to completion of the EIR process, and that the process was administered in a way that is clearly contrary to well-established laws as interpreted by the appellate courts. As Fix the City argues: "The Plan Update EIR ... lacks an analysis of sufficient ranges of alternatives and fails to provide substantial evidence supporting its decisions to analyze only the narrowest range of alternatives. [Par.] While it may be a reasonable policy decision for the City to plan for the level of population growth accommodated in the Plan Update, the City cannot make that decision without a genuine understanding of what the environmental trade-offs are of accommodating this level of growth. The Plan Update EIR is the document designed to inform both the decision makers and the public of the environmental consequences of the Plan Update and of alternative approaches to the critical task of planing the City's growth.... CEQA does not permit an agency to evade its disclosure duties in this manner; the failure to analyze a reasonable range of alternatives without any support of a finding of infeasibility is an abuse of discretion." Fix the City

Opening Memo. at 18:21-19:7.

One can only wonder how this planning process ran so far off the track when consideration is given to the recent history of the Framework itself and the corrective action it required.[18]

In response to these arguments, neither City nor Intervenor presents any adequate counter-arguments. Both City and Intervenor ignore the cases, statutes and Guidelines cited by the petitioners. City instead focuses, *inter alia*, on other claimed defects in the petitioners' contentions, but these assertions do not respond to the fundamental point that petitioners have established: City did not proceed in the manner required by law with respect to ascertainment and discussion of these 'core components of the EIR process' as alternatives analysis is defined by our Supreme Court. *In re Bay-Delta Programmatic Environmental Impact Report Coordinated Proceedings*, *supra*, 43 Cal.4th 1143, 1162.

Public Services

Fix the City contends, and City acknowledges, that the EIR's thresholds of significance did require City to evaluate whether the significant capacity increase permitted by the HCPU would require "unplanned upgrading or improvement of existing fire protection equipment or infrastructure" or would "induce substantial growth or concentration of population beyond the capacities of existing police personnel and facilities; or whether the HCPU would "cause deterioration in the operating traffic conditions that would adversely affect [police and fire] response times. City's Op. at 20. As Fix the City points out, "[t]he EIR determined that in fact such thresholds of significance would be exceeded for both police and fire services.... conclud[ing] that, absent mitigation, degraded performance in the[se] critical services was likely." (Fix the City's Reply at 13:4-14.) The issue was of substantial concern to many participants in the environmental and plan review process, including then Council member Eric

---

[18] See footnote 1, *ante*.

Garcetti, who wrote a letter (dated March 23, 2012) highlighting the need for improved response times by City's Fire Department (AR21362).

Delayed response times of emergency services may be a factor in determining whether increased population concentration is significant. The focus of such analysis is on the physical changes that may result from economic and social changes. Guidelines section 15064(e) addresses this issue; e.g., population increases, as well as other "economic and social effects of a physical change may be used to determine that the physical change is a significant effect on the environment". *See also* Guidelines section 15131; and *Christward Ministry v. Superior Court* (1986) 184 Cal.App.4th 180.

For reasons explained throughout this decision, this EIR is fatally flawed. One of the reasons is particularly applicable here, *viz.*, the failure to use appropriate population statistics leads to fatally flawed estimation of the impact on fire and police services — and their impact on physical changes: "the effects of decreased response capacity, including both physical effects and social/economic effects that lead to physical effects, require [environmental] review." Fix the City's Reply at 15:12-13.

Prejudice

For reasons discussed above in detail, petitioners have demonstrated prejudice compelling the granting of relief. The facts and circumstances of the administrative proceedings in this record clearly evidence as much of a rush to completion of the EIR and HCPU as might be possible in a proceeding of this nature. As described, *ante*, the 2010 Census data became available within two months of release of the DEIR. As the time line, *ante*, demonstrates, there was ample time to revisit the critical population estimates and still have the documents [re]circulated, heard at public fora and submitted to various City committees and to the Council by June of the year after issuance. When community members and groups repeatedly wrote and spoke against key elements of the documents now being reviewed — and clearly articulated many reasons why the documents were flawed, there were two rushed efforts to supplement the relevant documents, including the first attempt to address some of the consequences of the 2010

Census data — but that only 5 days before the matter was voted on by the City Council. The result was a manifest failure to comply with statutory requirements.[19]

When a public agency does not comply with procedures required by law, its decision must be set aside as presumptively prejudicial. *Sierra Club v. State Bd. of Forestry* (1994) 7 Cal.4th 1215, 1236. "Noncompliance with substantive requirements of CEQA or noncompliance with information disclosure provisions 'which precludes relevant information from being presented to the public agency ... may constitute prejudicial abuse of discretion within the meaning of Sections 21168 and 21168.5, regardless of whether a different outcome would have resulted if the public agency had complied with those provisions." (§ 21005, subd. (a).) In other words, when an agency fails to proceed as required by CEQA, harmless error analysis is inapplicable. The failure to comply with the law subverts the purposes of CEQA if it omits material necessary to informed decisionmaking and informed public participation. Case law is clear that, in such cases, the error is prejudicial. (*Sierra Club v. State Bd. of Forestry* (1994) 7 Cal.4th 1215, 1236–1237[]; *Fall River Wild Trout Foundation v. County of Shasta* (1999) 70 Cal.App.4th 482, 491–493 []; *Kings County Farm Bureau v. City of Hanford* (1990) 221 Cal.App.3d 692, 712[]; *East Peninsula Ed. Council, Inc. v. Palos Verdes Peninsula Unified School Dist.* (1989) 210 Cal.App.3d 155, 174 []; *Rural Landowners Assn. v. City Council* (1983) 143 Cal.App.3d 1013, 1021–1023 [].)'" *County of Amador v. El Dorado County Water Agency* (1999) 76 Cal.App.4th 931, 946.

That is what occurred here to the legal prejudice of petitioners, mandating relief.

Failure to recirculate

Guidelines section 15088.5(a) mandates that a DEIR be recirculated when "significant new information is added...." Here, it is clear that the significant new information begins with the 2010 Census data, but it cannot stop there. It is also evident

---

[19] City's claim that the Framework mandated that SCAG estimates be used is without support for reasons discussed in the text, *ante*.

that that information must be given full consideration; this will in turn affect much of the analysis in key documents.

City's failure to incorporate and update the DEIR to reflect the significant different population statistics, and all that flows from them, necessarily means that the EIR is fatally flawed. As in *Mountain Lion Coalition v. Fish & Game Comsn.* (1988) 214 Cal.App.4th 1043, this DEIR is fundamentally inadequate, even with the Second Supplement, issued 5 days before City Council action — meaningful public review was thwarted by City's pyrrhic rush to final approvals. This hasty action constitutes an additional failure to proceed in the manner required by law, which is legally prejudicial.

GENERAL PLAN ISSUES

Contentions of Fix the City

Fix the City's opening brief sets the argument for this aspect of petitioners' contentions.[20] "California law and the Los Angeles City Charter require consistency between the policies set forth in the General Plan and land use ordinances adopted by the City," citing Government Code section 65300.5 and Los Angeles City Charter section 556.

This petitioner's principal contentions are that the HCPU is "fatally inconsistent" with the Framework because it fails to require policies that will ensure that the timing and location of development are consistent with City's ability to provide adequate infrastructure for additional development.

The findings made in support of the HCPU explain, correctly, that the Framework "establishes the standards, goals, policies, objectives, programs, terms, definitions, and direction to guide the update of citywide elements and the community plans."

Community plans, such as the HCPU, apply the elements of the Framework regarding growth and development in specific areas of the city, here of Hollywood. The

---

[20] La Mirada makes a similar contention. SaveHollywood.com, *et al.* do not address this issue.

Findings made for the HCPU discuss consistency with Framework Element Objective 3.3: "Accommodate projected population and employment growth within the City and each community plan and plan for the provision of adequate supporting transportation and utility infrastructure and public services."

The reasoning for the Finding was that the HCPU was consistent with Objective 3.3 because it includes a recommended pattern of land use that directs future growth to areas of Hollywood where new development can be supported by transportation infrastructure and different types of land uses can be intermingled to reduce the length and number of vehicle trips.

Fix the City places emphasis on this finding because "it focuses exclusively on transportation infrastructure and not [on] other types of infrastructure and pubic services that are required to support increased population or commercial development; the Finding therefore does not demonstrate consistency with Objective 3.3." Fix the City Opening Brief 29:2-5.

Fix the City further focuses on what it contends is City's ignoring significant policies included in the Framework that, it argues, are designed to enable City to meet Objective 3.3. "Most significantly, the City's findings ignore the policies designed to ensure a continual monitoring of population growth *and* the ability of infrastructure to support the pace of growth.... Specifically, the Framework Element requires the use of a monitoring program to assess the status of development activity and supporting infrastructure and public services and '[i]dentify existing or potential constrains or deficiencies of other infrastructure in meeting existing and projected demand." .... The [HCPU] is inconsistent with the Framework Element because it does not include any mechanism to ensure that the state of infrastructure will be assessed or to provide for controls for controls on development in the event that infrastructure is insufficient to support the level of development permitted by the [HCPU]..... The City's approach to the Framework Element is focused entirely on the aspects that encourage growth, with no attention to those policies that require period[ic] assessment of the capacity for

additional growth. Without inclusion of similar policies in the [HCPU], which is part of the Land Use Element of the General Plan, the City's General Plan is fatally inconsistent. The [HCPU], while permitting increased density and growth in key parts of Hollywood, fails to provide a mechanism to continually assess whether the infrastructure has the ability to support the increased development and therefore frustrates the policies in the Framework Element that are designed to ensure provision of adequate public services. The Framework Element permits only the appropriate amount of growth in light of the City's infrastructure; the [HCPU] omits the necessary mitigation measures to require controls on development where the infrastructure is threatened. (Emphasis in original.) Fix the City's Opening Memo. at 29-30.

Fix the City next contends that City Charter section 558 mandates a finding that any plan adopted by City will not have an adverse effect on the General Plan or any other plans. And, this petitioner contends that, although City adopted such a finding, the Findings do not demonstrate actual compliance with this requirement. The Findings rely on the concept of concentrating growth in particular sectors, near public transport such as the new metro system, and the protection of existing single-family neighborhoods from denser development. Yet, Fix the City argues, "[t]he Finding is notable for what it lacks: any substantive discussion of the potential [inter]-plan effects of the [HCPU]. Fix the City next poses the question: "How can the decision makers conclude that the [HCPU] will not have an adverse effect on other community plan areas without considering if the increased growth facilitated by the [HCPU] will harm other areas?" (Fix the City Opening Memo. at 30:16-18).

Fix the City concludes as follows: "Because this analysis [that of inter-plan/area impact] is not in the EIR or in the record before the Council, substantial evidence does not support this finding. Indeed, the record before the City showed that public services are stretched thin throughout the City. On this record, the City cannot find that the [HCPU] will not adversely affect other areas of the City; the finding must be overturned." (*Id.*, at 30:18-22.)

La Mirada's Contentions

La Mirada also contends that the HCPU is not consistent with the General Plan for the City of Los Angeles, but focuses on different aspects. This petitioner's view is that, while the Framework is "growth neutral," the HCPU is not. Instead, La Mirada argues first, that the HCPU is "growth inducing," and contends that the reason the 2005 SCAG population estimate was used was to lower the population increase for which planning was required in the HCPU to just over 24,000 -- rather than the more accurate number of 50,000 — that would need to be planned for for 2030.[21] Using the true population data results in a plan that is growth inducing according to La Mirada, which it argues "provides for a significant amount of excess capacity, a growth inducing effect." La Mirada's Opening Memo. at 23:3-23.

Second argues La Mirada, the objective of growth neutrality was dropped in the final EIR and HCPU. Thus it notes that the final version of the HCPU accommodates "more than double the natural amount of growth through 2030, dropp[ing] all pretense of growth neutrality, further showing an inconsistency with the ... Framework. [Par.] The result is an internally inconsistent General Plan. Is it growth accelerating and inducing, as provided for in the Land Use Element via the HCP, or is it growth accommodating and neutral, as required by the Framework.... Because of this inconsistency, the City cannot make the necessary findings required by Section 556." (La Mirada, Opening Memo. at 24:10-16).

City's Contentions

City advances several counter-arguments in defense of its actions.

On the key issue of whether the General Plan and Specific Plans must be consistent -- and how that requirement is achieved here -- City first acknowledges that a general plan must be "internally consistent and correlative" (City's Op. Memo. at 25:24-

---

[21] Whether that was the reason to use the higher baseline, or not, the result is the same — a substantial error in the population baseline and in all planning aspects that rely on it for other impacts.

27), and then points out that City has broad discretion to balance the many competing policies expressed in the general plan — and that balance "does not require equivalence, but rather a weighing of pros and cons to achieve an acceptable mix" (citing *Friends of Lagoon Valley v. City of Vacaville* [2007] 154 Cal.App.4th 807, 822 [quotations and citations omitted]). After noting the many factors and interests described in the findings made in this case, City notes the role of a court reviewing such arguments: "A reviewing court's role is simply to decide whether the city officials considered the applicable policies and the extent to which the proposed project conforms with those policies. (*Id.*, at 816 [internal citations omitted]).

Specifically in response to Fix the City's contentions,[22] City argues that there was no need to make a specific finding that the HCPU was consistent with Framework Objective Element 3.3. (City's Op. Memo. at 27:14-22). City's argument is that the HCPU is an amendment to a previous plan, the Hollywood Community Plan, which is itself a part of the General Plan, and that the adoption or amendment of a general plan is a legislative act -- and, pursuant to state law, "a city need not make explicit findings to support its action." *South Orange County Wastewater Auth. v. City of Dana Point* (2011) 196 Cal.App.4th 1604, 1619.

Further, City argues that General Plan amendments are governed by Charter Section 555 rather than section 556, which does not require any specific findings. And, to the extent that Section 556 applies, the findings it requires only need to show "'that the action is in substantial conformance with the purposes, intent and provisions of the General Plan; it does not require a separate specific finding of consistency for each of the thousands of policies and objectives contained in the General Plan.... The City's 16 pages of General Plan consistency findings would easily satisfy any requirements Section 556 would impose, if applied to the HCPU." (City's Op. Memo. at 27:28-28:7)

---

[22] City's collateral estoppel arguments as to Fix the City were discussed and found invalid, *ante*.

Applicable Law

1. Consistency

"'[T]he propriety of virtually any local decision affecting land use and development depends upon consistency with the applicable general plan and its elements.' (*Citizens of Goleta Valley v. Board of Supervisors* [1990] 52 Cal.3d 553, 570, 276 Cal.Rptr. 410, 801 P.2d 1161.) 'The consistency doctrine has been described as 'the linchpin of California's land use and development laws; it is the principle which infuse[s] the concept of planned growth with the force of law.' *Corona – Norco Unified School Dist. v. City of Corona* (1993) 17 Cal.App.4th 985, 994, 21 Cal.Rptr.2d 803.) 'A project is consistent with the general plan ' "if, considering all its aspects, it will further the objectives and policies of the general plan and not obstruct their attainment." ' " "A given project need not be in perfect conformity with each and every general plan policy. [Citation.] To be consistent, a subdivision development must be 'compatible with' the objectives, policies, general land uses and programs specified in the general plan.'" *Families Unafraid to Uphold Rural etc. County v. Board of Supervisors* (1998) 62 Cal.App.4th 1332, 1336 [emphasis added.].

"The general plan and its parts must be "an integrated, internally consistent and compatible statement of policies for the adopting agency." (Govt.C. 65300.5; see *Karlson v. Camarillo* (1980) 100 C.A.3d 789, 161 C.R. 260; *deBottari v. Norco* (1985) 171 C.A.3d 1204, 1210, 217 C.R. 790, infra, §1029 [referendum inconsistent with general plan is invalid]; *Families Unafraid to Uphold Rural El Dorado County v. Board of Supervisors of El Dorado* (1998) 62 C.A.4th 1332, 1336, 1341, 74 C.R.2d 1 [although given project need not be in perfect conformity with each and every general plan policy, it must be compatible with objectives, policies, general land uses, and programs specified in general plan; some general plans are more specific than others, leaving less room for discretion].)

"If a general plan is to fulfill its function as a 'constitution' guiding 'an effective planning process,' a general plan must be reasonably consistent and integrated on its

face. A document that, on its face, displays substantial contradictions and inconsistencies cannot serve as an effective plan because those subject to the plan cannot tell what it says should happen or not happen. When the court rules a facially inconsistent plan unlawful and requires a local agency to adopt a consistent plan, the court is not evaluating the merits of the plan; rather, the court is simply directing the local agency to state with reasonable clarity what its plan is." *Concerned Citizens of Calaveras County v. Board of Supervisors* (1985) 166 Cal.App.3d 90, 97.

The court in *Garat v. Riverside* (1991) 2 Cal.App.4th 259, *overruled on other grounds in Morehart v. County of Santa Barbara* (1994) 7 Cal.4th 725, 743, fn. 11 (discussed on this point in *Napa Citizens for Honest Government v. Napa County Bd. of Supervisors* (2001) 91 Cal.App.4th 342, 388 [*Napa Citizens*], confirmed the application of the consistency requirement to charter cities such as Los Angeles, explaining that under Govt. Code sec. 65700(a), a charter city's general plan must contain the mandatory elements required by Govt. Code sections 65300 et seq. and section 65700, which construed together require not only that a charter city's general plan have the mandatory elements of Govt.Code sec. 65302, but also that these elements be internally consistent as required by Govt. Code sec. 65300.5. *Id.*, at 285, 287. *See Irvine v. Irvine Citizens Against Overdevelopment* (1994) 25 Cal.App.4th 868, 875, 876, 879 [Govt.C. 65860(a) prohibition of inconsistent zoning ordinances applied to charter city that had enacted ordinance requiring zoning and general plan consistency; hence, proposed referendum inconsistent with general plan was properly declared invalid]. As colorfully explained in *Napa Citizens, supra*, a "zoning ordinance that is inconsistent with the general plan is invalid when passed [citations] and one that was originally consistent but has become inconsistent must be brought into conformity with the general plan. [Citation.] The Planning and Zoning Law does not contemplate that general plans will be amended to conform to zoning ordinances. The tail does not wag the dog. The general plan is the charter to which the ordinance must conform." *Id.*, at p. 389.

2. Standard for review of general plan/specific plan consistency issues

General plan consistency issues such as those presented by these parties are reviewed under a particularly deferential standard. While a city has broad discretion to weigh and balance competing interests in formulating development policies (*Federation II, supra,* at p. 1196), a charter city's[23] general plan must be internally consistent.

The case upon which City relies sets out the standard to be applied here: "The adoption or amendment of a general plan is a legislative act. [Citation.] A legislative act is presumed valid, and a city need not make explicit findings to support its action. [Citations.] A court cannot inquire into the wisdom of a legislative act or review the merits of a local government's policy decisions. [Citation.] Judicial review of a legislative act under Code of Civil Procedure section 1985[24] is limited to determining whether the public agency's action was arbitrary, capricious, entirely without evidentiary support, or procedurally unfair. [Citations.] A court therefore cannot disturb a general plan based on violation of the internal consistency and correlation requirements unless, based on the evidence before the city council, a reasonable person could not conclude that the plan is internally consistent or correlative. [Citation.]" (*Federation of Hillside & Canyon Assns. v. City of Los Angeles* (2004) 126 Cal.App.4th 1180, 1195, 24 Cal.Rptr.3d 543.) SOCWA has the burden of proof to demonstrate that the amendment to the general plan rendered the plan internally inconsistent. (See *Garat v. City of Riverside* (1991) 2 Cal.App.4th 259, 293, 3 Cal.Rptr.2d 504, disapproved on other grounds in *Morehart v. County of Santa Barbara* (1994) 7 Cal.4th 725, 29 Cal.Rptr.2d 804, 872 P.2d 143.)." *South Orange County Wastewater Authority v. City of Dana Point* (2011) 196 Cal.App.4th 1604, 1618-1619 [*South Orange County*].

On the other hand, it is also true that direct conflict is not the litmus test for general plan consistency. All three petitioners cite *Napa Citizens*, a leading case on this

---

[23] There is no dispute about Los Angeles' status as a charter city.

[24] Clearly a typographical error in the opinion; the citation should be to section 1085.

issue. And, City does not either rely on or seek to distinguish the holding of *Napa Citizens* when discussing the consistency arguments made by petitioners.

In *Napa Citizens*, the court of appeal specifically addresses the consistency issue in a way that the court in *South Orange County* does not. The *Napa Citizens* court explains:

> "We are of the opinion that the consistency doctrine requires more than that the Updated Specific Plan recite goals and policies that are consistent with those set forth in the County's General Plan. We also are of the opinion that cases such as *FUTURE v. Board of Supervisors, supra,* 62 Cal.App.4th 1332, do not require an outright conflict between provisions before they can be found to be inconsistent. The proper question is whether development of the Project Area under the Updated Specific Plan is compatible with and will not frustrate the General Plan's goals and policies. If the Updated Specific Plan will frustrate the General Plan's goals and policies, it is inconsistent with the County's General Plan unless it also includes definite affirmative commitments to mitigate the adverse effect or effects." *Id.,* at 379.

By contrast with *Napa Citizens*, the facts and procedural setting discussed in *South Orange County* lead to the conclusion that it is of limited value; indeed it is readily distinguishable from the present case. There, the issue of consistency with the general plan was not presented to the trial court; and the question of conflict was far more limited -- there, only whether a single zoning change was appropriate in the context of that general plan — rather than the massive, multi-faceted set of issues addressed in the HCPU. Further, the court of appeals there noted that no change could occur without further action, including review by the Coastal Commission. *Id.*, at 1609.

Analysis

Applying these principles to the present case, City's opening argument in its opposition, that it was not required to make findings in support of the HCPU, although

literally true, nevertheless lacks merit.[25]

While Charter section 555 contains no requirement that findings be made, this does not obviate the need for consistency. The consistency doctrine is, as noted, "the linchpin of California's land use and development laws." *E.g.*, *Families Unafraid, etc. v. County Board of Supervisors, supra*, 62 Cal.App.4th at 1336.

Fix the City points to what it contends is a fundamental inconsistency between the Framework and the HCPU, *viz.*, City's failure to address the absence from the HCPU of "policies that require monitoring of infrastructure to determine whether the growth permitted in the Plan Update should continue at a given time. The City's Revised Findings reveal how the Plan Update twists the monitoring requirements in Framework Policy 3.3.2 (the infrastructure monitoring policy)..... The City's position is that the Plan Update sufficiently addressed the infrastructure capacity of the area such that *no further monitoring is required during implemental of the Plan Update. This hands-off policy is completely contrary to the Framework Element's objective of continuous monitoring of development activity.* By asserting that the Plan Update conclusively establishes the ability of the infrastructure to absorb the level of development planned, the City thwarts the Framework Element's policy of limiting development when capacity becomes threatened. The failure to include a monitoring requirement makes the Plan Update inconsistent with the Framework Element." Fix the City's Reply at 24:8-26 [first emphasis in original; second emphasis added].

La Mirada's reply to City's arguments is multi-faceted.

(1) City's reliance on SCAG estimates is faulty and there is no substantial evidence to support the validity of that 2005 SCAG estimate;

(2) there is internal inconsistency with the Framework's focus on "growth neutrality" as the true data reveal that the HCPU is in actuality a plan to more than

---

[25] It also is inconsistent as City concedes it was required to make findings in support of the zoning changes called for by the HCPU, which it did.

double the population in Hollywood;

(3) City's plan to focus growth close to transit stations elevates one policy over others, creating an inconsistency; and

(4) the 16 pages of findings used by City to justify its actions start from a false premise — the misleading population data used by City which is "less than half what the [HCPU actually] provides..... Accordingly, there is no evidence on which to base the findings, and abuse of discretion is established. Code of Civil Proced. Sec. 1094.5(b)." (La Mirada Reply 17:26-18:3.)[26]

City's reliance on the holding of *Napa Citizens, supra,* that "a governing body's conclusion that a particular project is consistent with the relevant general plan carries a strong presumption of regularity that can be overcome only by a showing of an abuse of discretion" (id., at 357) is correct (City's Opposition Memo. at 8:15-19) — but on these facts, circumstances and record — not sufficient. Petitioners' arguments on lack of consistency, particularly those of Fix the City, on balance, overcome the presumption of regularity and explain why adoption of the HCPU on this record constituted an abuse of discretion.

The Court also concludes that the actions of City do constitute an abuse of discretion. Fix the City, in particular, cogently sets forth the reasons (summarized above). The fundamental inconsistency between the Framework and the HCPU on the failure of the HCPU monitoring policy is completely contrary to the Framework's essential component of continuous monitoring of development activity. There is a void in an essential aspect of the HCPU where instead there should be a discussion of the inter-plan/area impacts created by the HCPU. And, to the extent City relies on the

---

[26] Citation of this statute is inapposite; perhaps an inadvertence comparable to the typographical error noted in footnote 24, *ante*. General Plan adoption issues are legislative acts reviewed by ordinary mandamus under Code of Civil Procedure section 1085. Govt. Code section 65301.5; *Yost v. Thomas* (1984) 36 Cal.3d 561, 570-571; *Federation II, supra*, at 1195; see, generally, Miller & Starr, Calif. Real Estate Law, 3rd Ed. Ch. 25:9 at p. 25-39 and fn. 32.

entirely discredited SCAG 2005 population estimate (with the substantial impact that has on many facets of the HCPU), there is a fatal inconsistency between the HCPU and the General Plan.

The HCPU cannot survive in its present form and substance in the face of these very substantial inconsistencies. The HCPU is fatally flawed as a planning document as it presently stands.

City's Contentions Regarding the Tentative Decision

City filed two sets of comments concerning the Tentative Decision, to which the other parties responded. City's citation of *Neighbors for Smart Rail v. Exposition Metro Line Construction Authority* (2013) 57 Cal.4th 439 is inapposite as this Court has concluded that, in the particular circumstances of the present case, reliance on the erroneous baseline was in fact prejudicial. Also, inapposite is City's contention regarding newly enacted Government Code section 65755(c).

To be clear, this Court has not ruled on Fix the City's challenge to the use of the Transportation Improvement and Mitigation Program (TIMP) as this Court finds that the overall impact analysis to be factually flawed and legally inadequate.

CONCLUSION[27]

For the reasons stated, petitioners are entitled to relief as follows:

(1) to a peremptory writ of mandate ordering respondents and defendants City and City Council to (a) rescind, vacate and set aside all actions approving the HCPU and certifying the EIR adopted in connection therewith and all related approvals issued in furtherance of the HCPU, including but not limited to the text and maps associated with the HCPU, the Resolution amending the Hollywood Community Plan, the adoption of

---

[27] The relief set out below is the full relief to be awarded in the three cases. Any argument made and not addresses is deemed rejected.

rezoning actions taken to reflect zoning changes contained in the HCPU, all amendments to the General Plan Transportation and Framework Elements made to reflect changes in the HCPU, adopting the Statement of Overriding Considerations, adopting the Mitigation and Monitoring Program, and adopting Findings in support of the foregoing; provided, however, that the phrase "all related approvals" refers only to those quasi-legislative actions necessary to carry out the HCPU and the related CEQA documents, and provided further, that the provisions hereof are not intended to order that respondents rescind those adjudicatory approvals not challenged which City may have made under the HCPU after its adoption by City; and (b) should City exercise its discretion to amend the HCP, City is to do so in a manner that conforms to the policies and objectives of the General Plan and the requirements of CEQA;

(2) to an injunction that respondents and defendants City and City Council, their officers, employees, agents, boards, commissions and other subdivisions shall not grant any authority, permits or entitlements which derive from the HCPU or its EIR until an adequate and valid EIR is prepared, circulated and certified as complete and is consistent with CEQA, CEQA Guidelines, and all other applicable laws, and until legally adequate findings of consistence are made as required pursuant to the Charter of the City of Los Angeles and other applicable laws;

(3) attorneys fees and costs as may hereafter be determined.

ALLAN J. GOODMAN
JUDGE

DATED: January 15, 2014

ALLAN J. GOODMAN
JUDGE OF THE SUPERIOR COURT

MTI Report 01-12

A New Planning Template for Transit-Oriented Development

Dick Nelson
John Niles
Aharon Hibshoosh

September 2001

a publication of the
Mineta Transportation Institute
College of Business
San José State University
San Jose, CA 95192-0219

Created by Congress in 1991

Technical Report Documentation Page

1. Report No. FHWA/CA/RM-2000/06	2. Government Accession No.	3. Recipients Catalog No.
4. Title and Subtitle A New Planning Template for Transit-Oriented Development		5. Report Date September 2001 6. Performing Organization Code
7. Authors Dick Nelson, John Niles, Aharon Hibshoosh		8. Performing Organization Report No. 01-12
9. Performing Organization Name and Address Norman Y. Mineta International Institute for Surface Transportation Policy Studies College of Business, San José State University San Jose, CA 95192-0219		10. Work Unit No. 11. Contract or Grant No. 65W136
12. Sponsoring Agency Name and Address U.S. Department of Transportation Research and Special Programs Administration 400 7th Street, SW Washington, D.C. 20590-0001	California Department of Transportation Office of Research MS42 P.O. Box 942873 Sacramento, CA 94273-0001	13. Type of Report and Period Covered Final Report 14. Sponsoring Agency Code

15. Supplementary Notes

This research project was financially sponsored by the U.S. Department of Transportation's Research and Special Programs Administration (U.S. DOT RSPA) and by the California Department of Transportation (Caltrans)

16. Abstract: The Mineta Transportation Institute (MTI) at San José State University assigned a project team to design a planning template for transit-oriented development (TOD) that incorporates an understanding of nonwork travel, that is, trips for shopping, eating out, and engaging in recreational and cultural activities. Nonwork trips are growing in signifigance and now account for four of every five trips. At the same time, TOD has become a popular planning response to the impacts of metropolitan growth. Some planners believe that TOD will induce more pedestrian and transit trips and will reduce the average length and frequency of household auto travel. This effect is assumed to result from improved accessibility to employment and nonwork venues located in compact, mixed-use centers. Planning professionals in many MPOs also suggest that if multiple centers are linked by high quality transit, such as light or heavy rail, access is enabled to the broad range of nonwork activities.

The project arrived at these essential findings: (1) Venues for nonwork activities are very numerous and geographically dispersed. (2) The spatial environment for nonwork activities is the result of growing prosperity, technical innovation, and a dynamic, competitive marketplace. (3) The consumer marketplace will provide many more places to go than mass transit can cost-effectively serve. (4) Current metropolitan planning methods and modeling tools focus on the work trip and do not adequately account for the complexity of nonwork trips and their linkage to work trips.

These findings support the need for a new regional planning process to complement current methods. One recommended approach is that metropolitan communities establish a Nonwork Travel Improvement Planning Process using a multidisciplinary expert advisory group interacting with a core, Internet-enabled, professional transportation planning staff. An iterative interaction across varied but relevant skill sets could be achieved through a Backcasting Delphi process. The focus of the interaction would be on understanding the ramifications of consumer and retail industry behavior for TOD and other new transportation strategies, and then assessing the available strategies for cost-effectiveness in reducing the impacts of growth and automobility in a complex and uncertain metropolitan market.

17. Key Words nonwork travel, regional urban planning, TOD, transit-oriented development	18. Distribution Statement No restrictions. This document is available to the public through the National Technical Information Service, Springfield, VA 22161		
19. Security Classif. (of this report) Unclassified	20. Security Classifi (of this page) Unclassified	21. No. of Pages 128	22. Price $15.00

Form DOT F 1700.7 (8-72)

Library of Congress No. 2001095678

To order this publication, please contact the following:

Mineta Transportation Institute
College of Business, BT550
San José State University
San Jose, CA 95192-0219
Tel (408) 924-7560
Fax (408) 924-7565
E-mail: mti@mti.sjsu.edu
http://transweb.sjsu.edu

ACKNOWLEDGEMENTS

The Mineta Transportation Institute Project Team for this study consisted of Principal Investigator Dick Nelson and John Niles. Research Associate Professor Aharon Hibshoosh provided valuable input on all working papers and an earlier draft of this report, and his contribution is especially appreciated. Student Assistant Rhys Rowland also contributed to this project by providing important assistance with the maps.

This document has been significantly improved because of constructive feedback received on earlier drafts from Jerry Schneider, Gary Lawrence, Scott Rutherford, Kenneth Dueker, Douglas Porter, Douglas Lee, Ed Mierzejewski, Richard Morrill, Susan Handy, Ed Risse and Richard Wilson.

The Project Team thanks the staff of the Puget Sound Regional Council for critical data files that were used to prepare maps and tables.

The report authors integrated data from many sources and made numerous critical interpretations, and any opinions expressed are solely those of the authors.

The U.S. Department of Transportation's Research and Special Programs Administration and Caltrans funded this project through the Mineta Transportation Institute. Thank you to the Mineta Transportation Institute staff, especially Research Director Trixie Johnson for her guidance, and to former Communications Manager Jeanne Dittman, Research and Publications Assistant Sonya Cardenas, Graphic Designer Ben Corrales, Student Editorial Assistant Robyn Whitlock and Editorial Associate Susan Sylvia for their editing and publishing assistance.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

EXECUTIVE SUMMARY

PROJECT OVERVIEW

The purpose of this project is to improve the planning methodology for Transit-Oriented Development (TOD) by bringing into sharp focus the dynamics of the retail marketplace and nonwork travel demand. TOD involves increasing the density of housing, offices, stores, and services around mass transit stations in an urban region, and making pedestrian access very easy, in order to encourage more use of transit and a reduction in automobile driving. TOD is intended to influence both travel to work (commuting and business travel), as well as all of the other reasons for local travel (so-called nonwork trips, including shopping and leisure travel). Specifically, the project has sought to:

- Analyze nonwork travel demand as influenced by retail market dynamics on a national and regional level.
- Review the state-of-the-art in regional transportation planning by Metropolitan Planning Organizations (MPOs) with respect to nonwork travel.
- Create a planning template for regional transportation and land use planners who are pursuing TOD that encompasses nonwork travel.

The central Puget Sound region of Washington State (four counties making up the Seattle-Tacoma-Bremerton-Everett metropolitan area) was used as a case study for the development of the template. The nonwork travel environment of the region was mapped and analyzed, and the findings generalized to other large metro regions. Of particular interest were the myriad “retail” activities from which consumers choose their shopping and recreational destinations. As a group, these activities generate more than half of all person trips: shopping for goods and services, eating out, entertainment, recreation, culture, and other leisure pursuits.

A basic planning template was designed that generates three new kinds of data: specification of the major nonwork venues that generate travel demand and that should therefore be mapped and spatially analyzed, listing of the forces shaping urban form that need to be monitored and understood for travel generation and land-use implications, and the identification of the factors that will determine the regional (not just station-area) success of TOD in stimulating a shift from driving to mass transit patronage.

The framework for measuring the success of TOD that we use throughout this project is comparing public costs to public benefits. According to this cost-benefit framework, a necessary part of the regional planning process is comparing the estimated future benefits from TOD to the benefits from alternative investments. The most critical regional public benefits come from the expected market share shift from automobile to public transit: increased transit ridership, reduced average travel times and vehicle congestion, and measurable environmental gains such as improvement in air quality. In order for a TOD plan to be judged as successful in our framework, the plan's level of expected future benefits must be commensurate with the level of capital investments made to implement TOD. Those investments include new transit facilities and the financial incentives and other public costs incurred to shape private real estate development toward the more compact and mixed land use forms required to make TOD successful.

NONWORK TRAVEL: IMPLICATIONS FOR TRANSIT-ORIENTED DEVELOPMENT

Travel to nonwork activities has grown steadily over the last three decades in the United States. It now accounts for about three-fourths of all household vehicle trips and four of every five person trips. Nonwork is the major travel purpose even in weekday peak periods, both morning and afternoon. As people strive to make efficient use of valuable time, nonwork trips are increasingly linked into trip chains or tours involving several stops. This is true for travel to and from work as well as for travel to purely nonwork activities. More than half of all trips from work to home involve a stop to shop, pick up a family member, or conduct personal business.

The observed growth of nonwork travel is directly related to the relentless progression of changes that have occurred in the retail and consumer services marketplace. Technological innovation, combined with increasing wealth, has produced a greater variety of business opportunities and consumer choices.

Nonwork travel, because of its magnitude, has important implications for transportation and land use policy, particularly transit-oriented development. TOD is a policy response to the impacts of metropolitan growth and its effects, including traffic congestion and travel-related environmental impacts, and to the concern that growth patterns threaten the livability of American communities.

As TOD has been implemented, it has come to mean compact, mixed-use centers made up of residential units, offices, and stores, supported by and, in turn, supporting new rail transit investments. Pedestrian movement is emphasized, and parking is limited. The number of metro areas, large and

small, that have embraced this approach to managing growth has increased over the last two decades to the point that it can be said that rail-TOD is one of the most important urban planning paradigms in the United States. Federal policies, especially the land-use criteria that must be met to qualify for "new starts" fixed-guideway transit funding, encourage TOD.

These efforts are motivated by the belief that TOD will induce more pedestrian and transit trips and will reduce both the average length and frequency of household auto travel. This is assumed to result from improved accessibility to work locations and to better proximity to nonwork venues. Further, it is suggested that if multiple centers are linked by high quality transit, access is enabled to a broad range of nonwork activities across a metropolitan region.

SUMMARY OF FINDINGS

The research arrived at a number of key findings that support the initial project premise of a need for a new regional planning process to complement current methods.

- Although support for transit-oriented development is based, in large part, on the assumption that when venues for nonwork activities are located at TOD station areas more people will use transit, there has not been a careful analysis of the actual spatial environment for nonwork activity and the travel patterns it engenders.
- The consumer marketplace for goods, services, eating out, and leisure activities in a metropolitan region is exceedingly large, varied and geographically dispersed. For example, a map prepared by the authors (Figure 3-4) indicates the locations of approximately 1900 major nonwork destinations in the Puget Sound region, overlaid on the 21 urban centers around which TOD will be emphasized.
- The number and location of, and the spatial relationships for, the myriad nonwork venues is the result of growing prosperity, technological innovation, and a highly adaptive entrepreneurial market that seeks to satisfy consumer needs and wants.
- Nonwork activities, which now account for approximately two-thirds of all personal travel, will continue to grow in variety as wealth and prosperity spread, and as the nation becomes more ethnically diverse.
- Since the consumer marketplace for goods and services will inevitably provide many more places to go than mass transit can effectively serve, the success of TOD as measured by less automobility cannot be taken for

granted.

- Even the choice of mode for the work trip is determined in large measure by nonwork activities, as people make stops during the commute to shop, drop off and pick up family members, and conduct personal business.
- For the purpose of gauging the success of TOD, it is important to distinguish between local (station-area) benefits and costs, and corridor or regional benefits and costs.
- Academic research to date suggests that neotraditional forms of development in a station area, such as grid street patterns and compact, mixed-use centers, alone will not have a significant impact on personal travel patterns.
- A benefit-cost ratio for the TOD paradigm that is superior to other investments that increase transit market share may not be an *a priori* possibility in every metropolitan region. Regions differ greatly from each other in their existing land use pattern, travel pattern, transit corridor availability, topography, political culture, and governmental structure. One size does not fit all.
- Metro regions may discover greater net public benefits by exploring a wider range of paradigms that encompass other strategies for dealing with the large growth in automobility associated with nonwork activities.
- The current metropolitan planning process is focused on the work trip and produces a limited set of strategies that do not bracket the range of possible cost-effective alternatives that are needed to address the variety and volume of nonwork travel.
- If a broader search for cost-effective alternatives is to be carried out, a new complementary planning process is required, one that involves a much wider and deeper knowledge base and range of expertise than is typically included in the current process.
- Unlike the current process, the new planning process must be able to account for the inherent complexity of human behavior and associated land use and travel patterns, and it must address the large uncertainty attached to the prediction of future patterns and the impact of government actions on these patterns.

RECOMMENDATIONS

In response to these findings, we recommend:

- Development and testing, in a few metro areas, of an explicit augmentation

to the metropolitan planning process that responds to complexity and uncertainty, and that deals with nonwork travel in the context of transit-oriented development.

- In response to the realities of and reasons for consumer behavior and retail industry practices as seen now and as predicted for the future, the new process should strive to specify ways that TOD can be strengthened so that consumers more often use mass transit and walking to shop and recreate. This specification would describe how and to what extent the market economy can be influenced to support TOD land use patterns.
- If, on the other hand, the recommended augmentation to the process reveals that transit investments and government policies cannot realign the market to yield a larger transit market share in the urban travel market, then the planning process should direct attention to the specification of paradigms other than TOD.

A Backcasting Delphi process, previously used to predict the efficacy of transportation and land use strategies outside the US, can be a useful supplement to the current method. It is expected that each metro region that uses the process will elaborate on the basic template to meet their specific circumstances and needs. The process would have the following key characteristics and elements:

- Defining the problem in terms of desirable behavior change to be achieved as measured by actual improvements in transportation system performance and environmental externalities, as opposed to simply providing options for behavior change.
- Focusing on choice of mode for travel to nonwork activity.
- Creating a knowledge-based understanding of nonwork activity and travel trends in the region, including new trends that are difficult to quantify but that may affect future travel and land use patterns.
- Designing the process to be carried out either by the MPO as an augmentation to existing procedures, or else by a civic organization acting in parallel to complement the existing MPO process.
- Recruiting and using multidisciplinary professionals in a structured, interactive process in which they share ideas and learn from each other and educate the regional leadership and populace.
- Employing an iterative process (Backcasting Delphi) of designing feasible transportation investments and strategies with costs and risks that are justified by the likely transportation performance to be achieved.

Although the focus of the research leading to the above recommendations was on nonwork travel, we suggest that the supplementary planning process examine the growing geographic dispersion of employment sites, the diverse requirements of journeys to work and work-related travel, and the increasing linkage of work and nonwork trips in complex trip chains. In other words, all trip types in a metropolitan area should be covered in the planning process we have sketched in this report. The planning template would be useful whether or not the metro region has embarked, or plans to embark, on TOD.

The U.S. DOT should support the refinement and testing of the new planning tool through its grant process, just as it now supports conventional regional planning.

Several actions should be taken to provide empirical data and other information in support of TOD planning, whether or not it is undertaken with the recommended planning process**.**

- Federal and local government consumer surveys should be structured to shed more light on the reasons people choose to live in a TOD. This would help in understanding whether TOD attracts people other than current transit users.
- Similarly, surveys should identify the locations for nonwork stops on the commute trip to assist in understanding the malleability of these locations, i.e., can they be induced to relocate to station areas?
- Studies should be undertaken of how well older neighborhood commercial areas and central business districts have adapted to the changes that have occurred in the larger retail marketplace.
- Research should be conducted to identify and catalog existing and emerging retail goods and services business strategies that have demonstrated synergy with the public policy requirements (for example, floor space and parking limitations) of locating facilities within transit-oriented developments.
- Other nonwork, nonretail activities may involve personal choices that result in trips outside the household's immediate neighborhood even though there are closer opportunities. The travel patterns associated with these activities, such as visits to the family doctor, and trips to school and church, should be investigated.

PROJECT REPORTS

During the course of the project, the authors produced five documents that are referenced in this final report. These documents, summarized below, are available for access and review at http://www.globaltelematics.com/mineta/

Report One, The Growing Importance of Nonwork Travel: The first report summarizes national trends for nonwork activities and travel patterns. Growth of nonwork travel is related to the changes that have occurred in the retail and consumer services marketplace, particularly in shopping for goods and services, eating out, and engaging in leisure activities. The travel impacts of these activities estimated by aggregating four of the trip purposes in the Nationwide Personal Transportation Survey (NPTS): shopping, eating out, recreation, and other kinds of personal business. In the NPTS of 1995, these four categories encompass 54 percent of person trips. Report One also assesses the state of the art in the modeling of future nonwork travel behavior.

Report Two, Preliminary Template Design: In the second report, the TOD paradigm and the impetus for its widespread adoption is described. The report reviews the limited experience of TOD's effect on travel and land use patterns, and it summarizes the growing critique of TOD's benefits compared to its costs as measured by changes in regional transportation systems performance and development patterns.

A new Nonwork Travel Improvement Planning Process (NWTIPP) is proposed that would provide additional guidance to metropolitan decision makers beyond the traditional transportation planning protocol that focuses on journey-to-work and four-step demand modeling. The NWTIPP centers on aggregating diverse expert opinion, and is intended to cope realistically with considerable complexity in the present and with much uncertainty about the future.

Report Three, Prototype Nonwork Database: The third report presents an example database of maps, tables, and commentary that would serve as a key input to the Nonwork Travel Improvement Planning Process sketched in the previous report. The central feature of this database (covering for purposes of illustration, the Seattle metropolitan region in western Washington State) is a series of maps that illustrate key elements of the retail and consumer services environment that generate nonwork travel. Other parts of the database include information on residential and employment conditions, transportation system performance, land use planning status, current planning tools now used in the region, and a summary of exogenous forces potentially shaping activities, land use, and travel.

Report Four, Revised Template Design: This document revises the template in Report Three based on a more thorough review of the literature for the Backcasting Delphi procedure and recent research on transit-oriented development, and the completion of the prototype nonwork database assembled in Report Three.

Report Five, Final Template Design: The fifth report sets out the final template design that was arrived at after submitting the revised design to a peer review of transportation and land use planners.

CHAPTER ONE

TRANSIT-ORIENTED DEVELOPMENT: A POPULAR PLANNING PARADIGM

INTRODUCTION

Low-density, separated-use development has become the predominant land use form across much of urban America in the post-World War II period. This form's connection to the large growth in personal and commercial travel in the same time span is well recognized, if not fully understood. Concerns over the impact of land use and personal transportation on the human and natural environment have been voiced in rising and falling crescendos over the last fifty years. Recently, interest has risen anew in response to the continuing growth and spread of urban development, ever higher rates of personal travel, and to the linkage between increasing travel and the greenhouse gases responsible for the suspected warming of the earth's atmosphere.

Public concern over growing congestion is the most tangible manifestation of problems linked to current urban form. In reaction, the federal government, states, local jurisdictions, metropolitan planning organizations, and transit agencies have adopted policies and strategies directed at reshaping development into more compact, mixed-use patterns. These efforts have been encouraged by numerous non-governmental organizations and individuals who view our current land use patterns as both environmentally and socially damaging.

One policy that has gained wide acceptance is transit-oriented development. TOD has, over the last decade, become a leading urban planning paradigm in the United States. Proponents of TOD envision dense, mixed-use activity centers connected by high quality transit systems. Metropolitan planning organizations, local governments, and public transit agencies have launched major efforts to direct growth to existing centers, infill sites, and new suburban communities, and in some cases to constrain growth from leap frogging and spilling into adjacent jurisdictions. These efforts are motivated by the belief that new urban forms, which in some ways replicate older forms, will produce significant transportation benefits. Planners assume that TOD will induce more pedestrian and transit trips, and reduce both the average length and frequency of household auto travel.

THE CONCEPT

Figure 1-1 depicts TOD's hypothetical spatial environment. Calthorpe (1993) provides a detailed delineation of the TOD concept. He defines a TOD as a center with a mix of high-density residential, retail, office, public, and open space uses. Retail shops and services are in a commercial core within an easy walk of homes (600 meters or about ten minutes). A transit station is at the center of the core. Uses in the core are "vertically integrated"—apartments and offices rise above ground-floor stores.

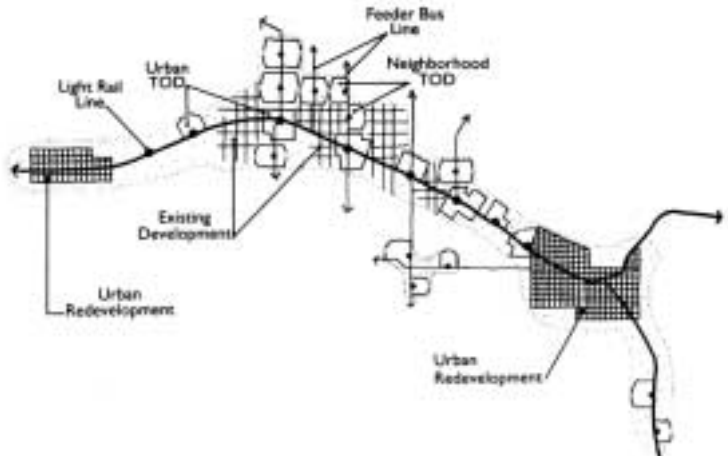


Figure 1-1. Schematic of the Transit-Oriented Development (TOD) Planning Concept (Calthorpe 1993)

Secondary areas for lower intensity uses surround the core to a distance of 1,600 meters. These areas might be locations for single-family housing in a range of sizes, small parks, schools, and light industry. Housing design emphasizes "neo-traditional" features: front porches, shallow setbacks from the street, and alley access to off-street parking. Streets largely conform to a grid pattern and provide direct walking and biking access to the core.

Calthorpe explains that the number and mix of commercial establishments in each TOD would vary depending on the size, location, and overall function of each center, whether servicing nearby residents or an entire community.

Linkage of Centers

Proponents of TOD acknowledge that in order for significant numbers of people to be persuaded to switch from driving their cars to riding transit, centers must be linked by a high quality regional transit system. The centers and the transit linkages between them must be sufficiently numerous and dense to form a "transit metropolis" (Bernick & Cervero 1996). This kind of

metropolis would cause significant numbers of people to switch from using automobiles to riding transit because both their homes and their work locations would be well-served by transit stations. Aside from support of commuting to work, the regional transit linkages of a transit metropolis would also enable access to a range of goods, services, and recreation unavailable in a community center.

Types of Centers

Calthorpe distinguishes two types of TODs—urban and neighborhood—depending on their articulation with the transit system and the intensity of their development.

- Urban TODs are located at stations on a trunk line of the regional system, which could be light rail, heavy rail, or express bus. Their locations are determined by station spacing and are typically 0.8 to 1.6 kilometers apart. Urban TODs have high commercial intensities, employment clusters, and moderate to high residential densities. If urban TODs are located in established neighborhoods, Calthorpe recommends that they be developed at the mix of uses and densities allowed or required under current planning rules.
- Neighborhood TODs are located on a local or feeder bus line within three miles (no more than ten minutes) of a trunk line transit station. They are developed at moderate residential densities and provide for retail, service, entertainment, recreation, and civic uses. Neighborhood TODs can be closely spaced to form a “corridor” of activity nodes.

Proximity of Competing Retail

Since a TOD depends, in part, on retail uses to attract pedestrians and transit riders, nearby auto-oriented retail centers can compete with and diminish its utility. For this reason, Calthorpe (1993, p.82) proposes that new competing retail uses should be strictly limited within one mile of the core commercial area through zoning amendments within the TOD market area.

A RISING NATIONAL PARADIGM

So numerous are the metropolitan planning organizations across the United States that have embraced transit-oriented development (TOD), that it would not be inaccurate to describe it as the key national transportation-land use planning paradigm. Its genesis goes back at least to the rail systems built just after WW II. Porter (1997, 1998) recently reviewed the status of station-area development for North American urban rail systems that were placed in operation beginning in the mid 1950s. His categorization of these systems and older systems by generation is shown in Table 1-1.

Efforts are underway to extend and upgrade several of the current systems, and many other regional and local transit agencies have initiated or are contemplating major investments in new transit capacity, particularly light rail systems. These agencies expect that dense and mixed-use development around stations will follow and cause significant shifts away from automobile usage for both work and nonwork trips.

Table 1-1. Generations of Urban Rail Transit Systems

Generation	City or Region (Year Operations Initiated)
Simultaneous city/transit development, continuous since the mid 1800s, including modern extensions:	Boston Chicago Cleveland New York Philadelphia
Mid 1950s to mid 1970s major regionwide systems:	Toronto (1954) San Francisco (1973) Washington, D.C. (1976)
The Third Wave, late 1970s through 1980s:	Atlanta (1979) San Diego (1981) Miami (1984) Buffalo (1985) Pittsburgh (1985) Portland (1986) Vancouver (1986) Baltimore Metro (1987)
New systems the 1990s:	Los Angeles (1990) Sacramento (1990) San Jose (1991) Baltimore LRT (1992) Detroit (1993) St. Louis (1993) Denver (1994) Dallas (1996)

Source: Porter 1997, 1998

FEDERAL AND PRIVATE SECTOR ENCOURAGEMENT OF TRANSIT-SUPPORTIVE LAND USE

Federal transit support for construction of these new systems is conditioned on a showing of supportive land use patterns. And several separate federal initiatives have been mounted to encourage the integration of transportation with land development. Federal interest in the linkage between land use and transportation goes back to the late 1970s when new subway systems in the San Francisco Bay area and metropolitan Washington, DC failed to gain the ridership expected because not enough housing and commercial development was close to the train stations (TCRP 1995). Authority for the most recent efforts was granted in the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991 and revised in the Transportation Equity Act for the 21st Century (TEA-21) of 1998. TEA-21 requires that the metropolitan planning process provide for consideration of projects and strategies that will, among other things, "protect and enhance the environment, promote energy conservation, and improve the quality of life."

Regulations implementing the Act (23CFR450.316) require several factors to be considered and reflected in metropolitan transportation plans including: "the likely effect of transportation policy decisions on land use and development and the consistency of transportation plans and programs with the provisions of all applicable short- and long-term land use and development plans." The regulations specify that this analysis should include "projections of metropolitan planning area economic, demographic, environmental protection, growth management, and land use activities consistent with metropolitan and local/central city development goals, and projections of potential transportation demands based on the interrelated level of activity in these areas."

Thus, TEA-21 appears to explicitly require a future estimate of the level of activities encompassing both work and nonwork and their impact on transportation patterns.

Federal New Starts and Funding Criteria

"New starts" transit projects are funded by the Federal Transit Administration under authority granted by Congress in TEA-21 and the federal transportation budget. Recommendation for full funding is now based, in part, on a number of land use criteria that are strongly supportive of TOD goals (Table 1-2). Projects receive higher ratings and are more likely to be funded when there are transit-supportive land use conditions and government policies, including regional growth management policies to control dispersed development.

Current New Starts Funding Status

The U.S. General Accounting Office, in a report to Congress that scrutinized the "new starts" transit projects, identified 14 projects under construction, and 42 other projects already either in final design or preliminary engineering stages (GAO 1999b). The GAO estimated that the $8.2 billion that Congress authorized in 1998 for new transit projects will fall $7.6 billion short of the federal money needed to construct these projects. In addition, the GAO said the FTA expects that over $40 billion more in federal dollars will be requested to help fund another 100 projects currently in the early planning stage.

.

Table 1-2. FTA Land Use Criteria for New Starts

Category	Rating Based On:
Corridor Economic Conditions	Demand for locating in corridor
Existing Zoning	Density and mixed-use allowable
Existing Station Area Development	Existing land use is transit-supportive
Station Area Planning	Is being conducted and is supportive of TOD
Regional Growth Management	Effective region wide policies implemented
Urban Design Guidelines	TOD-supportive; implemented for station areas
Promotion and Outreach	Agencies actively conducting for TOD
Parking Policies	Strength of restrictive policies
Zoning Changes	TOD-supportive, implemented or developed
Market Studies	Comprehensive analysis of TOD market potential
Joint Development Planning	Strength of public-private program

Source: U.S. DOT 1998

Other Federal Support for TOD

Several federal agencies, including Department of Transportation, Department of Housing and Urban Development, and Environmental Protection Agency have initiated efforts to encourage more compact and efficient patterns. These new initiatives include grant programs the Federal administration announced in January 1999 and re-emphasized in the FY2001 budget submission in January 2000. The programs try to protect sensitive lands and leverage new, more intensive forms of development (Table 1-3). They supplement efforts begun under ISTEA and continued under TEA-21 to rate and fund new mass transit starts based on a set of land-use criteria.

Table 1-3. New Federal Transportation-Land Use Initiatives

Agency	Program
Environmental Protection Agency	Better America Bonds—$10.75 billion in bonding authority over five years to finance projects that preserve green space, create or restore urban parks, protect water quality, and clean up brownfields.
Department of Transportation	Transportation and Community and System Preservation Pilot—$52 million in FY 2001 encouraging states and localities to coordinate land use plans and transportation.
Department of Housing and Urban Development	Regional Connections Initiative—$25 million in FY 2001 for matching grants to design and pursue smarter growth strategies across local government jurisdictional lines.

Source: Clinton-Gore 2000

Fannie Mae Mortgage Initiative

In August of 1999, Fannie Mae announced a $100 million “location efficient” home mortgage initiative (Fannie Mae 1999). The program will attempt to increase home ownership in densely populated communities accessible to efficient public transit. It recognizes the lower household expenditures that result if household members use transit rather than a personal vehicle. More of a household's income is thus available to pay housing costs, and the owner can

qualify for a mortgage loan at a lower level of income. Trials of the program are underway as of mid 2000 in five cities.

ACTUAL EXPERIENCE AND GROWING CRITIQUE

In spite of unprecedented efforts to rebuild metropolitan areas around transit-oriented development, the actual future benefits of TOD on a metropolitan scale remain uncertain, as we will show in the research review below. The most important reason for the uncertainty is the difficulty of predicting the market's response to policies dependent upon major transit system changes and land use shifts.

As described in the previous section, TOD often involves major new transit capacity investments, usually hundreds of millions of dollars or more in light rail and commuter rail systems. In order to stimulate new land use patterns and density, these public investments are typically made before supportive land uses — employment, housing, and commercial services— are in place.

Unfortunately, at the state of the planning art at the end of the 20th century, transit investments are made without the assistance of empirical data or predictive models that can test the veracity of the assumption that benefits commensurate with costs will be achieved. In particular, the effect of TOD on nonwork activities, from which a majority of all personal travel is derived, has not yet been thoroughly addressed by research. The analysis of nonwork travel for shopping, eating out, and recreation is complex because of the interplay of numerous variables that determine developer, store owner, and consumer reaction to transit investments, land use policies, and other government actions. New data and insights regarding the consumer marketplace are needed to realistically evaluate the likely success of TOD and the expensive investments in new transit capacity that it requires.

Furthermore, taxpayer-funded investments whose payoff depends on private-sector organizational and consumer embrace of TOD are invariably made without a research-based recognition of the many elements that already determine the current patterns of retail structure and consumer behavior (Nelson & Niles 1999). An understanding of retail structure and derived travel as it exists today is obviously essential for the determination of TOD success tomorrow. Retail, when broadly defined as activities involving shopping, eating out, or engaging in recreation and other leisure pursuits, constitutes a major portion of all personal and household trips. In addition, retail logistics patterns account for much of the growing intraurban commercial truck travel that contributes to traffic congestion.

Thus, information that reveals the interplay of real estate and retail industry investments and consumer preferences is important for the purpose of validating two separate, widely-held planning assumptions: 1) that TOD, and its required transit expenditures, will actually result in dense, mixed-use centers; and 2) that these centers will, if created, appreciably change the overwhelming preference for automobile-based mobility.

After further framing of the important research questions, this section reviews the existing research that does bear on these issues.

Framework for Measuring TOD's Success

In our research framework, the central question for planners and decision makers is the magnitude of TOD's effect on travel behavior on a regional scale in established metropolitan areas. From an economic perspective, regional success of TOD will depend on the benefits it produces—both public or societal and personal—relative to its costs (Table 1-4). The public may experience benefits in the form of congestion reduction and air quality improvements. To the extent that TOD reduces excessive infrastructure costs associated with dispersed development, these would be accounted as secondary public benefits. The principal personal benefits may be travel time and expense saved, in addition to reduced congestion time. Personal benefits also include the possibility that some households can reduce the number of cars they own and operate. Other benefits, of a social nature and more difficult to monetize, are associated with the enhanced quality of living that some social analysts believe TOD produces (TRCP 1997).

Table 1-4. Simplified TOD Regional Cost-Benefit Accounting

Costs	Benefits
Transit system construction	Congestion reduction (time delay and excess fuel)
Transit system operations	Air quality improvement (health costs reduction)
Mitigation of traffic congestion caused by compact development	Reduced infrastructure
TOD planning, developer incentives	Personal travel time, vehicle operation savings
	Personal vehicle ownership reduction

Source: Nelson & Niles 1999b

The antecedent transit capital and operating costs are the primary public costs of TOD. The cost of producing housing in proximity to stations may also be higher. Other direct costs may arise, as well. For example, to the extent that increased density does not result in reduced travel, congestion mitigation measures may be required. There may also be costs associated with TOD planning and any public incentives that may be needed.

Achieving a level of benefits that exceed costs under the accounting in Table 1-4 depends on the response of developers, consumers, and taxpayers to the concept and to the public strategies that encourage it. We note in passing here that this response depends on even more elements than the complex of retail industry and consumer behavior issues, which this report identifies. The specific characteristics of the selected transit technology, the compatibility of TOD with personal housing, employment and commuting preferences, and the economics of location selection by organizations that do not serve the general public are also pertinent. Niles and Nelson (1999a) have identified 16 planning elements that will determine success at the regional or transit corridor level (Table 1-5). The table also highlights that fewer factors will control success at a single station-area, which puts the already well recognized challenges of station-area planning in perspective (PSRC 2000).

Table 1-5. Factors Determining the Success of TOD

Factor	Station Area Success	Regional Success
Number and siting of TODs (station areas)		X
Transit quality		X
Transit technology		X
Street pattern	X	X
Station area parking	X	X
Employment and housing density	X	X
Commercial mix	X	X
Retail siting criteria		X
Regional market structure		X

Table 1-5. Factors Determining the Success of TOD (Continued)

Factor	Station Area Success	Regional Success
Consumer activity patterns		X
Travel behavior/trip chaining		X
Zoning flexibility/land assembly	X	X
Resident reactions	X	X
Housing type preference/life style & life stage		X
Self-selection in residential choice	X	X
Government policies		X

Source: Niles & Nelson 1999b

Empirical Studies of TOD's Impacts

Since multi-center TOD on the regional level is now only a vision in the minds of planners, the impact of TOD on regional travel demand, patterns and mode choice cannot yet be directly measured from experience. Consequently, researchers have resorted to comparing older neighborhoods that approximate TOD and conventional suburban neighborhoods that do not. Other studies attempt to isolate the influence of specific design features and land use density and diversity. Also, metropolitan planning organizations and others have carried out limited modeling of TOD under a layer of arbitrary assumptions about future mode splits.

Empirical studies suggest that compact and mixed-use development may produce localized transportation benefits (See Table 1-6). However, these investigations fall short of giving planners and decision makers confidence that the promised macro-scale transportation benefits of TOD can be achieved (Nelson & Niles 1999a).

Table 1-6. Empirical Studies of the Travel and Land Use Impacts of Transit-Oriented Development and Related Design Elements

Location	Authors
Neighborhood/Community Form Comparisons	
Austin (Texas)	Handy 1996
Palm Beach County (Florida)	Ewing et al. 1994
Puget Sound region (Seattle)	Moudon et al. 1997
San Francisco Bay area	Handy 1992 & 1993
San Francisco Bay area	Friedman et al. 1994
San Francisco Bay area	Cervero & Radisch 1996
Seattle area	Rutherford et al. 1996
Density, Design, and Mixed Use Factors	
Los Angeles metro area	Boarnet & Sarmiento 1998
Puget Sound region (Seattle)	Frank & Pivo 1994
San Diego County	Crane & Crepeau 1998
San Francisco Bay area	Cervero & Kockelman 1997
Regional Congestion Management	
San Francisco Bay area	Luscher 1995
Post TOD Studies	
Portland metro area	Dueker & Bianco 1999
Los Angeles Blue Line	Moore 1993

Source: Nelson & Niles 1999a

In particular, the studies available do not sustain the belief that the necessary restructuring of the urban landscape and retail marketplace can actually be accomplished. And even if major restructuring can be realized, they provide little evidence that the large transit investments supporting the restructuring are

likely to produce transportation system performance benefits that the traveling public seeks.

Crane (1999) summarizes his review of empirical studies of the effect of land use variables on transportation as follows: “The results reported in any given study (may not be) incorrect, (rather) they appear to lack sufficient credibility to be the basis for policy. The risks of assuming they are reliable include unintended consequences, such as worsening traffic problems.”

There have been books and articles written that offer the opposite point of view (Calthorpe 1993, Cervero 1998), but none of them provide empirical evidence that refutes the conclusion we offer here.

Portland, Oregon, has been a laboratory for TOD and a focal point for research. Its Eastside Metropolitan MAX light rail transit line, the first in a planned metro-wide radial network focusing on downtown Portland, opened in 1986. Portland has gone to considerable lengths to encourage transit-oriented development that supports MAX.

Dueker and Bianco (1999) analyzed data to measure the impacts of the first ten years of operation of MAX on development patterns, choice of residential location, freeway traffic, and transit ridership. They found that light rail alone was not sufficient to change development patterns appreciably, and that the length of the peak period became longer for freeway traffic in the same corridor over the same decade. Growth in MAX riders occurred mainly in the non-peak and weekend periods. The researchers also observed substantial self-selection in housing location choice, meaning that some of the new housing near MAX light rail stations was mainly filled with residents who were already heavy transit users, rather than by formerly auto dependent households looking for a new, more transit-oriented style of mobility.

Implications of Empirical Research

Having an awareness of this empirical research, Dunphy (1995) suggests that if TOD is to make a meaningful difference in development patterns, there must be significant change on a regional scale. This change must be accomplished within the economic and political context of a particular region whose urban form has developed over a long period, the result of local zoning policies and myriad private investment decisions. Zoning, once established, is difficult to change, especially if the intent is to increase density. And because real estate is inherently a long-lived investment, a large majority of structures will still be standing at the end of the normal planning period.

Assuming that higher density centers linked by a quality transit service can be created, the scale of the transit investment required is an important

consideration. Downs (1994) provides one estimate by calculating the number of TODs needed to accommodate the average population growth during the 1980's of metropolitan areas with a 1990 population of one million or more. He concludes that TODs could handle the growth if their numbers were large, but that this would require a regional transit system that would likely not be financially feasible.

Long-term public support for such major investments requires that the potential benefits of TOD be clearly identified. Although station-area benefits are important, the public will put more weight on regional benefits, since typical household travel patterns extend beyond an individual's home neighborhood. Furthermore, most people will measure success by reduced congestion on major corridors and improved regional air quality, not by the more subjective goals of the proponents of New Urbanism and opponents of automobile-dependent development, goals such as less social segregation, a better quality of life, and a heightened sense of community.

TOD is more than a planning exercise; it involves major public investments. Sound public process dictates that officials estimate TOD's benefits before making major policy decisions. Beyond building new regional transportation systems, governments will need to buy public services and infrastructure that support compact development—streets, sidewalks, and parks. To the extent that mode shift does not follow from the changes in land use, there will be additional public expense associated with the management of increased vehicle traffic within compact areas.

These investments will likely compete with other demands on the public purse. And, if intended benefits are not forthcoming, they will translate to lost opportunity costs for government and to wasteful expenditures of political capital required to achieve significant urban restructuring.

As Bookout (1992) suggests, the challenge is to know the market that planning seeks to restructure, i.e., gain more information on the "ever-changing needs, preferences, and aspirations of people who make up communities." Howe and Rabiega (1992) posed a similar question after finding that the attitudes of members of the Oregon planning profession were negative toward strip malls and positive about "urban village" forms of commercial structure: "What do consumer choices and travel patterns reveal about their relationship to the most elemental parts of the commercial urbanscape—the stores?" Calthorpe, a leading proponent of TOD, acknowledges this challenge: "Clearly much more research and analysis is needed to clarify and quantify the potential results of new land use patterns on our travel behavior. It is critical... to effectively directing federal and state transportation dollars..." (Calthorpe 1993).

Robert Cervero, who has done extensive studies of the land use and transportation connection, has commented that “transit investments that are out of kilter with how our cities and regions grow do nobody any good. Running trains and buses that fail to draw people out of drive-alone cars does little to relieve traffic congestion, conserve fuel, or reduce pollution. The best prescription for filling trains and buses, and winning over motorists to transit, is to find a harmonious fit between transit systems and the cities and suburbs they serve” (Cervero 1998).

CHAPTER TWO

IMPORTANCE OF NONWORK ACTIVITIES AND TRAVEL IN REGIONAL PLANNING

INTRODUCTION

Travel for the purpose of engaging in nonwork activities has grown steadily in significance over the last three decades of the twentieth century. As we will show in this chapter, nonwork travel now accounts for about three-fourths of all household vehicle trips and four of five person trips. Nonwork is the major travel purpose even in weekday peak periods, both a.m. and p.m. Increasingly, nonwork trips are linked to work trips as well as to other nonwork trips in tours involving several stops. And nonwork activities may also be indirectly responsible for the increasing volume of commercial vehicle trips.

Yet, in spite of its overwhelming dominance in trip volumes, nonwork travel has received little attention in personal travel research and transportation planning, compared to the work trip. There have been only a few cursory analyses of nonwork travel, and these have neglected the probable impact of the large changes in the consumer marketplace that occurred in the 1980s and 1990s.

The focus on the work trip may be the result of its presumed regularity and predictability and its association with peak demand and congestion. Nonwork, in contrast, covers a broad variety of purposes, destinations, and starting times. Patterns of nonwork activities for one traveler change from day-to-day, and this has led some analysts to consider it to be discretionary travel. Nonwork travel is inherently more complicated and therefore more difficult to address analytically—to measure and to model predictably—than is work travel.

In real-world applications of transportation data, planners and project engineers often estimate the impact of nonwork trips through standardized trip generation rates for different land uses, covering the spectrum from fast food restaurants to major shopping malls. However, the effect of multiple generators on aggregate travel demand does not appear to have been fully explored.

A complete picture of personal travel in the United States requires an understanding of nonwork as well as work trips, the specific purposes and spatial locations of nonwork trip generators, and the often complex travel patterns that involve nonwork activities linked in a trip chain or tour. This understanding is of more than academic interest. Nonwork travel, because of

its magnitude, has important implications for current transportation and land use policy, particularly transit-oriented development (TOD).

In this chapter we summarize national trends for nonwork activities and travel patterns. We review the conclusions of previous studies that speculated on the causation of growth of certain categories of nonwork trips, and we offer some additional reasons for nonwork travel growth that seem more explanatory of the observed phenomena. In particular, we relate the growth of nonwork travel to the dynamic changes that have occurred in the retail and consumer services marketplace, particularly to shopping for goods and services, eating out, and other leisure activities.

NONWORK TRAVEL DEMAND

The Nationwide Personal Transportation Survey provides data on nonwork travel aggregated at the national level (U.S. DOT 1995). Table 2-1 indicates the distribution of the 379 billion person trips by all modes in the United States in 1995, by specific trip purpose. Shopping generates more individual point-to-point trips than going to work. The three next largest purposes are also nonwork categories: “other family and personal business”, “other social and recreational,” and “eating out.” The “other family and personal business” category includes the purchase of services such dry cleaning, auto repair, personal care, banking, and legal services. “Other social and recreational” includes entertainment, recreation, and cultural events. These four nonwork categories accounted for about 54 percent of all person trips in 1995.

Our focus is on these trip purposes because they involve locations that comprise what we define as the retail marketplace: namely stores and other businesses offering consumer goods and services, restaurants and drinking establishments, and venues for a wide range of recreation, social, and cultural activities. These activities tend to have numerous locations as a result of multiple enterprises competing to find the best sites for attracting the consumer’s dollar and attention. In other words, a traveler has more than one possible choice of destination for each activity. The “other” category includes some nonwork activities that are more likely to be constrained to locations that are fixed by circumstances, such as visiting friends, seeing a doctor or dentist, and trips to school and church, although we recognize that even doctors, schools, and places of worship in some sense compete for customers, and that people switch their allegiance from time to time.

Table 2-1. Trip Purpose as Percentage of All Person Trips, 1995

Trip Purpose	Percentage	Destination Flexibility
Work and Work Related	18	Somewhat inflexible
Shopping	21	Flexible
Other Family and Personal Business	15	Somewhat flexible
Out to Eat	8	Flexible
Other Social/Recreation	10	Flexible
Other	28	Somewhat inflexible

Source for columns 1-2: U.S. DOT 1995
Source for column 3: Integrated Transport Research

Growth of Nonwork Travel

Nonwork travel can now be tracked across five applications of the NPTS as shown in Table 2-2. (The data are divided into two periods to reflect changes in the survey methodology that were made in the 1995 NPTS.) Although nonwork person trips have remained essentially constant as a share of all trips, nonwork vehicle trips have increased in relative significance. The largest vehicle trip frequency growth over the 26-year period has been for purposes of shopping and other family and personal business. VMT and vehicle trip length also increased until 1995, when some decreases were noted. Work trips grew between 1990 and 1995 as employment expanded in a strong economy.

Table 2-2. Percentage Change in Vehicle Travel and Trip Length by Trip Purpose, Per Person, 1969-90 and 1990-95

Trip Purpose	Average Annual Vehicle Trips		Average Annual VMT		Average Vehicle Trip Length	
	1960-90	1990-95	1969-90	1990-95	1969-90	1990-95
All Purposes	27	12	27	15	1	2

Table 2-2. Percentage Change in Vehicle Travel and Trip Length by Trip Purpose, Per Person, 1969-90 and 1990-95 (Continued)

Trip Purpose	Average Annual Vehicle Trips		Average Annual VMT		Average Vehicle Trip Length	
	1960-90	1990-95	1969-90	1990-95	1969-90	1990-95
To or from work	1	22	20	33	17	8
Shopping	76	16	108	28	16	16
Other family and personal business	137	8	169	1	14	-5
Social & Recreation	15	7	-1	11	-10	-5
Other*	27	36	-32	68	1	23

* Includes trips to school, church, doctor/dentist, and to drop off and pick up.
Source: U.S. DOT 1995

The average length of trips show interesting differences; work, shopping, and other family and personal business trips all increased in length to about the same degree in the 1969-90 period. In contrast, social and recreational trip lengths decreased.

Mode Choice for Nonwork Travel

Table 2-3 indicates the mode used for trips to work and selected nonwork purposes. The private vehicle, in its various forms, dominates as expected, across all trip purposes, but especially for nonwork trips. Walking is the second mode of choice compared to transit for a small, but still significant, portion of trips. This is especially true for “eating out” and “other social and recreational” activities, which probably reflects the convenience of walking from home to a nearby neighborhood commercial center.

.

Table 2-3. Percentage of Daily Person Trips by Mode and Selected Trip Purpose, 1995*

Trip Purpose	Private Vehicle	Public Transit**	Walk	Other***
To work	85.8	3.2	4.3	6.7
Shopping	87.6	1.0	4.9	6.5
Other family or personal business	86.0	1.4	4.6	8.0
Out to eat	86.4	0.5	5.8	7.3
Other social/ recreational	79.1	1.8	7.5	11.6
ALL	84.5	2.0	5.3	8.2

*Does not include 3 percent of all trips for which a mode was not ascertained.
**Includes taxicab.
***Includes school bus and bicycle.
Source: U.S. DOT 1995

Timing and Linkage of Nonwork Trips

Nonwork trips are a major portion of all trips at all times of the day as seen in Figure 2-1. More than 80 percent of trips that start in the 4-7 p.m. peak period are for nonwork purposes. Many of these trips are individual links in chained trips or tours as indicated in Table 2-4. More than 60 percent of women and 46 percent of men make at least one stop on work-to-home tours. The location of stops in these tours is important because it tends to reflect the spatial distribution of nonwork activities. However, NPTS data is not geocoded for destination location so it does not give us the spatial pattern of tours.

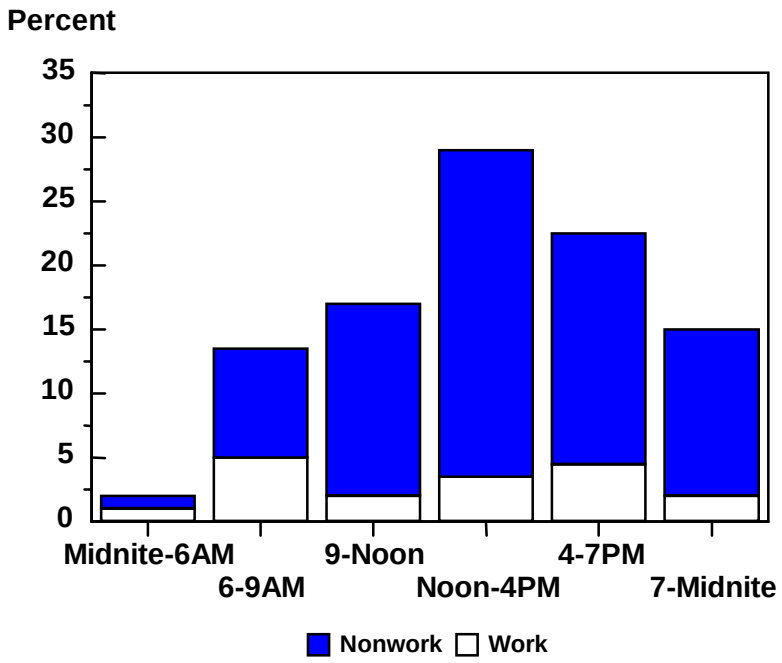


Figure 2-1. Percent of Work and Nonwork Trips by Time of Day

Source: U.S. DOT 1995

Table 2-4. Percentage of Men and Women Who Stop on Work-to-Home Tour

Number of Stops	Men	Women
One or more	46.4	61.2
Two or more	17.7	28.3

Source: McGuckin & Murakami 1998

As chaining of nonwork with work trips has become more prevalent, the distribution of nonwork trips across the seven days of a week has changed. For example in 1995, 77 percent of all shopping trips occurred on weekdays. On average, shopping trips had a higher frequency on weekdays than on weekend days (U.S. DOT 1995).

Vehicle Occupancy in Nonwork Travel

As Table 2-5 shows, vehicle occupancy has decreased for all major trip purposes since it was first recorded in 1977. Yet occupancy for nonwork trips remains considerably greater than for work trips, reflecting the social nature of shopping, family business, and leisure activities. Of course, it is understood that two or more people going to the same destination makes driving more attractive than transit when a private vehicle is available.

Table 2-5. Trends in Average Vehicle Occupancy for Selected Trip Purposes

Trip Purpose	1977	1983	1990	1995	Change (1977-95)
To or from work	1.30	1.29	1.14	1.14	-15.4%
Shopping	2.10	1.79	1.71	1.74	-19.1%
Other family or personal business	2.00	1.81	1.84	1.78	-10.0%
Social and recreational	2.40	2.12	2.08	2.04	-16.7%
All purposes	1.90	1.751	1.64	1.59	-15.8%

Source: U.S. DOT 1995

DISCUSSION

The large growth in personal travel in the last three decades has largely resulted from increased frequencies of nonwork trips, especially trips for shopping and other family and personal business activities. Retail activities account for more than half of all person trips, and most are made to locations where the traveler has more than one choice of destination. Many retail trips are linked in complex tours that involve multiple stops for a variety of purposes. Several family members may be traveling together. These tours require the flexibility that the private vehicle provides, and consequently transit and pedestrian modes are chosen for only a small proportion of all person trips.

CHAPTER THREE

RETAIL ENVIRONMENT AND NONWORK TRAVEL TRENDS

INTRODUCTION

Although the NPTS and regional surveys have documented the large and continuing increases in several categories of nonwork trips since the late 1960's, there have been surprisingly few investigations into root causes. Researchers have suggested various reasons for the growth of nonwork travel: changing lifestyles, a greater proportion of women in the work force, and the decentralization of housing and jobs that has reduced commute time, allowing time saved to be used for nonwork pursuits.

In this chapter we suggest why these explanations provide an incomplete causal understanding of nonwork travel growth. As we have indicated, activities generating nonwork trips have also changed remarkably in the past few decades. An important additional explanation of nonwork travel growth is the rise of considerably more opportunities and choices than ever before to shop, purchase services, and engage in recreation and other leisure pursuits.

We summarize in this chapter the transformation that has occurred in the national retail environment in the new postindustrial, information-based economy. Societal, behavioral, and market forces have combined to create new patterns of retail structure and nonwork activities. Our focus, illustrated by national data, is on the major changes that have transpired in the last three decades in the consumer goods and services marketplace. These changes are ongoing and have important transportation policy implications.

National data are supplemented by the example regional database assembled in this study for the Puget Sound region (see Task 3 report, available at http://www.globaltelematics.com/mineta/). A search of the literature turned up only one other study of the current retail structure of a U.S. metropolitan region. An examination of metropolitan Atlanta found that retail activity in existing neo-traditional communities tended to be limited in scope—coffee bars, restaurants, and dry cleaners—and that general household shopping requires numerous auto trips outside the neighborhood (Fujii & Hartshorn 1995).

NEW STORE FORMATS

The retail landscape has been reshaped by the introduction of numerous new "discount" formats, some at the expense of traditional formats such as

department stores and smaller, often neighborhood, stores. The new formats range from mass merchandisers like Wal-Mart to a wide variety of specialty retailers. The pace of their introduction has been extraordinary (Table 3-1), typically yielding a tenfold or more growth in the number of stores over the last two decades. Because of the many variations and the constantly changing environment, it is difficult to classify all of the store concepts and formats. But nine distinct categories stand out, each increasingly dominated by a small number of national chains (Table 3-2).

Table 3-1. Selected Examples of the Rapid Growth of Mass Retailers

Chain	Category	Units		
		1979	**1989**	**1999**
Wal-Mart	Discount Department Store	229	1,378	2,433
Home Depot	Home Center	3	118	761
Toys “R” US	Toy Superstore	84	522	700
Costco	Wholesale Club	--	43	217
Circuit City	Home Electronics Superstore	--	125	585
Staples	Office Supplies Superstore	--	50	745
Walgreen’s	Combination Drugstore	926	1,416	2,800

Sources: Discount Merchandiser 1999
Chain Store Age: State of the Industry Report 1979, 1989, and 1999

Table 3-2. The New "Discount" Mass Retail Formats

Format	Approx. Units Nationwide - 1998	Size Range or Average (sq. ft.)
Mass merchandiser (discount department store)	9,000	10,000-100,000
Supercenter	1,000	120,000-200,000
Club warehouse	800	100,000
Specialty or "superstore"	91,500	20,000-100,000
Home center	1,000	150,000
Outlet store	10,000	10,000
Combination supermarket	3,900	59,000
Combination drugstore	3,600	13,500
Convenience Store	93,200	800-5,000

Sources: Discount Merchandiser 1999
National Association of Convenience Stores 1998
American Express, 1999

All of these new retail formats are described in some detail in a progress report (see the Task 1 Report, available on the Web for downloading at http://www.globaltelematics.com/mineta/). We focus here on only two: "superstores" and "combination" grocery stores. These stores exemplify the changes in trade areas and trip patterns as stores seek to find competitive advantage in specialization and economy of scale.

Superstores

Superstores, also known as "category killers," are chain stores that control a particular specialty market (Table 3-3). These stores attract customers by offering a large variety of goods within a particular specialty such as books, sporting goods, or office supplies. Superstores typically draw their customers from large trade area equivalent in size to one that is commanded by a regional mall. In fact, many superstores tend to cluster near malls creating major retail concentrations. However, they are not just a suburban phenomenon; superstores are distributed widely across the urban landscape, both inside and

outside central cities. Because of its recent and rapid growth, the superstore phenomenon has not been well documented.

Table 3-3. Superstores in the Puget Sound Region

Category	Number of Stores
Arts & Crafts	6
Books	14
Car electronics	7
Computers	25
Drugs & misc. goods	31
Electronic games	9
Home electronics	25
Home furnishings	10
Music recordings	12
Office supplies	29
Pets & supplies	27
Sporting goods	32
Thrift (second hand)	4
Video tapes	41

Source: Integrated Transport Research

Super or Combination Grocery Stores

Grocery stores are growing in size and decreasing in number, even as the population grows. The number of stores peaked in about 1978 and over the last two decades has been steadily decreasing (Figure 3-1). Between 1990 and 1995, all types of grocery stores decreased 7 percent. Conventional supermarkets decreased 20 percent while the number of grocery "superstores," which typically have a delicatessen, bakery, and nonfood goods and services, increased 17 percent. Some grocery stores have added gasoline pumps. As a result, trips to the supermarket are growing in distance and probably in time expended.

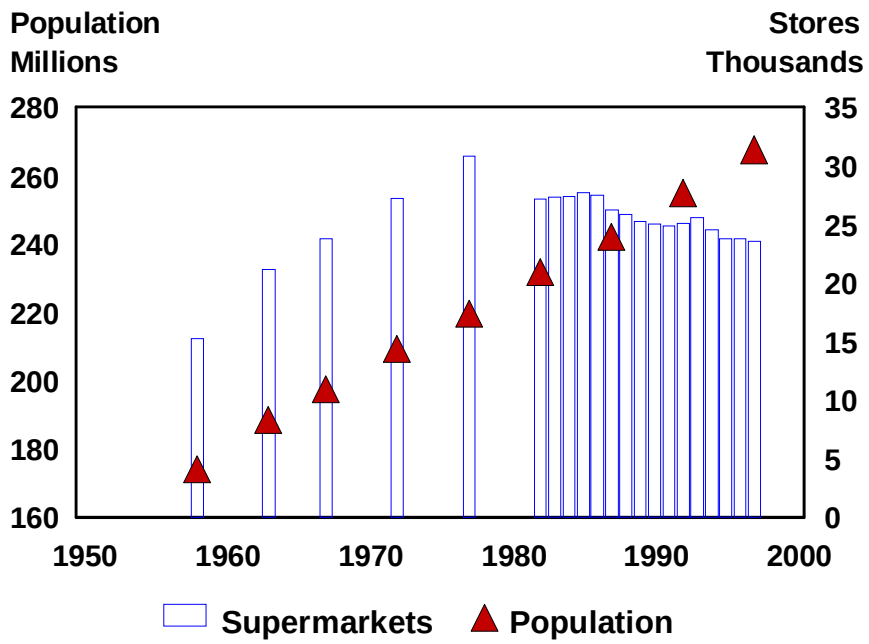


Figure 3-1. Relative Growth of Grocery "Supermarkets" and Population, 1958-1997

Source: U.S. Department of Agriculture, Economic Research Service 1998

NEW CONSUMER SERVICES

The importance of the service industry in the new economy is often measured by its increasing share of the job market. But another measure is the growing diversity of commercial services. Many specialty businesses have been created just for the maintenance and repair of houses, cars, and other personal equipment, and to serve other household and small business needs. Several services in these categories are listed in Table 3-4. A number of these reflect the society's growing wealth and decreasing available time. More people place a higher value on their time and will pay for services, even for routine home maintenance tasks that may have been previously performed by a household member. Time freed up can then be used for higher-valued purposes, whether work or leisure.

.

Table 3-4. New Consumer Services

Services We Travel To
ATMs
Specialized auto servicing and repair
Copy centers
Day care
Health clinics
Personal beauty care
Services That Come To Us
Package delivery
Home systems repair
Landscaping
Housecleaning
Used goods charity pickup
Municipal recycling pickup
Home security
Delivery of online and mail-order merchandise

Source: Integrated Transport Research

GROWTH OF OUT-OF-HOME DINING

Dining out continues to be a strong feature of American leisure habits. Although people are not eating and drinking more, they appear to be enjoying a much greater variety. While per capita food expenditures remained essentially constant, food consumed away from home grew from 34 percent of food expenditures in 1970 to 45 percent in 1997 (U.S. Department of Agriculture 1998). The number and variety of eating and drinking establishments grew even faster. In the period 1963 to 1992, the total of these venues rose 66 percent, compared to a 35 percent increase in population. Annual sales growth

between 1999 and 2000 is estimated at five percent by the National Restaurant Association (National Restaurant Association, 2000).

As viewed from the consumers perspective, several reasons have been suggested for the increase in spending on food away from home: 1) the increase in two-earner households that leaves less time for food preparation, and which also increases household income and makes more discretionary income available; 2) the rise in single person households; and 3) the greater variety of restaurant options available (Robicheaux & Harmon 1997).

Fast Food Dominance

Table 3-5 indicates the current major restaurant industry segments and market shares of the leading 100 companies in 1998. These companies accounted for about $125 billion in sales and 164,000 units (Nation's Restaurant News 1999). This was about half of all away from home food expenditures and two-thirds of all units. Fast food—sandwiches, chicken, pizza, snacks—is the predominant choice over sit down eating, and it represents more than half of all units.

Table 3-5. Restaurant Market Share by Major Market Segments for Top 100 Chains

Concept	Market Share
Sandwich	42
Dinner House	10
Pizza	9
Family	7
Chicken	6
Snack	2
Grill-Buffet	2
Fish	1
Other (Contract/sports concessions, Hotel, Buffet, Coffee, Convenience Store, In-Store, and Theme Park)	21

Source: Nation's Restaurant News 1999

Popularity of Cuisines

Although national counts that would reveal the restaurant industry's fine structure are lacking, the changes in the restaurant industry involve much more than the growth of fast-food establishments. For example, foreign and specialty cuisines have shown astonishing popularity, and consequently the food dollar is being spent at many more locations than previously. Table 3-6 indicates the growth of foreign and specialty cuisine restaurants in the Seattle metro area. An industry survey of leading chefs strongly pointed to ethnic cuisines and foreign flavors as the dominant trend (National Restaurant Association 1999). The impetus, in part, may be due to the large immigrant stream from many nations in the last decade. Another factor may be the growing number of Americans who travel abroad and are exposed to foods of different regions and cultures.

Table 3-6. Growth of Cuisine Restaurants in Seattle Metropolitan Area, 1980 -1998

Restaurant Cuisine	Number of Establishments 1980	1998
American	14	30
Barbeque	5	23
Chinese	27	81
Indian	1	27
Italian	13	101
Japanese	10	77
Mexican	19	67
Pizza	13	26
Seafood	13	36
Thai	1	67
Vietnamese	1	24
Other (46 cuisines)	73	188
TOTALS	190	747

Source: U.S. West Yellow pages

GROWTH OF LEISURE ACTIVITY

Recreation is still another example of the major transformation that has occurred in nonwork activities. The share of household expenditures on entertainment and recreation, increased 40 percent between 1950 and 1995, from 4.0 percent to 5.6 percent (U.S. Department of Labor). Real dollars spent by all households on entertainment jumped 8 percent between 1987 and 1997. Since a large portion of recreation is consumed outside the home, the travel effects have been equally large.

More revealing are economic studies that show per capita participation rates for recreation have increased as incomes and leisure time have increased, and as invention and technology have stimulated a rich diversity in the types of recreational opportunities, whether for participants or spectators (Costa 1997). People are able to buy much more recreation value for every dollar they spend. From an increasingly wide variety of choices, people enjoy the opportunity to select the forms of recreation that best serve their interests, abilities, age, and lifestyle.

According to Schwenk, the trends in leisure time and entertainment expenditures can be attributed to demographic patterns, the movement toward healthier lifestyles, and new technology (Schwenk 1992). In 1989, baby boomers between age 35 and 44 spent more than those in other age groups on recreation and entertainment. As these people age, they can be expected to have more discretionary income to spend on leisure activities compared to previous generations.

The great diversity of leisure opportunities makes analysis of participation rates specific activities and the spatial patterns of venues very difficult. Given the ever-changing nature of leisure, trends are even more difficult to follow. Most activity surveys are either lacking in scope or accuracy of measurement technique to allow much more than the identification of broad trends. One national survey has tracked attendance at live artistic performances and participation in other leisure activities since 1982 (National Endowment for the Arts 1998). Growth in participation rates is evident in most major categories (Table 3-7).

Table 3-7. Participation in Arts Events and Other Leisure Activities

Activity	Percent Attending or Participating Once in Last 12 Months			
	1982	**1985**	**1992**	**1997**
Classical Music	13	13	13	16
Musical Play	18	17	17	25
Non-musical Play	12	12	14	16
Active Sports	39	41	39	45
Exercise	51	57	60	76
Amusement Park	49	45	50	57

Source: National Endowment for the Arts 1998

SPATIAL ORGANIZATION OF RETAIL STRUCTURE

In addition to the growing variety of retail activities, the spatial structure of the retail environment has undergone major reorganization in the past few decades. We can only review here the highlights of these changes on a national level that we described more fully in the Task One report. We also provide examples of the spatial distribution of retail locations selected from a series of maps produced for the Puget Sound region nonwork database that was documented in the Task Three report.

Growth in Numbers and Types of Shopping Centers

The planned shopping center is largely a post WW-II invention. Figure 3-2 shows the growth in number of shopping centers of all categories and sizes since 1986, when reasonably accurate national data was first collected. For shopping centers of all sizes, the 1980s were a period of rapid growth that mirrored the increasing numbers of baby boomers who have high levels of personal expenditures.

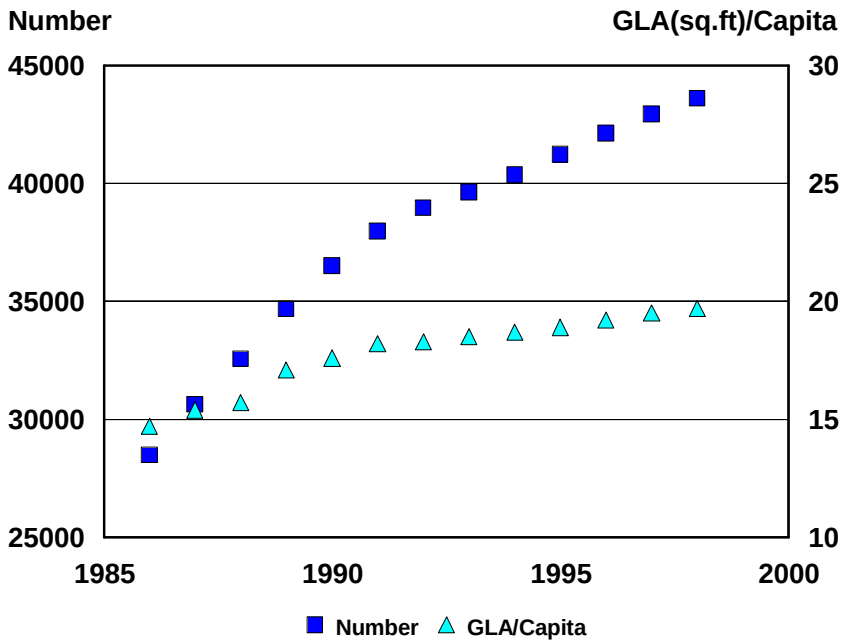


Figure 3-2. Shopping Center Trends

Source: National Research Bureau 1999

Over half of all shopping center area is in facilities that are less than 200,000 square feet. On a per capita basis, the amount of shopping center area has continued to increase. If automobile sales are ignored, planned shopping centers now account for more than half of all retail sales (ICSC 1998). Over the years, new types of centers have emerged, comprising a wide variety of spatial configurations and sizes (Table 3-8).

Table 3-8. Types and Spatial Characteristics of Shopping Centers

Shopping Center Type	Typical Configuration	Floor Area (Sqare Feet)	Primary Trade Area Radius (Miles)
Super regional	Mall, usually enclosed	>800,000	5-25
Regional	Mall	400,000-800,000	5-15

Table 3-8. Types and Spatial Characteristics of Shopping Centers (Continued)

Shopping Center Type	Typical Configuration	Floor Area (Sqare Feet)	Primary Trade Area Radius (Miles)
Community	Strip	100,000-350,000	3-6
Neighborhood	Strip	30,000-150,000	3
Power	Freestanding Cluster	250,000-600,000	5-10
Specialty	Mall	80,000-250,000	5-15
Theme	Mall, sometimes in historic building	80,000-250,000	N/A
Outlet	Mall, strip, "village" cluster	50,000-400,000	25-75

Source: International Council of Shopping Centers 1998

OTHER SPATIAL PATTERN CHANGES

Retail Activity Increasingly Polycentric and Dispersed

That metropolitan America is rapidly developing a polycentric structure is a fact that has been widely documented. Perhaps an extreme example is the Atlanta region, which has more than 70 retail cores, including downtowns and regional malls, with over 1000 retail employees each (Fujii & Hartshorn 1995).

Clustering at Regional Centers Creates Major Retail Concentrations

Both regional and superregional centers are often surrounded by other smaller centers that together comprise very large retail concentrations. National, and even regional, data on the number and size of these commercial clusters is lacking. One regional mall in the Puget Sound area has as many stores and retail space outside as inside (Task Three report). These stores are in strip malls and power centers within one mile of the regional mall.

Freestanding is Still a Major Choice

Many national chains prefer freestanding sites for enhanced visibility and customer access. In 1997, more than half of retail construction starts in the U.S. were freestanding (Levine 1998).

Decay, Renewal and Adaptation of Older Neighborhood Centers and Arterial Strips

The major changes in store format and size, and the increasing number and variety of shopping centers has obviously had an impact on older community and neighborhood centers and strips, as well as the downtowns of older cities in a metropolitan region. However, other than a few studies of individual inner city strips and centers in Los Angeles and some anecdotal information about the condition of strips elsewhere (Loukaitou-Sideris 1997; Jacobs 1997), there appears not to have been a systematic study of the change that these centers have experienced. Although commercial activity in some of these centers has declined, others have adapted and prospered by becoming specialty centers serving a large trade area. One older neighborhood commercial strip in Seattle (Wallingford) is now a center for eating out and entertainment that attracts customers from across the city and nearby suburbs.

Markets Differentiated by Age and Lifestyle

Many stores, especially those selling apparel and other soft goods, target market segments having narrow age and lifestyle ranges. Some stores now cater exclusively to the early teenage market. Thus, household shopping excursions can be expected to involve stops at several different locations, or in the extreme, several separate trips.

Maldistribution of Essential Services

In some instances, the market does not provide convenient access to necessary goods and services for those with low levels of mobility (U.S. HUD 1999). One example that has been studied is the lack of inner-city supermarkets, and as a consequence, higher food prices and/or transportation costs for residents of these areas. A study of 21 metro areas found significantly fewer grocery stores per capita in the lowest-income areas compared to region wide averages. These same areas also had the lowest rates of vehicle ownership (Cotterill & Franklin 1995). Those inner-city families who are able to gain the income and wealth to purchase a vehicle or to move to a better neighborhood probably enter into a more automobile-dependent lifestyle of the type that TOD planners are working against.

Examples of Retail's Spatial Environment

The Task 3 report described the Puget Sound region's retail environment in a series of maps that indicate locations for major nonwork activity venues relative to the proposed TOD structure. Just two of those maps are reproduced here to provide examples of the variety and dispersion of these venues. Figure 3-3 shows the locations of the 300 "superstores" listed in Table 3-3. Many of these stores are clustered in proximity to the major malls and have equally large trade areas. Figure 3-4 shows the locations of all of the major nonwork

trip generators that were geocoded and mapped in the process of creating the Puget Sound nonwork database. These range from discount department stores to nightclubs, and total approximately 1,900 separate venues.

DEVELOPER, RETAILER, AND CONSUMER DECISION DYNAMICS

Several market indicators help explain the observed spatial structure of the retail marketplace, including the size of individual stores, their siting at particular locations, and their spatial relationships to other establishments. They also explain why the retail structure appears to be successful, i.e., why consumers patronize the stores, how it attracts their discretionary spending, and how their response in turn helps shape the retail environment. This synergistic relationship between the interests of developers/retailers and consumers is an essential determinant of nonwork transportation patterns.

New Retailing Strategies

Retailers today, more than ever before, are running their businesses based on a financial planning approach rather than a merchandising approach. A strong economy throughout the 1990s and resulting available investment capital has meant growth in the size of retail firms and resulting monopolistic and oligopolistic behavior. For example, in 1992, the top five supermarket chains had 19 percent of the national market; in 1999 that share grew to 33 percent (Bergmann 1999). Merger activity is high. Hence, the increased importance of larger, national chains in the marketplace.

Investments by larger firms in information and other technologies have caused advancements in manufacturing and logistics to the point that cost of goods and the physical distribution to the store are a shrinking share of the cost of consumption. The main problem faced by firms serving consumers is that of marketing against competition. For retailers, store location is paramount, and planning multiple store sites in a regional market has become much more sophisticated.

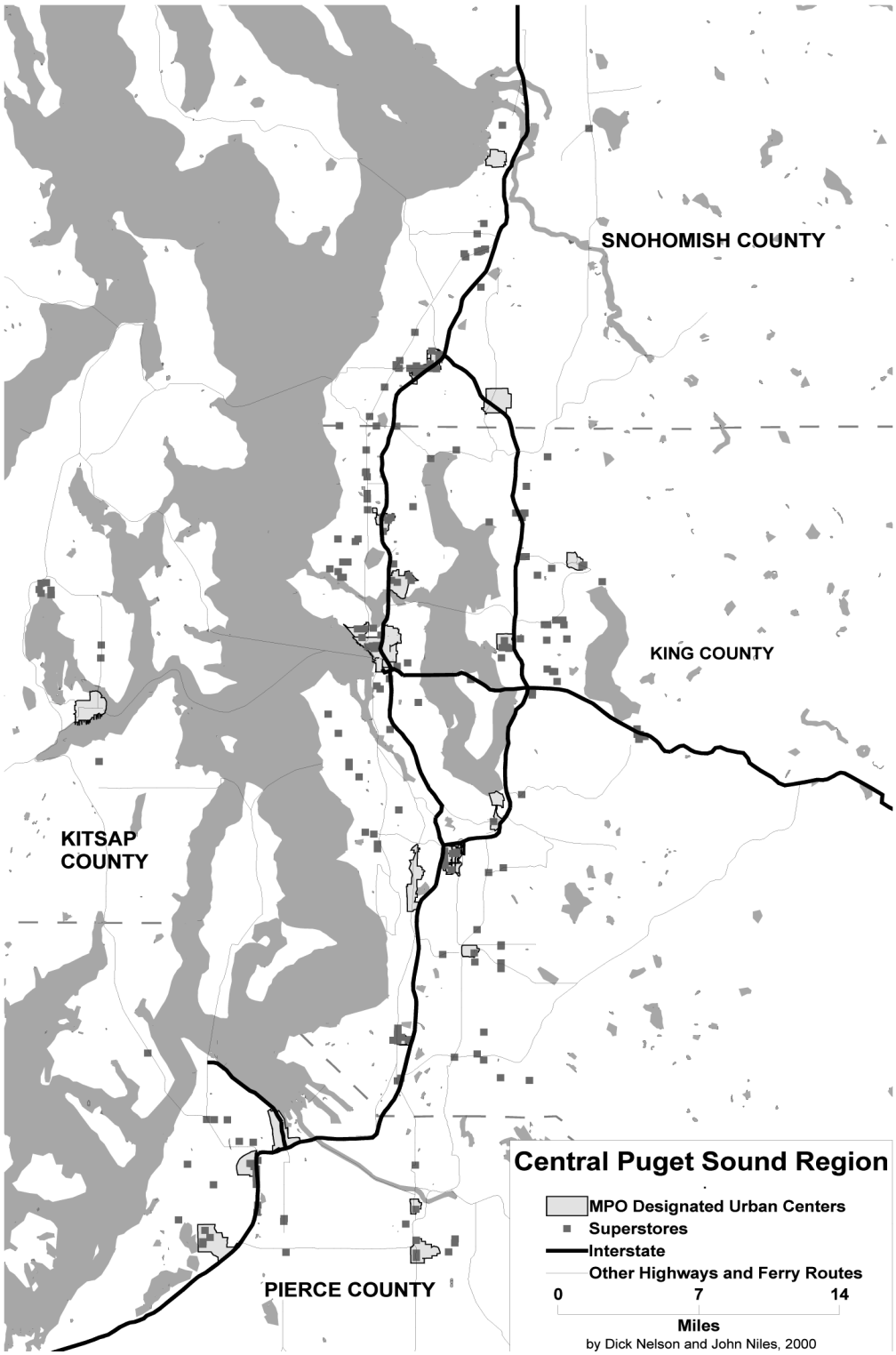


Figure 3-3. Locations of "Superstores" Relative to the Proposed TOD Structure of the Puget Sound Region

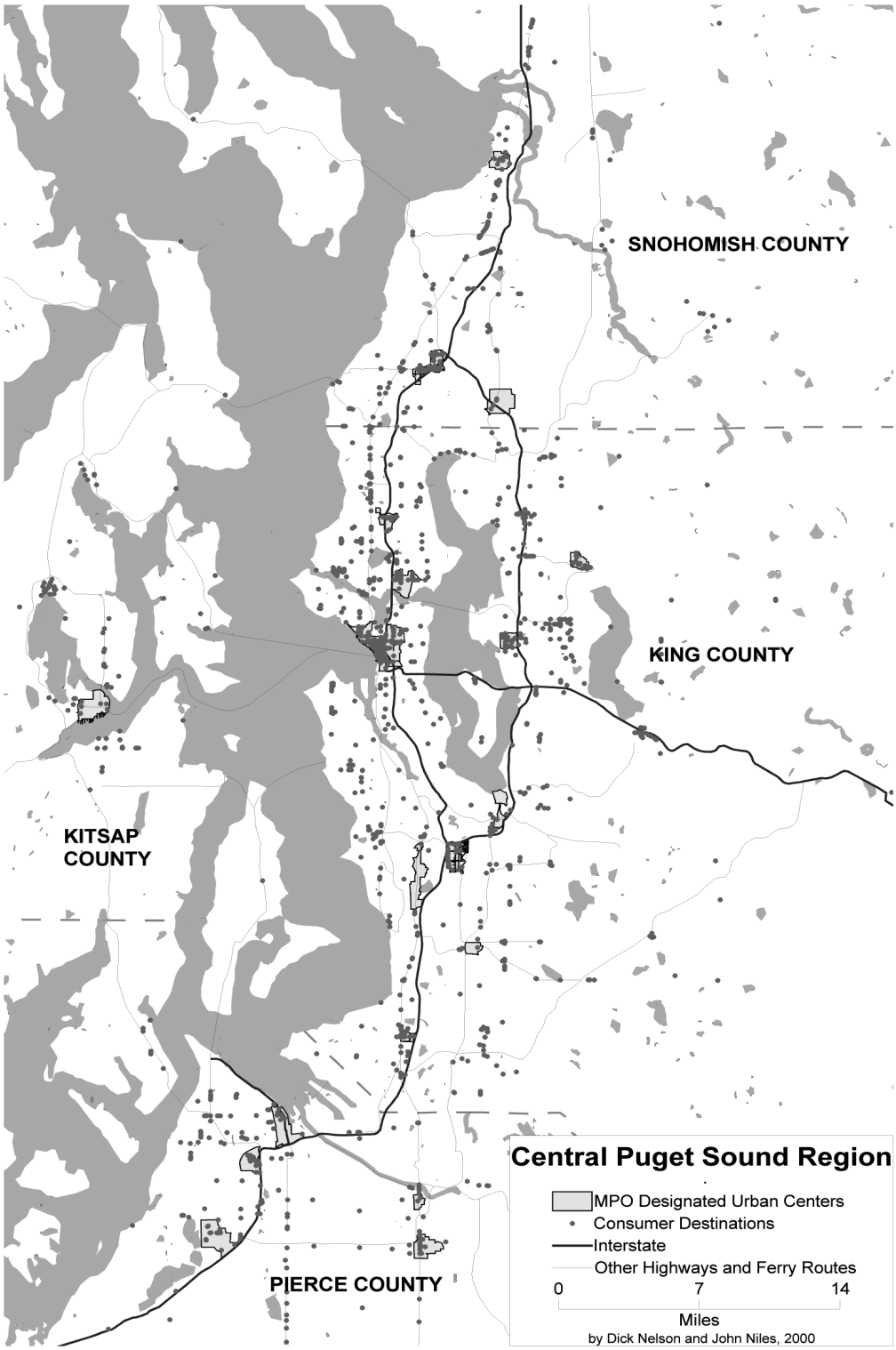


Figure 3-4. Locations of Major Nonwork Trip Generators Relative to the TOD Structure of the Puget Sound Region

Power in the market has shifted to the consumer and in turn to retailers who are closer to the consumers and are aware of their needs. One need is time saving. Thus as society becomes more affluent, the time constraint is replacing the income constraint in the allocation of goods. Increasingly, people buy goods and services that save time that is then allocated to other activities.

The trend toward increasing polarity in retailing continues. On one hand, superstores emphasizing large-scale diversified operations and logistical efficiency take a larger share of the market. On the other hand, firms that emphasize deep but narrow product lines and more responsive consumer services grow in importance. As the share of the market of both types increases, the share of firms in the space between these two poles shrinks.

Social institutions, such as the family, the work place, and the school, are in charge of shaping consumption and are directing and constraining both the times and nature of activities. Social institutions similarly influence the choices that consumers make among major product categories associated with activities.

Store Location Strategies

Table 3-9 lists the chief factors that are involved in the land developer's and retailer's choice of size of retail unit, and the general location and specific site selected for the unit (Nelson & Niles 1999). We briefly describe each of these factors.

Table 3-9. Key Retail Location Decision Factors

Scale and scope economies
Agglomeration economies
Regional accessibility
Visibility, local access and parking
Environmental impacts
Zoning and public resistance
Local government revenue needs

Source: Nelson & Niles 1999

Scale and Scope Economies

Economies of scale and scope are the most visible manifestations of the new retail economy and structure. Many categories of retail firms are building

bigger stores that attract customers from a larger geographic market area. Even stores that have been traditionally a part of neighborhood retail centers, and that remain so today—groceries, barbershops, pharmacies, and bookstores—have scaled up. Some retail formats have reached a market size that requires a store area, including parking, that would be a difficult fit in a core commercial center such as a downtown. These include "big box" retailers—discount department stores, warehouse club stores, home improvement centers, and other "category killers"—that generate large numbers of trips for many hours of both week days and weekends. Most customers arrive by car which enables them to conveniently haul purchased items that are heavy, bulky, or numerous.

Even the convenience store, which has replaced the "mom and pop" neighborhood grocery as the nearest place to purchase food, bottled drinks, and tobacco, has achieved a market scale that creates a difficult fit except in locations at the edge of a residential neighborhood. Most convenience stores are on busy arterials, and their customers are drawn from a large trade area.

Agglomeration Economies

Clustering has long been a feature of the retail marketplace. Competition leads simultaneously to competing stores positioning themselves geographically into clusters and to similarity among products (Hotelling 1929). Retail firms also tend to locate in close proximity to other firms that offer complementary goods (Jones & Simmons 1990). The clustering of competitors facilitates comparison shopping; the clustering of different kinds of stores facilitates one-stop shopping. In both cases, clustering benefits both the retailers and their customers. Total travel distance and cost are reduced, and positive externalities are created, i.e., a total market that is greater than the sum of the individual markets when the same stores are not clustered. Agglomerations also offer retailers the benefit of reduced overhead. Parking is shared, as are other costs such as security and even advertising.

Clustering occurs at several levels: in central business districts, regional malls, outlet malls, "power centers," and smaller malls and retail strips along arterials. Clusters involve services as well as retail stores, e.g., post offices, libraries, banks and ATM machines in shopping centers and malls. The mix of stores is usually subject to careful selection to maximize cumulative attraction and impulsive purchasing.

Fast food outlets cluster with department stores in regional malls to take advantage of high pedestrian flows generated by their neighbors. Restaurants also cluster. Pilsbury concluded, after an extensive study of the Atlanta-area restaurant industry, that clustering was the most important factor determining restaurant location (Pilsbury 1987). According to Pilsbury, this "competitive

linkage" strategy has produced an almost total clustering of restaurants in most communities in Atlanta.

As the retail marketplace continues to reinvent itself, clustering becomes even more heterogeneous. A recent development is the "stacked entertainment zone," that may include restaurants, food courts, cinemas, ice rinks, video game arcades, art galleries, and spas. These highly diverse activity assemblages have replaced the department store as the destination anchor in some shopping centers.

Regional Accessibility

The growing size of market areas is obviously related to the greatly increased regional accessibility that personal vehicles and modern urban roadway systems provide. Some retail centers—e.g., ethnic and lifestyle shopping districts, factory outlet malls, major recreation venues—may be dependent on a market that extends across an entire metropolitan area. Even regional shopping malls generate a considerable amount of "cross shopping," i.e., shoppers live close to one mall but also frequently shop at other regional malls.

Large stores and their lower prices are also very much facilitated by modern information technology, another form of accessibility. This includes bar-code price scanners to keep checkout lines moving, point of sale terminals wired to inventory management systems and credit/debit card networks, and global logistics management systems connecting stores to warehouses and factories worldwide.

Visibility, Local Access, and Parking

All stores seek visibility to attract customers and to provide convenient access to the site. Since the car is the dominant mode for shopping trips, many retail chains prefer stand-alone sites on major roads and at key intersections. Such sites serve to project the image of the company and to support its advertising, and they provide convenient site access, entrance and egress, and parking that is free from competition from other activities. Compared to a shopping mall location, freestanding stores control their own business hours and can be open to customers around the clock. Stand-alone sites also allow retailers to grow at faster rates than through traditional shopping center development.

Environmental Effects

Quite apart from the vehicle traffic consequences caused by large size, certain stores are difficult to locate adjacent to residential areas because the activity generates noise, high volumes of refuse, or just looks bad. These include modern grocery stores, auto repair services, funeral homes, and operations like craft stores and brew-pubs that have manufacturing or processing operations on the premises.

Zoning and Resident Resistance

In already developed areas, current zoning is a central political issue for realization of restructured neighborhood centers. Residents resist rezones that allow more mixed-use development. Efforts to introduce commercial businesses into existing residential areas, even when not requiring zoning changes, often meet opposition. Expansion of commercial activities is more probable in commercial zones that have underutilized capacity. It will tend to take the form of the existing commercial center, which is most often an arterial strip.

Local Government Competition

Local governments generally see commercial development as a net tax revenue generator compared to even dense residential development, and are inclined to being receptive to the siting of major retail stores and complexes. Some local governments provide incentives to attract developers who are looking for a site and who can choose among locations within a large trade area.

Consumer Behavioral Factors

Several key behavioral traits of consumers that hold implications for TOD planning are listed in Table 3-10.

Table 3-10. Key Consumer Behavior Factors

Bargain hunting
Comparison shopping
Preference for variety
Destination flexibility
Schedule flexibility

Source: Integrated Transport Research

Bargain Hunting

Competition attracts price-conscious consumers who travel outside their neighborhood, trading higher travel and time costs for lower-cost merchandise. This is particularly the case when consumers purchasing prepackaged, standardized, well-known brands are responding to regional promotion. Newspapers typically carry inserts containing coupons, rebates and advertising

inserts describing low-priced goods available only in big-box stores, superstores, and off-price retailers located throughout a metropolitan region.

Comparison Shopping

Both stores and goods are classified as either convenience or specialty. Convenience stores and goods account for most purchases, and consumers choose locations for convenience shopping that minimize travel. Even for specialty shopping, consumers generally prefer locations that are as close as possible.

However, some specialty stores—such as those selling furniture, major appliances, or automobiles—generate higher levels of longer, "comparison" shopping trips, i.e., customers will bypass other similar stores to shop there. This behavior results from marketplace competition offering customers unique mixtures of price, quality, variety, and service that may be scattered throughout a metro area.

High levels of comparison shopping have been observed on a regional scale. Although large malls in the same metro region may have the same anchoring chain stores, they may differ in their mix of specialty stores. Some may have a more upscale mix compared to the regional average. This tends to produce "cross shopping," with some consumers consistently visiting two or more regional malls.

Preference for Variety

People will pay more in travel costs to find variety or a unique shopping experience. For some, shopping is a recreational activity, and "satisfaction" is a large component. Malls that include food courts, multi-screen cinemas, amusement rides and electronic game parlors, concert stages, traveling festivals, and fashion, automobile, hobby, and crafts shows are playing to this preference. These venues and events are typically designed to draw customers and their family members from a large area well beyond the immediate neighborhoods.

Bargain hunting, comparison shopping, and preference for variety all show up in market research. From 1995 to 1999, the number of weekly shopping trips by females held steady at 3.5, but the number of stores visited doubled, from 1.4 to 2.9 across the same period of time (Prepared Foods Online Newsletter 2000). Consumers who were surveyed viewed shopping as part necessity, adventure, pragmatism, and emotion.

Location Flexibility

Choice in the marketplace allows travelers to adjust to changes in the cost of a trip. For example, to avoid congestion or to combine several travel purposes in

a chained trip, consumers can access the same retail store at another location without increasing the time or direct cost of the trip.

Schedule Flexibility

Consumers exhibit considerable flexibility in the time scheduling of trips to retail activity centers, often made possible by extended store hours. Nonwork trips combine with trips to and from work, and they originate from work sites. Tours involving one or several nonwork activities typically occur after work hours and on weekends.

Dispersion of Other Nonwork Activities

In the past, people might have chosen to patronize local businesses and professional services. Now, many of these nonretail, nonwork household activities, have for many people moved to locations outside their immediate neighborhoods. Examples are choice of church, children's school, and family doctor.

DISCUSSION

Table 3-11 summarizes important current national trends in the size, number, variety and spatial dispersion of stores (Nelson & Niles 1999b). Equally important trends are apparent in the consumer services and recreational sectors.

Table 3-11. Major Trends in Retail Structure

Retail activity increasingly polycentric and dispersed
Planned shopping centers dominate market
Smaller malls cluster around major malls
"Big Box" market share growing
"Super" stores growing in kind and number
Many chains prefer stand alone sites
Drive to and through convenience growing

Source: Nelson & Niles 1999b

From a transportation perspective, the most important aspects of the new store formats is their number, spatial distribution, and spatial organization, i.e., their siting with respect to other stores and to older centers of retail activity. The number of trip generators has expanded greatly, much faster than population. At the same time, retail's spatial structure has changed in ways that both

increase and decrease travel. One trend is to one-stop shopping, either within an individual retail unit that offers a wide range of goods and services, or as a result of the spatial clustering of several separate units. The result in the latter case can be very large retail concentrations such as those found at regional malls. Another trend is the choice of some retail businesses to prefer isolated locations. While some retailers prefer to cluster, even with their competitors, other retailers choose stand-alone sites that provide greater visibility, access, and control over hours of operation, which increasingly are 24/7—24 hours per day and 7 days per week. The market has reacted to the need for more flexible hours of operation that more closely fit increasingly varied household schedules.

Store locations and their spatial organization have not been unduly constrained by land use limitations, and developers and retailers have been generally free to build stores where they are most profitable. Their freedom to locate has been indirectly assisted by residents who, being very protective of existing residential zoning, are not critical of the retail strip and the retail clustering that are the bane of planners. Freedom for retailers to locate about anywhere is also helped by competition among local jurisdictions for tax revenue generated by retail sales.

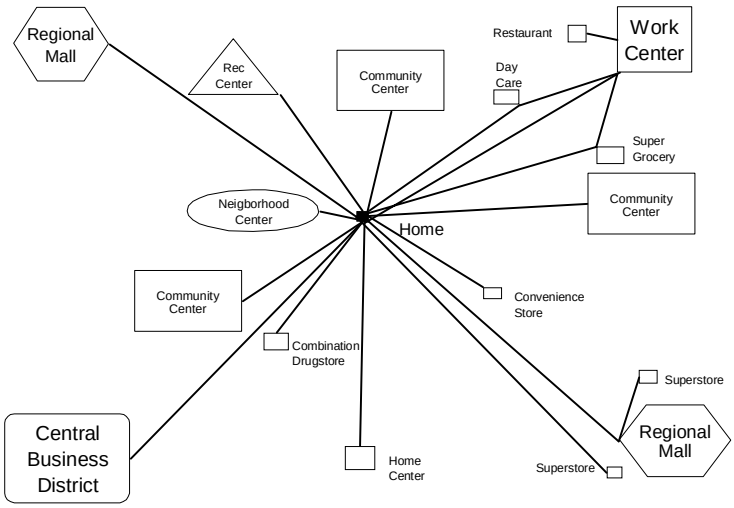


Figure 3-5. Hypothetical Household Nonwork Travel Patterns

Source: Integrated Transport Research

Figure 3-5 attempts to represent schematically the household travel patterns generated by the new retail structure. Obviously, individual household patterns

will differ greatly. And a simple diagram cannot begin to suggest the complexity of actual travel patterns that are integrated over the population and time. Even the frequency of travel from one household to specific locations is not easily captured in one diagram.

But the schematic is instructive in that it does provide a sense of the increased number of retail destinations, their spatial relationships, and how high levels of mobility and accessibility enable trips to multiple centers and stand-alone sites dispersed across a metropolitan region.

Figure 3-5 also suggests how chaining of trips improves the efficiency of travel. Finally, it attempts to portray a basic reality: consumers are willing to spend more of their disposable income on transportation to access the great variety of offerings now available in the marketplace.

An understanding of the new retail environment provides insight into the growth of nonwork travel, which is an essential element of TOD planning. Nonwork activities and travel have grown in a dynamic process involving consumer demand, technological change, and market innovations. Growing disposable income provides the buying power that supports expanding consumer preferences for a variety of goods and services and for the needs of saving time and achieving multiple purposes in trips to make purchases. These consumer needs are fed by the outputs of technological and market innovation, including new products and services, global production and supply chains, various levels and forms of customer service, and development of new retail niches. Innovation and expanding consumer preferences feed on one another, yielding the modern retail structure described in this chapter—many retail venues both large and small, dispersed widely, and responsive to the accessibility provided by automobiles, the overwhelmingly dominant mode of transport. This retail structure in turn leads to increasing nonwork travel demand.

An inherent aspect of a modern capitalistic market system is a two-way link between consumer preferences and business-driven innovation. Feedback serves and expands those preferences. And opportunities generated by growing wealth and technological innovation stimulate the market to offer even more variety and choice.

All of this plays out in the spatial realm of a metropolitan region, whether inside or outside the central city. New trip attractors are continually being added that change personal and aggregate travel patterns, both increasing the number of nonwork trips and vehicle miles traveled. People organize their trips into complex tours that allow efficient access to the increasing numbers of

destinations, while minimizing trip time and distance within their activity budgets.

CHAPTER FOUR

NEEDED: PLANNING METHODOLOGIES THAT ACCOUNT FOR URBAN COMPLEXITY AND UNCERTAINTY

INTRODUCTION

Retail dynamics, consumer behavior, and nonwork trip generation establish the dimensions of the complex, dynamic urban system that is the context for TOD planning. The complexity encompasses the interaction of known, multiple forces and the continuing introduction of new forces as a result of technological innovation, entrepreneurship, and competition. This chapter begins with a brief review of the theoretical understanding of complex systems and uncertainty. It then describes the limitations of current urban planning to encompass complexity and uncertainty, and it indicates the key elements of a new urban transportation and land use planning process that can deal with the complexity and future uncertainty of the dynamic urban system.

As Richmond (1998) points out, planners have to face up to this complexity in their planning: "Recognizing that transportation is inevitably tied into an intricate web of overlaps with all other urban functions and with the rich morass of human life complicates the planning task but makes it more likely to achieve meaningful results." Along the same lines, Innes and Booher (1999) note that in the complex metropolitan development system "simplification results in fundamentally wrong answers, and focus on individual sectors separately will be counterproductive."

CHARACTERISTICS OF COMPLEX SYSTEMS

As Casti (1997) describes, complex systems generate surprises from five distinct mechanisms:

- Paradoxes, leading to inconsistent phenomena;
- Instability, leading to large effects from small changes;
- Incompatibility, leading to behavior that transcends rules;
- Connectivity, leading to behavior that cannot be decomposed into parts; and
- Emergence, leading to self-organizing patterns.

These mechanisms work across the dynamics of daily vehicle traffic, of consumer response to opportunity over a seasonal buying period such as Christmas or summer, of the labor market as firms start up, expand, contract, and shut down, and of industry responses to business opportunity, whether the industry is commercial real estate, entertainment, or retail.

The surprises that come from complexity force planners to grapple with three forms of uncertainty about the future (van der Heijden 1996):

- Risk, where the occurrence has historical precedent, and the probability of reoccurrence can at least be estimated.
- Structural uncertainties, where we can understand how a unique new event can happen, even though there is not enough experience to judge the likelihood.
- Unknowables, where a future event cannot even be imagined. The existence of unknowables calls for enhanced perception and skill in reacting appropriately.

FACTORS CAUSING COMPLEXITY IN URBAN TRANSPORTATION AND LAND USE PLANNING

Table 4-1 summarizes the substantive factors that should be accounted for in long-range transportation and land use planning. This list of sources of risk, uncertainty, and complexity is organized around a list of topics and categories that we created from our own observations and general reading about the forces that bear on how urban areas function. Many of these are complex in themselves, and some are obviously interrelated, which adds additional complexity. Aspects of this complexity are analyzed by Hibshoosh and Nicosia (1987), who describe how the dynamics of family life, employment, and other social institutions work individually and in combination to influence travel behavior.

It is important to note that many of these factors carry both a weight and direction in terms of their impact on metropolitan spatial form and travel patterns (Colby 1933). In other words, they differ in the effect they have on the compactness and integration of land uses. Some are centripetal, tending to produce lower densities and separation of uses, e.g., the need of families for affordable housing tends to move demand and growth to the periphery of an urban region. Others are centrifugal, tending to cause higher land use densities and an amalgamation of uses. This could be the case for some members of an aging population who seek to downsize their residence and find a location convenient to goods and services. The factors are vectors in mathematical terminology, and should be treated as such when used in a planning exercise.

Furthermore, the amount of change across any future time period cannot be very well predicted, and thus is a cause of the risk and uncertainty inherent in transportation planning. The new factors that might arise in Table 4-1 that are totally unexpected illustrate the potential for unknowables.

An understanding of these vectors is enhanced by both national and regional empirical data and other more subjective information. We have presented national data in our Task one report. Regional nonwork-related data for the case study region, the central Puget Sound area, is presented in the Task three report.

COMPLEXITY AND THE CURRENT PLANNING PROCESS

The results of metropolitan planning processes carried out by Metropolitan Planning Organizations (MPOs) are generally not infused with a recognition of the complexity and uncertainty that is underlined by the length of the list in Table 4-1. Metropolitan Transportation Plan (MTP) documents rarely describe and discuss the many risks and areas of uncertainty that result from the action and interaction of the factors listed. In particular, an emphasis on guiding development toward areas of currently existing and emerging areas of geographic concentration, and then connecting the areas with mass transit, does not obviously seem to embrace the need for flexibility to respond to unknowables.

Mierzejewski reaches a similar conclusion about the handling of complexity and uncertainty after a comprehensive survey of current planning and modeling approaches (Mierzejewski 1995, 1996, 1998a), and a close study of the planning efforts of 25 MPOs in Florida (Mierzejewski 1998b). He reviews the inability of travel demand models to accurately predict future travel patterns, and he suggests a need for new regional planning methods that take into account uncertainty and provide for flexibility in transportation investments and strategies.

Table 4-1. Sources of Complexity, Risk, and Uncertainty

Demographics/Socioeconomics
Net population change, including migration
Household size trends
Age profile, life span, and lifestyle
Income levels and distribution
Residential Dynamics

Table 4-1. Sources of Complexity, Risk, and Uncertainty (Continued)

Residential mobility
Preference for residential size, style, and environment
Regional distribution of housing costs
Effects of aging population
Preference for home ownership
Self-selection by transit riders
Household reaction to congestion
Employment/Education Dynamics
Industrial Structure
Spatial distribution of workplaces
Change in workday and week
Part-time and temporary work
Multiple jobholders
Self employment/work at home
Telecommuting/telelearning
Employer reaction to congestion
Work-based travel for work-related and other purposes
Population Distribution
Growth beyond central cities and counties
Intra-regional shifts
Inter-regional shifts
Older central city resurgence
Land Use Dynamics
Land use policies and regulations
Redevelopment and in fill development

Table 4-1. Sources of Complexity, Risk, and Uncertainty (Continued)

Open space preservation
Public reaction to density and mixed-use
Nonwork Activity
Variety and spatial distribution of "retail"
Local government need/competition for tax revenues on location
Trends in going out vs. staying at home
E-commerce
Freight and Goods Movement
Just-in-time delivery to industry
Home delivery of goods
Courier services
Changing load factors in trucks
Costs, Benefits, and Other Fiscal Factors
System capital and operating costs, including those for feeder
System utilization rate--new transit riders
Externalities, including delay time and wasted fuel
Direct private vehicle costs, including demand pricing
Net benefit (cost) of alternatives
Opportunity costs
Available government and private resources
Employer subsidization of alternative modes
Personal and Public Transportation Technology
Alternative fuels
Advanced vehicle propulsion technology
Advanced fixed-guideway systems

Table 4-1. Sources of Complexity, Risk, and Uncertainty (Continued)

Safety improvements
ITS applications
Other Technology Affecting Travel to Work and Nonwork Destinations
Teleconferencing
Electronic service delivery
Ubiquitous Internet
Virtual reality
Environmental Policy
Air quality standards
Greenhouse gases
Pollution from surface water runoff

Source: Integrated Transport Research and Global Telematics

LIMITATIONS OF CURRENT MPO MODELING

The response to complexity seen in the typical MPO planning processes (standardized in Federal laws such as ISTEA and TEA-21) yields a simplified geographic configuration consisting of travel analysis zones (TAZ) made up of three kinds of subzones where people to varying degrees sleep, work, and engage in buying goods and services. The usual four-step model used to describe movement among these zones and subzones is a series of equations calibrated to the latest available data on traffic flows and transit patronage. The model defines how land use is related to the movement of cars and transit vehicles. The basic structure of the model is then applied 20 or more years in the future against the same zones with projected estimates of who and what will be in the zones, based on assumptions for future residential population, employment, and kind of development. The mode by which people will travel in the future, car, train, bus, or walking is also estimated.

The modeling process carried out as described has a number of significant limitations (Nelson & Niles 1999), summarized in Table 4-2.

Table 4-2. Limitations of Four-Step Transportation Modeling Applied to Nonwork Travel

Characterizes nonwork travel as unlinked trips
Aggregates all nonwork purposes into one or two categories
Assumes that functional relationships between input data and nonwork activity are constant from the present to 30 years out in the future
Does not encompass all the presently known forces shaping consumer activities and destinations
Cannot be calibrated in the baseline historical year with nonwork activity data
Makes no allowance for consumer or retail industry response to congestion

Source: Integrated Transport Research

A planning methodology that exposes the considerable complexity in current and future transportation and land use patterns will consequently add to the uncertainty attached to regional models used to predict future patterns and transportation system performance. This should cause MPO planners to reconsider the application of models to long term prediction or, in the very least, should persuade them to introduce uncertainty into their modeling practice in their predictions of both continuous and discrete values.

CURRENT MAJOR PREMISE: GOVERNMENT ACTION SHAPES URBAN FORM

The overarching paradigm and set of policies governing all the assumptions in MPO planning is a government plan for changing transportation and land use in the future—typically, new roads, expanded public transportation systems, and more density near the places to be served by public transportation.

The very common TOD-rail paradigm that is considered a front-edge planning practice in alignment with Smart Growth principles is essentially a high-stakes gamble that in the long-run, government investment, incentives, and rules will cause the density of population, employment, and service offerings to increase around a network of transit stations. This density boost on top of the

availability of transit capacity is assumed in the future to cause a reduction in driving, to be replaced by transit use, walking, and bicycling.

Ironically, while the TOD paradigm responds to the complexity of the marketplace, technology, and entrepreneurial behavior with a seemingly elegant concept, TOD also introduces additional complexity to both urban development and the lives of individuals:

- Mixed-use buildings in a dense configuration are more complex to construct and operate than single uses in a more dispersed configuration (City of Seattle 1999).
- Experience has shown that mixed-use TOD projects introduce complications to the development process. For example, as Boarnet et al (1997, 1998, 1999) have found in California that local governments that are pursuing the TOD-rail paradigm seek to maximize their tax revenue by emphasizing commercial and minimizing housing near transit stops. In most cases they pursue local needs over regional policies.
- For travelers, journeys involving transfers at transit stations between modes or vehicles are often more complex and time-consuming than single-mode auto journeys.
- Visible stores in a traditional mall with parking may be easier for more consumers to find and use more of the time than multilevel retail space packed around a train station.

One track for urban transportation improvement, of course, is to work to overcome these complexities inherent in TOD. But even doing that does not reduce the real risk that TOD—even if very well done—may not be able to change the travel behavior of enough people in a region to make any difference in the environmental quality that people care about. Our conclusion from the findings presented so far is that the time is right for a new, structured examination of the assumptions and results of the MPO's planning work. A new process could take advantage of the existing modeling, design-oriented visioning, and other MPO practices, but then bring an additional focus on the complexity in metropolitan markets and nonwork travel, and the resulting uncertainty about the future. The results of a supplementary process, described below, could then be melded into the results of the MPO planning process for a more robust result in the face of risk, uncertainty, and unknowables. The new planning process could generate a range of possible future scenarios that go beyond TOD, that could serve an alternative or supplementary response to growing complexity and the manifestly uncertain impact of present TOD policies designed to achieve goals.

KEY ELEMENTS OF A NEW NONWORK TRAVEL PLANNING PROCESS

We call the new approach the Nonwork Travel Improvement Planning Process (NWTIPP). These are the definitions of terms we commonly use:

- Premise: The assumptions about how the world operates that stand behind paradigms, scenarios, and policies. A common main premise in MPO transportation planning is that government over several decades can influence land use to change sufficiently to cause modifications in household behavior that show up as a regional shift in travel mode.
- Paradigm: A vision of how society could work if certain premises about individual and organizational behavior hold true and if certain policies are implemented. TOD is a paradigm that follows from the main premise in MPO transportation planning.
- Scenario: Summary description of patterns of events in the future, as influenced by uncontrollable external forces and by public policies and spending. Scenarios are alternate implementation paths for paradigms. An example of a scenario: Developers of retail space changing their focus from customers arriving by automobile to customers arriving by transit.
- Policy or strategy: Broad principles that guide action by government and the private sectors, often in pursuit of a paradigm, as in the case of transportation planning. Investment in rail mass transit to influence future land use is an example of a policy or strategy. In the private sector, “strategy” has a connotation of taking competitive behavior into account, whereas “policy” does not.
- Program or tactic: Specific action that conforms to and implements policy or strategy. The detail of zoning and design requirements around a transit station is an example.

One objective in the design of the NWTIPP is to create a planning template that is capable of identifying strengths and weaknesses in the main premise behind the TOD-rail paradigm. In detail, the main premise is that low-density, single-use urban form can be reshaped by government action—rail (mass) transit investments and land use policies/strategies—to result in compact, mixed-use urban form that in turn supports and justifies the rail investment by producing new transit riders.

Example statements that summarize the TOD-rail paradigm are shown in Table 4-3. They range from general to specific and from national to regional to local. The first is from a meeting of U.S. planning professionals and local

government officials in 1991, the second from a metropolitan planning organization, and the third from a city planning department. In the case of the Puget Sound Regional Council statement, "transit" refers to a mix of light rail, express buses, and local buses. Viewed in light of the previous chapters, these statements together represent good intentions of well-meaning leaders to change the way businesses operate and people live their lives, despite the challenge of market forces that work in different directions.

Table 4-3. The TOD Paradigm: From General to Specific

Congress of New Urbanism: The Ahwahnee Principles **Guidelines for New Urbanism Development — Community Principles** "Community size should be designed so that housing, jobs, daily needs, and other activities are within walking distance of one another." "As many activities as possible should be located within easy walking distance of transit stops." Source: Local Government Commission 1992
Puget Sound Regional Council – Vision 2020 Plan for Urban Centers "The VISION 2020 strategy is to reinforce and diversify our existing urban centers ... to build an environment that will attract residents and businesses to the advantages it offers. These advantages include excellent access to frequent and fast transit that connects to other centers and to surrounding neighborhoods, a selection of attractive and well-designed residences, and proximity to a diverse collection of services, shopping, recreation and jobs." Source: Puget Sound Regional Council 1995
City of Seattle Transportation Strategic Plan – October 1998 "Support Development of 'Full Service' Neighborhood Business Districts." "This strategy promotes shopping within neighborhoods by helping Seattle's urban villages to offer a full range of products and services to meet people's day-to-day needs." Source: City of Seattle 1998

We think a good planning process needs to consider alternative premises: for example, that the forces at large in the marketplace are too numerous and strong for government actions to reshape regional form and modes of travel to any meaningful degree. Following from revised premises, the NWTIPP would be able to identify alternative paradigms, scenarios, and policies/strategies.

Premise and Paradigms are a Planning Choice

Table 4-4 illustrates how the recognition of a broad premise—that government action can make a difference—leads to the opportunity to choose among a variety of paradigms and strategies that may reduce automobility and its impacts. Note that we take account of cost in classifying the strategies for a particular paradigm. The pursuit of one strategy may consume so many public dollars that the opportunity to pursue other strategies is lost because of insufficient resources. In short, every strategy carries with it an *opportunity cost*.

Although the paradigms and strategies listed in Table 4-4 appear to encompass a broad range of possibilities, the listings in the table are intended to serve only as examples. And as we continually emphasize, the planning process may choose to begin with a wholly different premise regarding the efficacy of public transit construction to shape land use and the resulting regional market share of transit and walking modes.

Other characteristics we have designed into the NWTIPP:

- **An emphasis on continuous learning by participants in the planning process.**

From analyzing urban development in California as a complex system, Innes and Booher (1999) conclude that more sustainable urban development will come from learning that is generated from the individual interactions of system participants. They note that "sustainability is about process, not about a particular vision, pattern, set of rules, or criterion."

Table 4-4. Policy Paradigm Choices and Strategies in Government Action that Address Growing Urban Automobile Usage

Paradigm	Strategy Examples Classified by Relative Cost			
	Higher Cost	Moderate Cost	Lower Cost	Incremental
Improve or promote transit to increase its market share in the competition with cars	Rail construction	Bus rapid transit; park and ride lots	Increase frequency and quality of existing transit service	Subsidies and incentives for bus pass distribution, carpools, and vanpools

Table 4-4. Policy Paradigm Choices and Strategies in Government Action that Address Growing Urban Automobile Usage (Continued)

Paradigm	Strategy Examples Classified by Relative Cost			
	Higher Cost	Moderate Cost	Lower Cost	Incremental
Change land use to stimulate more walking and transit use and constrain car use	TOD at new transit stations	TOD at existing transit centers	Limit parking spaces at new developments if served by transit	Prohibit zoning that limits apartment development in areas served by transit
Accommodate cars and other vehicles by increasing road capacity	Build new roads	Intelligent Transportation Systems (ITS) applications	Widening, intersection improvement and better signalization	Maintain existing roads to quality standards; build more only in proportion to population growth
Reduce pollution from cars to make their use less damaging	Buy back old, polluting vehicles	Promote the use of zero-emission vehicles	Annual emissions inspections	Spot detection and citation of polluting vehicles
Constrain automobility to reduce use of cars	Congestion pricing on existing highways	Tolls to finance new highways	Traffic calming	Raise taxes and fees on gasoline or cars
Preserve open space and sensitive lands	Extensive government land purchase	Moderate land purchase	Purchase of development rights	Require cluster development and dedicated open space

Note: Shaded two cells together constitute the Rail-TOD paradigm. Paradigms and strategy elements are illustrative. They can be mixed and matched in various combinations. The main point is to illustrate the wide range of choices available.

Source: Integrated Transport Research

Based on the findings described earlier in this report, we conclude that a uniform, nationwide planning model imposed by the Federal Government on complex metropolitan transportation development may not yield sufficient learning to successfully address the complex problems at hand.

- **Explicit focus on nonwork travel.**

As fully described earlier, travel for shopping, eating out, culture, and recreation constitutes the majority of urban trips and these activities are a very important shaper of urban form. Our process also includes the residential and employment site location dynamics—the places where nonwork trips either originate or terminate.

- **Metro-region-wide process.**

Many retailers now think in terms of total metropolitan areas, so we recommend that thinking about nonwork travel improvement be focused on this scale as well, instead of at the corridor level or subarea level like the Major Investment Studies (MIS) carried out under ISTEA and now merged into Environmental Impact Statements (EIS) as a result of TEA-21. For TOD in particular, much of the research and planning focus is now carried on at the station-area level, rather than at the level of comprehending regional impacts.

- **Explicit recognition that not making an additional transportation investment, or doing less than initially contemplated, may be the most desirable alternative.**

There are two reasons for this recognition—(1) people can adapt to reduced transportation services by using alternative locations and behaviors, and (2) there are productive, non-transportation purposes for spending the money that is diverted from transportation-related spending, with some of these purposes serving the same needs that transportation spending would fulfill.

As a general example, it may make more sense to build a new shopping center close by to a residential community that lacks adequate roads to a distant shopping center, rather than expanding the road capacity to the existing shopping center. By putting limits on transportation spending, the planning process remains open to the larger array of issues and options in which transportation planning is embedded.

- **May be carried out by Metropolitan Planning Organizations (MPOs), but more likely to be carried out initially by civic interests not officially sanctioned by the MPO.**

MPOs are generally deeply invested in a limited set of options. The opportunity for designing new alternatives is most likely to come from a new set of actors. If not carried out by an MPO, the end result of the planning process will have influence on official decision making to the degree that the analysis carries the authority of expert knowledge and persuasive reasoning.

- **Will not necessarily follow federal planning guidelines, programs, and other requirements for transportation planning by MPOs.**

Figure 4-1 depicts a general representation of the urban transportation planning process carried out by MPOs, as described by Pas (1995). The NWTIPP we describe below emphasizes just the underlined portions of the overall process, in addition to the focus on nonwork travel. The Planning Team may recommend changes in federal requirements if they appear to block the execution of a superior planning process and set of resulting outcomes. Table 4-5 makes a comparison between the NWTIPP and the typical Metropolitan Transportation Plan carried out by MPOs.

- **Able to work within a more time-constrained planning horizon than the 20 years mandated by the U.S. government for a Metropolitan Transportation Plan, and much more constrained than the 30 to 50 year time frame utilized by some MPOs.**

We have stressed the complexity of the urban milieu that governs human activity and transportation, and entrepreneurial real estate development and consumer service offerings. The rapidly emerging Internet economy adds to the complexity. While planning for capital-intensive transportation infrastructure such as bridges, tunnels, freeways, and rail systems certainly calls for a multi-decade planning horizon, we note that options for transportation improvement need not be limited to capital expenditures of this type. We find the notion of putting all transportation planning into a multi-decade framework troubling, because the result may be an unnecessary

emphasis on capital expenditures, and a variety of lower cost, more short-term options may remain unconsidered.

Table 4-5. Comparison between the Proposed Transportation System Improvement Planning Process, and the Current Metropolitan Transportation Planning Process (MTP)

MTP	NWTIPP
Carried out by MPO under legal mandates	Possibly carried out by MPO, but more likely to be carried out initially by other civic interests
Legal basis for regional transportation investments	Potential influence on investments based on quality of planning results
Based on Federal regulatory requirements	Not constrained by Federal regulations
Seeks to optimize the morning peak period	Can be focused on other problems and issues
20+ year time horizon mandatory	Shorter time horizons possible and preferred
Typically begins with a paradigm such as rail-TOD or new road projects and seeks to justify that paradigm	Seeks to find better paradigms to address problems of public policy importance
Centered on the 4-step urban transportation model	4-step model results are just one input

Source: Integrated Transport Research

URBAN TRANSPORTATION PLANNING PROCESS

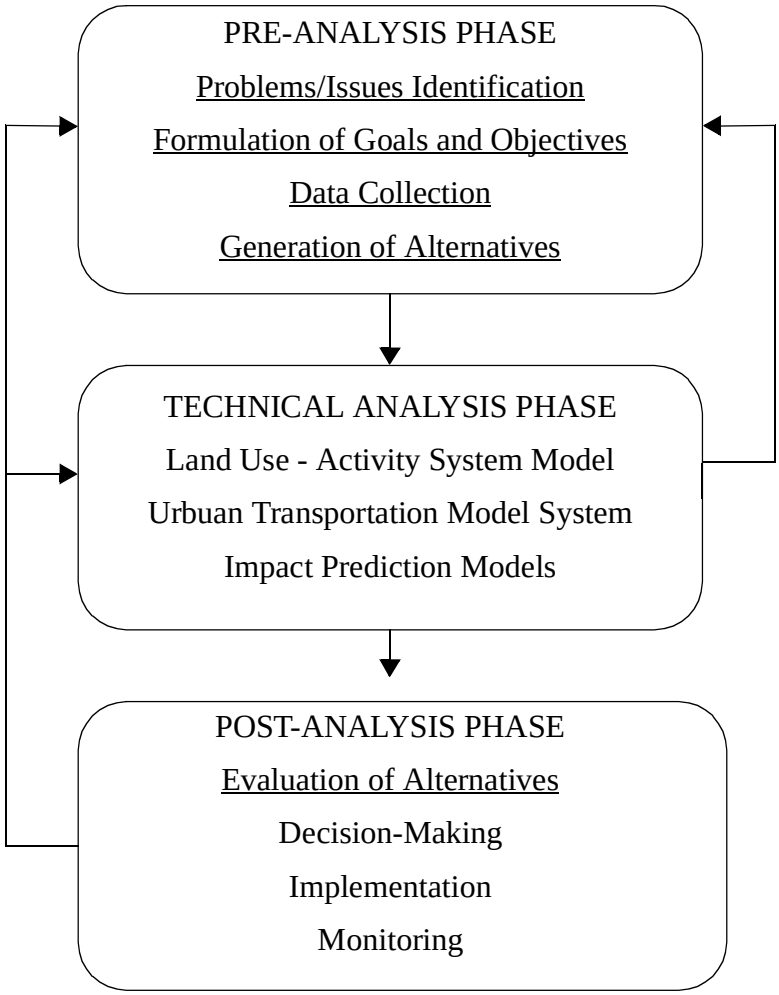


Figure 4-1. Urban Transportation Planning Process Flow Chart

Source: Pas 1995

Planning for more incremental expenditures may provide a more flexible response to an uncertain future, as opposed to demonstrating an heroic but ill-founded attempt to shape the future with steel and concrete built for the ages. With longer time horizons, solutions that are more easily implemented and

more flexible may be ignored in comparison to solutions that appear to be more durable and long-lasting, yet less effective in terms of public benefits (Zwerling 1974).

The reason that a more time-constrained planning horizon may be preferable in the case of the transportation planning overlay we are recommending goes beyond the uncertainty about the future that is inherent in a complex system. The accelerating rate of change of the system adds to the uncertainty. The volume curves for several drivers of our society at the end of the century show accelerating rates of growth—transistors in a microchip, Internet hosts, Internet web sites, volume of online shopping, business-to-business electronic commerce, and e-mail messages.

- **Generates and supports strategies and policies that are flexible and adaptable.**

Given the complexity of urban development and of the market economy that drives development, we expect that premises may need to be modified with the passage of time as a result of new understanding about the way the metropolitan area is functioning, and about the impact of public policies. The ability of a policy to change as premises and paradigms change is a measure of the policy's ability to achieve objectives and solve problems under an array of scenarios that may not be in government's control.

- **Incorporates predictive models that are transparent.**

The four-step, gravity-analog transportation models that are at the heart of MPO transportation planning are notoriously obscure for the non-specialist. We believe it is important to carry out additional processing on the raw outcomes from these models.

Assumptions, simplifications, and their impact on accuracy need to be apparent and outside the complex inner workings of the "black box" computer model.

- **Provides outputs as a range, in addition to discrete "point estimate" values.**

In practice, many MPO planners use their transportation models to issue only single values, rather than ranges. This practice portrays the estimates of transportation performance several decades in the future as more precise that they really are. Providing "predictive intervals" is educational as to the degree of uncertainty about the future.

- **Acknowledges and manages all technical transportation system alternatives — immediately feasible or not.**

Individual members of the public and the media are very interested in the prospect of advanced transportation systems. Businesses around the world have new options on the drawing board. A higher level of public involvement will result if a fairly open process of considering all technical transportation options is maintained. These can be handled fairly through a consideration of their performance and cost parameters. We observe that transportation planning in practice focuses very quickly and conservatively on a rather narrow range of technical alternatives—light rail, commuter rail, and standard buses.

- **Comes to grips with the emergence of the Internet economy, widely deployed microcomputers, ubiquitous personal communications, and other likely technology expansions over the next five years, and the decades beyond.**

The rise of the network economy is already a distinctive feature of the present era. The ubiquitous presence and use of computers and telecommunications is not yet mentioned in very many Metropolitan Transportation Plans, yet already is producing impacts on transportation. The routine use of cellular phones in cars is increasing the value of time alone in a moving automobile, for example. The continuing growth in small package delivery services in urban areas is another example, along with the announcement of billions of dollars in warehouse construction by firms selling goods on the Internet. The growing impacts from online selling on particular categories of retail businesses—bookstores, automobile dealers, and travel agencies—is a third illustration.

- **Accounts for the range of costs and benefits of the various scenarios that will arise from each examined alternative paradigm and its associated policies.**

This accounting also should describe the public costs and potential revenue sources to implement the policies.

CHAPTER FIVE

BACKCASTING DELPHI: A PLANNING TOOL FOR A COMPLEX PRESENT AND AN UNCERTAIN FUTURE

INTRODUCTION

This chapter provides a description of the template for the Nonwork Travel Improvement Planning Process (NWTIPP) that implements the characteristics we described in the previous chapter. We designed the methodology, a modification of the Delphi process, after a search of the planning literature to find an approach with a scope that matches the complex and dynamic scope of the urban transportation planning problem. As described earlier, we see the NWTIPP as an overlay and complement to the existing, well-established, government-mandated Metropolitan Transportation Plan (MTP) processes. The recommended steps listed here could certainly be carried out by existing Metropolitan Planning Organization (MPO) staff if they chose to do so. We would encourage that outcome. More likely, however, a new set of regional players from among the civic leadership of a metropolitan region would need to step forward to implement our recommendations.

THE DELPHI METHOD

An existing, well-tested group process that we recommend be adapted to meet the requirements listed in Chapter 4 is the Delphi expert panel, a technique originally developed at the Rand Corporation in the early 1950s. A Delphi panel is a structured interaction among the members of a group with different kinds of expertise that allows a consensus—or possibly very explicit points of divergence—to be reached on judgments about a complex topic, typically a forecasting problem.

In standard Delphi methodology, all responses to a given set of question on the problem are compiled in a feedback document, with display of the reasons for responses that deviate from an emerging consensus average. The feedback document is sent back to each participant, each of whom is now given the opportunity to change opinion and provide new responses based on what others have said that is persuasive. If a response will lie outside the average found in the previous iteration, the respondent is asked to supply supporting information. The goal is to achieve consensus among the experts as they learn from each other. Consensus is typically achieved after three to five rounds of feedback and response (Irving and Conrath 1988).

Khan, who has reviewed available methodologies for transportation policy and planning decision making, views the Delphi process as capable of dealing with uncertainties in factors that determine future travel demand and the technical performance of transportation systems (Khan 1989). He suggests that through group assessment and the application of decision theory, available information can be better utilized and more flexible plans are produced that can adapt to a range of future requirements.

Backcasting Delphi

Traditionally, Delphi has been used in making forecasts of the future. Backcasting, on the other hand, makes judgments about the steps needed to reach a desired future state of affairs. In the NWTIPP, we are somewhat interested in forecasting and even more interested in backcasting. In the context of the NWTIPP, backcasting means bringing goals, resources available to effect change, the reality of activity and movement, the feasibility of changes, and public policy recommendations all into alignment. A Backcasting Delphi panel works backwards from the problem and desired outcome—reduced traffic congestion, for example—to determine if it is feasible, and then assesses necessary policies and other inputs that will produce the outcome or a set of potentially feasible alternative solutions on which experts have agreed to disagree. When consensus cannot be reached on proposed solutions, alternative solutions are brought forward, or else some aspect of the goal is changed based on new knowledge (Robinson 1990, Dreborg 1996).

Table 5-1 summarizes Delphi and backcasting, the combination of which is a distinct feature of the proposed planning template.

Table 5-1. The Components of Delphi Backcasting

Delphi: Diverse expert opinion collected from a group and iteratively presented as feedback to the group to modify opinions and converge on a consensus.
Backcasting: Working backward from a particular desirable future endpoint to determine the feasibility of that future and what policy measures would be required to reach it.

Source: Integrated Transport Research

Note that “backcasting” is *not* used here in the sense of transportation planners calibrating their traffic forecast models by adjusting parameters to make the

models conform to already available input and output data describing the baseline year and the forecast year.

PREVIOUS APPLICATIONS OF DELPHI METHOD TO TRANSPORTATION AND LAND USE

Backcasting and Delphi have been applied separately and together to transportation futures, principally in Europe and Canada. Hojer (1998) used Backcasting Delphi to study the feasibility and effectiveness of three alternative passenger transportation scenarios: improved road system with user fees, improved public transit through rider information, and a hypothetical dual mode system which combines the flexibility of the private car with the capacity of public transport.

Backcasting Delphi was also employed by Marchau and van der Heijden (1998) to explore the likely benefits of driver support systems. Cooper et al (1974) used the Delphi technique to study the likelihood of future environmentally desirable developments in transportation.

An application of Delphi somewhat similar to its proposed use in supplementing MPO planning for TOD was the study by Cavalli-Sforza and Ortolano (1984). These investigators used the Delphi method to predict the impacts of three alternative transportation programs in Santa Clara County (San Jose) California. Three alternative transportation improvement scenarios were evaluated: highway improvements, highway improvements with HOV lanes, and highway improvements plus a light rail system supported by zoning changes at stations. Each of the alternatives also involved a bus system improvement plan. Forecasts of residential land use and choice of transit mode were made for 1990 and 2000, from 1978 baseline data.

A related point of familiarity is that expert panels are routinely employed by MPOs to predict future land use patterns that are used as inputs in regional travel demand modeling. Although perhaps not a formal Delphi method, local planners are asked to estimate the distribution and of new residential population and employment out 20 to 30 years.

SCOPE OF THE PROPOSED METHOD

In the NWTIPP, we envision engaging a multidisciplinary panel with expertise collectively to understand the many areas of substantive knowledge and experience that bear on the key factors necessarily considered in transportation and land use planning, listed comprehensively in Table 4-1. We call this panel the Expert Advisory Group (EAG).

We recommend that the EAG consist of at least fifteen persons with a range of diverse expertise that bears on an assessment of consumer activities and nonwork travel in the present and the future. Areas of useful expertise for this group are shown in Table 5-2.

Table 5-2. Areas of Expertise for the Expert Advisory Group

Regional economics
Population demographics
Retail business strategy and store location planning
Consumer behavior regarding spatial choice in shopping, residential preference
Leisure and recreation
Behavioral characteristics of key segments: by age range, ethnicity, income group
Public opinion analysis
Electronic commerce: telework and teleshopping
Commercial real estate development, leasing, appraisal
Residential real estate development, marketing, appraisal
Public transit planning
Highway planning
Intelligent Transportation Systems (ITS)
Personal travel behavior
Freight logistics
Rideshare/vanpool promotion and coordination
Local government lawmaking and regulation
Urban land use planning
Architecture
Urban geography

Table 5-2. Areas of Expertise for the Expert Advisory Group (Continued)

Environmental quality
Cost-benefit analysis
Dynamics of citizens' land use objections

Source: Integrated Transport Research

Before the backcasting exercise in NWTIPP, we have specified two forecasting exercises to orient the panelists to the overall transportation planning topic and the process of providing opinions and receiving feedback. We envision that a draft problem statement, set of alternative solutions, and framework for evaluation would be initially provided by a professional planning team at the beginning of the backcasting procedure. The panelists themselves as independent authorities would have the opportunity to modify all inputs in the pursuit of a better way of approaching the problems of urban transportation.

ADVANTAGES OF BACKCASTING DELPHI

Within the context of the NWTIPP overlay on existing MPO processes, and for the purpose of TOD reassessment and new approaches to nonwork travel, Backcasting Delphi provides several advantages over other methods. In the ideal case, it would precede decisions to invest in capital-intensive transit capacity such as light rail. It would allow involvement of a broader range of expertise than is normally the case in transportation and land use planning. For example, retail industry analysts, commercial real estate portfolio managers, and consumer market researchers would have equal status with regional transportation planners. Many more of the significant forces shaping urban form would be considered. The process would allow setting a planning horizon that reflects the uncertainty inherent in these forces. The land use-transportation scenarios evaluated would not be limited to the regional planning vision and to typical "no-build" and "build" transportation alternatives.

Within many of the areas of expertise that bear on understanding urban activities, movement demands, and transportation and land use options, there are divergent opinions among experts. The results of the Delphi process will be dependent on the specific point of view of the individual representative experts selected. This introduces some uncertainty into the outcome of the planning process, which we do not regard as a bad event.

Through the iterative process, both capital-intensive and low-cost incentive and marketing solutions would be considered until a consensus is reached on

one or even several scenarios that are compatible with the forces shaping the urban environment. With appropriate framing, broader social equity questions would be considered, as well as a range of opportunity costs.

The attributes of Backcasting Delphi are summarized in Table 5-3.

Table 5-3. Attributes of Backcasting Delphi

Embraces multiple disciplines of expertise
Considers all forces shaping urban form
Incorporates all environmental and economic dimensions
Allows for iteration to reach policy consensus
Can be executed at any geographic scale, including across multiple jurisdictions
Understandable by a wider audience than is four-step transportation modeling as practiced by MPOs

Source: Integrated Transport Research

THE TEMPLATE: IMPLEMENTING BACKCASTING DELPHI IN A NEW PLANNING PROCESS

The NWTIPP is presented in this research effort as a planning "template," that is, a set of guidelines and elements, that indicate how to augment and modify an MPO-created Metropolitan Transportation Plan (MTP) to reflect more accurately and comprehensively the existence and characteristics of nonwork activities and trips. The heart of the proposed process is interaction between a small core Planning Team and the Expert Advisory Group that will carry out a focused environmental assessment and a public policy backcast using a structured Delphi Backcasting technique of opinion-gathering and feedback. As this planning exercise proceeds, it is quite likely that the participants will modify it to fit the circumstances of the metropolitan region. Thus, the template is described next with a minimum of detail. Somewhat more detail than is presented here is provided in the Task six report from this project, posted at http://www.globaltelematics.com/mineta/.

Table 5-4. Components of the Nonwork Travel Improvement Planning Process (NWTIPP)

Charter that establishes the sponsorship and mission of the NWTIPP.
Expert Advisory Group that brings diverse knowledge to the improvement of transportation planning for urban nonwork travel.
Professional Planning Team to carry out a knowledge acquisition and dissemination process and to facilitate the knowledge generation activities of the Expert Advisory Group.
Knowledge Management Process that initiates, refines, expands, and disseminates a Knowledge Base.
Initial Knowledge Base that includes the findings from this project, plus a region-specific database like the prototype presented in the third report of this project, and that will expand throughout the project.
Delphi process for eliciting structured opinions and justifications from the Expert Advisory Group; backcasting orientation brings goals, policies, and market conditions into alignment.

Source: Integrated Transport Research

COMPONENTS, PHASES, AND TASKS OF THE NWTIPP

The key components of the NWTIPP are listed in Table 5-4. The NWTIPP consists of fourteen steps, organized into the five distinct phases, all listed in Table 5-5.

Table 5-5. Phases and Tasks of the Nonwork Travel Improvement Planning Process

Phase 1: Process Initiation	
Task 1-1:	NWTIPP Planning Team chartered and organized
Task 1-2:	Planning Team assembles Knowledge Base
Task 1-3:	Planning Team recruits Expert Advisory Group

Table 5-5. Phases and Tasks of the Nonwork Travel Improvement Planning Process (Continued)

Phase 2: Orientation of Expert Advisory Group Task 2-1: Expert Advisory Group receives and assimilates initial Knowledge Base in preparation for meeting Task 2-2: Planning Team and Expert Advisory Group meet face-to-face for team building and exchanging viewpoints Task 2-3: Planning Team modifies initial Knowledge Base and adjusts remaining processes in response to Expert Advisory Group feedback
Phase 3: Consideration of consumer activities and nonwork travel scenarios Task 3-1: Planning Team facilitates Expert Advisory Group's web-based Delphi review process on consumer activities and nonwork travel scenarios Task 3-2: Planning Team modifies the Knowledge Base in response to the Expert Advisory Group's Delphi findings
Phase 4: Development of public policy objectives and action alternatives Task 4-1: Planning Team compiles draft public policy objectives for nonwork travel Task 4-2: Planning Team creates draft action alternatives to meet nonwork travel policy objectives Task 4-3: Planning Team facilitates Expert Advisory Group's web-based Delphi Backcasting process on objectives and action alternatives Task 4-4: Planning Team modifies objectives and finalizes action alternatives based on Expert Advisory Group's Delphi Backcasting outcome
Phase 5: Process completion: Evaluation and dissemination of results Task 5-1: Planning Team prepares reporting documents on results of NWTIPP Task 5-2: Planning Team and Expert Advisory Group evaluate the NWTIPP just completed

Source: Integrated Transport Research

FURTHER DETAIL ON THE TASKS OF THE NWTIPP

The following is a brief preliminary sketch of the work steps of a prototype Nonwork Travel Improvement Planning Process that meets the requirements set out earlier in this report. More detail is provided in the Task 6 report at http://www.globaltelematics.com/mineta.com/.

Phase 1: Process Initiation

Task 1-1: NWTIPP Planning Team Chartered and Organized

The basic requirement for proceeding with an NWTIPP is its chartering and the commitment of resources to compensate and otherwise support the professional Planning Team. The source of resources could be a government agency or legislative body, foundation, corporation, or individual.

We envision that the Planning Team (PT) would consist of at least one full-time project management professional as Team Leader and enough other personnel to equal one and one half additional Full Time Equivalent persons. We recommend that the Planning Team organize around the following full and part-time roles: research coordinator, student intern supervisor, liaison with MPO, public involvement coordinator, web master, and Expert Advisory Group coordinator. At least half of the members of the Planning Team should have transportation planning experience, although it will be useful that some have relevant experience outside of transportation planning.

Task 1-2: Planning Team Assembles Knowledge Base

The Planning Team should carry out its work in a framework of knowledge management (Cortada 1999, Heide 1996). The PT will be continually augmenting a Knowledge Base (KB) that is made available to the Expert Advisory Group and other interested parties. The conclusions of the EAG will be part of the KB also. We recommend presenting this KB as a well indexed, well summarized, cross-linked series of documents on the World Wide Web.

The KB would begin with an updated *review of academic research focused* on land use, transportation, and the TOD paradigm, as was begun by the present project in the review of literature in the appendix.

Other important parts of the Knowledge Base:

- Review of the forces shaping the future of retail.
- Assessment of present and future consumer activities.
- Descriptive data on present land use and land use trends underway.
- List of the exogenous forces likely to be shaping the retail land use and activity in the region over the next five to ten years.

- Information on how and why people travel now.
- The current Metropolitan Transportation Plan by the MPO .
- “Present commitments” land use map of the region in the MPO's planning horizon year.
- Assessment of significant transportation-related actions to be taken by governments, large employers, and significant trip-attraction sites.
- Overview of the available financial resources to pay for government implementation of transportation capital construction and services.
- All of the information described above should be rolled up by the Planning Team into a series of alternative, descriptive draft scenarios on the future of nonwork travel in the region.

Task 1-3: Planning Team Recruits Expert Advisory Group

As a central feature of the NWTIPP, the Planning Team interacts with a specially recruited panel of at least 15 experts we call the Expert Advisory Group (EAG). The EAG will carry out an initial review of the Knowledge Base at the beginning of their work, plus two Delphi exercises that assess and expand upon critical additions to the KB made by the PT. Earlier in Table 5-2 we specified the expertise of the EAG.

Phase 2: Orientation of Expert Advisory Group

Task 2-1: Expert Advisory Group receives and assimilates initial Knowledge Base in preparation for meeting

The EAG will be provided immediately with Internet web access to the structured Knowledge Base, with their attention initially invited toward the mission of the NWTIPP, an overview of the process that is planned to be followed, and a baseline set of findings and conclusions from previous literature on consumer activities and nonwork travel. Over a period of a month or so, each member of the EAG would need to have a working familiarity with the full range of material in the initial KB as sketched in Task 1-2 earlier.

Task 2-2: Planning Team and Expert Advisory Group meet face-to-face for team building and exchanging viewpoints

In general, because we recommend the use of a web-enabled Delphi process, the PT and the EAG do not need to do their work in a face-to-face fashion. However, we do recommend one early face-to-face meeting of the EAG and the Planning Team to gain a common understanding of the NWTIPP to motivate a high level of participation and to build mutual understanding and trust.

This meeting would be an important opportunity for the EAG members to learn about the Delphi process to be used, and to provide feedback on the initial Knowledge Base and on the planned Delphi activities over the coming months of activity. The face-to-face meeting should result in a common understanding by the EAG and Planning Team on problem definition, and the range and scope of the premises, paradigms, and strategies that the NWTIPP will encompass.

Task 2-3: Planning Team modifies initial Knowledge Base and adjusts remaining processes in response to Expert Advisory Group feedback
In response to information received during the face-to-face meeting between the EAG and the PT, the PT would in this step take steps to augment the KB with additional information requested by the EAG. The PT would also make adjustments in the planned Delphi processes to take into account suggestions made by the EAG members about those processes.

Phase 3: Consideration of Consumer Activities and Nonwork Travel Scenarios

Task 3-1: Planning Team facilitates Expert Advisory Group's web-based Delphi review process on consumer activities and nonwork travel scenarios
In this step, the Planning Team facilitates the Expert Advisory Group's Delphi review process on consumer activities and future nonwork travel scenarios. This facilitation requires providing the EAG with structured information on a series of options for these activities and scenarios that the members can validate, refine, qualify, extend, or endorse.

The EAG members would be encouraged to ask for additional information as they see fit from the Planning Team or anyone else. Information requested by one EAG member would be made available to all members. We would expect that the specialists on the EAG would come up with descriptions of many areas of risk and uncertainty that should be incorporated into the Knowledge Base.

Developing conclusions on important trends defining consumer activities over the next five to ten years in the region is the first desired result from the Delphi process to be exercised with the EAG. Under the guidance of the PT, over one to three iterations, the EAG would review, comment on, add to, and vote on a structured list of potential trends provided by the PT.

Simultaneously and in coordination with this review of trends, as a second component of the Delphi exercise, the EAG would review, comment on, add to, and vote on a number of scenarios on future regional nonwork trip-making for consumer activities, as prepared by the PT.

Task 3-2: Planning Team modifies the Knowledge Base in response to the Expert Advisory Group's Delphi findings

After the EAG has reached its conclusions on consumer activities and nonwork travel scenarios, the PT will incorporate the results of the Delphi process into the KB.

Phase 4: Development of Public Policy Objectives and Action Alternatives

Task 4-1: Planning Team compiles draft public policy objectives for nonwork travel

In this step, only after gaining insight into the nature of the urban environment as described in this project, the Planning Team establishes draft public policy objectives for nonwork travel. This means defining the problem or problems that the government is capable of addressing in its transportation and land use policy, and how one would know the extent to which the problems are solved. Reduce the congestion caused by the growth of nonwork travel? Reduce air and water pollution from vehicular travel? Preserve and protect environmental values? Increase the quality of urban life, including opportunities for home ownership with desired amenities? The objectives may go beyond those in the MTP. To the degree possible, the PT should work with regional decision makers to understand and incorporate their views into the draft objectives.

The objective for nonwork travel may be the same as the objective for *all* travel in the region. It may be that the public policy objective for nonwork travel is related to land-use; freezing the number of major decentralized shopping destinations, for example.

The statement of the objectives that the NWTIPP can reasonably address also needs to specify how to measure these problems in a base year and in a defined out year, and how success in the resolution of these problems will be judged in the out year. As stated before, it is also important that financial budget limitations be recognized in the statement of objectives.

Task 4-2: Planning Team creates draft action alternatives to meet nonwork travel policy objectives

In this step, the Planning Team would formulate one or more paradigms and the associated policy packages that would potentially cause the region to achieve the draft objectives defined in the previous step. The output of this step is a draft list from the Planning Team of three to five effective and efficient policy packages intended to impact transportation performance in the out year for submission to the EAG.

Planners carrying out this NWTIPP template may want to include TOD as one of the alternative paradigms, but they should be free to design and choose whatever alternatives fit the circumstances of the region that is the focus.

Task 4-3: Planning Team facilitates Expert Advisory Group's web-based Delphi Backcasting process on objectives and action alternatives
In this critical portion of the NWTIPP, the focus for the Expert Advisory Group would be on judging the effectiveness and cost-effectiveness of different policy packages developed by the PT. By cost-effectiveness, we mean consideration of what transportation performance or what amount of problem resolution is delivered for each dollar of cost. Cost-effectiveness may well have to be estimated, and different policy packages may offer different kinds of performance, so comparing packages may well be subjective.

The recommended policy package may end up being one suggested by the Planning Team, or it may be an alternative policy design. Under the backcasting protocol that is part of this step, the PT must be ready to accommodate an adjustment of the problem definition or at least of the public policy objectives associated with the definition, if the EAG is unable to find a set of policies and associated actions that is likely to solve the defined problem within a cost that is reasonable given available resources.

Task 4-4: Planning Team modifies objectives and finalizes action alternatives based on Expert Advisory Group’s Delphi Backcasting outcome
After two to three iterative rounds of Delphi consideration by the EAG that reaches consensus or at least a stable point of non-consensus, the PT would end the EAG process and add what was learned from their deliberations to the KB.

Phase 5: Process Completion

Task 5-1: Planning Team prepares reporting documents on results of NWTIPP
If this template works as designed, a refined, winnowed package of policy initiatives will be the result. This work of the Planning Team and Expert Advisory Group should be packaged for presentation to the media, the MPO, government administrators, elected decision makers, the general public, and the civic leadership of the region.

The Team may also recommend further planning steps. Under the influence of what the EAG reports, the Planning Team may face the prospect of having to repeat and rework earlier steps to account for considerations brought to light by the interaction of the diverse experts. There may be a need for further iterations of the objectives-paradigms-policies development. Alternatively or additionally, recommendations for action by the MPO may result.

Task 5-2: Planning Team and Expert Advisory Group evaluate the NWTIPP just completed

A final step in the NWTIPP is a reflective end-of-project evaluation of how the entire process functioned, with an emphasis on documenting and disseminating recommendations for the improvement of future planning rounds. A fundamental characteristic of the NWTIPP will be the probable need to revisit the process regularly as new knowledge is developed.

ADDITIONAL CONSIDERATIONS

The intent of the described NWTIPP planning template is to produce a supplemental transportation plan in the form of a report, web site, or other document that can educate and influence established planning authorities, decision makers both elected and appointed, the business community, various special interests, other stakeholders, the media, and the public generally.

We have not specified in any detail how the NWTIPP should or could manage its relationships with all of these parties along the way during the elapsed time when the planning process described above is carried out. These ongoing relationships are important, and they will need to be managed by the professional Planning Team and those responsible for oversight of the NWTIPP.

In this description of the NWTIPP we have maintained a sharp focus on a particular area of substance (consumer behavior, retail industry dynamics, and resulting nonwork travel behavior) that is too slightly considered in today's MPO-led transportation planning. We will leave specifying the important tasks of external relations to the pioneering community leaders that first implement the NWTIPP.

CHAPTER SIX

CONCLUSIONS ABOUT PLANNING FOR TOD

GROWING POPULARITY AND CRITIQUE OF TOD

Regional and federal planners and decision makers, in response to traffic congestion and other impacts resulting from growth and change in human activity patterns, have embraced transit-oriented development. However, there is a growing body of empirical research suggesting that TOD, when preceded by large investments in rail system capacity, will in most cases not produce benefits that are commensurate with the costs. Consequently, TOD planners need to be informed of the technology and market factors beyond the control of public policy that cause traffic growth, congestion, and related environmental impacts. In addition, they need to appreciate the difference between TOD's success at the station-area level compared to the regional level, and adopt methods to measure regional success.

With regard to regional success, the large differences in patterns of population and land use change across metropolitan America over the past few decades suggests that a one size fits all approach to land use and transportation planning is not effective. Each urban region has its own unique set of characteristics and forces that are determining settlement and mobility patterns.

IMPORTANCE OF NONWORK TRAVEL

The large growth in personal travel in the last three decades has in large part resulted from increased frequencies of nonwork trips, especially trips for shopping and other family and personal business activities. Retail activities account for more than half of all person trips, and most are made to locations that are flexible in that the traveler has more than one choice of destination for a given activity. Many retail trips are linked in complex tours that may involve multiple stops for a variety of purposes and several family members traveling together. These tours would usually benefit from the flexibility that a private vehicle provides, and consequently transit and pedestrian modes are chosen for a small proportion of all person trips.

THE EVER CHANGING RETAIL MARKETPLACE

The new retail marketplace is characterized by considerably more variety and opportunity than ever before in history. Consumers now have a much larger

array of choices for their household needs, leisure-time pursuits, and other personal activities. For retail structure, this has translated to larger and fewer retail store formats in any one category, at the same time the number of individual categories has greatly increased. Some retailers have taken advantage of consumer demand for more choice and good values by inventing new formats and offering a wide scope of products. Others have carved niches from older store formats while expanding product offerings.

Although past trends suggest future realities, the retail marketplace can be expected to continue to reinvent itself in new ways that are difficult to predict. A good example is online marketing. E-commerce is currently a small fraction of all retail sales, yet it has a large and unknown potential, and an equally large possible impact on personal travel patterns.

PLANNING THAT ADDRESSES COMPLEXITY, RISK, AND UNCERTAINTY

A large number of socioeconomic, technological, and other factors, in addition to those that define the retail environment, are active in a metropolitan region, and they produce a state of continuous dynamic change in urban form and personal travel patterns. Key among these are preferences for the location and size of residence, the location of work centers, and the growth and spatial dispersion of nonwork activities. These forces are strong in comparison to the policy tools that American government jurisdictions have at their command to control and shape urban growth. Taken together, the array of forces implies a future planning environment that must deal with considerable complexity, risk, and uncertainty.

A NEW METRO PLANNING TOOL: BACKCASTING DELPHI

There is a clear need for a new and better urban transportation planning approach that supplements existing four-step modeling and other statutory processes, and that more directly matches the difficulty of the urban transportation problem. A new and better planning tool would take into account the complexity and ongoing dynamic evolution of the metropolitan economy. A new and better tool would employ available descriptive data and information, and not demand that only quantitative results from mathematical approximations be relied upon for estimating the likely impacts of TOD. A new and better tool would bring in new, heretofore unconsidered descriptions and analysis of the way the market economy for consumer goods and services is now being served in metropolitan areas.

One tool that appears to meet these requirements is Backcasting Delphi. With this technique, the urban transportation problem is addressed by using a

diverse panel of experts (Delphi) to consider the feasibility of TOD and alternative paradigms and strategies (Backcasting).

FINAL CONSIDERATIONS

The core of the research project that designed the NWTIPP lies not in the particular details of the phases and tasks of how the process is carried out, but rather in the specification of four ideas for action to improve transportation planning:

- Emphasizing nonwork trips in urban transportation planning.
- Assembling data to describe these trips and the activities and destinations that cause them.
- Assessing the complexity, risk and uncertainty that these data reveal for transportation in the future.
- Adjusting the direction of public policy in response to the revealed data and the assessment of what they mean for the future.

If the specifics in this Planning Template do not resonate within a particular metropolitan community's leadership as a good way to implement the four ideas listed, we recommend trying an alternative implementation that fits the community.

BIBLIOGRAPHY

American Express. 1999 Survey of the Top 100 Specialty Stores for the National Retail Federation. http://www.stores.org/eng/archives/aug99cover.html

Bernick, Michael, and Robert Cervero. *Transit Villages in the 21st Century.* New York: McGraw-Hill, 1996.

Boarnet, Marlon G., and Nicholas S. Compin. "Transit-Oriented Development in San Diego County: The Incremental Implementation of a Planning Idea." *Journal of the American Planning Association* 65.1 (Winter 1999): 80-95.

Boarnet, Marlon G., and Randall Crane. "Public Finance and Transit-Oriented Planning: New Evidence from Southern California." *Journal of Planning Education and Research* 17 (1998): 206-219.

Boarnet, Marlon, and Randall Crane. "L.A. Story: A Reality Check for Transit-Based Housing." *Journal of the American Planning Association* 63.2 (Spring 1997): 189-204.

Boarnet, Marlon G., and Sharon Sarmiento. "Can Land Use Policy Really Affect Travel Behavior? A Study of the Link Between Non-Work Travel and Land-Use Characteristics." *Urban Studies* 35.7 (1998): 1155-1169.

Bookout, Lloyd W. "Neotraditional Town Planning: Toward a Blend of Design Approaches." *Urban Land* August 1992: 14-19.

Calthorpe, Peter. *The Next American Metropolis: Ecology, Community, and the American Dream*. New York: Princeton Architectural Press, 1993.

Casti, John L., *Would-Be Worlds: How Simulation Is Changing the Frontiers of Science*. John Wiley & Sons, New York, 1997, Table 3.1, page 93.

Cavalli-Sforza, Violetta, and Leonard Ortolano. "Delphi Forecasts of Land Use-Transportation Interactions." *Journal of Transportation Engineering*, 110.3 (1984): 324-339.

Cervero, Robert. *The Transit Metropolis: A Global Inquiry.* Washington, DC: Island Press, 1998.

Cervero, Robert, and Kara Kockelman. "Travel Demand and the 3Ds: Density, Diversity and Design." *Transportation Research D* 2.3 (1997): 199-219.

Cervero, Robert, and Carolyn Radisch. "Travel Choice in Pedestrian Versus Automobile Oriented Neighborhoods." *Transport Policy* 3.3 (1996): 127-141.

Chain Store Age. "State of the Industry Report," 1979, 1989, and 1999.

City of Seattle. *Transportation Strategic Plan*, October 26, 1998.

City of Seattle, Strategic Planning Office. "Transit-Oriented Development (TOD) Case Studies," August 13, 1999 at http://www.ci.seattle.wa.us/planning/todstudy/CS00Sum.htm

"Clinton-Gore Livability Initiative: Building Livable Communities for the 21st Century," a statement released by the White House in early 2000 and available at http://www.whitehouse.gov/CEQ/livability.html as of July 2000.

Colby, Charles C. "Centrifugal and Centripetal Forces in Urban Geography." *Annals of the Association of American Geographers* 23.1 (March 1933): 1-20.

Cooper, Benjamin S., Charles A. McCoy, and Wayne K. Talley. "Multi-Discipline Design Teams and the Delphi technique for Transportation Planning," *Land Economics* 50 (1974): 419-421.

Cortada, J. W., and J. A. Woods (Eds.), *The Knowledge Management Yearbook 1999-2000*. Butterworth Heinemann, 1999.

Costa, Dora L. "Less of a Luxury: the Rise of Recreation Since 1888." *Working Paper 6054*. Cambridge, MA: National Bureau of Economic Research, Inc., June 1997.

Cotterill, R., and A. Franklin. *The Urban Grocery Store Food Gap*. Food Marketing Policy Issue Paper No. 8, University of Connecticut, Storrs, Connecticut, April 1995.

Crane, Randall. "The Impacts of Urban Form on Travel: A Critical Review." *Working Paper, Lincoln Institute of Land Policy*, Cambridge, MA, 1999.

Crane, Randall, and Richard Crepeau. "Does Neighborhood Design Influence Travel?: A Behavioral Analysis of Travel Diary and GIS Data." *Transportation Research D* 3.4 (1998): 225-238.

Discount Merchandiser (magazine), *1999 State of the Industry Report*, July 1999.

Downs, Anthony. *New Visions for Metropolitan America.* The Brookings Institution and Lincoln Institute of Land Policy: Washington, DC, 1994.

Dreborg, Karl. "Essence of Backcasting." *Futures* 28.9 (1996) 813-828.

Dueker, Kenneth J., and Martha J. Bianco. "Light Rail Transit Impacts in Portland: the First Ten Years." *Transportation Research Record 1685*. Washington, DC, Transportation Research Board, 1999: 171-180.

Dunphy, Robert T. "Transportation-Oriented Development: Making a Difference?" *Urban Land* (July 1995): 32-48.

Ewing, Reid, Padma Haliyur, and G. William Page. "Getting Around a Traditional City, a Suburban Planned Unit Development, and Everything in Between." *Transportation Research Record 1466*. Washington, DC, Transportation Research Board, 1994: 53-62.

Fannie Mae. *Location Efficient Mortgages.* Informational Bulletin, August 1999.

Frank, Lawrence D., and Gary Pivo. "Impacts of Mixed Use and Density on Utilization of Three Modes of Travel: Single-Occupant Vehicle, Transit, and Walking." *Transportation Research Record 1466*.Washington, DC: Transportation Research Board, 1994: 44-52.

Friedman, Bruce, Stephen P. Gordon, and John B. Peers. "Effect of Neotraditional Neighborhood Design on Travel Characteristics." *Transportation Research Record 1466.* Washington, DC: Transportation Research Board, 1994: 63-70.

Handy, Susan L. "Regional Versus Local Accessibility: Neo-Traditional Development and its Implications for Non-work Travel." *Built Environment* 18.4 (1992): 253-267.

Handy, Susan L. "Regional Versus Local Accessibility: Implications for Nonwork Travel." *Transportation Research Record 1400*,Washington, DC: Transportation Research Board, 1993: 58-66.

Handy, Susan L. "Urban Form and Pedestrian Choices: Study of Austin Neighborhoods." *Transportation Research Record 1552* Washington, DC: Transportation Research Board, 1996: 135-144.

Heide, Henk Ter and Michel Horrevoets, "Knowledge Maps as Aids to Knowledge Management in Spatial Planning" *European Planning Studies*, Vol. 4, No 2, 1996, pp. 185-202.

Hojer, Mattias. "Transport Telematics in Urban Systems — A Backcasting Delphi Study." *Transportation Research - D,* 3.6 (1998): 445-464.

Hotelling, Harold. "Stability in Competition," *The Economic Journal* 39 (March 1929): 41-57.

Howe, Deborah A., and William A. Rabiega. "Beyond Strips and Centers: The Ideal Commercial Form." *Journal of the American Planning Association* 58.2 (Spring 1992): 213-219.

Innes, Judith E. and David E. Booher, "Metropolitan Development as a Complex System: A New Approach to Sustainability." *Economic Development Quarterly* 13.2 (May 1999): 141-56.

International Council of Shopping Centers (ICSC). *Basic Facts & Economic Impacts of Shopping Centers-1998*. http://www.icsc.org/srch/rsrch/scope/current/index.html

Irving, R.H. and D.W. Conrath, "The Social Context of Multiperson, Multiattribute Decisionmaking." *IEEE Transactions on Systems, Man*, and Cybernetics, 18.3 (May/June 1988): 348-357.

Fujii, Tadashi, and Truman A. Hartshorn. "The Changing Metropolitan Structure of Atlanta, Georgia: Locations of Functions and Regional Structure in a Multinucleated Urban Area." *Urban Geography* 16 (1995): 680-707.

Hibshoosh, Aharon, and Franco Nicosia. "The Social Consumer: Institutional Aspects of Consumer Decision Processes" in Firat, A.F., N. Dholakia, and R. P. Bagozzi, Eds. *Philosophical and Radical Thought in Marketing*. Lexington, MA: Lexington Books, 1987.

Jacobs, Allan B., Elizabeth Macdonald, Diana Marsh, and Clark Wilson. "The Uses and Re-uses of Major Urban Arterials: A Study of Recycling, Revitalizing, and Restructuring 'Gray Area' Transportation Corridors." *Working Paper 695*. University of California at Berkeley, Institute of Urban and Regional Development. Berkeley: 1997.

Jones, Ken, and Jim Simmons. *The Retail Environment*. New York: Routledge, 1990.

Khan, Ata M. "Realistic Planning for Transportation-A Flexible Approach," *Long Range Planning* 22.5 (1989): 128-136.

Levine, Bill. "The Store Stands Alone." *Chain Store Age* April 1998: 107-108.

Local Government Commission. *Land Use Strategies for More Livable Places.* Sacramento, CA, May 1, 1992.

Loukaitou-Sideris, Anastasia. “Inner-City Commercial Strips: Evolution, Decay--Retrofit?” *Town Planning Review* 68.1 (1997): 1-29.

Luscher, Daniel R. “Transit-Oriented Development as a Congestion-Reduction Strategy in the San Francisco Bay Area.” *Berkeley Planning Journal* 10 (1995): 55-74.

Marchau, V. A. W. J., and R. E. C. M. van der Heijden. “Policy Aspects of Driver Support Systems Implementation: Results of an International Delphi Study.” *Transport Policy* 5.4 (1998): 249-258.

McGuckin, Nancy, and Elaine Murakami. “Examining Trip-Chaining Behavior: A Comparison of Travel by Men and Women.” *1995 Nationwide Personal Transportation Survey Report* posted at NPTS Web site (www.ct.ornl/npts/1995/Doc/publications.shtml), 1998

Mierzejewski, Edward A. “Recognizing Uncertainty in the Transportation Planning Process.” *Compendium of Technical Papers, 65th Annual Meeting, Institute of Transportation Engineers*, Denver, pp. 343-347.

Mierzejewski, Edward A. “An Assessment of Uncertainty and Bias: Recommended Modifications to the Urban Transportation Planning Process.” Ph. D. Dissertation, Department of Civil and Environmental Engineering, University of South Florida, Tampa, May 1996.

Mierzejewski, Edward A. “A Strategic Approach to the Transportation Planning Process.” *Journal of Public Transportation* 2.1 (1998): 27-42.

Moore, James E. II. “Ridership and Cost on the Long Beach- Los Angeles Blue Line Train.” *Transportation Research A* 27A.2 (1993): 139-152.

Moudon, Anne Vernez, Paul M. Hess, Mary Catherine Snyder, and Kiril Stanilov. “Effects of Site Design on Pedestrian Travel in Mixed-Use, Medium-Density Environments.” *Transportation Research Record 1578* . Washington, DC: Transportation Research Board, 1997: 48-55.

National Association of Convenience Stores, *1998 Convenience Industry FactBook*, Ninth Edition. Alexandria, VA.

National Endowment for the Arts. *1997 Survey of Public Participation in the Arts: Summary Report*, Washington, DC, December 1998.

National Restaurant Association. *1999 Restaurant Industry Forecast: Food Trends*. http://www.restaurant.org/research/forcast/fc99-10.htm

Nation’s Restaurant News. *Special Report: Top 100 Restaurant Chains*. July 28, 1999: 97-135.

Nelson, Dick, and John Niles. "Market Dynamics and Nonwork Travel Patterns: Obstacles to Transit-Oriented Development?" *Transportation Research Record 1669*. Washington, D.C.: Transportation Research Board, 1999: 13-21.

Nelson, Dick, and John Niles. "Observations on the Causes of Nonwork Travel Growth." Paper presented at 79th Annual Meeting Transportation Research Board, Washington, D.C., January 9-13, 2000.

Niles, John, and Dick Nelson. "Essentials for Transit-Oriented Development Planning: Analysis of Nonwork Activity Patterns and a Method for Predicting Success." Proceedings of the *Seventh National Conference on the Application of Transportation Planning Methods*, Transportation Research Board, Boston, MA, March 7-11, 1999a.

Niles, John, and Dick Nelson. "Measuring the Success of Transit-Oriented Development: Retail Market Dynamics and Other Key Determinants." *Proceedings of the American Planning Association National Planning Conference*, Seattle, Washington, April 24-28, 1999b.

Pas, Eric I. "The Urban Transportation Planning Process." In Susan Hanson, *The Geography of Urban Transportation*, New York: Guilford Press, 1995, page 60.

Pilsbury, Richard. "From Hamburger Alley to Hedgerose Heights: Toward a Model of Restaurant Location Dynamics." *Professional Geographer* 39.3 (1987): 326-344.

Porter, Douglas R. "Transit-Focused Development: A Synthesis of Research and Experience." *Transit Cooperative Research Program Report No. 20*, Washington, D.C.: National Academy Press, 1997.

Porter, Douglas R. "Transit-Focused Development and Light Rail Systems: The Lite Connection." *Transportation Research Record 1623*. Washington, DC: Transportation Research Board, 1998: 165-69.

Prepared Foods Online Newsletter, March 13, 2000 http://www.preparedfoods.com/newsletter/articles/0300/03270004.htm

Puget Sound Regional Council. *Vision 2020 Update and Metropolitan Transportation Plan*, Seattle, WA, March 10, 1995.

Puget Sound Regional Council. *Creating Transit Station Communities in the Central Puget Sound Region: A Transit-Oriented Development Workbook*. Seattle, June 1999.

Richmond, Jonathan E. D., "Simplicity and Complexity in Design for Transportation Systems and Urban Forms." *Journal of Planning Education and Research* 17 (1998): 220-230.

Robinson, John B. "Futures Under Glass." *Futures* (October 1990): 820-842.

Rutherford, G. Scott, Edward McCormack, and Martina Wilkinson. "Travel Impacts of Urban Form: Implications from an Analysis of Two Seattle Travel Diaries." Department of Civil Engineering, University of Washington, Seattle. Paper prepared for the *Conference on Urban Design, Telecommuting and Travel Behavior*, Williamsburg, Virginia, October 27-30, 1996.

Schwenk, Nancy E. "Trends in Entertainment." *Family Economics Review* (U.S. Department of Agriculture), 5.1 (1992): 17-22.

Transit Cooperative Research Program (TCRP). "An Evaluation of the Relationships Between Transit and Urban Form," *Research Results Digest* Number 7, Transportation Research Board, Washington, D.C., June 1995.

Transit Cooperative Research Program (TCRP). *Report 22. The Role of Transit in Creating Livable Metropolitan Communities.* Transportation Research Board, Washington, D.C., 1997.

U.S. Department of Agriculture, Economic Research Service. *Food Consumption, Prices, and Expenditures, 1970-97*, (1998).

U.S. Department of Labor, Bureau of Labor Statistics. *Consumer Expenditure Survey*, annual.

U.S. Department of Transportation (USDOT), 1995 Nationwide Personal Transportation Survey.

U.S. Department of Transportation (U.S.DOT), Federal Transit Administration. *Assessment of Transit Supportive Land Use for New Starts Projects: FY 1999 New Starts Report*, Washington, D.C., November 1998.

U.S. General Accounting Office (GAO). "Status of New Starts Transit Projects With Full Funding Grant Agreements." *Report to Congressional Requesters*, August 1999b, GAO/RCED-99-240.

van der Heijden, Kees, *Scenarios: The Art of Strategic Conversation*, Wiley & Sons, Chichester, England, 1996, pages 83-84.

Zwerling, Stephen. "Social Complexity and Technological Choice: The Bay Area Rapid Transit System." *Urban Law Annual*, 8 (1974): 97-120.

APPENDIX A:

REVIEW OF SELECTED TOD LITERATURE

A number of researchers have been actively testing various features of the TOD paradigm and the premise that government actions can significantly reshape urban form and travel patterns so that a greater share of urban travel is by mass transit. We very briefly review and cite selected examples of their work. These papers touch on, to various degrees, important TOD issues, including nonwork activity patterns and the land use-transportation linkage. We provide direct quotes (in italics) that appear to summarize key findings and conclusions. While this review does not by any means include all of the research literature on these topics, we believe these authors and papers to represent a consistent and comprehensive perspective of the current state-of-understanding.

Marlon Boarnet

Marlon Boarnet is associate professor, Urban Planning and Economics Departments, University of California at Irvine, and research associate of UC-Irvine's Institute of Transportation Studies. His interest is how local governments actually implement TOD. In a series of papers and a forthcoming book with Randall Crane, Boarnet addresses the financial and other objectives of local governments that can differ from regional planning goals.

Boarnet investigated the development of housing at 232 station-areas across Southern California, and compared the intensity of housing with that allowed under local zoning (Boarnet & Crane 1997). He found that municipalities behave as if they prefer to use rail transit stations for economic rather than residential development. There is a stronger trend toward commercial rather than residential zoning that is consistent across existing and proposed rail lines, whether in central or suburban communities.

Residential development appears to be a secondary goal, at best. Left to their own devices, almost every city wants the train to bring people into town in the morning rather than send them elsewhere (in order to maximize the fiscal and economic benefits).

Boarnet suggests that this creates an imbalance in the form of an excessive number of employment and shopping “destination” stations relative to the number of residential “origin”' stations. And he doesn’t believe that California is unique.

The cross-jurisdictional economic competition that makes transit-based commercial development attractive in Southern California is also characteristic of many other urban areas. The tensions that prompt municipalities to think first of their own economic development have, if anything, grown stronger over time.

In a follow-up paper, Boarnet suggests that local fiscal concerns are evident in a broad range of planning activities beyond transit-oriented development (Boarnet & Crane 1998).

Anecdotal evidence suggests that local competition for regional shopping malls and big-box retailers is becoming increasingly intense. In the past, researchers have studied incentives for fiscal zoning focusing on attempts to increase the local property tax base. In California, and likely in other states also, fiscal pressures are increasingly focusing on land uses that generate sales tax revenue. Fiscal competition now is over commercial uses, and the ramifications of these new fiscal pressures are not fully understood.

Boarnet undertook a more detailed study of TOD implementation in San Diego that has the oldest of the current generation of light rail lines (Boarnet & Compin 1999). He found, through detailed interviews with planning directors, that cities along rail routes, though sympathetic to regional rail planning objectives, have approached TOD from a perspective of local goals, opportunities, and constraints.

The lesson from San Diego County is that progress towards TOD goals is often incremental. TOD projects are the results of a number of local governments acting in their own interests, pursuing opportunities as they present themselves, and working within local constraints. The legacy of preexisting land uses (and rights-of-ways) is an important determinant of TOD implementation. Placing rail lines along high-growth corridors can be expensive, especially when those corridors do not have suitable existing rail rights-of-way. Whether TOD benefits, such as an increase in transit ridership, outweigh the cost of placing a line along a high growth corridor is open to question.

Boarnet and a coworker also modeled the effect of general neighborhood land use variables (extent of grid street pattern, population density and retail and service job concentrations) on nonwork automobile trips, using southern California travel diary data (Boarnet & Sarmiento 1998). None of the land-use variables was found to be significant either individually or jointly, which is consistent with the findings of Crane. Based on the results, they conclude:

We are not yet ready to make transport policy based on the link between nonwork travel and land-use patterns. The primary lesson to emerge from this study is that any link between land use and nonwork trip generation is a complicated one.

The authors suggest that several issues need to be addressed in further research: New Urbanists designs are at a neighborhood scale, whereas nonwork trips cover much larger areas; the possibility that persons choose their residential location based in part on how they wish to travel; and the complexity of non work trips, i.e., trip chaining.

Robert Cervero

Robert Cervero is professor, Department of City and Regional Planning, University of California at Berkeley. He and his coworkers have conducted many studies of the relationship between travel patterns and urban design features, both in the United States and abroad. Cervero has published extensively in transportation and planning journals, and has written several books on the topic of the land use and transportation problem.

Cerver's perspective is clearly one of support for a menu of government policies that can have some impact on urban form in ways that will reduce the effects of automobility. Yet, he tempers his enthusiasm for these efforts with a pragmatic assessment of what has been experienced and can be expected in terms of actual outcomes.

Cervero comments on the concern expressed about light rail systems (1998a):

Proposals to build and extend fixed-guideway systems, especially light rail, in the United States have triggered a wrath of criticism. Even cities that show great promise, such as Portland, have come under attack, and with some justification. The track record with new rail systems in the United States leaves a lot to be desired. Studies show that new-generation rail systems have failed to produce the ridership that was promised and ended up costing more than was forecast.

Although the reasons for transit's poor showing over the years are many, the gross under pricing of automobile travel—especially along heavily trafficked corridors where transit is most needed—heads the list. An absence of coordinated and comprehensive planning, carried out on a regional scale, is also to blame. Putting a point-to-point rail system in a sea of spread-out, auto-oriented development is hardly a recipe for successful and sustainable transit. Quite simple, too often across America, transit and cityscapes have been way out of synch.

Of course, transit investments that are out of kilter with how our cities and regions grow do nobody any good. Running trains and buses that fail to draw people out of drive-alone cars does little to relieve traffic congestion, conserve fuel, or reduce pollution. The best prescription for filling trains and buses, and winning over motorists to transit, is to find a harmonious fit between transit systems and the cities and suburbs they serve.

Cervero also comments on bus rapid transit, debunking what he terms the myth that bus transit is incapable of shaping urban form and attracting high-rise development around stops:

Besides buses being stigmatized as a second-class form of conveyance, the conventional wisdom holds that buses repel development because of their negative-byproducts: diesel toxins that spew from tail pipes. Experiences around busway stops in Ottawa and Curitiba should put this myth to rest. In both cities, some of the priciest condominiums anchor sites adjacent to busway stops. Retail and office developers also flocked to busway corridors in both cities. Good quality service—whether vehicles are propelled by electricity or fossil fuels, or whether they roll on steel wheels or pneumatic tires—will spawn compact development. It is the accessibility premium that attracts real estate development, not the type of transit equipment. In fact, compared to freeways and even rail corridors, busways produce relatively low ambient noise levels. Its inherent flexibility advantages and superior adaptability to spread-out patterns of development make bus transit—especially when combined with dedicated busways—a potentially stronger shaper of growth patterns than rail transit in some settings.

Cervero has also reviewed TOD in California which he has actively sought to promote through government polices (1998b):

Despite successes, the track record with TOD in California has not always been positive. Far more growth in the Bay Area has been auto-oriented than transit-oriented, despite BART's 25-year presence. A number of stations along Sacramento's light rail line have attracted big-box retail projects; despite repeated efforts by the Sacramento Regional Transit Authority to promote TOD, in the final analysis, the prospect of localities receiving large sums of sales tax revenues won out over regional concerns, like TOD.

In a separate study, Cervero and a co-author estimate that only about 9 percent of the residents from the three BART-served counties lived within a half mile of a BART station in 1990 (Bernick & Cervero 1996). And 1990 Census journey-to-work data indicate that only 18 percent of these station-area residents commuted by rail transit. Multiplying these two percentages led them

to conclude that fewer than 2 percent of 1990 commute trips within the three counties were by station-area rail users.

Doubling the number of station-area rail users would have a pretty small impact on current commuting and environmental conditions in the Bay Area.

The two authors suggest that more than singular measures, such as transit-based housing are needed if outcomes are to be more than minimal.

Transit-oriented development matters when bundled together with other supportive policies.

They call for fundamentally different settlement patterns and pricing arrangements for driving:

Putting more suburban jobs in office towers near rail instead of sprawling business parks would no doubt make these numbers more impressive. So would dramatically raising the price of fuel and parking (so that motorists pay for externalities they create, including time losses and air pollution).

Urban villages, they suggest

...would tap the synergy of orienting the future growth of both ends of the commute trip—homes and workplaces—to rail, in addition to retail shops, restaurants, entertainment centers, and other urban uses. Land-use initiatives, like transit-supportive development, by themselves are clearly no panacea to today's congestion, air quality, and social equity problems.

Randall Crane

Randall Crane is associate professor of urban planning, environmental analysis, and economics at the University of California, Irvine. He has done extensive modeling and empirical analysis of the possible influence of urban design factors on travel behavior, and has authored several papers and is co-authoring a book with Marlon Boarnet on the subject which is due to be published in September 2000.

We refer here to only two papers, in which he summarized the results of his work (Crane 1998, 1999). Crane's concern is that much of the analysis that purports to support the belief that changes in urban form can shape travel behavior is problematic. It does not, in his opinion, have a strong behavioral foundation. Crane has attempted to improve the research on TOD by isolating the separable influences of urban design on travel.

Individuals make choices based on their preferences for benefits obtained by travel and on the relative costs of making different trips and of taking different modes. Past empirical research about the influence of neighborhood design on travel has neglected the role of costs in choosing among trips and modes.

Crane believes that individual design elements, such as grid street patterns, traffic calming features, and a concentration and greater mix of uses, may both increase and decrease car trips and VMT. Walking trips may be similarly affected. Crane cites the example of shopping:

People may shop more often if stores are nearby, and they may make so many shopping trips that they drive more miles.

Crane believes the net effect of urban design features on travel is uncertain at best, and that actual outcomes depend on specific details of implementation at each location, not on their intrinsic traffic-affecting properties.

There is no evidence that New Urbanist's designs influence travel behavior at the margin. They remain a wobbly foundation indeed for current transportation policy.

Crane comments on previous research involving the effect of urban design on travel:

Any empirical work of this nature is problematic given the enormous complexity of the behavior to be explained and the great difficulties of conceptualizing the interaction of travel and the physical character of the city.

Anthony Downs

Downs is a senior fellow in the Economic Studies Program at the Brookings Institution (Washington, D.C.). He has analyzed and commented on the patterns and problems of American urban areas for more than three decades. His recent books include strategies to address traffic congestion and the renewal of large older central cities. He has also written on the problem of urban sprawl. Downs' perspective is often conditioned by what he feels is politically possible and feasible in the American system.

Downs often uses simple spatial models to elucidate his points. He did so to estimate the effect on transit commute mode share of a major radial mass transit system serving the central city's employment center (Downs 1992). He concluded that

...even an extensive rapid transit system serving many high-density housing clusters near their stops would carry only relatively few suburban commuters. The results would be minor in comparison to the economic and political efforts required to build and maintain the transit systems and create high-density clusters.

Downs subsequently extended this analysis by estimating the size of the TOD areas and rail transit system required to accommodate the population growth experienced by the average Metropolitan Statistical Area over one million in

population in the decade of the 1980s (Downs 1994). He found that the system would have to be much larger than the actual systems in either the Washington, DC, or the San Francisco Bay metro areas, yet those areas have much larger total populations than the population used to calculate the model.

Realistically, it may not be feasible to accommodate all or even most urban growth in transit-oriented developments. The feasibility of applying them on a large scale is weakened by the high cost of building the rapid-transit links among them. However, Calthorpe's TODs should be viewed as building blocks that could be used to handle some significant part of growth in the range of visions except the unlimited low-density vision.

In a contribution to a multifaceted discussion of sprawl, Downs sounds a rather pessimistic note about government's ability to adopt tactics that effectively address the growth problems plaguing many metro areas (Downs 1998).

Effectively adopting any of these tactics, or certainly most of them, would require a strong region wide implementing body. Yet hardly any US metro areas have been willing to consider doing this. Nor is it certain that these tactics would overcome a region's growth related problems. For example, I am positive that traffic congestion will get worse almost everywhere, no matter what tactics anyone adopts. Until advocates of limited future sprawl can overcome the metropolitan majority's belief that the benefits of sprawl outweigh its social costs, they are not likely to notably reduce sprawl's dominance.

Kenneth Dueker

Ken Dueker is professor of Urban Studies and Planning and director of the Transportation Studies Center, Portland State University. He directed the Center for Urban Studies at PSU from 1979 to 1998. His areas of research interest include transportation and land use interactions.

Dueker and his PSU colleagues have been closely monitoring the impacts of Portland's light rail transit system and its TOD strategy. Just as the State of Oregon has been a testing ground for strong growth controls, Portland is a laboratory for TOD. Its Eastside light rail line, the first in a planned metro-wide radial network focusing on downtown Portland, opened in 1986. Portland has gone to considerable lengths to encourage development that supports light rail.

Dueker has used data for the first 10 years of operation to research the impacts of the rail line on development patterns, choice of residential location, freeway traffic, and transit ridership (1999a). In a presentation at a 1999 conference (1999b), Dueker reported that:

What we have found is that light rail alone has not been sufficient to change development patterns appreciably.

He sees an apparent self-selection in housing location choice. People who are already prone to use transit are willing to relocate to areas accessible to light rail, but rail has not had an impact on traffic congestion.

What we're observing is that the peak period for highway traffic is widening, and that non-peak and weekend travel on light rail is where the growth in transit riders is occurring.

And Dueker has concerns about the transit component of Portland's TOD.

A lot of bus lines, including express bus lines, have been discontinued, and a lot of people have been forced onto light rail and to make transfers. Light rail in suburban service has problems. When you get 15 miles out, you're almost an hour by light rail to downtown, because it has to stop at every stop. I think that express bus service could do a better job for the suburban commute.

Dueker confirms that Portland's success at controlling growth is somewhat clouded by its proximity to Clark County in Washington State, which is a bedroom suburb just across the Columbia River (1999c). Clark County is the most rapidly growing county in Washington State, with an annual population growth rate that surpassed even the high range of forecast population. Its 1999 population accounted for approximately 25 percent of the Portland-Vancouver urbanized area.

Reid Ewing

Reid Ewing is with the Surface Transportation Policy Project in Washington, D.C. He formerly was associate professor, College of Engineering and Design at Florida International University. He has authored books on development practices and transportation and land use innovations, as well as research dealing with travel patterns in Florida communities and their land use relationships (Ewing, et al, 1994). Ewing wrote a lengthy paper from the "anti" sprawl perspective as counterpoint to a "pro sprawl" paper by Peter Gordon (Ewing 1997). We quote from that paper.

We include Ewing because he is a thoughtful proponent of strategies to minimize auto externalities. Ewing believes that sprawl, that he defines as suburban development lacking accessibility and open space, is not a natural response to market forces, but a product of subsidies and market imperfections. His solution is active planning as it is practiced "almost everywhere but the United States."

Ewing's analysis of Florida suburban communities found that regional accessibility, not land use density, is the most significant land use variable. In other words, land use patterns that recognize that density is not feasible but provide more services in closer proximity can reduce some auto trips. Ewing also recognizes that

As suburban areas grow, the central city becomes less and less accessible. At some point, emergence of other centers is beneficial.

He favors "good" development over "bad." He cites Florida's best practices as an example of an initiative to upgrade the quality of development, "wherever" and "whenever" it should occur. Cluster development, which concentrates housing and commercial in walkable areas while preserving a large part of the land area as park or natural open space, is one approach.

Peter Gordon

Peter Gordon is professor of planning and economics in the School of Urban Planning and Development and the Department of Economics, University of Southern California. Gordon, often together with his colleague Harry Richardson, has authored numerous research papers addressing the forces shaping the growth of major metro areas and associate travel patterns.

Gordon (& Richardson's) general premise is stated in the first sentence of his "pro" sprawl article:

The revolution in information processing and telecommunications is accelerating the growth and dispersion of both economic activities and population, possibly moving towards the point where 'geography is irrelevant' (Gordon & Richardson 1997).

Gordon has a blunt opinion of high-capacity transit and TOD.

Low densities make high-capacity transit systems unattractive and therefor wasteful of all resources utilized, including energy. Because the spreading out of cities reduces markets for conventional public transit (especially fixed rail, which is spatially inflexible and usually oriented downtown, it should be no surprise that the U.S. transit industry has been in decline for most of the 20th century. Massive subsidies have not helped. New federally assisted systems have not added to mass transit; instead, they have replaced flexible bus routes with costly fixed-routes to a few downtown areas, while the growth of jobs and population has been in the suburbs and in the smaller cities. At the same time transit fleets in general are under used, and the new systems have added to costs without attracting riders from cars.

Citing Cervero and Downs, he says:

It appears that 'Neo-traditional' neighborhoods do not make much of a difference.

Genevieve Giuliano

Giuliano is professor and vice dean, School of Policy, Planning and Development, University of Southern California. She has investigated the land use and travel impacts produced by the high accessibility that modern roadway systems create, and the effectiveness of land use policy on reducing congestion and the environmental costs of automobility. Giuliano has also contrasted the land use-transportation relationship in Europe and the United States.

Because of the federal highway program of the 1950s through the 1970s, she observes that Metro areas are marked by well-developed transportation systems (Giuliano 1995):

Even a large investment (such as a new freeway segment) will have only an incremental effect on accessibility. Moreover, the decentralized land use pattern of today's metro areas has reduced differences in accessibility among locations.

Giuliano also observes that rail transit continues to have strong public support, in spite of "rather overwhelming evidence" that transit investment is not an efficient means for affecting land use patterns (1). She cites Los Angeles as the most extreme example of this view.

Planners expect this massive program (originally a $78 billion rail-transit investment) to increase the proportion of commuters who use transit from 4.5 percent to 19 percent by the year 2010, through the generation of high-density and mixed-use development along transit lines. To test whether their expectations were reasonable, the regional planning agency sponsored a study using a transportation forecasting model to determine the effect of various land use scenarios on transit use. Results show that by relocating 75 percent of all forecast employment growth and 65 percent of all population growth in the 5-county region to transit-station areas, 7 to 10 percent of commuters would use transit. Study authors conclude that even if anticipated land use changes were to occur, travel patterns would not change very much, because the overall regional pattern of land use would not change very much.

Giuliano does not view land use policy as an effective means for reducing the environmental impacts associated with private vehicle use (Giuliano 1999):

Significantly less private vehicle use would require substantial increases in densities from existing levels and a reversal of development trends that have been in progress for many decades. I do not think such increases in density can be achieved, and increases in density that might be achieved would have at

best very little effect on private vehicle travel. The trends in car use and decentralization are powerful (even in Europe where government land use controls are stronger and where tax and pricing policies favorable to car ownership and use are not present). They are supported by changing economic structure and rising affluence, and there is no reason to believe that fundamental shifts away from these trends will occur in the future. The greatest success in addressing automobile externalities has been realized by regulating the car, rather than the driver.

Susan Handy

Handy is Assistant Professor of Community and Regional Planning, School of Architecture, University of Texas at Austin. Part of her research was done at the Institute of Transportation Studies, University of California at Berkeley.

Handy was the first researcher to question the suggestion by supporters of New Urbanism that traditional urban form (rectilinear street patterns, sidewalks, accessibility to transit service, and proximity to a mix of commercial establishments, including jobs) discourages automobile dependence (Handy 1991). She points out that there is a tension between providing local services and regional transit links:

- *The ability of residents to live and work in the same place is limited by numerous constraints, including the match between employee qualifications and employer needs, dual wage earner households, job security, etc.;*
- *The growing variety and complexity of lifestyles requires a number of services that can't be supported by a small neighborhood population;*
- *Residents may choose not to use local services if they have easy access to other areas, and if other factors that affect destination choice play a role. These include price, quality of service, habit, etc.; and*
- *Services evolve over time as the size and character of the population changes; what is sufficient to encourage use of local facilities now may be insufficient in the future.*

In a series of papers (Handy 1992, 1996a, 1996b, 1996c), she addresses the effect of TOD design elements on mode choice, particularly pedestrian travel to nonwork destinations, in San Francisco Bay area and Austin neighborhoods. In the most traditional Austin neighborhood, 95 percent of residents live within walking distance of the neighborhood commercial center. She both surveyed and modeled the travel behavior of residents.

Handy finds that certain design aspects can encourage walking trips but the savings in travel from substitution for driving are likely to be small. For San Francisco:

The evidence does not support the popular belief that neo-traditional style development will help reduce levels of nonwork travel (Handy 1992).

For Austin:

The total savings in automobile travel appears to be on the order of 8 km per adult resident per month—a drop in the bucket when average driving per month is approximately 2000 km per household (Handy 1996a).

Handy, based on further detailed analyses of the San Francisco neighborhoods, suggests that some land use policies may help provide alternatives to driving, but their effectiveness in reducing total travel will be at least partially offset by the range of choices available to residents of a metropolitan region (Handy 1996b).

A greater range of choice seems to be associated with greater trip frequency; a greater range of choice may induce some trips that would not have been made given more limited choices. And the greater the range of destinations visited, the longer the average trip, such each additional destination is farther away.

Handy suggests that the overall policy goal—namely that of reducing auto travel—toward which much of research on the link between urban form and travel behavior is directed, should be reconsidered (Handy 1996c).

Land-use policies are likely to have only a marginal impact on travel given the extent of existing development and the relatively small increment that new growth represents. Certainly it is important that any development that occurs be designed appropriately so as to minimize the need for automobile travel, but other strategies to manage travel demand, such as pricing strategies, are also needed.

Richard W. Longstreth

Longstreth is an architectural and urban historian whose interest is in understanding the role of the retail marketplace in shaping the modern metropolis. In a comprehensive study (Longstreth 1997), he has traced the evolution of the regional mall in Los Angeles in the mid 20th-century, and how these shopping centers, together with the rapid growth of private vehicles, shaped the land use and travel environment of the city and region.

His book is an observational and deductive work, relying on photographs, maps, and historical records found in newspapers and other documents. From

this evidence, Longstreth sees relationships and patterns that lead him to draw several conclusions about the importance of retail in the building of Los Angeles and post-auto cities generally:

...(M)ost historical studies of how the automobile has affected the landscape imply, at least, that the process was un- or even anti-urban, ultimately leading to decline and decay in the city. Such characterizations, however, ignore the inherently urban circumstances affecting change in the commercial sphere. Los Angeles reveals that the automobile was not an isolated cause but one of several factors that contributed to a recasting of metropolitan form rather than its destruction.

Just as Los Angeles is one of the major population, business, and cultural centers of the nation, so retail development is a key indicator of urban form and identity. No other single component of the city attracts so many people so frequently and for so many reasons. No other more frankly reveals current attitudes toward public assembly and decorum. No other so clearly reflects change both in market conditions and consumer taste. No other embodies more fully the unyielding impact of motor vehicles on the landscape.

At a time when "sprawl" is becoming a code word for urban ills, much as "congestion" and "overcrowding" were two generations ago, we need to be careful not to condemn in wholesale fashion the environment created in recent decades. My argument is not to defend all that has been developed in the recent past, nor is it against the strategies for change, but only that we should not repeat the mistake of previous generations who dismissed cities of the nineteenth and early twentieth centuries as wastelands. Only through understanding the modern metropolis can our choices for the future be informed, rational, and productive.

Daniel Luscher

Luscher is manager, economics and policy analysis, Acurex Environmental Corporation, Mountain View, CA. The paper summarized here is based on work done at the J. F. Kennedy School of Government, Cambridge, MA.

Luscher's work is unique because it directly addresses a central public concern: congestion. He estimated the congestion reduction benefits of TOD in the San Francisco Bay area using a simple spatial model (Luscher 1995). His analysis focused on residential development and did not directly address the role of TODs in altering commercial development patterns. Luscher found that, employing optimistic travel behavior modification assumptions, that redeveloping the area around most of the existing rail transit stations, coordinating similar development around feeder bus routes, and clustering one-fifth of the region's population in these areas would reduce vehicle

miles traveled by 5 percent. The strategy would offset about three years of VMT growth.

Luscher concludes that TOD would not have a significant impact on the Bay Area's congestion problems but may have collateral benefits.

It is clear that TOD is inappropriate as the foundation of a congestion reduction strategy for the Bay Area. To the extent that TODs are a part of a larger scale rethinking of urban design, they are likely to have worthwhile non-transportation benefits, such as an enhanced sense of community and the preservation of open space on the suburban fringe.

Douglas Porter

Porter is president of The Growth Management Institute, Chevy Chase, MD, and a planning and development consultant. He has written and edited books on growth management, and was the author of the Transit Cooperative Research program study of transit-focused development in 23 U.S. cities and metro regions (Porter 1997, 1998). We excerpt and summarize here some of the conclusions he reached in the latter research.

Porter was interested in the effect of TOD-supportive policies on development around light and heavy rail station areas. He did not probe for actual transportation benefits. What he observed were actual patterns of development that, in some cases, were the result of governmental efforts over several decades. His analysis suggests that transportation and land use planners, who have expectations that TOD can reduce auto dependency, must recognize the realities of the real estate markets, public attitudes, and the nature of rail lines themselves.

Especially along light rail lines, development opportunities will be influenced by changes in the development industry and its primary markets, increasing deference to neighborhood groups regarding development impacts, and the generally lower intensity of use of suburban rail stations compared to stations along heavy rail lines. Unlike experience with heavy rail systems, non central business-district stations on light rail lines are more likely to attract relatively small, uncomplicated projects (Porter 1998).

Porter found that the intensive development that has taken place has occurred mostly in central business districts and some midtown and inner suburban locations.

Except in older cities and downtown area, development falls short of the density and design thresholds needed for generating significant transit ridership; transit-focused development still remains more a concept than a reality in most regions. The primacy of the automobile and the desire of most

North Americans to live and work in low-density surroundings strongly dissuade market forces and governmental policies from producing densities and forms of development most supportive of transit.

Jonathan E. D. Richmond

Jonathan Richmond is a fellow at the Taubman Center for State and Local Government, Kennedy School of Government, Harvard University. Richmond has extensively studied light rail systems built in the U.S. since 1970. He recently published a review of the capital and operating costs, and the ridership levels, of these systems (Richmond 1998a). His findings correspond with earlier work by Pickrell who found that costs typically were underestimated and ridership was overestimated.

Richmond has also investigated the reasons rail systems are highly popular in spite of considerable evidence that they do not perform well (Richmond 1998b). This may be his most interesting and useful work for TOD planning. It is only possible to distill the essence of this work into a few selected quotes, since space limits a thorough review.

Transportation as a problem is most basically understood as a static concept—a derived demand. But transportation is part of a complex and dynamic system of elements that overlap and interact in a plethora of ways at a given point in time and whose interaction patterns shift over time in response to those interactions.

The public-sector response to transportation problems has focused on transportation facilities and not the underlying problems.

There are frequent references to the need for a 'balanced' transportation system. The idea of 'balance' is attractive because it simplifies complex ideas into a physically based metaphor.

The train is seen as necessary part of a balanced system, excluding the possibility that rail service may not be appropriate for all cities. The vast per capita expenditures on the rail system take away opportunities for the more productive use of scarce resources.

The artificially created 'urban village' does not reflect the richness of today's multifaceted and overlapping urban possibilities. Residents will remain attracted to exploiting the overlapping richness of the city with automobiles in ways that remain beyond the ready capabilities of public transport.

The assumption that people will use local facilities in a village-like community setting and that they will cycle to the train station along dedicated landscaped cycle routes is easy to make if you do not appreciate the web of complex

interactions for work, shopping, and leisure that automobility has created throughout the metropolis.

Recognizing that transportation is inevitably tied in an intricate web of overlaps with all other urban functions and with the rich morass of human life complicates the planning task but makes it more likely to succeed.

The successful transportation planner of the future must move from attempting to shape lifestyles in ways that cannot succeed in a democratic society to instead appreciate the many dimensions of how people have chosen to live and interact across space and how this relates to their aspirations for life in the future. And then accommodate their wishes in environmentally responsible ways.

BIBLIOGRAPHY FOR APPENDIX A

Bernick, Michael, and Robert Cervero. *Transit Villages in the 21st Century*, New York: McGraw-Hill, 1996.

Boarnet, Marlon G., and Nicholas S. Compin. "Transit-Oriented Development in San Diego County: The Incremental Implementation of a Planning Idea." *Journal of the American Planning Association* 65.1 (Winter 1999): 80-95.

Boarnet, Marlon G., and Randall Crane. "Public Finance and Transit-Oriented Planning: New Evidence from Southern California." *Journal of Planning Education and Research* 17 (1998): 206-219.

Boarnet, Marlon, and Randall Crane. "L.A. Story: A Reality Check for Transit-Based Housing." *Journal of the American Planning Association* 63.2 (Spring 1997): 189-204.

Boarnet, Marlon G., and Sharon Sarmiento. "Can Land Use Policy Really Affect Travel Behavior? A Study of the Link Between Non-Work Travel and Land-Use Characteristics." *Urban Studies* 35. 7 (1998): 1155-1169.

Boarnet, Marlon G., and Randall Crane. *Travel By Design? The Influence of Urban Form on Travel*, New York: Oxford University Press (forthcoming).

Cervero, Robert. *The Transit Metropolis: A Global Inquiry*, Washington, DC: Island Press, 1998a.

Cervero, Robert. "Transit Villages in California: Progress, Prospects, and Policy Reforms." *Working Paper 98-08*, Institute of Urban and Regional Development, University of California at Berkeley, 1998b.

Crane, Randall. "Travel by Design?" *Access* 12 (Spring 1998): 2-7.

Crane, Randall. "The Impacts of Urban Form on Travel: A Critical Review." *Lincoln Institute of Land Policy Working Paper*, Cambridge, MA, 1999.

Crane, Randall, and Richard Crepeau. "Does Neighborhood Design Influence Travel?: A Behavioral Analysis of Travel Diary and GIS Data." *Transportation Research D* 3.4 (1998): 225-238.

Downs, Anthony. *Stuck in Traffic: Coping With Peak-Hour Traffic Congestion*, The Brookings Institution, Washington DC, and The Lincoln Institute of Land Policy, Cambridge, MA, 1992.

Downs, Anthony. *New Visions for Metropolitan America*. The Brookings Institution, Washington DC, and The Lincoln Institute of Land Policy, Cambridge, MA, 1994.

Downs, Anthony. "How America's Cities are Growing." *Brookings Review*, 16.4 (Fall 1998) 8-11.

Dueker, Kenneth J., and Martha J. Bianco. "Light Rail Transit Impacts in Portland: The First Ten Years." In *Transportation Research Record 1685*, 1999a

Dueker, Kenneth J. Presentation to the Center for the New West Forum, "Sprawl and Congestion: Are Light Rail, High Density Living and Transit-Oriented Development the Answer?" Colorado Springs, CO, June 16-17, 1999b.

Dueker, Kenneth J. Private communication with authors, 1999c.

Ewing, Reid. "Is Los Angeles-Style Sprawl Desirable?" *Journal of the American Planning Association* 63.1 (Winter 1997) 107-126.

Ewing, Reid, Padma Haliyur, and G. William Page. "Getting Around a Traditional City, a Suburban Planned Unit Development, and Everything in Between." In *Transportation Research Record 1466*, Washington, D.C., Transportation Research Board, National Research Council, 1994: 53-62.

Giuliano, Genevieve. "The Weakening Transportation-Land Use Connection." *Access*, 6 (Spring 1995) 3-11.

Giuliano, Genevieve. "Land Use Policy and Transportation: Why We Won't Get There From Here." In *Transportation, Energy, and Environment (Proceedings of the Conference on Policies to Promote Sustainable Transportation Policies*, Asilomar, CA, August 17-20, 1997). Transportation Research Circular 492, August 1999, 179-198.

Gordon, Peter, and Harry W. Richardson. "Are Compact Cities a Desirable Goal?" *Journal of the American Planning Association* 63.1 (Winter 1997) 95-118.

Handy, Susan L. "Neo-Traditional Development: The Debate." *Berkeley Planning Journal* 6 (1991) 135-144.

Handy, Susan L. "Regional Versus Local Accessibility: Neo-Traditional Development and its Implications for Nonwork Travel." *Built Environment* 18.4, 1992, pp. 253-267.

Handy, Susan L. "Urban Form and Pedestrian Choices: Study of Austin Neighborhoods." In *Transportation Research Record 1552*, Transportation Research Board, 1996a: 135-144.

Handy, Susan L. "Understanding the Link Between Urban Form and Nonwork Travel Behavior." *Journal of Planning Education and Research* 15 (1996b) 183-198.

Handy, Susan L. "Methodologies for Exploring the Link Between Urban Form and Travel Behavior." *Transportation Research D* 1.2 (1996c): 151-165.

Longstreth, Richard W. *City Center to Regional Mall: Architecture, the Automobile, and Retailing in Los Angeles, 1920-1950*, The MIT Press, Cambridge, MA, 1997.

Luscher, Daniel R. "Transit-Oriented Development as a Congestion-Reduction Strategy in the San Francisco Bay Area." *Berkeley Planning Journal* 10 (1995): 55-74.

Porter, Douglas R. "Transit-Focused Development: A Synthesis of Research and Experience." *Transit Cooperative Research Program Report No. 20*, Washington, D.C.: National Academy Press, 1997.

Porter, Douglas R. "Transit-Focused Development and Light Rail Systems: The Lite Connection." In *Transportation Research Record 1623* (1998): 165-69.

Richmond, Jonathan E. D. *New Rail Investments — A Review. Taubman Center for State and Local Government*, John F. Kennedy School of Government, Harvard University, Cambridge, MA, June 29, 1998a.

Richmond, Jonathan E. D. "Simplicity and Complexity in Design for Transportation Systems and Urban Forms." *Journal of Planning Education and Research* 17 (1998) 220-230.

APPENDIX B: GLOSSARY OF ACRONYMS	
ATM	Automated Teller Machine
EAG	Expert Advisory Group
EIS	Environmental Impact Statement
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
GAO	General Accounting Office
ICSC	International Council of Shopping Centers
ISTEA	Intermodal Surface Transportation Efficiency Act
ITS	Intelligent Transportation System
KB	Knowledge Base
MIS	Major Investment Study
MPO	Metropolitan Planning Organization
MTP	Nationwide Personal Transportation Survey
NWTIPP	Nonwork Travel Improvement Planning Process
PSRC	Puget Sound Regional Council
PT	Project Team
TAZ	Transportation Analysis Zone
TEA-21	Transportation Efficiency Act for the 21st Century
TCRP	Transit Cooperative Research Program
TOD	Transit-Oriented Development
U.S. DOT	United States Department of Transportation
VMT	Vehicle Miles of Travel

APPENDIX C:

ABOUT THE RESEARCH TEAM

DICK NELSON

Dick Nelson is president and senior researcher at Integrated Transport Research, a Washington State nonprofit corporation. He is also a Research Associate at the Mineta Transportation Institute. His recent work has focused on the integration of land use and transportation, specifically the concept of transit-oriented development. From 1977 through 1992, he was a member of the Washington State House of Representatives, where he worked to establish state laws that address growth management, state transportation planning, the linkage of transportation and land use, incentives to use transit and carpool, and transportation demand management. Over the past two decades, he has been a member of numerous state and local boards, commissions, and advisory committees related to transportation. He earned the Sc.D. from Massachusetts Institute of Technology and the BS from the University of Washington.

JOHN NILES

John Niles is founder and president of Global Telematics, a contract research and policy consulting firm based in Seattle, Washington that focuses on the interaction of transportation and telecommunications. In addition, he is a Mineta Transportation Institute Research Associate. Lately, the focus of his work has been the response of transportation policy to the network economy. He has led research studies on telecom-driven travel reduction for several Metropolitan Planning Organizations and the United States Department of Energy. He is a member of the Telecommunications and Travel Behavior Committee of the Transportation Research Board and participates in the Washington State Telework Coalition. He earned the M.S. from the Graduate School of Industrial Administration at Carnegie Mellon University and the S.B. from Massachusetts Institute of Technology.

AHARON HIBSHOOSH

Aharon Hibshoosh is a Professor in the Department of Marketing at San José State University and Research Associate at the Mineta Transportation Institute. He received the Ph.D. at University of California, Berkeley and the B.A. at Hebrew University in Israel. He has written many publications in diverse areas of marketing and applied economics, and has developed a variety of forecasting systems and quantitative tools and systems for regional planning and for urban and rural businesses. Research interests in support of

transportation planning include retail site location decisions, and consumer activity choice and time budgets.

RHYS ROWLAND

Rhys Rowland is a Planner in the Director's Division of the County of Santa Clara, California, and a graduate student in Urban and Regional Planning at San José State University. He earned the B.S. in Environmental Studies and Urban Planning from San José State University in 1997.

PRE-PUBLICATION PEER REVIEW

San José State University, of the California State University System, and the Mineta Transportation Institute Board of Trustees have agreed upon a peer review process required for all research published by the Institute. The purpose of the review process is to ensure that the results presented are based upon a professionally acceptable research protocol.

Research projects begin with the approval of a scope of work by the sponsoring entities, with in-process reviews by the Mineta Transportation Institute Research Director and the project sponsor. Periodic progress reports are provided to the Research Director and the Research Associate Policy Oversight Committee (RAPOC). Review of the draft research product is conducted by the Research Committee of the Board of Trustees and may include invited critiques from other professionals in the subject field. The review is based on the professional propriety of the research methodology.

Reason Foundation
Policy Study No. 447
November 2015

Increasing Mobility in Southern California: A New Approach

by Baruch Feigenbaum

Reason Foundation

Reason Foundation's mission is to advance a free society by developing, applying and promoting libertarian principles, including individual liberty, free markets and the rule of law. We use journalism and public policy research to influence the frameworks and actions of policymakers, journalists and opinion leaders.

Reason Foundation's nonpartisan public policy research promotes choice, competition and a dynamic market economy as the foundation for human dignity and progress. Reason produces rigorous, peer-reviewed research and directly engages the policy process, seeking strategies that emphasize cooperation, flexibility, local knowledge and results. Through practical and innovative approaches to complex problems, Reason seeks to change the way people think about issues, and promote policies that allow and encourage individuals and voluntary institutions to flourish.

Reason Foundation is a tax-exempt research and education organization as defined under IRS code 501(c)(3). Reason Foundation is supported by voluntary contributions from individuals, foundations and corporations. The views are those of the author, not necessarily those of Reason Foundation or its trustees.

Reason Foundation

Increasing Mobility in Southern California: A New Approach

By Baruch Feigenbaum

Executive Summary

Productive regions offer mobility for people and goods, but Southern California's productivity is seriously threatened by reduced mobility. Without fundamental policy change, congestion and the lack of quality transit service threaten to strangle the region's economy. The ability to move goods and services efficiently, combined with the need to provide a high quality of life for employees and their families, should put improving mobility at the top of Southern California's priorities. The consequences of ignoring this growing problem will be severe.

The L.A. region, contributing the most congestion to Southern California, has been the nation's most congested metropolitan area for decades. The cost of congestion—as measured in wasted time and fuel—is estimated at $13.3 billion per year, or $1,711 per commuter annually. Average annual hours of delay per traveler have increased from 52 in 1985 to 80 in 2014. The travel time index (the ratio of travel time during peak periods to the same trip off-peak) increased from 1.31 to 1.43 during the same period. As population and employment in the region continue to grow, these numbers will get even worse unless new measures to reduce congestion are implemented.

While the region continues to spend significant resources on new rail lines, Southern California residents are taking fewer transit trips per capita today than 20 years ago. Transit-dependent residents must rely on a smaller bus network that fails to adequately serve their needs.

This study examines Southern California's mobility challenges in detail. While the Southern California Association of Governments' (SCAG) Long Range Transportation

Plan includes some new capacity, it does not allocate nearly enough resources to improving mobility. The region's planned transportation approach of investing heavily in fixed-rail transit and land-use changes to reduce the extent of driving can benefit the region but the approach will not significantly reduce traffic congestion or improve transit service in Southern California. The current plan would lead to only a modest increase in transit's market share, while overall congestion would continue to increase. While non-automobile alternatives—including a larger and better-designed bus network, sidewalks for walking and a bike network for commuting—definitely have an important role to play, they alone cannot reduce congestion.

The new approach we recommend is a comprehensive plan to improve mobility. It reduces congestion by dealing with both major sources: recurrent and non-recurrent. For non-recurrent congestion, which is caused by incidents (accidents, work zones, weather, etc.), Southern California should expand efforts under way, such as quicker identification of, response to, and clearance of incidents. On arterial streets, improvements in traffic signal coordination and access management will also help.

For the remainder of congestion that occurs seven days a week in Southern California for up to 16 hours a day, some roadway system expansion is needed because demand greatly exceeds roadway capacity. Doing so in a smarter and more sustainable way can reap the greatest benefits. While rebuilding some of the most congested interchange bottlenecks is a part of the plan, the most important component is using variable (time-of-day, demand-sensitive) pricing on all new expressway lanes to keep them free from congestion, similar to the SR 91 and I-10 express lanes.

We also recommend adding electronically priced bridges and/or tunnels on selected arterials to permit vehicles to bypass traffic signals at major intersections. These bridges/tunnels, combined with intelligent transportation system (ITS) features and access management, would give arterial users the option of faster, less-congested travel on these busy highways. Creating a network of these express lanes and electronic toll lanes is a cost-effective way to improve the entire roadway network.

It is crucial to improve the transit network as well. Our express lane network allows buses to travel in the lanes free of charge, and our managed arterial network allows buses to use the tolled grade separations for free. Using these premium features will decrease the travel times and increase the reliability of BRT (bus rapid transit) and express bus. We also provide details on how to build on the success of the region's express bus network and L.A. Metro's BRT-lite system. Combined with local bus, express bus and the existing rail options, the region can create a bus-based transit system with the quality and coverage a rail-based system cannot provide.

These approaches will also provide commuters with more choices. If they need the flexibility of the automobile, they can use the general purpose lanes for free or pay to use the free-flowing express lanes. If they want to take transit, they can choose fast, reliable region-wide bus rapid transit and express bus. This approach assures commuters and other travelers of faster and more-reliable travel choices within a financially feasible and sustainable system.

From a revenue perspective, tolling—a major part of our plan—contributes significant resources to the biggest projects. Tolling would help build approximately 710 lane-miles of new expressway capacity, 3,475 new/converted lane-miles of express lanes and truck toll lanes, and 559 new managed grade separations. The tolled facilities will generate approximately $362 billion in toll revenue over the infrastructure's life cycle, providing more than 100% of the total revenue needed to build and operate the tolled components (new expressways/tunnels, express toll lanes and components, managed arterials and components), while providing a contingency in case costs are higher than forecast or revenue is lower.

This study identifies many infrastructure improvements. Table ES1 below lists our plan's major capital components and their anticipated costs. Figure ES1 presents a full map of our plan.

Table ES1: Reason's Plan for Southern California Region Congestion Relief

Component	Total Cost Year of Expenditure (nominal)
New surface expressways/tunnels	$97.2B
Expressway interchanges reconfiguration	$4.1B
Arterial/local road capital	$74B
Arterial interchange reconstruction	$15.6B
Express toll lanes	$105.0B
Express toll lane interchanges	$24.0B
Managed arterials widening(s)	$16.5B
Managed arterials optional tolled grade separations	$33.7B
Managed arterials new alignments	$2.9B
Toll contingency	$32.5B
Transit capital/bus	$42.7B
Roadway operations and maintenance	$90.5B
Transit operations and maintenance	$102.4B
Intelligent transportation systems	$10B
Active transportation	$7.7B
Transportation demand management	$5.2B
Debt service	$50.1B
Total	**$714.1B**

Figure ES1: Reason's Plan for Southern California Congestion Relief

Adjusted for inflation, our plan requires $352 billion in taxpayer resources while SCAG's plan needs $606 billion. As a result our plan can be constructed with current resources; no tax increase is needed. SCAG's plan needs to find an additional $254 billion over 25 years. Our plan to use tolling supports more improvements than SCAG's plan, even with a tax increase.

To reduce the risks inherent in our tolling projects (express lanes, managed arterials, new toll expressways/tunnels), we recommend that they be carried out under long-term concession agreements in which the private sector partners would bear the risks of cost overruns and revenue shortfalls. Public private partnerships (P3s) of this scale are being successfully employed in Colorado, Florida, Texas, Virginia and around the world.

Implementing this approach would generate significant economic benefits. Reduced travel times allow employers to recruit from a larger area and employees to seek jobs within a larger area, better matching skills with needs. The direct result of increase in quantity and quality of employment makes an urban area's economy more productive.

Individual motorists would benefit every day, as future trip times would shorten. With a network of uncongested express toll lanes on the entire expressway system, everyone with a transponder would have the peace of mind of knowing that he or she had a time-saving option available whenever it was crucial to get somewhere on time.

As noted, the network of uncongested express toll lanes and managed arterials can facilitate a large expansion of transit services. The region's transit providers would gain

the virtual equivalent of a network of exclusive busways, since the priced lanes would permit reliable, free-flowing bus operations at all times. Yet unlike rail transit projects, for which funding is constrained, the infrastructure cost of this busway system would be paid for by motorists. This would give the region new options for corridors where it has become increasingly difficult to fund planned new rail lines. Also helpful would be development of a region-wide mobility center to coordinate bus routes and demand-response service for the elderly and disabled, as well as for residents of low-density areas, to create a seamless transportation network.

Southern California has come to a crossroads in transportation policy. Continuing down the status-quo path will lead to a future with an incomplete rail transit system and an undersized highway system, resulting in much worse congestion than today. The path suggested in this study accepts the reality that cars will continue to dominate personal transportation, trucks will remain the backbone of goods movement, and buses will be the mainstay of transit systems. It therefore would expand the multimodal highway infrastructure in smart, new ways to cope with those realities. This path promises a future of significantly less congestion than today, and of new mobility options—for motorists, for transit users, and for goods movement.

“Congestion results from poor policy choices and a failure to separate solutions that are effective from those that are not,” said former Transportation Secretary Norman Mineta. We hope Southern California will make wise policy choices for greatly increased mobility.

Table of Contents

Acknowledgment: This policy study is the independent work product of Reason Foundation, a nonprofit, tax-exempt research institute headquartered in Los Angeles. It was funded by the Galvin Foundation, as part of a multi-year, multi-state project to focus urban transportation policy on reduction of serious congestion.

Part 1

Southern California's Mobility Problem

According to the *2015 Urban Mobility Report* from the Texas A&M Transportation Institute, the greater Los Angeles region's average annual delay per traveler reached 80 hours in 2014.[1] The Los Angeles metro area's travel time index is 1.43 (meaning it takes an average of 43% longer to travel during peak periods than outside peak periods). Metro Los Angeles is worst in the country in both measures. In fact, Los Angeles is more congested than any other metro area in the United States, United Kingdom, France, Germany, Belgium and the Netherlands.[2]

Future prospects are not encouraging. With the end of the Great Recession, congestion is worsening throughout the country.[3] And despite a declining growth rate and a major rail expansion program, Southern California's traffic congestion has remained substantially worse than every other urban area in the country.

Business leaders are very concerned with Southern California's congestion problem. According to a recent study titled *Employer Views of Traffic Congestion*, congestion in the Los Angeles region is so bad that many employers are considering relocating to other areas.[4] The greater metro area is one of the few in the country that has lost jobs over the past 20 years. California also has one of the lowest labor force participation rates of any state in the country.[5] While some of these economic issues are due to the region's economic base and regulation, many of them are due to impaired mobility. Specifically, traffic congestion is such a problem that many employees seek to live exceptionally close to their jobs. But demand that exceeds housing supply results in increased home prices in certain areas. Many employees with the skills and abilities to relocate have migrated to less-congested areas where they can buy cheaper houses located farther from their jobs, such as Atlanta, Austin, Dallas, Houston, Miami, Phoenix and even Seattle.[6]

Finding more effective and sustainable methods of managing existing transportation assets and financing new infrastructure is the fundamental challenge faced by state and local decision-makers serving regions plagued by chronic traffic congestion. The social and economic costs of traffic congestion are staggering and continue to mount, as regions struggle to find better ways to expand inadequate transportation infrastructure to meet

current and future travel growth. This is particularly true in the vast geographic area of Southern California.

Among other objectives, this study seeks to develop practical, cost-effective solutions to the region's traffic congestion. Our aim is to offer local decision-makers a menu of innovative multimodal strategies to improve regional mobility and system performance. This report identifies opportunities to address the region's mobility problem through a combination of strategies, including innovative engineering, value pricing, public-private partnerships, and innovations in performance and management. We hope this mobility study will provoke and inspire further, more-detailed research.

A. Southern California Congestion Is Different

What makes the congestion problem in the urban Southern California area so severe? The region's congestion problems stem from its high suburban population density, an expanding population, limited growth in highway and arterial road capacity, geographic barriers such as the Hollywood Hills, and a lack of funding for core infrastructure.

In more basic terms the Southern California urban area is both spread out, with numerous activity centers located far apart from each other, and also densely populated, with the highest population density of any major urban area nationwide. While the common image of Los Angeles is a sprawling metro area where residents drive up to 50 miles one way to work, the reality is far different. Metro Los Angeles is 12% denser than nearest competitor, San Francisco, 32% denser than metro New York, and far denser than other Sunbelt metro areas, including Houston (L.A. is 135% denser) and Atlanta (L.A. is 310% denser).[7] L.A. area commuters travel some of the shortest home-to-work *distances* in the country. It is this condition of "dense sprawl" that results in the high levels of congestion unmatched by any other region in the country. As stated in a Los Angeles report, "Los Angeles differs from other metropolitan areas in that people here travel in all directions. They don't just travel from the suburbs to downtown. There are many centers of employment, recreation and residence. And, the vast majority of residents do not use transit. The lack of a clearly identifiable commute pattern, combined with being one of the most densely populated urban areas in the country, makes the task of planning transportation for Los Angeles extremely complex."[8]

Table 1: Very Large Urbanized Area Commuting Facts

Metro Area	Urbanized Area Density (people per square mile)	Average Travel Time to Work (in minutes)	Average One-Way Commuting Distance (in miles)
Los Angeles	6,999	28.2	8.8
San Francisco	6,266	28.3	8.0
New York	5,319	34.8	7.7
Chicago	3,524	31.0	10.0
Washington, D.C.	3,470	33.1	9.1
Houston	2,979	27.8	12.2
Dallas	2,879	26.2	12.2
Philadelphia	2,746	28.3	7.8
Boston	2,232	29.0	N/A
Atlanta	1,707	30.2	12.8

Source: U.S. Census Bureau, American FactFinder Tables GCT-PH1, Brookings Institution

As defined for purposes of this study, Southern California consists of Los Angeles and Orange Counties, as well as the western portions of Riverside and San Bernardino Counties and the eastern portions of Ventura County. In this large geographic area, primary destinations are varied and widely dispersed. The share of employment located in downtown Los Angeles is modest when compared to other significant regional employment hubs, such as Westwood, Century City, Santa Monica, Woodland Hills, Glendale, Pasadena, Long Beach, and Torrance. And those are just in Los Angeles County. Much of L.A. metro's employment is located in Orange County, particularly Irvine, Anaheim, Santa Ana and Costa Mesa. As such, the number of commuter trips between counties is high as residents seek less expensive housing in San Bernardino, Riverside and Ventura Counties while they work in Los Angeles and Orange Counties. The same pattern is true of non-work trips, with medical, shopping and recreational centers located throughout the region.

Redevelopment opportunities will likely increase population density in the cores of Los Angeles and Orange Counties going forward. Nevertheless, the majority of future population and employment growth will occur outside of the inner core, in areas including north Los Angeles County (Santa Clarita, Lancaster, Palmdale), the eastern San Gabriel Valley, south Orange County, San Bernardino County, Riverside County and Ventura County.[9] The combination of high density and varied endpoints in Southern California results in long trip lengths and a high number of vehicle-miles traveled. The transportation system has struggled to handle this blend of characteristics, with numerous freeways and arterials being overloaded for eight or more hours each day.

B. Southern California Commuting Patterns

A lack of mobility is more than a nuisance. It hurts the economy, degrades the environment and harms residents' personal lives. Table 2 and Figure 1 show the metro Los Angeles commuter mode split and commuting patterns over four decades.

Table 2: Los Angeles Commute Mode Shares and Travel Times, 1980-2012

Travel Mode	1980 Share	1990 Share	2000 Share	2010 Share	2012 Share	Mean 2012 Travel Time (in minutes)
Total Workers	5,184,393	6,809,043	6,767,619	5,507,175	N/A	N/A
Total Auto	87.3%	87.8%	86.5%	84.2%	84.2%	N/A
Drive Alone	70.2%	72.3%	71.9%	73.4%	74.0%	26.9
Carpool	17.1%	15.5%	14.6%	10.9%	10.3%	29.7
Transit	5.1%	4.5%	5.6%	6.3%	6.2%	48.6
Bicycle	N/A%	0.7%	0.7%	0.9%	0.9%	N/A
Walk	3.5%	2.9%	2.7%	2.7%	2.6%	N/A
Work at Home	N/A	2.7%	3.5%	4.1%	4.8%	N/A

Source: American Fact Finder Table S0801, Means of Travel to Work

Figure 1: Percentage of L.A. Region Workers Who Commute to Work by Mode, 1990–2012

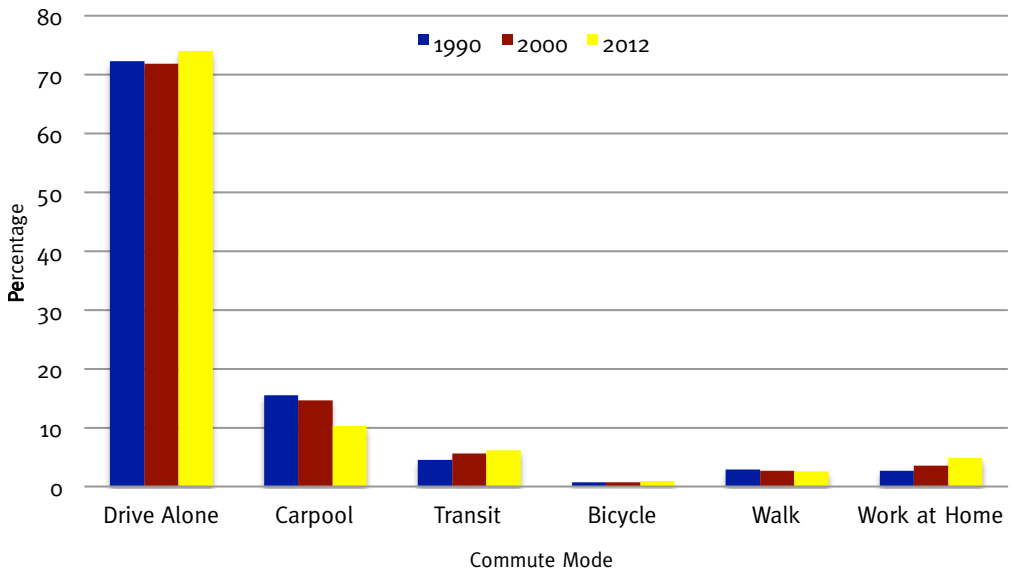


*Figure 1 uses numbers from Table 2

Table 2 and Figure 1 above show how L.A. metro area commuter mode shares and mean travel times by mode have changed from 1990 to 2012.

Driving continues to dominate commuting and accounts for 84.2% of the mode share by 2012. Since 1980, the estimated drive alone mode share in the greater L.A. area has increased from 70.2% to 74.0%, while the carpool mode share declined from 17.1% to 10.3%—representing a shift in traveler preference from carpooling to driving alone.

The transit mode share has increased from 5.1% in 1980 to 6.2% in 2012. However the transit share actually decreased between 2010 and 2012. More importantly, bus provides the vast majority of transit service, 4.8% of the 6.2%.[10] The "work at home" mode share has nearly doubled from 2.7% in 1990 to 4.8% in 2012. During that same time period,

there has been a small increase in bicycling from 0.7% to 0.9% and a small decrease in walking from 2.9% to 2.6%. However, few people commute using active transportation so the actual numerical changes are very small.

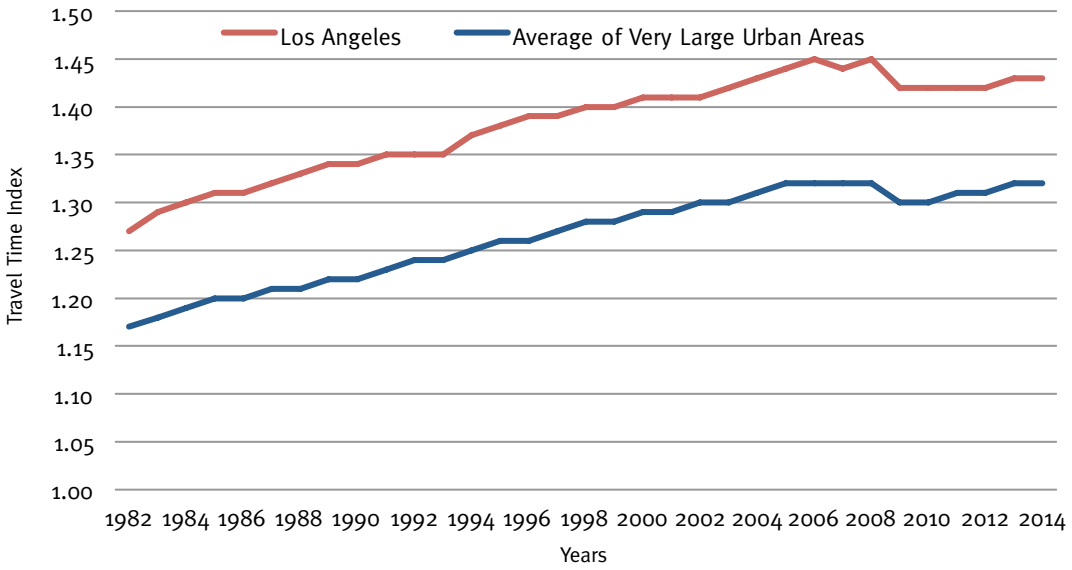
From the travel time data, it should be clear why the automobile mode shares are highest. Except for the short work trips that can be made by foot or on bicycle, driving provides by far the quickest trip, despite the added time due to congestion.

C. A Lack of Mobility

The current levels of traffic congestion in Southern California impose significant costs on individuals, businesses, and the regional economy.

Southern California has been the nation's leader in total traffic congestion for the past 25 years. In the year 2014, Los Angeles drivers spent an estimated 623 million person-hours sitting in congested traffic.[11] Currently, it takes 43% longer to travel in Los Angeles during peak periods, when congestion is severe, than during off-peak hours. Researchers at the Texas A&M Transportation Institute (TTI) define this as a Travel Time Index of 1.43. Figure 2 shows the trend in the Travel Time Index in Los Angeles over time, compared to the average of other very large urban areas (current regional population of over three million).

Figure 2: Travel Time Index, Los Angeles Urban Area vs. Very Large Urban Areas, 1982–2014

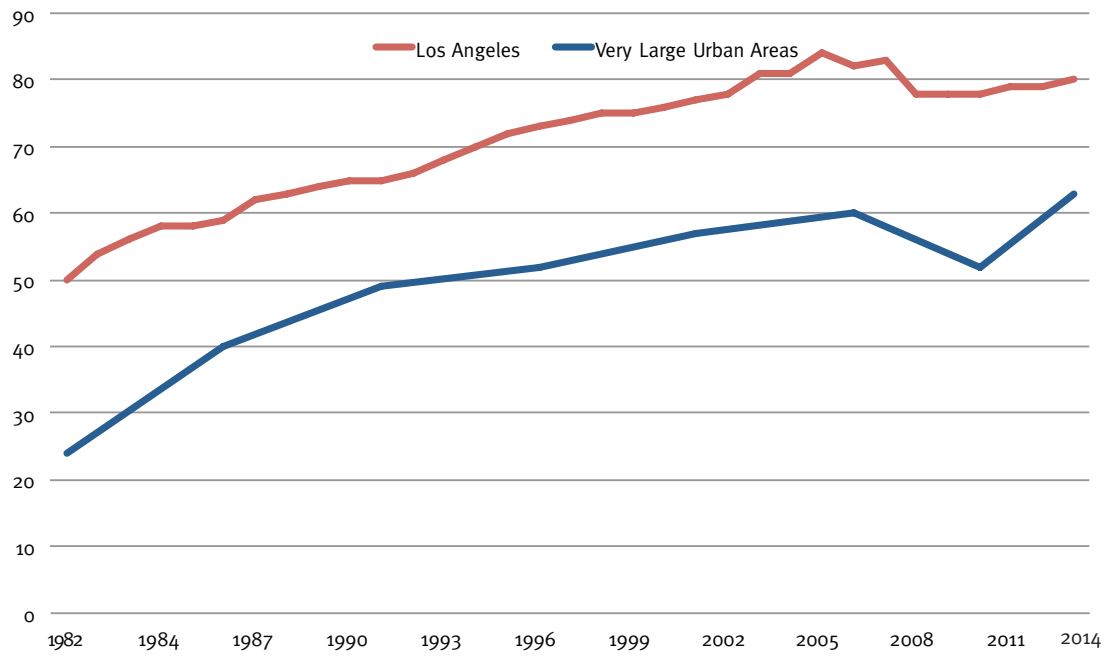


Source: 2012 Texas A&M Transportation Institute Annual *Urban Mobility Report*, 2015 Texas A&M Transportation Institute Annual *Urban Mobility Report*

The Travel Time Index in Los Angeles has been consistently higher than other major urban areas over time, having increased from 1.27 in 1982 to 1.39 in 2002, and to a record high of 1.43 in 2014.

Figure 3 shows the trend in average annual hours of delay in Los Angeles over time based on TTI data, compared to the average of other very large urban areas.

Figure 3: Annual Delay Per Peak Traveler, Los Angeles Urban Area vs. Very Large Urban Areas, 1982–2014

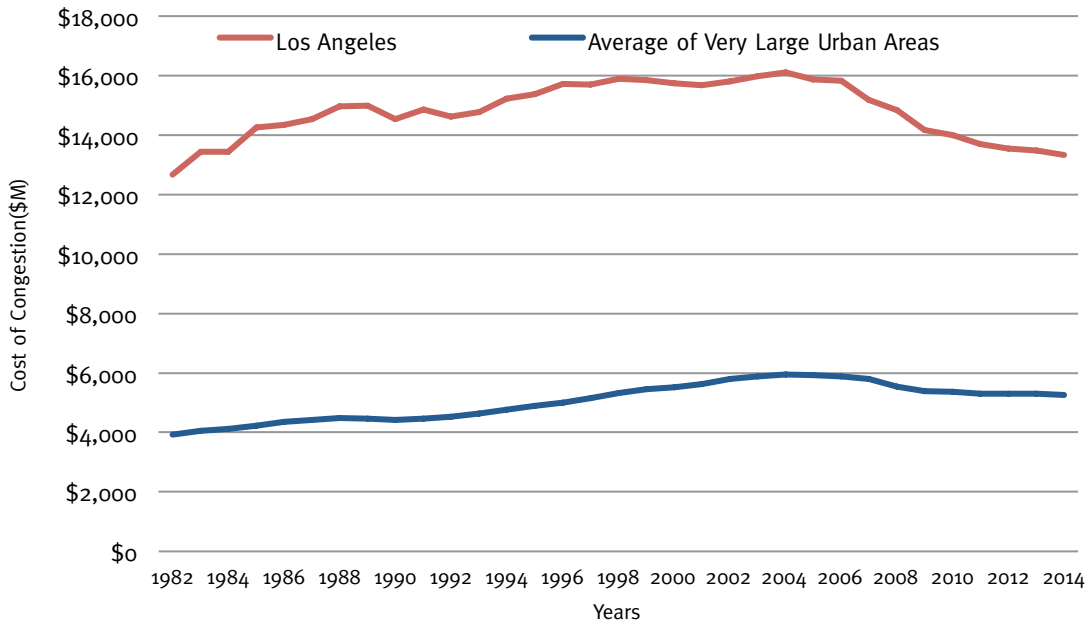


Source: 2012 Texas A&M Transportation Institute Annual *Urban Mobility Report*, 2015 Texas A&M Transportation Institute Annual *Urban Mobility Report*

The annual traveler delay in Los Angeles was 49% higher than the very large urban area average in 1985 (58 hours compared to 39 hours), 38% higher in 1995 (70 hours compared to 51 hours), 31% higher in 2002 (77 hours compared to 59 hours), 29% higher in 2011 (79 hours compared to 61 hours) and 27% higher in 2014 (80 hours compared to 63). Clearly, L.A. area travelers experience congestion levels that are significantly higher than those in other areas, a trend that has continued over time despite tremendous multimodal investments in the Southern California region's transportation system.

Figure 4 shows the trend in annual cost of congestion in the L.A. area over time, compared to the average of other very large urban areas.

Figure 4: Annual Cost of Congestion (millions), Los Angeles Urban Area vs. Very Large Urban Areas, 1982–2014



Source: 2012 Texas A&M Transportation Institute *Urban Mobility Report*, 2015 Texas A&M Transportation Institute *Urban Mobility Report*.

The region does not rank any better in other congestion measures. It is second worst in cumulative delay and delay per commuter.[12] It has the highest commuter stress index and freeway planning index—the amount of buffer time that needs to be factored in due to the unpredictability of congestion—in the nation. Since gridlocked traffic uses more gasoline than traffic operating at free flow speeds, Southern California drivers waste almost 200 million gallons of gasoline each year, second worst in the country.[13]

Even compared to the very largest areas, Los Angeles ranks poorly. Table 3 compares Los Angeles with some other major metro areas that have more than 5,000,000 residents.

Table 3: Comparison of Metropolitan Area Characteristics, 2014

Urban Areas	Population	Area (Square Miles)	Population Density (persons per sq mile)	Travel Time Index	Annual Hours of Delay	Annual Cost of Congestion (ooos)	Annual Congestion Cost per Peak Traveler
Los Angeles	12,635,000	2,285	5,790	1.43	622,509,000	$13,318,000	$1,711
New York City	19,040,000	4,780	3,964	1.34	628,241,000	$14,712,000	$1,739
Chicago	8,700,000	2,800	3,073	1.31	302,609,000	$7,222,000	$1,445
Washington D.C.	4,920,000	1,310	3,521	1.34	204,375,000	$4,560,000	$1,834
Atlanta	4,500,000	3,050	1,430	1.24	148,666,000	$3,214,000	$1,130
San Francisco	3,480,000	1,270	3,229	1.41	146,013,000	$3,143,000	$1,675
Houston	5,000,000	1,905	2,167	1.33	203,173,000	$4,924,000	$1,490

Source: 2012 Texas A&M *Urban Mobility Report*; 2015 Texas A&M *Urban Mobility Report*

Los Angeles's annual congestion also has substantial economic costs. Annual congestion totals $13.3 billion in excess costs, or $1,711 per commuter.[14] In gasoline costs, this is the equivalent of driving an additional 12,221 miles per year with gasoline priced at $3.50 per gallon in a car that averages 25 miles per gallon. Truck congestion totals $1.7 billion, equating to $306 billion in truck commodity value. (Commodities are the products or goods transported by trucks. Truck commodity value is the total worth of all of the goods shipped by trucks.)[15] For comparison, $412 billion could buy a brand-new Toyota Camry for every man, woman and child in the Los Angeles metro area. Clearly there are significant economic costs to congestion.

The direct cost of congestion in metro Los Angeles in 2014 was enormous, at an estimated $13.3 billion. This cost has increased from $2.13 billion in 1982, $6.77 billion in 1992, and $10.8 billion as recently as 2011.[16] The current average cost of congestion in other very large urban areas is $5.3 billion, less than half of Los Angeles's $13.3 billion.

In one metric Los Angeles's congestion may not seem that bad. As the densest metro area in the country, the region has the 3rd shortest commute time of any major metro area. Yet, the region's commuters travel some of the shortest distances in the country. Some metro areas including Atlanta and Dallas have congested traffic because workers live far from their place of employment. Yet, the L.A. region's congestion is far worse than these cities, despite people traveling approximately half as far, on average.

The preceding numbers detail Los Angeles's congestion issues. But to actually fix the problem, we have to understand why the area's current system is not working.

Despite a robust network, because of its high densities, the L.A. area's expressway and surface arterial networks are severely overloaded. The following table compares the L.A. region's expressway and arterial data with other major metro areas. The L.A. figure for expressway VMT per lane-mile is the basic measure of how overloaded this region's expressways are, compared to those of other very large urban areas.

It is no mystery that L.A. area congestion is so severe. Furthermore, unlike some other metro areas, L.A. was already severely congested back in 1982. There is simply not enough roadway capacity for the huge amount of car, bus and truck travel needs of this huge, dense metro area. Figure 5 shows that even as L.A.'s daily vehicle-miles of travel increased by more than 100%, expressway lane-miles increased by less than 50%. Despite extensive congestion in 1982, over the next 30 years the agencies in charge chose not to significantly invest in adding capacity to keep pace with the growth in travel, resulting in the severe congestion conditions in the area currently.

L.A. regional congestion adversely affects transit as well. The backbone of the L.A. area transit network is bus service, with 77% of all transit passengers using bus as their primary transit vehicle rather than rail. Table 4 shows the commute choice in the automobile, rail transit and bus transit modes. In addition, many of those who use rail transit also take a bus to get to rail stations. Limited-stop, bus rapid transit and express bus are available as well as demand-response service for the elderly and disabled. All of these buses travel on roads, which are often congested. Reducing congestion would allow buses to travel their routes faster and more reliably, increasing the popularity of bus routes and allowing transit officials to decrease the headway between buses.

Reducing congestion would also allow suburban transit users who drive to commuter rail and express bus park-and-ride lots to have easier access to transit service, increasing transit usage. Severe congestion between their residence and the transit station might cause these choice riders, who can drive or take transit, to bypass transit for a quicker alternate route. Table 4 shows the split between driving and taking transit. The transit numbers are further divided into rail and bus. Some transit trips include bus and rail portions, so we chose the mode used for the majority of the trip.

Table 4: Los Angeles Region Commuter Mode Split

Mode	Total Commuters	Percentage of Total Commuters
Drive	5,474,045	85%
Bus	321,541	4.8%
Rail	39,771	1.4%
Other Modes (Telecommute, Bike, Walk)	N/A	8.8%

Source: U.S. Census, American FactFinder

As Table 4 shows, bus transit transports the majority of transit users. For every person who uses rail, eight people use bus.[17] As a result, congestion affects both the timeliness and reliability of the majority of transit trips.

Part 2

The Causes and Consequences of Lack of Mobility

A lack of mobility due to congestion is more than just a nuisance—it has real, negative consequences that stretch beyond arriving late at work. Understanding why and how congestion affects mobility starts with recognizing the two different types of congestion and their effect on the economy, the environment and the social sector.

A. Different Types of Congestion

Congestion is frustrating regardless of whether it is caused by an accident or routine peak period traffic volume. Transportation research identifies two primary types of congestion. Since they have different causes, they have different solutions. Understanding the differences between non-recurrent and recurrent congestion is vital for Southern California to reduce both types.

The first of these is what most people encounter every day on their trips to and from work—the overloading of the roadways with more vehicles than they can handle. Researchers refer to this as *recurrent* congestion, resulting from a basic mismatch of highway capacity with vehicles during peak periods. This type of congestion is costly—but at least it is predictable.

Non-recurrent congestion, which makes up as much as 50% of Southern California's total congestion, has many causes, including mostly unpredictable events (breakdowns and crashes), partially predictable events (weather) and very predictable events (construction work zones).[18] Since this incident-related congestion occurs randomly and without warning, it adds unreliability to trips. The rubbernecking resulting from a fender-bender may add 30 minutes to a 45-minute trip. When these incidents occur frequently, commuters often add extra "buffer time" to their trips. The Texas A&M Transportation Institute has recently added a planning time index to its standard measures of congestion to better ascertain the cost of such congestion.[19]

A recent National Cooperative Highway Research Program report examined the sources of congestion in very large urban areas such as Los Angeles. In most of these very large metro areas, about 50% of all traffic congestion is caused by incidents.

Table 5: Sources of Congestion in Very Large Urban Areas

Source of Delay	Percentage Contribution
Demand greater than capacity	37%
Poor signal timing	5%
Total Recurring Congestion	**42%**
Crashes	36%
Breakdowns	6%
Work zones	10%
Weather	5%
Special events, other	1%
Total Non-Recurring Congestion	**58%**

Source: The 21st Century Operations-Oriented State DOT

B. The Economic Costs of Congestion

The cost of congestion, which affects automobiles, truckers and transit vehicles alike, is measured by many different metrics. Specifically, congestion can increase bus travel times and reduce reliability, making transit significantly less appealing. The Texas A&M Transportation Institute (TTI) estimates direct congestion costs of approximately $160 billion nationwide.[20] However, this only accounts for the direct costs. The U.S. Department of Transportation estimates annual indirect congestion costs of $48 billion in 2014 due to productivity losses, another $48 billion due to unreliability, $4.8 billion due to cargo delay and $15.8 billion in safety and environmental costs. Combining both the direct and indirect costs, total congestion costs exceeded $275 billion ($276.6 billion) annually.[21]

Several years ago, the National Cooperative Highway Research Program (NCHRP) funded pioneering research attempting to get a handle on the cost of congestion to regional businesses.[22] They found that congestion interferes with just-in-time delivery systems, thereby increasing inventory costs. It reduces the availability of skilled workers, and raises payroll costs needed to attract such workers. It shrinks the market area for local firms' products and services, and it reduces the range of job opportunities for workers.

The NCHRP research team used Chicago and Philadelphia to gather data on logistic and labor market effects of congestion, with which to do some modeling. The team estimated that a 10% reduction in congestion would save businesses $1,274 million per year in Chicago and $312 million a year in Philadelphia in 2014 dollars.[23] They quantified labor market effects at an estimated $455 million in Chicago and $260 million in Philadelphia in 2014 dollars.

We have applied their research to Southern California to determine the economic effects of a 10% reduction in congestion. Such a reduction would save Southern California area businesses almost $2 billion per year. The labor market effects work out to more than $700 million per year in 2014 dollars.

Congestion affects the labor market because most people will not spend more than a particular amount of time each day on the journey to work. As congestion increases, the number of miles they can travel within this amount of time decreases. Imagine a person's home in the center and a range of employers, some five miles away, some 10 miles away and some 20 miles away. When congestion is low or zero, commuters can reach every point within a 20-mile circle, but in a highly congested region such as Southern California some people can only reach the points within the 10-mile circle. Others may be able to reach only points within the five-mile circle. According to basic geometry, the area of a 20-mile radius circle is four times that of a 10-mile radius circle. If work possibilities are randomly distributed across the landscape, the 20-mile circle will include four times as many job opportunities as the 10-mile circle. And the same applies in reverse for an employer. It will have four times as many potential employees within a 20-mile circle as a 10-mile circle.

In a large and diverse metro area, economic productivity depends on matching skilled employees with employers who can make the best use of their abilities. When Remy Prud'homme and Chang-Woon Lee studied this question using data on travel times and labor productivity for French cities, they reached several conclusions.[24] They found a robust relationship between the effective labor market size (the size of the available circle, as defined by acceptable travel time) and the productivity of that city. Specifically, when the effective labor market size increased by 10%, productivity (and hence economic output) increased by 1.8%. David T. Hartgen and M. Gregory Fields studied labor market size in the U.S. and found economic gains from reducing traffic congestion of up to 30%, depending on location.[25]

Congestion costs are a major issue for manufacturing and distribution businesses. And understanding the total congestion costs can be challenging. While TTI counts truck congestion, the truck time value reflects only the hourly operating cost of trucks, not the value of trucking services to shippers. Truck congestion affects more than time; congestion wreaks havoc on the reliability of truck pick-up and delivery schedules, a substantial cost that is not included in the *Urban Mobility Report* figures.

Southern California has the busiest ports in the country, with the ports of Los Angeles and Long Beach collectively handling about 40% of the nation's imports and about 24% of the nation's exports.[26] One out of every seven jobs in Southern California depends on this

trade, making the effective ground transport of goods extremely important to the region in order to retain its economic competitiveness. Container volume processed by the ports grew by 59% between 2000 and 2010, and is expected to nearly triple by 2030. Much of this ground transport of goods occurs on the region's most congested facilities, including I-5, I-10, I-405, I-710 and SR 60.

Finally, congestion decreases Los Angeles's economic competitiveness. L.A. has been losing jobs for the past 20 years. According to the Census Bureau, the region has fewer jobs today than in 1990 despite gaining 2,000,000 residents.[27] While Southern California's transportation challenges are certainly not the only reason for the economic problems, and fixing the transportation issues will not by itself improve the economy, persistent congestion needs to be addressed. A total of 21 Fortune 500 companies are based in the greater Los Angeles area. If the region wants to keep these important headquarters and attract others, it needs to reduce its congestion problem.[28]

Table 6: Civilian Employment and Labor Force Participation in U.S. Metro Areas

Urban Area	1990 Employment	2010 Employment	1990 Labor Force Participation	2010 Labor Force Participation
New York	3,759,900	8,687,798	73.3%	63.5%
Los Angeles	6,809,043	5,507,175	77.9%	58.8%
Chicago	3,099,100	4,068,433	86.4%	60.6%
Washington D.C.	2,134,400	2,467,218	82.9%	67.7%
Atlanta	1,444,700	2,162,164	81.1%	62.4%
San Francisco	844,300	1,657,843	80.3%	61.2%
Houston	1,634,200	2,361,278	81.6%	63.5%

Source: U.S. Census, Employment Tables—Non-farm Employment, 1990 and 2010, Los Angeles 2020 Commission

C. The Social Costs of Congestion

In many other ways congestion harms Southern Californians beyond those discussed above. It reduces safety, entertainment possibilities, recreation and social life. Gridlocked roads significantly hamper emergency vehicle response time; paramedics may not arrive in time to save a life, or firefighters may be delayed in getting to a fire. Congestion also increases stress. A study conducted by Dr. David Lewis of the International Stress Management Association found some commuters had a higher stress level than fighter pilots entering battle.[29]

After-work congestion causes people to avoid places (restaurants and theaters) that become too much of a hassle to reach. Many commuters leave for work as early as 5:00 AM and leave work as late as 8:00 PM. Parents may miss meal times and their kids' bed times. Congestion shrinks circles of opportunity. Computer dating services report that many subscribers are unwilling to match up with prospects who live more than a certain number

of miles away because congestion simply makes it too difficult to develop a relationship.[30] In very large urban regions such as Southern California this can be as few as five miles.

D. The Environmental Costs of Congestion

Oftentimes citizens object to building or widening highways for environmental reasons. While these reasons may be justified, a high level of congestion has many negative effects on the environment. The two compounds in car emissions that harm the environment the most are carbon dioxide (CO_2) and mono-nitrogen oxides (NOx). For both compounds, emissions-released versus speed-traveled is a U-shaped pattern. Cars traveling at free-flow speeds (30–55 miles per hour) release less carbon dioxide than cars traveling in stop-and-go patterns (speeds between 0 and 30 miles per hour).[31] However, typical Southern California congestion reduces traffic speeds in certain areas below 30 miles per hour for up to 12 hours per day, increasing carbon dioxide emissions.

Emissions rates can be reduced the most by decreasing very heavy congestion that keeps vehicle speeds below 30 miles per hour. With increased vehicle fuel efficiency requirements and continued refinement in car engine technology, increasing vehicle free flow speeds to 30 miles per hour or higher will result in the largest reduction in emissions from the light duty vehicle fleet.

E. Live/Work/Play Communities' Effect on Congestion

One recent trend in development patterns is live/work/play communities. Live/work/play communities are part of a broader movement to encourage residents to live closer to where they work. Some policy makers believe that an increase in live/work play communities will significantly reduce congestion. The reality is much more nuanced.

For example, live/work/play communities are not feasible for some residents. Many people cannot afford to live in many mixed-use communities.[32] Housing in these developments is typically affordable for only part of the population. While affordable housing is offered, it is usually for a very limited number of units. In most communities, including mixed-use, many households have two-income earners. While one earner may live close to his job, it is very unlikely that both will live close to their employment. Residents who choose not to live in mixed-use communities often prioritize quality schools or living in a house with a big yard, over commute times. Often neighborhoods with these features are far from job centers. Further, many folks who live in live/work/play communities do so for the development style of smaller lot sizes and mixed uses—not to be closer to work. Their jobs require long commutes accomplished via the automobile. One of the most famous

live/work/play communities, Atlantic Station in Atlanta, has rows of underground parking as most residents own cars and commute to work by car.[33]

Studies find that the effect of new mixed-use developments on overall travel or congestion is minor.[34] Further, mixed-use communities are likely to remain a subset of all residences. Southern California needs a transportation solution for folks who live in central cities, those who live in mixed-use communities and those who live in traditional suburbs.

F. Congestion and Southern California's Future

While the L.A. area dithers on congestion reduction, other major metro areas are taking concrete action. Dallas and Houston have signed on to the Texas Metropolitan Mobility Plan, under which each has selected a lower travel time index than today's to reach by 2030.[35] Seattle, Washington has a strategic blueprint that details how to reduce congestion in the metro area. Regional competitors, including Phoenix and San Francisco, are making substantial investments in their transportation systems to reduce congestion.[36]

In short, major congestion is a significant problem in Southern California, and the economic, social, and environmental costs are substantial. Congestion can harm residents' social life *and* limit economic growth.

Part 3

Current Plans to Reduce Congestion and Improve Mobility

A. Metropolitan Planning Organization Planning Requirements

Several regional and state agencies, led by the Southern California Association of Governments (SCAG), are tasked with developing regional plans to reduce congestion in Southern California.

As a result of federal transportation reforms enacted in the 1991 Intermodal Surface Transportation Efficiency Act (ISTEA), all metro areas with a population of 50,000 or greater must have a metropolitan planning organization (MPO) charged with distributing federal transportation monies throughout the region. SCAG is Southern California's federally designated planning organization. MPOs must create a long-range transportation plan (LRP), which is a summary of all planned transportation projects over the next 20 years. The MPO takes the projects it plans to complete in the near future and places them in its transportation improvement plan (TIP). Metro areas over 200,000 people are defined as transportation management areas (TMAs). These areas must also have a congestion management system (CMS) that identifies strategies and specific actions to reduce congestion and increase mobility. MPOs also coordinate transportation and air quality planning in metro areas, such as Los Angeles, that are defined as being in "non-attainment" of federal air quality standards.

The state of California has also enacted several specific environmental requirements for planning. First, all plans must incorporate the requirements of Assembly Bill 32—The California Global Warming Solutions Act of 2006. AB 32 requires California to reduce its greenhouse gas emissions to 1990 levels by 2020. AB 32 applies to carbon dioxide, methane, nitrous oxides, hydrofluorocarbons, perfluorocarbons, sulfur hexafluoride and nitrogen trifluoride. MPOs must also incorporate SB 375—The Sustainable Communities and Climate Protection Act of 2008. SB 375 requires the state Air Resources Board to set regional targets for GHG emissions from passenger vehicle usage. Each MPO must

prepare a "sustainable communities strategy" as a part of its transportation plan. The Air Resources Board must approve the plan to verify that it meets GHG reduction targets.

The MPO is required to involve other relevant agencies in transportation planning. In Southern California this includes the California Department of Transportation (CalTrans), which partners with SCAG on state and local roads, the six metro counties of Imperial, Los Angeles, Orange, San Bernardino, Riverside and Ventura, and the 191 cities in those counties which partner with SCAG to build county and local infrastructure. (Note: While SCAG includes Imperial County in southeast California in its service area, Imperial County is not considered part of the Los Angeles Region and is not included in this study.) SCAG must also coordinate with transit agencies including Los Angeles Metro, Foothill Transit, Metrolink, the Orange County Transportation Authority, the Riverside Transit Agency, San Bernardino Associated Governments and the Ventura County Transportation Commission.[37]

B. SCAG's Plan 2035 Overview

Traditionally, SCAG has focused on improving mobility. However, in 2000—under pressure from environmental activists—SCAG added livability, prosperity and sustainability to its mobility plans. And for its 2012 plan, as a result of SB 375 that mandates specific reduction in greenhouse gases for cars and light trucks, SCAG had to create a plan that reduces greenhouse gas emissions.[38]

As a result, SCAG developed this 2012 plan differently than previous long-range plans. The agency more closely integrated transportation and land use planning. It developed four plan elements:

- *Development Location* ranging from dispersed growth to focused development,
- *Community/Neighborhood Design* ranging from auto-oriented to walkable,
- *Housing Options/Mix* ranging from single-family subdivisions to multi-family-focused housing, and
- *Transportation Improvements* ranging from roads/highways to transit/non-auto strategies.

After developing the elements, plan makers developed four growth scenarios that structure development in different patterns ranging from moderate density to exceptionally high density.

Scenario 1: This scenario is based on the General Plans prepared by cities and compiled by SCAG, with assistance from local planners, using the Local Sustainability Planning Tool (LSPT). It includes a significant proportion of suburban, auto-oriented development, but also recognizes the recent trend of increased growth in existing urban areas and around transit. New housing is mostly single-family (58%), with an increase in smaller-lot single-family homes, as well as an increase in multi-family homes (42%). The transportation system is based on the package of improvements in the 2008 RTP. While these investments tend to favor automobile infrastructure, they also support new transit lines and other non-auto strategies and improvements.

Scenario 2: This scenario focuses more growth in walkable, mixed-use communities and in existing and planned High-Quality Transit Areas. This scenario would increase investments in transit and non-auto modes as compared to the 2008 RTP. Employment growth is focused in urban centers, around transit. Fewer new homes (29%) are single-family homes, based on the idea that there is a demand for a broader range of housing types, with new housing weighted less toward large-lot single-family homes (2%) and more toward smaller-lot single-family homes (27%) and multi-family condos, townhomes, and apartments (70%).

Scenario 3: This scenario builds on the walkable, mixed-use focus of the growth in Scenario 2 and also aims to improve fiscal and environmental performance by shifting even more of the region's growth into areas that are closer to transit and less auto-centric. Like Scenario 2, this scenario aims to meet demand for a broader range of housing types, with new housing weighted toward smaller-lot single-family homes, townhomes, multi-family condos, and apartments. In terms of percentage, the mix of housing types is very similar to Scenario 2, but the location of the growth within the region shifts more toward transit-rich locations. Also as in Scenario 2, transportation system investments are weighted more toward transit investments, transportation demand management[39] (TDM), and non-auto strategies, which would support the planned move away from more auto-oriented development patterns.

Scenario 4: This scenario maximizes growth in urban and mixed-use configurations in already developed areas and around existing and planned transit investments. To support this shift, transportation system investments are heavily weighted toward transit infrastructure and operational improvements (i.e., higher frequencies and more transit feeder service), as well as improvements to bicycle and pedestrian infrastructure. In order to maximize the transit investments and accommodate population in already developed areas, the vast majority of new housing (96%) is multi-family, while 4% is single-family development.

While SCAG chose a mix of scenarios depending on location, most of its plan seems to focus on Scenarios 2 and 3.

The 2035 Regional Transportation Plan titled Mobility 2035 was adopted in April 2012. This long-range plan includes projects totaling more than $605 billion to improve Southern California's surface transportation system.

The 2035 Regional Transportation Plan devotes funding to the following components. Note: The SCAG plan figures in Tables 7 and 8 reflect nominal dollars estimated for 2010–2035. We have converted these numbers to reflect the years 2015–2040, as shown in parentheses. Full funding details are provided in Table 8:

- **$216.9** billion in maintenance funding. Much of this funding ($139.3 billion) supports transit. The remaining $77.6 supports highways and arterials.
- **$64.2** billion for new highways
- **$55** billion for new transit services including new heavy-rail, light-rail and BRT lines
- **$51.8** billion in new passenger rail services. Most of this funding ($47.7 billion) supports developing high-speed rail between Los Angeles and San Diego, and Los Angeles and the Antelope Valley. A fraction ($4.1 billion) supports new commuter rail.
- **$48.4** billion for goods movement. Most of this funding supports improvements at and related to the Ports of Long Beach and Los Angeles.
- **$22.1** billion for new arterials
- **$7.6** billion for transportation system management
- **$6.7** billion for active transportation (bicycling and walking)
- **$4.5** billion for transportation demand management

Table 7: SCAG Suggested Transportation Investments

Component	Description	Cost
Transit		$55 B
Bus Rapid Transit	New BRT routes, extensions, and/or service enhancements in Los Angeles, Orange, Riverside, San Bernardino, and Ventura Counties	$4.6 B
Light Rail Transit	New light rail routes/extensions in Los Angeles and San Bernardino Counties	$16.9 B
Heavy Rail Transit	Heavy rail extension in Los Angeles County	$11.8 B
Bus	New and expanded bus service in Los Angeles, Orange, Riverside, San Bernardino, and Ventura Counties	$21.7 B
Commuter and High-Speed Rail		$51.8 B
Commuter Rail	Metrolink extensions in Riverside County and Metrolink systemwide improvements to provide higher speeds	$4.1 B
High-Speed Rail	Improvements to the Los Angeles to San Diego (LOSSAN) Rail Corridor with a goal of providing San Diego-Los Angeles express service in under two hours. Phase I of the California High-Speed Train (HST) project that would provide high-speed service from Los Angeles to the Antelope Valley	$47.7 B

Table 7: SCAG Suggested Transportation Investments

Component	Description	Cost
Active Transportation		$6.7 B
Various Active Transportation Strategies	Increase bikeways from 4,315 miles to 10,122 miles, bring significant amount of sidewalks into compliance with the Americans with Disabilities Act (ADA), safety improvements, and various other strategies	$6.7 B
Transportation Demand Management (TDM)		$4.5 B
Various TDM Strategies	Strategies to incentivize drivers to reduce solo driving including increased carpooling, vanpooling, transit use, telecommuting; redistributing vehicle trips from peak periods to off-peak periods; developing mobility hubs and adding bike racks to buses	$4.5 B
Transportation Systems Management		$7.6 B
Various TSM Strategies	Incident management, ramp metering, traffic signal synchronization, data collection, smart transit cards	$7.6 B
Highways		$64.2 B
Mixed Flow	Interchange improvements to and closures of critical gaps in the highway network to provide access to all parts of the region	$16.0 B
High Occupancy Vehicle, High Occupancy Toll	Closure of gaps in the high-occupancy vehicle (HOV) lane network and the addition of freeway-to-freeway direct HOV connectors to complete Southern California's HOV network. A connected network of Express/HOT lanes	$20.9 B
Toll Facilities	Closure of critical gaps in the highway network to provide access to all parts of the region	$27.3 B
Arterials		$22.1 B
Various Arterial Improvements	Spot widenings, signal prioritization, driveway consolidations and relocations, grade separations at high-volume intersections, new bicycle lanes, and other design features such as lighting, landscaping, and modified roadway, parking, and sidewalk widths	$22.1 B
Goods Movement		$48.4 B
Various Goods Movement Strategies	Port access improvements, freight rail enhancements, grade separations, truck mobility improvements, intermodal facilities, and emission-reduction strategies	$48.4 B
Operations and Maintenance		$216.9 B
Transit	Operations and maintenance to preserve our multimodal system in a good state of repair	$139.3 B
Highways		$56.7 B
Arterials		$20.9 B
Debt Service		$45.1 B
Miscellaneous Items/Rounding		$2.7 B
Total		**$605.6B**

Source: Southern California Association of Governments 2012 Long Range Plan

Table 8: SCAG Planned Additional Revenue Sources

Revenue Source	Description	Amount
Bonds Proceeds from Local Sales Taxes	Issuance of debt against sales tax revenues	$25.6 B
State and Federal Gas Excise Tax Adjustments	Additional gasoline tax imposed at the federal and state levels from 2017-2024	$16.9 B
Mileage-Based User Fees	Mileage-based user fees (MBUF) to replace gas taxes in 2025	$110.3 B
Highway Tolls	Toll revenues generated from SR 710 North Extension, I-710 South Freight Corridor, East-west Freight Corridor, segment of the High Desert Corridor, and Regional Express/HOT Lane Network	$22.3 B
Private Equity Participation	Private equity share	$2.7 B
Freight Fee/National Freight Program	Expected federal funding for freight	$4.2 B
E-Commerce Tax	Existing revenues which are not being collected	$3.1 B
Interest Earnings	Interest earnings from toll bond proceeds	$0.2 B
State Bond Proceeds	State general obligation bonds	$33.0 B
Value Capture Strategies	Formation of special districts using tax increment financing (TIFs)	$1.2 B
Total		**$220 B**
Total Converted to 2015–2040 nominal dollars		**$254 B**

Source: Southern California Association of Governments 2012 Long Range Plan

C. Plan Analysis

While the 2012 plan includes many important projects, the plan fails to solve some of the region's biggest problems, due in large part to mandates outside SCAG's control. SCAG did a great job given the limitations in California law. SB 375 takes much of the decision-making power out of the hands of professionally trained engineers and planners. As a result the 2012 plan is fragmented.

This $606 billion plan should more effectively improve mobility, defined as reducing congestion from current levels. Since the plan must take a certain approach to reducing GHGs, the plan fails to increase mobility. There are other ways to reduce greenhouse gases without impairing mobility. These alternatives are discussed later in this chapter.

D. Mobility

The plan spends only $64.2 billion (12.2%) of its total budget on adding highway capacity (interchanges, express toll lanes and other toll facilities). Based on current levels of congestion that is unlikely to significantly reduce congestion. The plan spends more than twice as much on transit services as it devotes to highway capacity, much of it on construction and maintenance of new rail lines. The $48.4 billion the plan spends on port access, freight rail enhancement and intermodal facilities will provide needed improvements to the freight transportation system. The $7.6 billion in revenue devoted to intelligent transportation systems (ITS), is a good use of resources. ITS systems have the best benefit-cost ratios of any transportation improvement.

The plan includes $51.8 billion in new railway spending. A fraction—$4.1 billion—is new commuter rail while the remainder—$47.7 billion—is dedicated to building high-speed rail between Los Angeles and San Diego and Los Angeles and the Antelope Valley. Both types of railway projects have very large construction costs. Commuter rail typically costs at least three times as much as more direct bus service.[40] SCAG and the transit agencies should instead use the money on bus rapid transit and express bus services. California's high-speed rail (HSR) line is in limbo barring the resolution of several court cases. Most transportation experts believe the entire line is unlikely to be built in the near future. All of this $51.8 billion could be used on higher priority projects.

The 2012 plan also includes $55.0 billion for new transit. Unfortunately the plan devotes only $26.2 billion to bus service (BRT, express bus, limited-stop bus, local bus) while spending $28.7 billion on rail service (light rail, heavy rail). Yet bus riders outnumber rail riders in Southern California 8 to 1.[41] Further, the area's urban spatial structure of moderate density and multiple job centers does not allow fixed-rail service to work

effectively. Southern California could create a world-class bus-based transit system if it devoted its rail expenditures to bus services.

The 2012 plan spends $6.7 billion on active transportation. Active transportation includes biking, walking and other non-motorized transportation. We understand the importance of biking and walking to Southern Californians, including adding bikeways and bringing sidewalks into compliance. Assuming these projects support transportation mobility, these funds are an appropriate use of transportation monies. We also support narrowing lane-widths, where appropriate, from 12 feet to 10.5 feet to create bike lanes.

The 2012 plan devotes $4.5 billion to transportation demand management (TDM). SCAG's TDM plan includes increasing carpooling, vanpooling, transit, active transportation and telecommuting, as well as redistributing vehicle trips from peak to off-peak hours and including bike racks on transit vehicles. TDM is an excellent strategy, and a smart use of limited funds. We also encourage the private sector to take on the responsibility of adding bike racks and engaging in promotions and advertising.

The 2012 plan devotes $139.6 billion to transit operations and maintenance. This is the largest component of the plan. While maintenance is vital, by building several new rail lines Southern California is forcing itself to spend more on maintenance than it would if it added new bus lines. Both bus and rail lines have similar costs to maintain the vehicles. But while buses make use of roadway paid for by operators of cars and trucks, rail operators must shoulder their entire infrastructure costs themselves. And rail lines need to maintain their power systems; heavy-rail lines need to maintain their third rail electrical systems, while light-rail lines need to maintain their catenary system.

Table 9 below details all of SCAG's performance indicators. SCAG develops a number of performance measures but only the Mobility and Accessibility metrics are concerned with reducing congestion and improving mobility. Further, only the Investment Effectiveness determines whether the projects are an efficient use of taxpayer funds.

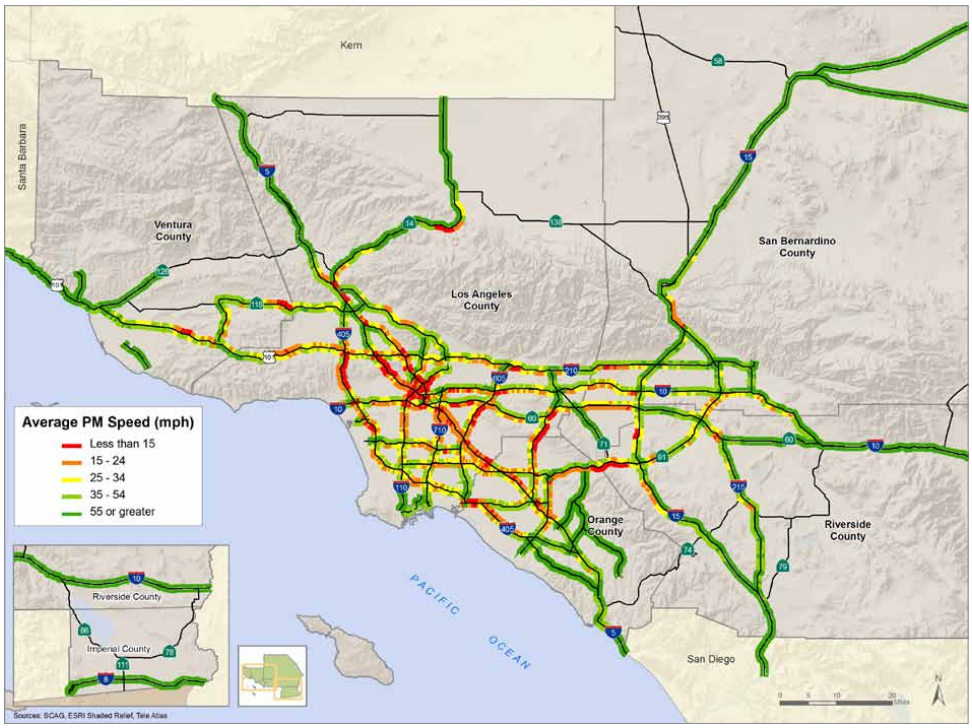
Table 9: SCAG Performance Improvements

Outcomes	Performance Measure/Indicator	Definition	Performance Target	Data Source Used
Location Efficiency	Share of growth in High-Quality Transit Areas (HQTAs)	Share of the region's growth in households and employment in HQTAs	Improvement over No Project Baseline	Census
	Land consumption	Additional land needed for development that has not previously been developed or otherwise impacted, including agricultural land, forest land, desert land, and other virgin sites	Improvement over No Project Baseline	Rapid Fire Model
	Average distance for work or non-work trips	The average distance traveled for work or non-work trips separately	Improvement over No Project Baseline	Travel Demand Model
	Percent of work trips shorter than 3 miles	The share of total work trips shorter than 3 miles	Improvement over No Project Baseline	Travel Demand Model
	Work trip length distribution	The statistical distribution of work trip length in the region	Improvement over No Project Baseline	Travel Demand Model
Mobility and Accessibility	Person delay per capita	Delay per capita can be used as a supplemental measure to account for population growth impacts on delay	Improvement over No Project Baseline	Travel Demand Model
	Person delay by facility type (mixed flow, HOV, arterials)	Delay—excess travel time resulting from the difference between a reference speed and actual speed	Improvement over No Project Baseline	Travel Demand Model
	Truck Delay by facility type (highway, arterials)	Delay—excess travel time resulting from the difference between a reference speed and an actual speed	Improvement over No Project Baseline	Travel Demand Model
	Travel time distribution for transit, SOV, HOV for work and non-work trips	Travel time distribution for transit, SOV, HOV for work and non-work trips	Improvement over No Project Baseline	Travel Demand Model
Safety and Health	Collision/accident rates by severity by mode	Accident rates per million vehicle-miles by mode (all, bicycle/pedestrian, and fatality/killed)	Improvement over Base Year	CHP Accident Data Base, Travel Demand Model Mode Split Outputs
	Criteria pollutants emissions	CO, NOx, $PM_{2.5}$, PM_{10}, and VOC	Meet Transportation Conformity requirements	Travel Demand Model/ARB EMFAC Model
Environmental Quality	Criteria pollutant and greenhouse gas emissions	CO, NOx, $PM_{2.5}$, PM_{10}, and VOC Per capita greenhouse gas emissions (CO_2)	Meet Transportation Conformity requirements and SB 375 per capita GHG-reduction targets	Travel Demand Model/ARB EMFAC Model
Economic Well-being	Additional jobs supported by improving competitiveness	Number of jobs added to the economy as a result of improved transportations conditions which make the region more competitive	Improvement over No Project Baseline	Regional Economic Model REMI
	Additional jobs supported by transportation investment	Total number of jobs supported in the economy as a result of transportation expenditures	Improvement over No Project Baseline	Regional Economic Model REMI
	Net contribution to gross regional product	Gross regional product due to transportation investments and increased competitiveness	Improvement over No Project Baseline	Regional Economic Model REMI
Investment Effectiveness	Benefit/cost ratio	Ratio of monetized user and societal benefits to the agency transportation costs	Greater than 1.0	California Benefit/Cost Model
System Sustainability	Cost per capita to preserve multimodal system to current and state of good repair conditions	Annual costs per capita required to preserve the multimodal system to current conditions	Improvement over Base Year	Estimated using SHOPP Plan and recent California Transportation Commission 10-Year Needs Assessment

Source: Adapted from SCAG Table 5.1

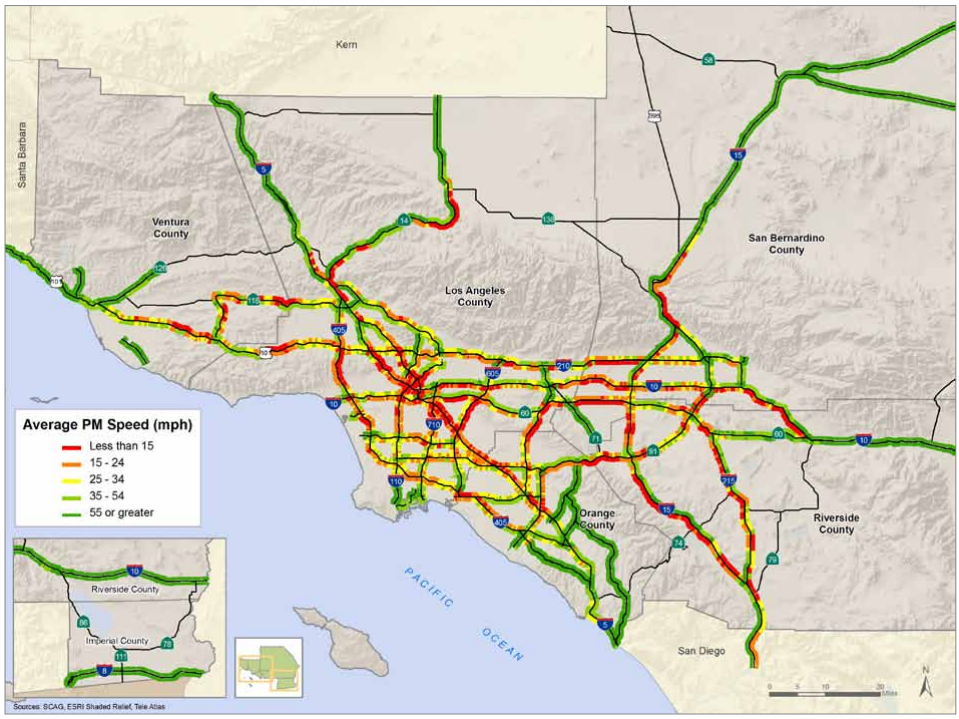
For the Mobility measures, SCAG provides three figures we included below: a 2008 figure, a 2035 figure if no improvements are made, and a 2035 figure if plan improvements are made. For most categories, the congestion in 2035 with the improvements is the same as or worse than in 2008. In other words, the region is preparing to spend $606 billion over the next 25 years to provide a system with mobility that is no better than the status quo.

Figure 5: 2008 Southern California Expressway Speeds



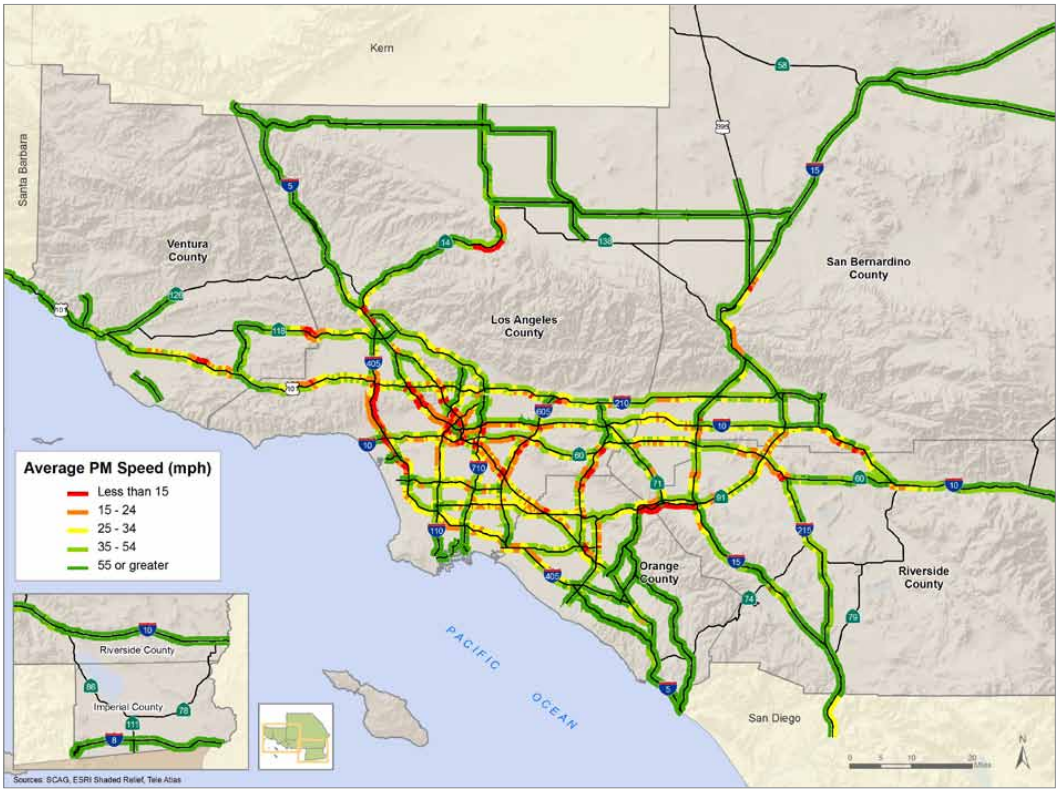
Source: SCAG's 2012 Long Range Plan, Highways and Arterials Appendix

Figure 6: 2035 Southern California Expressway Speeds with No Improvements



Source: SCAG's 2012 Long Range Plan, Highways and Arterials Appendix

Figure 7: 2035 Southern California Expressway Speeds with Planned Improvements



Source: SCAG's 2012 Long Range Plan, Highways and Arterials Appendix

Specifically, as shown in Table 10 below, person hours of delay are about the same for freeway/expressway and arterial and slightly better for HOV and regional average. Heavy-duty truck hours of delay are actually significantly worse for expressways and slightly worse for arterial truck hours of delay.

Table 10: Delay by Facility Type

Type of Road	Trend between 2008 and 2035
Expressway	About the Same
High Occupancy Vehicle Lane	Slight Improvement
Arterial	About the Same
Regional Average	Slight Improvement
Truck Expressway	Significant Deterioration
Truck Arterial	Slight Deterioration

Source: Southern California Association of Governments 2012 Long Range Plan, http://rtpscs.scag.ca.gov/Pages/2012-2035-RTP-SCS.aspx

Many of the worst expressway sections show no improvement between today and 2035 with the plan implemented. Table 11 below measures all sections of Southern California's

expressways with average travel speeds below 15 miles per hour.[42] There are many other sections where speeds are below free-flow conditions; the sections below are the worst of a poorly performing system. A total of 36 segments operate below 15 miles per hour today, in 2035 with improvements, or in most cases both today and in 2035 with improvements. Thirty-three of the segments are congested today and 30 remain congested in 2035 if the plan's improvements are made. Four sections that do not operate below 15 miles per hour today will do so in 2035 even with all the improvements in the plan. While there is a minor improvement overall, $606 billion should enable Southern California to get a much larger increase in mobility.

Table 11: Severely Congested Expressway Segments (Average speeds less than 15 miles per hour during afternoon rush hours)

Segment	County	In 2012	In 2035 with Plan implemented
I-5N between SR 261 and SR 91	Orange	Yes	Yes
I-5N between SR 91 and I-605	Los Angeles, Orange	Yes	Yes
I-5N between I-605 and I-10E	Los Angeles	Yes	Yes
I-5N between I-10E and SR 134	Los Angeles	Yes	Yes
I-5N between SR 134 and I-405 north junction	Los Angeles	Yes	No
I-5N between I-405 north junction and SR 14	Los Angeles	Yes	Yes
I-5S between SR 134 and I-10E	Los Angeles	Yes	Yes
I-5S between I-710 and I-605	Los Angeles	Yes	Yes
I-10E between I-405 and I-5	Los Angeles	Yes	Yes
I-10E between I-5 and I-605	Los Angeles	Yes	Yes
I-10E between SR 210 and SR 60	Riverside, San Bernardino	No	Yes
I-15N between SR 60 and I-210	Riverside, San Bernardino	Yes	Yes
I-15N between SR 138 and SR 18	San Bernardino	No	Yes
I-15N between I-215 and SR 138	San Bernardino	Yes	No
I-15S between SR 60 and SR 91	Riverside, San Bernardino	Yes	No
I-105E between SR I-710 and I-605	Los Angeles	Yes	No
I-110/SR 110N between I-10 and I-5	Los Angeles	Yes	Yes
I-210E between SR 134 and I-605	Los Angeles	No	Yes
I-210E between I-605 and I-57	Los Angeles	Yes	Yes
I-215S between SR 91 and SR 60	Riverside	Yes	Yes
I-405N between SR 55 and SR 22	Orange	Yes	No
I-405N between I-10 and US 101	Los Angeles	Yes	Yes
I-405S between I-10 and I-105	Los Angeles	Yes	Yes
I-405N between SR 22 and I-605	Los Angeles, Orange	Yes	No
I-405S between I-605 and SR 22	Los Angeles, Orange	Yes	No
I-605N between I-5 and SR 60	Los Angeles	Yes	Yes
I-710N between I-5 and I-10	Los Angeles	Yes	Yes
US 101N between SR 110 and SR 170	Los Angeles	Yes	Yes
US 101S between SR 170 and SR 110	Los Angeles	Yes	Yes
US 101N between I-405 and SR 23	Los Angeles, Ventura	Yes	Yes
US 101N between SR 23 and SR 126	Ventura	Yes	Yes
SR 14W between Sierra Highway exit 26 and Sierra Highway exit 30	Los Angeles	Yes	Yes
SR 55N between I-5 and SR 91	Orange	Yes	Yes
SR 57N between SR 91 and SR 60E	Orange, Los Angeles	Yes	Yes
SR 91E between SR 241 and I-15	Orange, Riverside	Yes	Yes
SR 118E between SR 23 and SR 27	Los Angeles, Ventura	No	Yes
SR 118W between SR 27 and SR 23	Los Angeles, Ventura	Yes	Yes

Source: SCAG's 2012 Long Range Plan

E. Livability, Prosperity and Sustainability

The Department of Transportation defines livability as "…tying the quality of location of transportation facilities to broader opportunities such as access to good jobs, affordable housing, quality schools, and safer streets and roads."[43] Yet by reducing mobility, the plan reduces livability. Many of the residents who live in Riverside and San Bernardino County, where most of the affordable housing is located, work across the mountains in Los Angeles and Orange Counties, where most of the employment is located. Yet most of these commuters have just one congested expressway, a few congested arterials and several bus routes that use the congested roadways to make this commute; these limitations result in a longer trip that adds stress and reduces commuters' amount of leisure time. Many of the residents who place a priority on quality schools and safer streets live in suburban areas with long commutes to job centers. Even residents living in growing downtown Los Angeles often commute many miles to work because of the numerous business centers in the region. Since almost 90% of metro areas residents drive or take a bus to work, allowing congestion to worsen will make the majority of residents' lives worse, not better.

Prosperity typically means that residents have a high enough income to maintain a good quality of life. Yet California seems to be worsening in this regard. The Southern California region has lost jobs between 1990 and 2010. As we discussed in Part 2, severe congestion limits residents' circles of opportunity decreasing their job possibilities. Worse, California is one of the most expensive places to live in the country, with the fourth highest tax burden of any state.[44] While the state may provide more services than competitors, it is little comfort for the unemployed and underemployed. California has the highest percentage of underemployed residents in the country.[45]

Many of the components of the plan involve sustainability. Yet some of the back-to-the-city-center suggestions are not truly sustainable. While some people may only be concerned with environmental sustainability, sustainability is a three-legged stool with economic factors, environmental factors and equity issues receiving equal weight.[46] Economic sustainability tries to promote economic vitality. Environmental or ecological sustainability incorporates the natural system processes. The equity component in sustainability deals with social welfare.

One typical suggestion to improve sustainability is building more mixed-use developments closer to downtown. But as discussed in the previous chapter, while this can increase downtown's population, living in these developments often requires a six-figure salary and most offer very few low-income units; most of the commercial jobs located in mixed-use developments offer primarily low-wage retail positions. Often, the residents of mixed-use developments work somewhere else and the workers in the development live somewhere

else.[47] As a result there is a lot of single-occupant car commuting. This commuting scenario is not what most environmentalists want.

Another common way to improve sustainability is to locate a new development targeting upper-middle class residents near a rail line. Often this development either replaces low-income housing or raises taxes so significantly that low-income folks can no longer afford to live in the neighborhood. These low-income families are often displaced to the suburbs, far from where they work. While the new residents of the mixed-use developments use transit more than when they lived in the suburbs, the displaced residents who were dependent on transit in the city, face far more limited transit services in the suburbs.[48] As a result, the net use of transit decreases. This situation is not ecologically sustainable nor is it sustainable from an equity standpoint. It is also unlikely to be economically sustainable. Sustainability is an important goal, but many of the practices suggested in the region's transportation plan are unlikely to improve total sustainability.

There are better ways for Southern California to improve livability, prosperity and sustainability. If the region is looking to improve livability, it should attempt to bring more high-paying jobs to Riverside and San Bernardino Counties. California could also improve its public schools, ranked in the bottom 10 of all states in most education surveys.[49] For prosperity the state should try to lower its overall tax burden. It also needs to find ways to increase and diversify its employment base. Clean manufacturing is currently shunned by the state. Yet it appears to be a good match with the unemployed and underemployed living in Riverside and San Bernardino Counties. In this way, the region needs to look holistically for sustainability.

F. Climate Change

Reducing greenhouse gases, the main drivers of climate change, is an achievable and important goal for Southern Californians and California's numerous tourist attractions, including national parks and picturesque beaches. By forcing a certain type of development, SB 375 will not reduce GHGs any more than traditional development with the correct pricing of infrastructure.[50]

Further, substantial progress has already been made in reducing California's GHGs. The state reduced its carbon dioxide emissions by 30.9 million metric tons or 8.2% between 2000 and 2011.[51] Today's vehicle fleet generates 98% fewer hydrocarbons, 96% less carbon monoxide and 90% less nitrous oxides emission than cars 30 years ago.[52] The number of days of "unhealthy air" in the region has decreased 74% in just 12 years.[53] As a result, California's GHGs have decreased significantly despite an absolute increase in vehicles and miles traveled.

Current laws will reduce vehicle emissions even further. The federal government recently mandated a 54.5 miles per gallon standard for the new vehicle fleet by 2025.[54] Based on current estimates of vehicle-miles traveled, greenhouse gas emissions will be 19% lower in 2030 than in 2005.[55]

Fortunately, SCAG was able to develop several market-based approaches to reducing congestion. Demand management is an important component of the plan. Priced lanes including High Occupancy Toll (HOT) and express toll lanes that provide uncongested travel are an important part of the solution as well.

G. Funding Issues

Federal law dictates that each MPO should create a long-range plan that is financially realistic, balancing capital and operating costs with reasonable revenue expectations. The region's $606 billion plan will require approximately $254 billion in new resources as current taxes and user fees are forecast to raise only $352 million. Finding an additional $254 billion may not be realistic. While SCAG provides a list of potential sources, none of those revenues is guaranteed.

Part of the funding problem is the gap in funding for the planned high-speed rail system. The line from Los Angeles to San Francisco alone will cost $70 billion to build, and California only has $10 billion. And part of that $10 billion includes a state match that the state may not be able to produce. HSR backers are counting on using cap and trade funds, finding private financing and securing more federal funds. Use of each of these revenue sources is problematic. Cap and trade funds are supposed to be used on projects that substantially reduce greenhouse gases, but there is very little greenhouse gas reduction from high-speed rail, once the huge carbon footprint of its construction is taken into account.[56] Despite repeated requests, no private party has stepped forward to fund the high-speed rail project; further, as long as Republicans control Congress, through at least through January 2017, the project is unlikely to receive any further federal funding.

Due to the region's large population, it receives a significant amount of funding ($84.3 billion) from the federal government. Future federal funding is uncertain. The federal gas tax has not been raised in 20 years and maintaining current funding has been a major challenge.

H. Why the Historical Road-Building Approach Will Not Work

The region's plans (particularly scenarios 3 and 4) represent one extreme approach to increasing mobility—attempting to drastically curtail the use of autos, trucks, and buses by not expanding expressways and further densifying land use. Another extreme approach that is just as problematic is adding extensive non-priced highway capacity throughout the region. Non-priced capacity improvements alone in populated regions cannot solve the problem of urban congestion. Experience suggests that new general lane capacity quickly fills up in growing metro areas, with previous congestion levels reasserting themselves five to 10 years after the non-priced capacity improvement project is completed. This phenomenon of highways becoming congested soon after they are widened is labeled "induced demand" and occurs for two reasons.[57]

First, most metro areas are growing. While the new or expanded highway may have sufficient capacity for residents at the time it is completed, it does not have extra room for growth. A current example is the $1.1 billion project that added a single HOV lane (one-way) on I-405 through the Sepulveda Pass. Despite the added lane, Caltrans expects the southbound segment from US 101 to I-10 to be the most congested in the region as soon as the end of 2015.[58] Most large-scale roadway expansions provide congestion relief in the short-term and possibly the medium-term (depending on how fast the region grows), but become congested again thereafter.

Second, residents often have unmet travel needs. Severe congestion may discourage consumers from eating at a restaurant or watching a Los Angeles Dodgers game at the stadium. But when congestion is reduced, these residents will make these trips. Infrastructure improvements that induce residents to make additional trips are good from an economic development perspective. However, they undermine congestion relief.

Adding non-priced lanes is not realistic for other reasons: large-scale construction projects are politically challenging because they require the acquisition of extensive rights of way via eminent domain proceedings and displace significant businesses and residences. Moreover, the costs of such undertakings are very high, generally exceeding available funding.

As such, adding large amounts of unpriced lanes is not the best solution to any urban area's transportation problems. While SCAG includes some additional general lane capacity, our plan includes none. General purpose widenings should be discouraged in the future.

1. Our Proposed Southern California Mobility Strategy

Since neither of the extremes is an effective long-term way to increase mobility, we have developed a middle-ground that effectively increases mobility without increasing induced demand, adding greenhouse gases to the atmosphere or creating other land-use and environmental concerns.

First, the plan outlined in this report will reduce congestion on expressways by establishing a region-wide network of express lanes—dynamically priced, all-electronically tolled lanes that offer drivers fast, reliable travel times if they choose to pay for them. Many of these lanes will be new additions, as our plan does not convert existing general purpose lanes to express toll lanes, though it would convert existing HOV lanes to express toll lanes, as a cost-effective way to build out the network.

Second, our plan expands some inadequate expressway interchanges and rebuilds several functionally obsolete and structurally deficient interchanges. These investments will unclog some of the region's (and the country's) worst expressway bottlenecks.

Third, our plan proposes filling in a number of key missing links in the overall expressway network, including the gap in the I-710 expressway in South Pasadena. All six of these projects would be financed in part via toll revenues, and all the new lanes would be electronically tolled.

Fourth, our plan will reduce congestion on Southern California's arterial network—a vital complement to the expressway system—by adding dynamically priced, all-electronically tolled underpasses at busy intersections. These underpasses will allow buses and motorists to bypass signalized intersections, offering them faster and more-reliable travel times for those who choose to pay for them. These underpasses will also be new additions. The plan would not force anyone to use these underpasses. Arterials that have been improved in this way are known as "managed arterials" (analogous to managed lanes on expressways).

Fifth, our plan advocates better operational management that makes use of intelligent transportation systems (ITS). These improvements build on our previous work by making the most efficient use of the area's roadway system. Such improvements will also lessen non-recurrent congestion by reducing accidents and ensuring those that do occur are cleared from the road in a timely manner.

Sixth, this network of express toll lanes and managed arterials, combined with operational management using ITS, will enable a high-quality, region-wide transit system. Such a system will consist of existing local bus and limited-stop bus complemented by bus rapid transit running on managed arterials and express bus running in express toll lanes on

expressways. This kind of transit is vastly less expensive than heavy rail, light rail and commuter rail, because it uses infrastructure paid for largely by cars and trucks. Because of this much lower cost, the region will be able to build a comprehensive transit network many years sooner.

2. Roadway Cost Estimation Tool

In the following four parts we used the Federal Highway Administration's Highway Economic Requirements System (HERS) cost data for different types of construction. For the purposes of this study, Southern California comprises three sub-regions: Los Angeles-Orange County, which is considered a "major urbanized area," and Riverside-San Bernardino and Ventura, which are considered large, urbanized areas. To err on the conservative side we used the Los Angeles-Orange County figures for the entire region. We developed generic cost estimates for each of the components and added the costs together to create the proposed network. Details on the costs of each specific project and component are available in the appendices.

Unit costs for each of these components were developed using 2014 dollars. Any adjustments for inflation used a 2.9% annual inflation rate, the same rate SCAG uses.

Table 12: Cost per Roadway Component per Lane-Mile

Component (per lane mile)	Cost
New surface arterial lane	$12.7M
New expressway lane	$17.1M
New express lane	$18.0M
New truck express lane	$27.0M
New express lane via conversion from HOV lane	$8.4M
Right of way	$10.4M
New elevated lane	$18.8/$24.4M*
Flyover quadrant	$90M
Ramp from arterial to elevated roadway	$10M
Managed arterial overpass (standard)	$42M
Managed arterial overpass and underpass (dual)	$78M

*Exact cost depends on type of facility. Two-lane facilities are $24.4 million per lane-mile; four-lane or more facilities are $18.8 per lane-mile

Part 4

Alleviating Major Interchange Bottlenecks

The first major aspect of increasing mobility and reducing congestion is eliminating major bottlenecks. An expressway bottleneck is a specific point on the expressway network where traffic gets clogged due to physical limitations of the system. The worst bottlenecks tend to occur at expressway-expressway interchanges where on-ramps carry large numbers of vehicles onto an expressway without providing sufficient merging space or dedicated lanes. Some bottlenecks occur where on- and off-ramps are too close together, resulting in excessive weaving as cars cross each other's paths getting on and off in too short a distance. Other bottlenecks occur where the number of lanes suddenly decreases by one and traffic has to squeeze into the remaining lanes.

Expressways are not the only roads with bottlenecks. Arterials—surface streets that are designed to move cars, trucks and buses long distances—also have bottlenecks. This chapter will focus on arterial bottlenecks at expressway interchanges. Part 6 will focus on bottlenecks where one arterial crosses another arterial.

Fixing these minor bottlenecks is part of the ongoing work program of a state department of transportation (DOT) as it modernizes the roadway system over the years. But even though they are called "minor," these projects are still costly, so they may not get funded for many years, even though the need is obvious.

Bottleneck interchanges of this sort are being redesigned and rebuilt nationwide, as money can be found to pay for these major projects. A review of recent projects to reconstruct bottleneck interchanges around the country found that project costs range from about $50 million to about $1.2 billion.[59] These costs can also be far higher, depending on factors such as local geology, topography, engineering, and availability of financing.

Table 13: Recent Interchange Bottleneck Reconstruction Projects

Interchange	Project Description	Costs	Lane-Miles Added	Construction Dates
San Francisco SR 92/I-880	Replace 2 cloverleaf ramps with direct access ramps	$245M	0	10/07-10/11
Washington D.C. I-495/I-95S	Rebuild interchange ramps Including express lanes	$676M	0	10/03-07/07
Houston I-610/I-10W	Reconstruction of interchange and bridges	$262.5M	0	10/04-01/10
South Florida I-595 between I-75 and I-95	Build three new lanes, rebuild bridges, rebuild entry/exit ramps	$1.2B	41	02/10-06/14

Source: California Department of Transportation, Florida Department of Transportation, Texas Department of Transportation and Virginia Department of Transportation.

Since most of the Los Angeles region's worst bottlenecks are expressway-expressway and expressway-arterial, we have focused on addressing these failing interchanges.

A. Expressway-Expressway Bottlenecks

On expressways, Southern California has a large number of problematic cloverleaf expressway-expressway ramps whose geometric characteristics reduce the throughput of all vehicles, particularly trucks. These ramps, many 50 years old, need to be replaced. Due to costs and political challenges, our recommendations range from small fixes to partial reconstructions. Full reconstructions would cost more than $1 billion per interchange and would only reduce congestion around the interchange, not on the expressway as a whole. We focused on small to moderate projects that significantly reduce congestion while not using all of the region's resources on expressway interchanges. In order to determine the most-congested interchanges we used data from several sources. First, we used Texas A&M Transportation Institute's congested corridor report. The report, using 2010 data, takes a comprehensive look at the worst places for congestion in the United States.[60] We supplement this report with more recent 2014 data from Caltrans.

Many other improvements, detailed in later sections, remove many bottlenecks by creating redundancy or alternate connections in the expressway and arterial networks. However, 10 of the region's expressway-expressway bottlenecks are so congested that we recommend spending resources on the bottleneck. The 10 major bottlenecks are detailed below.

Costs were determined using the tables in the previous section. The figures were adjusted as needed, based on the width of the ramp lanes and merge lanes required. Each intersection, the movements affected, and the costs to rebuild the interchange are in the following table. Full cost details for each component are listed in Appendix A, Table A1.

Table 14: Most Congested Interchanges

Ranking	Interchange	Movements Affected	Cost
1.	I-10/I-110	I-10W to I-110S, I-10W to I-110N, I-10E to I-110S, I-10E to I-110N, I-110N to I-10W, I-110N to I-10E, I-110S to I-10E	$397.2M
2.	I-10/I-405	All and add 1 new lane on I-10 in each direction between I-405 and SR 1S	$506.4M
3.	I-10/I-5	I-5 to I-10W, I-10W merge with I-5N, I-5S to SR 60E, I-10W to I-5N, I-10E to I-5S, SR 60 to I-5N and on I-5 add 1 new lane in each direction between I-10W and I-10E and on I-10 US 101 Connector between I-5 and US 101	$396M
4.	US 101/SR 110	SR 110N to US 101N, US 101S to SR 110S	$118.6M
5.	I-405/US 101	I-405N to US 101N, US 101S to I-405S	$150M
6.	I-5/I-605	I-5N to I-605N, I-5S to I-605S, I-5N to I-605N, I-605N to I-5N	$334.2M
7.	I-5/I-710	I-710N to I-5N, I-5S to I-710S	$120M
8.	I-10/I-605	I-10W to I-605S, I-10E to I-605N, I-605N to I-10W, I-605N to I-10E,	$302.2M
9.	I-605/SR 60	I-605N to SR 60W, I-605N to SR 60E, I605S to SR 60W, I-605S to SR 60E, SR 60W to I-605S, SR 60W to I-605N, SR 60E to I-605S	$400M
10.	I-5/CA 55	I-5N to SR 55N, I-5N to SR 55S, I-5S to SR 55S, SR55N to I-5N, SR55S to I-5S,	$349.2M
Total			**$3.07B**

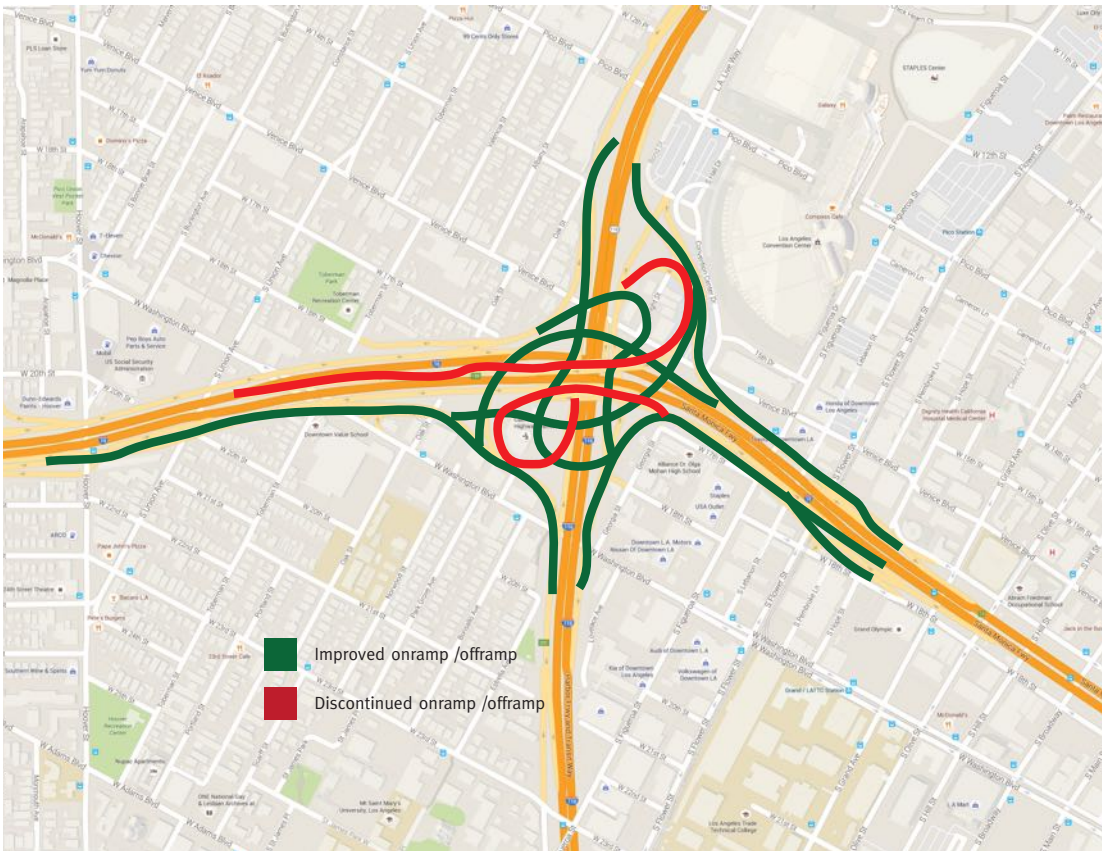
The following section describes each interchange bottleneck and examines the proposed changes. Complete details are available in Appendix A.

1. I-10 at I-110

The I-10 at I-110 interchange is located southwest of downtown Los Angeles in the west-central part of the region. I-10 has average daily traffic volumes (AADT) over 300,000 while I-110 has an AADT exceeding 270,000.

Fixing this interchange requires several steps. First, the ramp from I-110 north to I-10 west needs to be rebuilt with two lanes instead of one and the loop eliminated. Second, the ramp from I-110 north to I-10 east needs to be widened to two lanes. The ramp from I-110 south to I-10 east needs to be widened to two lanes and the loop eliminated. The ramp from I-10 east to I-110 south needs to be widened to two lanes and the ramp from I-10 east to I-110 north needs to be widened to three lanes with the terminus moved from the left side of the road to the right side. Both ramps from I-10 west to I-110 north and I-110 south need to be widened to two lanes.

Figure 8: Interchange Design: I-10 and I-110

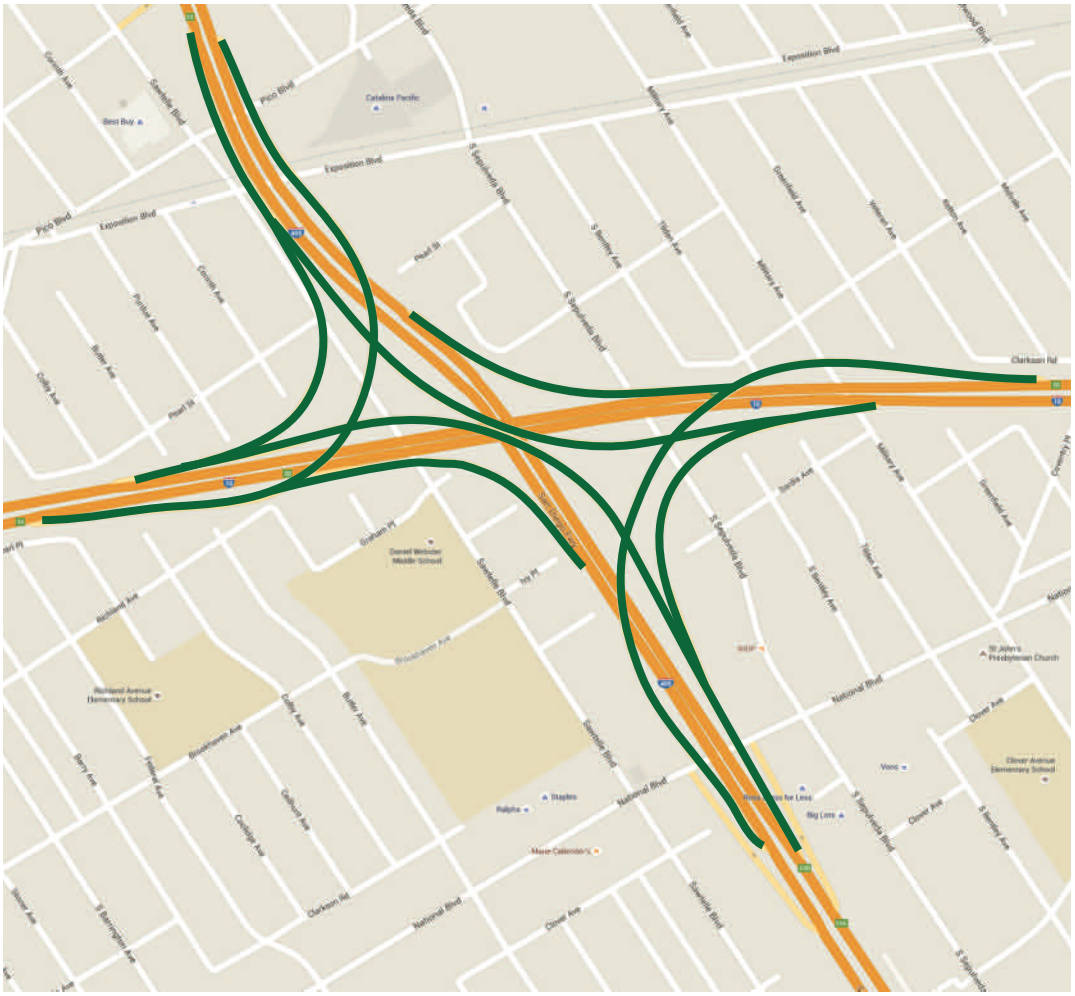


2. I-10 at I-405

The I-10 at I-405 interchange is located west of downtown in the west central part of the region between Culver City and Santa Monica. I-10 has average traffic volumes (AADT) of over 220,000 while I-405 has AADTs of over 310,000.

Similar to the first project, modernizing this interchange is a multi-step process. First, widen the ramp from I-10 west to I-405 north to three lanes and widen the ramp from I-10 west to I-405 south to two lanes throughout. Second, widen the ramp from I-10 east to I-405 north to two lanes throughout and widen the ramp from I-10 east to I-405 south to two lanes. Then, widen the ramp from I-405 north to I-10 east to two lanes and the ramp from I-405 north to I-10 west to two lanes throughout. Finally, widen the ramp from I-405 south to I-10 west to two lanes and widen the ramp from I-405 south to I-10 east to three lanes.

Figure 9: Interchange Design: I-10 and I-405



3. I-5 at I-10

The I-5 at I-10 interchange is located east of downtown Los Angeles in the central part of the region. The interchange is unusually complex and stretches more than a mile from north-south and ½ mile from east-west. The interchange includes two additional expressways: US 101 and SR 60. AADT are 260,000 on I-5 south of the interchange, 233,000 on I-5 north of the interchange, 300,000 on I-10 west of the interchange and 210,000 on I-10 east of the interchange, 190,000 on SR 60 and 200,000 on US 101.

I-5 at I-10 is one of the most complicated expressway interchanges in the country. Fixing this bottleneck requires many steps and some minor expressway widening. First, add one lane to the ramp connecting I-5 north and I-10 west and move the merge to the right side of the expressway. Add one lane on I-5 north from the I-10 west off-ramp to the I-10 east off-ramp. Move the I-10 west merge at I-5 north to the right side of the highway. Add one lane on I-5 south from the I-10 west off-ramp to the I-10 east on-ramp. Widen the ramp from I-5 south to SR 60 east and move the merge to the right side of the highway. Widen the ramp from I-10 west to I-5 north to three lanes and widen the ramp from I-10 east to I-5 south to three lanes and move the merge to the right side of the highway. Widen the ramp from SR 60 west to I-5 north to two lanes. Widen the I-10/US 101 connector from three lanes to four lanes in each direction.

Figure 10: South Interchange Design: I-5 and I-10

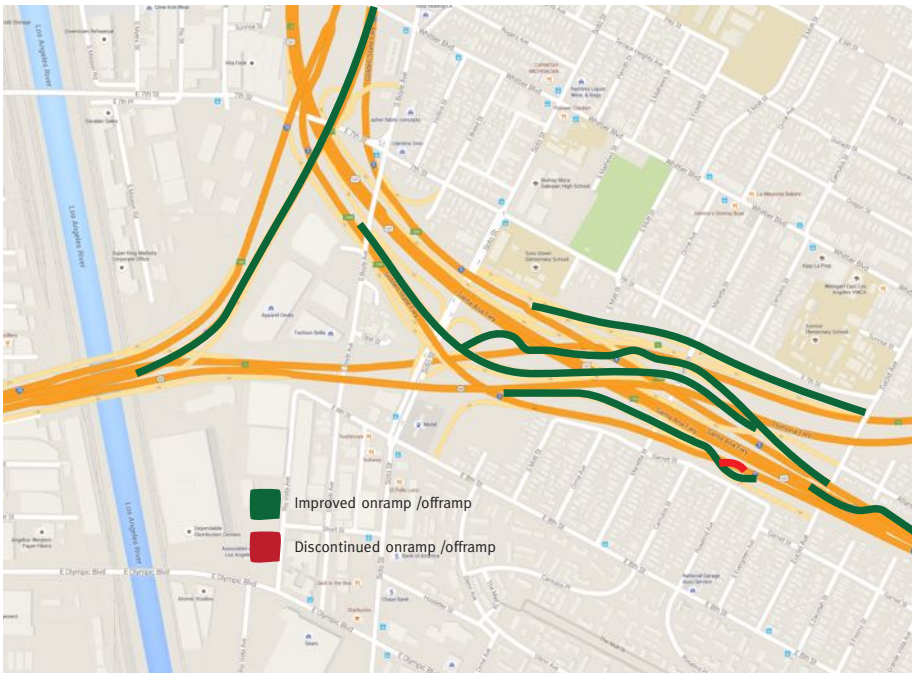
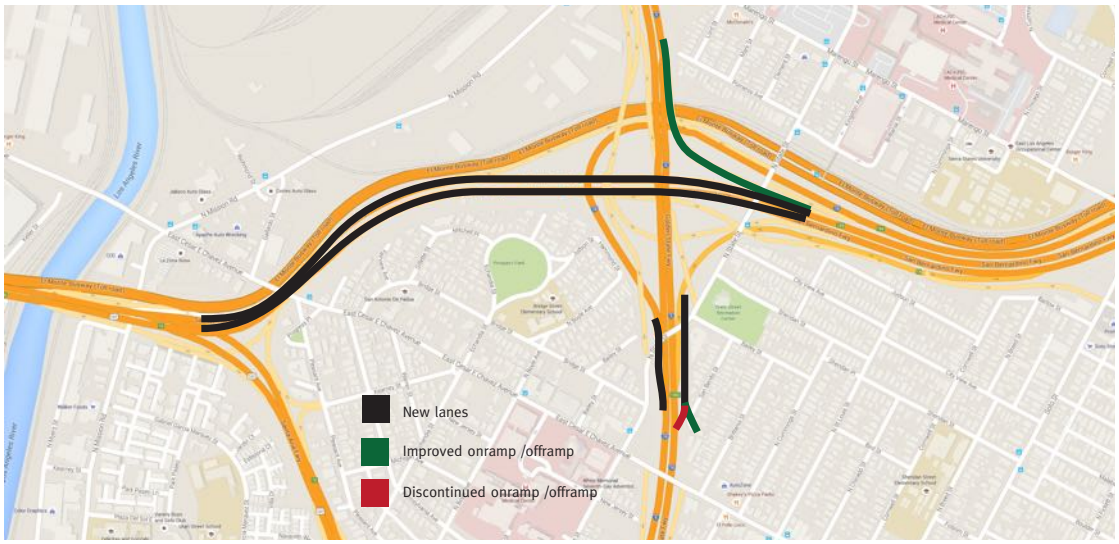


Figure 11: North Interchange Design: I-5 and I-10

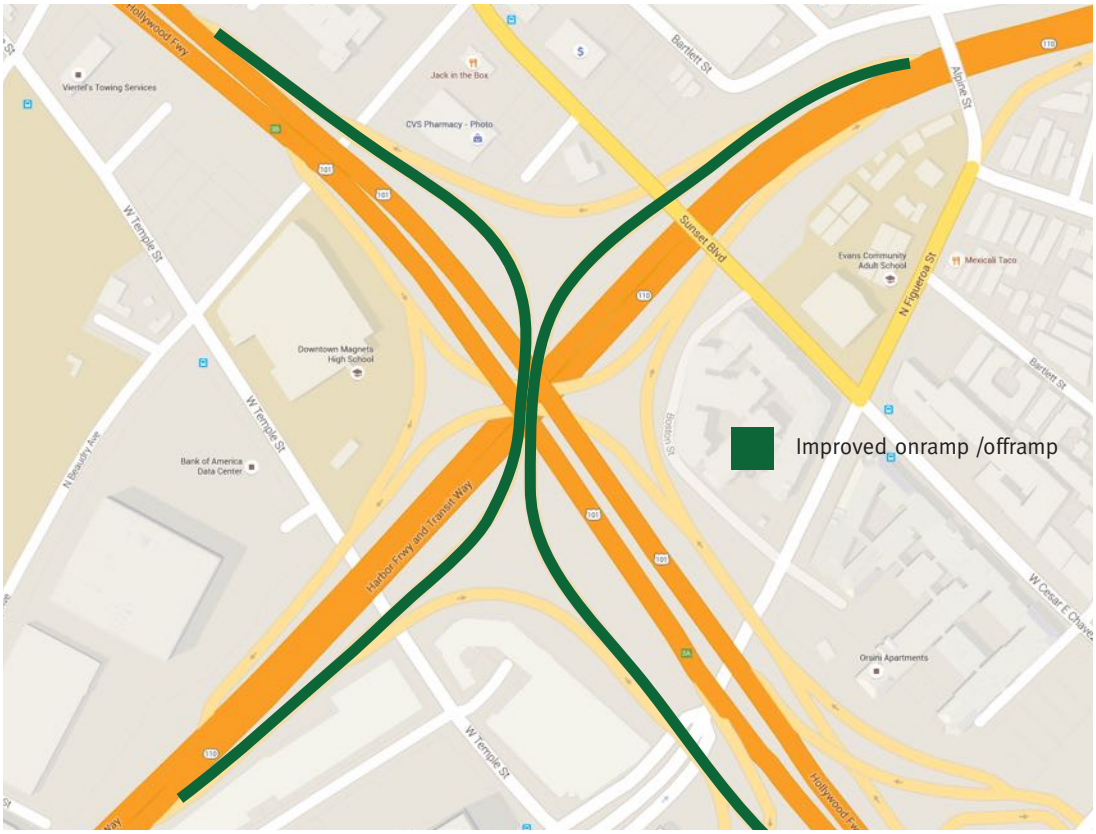


4. US 101 at SR 110

The US 101 at SR 110 interchange is located northwest of downtown in the west central part of the region. US 101 has AADT of 180,000, while SR 110 has AADT of 270,000 south of the interchange and 160,000 north of the interchange.

Improving two ramps will cost-effectively improve this interchange. First, widen the ramp from SR 110 north to US 101 north to three lanes. Second, widen the ramp from SR 110 south to US 101 south to three lanes.

Figure 12: Interchange Design: US-101 and SR-110

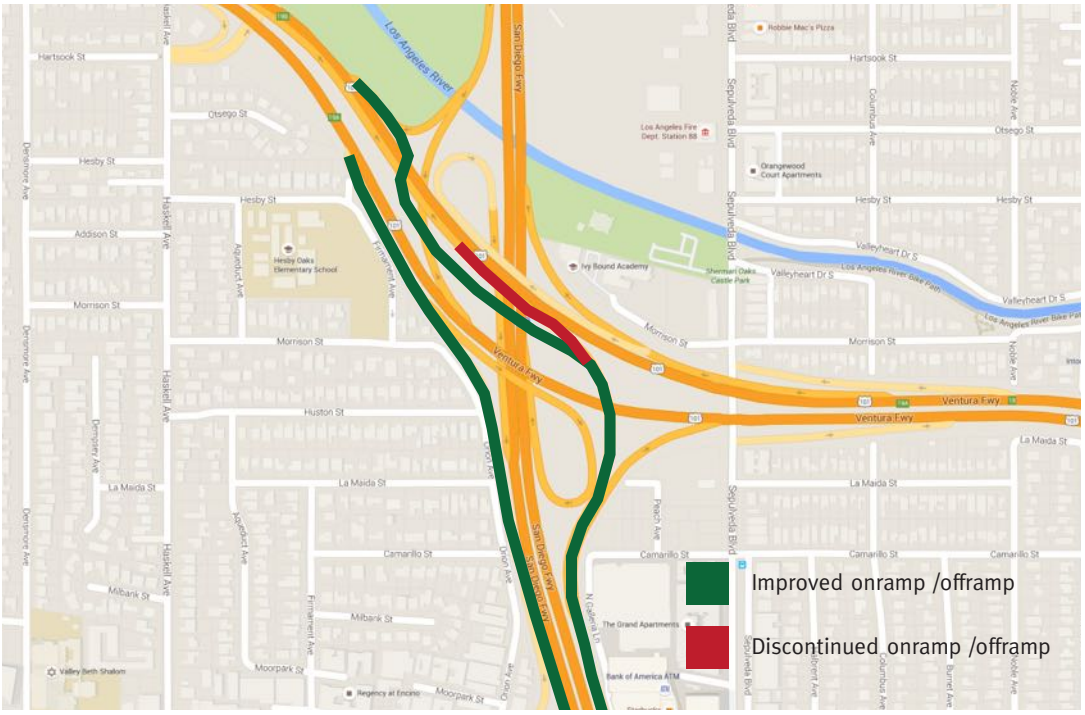


5. I-405 at US 101

The I-405 at US 101 interchange is located in the San Fernando Valley in the northwest part of the region. I-405 has AADT of 280,000 south of the interchange and 210,000 north of the interchange while US 101 has AADT of 300,000.

First widen the ramp from I-405 north to US 101 north to three lanes and move the merge from the left side of the road to the right. Second, widen the ramp from US 101 south to I-405 south to three lanes.

Figure 13: Interchange Design: I-405 and US-101

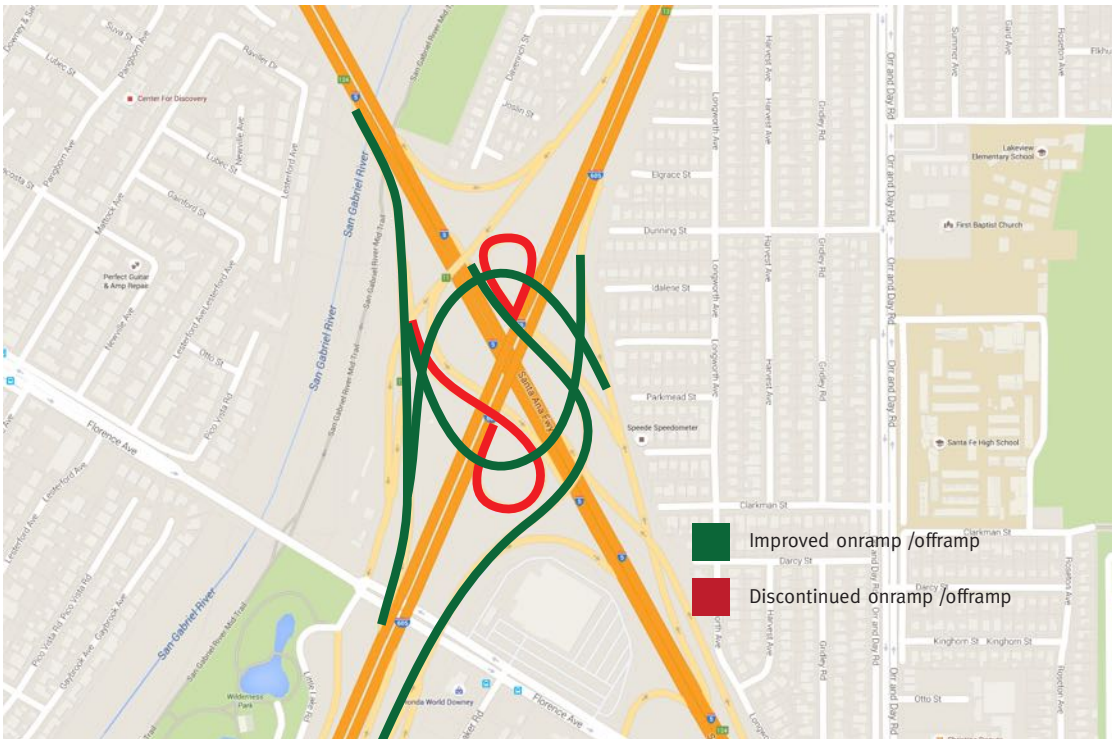


6. I-5 at I-605

The I-5 at I-605 interchange is located near Downey in the central part of the region. I-5 has AADT of 190,000 south of the interchange and 230,000 north of the interchange while I-605 has AADT of 290,000 south of the interchange and 260,000 north.

First, widen the ramp from I-605 north to I-5 north to 3 lanes. Second, widen the ramp from I-5 south to I-605 south to three lanes. Third, replace the loop ramp from I-5 north to I-605 south with a curve ramp and widen it to two lanes. Fourth, replace the loop ramp from I-5 south to I-605 north with a curve ramp and widen it to two lanes.

Figure 14: Interchange Design: I-5 and I-605



7. I-5 at I-710

The I-5 at I-710 interchange is located southeast of downtown in the central part of the region. I-710 is the main expressway connecting the port of Los Angeles to downtown. I-5 has AADT of 250,000 while I-710 has AADT of 200,000.

First, widen the ramp from I-710 north to I-5 north to three lanes and move the merge with I-5 to the right side of the expressway. Second, widen the ramp from I-5 south to I-710 south to three lanes.

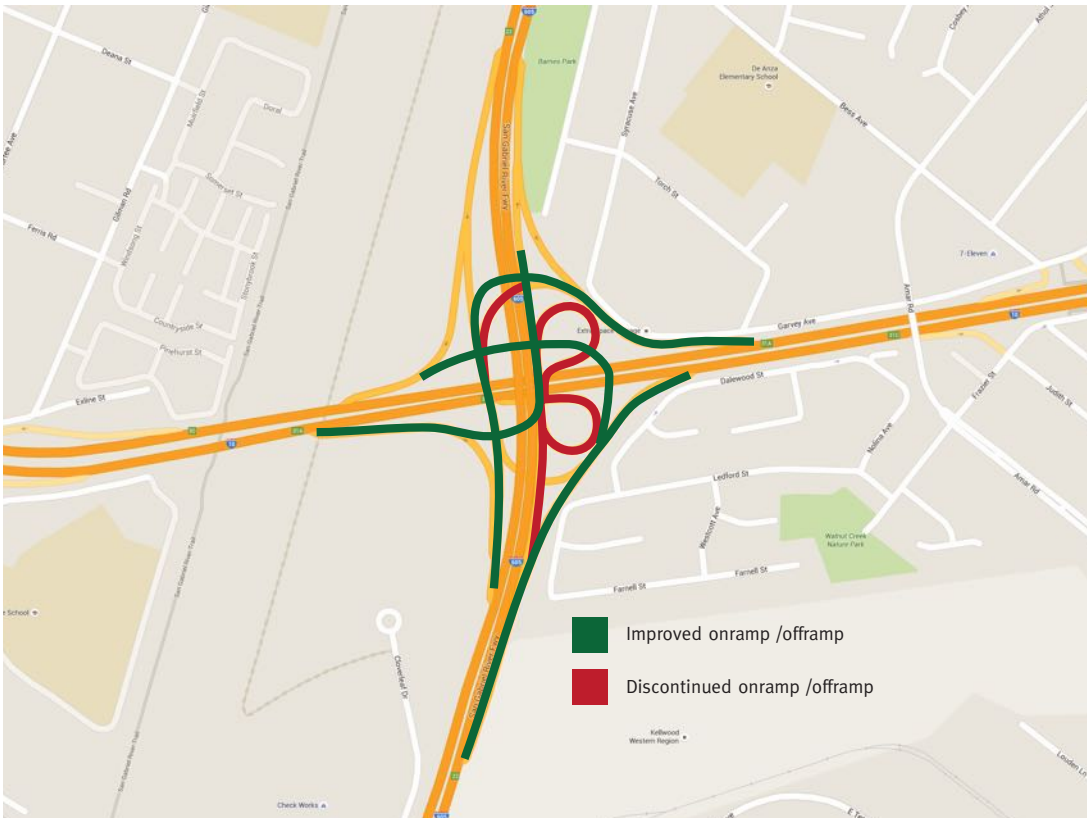
Figure 15: Interchange Design: I-5 and I-710

8. I-10 at I-605

The I-10 at I-605 interchange is located in West Covina in the north central part of the region. I-10 has AADT of 220,000 while I-605 has AADT of 220,000 south of the interchange and 170,000 north of the interchange.

First, widen the ramp from I-10 west to I-605 south to three lanes and move the ramp to the west side of the existing I-605 southbound collector distributor. Then, widen the ramp from I-605 north to I-10 east to three lanes. Replace the loop ramp from I-605 north to I-10 west with a curve ramp and replace the loop ramp from I-10 east to I-605 north with a curve ramp.

Figure 16: Interchange Design: I-10 and I-605

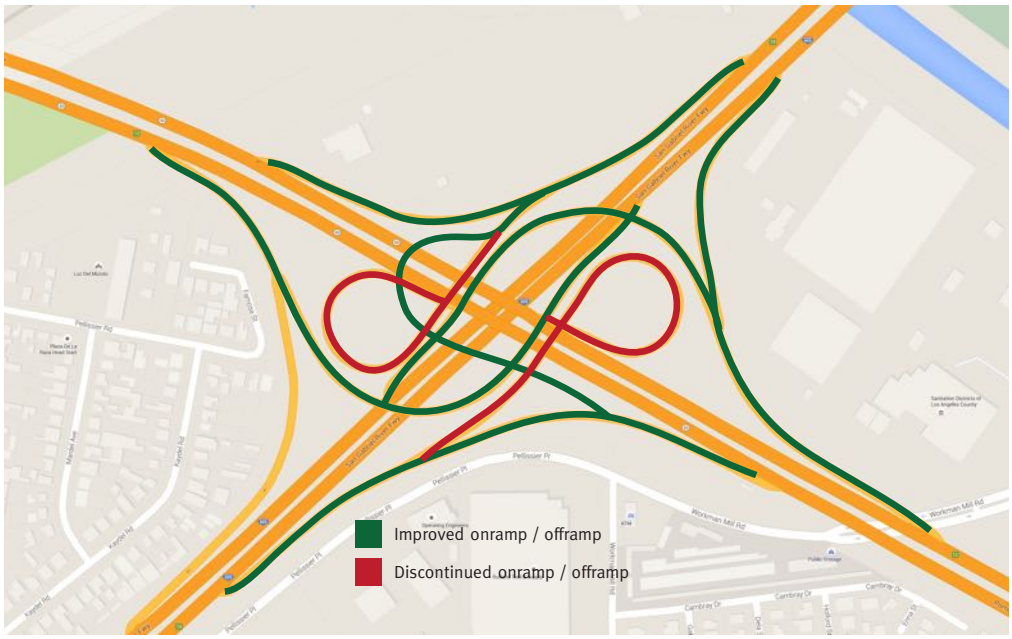


9. I-605 at SR 60

The I-605 at SR 60 interchange is located in the center of the region. I-605 has AADT of 250,000 south of the interchange and 210,000 north. SR 60 has AADT of 250,000.

Widen the ramp from I-605 north to SR 60 east to three lanes. Rebuild the ramp from I-605 north to SR 60 west and eliminate the loop. Widen the ramp from SR 60 west to I-605 north to two lanes. Widen the ramp from SR 60 west to I-605 south to three lanes. Widen the ramp from I-605 south to SR 60 west to three lanes. Widen the ramp from I-605 south to SR 60 east to two lanes and eliminate the loop. Widen the ramp from SR 60 east to I-605 north to three lanes.

Figure 17: Interchange Design: I-605 and SR-60

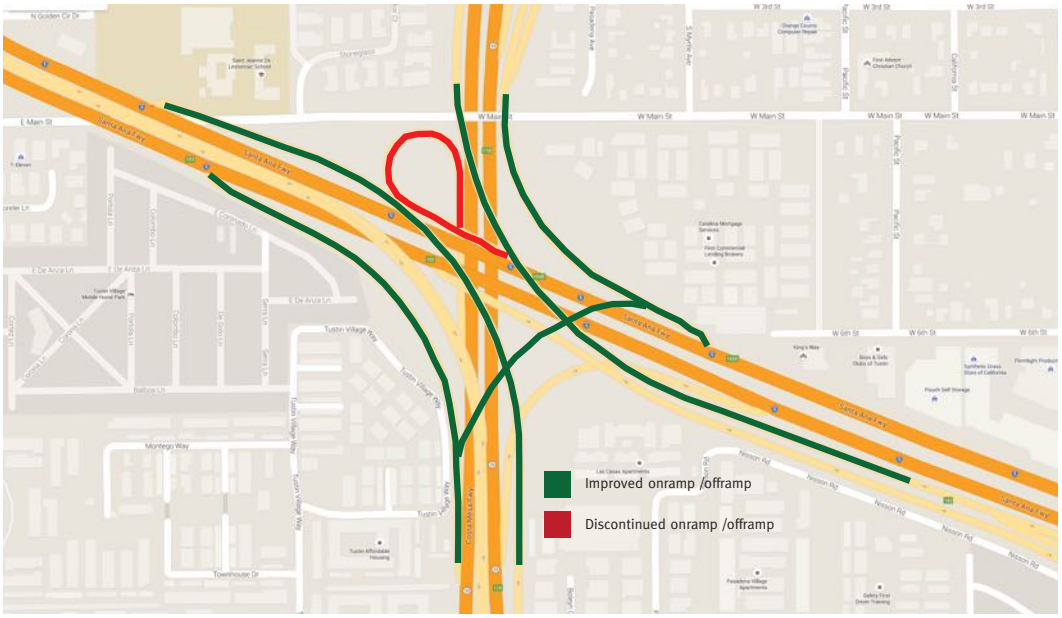


10. I-5 at SR 55

The I-5 at SR 55 interchange is located in Tustin in the southwest portion of the region. I-5 has AADT of 350,000 and SR 55 has AADT of 260,000.

First, widen the ramp from SR 55 north to I-5 north to three lanes. Widen the ramp from I-5 north to SR 55 north to three lanes. Widen the ramp from SR 55 south to I-5 south to three lanes. Widen the ramp from I-5 south to SR 55 south to three lanes. Rebuild the ramp from I-5 north to SR 55 and eliminate the circle curve.

Figure 18: Interchange Design: I-5 and SR-55



B. Expressway-Arterial Bottlenecks

For expressway-arterial bottlenecks, Southern California has a large number of diamond on- and off-ramps not designed for today's traffic. Other ramps feed into local streets before serving the main street, increasing delays and routing through-traffic into neighborhoods. On certain surface streets, ramps are too close together causing unnecessary weaving and congestion.

While there are a number of problematic expressway-arterial bottlenecks, we focused on the interchanges on our proposed managed arterial network, as these are the largest arterials that will have some of the largest traffic increases over the next 25 years.

The full list of interchanges is available in Appendix A, Table A2. All costs were calculated using average cost numbers detailed in Part 3. While fixing bottlenecks at expressway-arterial interchanges will not eliminate congestion around these interchanges, these projects are a cost-effective way to increase mobility.

The goal of these interchange improvements is not to eliminate congestion completely, but to improve badly failing interchanges. These modest improvements will significantly reduce congestion.

Part 5

Making Expressways Reliable: An Express Lanes Network for Southern California

A. Express Lane Overview

A major component of solving Southern California's mobility problem is providing a network of variably priced express lanes on all expressways. Most express lanes are open to light-duty vehicles, including transit buses and vanpools. Express lanes use dynamic pricing to provide a congestion-free travel option.[61] Express lanes are an addition to, not a replacement for, general purpose lanes.

Our report also includes several dynamically priced truck lanes on the busy I-710 and SR 60 corridors that link the Port of Los Angeles and freight distribution centers. These lanes are open to trucks only. While truck congestion can be severe, since most of the worst truck congestion is limited to a few expressways, the truck toll lane network is much more limited in size than the express lane network.

Dynamic pricing varies toll rates in the express lanes based on demand. Most express lane operators use an algorithm that analyzes the congestion level in the general purpose lanes and overall usage of the express lanes.[62] During peak periods, when demand is highest, prices may exceed $1.00 per mile, while during off-peak hours, such as middays and nights, prices may be as low as $0.01 per mile. This variable pricing serves several purposes. First, it guarantees a smooth flow of traffic. This smooth flow of traffic provides reliable travel times 24 hours a day. Second, it reduces induced demand (the tendency for drivers to make extra trips), as pricing provides incentives for motorists to combine trip purposes (known as trip-chaining). Third, it pays for the construction and operation of the express lane network.

Dynamically priced express lanes do not include toll booths. Around the year 2000, the installation of separate drive-thru toll lanes offered customers a way to bypass the tollbooths without having to stop or queue up. This open road tolling (ORT) spread rapidly since it reduced toll plaza congestion and accidents, in addition to reducing toll collection

costs. It also eliminated the need for drivers to carry large amounts of cash. Since 2010, toll road operators have been shifting to all-electronic tolling (AET) to dispense with tollbooths and toll collectors entirely. All U.S. express toll lanes have used AET from the outset; none have any kind of toll booths or toll plazas.

How does AET work? Customers are provided a transponder, which is a battery-operated, radio frequency identification (RFID) unit that transmits radio signals.[63] Most transponders are contained within a flexible window sticker. Customers place a sticker in the center of their windshield near the rearview mirror. When the customer passes a toll collection site, an antenna communicates with the transponder and then with a database. The toll is automatically deducted from the customer's prepaid account in the database (or in some cases, the information is used to create a bill).

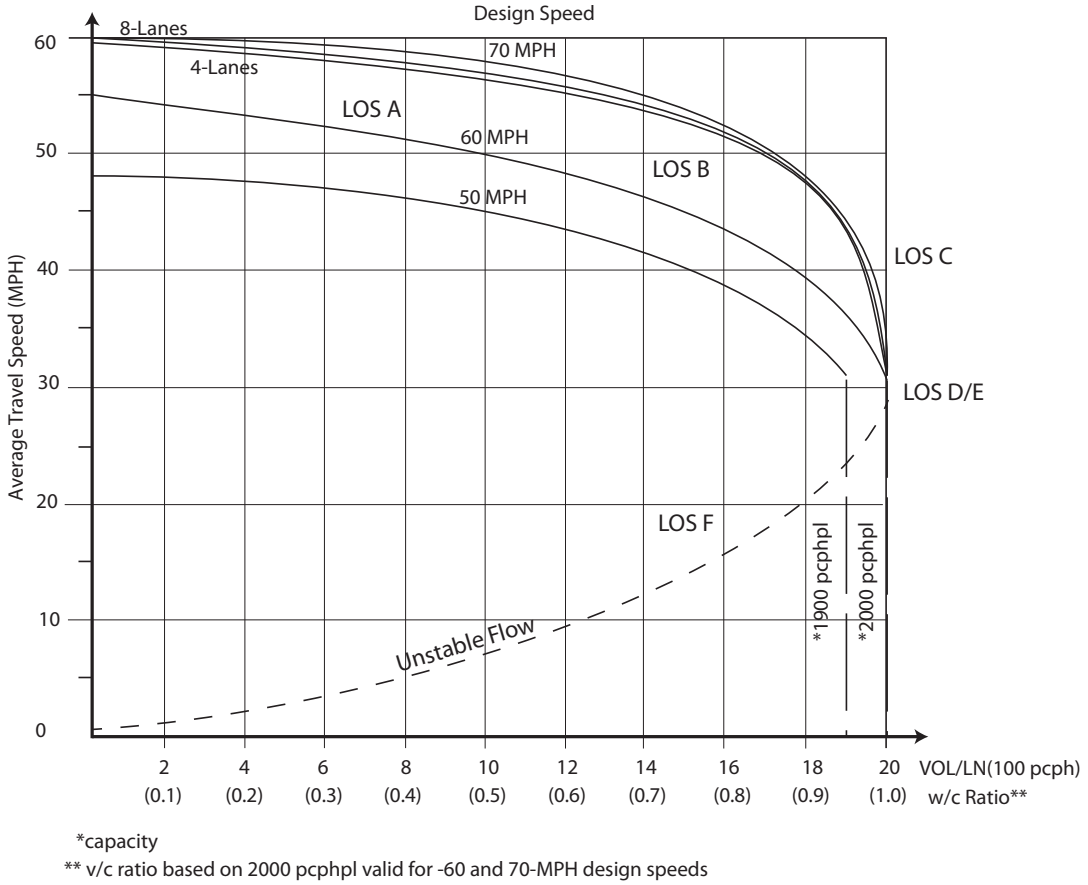
Many express lane operators offer alternatives to AET. Most allow users to pay by license plate. AET collection sites are outfitted with license plate cameras for enforcement purposes. But they also allow the toll agency to bill customers who do not have an AET account by license plate. The toll agency then sends a bill by mail to the customer with a small convenience fee. This fee covers the additional cost of billing and encourages express lane users to get a transponder.

Toll operators are sensitive to the reality that not every customer has or wants to have a credit card.[64] New technology is providing new options for toll payment. Many operators accept personal checks or allow customers to open a cash account or use a debit card. Providing options ensures that all potential customers have at least one easy way to pay for express lane use.

B. Express Toll Lanes Theory

Express lanes use pricing to reduce congestion more effectively than by adding general purpose lanes. Functional capacity can be increased by managing traffic flow in roadway lanes so that these lanes do not get so overloaded into the severely congested state referred to as hyper-congestion.[65] When traffic flow breaks down in that manner, speeds become chaotic and stop-and-go. Under such conditions, the throughput (number of vehicles per lane per hour) of the roadway decreases considerably. Whereas a roadway full of traffic moving steadily at 40 mph may have a throughput of 2,000–2,500 vehicles/lane/hour, if more vehicles try to crowd onto it, the flow rate can degenerate to 1,500, 1,200, or even less as speeds drop into the zero to 20 mph range. These conditions are shown in the traffic engineers' speed/flow curve, in Figure 19. Traffic engineers recognize six levels of service (LOS), ranging from A (uncongested free flow) to F (hyper-congestion). The kind of throughput associated with each is indicated on the figure.

Figure 19: Traffic Engineers' Speed/Flow Curve



*capacity
** v/c ratio based on 2000 pcphpl valid for -60 and 70-MPH design speeds

Source: Federal Highway Administration, Level of Service Guide

Figure 19 shows traffic speed on the vertical axis and traffic volume on the horizontal axis. At the top left, when traffic volume is low, speeds are high and consistent. Engineers refer to this kind of flow as Level of Service (LOS) A. As volume gets higher and cars get somewhat closer together, speeds decline somewhat, and we have traffic at LOS B—still flowing fairly well. Moving to the right, as volume continues to increase, speed declines and we reach the maximum rate of flow that each lane can handle with minimal congestion, designated LOS C. At that point, if more vehicles enter the lane, speed decreases but throughput still increases LOS D. If even more vehicles try to enter, speed declines further, and flow volume is only minimally increased LOS E. Once LOS E is reached, if more vehicles enter, the flow degenerates to stop-and-go traffic. This results in both low speed *and* low volume—called LOS F. Under LOS F conditions, the ability of the roadway to move traffic is hampered at precisely the time it is needed most. Once a roadway gets into severe LOS F, it can sometimes take an hour or more for it to recover.

In a system of dynamic congestion pricing, the price for using express lanes falls if those lanes are clear. But if those lanes start to become congested, the price for using them rises. By deterring drivers who are unwilling to pay the demand-responsive toll, dynamic pricing keeps traffic within the capacity of the tolled roadway, limiting the number of vehicles entering the lane so that traffic always flows at a specified level of service (perhaps C or D during peak periods). Traffic engineers have described this as maintaining traffic at the "sweet spot" represented by the upper right-hand portion of the speed/flow curve.

Express lanes with dynamic pricing are not just a matter of theory. In fact, such pricing was pioneered on the SR 91 Express Lanes in Orange County, in 1995. This proved very successful: during the busiest peak periods Orange County's 91 Express Lanes (a dual-lane facility), the two priced lanes handle 49% of the peak-direction throughput on this six-lane expressway, even though they represent only 33% of the *physical* lane capacity.[66] Thus, priced express lanes operating at LOS C during rush hour have about 50% more *functional* capacity (throughput) than the highly congested (LOS F) general purpose lanes alongside. A single-lane facility of this type can maintain non-congested conditions with about 1,800 vehicles/lane/hour, while a dual-lane facility can handle 2,000 vehicles/lane/hour. The upshot of this is that the SR 91 Express Lanes have remained free-flowing 24 hours a day for the past 20 years, thanks to congestion pricing.

1. Express Lanes Can Incorporate Truck Toll Lanes

Express lanes are not just for cars. Trucks operating on a tight schedule for today's just-in-time warehousing methods can benefit from special truck toll lanes. When trucks need to get somewhere on time, trucks can have the option of using these lanes. But since truck lanes will be slightly wider and built with stronger pavement, trucks may choose to use these lanes even when congestion in the general purpose lanes is minimal, as these lanes will allow truck tires to last longer and provide additional safety to drivers.

The truck lanes will feature the same dynamic pricing as express lanes for cars. Prices will rise and fall based on traffic levels in the general purpose and truck toll lanes to guarantee reliable travel times 24 hours a day, seven days a week.

Since truck lanes are a new concept, and since they will likely only be cost-effective on expressways with the highest traffic volumes, we are recommending building truck lanes on I-710 from the Port of Los Angeles to I-210, on SR 60 from I-710 to I-215, and on I-15 from SR 60 to I-10. These truck lanes are included as part of the express lanes network. Full cost details of the lanes are included in Appendix B.

2. Express Lanes Offer "Congestion Insurance"

Express lanes can continue to offer relief from traffic congestion because as traffic increases over time, future rush-hour prices will be higher than current prices, ensuring the lanes will remain free-flowing over the long-term. This means that motorists can be assured that no matter how bad traffic gets, they will always have a congestion-free option available when they need it.

Some have begun to call this concept "congestion insurance." People purchase insurance to guard against life's other hazards (fire, theft, accidents); similarly, with a network of express lanes, drivers will be able to purchase insurance to guard against being late. The initial cost of this "insurance" is very low: simply the cost of opening an account and installing a transponder on the car's windshield.[67] From that point on, the account-holder has the peace of mind that whenever he/she is running late and really needs to be somewhere on time, he/she has a means of buying that faster trip for a small price.

What kinds of trips might these be?

- Arriving at the day care center on time, before costly per-minute late fees start to mount up;
- Getting to work on time, when the boss has said one more late arrival will be grounds for termination;
- As a tradesperson, accomplishing one more job that day, rather than spending the time waiting in traffic on the roadway; and
- Getting to the airport on time to leave on a business trip or family vacation.

3. Express Lanes Promote Higher Overall Vehicle Occupancy

The goal of higher overall vehicle occupancy (originally intended to be realized via HOV lanes) can be better achieved via an express lanes network for several reasons. First of all, a region-wide set of priced lanes offering major time savings during peak periods gives people an incentive to carpool, so as to split the toll two, three or even four ways.[68] Additionally, the availability of such a network may increase interest in vanpools, since these priced lanes will remain congestion-free indefinitely, unlike HOV lanes which fill up over time and provide little or no time-saving advantages. The long-term sustainability of free-flow conditions makes it worthwhile to invest in vanpooling programs. And lastly, a region-wide, non-congested network makes an ideal guideway for region-wide express bus service. In fact, if a policy decision is made to *reserve* a fraction of the capacity of these lanes for such bus services, and if Metro, OCTA and other area transit agencies plan much of their express bus service around use of this network, then the network would meet the definition of a Virtual Exclusive Busway network providing the virtual equivalent (in terms of bus performance) of a region-wide network of exclusive bus lanes.[69]

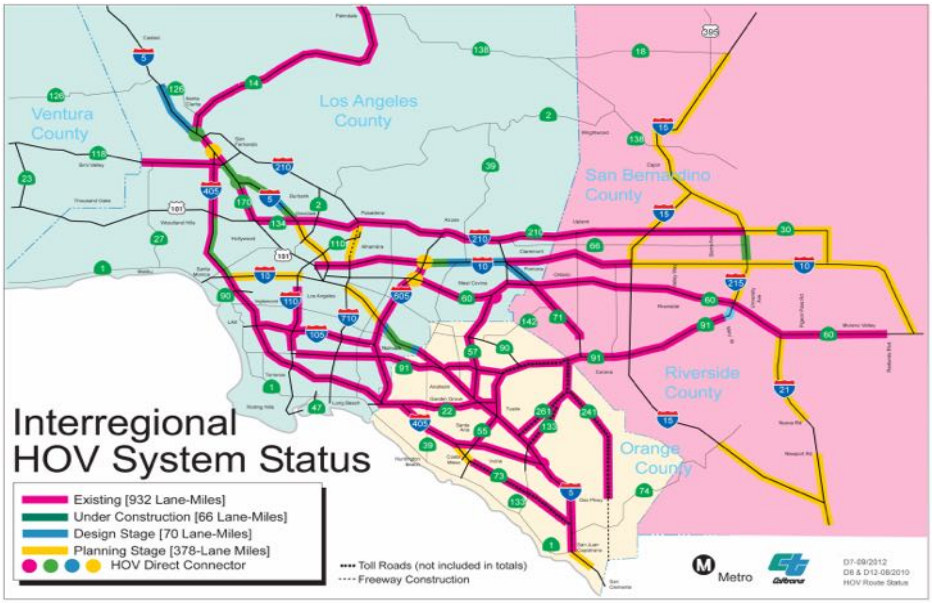
4. Express Lanes Are Not Lexus Lanes

Data from express lane projects in California, Florida, Georgia, Texas and Virginia support the premise that most people do not use these lanes twice a day, every day. Rather, most commuters use the lanes in "congestion insurance" mode, once or twice a week. The 91 Express Lanes in Orange County have 176,000 account-holders, but on any given day, only about 33,000 of them use the lanes.[70] And only a small fraction of those 33,000 are everyday commuters; most are those who, on that particular day, had a trip that was worth the toll. The five most common vehicle models in the Georgia Express lanes are the Ford F-150, Toyota Camry, Honda Accord, Toyota Corolla and Nissan Altima.[71] None of these models can be classified as a luxury vehicle.

5. Express Lanes, Not HOV Lanes

Southern California is fortunate to have a network of high occupancy vehicle (HOV) lanes. Los Angeles has one of the most extensive HOV lane networks in the country. Since 1980, Los Angeles County alone has added 438 miles of HOV lanes.[72] There are also extensive HOV facilities in Orange, Riverside, and San Bernardino Counties. The Southern California region as a whole has 813 HOV lane-miles, with a further 84 lane-miles under construction and another 349 lane-miles proposed for the near future. SCAG is also building new express lanes and has plans to transition some HOV lanes to express lanes. Figure 20 shows SCAG's most recent plan for new HOV and HOT lanes in the region. SCAG is updating its express lanes strategy and plans, and is expected to release additional details by 2016.

Figure 20: SCAG Plan Regional Transportation Plan HOV/HOT Network



Source: California Department of Transportation, http://www.dot.ca.gov/dist07/resources/hov/docs/Interregional%20HOV%20System%20Status.pdf

Originally, controlling vehicle occupancy was the only way to manage lane capacity. And while controlling occupancy can improve mobility at some times of the day, it has a limited effect on the overall network. It is challenging to optimize HOV-network performance. In simple terms, Southern California's HOV lanes suffer from the "Goldilocks" problem. Some HOV lanes are "too hot." During rush hour, HOV lanes on most freeways including I-10, I-110 and I-405 carry far more traffic than originally intended. As a result, cars in the HOV-lane move at approximately the same speed as cars in the general purpose lanes. This situation does not incentivize commuters to carpool or ride the bus. (This excess demand was one reason for transitioning parts of the I-10 and I-110 lanes to HOT lanes.) Most HOV lanes operating outside of peak periods are "too cold." Most HOV lanes between 10 AM and 2 PM, and HOV lanes operating in the reverse peak direction during peak periods carry far fewer cars than their design intended.

The problem with these traditional HOV lanes is that, in order to be efficient, the corridors they serve need to have an exact number of carpoolers. Most corridors may have this traffic volume one to two hours a day but not the rest of the time.

Fortunately, over the last 20 years, technology in the form of variable pricing on express lanes has proven to be a better solution than HOV lanes. During peak-direction rush hours—when demand is highest—express lanes prices are highest. This pricing guarantees a free-flowing trip in the express lanes, and also entices commuters to use the general purpose lanes, a different road, or travel at a different time, if possible. During other times the express lane price is lower, as low at $0.01. This encourages commuters to use the express lanes and shift their travel to the off-peak time where possible.

C. Express Lanes Network

While an individual express lane on one section of expressway can reduce travel times, the most effective express lanes will operate as part of a larger network. The Los Angeles metro area has 30 expressways. Most commuters use at least two of these facilities to commute from their home to work. If only one of the expressways has express lanes, commuters save time for one part of their journey but are stuck in traffic for another part. As a result, the express lane benefits travelers less since it provides travel time savings on only one highway, offering no guarantee of a quicker overall trip.

In addition to the congestion-relieving benefits, a regional express lane network would also generate operating revenue that can be applied to build out the full network within a shorter time frame. Regional express lane networks are being constructed in metropolitan areas throughout the country, including Atlanta, Dallas, Denver, Houston, Miami, Minneapolis, San Diego, San Francisco, Seattle and Washington, D.C.[73] Los Angeles is an excellent candidate for such a network as well, given the large network of existing

expressways, the presence of high-occupancy vehicle (HOV) lanes on most of these facilities, and the high levels of traffic congestion.

To maximize the benefits, Southern California needs a complete express lane network on all major expressways to better serve commuters.

1. Which Vehicles Pay to Use Express Lanes?

Two-person carpools (vehicles with two people travel together) are very popular in Southern California. Allowing these vehicles to travel free of charge in the express lanes would lead to congestion undercutting the lanes' value to transit and congestion-reduction benefits for automobiles. Since the number of three-person and four-person carpools drop-off significantly, we recommend offering free passage to vanpools and buses only. Other metro areas including Atlanta and Baltimore have adopted this policy for all newly constructed Express lanes.

As well, most two-person carpools are "fampools," whereby two members from the same family are traveling to the same location.[74] These carpools do not decrease congestion because these commuters would travel together without an incentive. In some cases a two+ person carpool lane actually induces congestion by encouraging parents to drive their kids to school instead of sending them on the school bus. Clearly this is not the intended goal of HOV lanes.

In order for such express lane policies to be enacted, it is important for planning agencies in Southern California to work closely with the public to explain the magnitude of the congestion problem, the true cost of congestion to the economy and quality of life, and the merits of congestion pricing.

2. Express Lane Conversions

Since express lanes are more effective than HOV lanes, we recommend converting all HOV lanes to express lanes. With approximately 900 miles of HOV lanes in operation or under construction, converting all lanes to express toll lanes would provide a major benefit.

New Capacity

To create a complete express lane network, Southern California needs to add tolled physical capacity to expressway corridors that do not have existing HOV lanes to convert. Other corridors have only one HOV lane in each direction but need two express lanes per direction to enhance mobility. Table B1, located in Appendix B, details where to add lanes and how many lanes to add. The table also delineates the total number of express lanes recommended for each freeway corridor.

Given the extreme levels of congestion on most of the region's expressways, we recommend a network with two express lanes in each direction. However, certain corridors justify more or fewer express lanes. Generally, we recommend one express lane per direction on expressways with current level of service "C" during peak hours with between 80,000 and 150,000 average annual daily traffic (AADT), and fewer than 20,000 AADT per lane. We recommend two express lanes per direction on expressways with current level of service "D" and "E" during peak hours, with between 150,000 and 300,000 AADT and between 20,000 and 28,000 AADT per lane. We recommend three express lanes per direction on expressways with current level of service "F" during peak hours and more than 300,000 AADT and more than 28,000 AADT per lane. The exact number of proposed lanes also varies based on other factors, such as construction costs, roadway geometry, seasonal variation, percent of truck traffic and expected growth rate over 35 years.

Building express lanes by themselves is not sufficient. As discussed above, most of the region's commuters use multiple expressways to commute from point A to point B. If commuters need to transition from the express lanes to the general purpose lanes to exit expressway A and then move from the general purpose lanes to the express lanes on expressway B, they will be subject to significant congestion at many interchanges. Such congestion will decrease the value of the express lanes. As a result, we also need to build flyover connectors between express lanes on different expressways to provide uncongested trips. Some such connectors already exist in Orange County, but they are less common elsewhere in the region. Table B2, located in Appendix B, details the express-lane-to-express-lane connectors needed for the network to operate optimally. The following figures, 21 and 22 illustrate the Southern California Express Lanes Network.

Figure 21: Southern California Express Lanes Network (South)

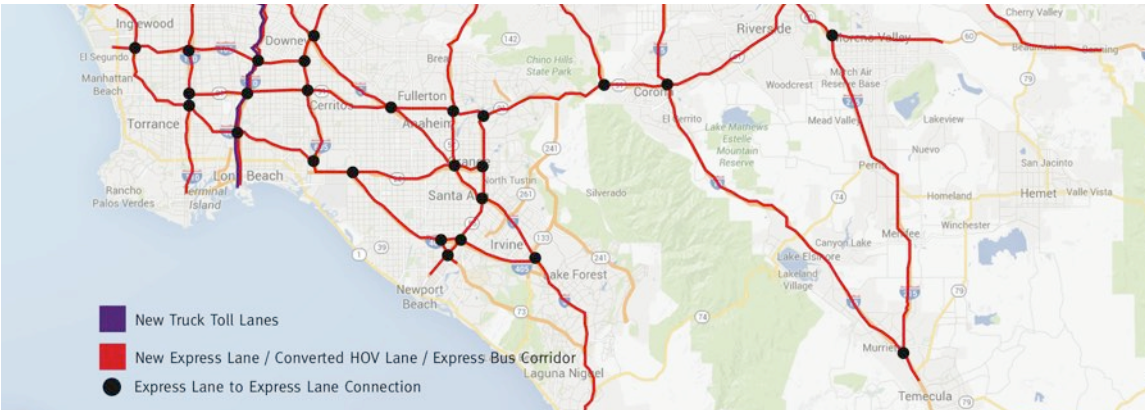


Figure 22: Southern California Express Lanes Network (North)

D. Financial Feasibility

While express lanes are growing in popularity throughout the country, many regions need to supplement toll revenue with gas tax revenue in order to have the resources to build and operate an express lane network. However, due to the Southern California's extreme congestion, high express lane usage and relatively high express lane tolls, tolls are projected to be large enough to comfortably pay for the construction, operation and maintenance of the entire network.

We model the express lanes as being constructed over 25 years. We propose that 20% of the network is built during each five-year window. We calculate toll revenue as growing at the rate of inflation (2.9%) and start tolling when the project opens to the public. We work from a toll revenue base of 40 years, as that time period is the expected life of the infrastructure. We recommend that the express lanes facility be constructed as a public private partnership due to the cost-savings over the life of the facility.

The following table provides an overview of the Express Lane network funding and financing. More details including Net Present Value calculations are displayed in Appendix D.

Table 15: Express Lane Network Costs at a Glance

Region	Gross Revenue	Net Revenue	Construction Cost	Transfer to Expressways/Tunnels	Contingency	Debt Service
Los Angeles	$204.9B	$174.2B	$129.0B	$7.2B	$11.8B	$26.2B

Table 15 shows several important express lane numbers. The total gross revenue collected over the lifetime of the project is $204.9 billion. We deduct 15% of the gross revenue to use for roadway operations and maintenance. The remaining 85%, $174.2 billion, is the net revenue.

The construction cost totals $129.0 billion. We use $7.2 billion of the total to fill in the gap in the new tolled expressways/tunnels described later in this paper. We devote the remaining resources to a combination of contingency costs and debt service.

Since express lane usage depends upon one's willingness to pay, which can vary based on economic circumstances, we have included $11.8 billion in contingency costs in case construction costs are higher than forecast and/or usage is lower than forecast. Even with the contingency, the tolling revenue still covers 100% of the construction, operations and maintenance of the network.

We do expect some express lane segments to recover close to 150% of their costs, while others may recover only 50%. However, the express lanes will only work if the lanes function as a true network, whereby all residents can have a congestion-free, predictable travel time from point A to point B on multiple expressways. More financial details are available in Appendix B.

Part 6

Taming Surface Road Congestion: Managed Arterials

The fourth part of solving Southern California's mobility problems is developing a comprehensive surface street network to serve as an alternative and complement to the extensive expressway network. Our proposed managed arterial concept offers a congestion-free trip on even the busiest arterials, providing additional options for buses and motorists throughout the region.

A. How Managed Arterials Work

Express lanes have helped revolutionize expressway travel by providing a quick, reliable trip for buses, vanpools and drivers willing to pay a toll to bypass congestion. Express lanes work because they are on limited access expressways that can easily be tolled. But most of the road mileage in major metro areas is on arterials, which function very differently. Arterials are high-capacity roads that primarily connect expressways and collector roads at the highest level of service.[75] They feature multiple intersections with side roads, shopping centers and businesses. Because of this, managing arterial lane capacity and traffic flow via tolling is much more challenging.

A "managed arterial" is an arterial that has been upgraded with a series of grade separations at major intersections. The managed arterial offers drivers the choice of using an underpass (or in selected cases, an overpass) to bypass the intersection and traffic light.[76] These underpasses allow an arterial to provide the same type of dependable travel time as an express lane. Since the largest chokepoints on arterials are traffic signals at major cross streets, creating grade separations at these intersections is the optimal way to relieve back-ups and congestion. Managed arterials relieve traffic congestion and offer quality transit service on busy arterials.

Limited resources make funding underpasses very challenging, but managed arterials can be financed similarly to express lanes. Managed arterials operate on the same general concept as express lanes as they offer drivers a choice of paying a small fee to use optional lanes to bypass traffic. These underpasses can be partially paid for by charging a small toll, generally $0.25 to $0.50 per crossing, depending on the size of the intersection and the

congestion.[77] To keep the cost and complexity low, all electronic tolling (AET) is used. AET uses transponders or sensors to determine the number of axles per vehicle and the corresponding toll rate. Then toll readers automatically deduct the correct toll amount from the customer's account. Drivers can also choose to continue on the main road and proceed through the signalized intersection for free.

Through using underpasses, managed arterials provide uninterrupted traffic flow across the intersection. Managed arterials also will lead to reduced congestion in the non-tolled lanes since many previous lane occupants will choose to use the underpasses. In this way the managed arterial provides not only more capacity but a different option, which does not further constrain the intersection, as the mere adding of lanes would do.

Figure 23 is an example of a managed arterial underpass. Figure 24 is an example of a managed arterial overpass.

Figure 23: Managed Arterial Underpass

Figure 24: Managed Arterial Overpass

To compute the throughput capacity of a managed arterial, we use a six-lane arterial, with two grade-separated lanes in each direction at major intersections and one at-grade through-lane in each direction (plus turn lanes) at major intersections. The hourly (peak-hour/peak-direction) capacity is calculated using standard DOT figures based on a four-lane, divided, uninterrupted flow facility plus one-half of the capacity of a four-lane, divided, minor arterial. In order to provide higher quality service for drivers using the tolled grade separations and to offer high-quality bus service, the roadway must operate at LOS C or better.

Many metro areas are converting or building bus-only lanes on arterials. While increasing the quality of bus transit may be an important goal, dedicating a full lane to bus travel may not be the most efficient approach. Table 16 displays the throughput capacity of a managed arterial. Table 17 compares a managed arterial to a six-lane arterial with two bus-only lanes.

Table 16: Hourly Directional Throughput Capacity of a Six-Lane Managed Arterial

Transit Percentage (person trips)	Vehicle Capacity (vph)	Cars per Hour	Auto Throughput (persons per hour @ 1.15 persons per vehicle)	Transit Through- put (persons per hour)	Required Buses per Hour (40 person capacity)	Total Vehicles per Hour	Total Throughput (persons per hour)
0%	3,225	3,225	3,709	0	0	3,225	3,709
2%	3,225	3,223	3,706	75	2	3,225	3,781
4%	3,225	3,221	3,704	153	4	3,225	3,857
5%	3,225	3,220	3,704	195	5	3,225	3,899
10%	3,225	3,214	3,696	409	11	3,225	4,105
15%	3,225	3,208	3,689	649	17	3,225	4,338
20%	3,225	3,202	3,682	920	23	3,225	4,602
25%	3,225	3,194	3,673	1,224	31	3,225	4,897
30%	3,225	3,185	3,663	1,567	40	3,225	5,230
32%	3,225	3,181	3,659	1,721	44	3,225	5,380
33%	3,225	3,180	3,657	1,797	45	3,225	5,454
34%	3,225	3,177	3,654	1,882	48	3,225	5,536

Table 17: Hourly Directional Throughput Comparison: 3 GP Lanes vs. 2 GP Lanes + 1 Bus-only Lane

Lanes	Demand (persons per hour)	Percent Transit	Vehicle Capacity of GP Lanes	Required Cars to Meet Demand in GP Lanes	LOS - GP Lanes	Transit Through- put (persons per hour)	Required Buses per Hour (40 person capacity)	Demand Beyond Capacity (vehicles per hour)	Demand Beyond Capacity (persons per hour)
3GP	3,250	0%	2,830	2,826	E	0	0	0	0
2GP+1Bus	3,250	0%	1,870	2,826	F	0	0	956	1,100
2GP+1Bus	3,250	2%	1,870	2,770	F	65	2	901	1,036
2GP+1Bus	3,250	4%	1,870	2,713	F	130	3	846	973
2GP+1Bus	3,250	5%	1,870	2,685	F	163	4	819	942
2GP+1Bus	3,250	10%	1,870	2,543	F	325	8	682	784
2GP+1Bus	3,250	15%	1,870	2,402	F	488	12	544	626
2GP+1Bus	3,250	20%	1,870	2,261	F	650	16	407	468
2GP+1Bus	3,250	25%	1,870	2,120	F	813	20	270	310
2GP+1Bus	3,250	30%	1,870	1,978	F	975	24	133	153
2GP+1Bus	3,250	32%	1,870	1,922	F	1,040	26	78	89
2GP+1Bus	3,250	33%	1,870	1,893	F	1,073	27	50	58
2GP+1Bus	3,250	34%	1,870	1,865	E	1,105	28	0	0

Note that for all percentages of transit use, the managed arterial has a significantly higher person throughput than a six-lane arterial configured for four general purpose lanes and two bus-only lanes. At 4% transit use, the six-lane managed arterial is able to move 3,857 persons per hour compared to 2,240 persons on the 4 GP/2 bus-only arterial. In this case the managed arterial has a person capacity 72% greater than the 4 GP/2 bus-only arterial, while maintaining a significantly higher LOS. At a transit usage of 34%, if that could actually be attained, the managed arterial would still provide almost 70% greater person throughput, again at a higher level of service.

An option to a six-lane managed arterial is an eight-lane arterial (six GP plus two bus-only lanes). A six-lane managed arterial does not require any more extra right of way than an eight-lane arterial. In fact, given that the seventh and eighth lanes would have to be maintained through the entire length of the facility, not just at the intersections, a six-lane managed arterial will require less right-of-way overall than an eight-lane arterial. The throughput capacity of an eight-lane arterial that includes two bus-only lanes is shown in Table 18.

Table 18: Hourly Directional Throughput Capacity of 8-Lane Arterial with 6 GP + 2 Bus-Only Lanes

Transit Percentage (person trips)	GP Lanes Vehicle Capacity (vph)	Cars per Hour	Auto Throughput (persons per hour @ 1.15 persons per vehicle)	Transit Throughput (persons per hour)	Required Buses per Hour (40 person capacity)	Total Vehicles per Hour	Total Throughput (persons per hour)
0%	2,830	2,830	3,255	0	0	2,830	3,255
2%	2,830	2,830	3,255	66	2	2,832	3,321
4%	2,830	2,830	3,255	134	4	2,834	3,389
5%	2,830	2,830	3,255	171	5	2,835	3,426
10%	2,830	2,830	3,255	363	10	2,840	3,618
15%	2,830	2,830	3,255	572	15	2,845	3,827
20%	2,830	2,830	3,255	819	21	2,851	4,074
25%	2,830	2,830	3,255	1,079	27	2,857	4,334
30%	2,830	2,830	3,255	1,378	35	2,865	4,633
32%	2,830	2,830	3,255	1,533	39	2,869	4,788
33%	2,830	2,830	3,255	1,604	41	2,871	4,859
34%	2,830	2,830	3,255	1,676	42	2,872	4,931

Managed arterials have several advantages over bus-only lanes. However, Southern California also must work to improve its bus service. Part 10 provides details on how to improve the region's transit network.

While converting a six-lane arterial into a managed arterial is slightly more expensive than widening the six-lane arterial to an eight-lane arterial, managed arterials can be paid for through tolls. In Southern California, tolls will support 100% of the project's construction, operating and maintenance costs. Traditional arterial widenings, which cost $10–$20 million a mile and sometimes more, are paid for by all motorists or all taxpayers regardless of whether they use the road or not.[78]

All of these factors make managed arterials an attractive option for policymakers trying to improve transit and reduce traffic congestion. However, the managed arterial concept is

still evolving. Managed arterials were first studied in Lee County, FL (Fort Myers) under the Federal Highway Administration's Value Pricing Pilot Program, in 2002. The study examined the possibility of using grade-separated overpasses at congested intersections to allow drivers who were willing to pay a toll to bypass the traffic signal and its queue.[79] It also examined operational issues, public acceptance and cost feasibility, finding that from an operations standpoint such grade separations are feasible. There are no technical or operational issues that would prohibit their use. With some (non-tolled) grade-separated intersections already in existence in Lee County, this was not a surprising finding.

Reason Foundation helped develop the concept of a managed arterial that was presented in 2012 at the National Academy of Sciences Transportation Research Board (TRB) Annual Meeting. A paper on the subject has been published in TRB's journal, *Transportation Research Record* No. 2297.[80]

B. Managed Arterials Revenue Estimation

The managed arterials pricing model is to charge a flat rate toll, adjusted annually for inflation and traffic growth, for each grade separation (underpass or overpass). The 18 managed arterials described previously and detailed in Appendix C proposes 559 newly constructed grade separations—underpasses or overpasses. Both the toll rates and the usage rates are based on previous studies that were undertaken for tolled, grade-separated interchanges in Lee County, Florida and adjusted for Southern California's unique congestion challenges.

The throughput of a six-lane arterial reconfigured as a managed arterial is up to 87,600 average annual daily traffic (AADT). Since SCAG projects that most of these corridors will operate at LOS F in 2035, we assume that during peak and shoulder periods on weekdays, the arterials will operate at capacity, with the managed arterial grade separations operating at LOS C. We also make the following assumptions:

- Of the total AADT, traffic equal to half that amount (43,800) occurs during eight peak hours, and another quarter (21,900) during four shoulder hours, with the balance during the remaining 12 hours.
- 2015 toll rates per tolling point (each grade separation used) are assumed to be $0.35 peak, $0.25 shoulder, $0.15 during off-peak hours and $.20 during the weekends.
- Based on the speed advantage of avoiding signaled interchanges, we assume that 50% of total arterial traffic opts to use the underpasses/overpasses rather than the signalized intersections lanes during peaks, 35% during shoulders, and 20% during off-peak hours and on weekends.

The assumption that 50% of total traffic approaching the intersection will use the grade separation during weekday peak periods may seem high, but there are good reasons for making this assumption. First, the underpass or overpass will provide a large amount of capacity, four lanes (two in each direction). Second, while the toll rate is easily adjusted, the congestion at the intersection is affected by the signal timing. Besides through-traffic, the signalized intersection must also serve left, right and U-turns as well as cross-street through-movements and turns. The best policy that minimizes total overall delay at the intersection is to maximize use of the grade separations. The best way to maximize use of the grade separations is to shift "green time" (green time is the time allotted to movements through the intersection and is usually expressed as a percentage) no longer needed by the through-movements to the other movements, thereby reducing overall delay.

Table 19 summarizes the calculation, based on the above assumptions.

Table 19: Managed Arterial Network Revenue Estimation

Time of Day	Traffic	Percent Traffic Using	Rate per Grade Separation	Number Used	Daily Revenue
Peak	43,800	50%	$.35	559	$4,284,735
Shoulder	21,500	35%	$.25	559	$1,051,619
Off-peak	21,500	20%	$.15	559	$360,555
Total Weekday					$5,696,909
Weekend & Holiday	52,560	20%	$.20	559	$1,176,136

With 250 weekdays per year, the annual revenue from weekday use is $1,424,227,188. The 115 weekend and holiday days yield an additional $135,255,640. After accounting for rounding, the annual total for all the managed arterial grade separations is $1,559,379,972.

We calculated that the managed arterial network will cost $53.1 billion over 25 years in inflation-adjusted dollars to construct. This includes the overpasses/underpasses and some minor road improvements. Similar to the express lanes, we recommend building 20% of the network over each five-year period until the entire network is constructed. Also similar to the express lane network, we recommend using P3s to stretch public resources further. The following chart compares the cost to build the system with the toll revenue.

Table 20: Managed Arterials Costs versus Revenue

Region	Gross Revenue	Net Revenue	Construction Cost	Contingency	Debt Service
Southern California	$114.9B	$97.7B	$53.1B	$20.7B	$23.9B

Table 20 includes several key numbers. The gross revenue is the total amount of toll revenue collected over 40 years. Revenue from the optional tolled grade separations on the managed arterial provides $114.9 billion in gross revenue. We deduct 15% of the gross revenue to use for roadway operations and maintenance. The remaining 85%, or $97.7 billion, is the net revenue. The construction costs are estimated at $53.1 billion.

Since no managed arterial network has been built in the U.S., we think it is crucial to include a large contingency in case construction costs are higher than forecast and/or usage is lower than forecast. We understand that a $20.0 billion contingency (18%) of total costs is high. However, we think the managed arterials are so crucial to Southern California reducing both its arterial congestion and improving its BRT service that these lanes need to be constructed. As a result we want to ensure a sufficient contingency for any surprises that may arise.

As Table 20 shows, the Southern California region's managed arterial network tolls easily cover construction, operating and maintenance costs, even with a 20% contingency. The positive modeling results indicate that Southern California is a great candidate for managed arterials.

C. Creating a Managed Arterial Network

Clearly, not every arterial in Southern California is appropriate as a managed arterial. Our plan proposes a managed arterial network—similar in structure to, but smaller in size than, the existing expressway network—that 1) develops a complementary system to ease expressway congestion and 2) fills in gaps in the expressway network. Expressways and arterials work in tandem to provide travel guideways for motorists and transit buses. Analysis suggests that managed arterials are most effective with six travel lanes in each direction. As a result, some sections of these proposed managed arterials are shown as being widened. The number of widened sections is extremely limited and conversions of parking lanes or auxiliary lanes were suggested where feasible.

We estimate that tolls would cover approximately half of the managed arterial costs. The rest of the costs will come from gas taxes, mileage-based user fees, or other road charges.

Our plan includes 18 managed arterials. Eleven run north-south while seven run east-west. All routings are approximate. Figures 25 and 26 illustrate our managed arterials network. The exact routings and details on the various managed arterials components are delineated in Appendix C.

Southern California policymakers will also need to devote some resources to improving minor arterials and local streets. These parts of the roadway network are beyond the scope of this study. Where possible, Southern California should fill in the existing road network and develop feeder streets to primary arterials and expressways.

Figure 25: Managed Arterial Networks

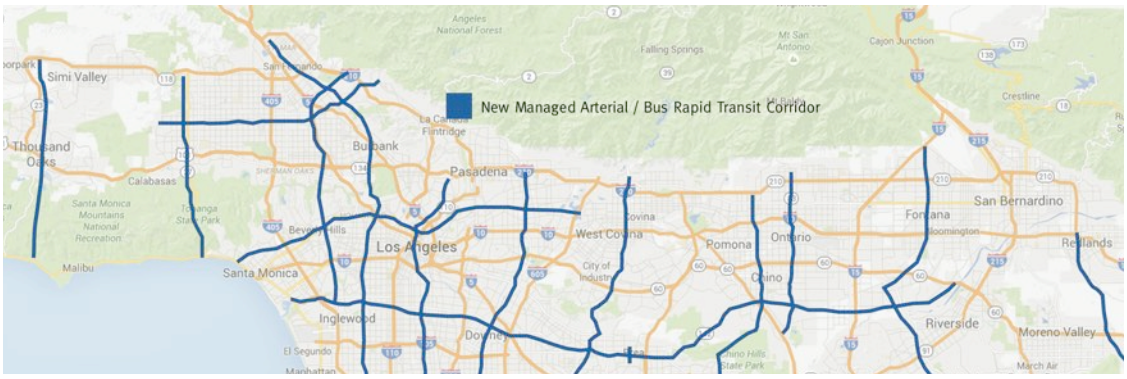
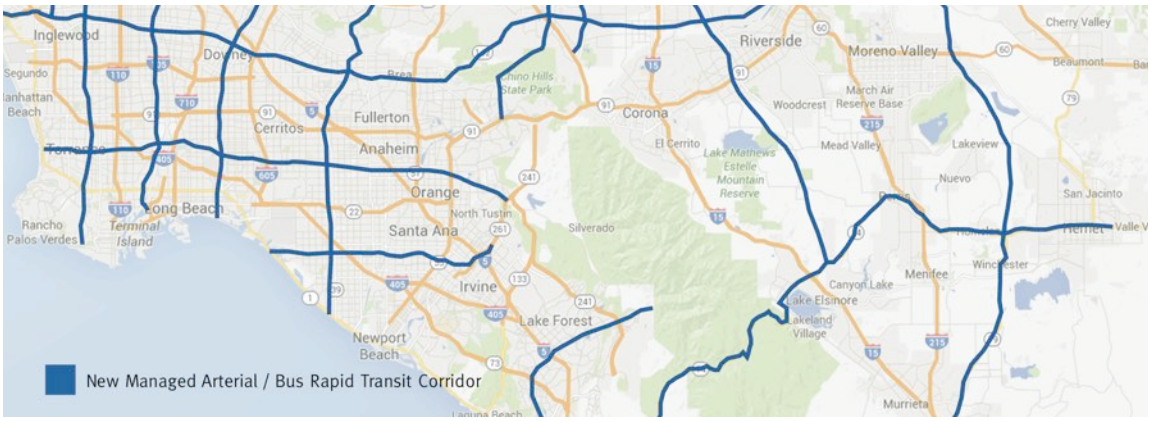


Figure 26: Managed Arterial Networks



Part 7

Filling in Missing Links in the Expressway Network via New Tolled Capacity

A. Identifying the Gaps

The third part of solving Southern California's mobility problem involves providing long-needed missing links in the expressway system to reflect the actual land uses and travel patterns of the Los Angeles metropolitan region. Given the shortage of conventional transportation funding, these new projects would have all lanes electronically tolled, and would use toll revenue to finance major portions of the costs.

To help more effectively manage congestion, we recommend building the following six expressway projects:

- Project 1: I-710 Extension (I-710T): A tunnel that extends I-710 north from Los Angeles to connect with I-210 in Pasadena.
- Project 2: High Desert Corridor (HDC): A new expressway between SR 14 in Palmdale and I-15 in Victorville.
- Project 3: Glendale-Palmdale Tunnel (GPT): A tunnel extending north from SR 2 in the Glendale area and connecting with SR 14 just south of Palmdale.
- Project 4: Irvine-Corona Freeway (ICE): A new combination expressway corridor/tunnel between Riverside and Orange Counties.
- Project 5: Cross Mountain Tunnel (XMT): A new combination expressway/tunnel connection between US 101 in the San Fernando Valley and I-10 in West Los Angeles.
- Project 6: Downtown Bypass Tunnel (DBT): A tunnel extension of SR 2 south through central Los Angeles to I-110.

Among these six projects, Project 1 (the I-710 Gap Closure Tunnel) and a portion of Project 2 (the High Desert Corridor) are included in the SCAG Financially Constrained 2012 RTP. We propose both projects as value-priced tolled facilities to maximize vehicle throughput and congestion relief, to provide an uncongested option, and to generate most of the revenue needed to build and maintain the facility beyond what is already in the SCAG Plan.

The other four projects represent an expansion or modification of the projects contained in the SCAG RTP. The projects have not been modeled for air quality compliance, though our overall modeling work showed that the proposed set of projects would slightly reduce overall vehicle-miles traveled (as more vehicles shift from arterials to more-direct freeway and toll-lane routes).

Implementing these projects would represent a huge, one-time catch-up in network capacity to better match the system's capacity to the growth in population and travel over the past 20–30 years during which expressway capacity additions were limited.

The remainder of this chapter details each of the major projects. For each project, an overview of the project, project rationale, project status and location map are provided. Toll rates and traffic volumes are detailed for each project. After all the projects have been introduced, we examine combinations of projects to analyze how the new facilities will work together. Finally, we estimate the total cost for each project. We examine the ratio of project costs to user benefits and the advantages of building tunnels compared to surface roads.

A summary of benefits for each of the six projects is provided next. Results are based on the Southern California Association of Governments (SCAG) regional travel demand model, including the year 2035 traffic model, the year 2035 road network, and year 2035 origin-destination matrices for six vehicle classes.

A more complete description of project benefits, including the analysis methodology and findings, are provided as Appendix D to this report.

B. Project Details

Project 1: I-710 Extension

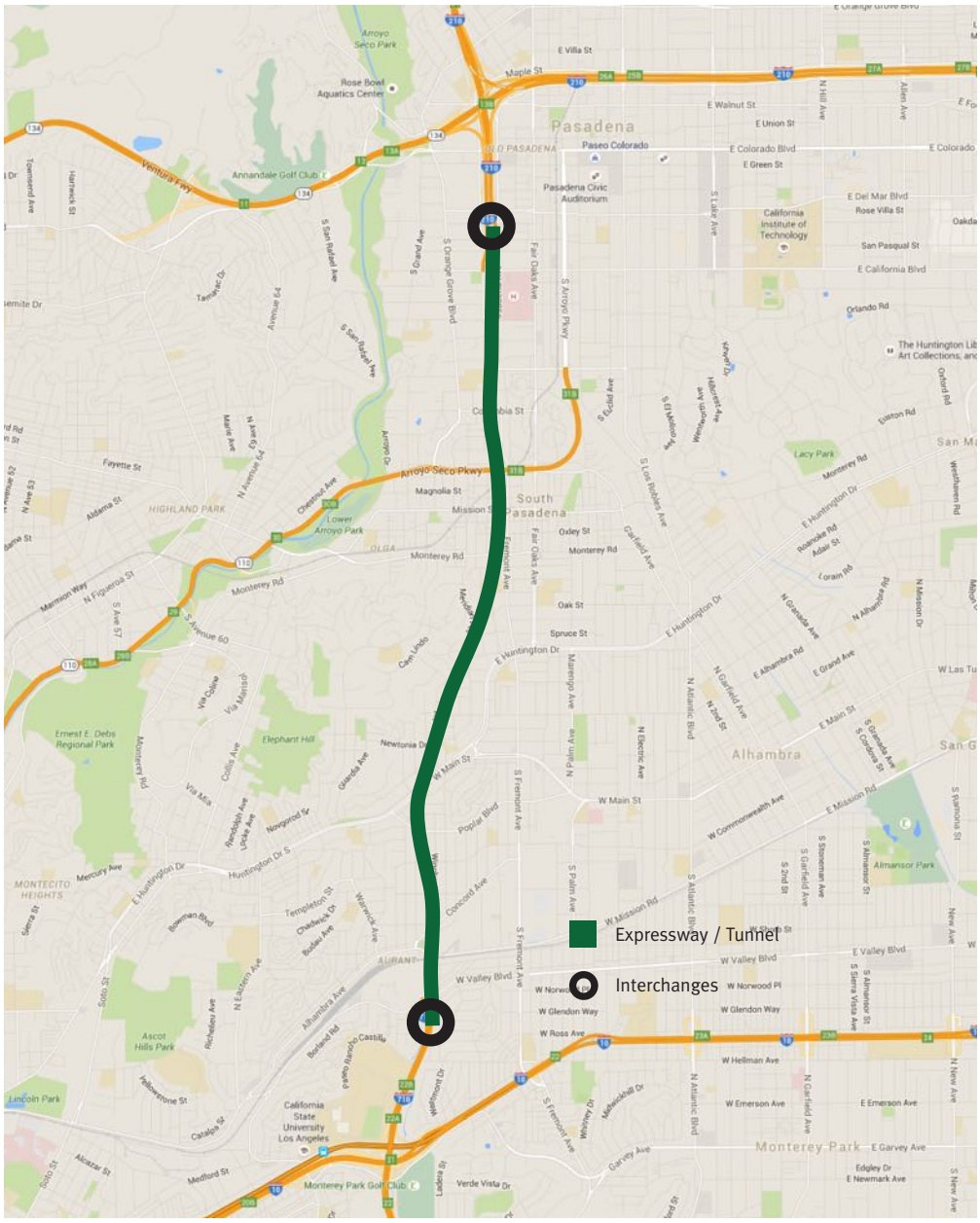
The I-710 expressway is an extensively traveled facility but has a 4.5-mile gap between Valley Boulevard, just north of the I-10 San Bernardino Expressway in the City of Los Angeles and Del Mar Boulevard in the City of Pasadena. The expressway continues from Del Mar Boulevard to the junction of the I-210 Foothill Expressway. Closing the gap relieves regional and local traffic congestion, particularly on I-5 and I-10, and enhances air quality. Surface expressway alternatives to close the gap have not advanced due to community and environmental concerns.

A 4.5-mile tunnel option with an additional 1.2 miles of surface construction, extending I-710 north to connect with I-210, completes this important link in the network and is viable from an engineering and a financial standpoint. Filling in this missing link significantly

reduces congestion on the expressways in that part of the metro area as well as on the surface streets of Alhambra, South Pasadena, Pasadena, and nearby cities. Perhaps more importantly, this missing link would provide travelers with another expressway option between North Los Angeles County and the South Bay to complement the highly congested I-5, US 101 and I-405 expressways.

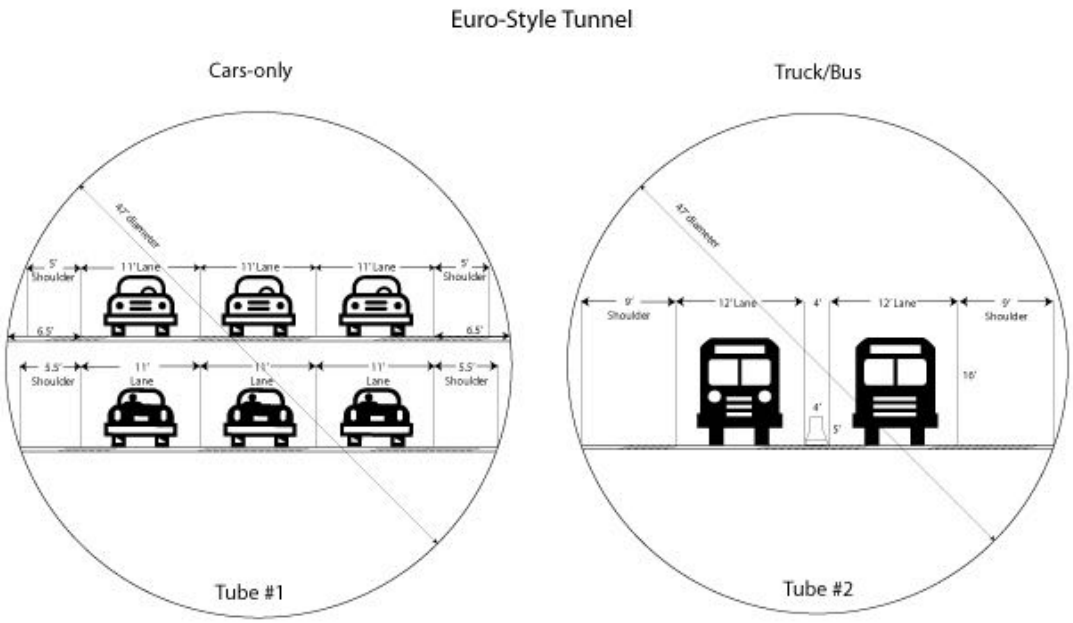
This tunnel is included in the SCAG Financially Constrained RTP, and does not split South Pasadena or create the environmental impacts of a surface project.[81] Figure 27 shows the I-710 Extension project study area.

Figure 27: I-710 Extension Study Area



For this project, two 46-foot inner diameter (50-foot outer) tunnels are to be constructed using two tunnel-boring machines (TBMs). Construction is forecast to take approximately 4.5 years. Each tunnel has two levels of lanes. One level allows for three 12-foot lanes for passenger vehicles. The other level, which carries two 12-foot lanes, is used for trucks and/or high occupancy vehicles. Figure 28 illustrates the tunnel cross-section.

Figure 28: I-710 Extension Cross Section



Source: Southern California Association of Governments

The I-710 tunnel uses open road tolling technology and transponders to collect tolls. With this technology, drivers affix a sticker to their windshield. Each time the car passes under a toll gantry, the toll is automatically deducted from a driver's prepaid account without the driver having to slow down. Vehicles without an electronic transponder are billed through video tolling based on license plate number.

The I-710 Extension has been extensively studied and has broad support from regional organizations. A version of the tunnel is included in the SCAG 2035 Financially Constrained RTP.

Toll Rate and Traffic Volumes

According to our analysis:

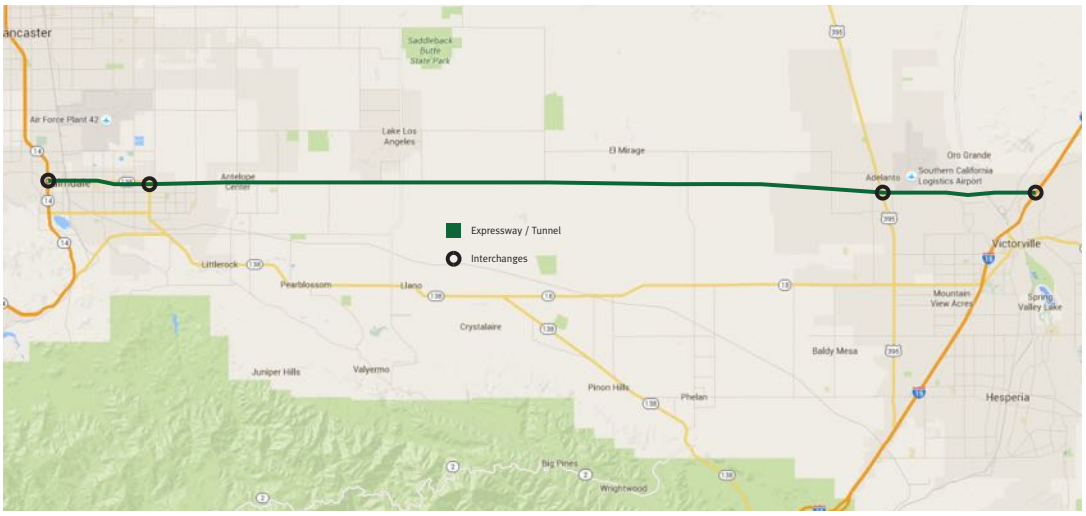
- The 2035 forecast of traffic on the I-710 Extension, with no toll and no trucks, is approximately 179,000 vehicles/day.
- The "maximum revenue" toll is about $3.00 (2015 $), yielding $273,000/day but would only be used by 91,000 vehicles, about 51% of capacity. This toll is lower than the rate suggested by earlier studies. However, since the regional network is quite dense, the road is relatively short and alternate paths for traffic exist. With a higher toll, traffic diversion could be an issue.
- At a $2.00 toll (2015 $) 2035 traffic is about 119,000 vehicles per day, 33% below the no-toll rates. A $2.00 toll (2015 $) efficiently balances traffic volume, capacity and revenues, yielding a volume/capacity ratio of 0.80-0.85, and daily revenues of $238,000.
- Any toll lower than $2.00 leads to significant congestion in the tunnel.
- The facility is forecast to slightly increase regional travel, by about 4.4%, but reduce regional travel time by about 33,000 hours. Traffic on major feeder routes (I-210 north, I-710 south and I-5 south) is forecast to increase, while traffic on major parallel routes will decrease.
- Increasing traffic for growth and tolls for inflation, the total toll revenue over 40 years (2015—2054) is about $7.7 billion.

Project 2: High Desert Corridor

The High Desert Corridor consists of a proposed 60-mile east-west surface expressway in North Los Angeles County between I-5 in Gorman and I-15 in Victorville. Models indicate that, over the next 25 years, only the 36.7-mile portion between SR 14 in Palmdale and I-15 in Victorville needs to be constructed. This report proposes creation of that eastern segment. There would be three value-priced toll lanes in each direction, with one lane per direction as a truck-only toll lane. The project would provide significant mobility benefits for the Lancaster-Palmdale area, projected to be the most rapidly growing portion of Los Angeles County through the year 2035. Currently, travelers between Lancaster-Palmdale and San Bernardino or Riverside Counties must use either SR 18 (not an expressway) or dip all the way down to I-210 and SR 14 in order to complete this trip.

This project has broad support from regional organizations. The entire corridor is included in the SCAG Financially Constrained RTP, with a completion date of the year 2030.[82] Figure 29 shows the study area for the High Desert Corridor project.

Figure 29: High Desert Corridor Study Area



As with the I-710 Gap Closure Tunnel, we propose this facility as consisting of value-priced toll lanes to ensure uncongested operations, maximize vehicle throughput and generate additional revenue to help offset the construction costs. Similar to all the projects discussed in this section, it would use All Electronic Tolling and would therefore not require toll booths or toll plazas.

Toll Rates and Traffic Volumes

According to our analysis:

- The 2035 forecast of traffic on the HDC traffic, with no toll, is about 93,144 vehicles per day.
- The "maximum revenue" average toll is about $0.45/mile, (2015 $) yielding $798,917/day but using only 40% of the six-lane roadway capacity (note that most travelers will not use the entire corridor).
- At an average $0.40/mile toll (2015 $), 2035 traffic is forecast to be 53,985 vehicles per day, 42% below no-toll rates. This average toll balances slightly lower revenues ($749,478/day) with higher traffic.
- A lower average toll ($0.20/mile or less) is needed to increase the volume on the facility to Level of Service (LOS) C and D, but even the "no toll" option operates at LOS D. However, this toll would leave less room for traffic growth toward the end of the 40-year project life.

- The facility reduces total regional daily travel by about 53,000 VMT, or about 0.7% of facility volume). It would reduce regional travel time by about 98,000 hours. The HDC reduces travel on parallel routes, including I-210, but it also increases traffic on feeder routes, particularly I-15 to the northeast.
- Increasing traffic for growth and tolls for inflation, the total toll revenue over 40 years is for (2015–2054) is about $22.2 billion.

Project 3: Glendale-Palmdale Tunnel

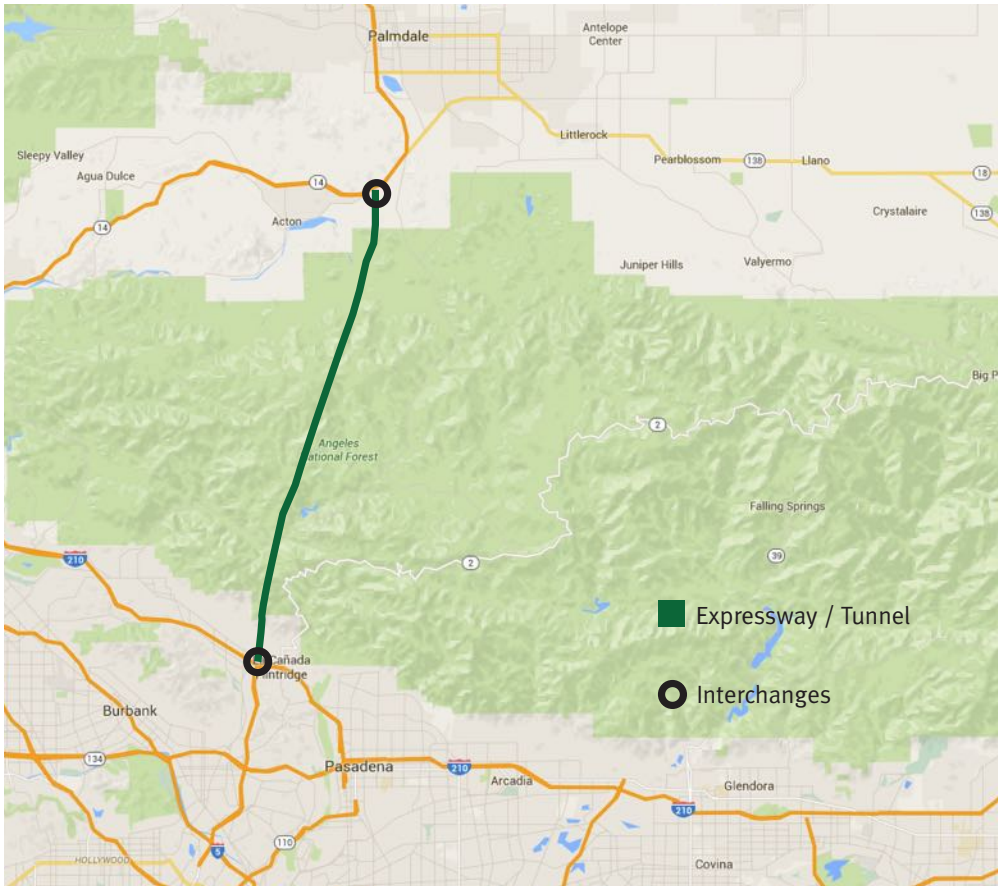
Significant population growth is expected in the Lancaster-Palmdale area of Los Angeles County through the year 2035. An additional north-south expressway corridor is needed to provide connectivity to the rapidly growing Lancaster-Palmdale area, to reduce traffic congestion on I-5 and SR 14, and to improve the viability of the Palmdale Airport as a reliever airport. Such a highway would reduce substantially the travel distance from many L.A. Basin locations to the Lancaster-Palmdale area (44% reduction from Pasadena, 27% reduction from Burbank, 34% reduction from downtown Los Angeles).

As noted in an earlier Reason Foundation study, the best possibility for such a corridor is a toll tunnel linking Palmdale with Glendale, deep-bored beneath the Angeles National Forest.[83] Relative to a surface alternative, a tunnel option costs less, has shallower grades thereby permitting higher speeds, and poses significantly fewer land-use and environmental impacts than a surface route.[84] Either alternative produces significant time-savings for many trips now made between Lancaster-Palmdale and the L.A. Basin, the San Fernando Valley and the San Gabriel Valley.

The toll tunnel/expressway extends north from SR 2 in the Glendale area to SR 14 six miles south of Palmdale. There are four value-priced toll lanes in each direction: three lanes for cars and light trucks, one lane for buses and heavy trucks. Heading northbound, most of the project is at a grade of 3 to 4%. The two primary segments are tunnels 4.7 miles and 10.8 miles long, with another five miles at-grade, for a total length of 21.2 miles.

Figure 30 shows the study area for this project.

Figure 30: Palmdale-Glendale Tunnel Study Area



The tunnel segments for this project consist of twin tubes created by tunnel-boring machines, with an inside diameter of 47 feet. Based on an approach used in France, the tunnel provides a total of eight lanes, six in one tube for light vehicles (cars and light trucks) in a double-deck configuration and two in the other tube for heavy trucks and buses.

However, current traffic conditions merit only a six-lane tunnel. We recommend building the six-lane light vehicle tunnel to provide congestion relief for most users as well as generate toll revenue. The parallel tube can be developed at a later date when traffic volumes justify more capacity. The lanes would be value priced to maintain free-flow speeds in the corridor during all times of the day.

The project is not part of the SCAG Financially Constrained RTP, but is included as an unfunded strategic plan project.

Toll Rates and Traffic Volumes

According to our analysis:

- The 2035 forecast of the 21.1-mile Glendale-Palmdale Tunnel (GPT) traffic, without a toll, is about 90,996 vehicles per day, operating at Level of Service D in the PM peak hour.
- The "maximum revenue" toll, $1.30/mile (2015 $), yields $1.06 million/day (2015 $) in 2035 but uses only 32% of the six-lane roadway capacity, which operates at Level of Service LOS A in the PM peak hour.
- At a lower toll, $0.90/mile (2015 $), the 2035 traffic is about 53,137/day, 42% below non-toll rates. The tunnel operates at LOS B in the PM peak hour. This toll yields slightly lower revenues ($1.0 million/day) with higher traffic and higher user benefits ($55.0B over 40 years).
- A lower toll ($0.70/mile or less) is needed to increase the volume on the facility to a LOS C level, but even with the "no toll" option, the facility operates at LOS D. However, a lower toll leaves less room for traffic growth near the end of the 40-year project life.
- The facility, at a $0.90/mile toll, reduces total regional daily travel by about 1,144,000 vehicle-miles, or about 0.2% of regional VMT. It reduces regional travel time by about 160,000 vehicle-hours (0.7% of regional VHT). The GPT is forecast to increase traffic on SR 2 near Glendale, and I-210 in northwest Los Angeles. Improvements being made to these expressways will allow them to handle this additional traffic.
- Increasing traffic for growth, and tolls for inflation, the total toll revenue over 40 years is $28.4 billion.

Project 4: Irvine-Corona Expressway

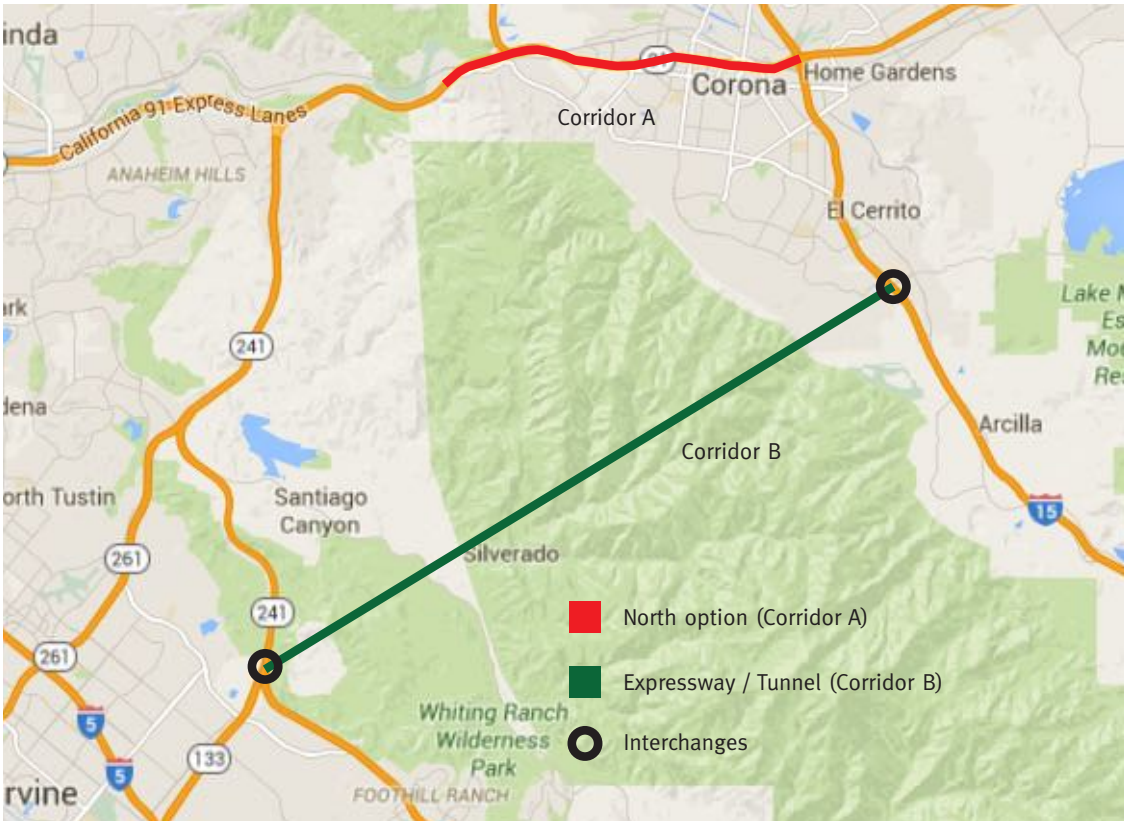
Continued population growth in Riverside County and continued employment growth in Orange County are forecast to strain the capacity of existing roadways between the two counties. There are currently only two primary roadways in use: SR 91 in the north and the narrow, two-lane SR 74 in the south. SR 91 carries over 95% of the daily traffic volume crossing the Orange/Riverside County line; it has one of the longest rush hours in the nation and is one of the most heavily congested expressway corridors in California.

SCAG has examined two projects intended to provide additional roadway capacity between the two counties:

- **North Alignment.** A new facility parallel to the existing SR 91, consisting of two elevated tolled lanes in each direction between SR 241 and I-15.
- **South Alignment.** A new, four-lane tolled facility (with two lanes in each direction) consisting of a tunnel connecting I-15 near Cajalco Road in Riverside County with SR 133 in Orange County.

Figure 31 shows the study area for these projects.

Figure 31: Riverside/Orange County Corridor Study Area



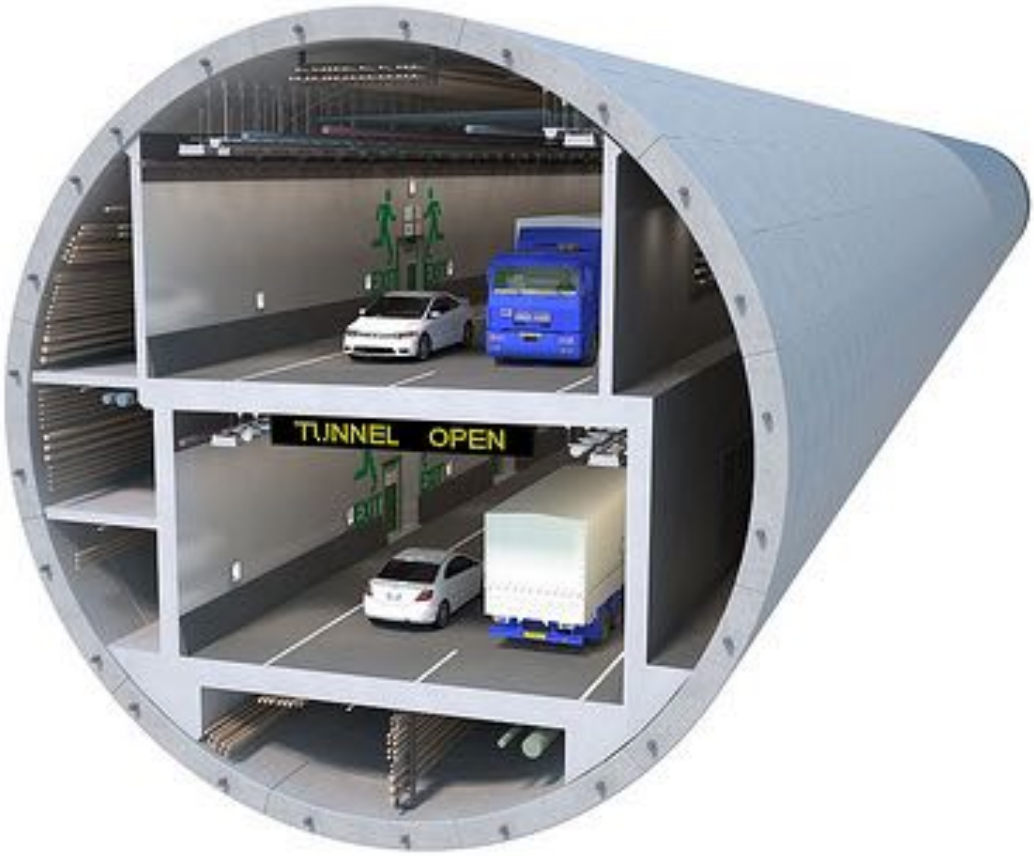
After analyzing both corridors, the south alignment (corridor B) is the better option, both from an overall network flow perspective and because much of the projected Orange County employment growth is expected to be in Irvine. The facility should be value priced to ensure uncongested operations, maximize vehicle throughput and generate additional revenue to help offset the construction costs.

The best tunnel option for this facility is two 48-foot diameter tubes, each 12 miles long, as part of a 14-mile total project length. The tube configuration is similar to the previously described Palmdale-Glendale Tunnel project.

Toll Rates and Traffic Volumes

For the Irvine-Corona Expressway (ICE), three sizes of the facility were evaluated: The four-lane section provided the best results. It is displayed in Figure 32 below.

Figure 32: Irvine-Corona Expressway Study Area



According to our analysis:

- In 2035 with no toll, the facility is forecast to carry about 85,944 vehicles per day, and operate at Level of Service (LOS) F in the PM peak hour. This volume is too high to be carried by a four-lane facility. Further, the volume is likely to increase beyond 2035.
- The "maximum revenue" toll, $0.70/mile (current $) for a four-lane facility, would carry about 48,200 vehicles/day in 2035 and yield about $404,880/day (current $) in 2035. A four-lane facility with a $0.70/mile toll would use about 60% of the roadway capacity and operate at LOS C in the PM peak hour. The facility would continue to divert enough traffic to maintain LOS D or better conditions through 2054.

- Any toll lower than $0.70 creates significant congestion on the facility.
- Any toll lower than $0.70 does not generate sufficient revenue.
- The facility is expected to reduce total regional daily travel by about 228,000 vehicle-miles, or about 0.04% of regional VMT. It is also expected to reduce regional travel time by about 66,000 vehicle-hours/day (0.3% of regional VHT). However, the ICE is expected to increase traffic on SR-241 and SR-133 (both toll facilities) near Irvine and on the Mid-County Parkway in Corona. Since these facilities are toll roads, they can use tolls to increase capacity if needed.
- The total nominal toll revenue for a $0.70/mile toll over 40 years (2015–2054) is about $11.7B.

Project 5: Cross Mountain Tunnel Expressway

There are three different tunnel concepts under consideration, all designed essentially for the same purpose: to provide another expressway connection between US 101 in the San Fernando Valley and I-10 in Central/West Los Angeles. The alternative concepts are as follows, going from west to east:

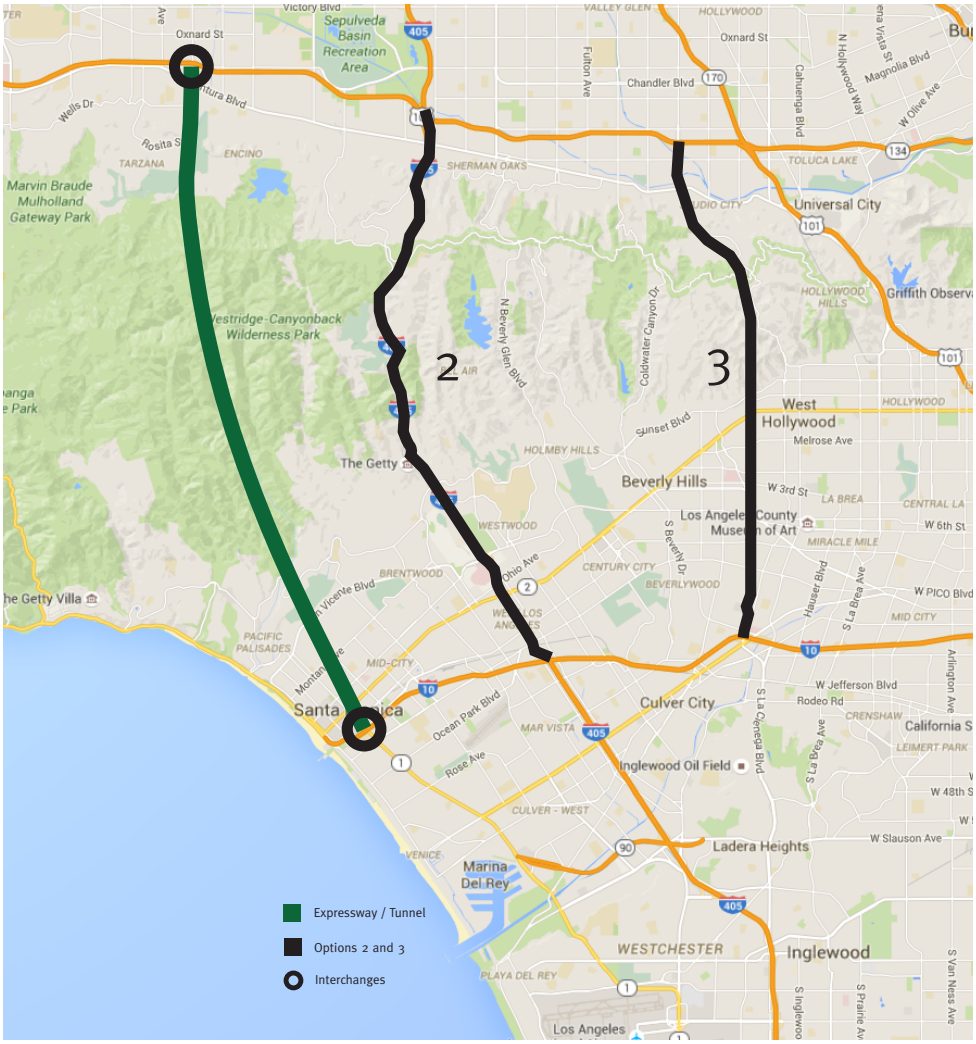
- Alternative #1 - Tunnel underneath Topanga State Park to the western end of I-10 (Tarzana – Santa Monica).
- Alternative #2 - Tunnel underneath the existing I-405 (Sherman Oaks – West Los Angeles).
- Alternative #3 - Tunnel underneath Laurel Canyon Blvd and La Cienega Blvd (Studio City – West Hollywood).

Any of the three alternatives, if implemented, would have a high traffic demand. Value pricing would be applied to ensure uncongested operations, maximize vehicle throughput and generate additional revenue to help offset the construction costs. From an overall network connectivity perspective, Alternative #1 (Tarzana – Santa Monica) is projected to provide the most benefit because it would provide a connection to/from the west San Fernando Valley. The other two alternatives more closely duplicate the geography of an existing expressway corridor. However, Alternative #1 is also the longest of the three, which will have cost implications.

The first two concepts are not part of the SCAG Financially Constrained RTP, but are included as unfunded strategic plan projects with no cost information provided. The third concept is not included in the SCAG RTP. Even as the highest price alternative, we recommend proceeding with Alternative #1, as the modeling shows the benefits significantly outweigh the costs.

Figure 33 shows the study area for these potential Cross Mountain Tunnel alignments.

Figure 33: Cross Mountain Tunnel Study Area



The Cross Mountain Tunnel would provide relief for three of the most congested freeways in the region (US 101, I-10, I-405). It would also provide relief for two of the top five most congested interchanges in the country (US 101 at I-405 and I-405 at I-10).

For this report, Alternative #1 was tested as a tunnel-surface facility using the alignment noted above. The facility connects US-101 in the north at Reseda Boulevard in Tarzana with I-10 in the south near 4th Street in Santa Monica. An interchange was added at Mulholland Drive, where the tunnel would feed into the surface links. This allows an additional entry-exit point for users of the facility, and provides an access point for construction and emergency vehicles into the middle of the facility and the interior tunnel portals.

Toll Rates and Traffic Volumes

For the Cross Mountain Tunnel (XMT), a six-lane facility was the only size analyzed.

According to our analysis:

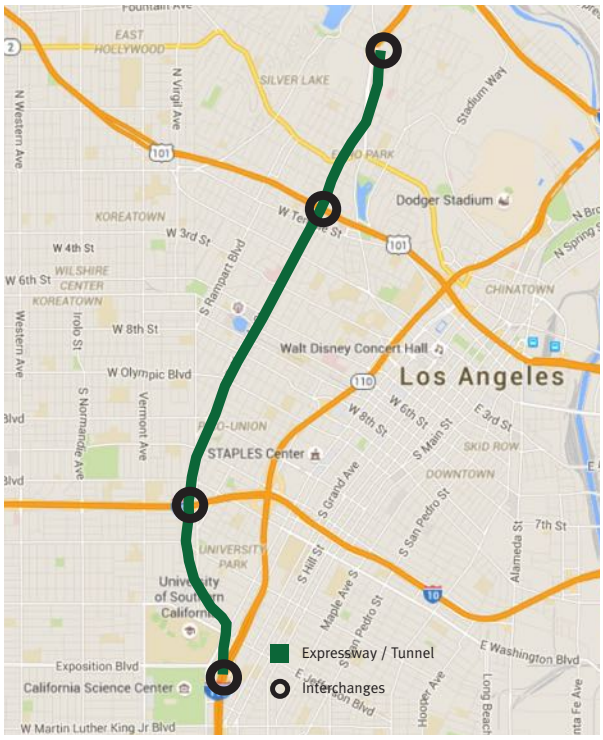
- In 2035 with no toll, a six-lane facility is forecast to carry about 109,000 vehicles per day, and operate at Level of Service (LOS) D in the PM peak hour.
- The "maximum revenue" toll of about $0.60/mile would carry about 51,300 vehicles/day in 2035 and yield $346,000/day (2015 $) in 2035. Such a toll would provide LOS B in the PM peak, leaving a great deal of unused capacity. The facility would continue to divert enough traffic to maintain LOS B conditions or better through 2054.
- A four-lane facility was analyzed, but over the long term it operated at LOS F and provided insufficient capacity.
- A six-lane facility with a toll lower than $0.60 does not generate sufficient revenue.
- The facility is forecast to reduce total regional daily travel by about 41,000 vehicle-miles, or about 0.01% of regional VMT. It is also forecast to reduce regional travel time by about 62,000 vehicle-hours/day (0.27% of regional VHT).
- The total gross toll revenue adjusted for inflation is about $9.7B.

Project 6: Downtown Bypass Tunnel

SR 2 currently transitions from an expressway to a surface arterial northwest of downtown Los Angeles, causing some traffic to divert onto Glendale Blvd and Alvarado St. The original freeway plan was to run the SR 2 expressway along what is now Santa Monica Blvd west to I-405.[85] This is no longer a viable option. However, another alternative, the Downtown Bypass Tunnel, would be a much shorter alignment through central Los Angeles to I-110 that would relieve highly congested expressways in the area including I-110, I-5 and US 101. Figure 34 shows the study area for the Downtown Bypass Tunnel project.

The project is not part of the SCAG Financially Constrained RTP, but is included as an unfunded strategic plan with full cost details provided in the index. We also recommend pricing the tunnel 24 hours a day to maintain free-flow speeds.

Figure 34: Downtown Bypass Tunnel Study Area



Toll Rates and Traffic Volumes

For the Downtown Bypass Tunnel (DBT), a six-lane facility with three lanes of traffic in each direction is adequate to carry the forecasted PM traffic and is the only size facility considered.

A six-lane facility appears adequate to meet the PM demand, as projected by SCAG demographic forecasts and traffic assignment modeling with a $ 1.00/mile toll. According to our analysis:

- In 2035 with no toll, a six-lane facility is forecast to carry about 151,000 vehicles per day, but would operate at Level of Service (LOS) F in the PM peak hour.
- A maximum revenue toll ($1.10/mile) and a toll of $1.00/mile provide similar LOS, similar revenues, and similar user benefits over 40 years.
- We used the $1.00/mile toll based on the lower cost to drivers. At a $1.00/mile toll (in 2015 $) traffic is about 93,000 vehicles/day in 2035 yielding revenue of $486,000/day. In 2035, the facility operates at LOS D in the PM peak hour with 74% of the capacity used. Such a toll also keeps traffic volumes low enough to maintain LOS D conditions or better through 2054.
- Any toll lower than $1.00 leads to congestion over the long term.

- The facility is forecast to increase regional daily travel slightly, by about 1,000 vehicle-miles, or about 0.0002% of regional VMT. However, it reduces regional travel time by about 48,000 vehicle-hours/day (0.21% of regional VHT).
- Increasing traffic for growth and tolls for inflation, the total toll revenue over 40 years (2015–2054) is about $13.6 B.

C. Project Combinations

Many proposed transportation projects have greater impacts when operating in combination than when considered individually. Conversely, sometimes project impacts can be offsetting rather than complementary. This section documents our analysis of potential traffic and user benefits for two combinations of the six previously assessed highway projects in the greater Los Angeles region:

- **Combination of Three Projects:** the I-710 Extension Tunnel (I-710T), the Glendale-Palmdale Tunnel (GPT) and the Downtown Bypass Tunnel (DBT).
- **Combination of All Six Projects:** the I-710T, the High Desert Corridor (HDC), the GPT, the Irvine-Corona Expressway (ICE), the Cross-Mountain Tunnel (XMT), and the DBT.

The three-project combination was selected on the geographical proximity of these projects to each other, and their complementary ability to relieve congestion. The six-project combination models all the projects operating as one system.

When operated in combination, whether as three or all six, the projects have cumulative effects that are greater than when operated individually:

- On average, facility use increases, percentage of capacity used in the PM peak increases, and facility level of service (LOS) decreases as congestion increases. The effect is particularly strong for the I-710 tunnel, which operates over capacity in 2035 if the other two projects are built. These LOS decreases can be significant and might require increases in facility capacity and/or increases in tolls in the later years to provide a LOS for which users would be willing to pay.
- The relative increase in impact is slightly greater for the three-combination group than for all six as a group, suggesting diminishing complementary impact for three projects. However, all six projects together still have substantial benefits. This does not mean that the three projects are less worthy (that depends on their costs versus benefits), but rather that their geographic locations do not produce much interaction with the initial three projects.

D. Project Summary

Table 21 provides a summary of the project details, benefits of individual projects and benefits of projects in combination.

Table 21: Summary of Project Details and Benefits

Project Details	I-710T	HDC	GPT	ICE	XMT	DBT	Total
Tunnel/Surface	Tunnel/ Surface	Surface	Tunnel	Tunnel	Tunnel/ Surface	Tunnel	
Toll for Best Use	$2.00	$0.40	$0.90	$0.70	$0.60	$1.00	
Type Toll	Flat	Per mile	Per mile	Per mile	Per Mile	Per Mile	
Tolling Length, Miles	5.7	36.7	21.2	12.4	11.3	5.2	92.5
Number of Lanes	8	6	6	4	6	6	
Tolling Length, Lane Miles	45.6	220.2	127.2	49.6	67.8	31.2	541.6
Projects by Themselves	I-710T	HDC	GPT	ICE	XMT	DBT	Total
2035 Daily Traffic at Toll	118,665	53,985	53,137	48,200	51,262	93,271	
2035 PM Level of Service	D	B	B	C	B	D	
2035 Percent Capacity Used, PM	75%	45%	44%	60%	39%	78%	
2035 Daily VMT at Toll	772,653	1,955,806	1,123,947	597,412	580,184	485,788	5,515,790
2035 Daily VHT at Toll	33,061	38,165	24,347	12,864	13,548	11,569	133,554
Daily VMT Saved	34,368	-52,977	-1,143,710	-228,022	-41,230	975	-1,430,596
Daily VHT Saved	-33,944	-98,075	-159,699	-66,361	-62,040	-48,382	-468,501
2035 Daily Toll Revenue	$237,239	$792,174	$1,011,552	$418,188	$348,110	$485,788	3,293,051
40-year Toll Revenue $2015B, no inflation	$6.08	$20.24	$25.90	$10.69	$8.88	$12.39	$84.18
40-year User Benefits (in billions), no growth	$10.74	$31.56	$55.01	$22.01	$19.99	$15.48	$154.79
40-Year Toll Revenue $2015B, 5% discount rate	$2.06	$7.02	$8.97	$3.70	$3.08	$4.29	$29.12
40-year User Benefits $2015B, 5% discount rate	$3.64	$10.96	$19.10	$7.64	$6.94	$5.38	$53.66
Projects in Combo 3	I-710T		GPT			DBT	
2035 Daily Traffic at Toll	170,941		57,139			96,772	
2035 PM Level of Service	F		B			D	
2035 Percent of Capacity Used, PM	107%		48%			81%	
2035 Daily VMT at Toll	970,451		1,208,791			504,002	2,683,244
2035 Daily VHT at Toll	31,293		26,516			12,292	70,101
Projects in Combo 6	I-710T	HDC	GPT	ICE	XMT	DBT	
2035 Daily Traffic at Toll	169,100	51,509	54,120	46,008	47,596	94,366	
2035 PM Level of Service	F	B	B	C	B	D	
2035 Percent of Capacity Used, PM	106%	43%	45%	58%	40%	79%	
2035 Daily VMT at Toll	959,999	1,889,909	1,144,934	570,248	538,689	491,474	5,595,253
2035 Daily VHT at Toll	30,586	36,617	24,856	12,147	12,538	11,819	128,563

1. Cost Estimates for Proposed Projects

Of the six projects being evaluated in this report, two (the I-710 Extension and the High Desert Corridor) are in the primary stages of planning and design. As a result, cost estimates from available reports can be used:

- **I-710T Extension:** Included in the 2008 and 2012 SCAG RTPs. The estimated project cost is $6.3 billion to construct four lanes in each direction, or eight lanes total ($1,117 million per mile or $139.6 million per lane-mile).[86]
- **High Desert Corridor:** Also included in the 2008 and 2012 SCAG RTP. The estimated project cost is $9.8 billion ($163 million per mile or $27.2 million per lane-mile).[87] This cost is significantly higher than earlier cost estimates, as site-specific factors and recent development have increased the cost.

For the other four projects, which are all tunnel projects, a range in cost from about $80 million to $300 million per lane-mile was identified based on peer research. An average construction cost estimate of about $150 million per lane-mile is used as a mid-range estimate.[88] This estimate is quite close to the per lane-mile cost estimate of the I-710 Tunnel, and is slightly higher because a portion of the I-710 extension is a surface facility as opposed to a tunnel. More-refined cost estimations of the proposed tunnel projects would need to be based on a thorough evaluation of site-specific factors including right-of-way restrictions, terrain, groundwater levels, soil and rock conditions, surrounding land use and local labor agreements.

Table 22 shows the cost estimates per project, and total overall, based on the discussion above.

Table 22: Reason Plan's Six Project Cost Estimates

Project	Length in Miles	No. of Lanes per Direction	Lane-Miles	Cost Per Lane-Mile	Cost Estimate (2015 $$)	Cost Estimate (YOE)
I-710 Extension	5.7	4	45.4	$139.6M	$6.3B	$10.7B
High Desert Corridor*	60.0	3	360.0	$27.2M	$9.8B	$16.6B
Glendale-Palmdale Tunnel	21.2	3	126.9	$150M	$19.0B	$32.2B
Irvine-Corona Expressway	12.4	2	49.6	$150M	$7.4B	$12.5B
Cross Mountain Tunnel	11.3	3	67.9	$150M	$10.2B	$17.3B
Downtown Bypass Tunnel	5.2	3	31.2	$150M	$4.7B	$8.0B
Total Capital Cost Estimate	**115.8**		**681.0**		**$57.4B**	**$97.2B**

* Note that only 37 miles of the 60-mile High Desert Corridor is tolled.
Source: Booz Allen Hamilton, Hartgen Group, Reason Foundation

For purposes of this section of the report, optimal tolls and facility sizes that were applied in the combination modeling runs were selected. There is a difference in project length and lane-miles of the High Desert Corridor (HDC) between the table above and previous tables because not all of the HDC project length is being tolled.

2. Financial Feasibility

Overall financial feasibility is based on the cost of building the project adjusted for inflation compared to the amount of toll revenue collected adjusted for inflation. Note that we take 15% of the toll revenue off the top to use for operations of the facility.

The estimated project cost for the express lanes is $97.2 billion, as shown in Table 22. This assumes a 40-year life-cycle. Table 23 shows the percentage of cost that is estimated to be covered by toll revenue.

Table 23: Reason's Plan's Six Projects: Percentage of Project Cost Covered by Toll Revenue over 40 Years

Project	Gross Project Revenue	Gross Revenue Less 15% for Operations	Project Cost Estimate	Percent of Project Cost Covered by Project Revenue
I-710 Extension	$7.7B	$6.5B	$10.7B	61%
High Desert Corridor	$25.6B	$21.7B	$16.6B	131%
Glendale-Palmdale Tunnel	$32.7B	$27.8B	$32.2B	86%
Irvine-Corona Expressway	$13.1B	$11.1B	$12.5B	89%
Cross Mountain Tunnel	$11.2B	$9.5B	$17.3B	55%
Downtown Bypass Tunnel	$15.7B	$13.3B	$8.0B	166%
Total Cost/Revenue	**$106.0B**	**$90.0B**	**$97.2B**	93%

As Table 23 shows, two of the six projects bring in more in toll revenue than they cost to build. The downtown bypass tunnel, due to the extreme congestion in the area, brings in $1.66 for every $1.00 it costs to build and operate. While the I-710 Extension and Cross Mountain Tunnel bring in 61% and 55% respectively in revenue compared to costs to build and operate, as a grouping the projects bring in 93% of their construction and operations costs.

Revenue of the toll expressways/tunnels was calculated in a similar manner to the express lanes and managed arterials. The gross revenue—or the total amount of toll revenue collected over 40 years—equals $106 billion for the six projects. We deducted 15% of the gross revenue to use for roadway operations and maintenance. The remaining 85%, or $90.0 billion, is the net revenue.

For the construction cost we use the 2.0% inflation rate to convert 2009's costs to 2015's costs. We then assumed that an equal amount of capital will be spent each year and adjusted each year's costs to inflation. The result is a construction cost of $97.2 billion based on year of expenditures.

These results leave us with a small hole of $7.2B. We recommend taking the remaining $7.2B from the surplus in the managed lanes funds. Many of the managed lanes connect to one of these six projects. These expressways/tunnels will substantially decrease travel times in the region and without these new projects, tolls on the managed lanes would need to be significantly higher for those lanes to operate at reliable travel speeds.

More details are available in Appendix D.

E. Tunnels

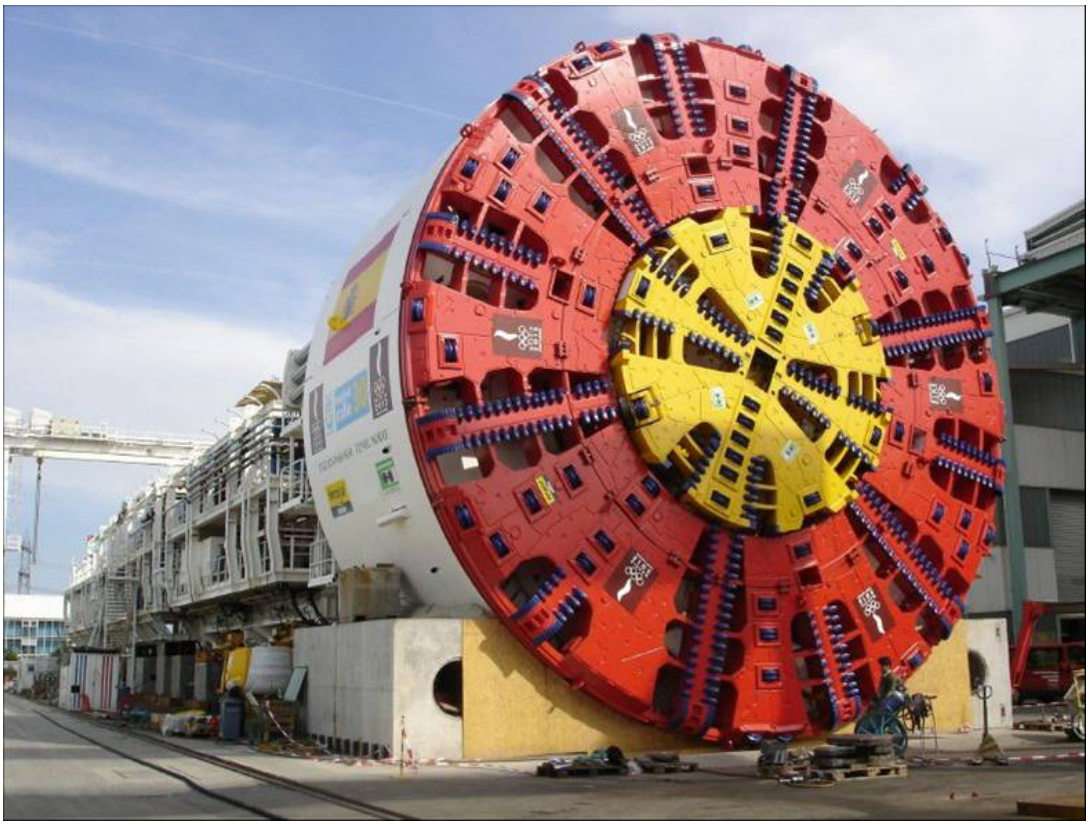
Due to the numerous mountain ranges, high suburban population density and heavy traffic congestion in Southern California, the region can benefit more than any other U.S. region from tunnel construction. Our report recommends building five tunnels to ease congestion. This section provides more details on the costs of tunnels, the advantages of tunnels, and other factors to consider.

Highway tunnels are fairly common in the U.S. More than 337 highway tunnels were in operation as of 2003.[89] New York City alone includes hundreds of miles of tunnels in the city and its vicinity for subways, highways, water systems, and railways. In Northern California, the Yerba Tunnel (1936) through Yerba Buena Island in San Francisco Bay in California was designed to be 540-ft long, 76-ft wide, and 50-ft high and it carries two decks of traffic.

In major cities and metropolitan areas across the nation, tunnels have emerged as a practical solution for transportation problems. Ironically, this was also true in the early 20th century, when high urban densities combined with low personal mobility jump-started major transit investments in subway tunnels in London (1863), Paris (1900), New York (1904), Tokyo (1927) and Moscow (1933). More recently, cities from Australia to Paris have re-evaluated the role tunnels could play in improving highway traffic circulation. Tunnels for highway use have been encouraged by dramatic efficiencies from improved design and tunnel-boring technologies. The ability to double stack lanes, for example, enabled the French transportation company Cofiroute to propose and build the A86 West missing link under Versailles.[90] Sydney, Australia was faced with similar problems as traffic slowed to a crawl. Building the Melbourne CityLink, a tolled mega-project that includes major elevated and tunnel projects through downtown Melbourne, Australia, helped reduce congestion.[91] New engineering designs and technologies allow for the construction and management of underground highway interchanges, dramatically improving the benefits of tunnels while minimizing above-ground disruptions to the urban environment.

The most important new technology is the tunnel-boring machine (TBM). (TBMs) are specialized machines used to excavate tunnels with a circular cross section. A popular alternative to drilling and blasting, TBMs do not produce surface disturbances and create a smoother tunnel wall. TBMs are typically assembled underground for a specific project and then disassembled and shipped to their next location. Figure 35 below shows a modern tunnel-boring machine.

Figure 35: Tunnel-Boring Machine



Source: ESA Images, http://www.esa.int/spaceinimages/Images/2012/04/Tunnel_boring_machine

Today's tunnels have an impressive array of air quality systems that allow the air inside of tunnels to be cleaner than that outside of tunnels. Air quality both inside and outside tunnels is controlled by the combination of tunnel ventilation systems and contaminant management technology.[92] Specific venting technology produces cleaner air inside the tunnel than at ground level outside the tunnel.

Modern tunnels have a number of safety features. Features once considered optional—such as cross passage emergency exits, fire suppression, and radio rebroadcasts—are now commonplace. One reason that tunnels are costlier to construct than surface roadways is that they are a far more comprehensive infrastructure system. Table 24 compares tunnel safety features by the decade.

Table 24: Tunnel Safety Features

Safety Feature	Before 1970	1970–1989	1990–1999	2000–2009	2010–2015
Cross Passage Emer. Exit, Pedest. Access	Yes: 3, 27% No: 3, 27% N/A: 5, 45%	Yes: 6, 60% No: 1, 10% N/A: 3, 30%	Yes: 6, 29% No: 1, 5% N/A: 14, 67%	Yes: 15, 44% No: 9, 26% N/A: 10, 29%	Yes: 9, 60% No: 0, 0% N/A: 6, 40%
Linear/Video Automatic Fire Detection	Yes: 5, 45% No: 0, 0% N/A: 6, 55%	Yes: 8, 80% No: 0, 0% N/A: 2, 20%	Yes: 5, 24% No: 1, 5% N/A: 14, 67%	Yes: 24, 71% No: 0, 0% N/A: 10, 29%	Yes: 10, 67% No: 0, 0% N/A: 5, 35%
Fixed Fire Suppression	Yes: 5, 45% No: 4, 36% N/A: 2, 18%	Yes: 1, 10% No: 3, 30% N/A: 6, 60%	Yes: 3, 14% No: 4, 19% N/A: 14, 67%	Yes: 22, 65% No: 1, 3% N/A: 11, 32%	Yes: 11, 73% No: 2, 13% N/A: 2, 13%
Smoke Control (Long/Transver)	Yes: 2, 18% No: 2, 18% N/A: 7, 64%	Yes: 8, 80% No: 0, 0% N/A: 2, 20%	Yes: 5, 24% No: 1, 5% N/A: 15, 71%	Yes: 24, 71% No: 0, 0% N/A: 10, 29%	Yes: 8, 53% No: 0, 0% N/A: 7, 47%
CCTV	Yes: 8, 73% No: 0, 0% N/A: 3, 27%	Yes: 7, 70% No: 2, 20% N/A: 1, 10%	Yes: 5, 24% No: 1, 5% N/A: 15, 71%	Yes: 13, 38% No: 0, 0% N/A: 21, 62%	Yes: 6, 40% No: 0, 0% N/A: 9, 60%
Radio Rebroadcast Emergency	Yes: 3, 27% No: 4, 36% N/A: 4, 36%	Yes: 7 70% No: 2, 20% N/A: 1, 10%	Yes: 5, 24% No: 1, 5% N/A: 15, 71%	Yes: 20, 59% No: 0, 0% N/A: 14, 41%	Yes: 7, 47% No: 0, 0% N/A: 8, 53%

Source: Review of Overseas Tunnels

Some regions build tunnels due to specific geographic features, such as the Hudson River west of New York City. A bigger concern in Southern California is seismic issues. Below is a letter detailing the safety of tunnels during the Loma Prieta quake of 1987 and the Northridge quake of 1994:[93]

Letter from Lindvall, Richter & Associates on Tunnel Seismic Issues:

> *We can state at the outset that deep tunnels are safer from damage during an earthquake than structures at or near the surface of the ground. Elevated transit structures could be the most hazardous because of the possibility of the trains falling off a column-supported guideway subjected to strong shaking. The reason that a deep tunnel is safer during earthquake shaking is that the tunnel is surrounded by a medium that is moving and moves along with it. At the ground surface, a ground/air interface exists and the shaking is more violent. Also, seismic surface waves are active, but they attenuate and de-amplify with depth.*

In a recent study titled "Damage to Rock Tunnels from Earthquake Shaking" by Dowding and Rozen),[94] the authors studied 41 tunnels where damage occurred and concluded that tunnels are less susceptible to damage from shaking than above-ground structures at the same intensity level. Kanai and others in Japan came to a similar conclusion in their paper titled "Comparative Studies of Earthquake Motions on the Ground and Underground.[95]

In Richter's book, *Elementary Seismology*, a similar phenomenon is reported from people in a deep cave when an earthquake struck; those in the cave were not aware of the quake while others at the ground surface were concerned for their safety.[96]

Another example is found in the 1973 National Oceanic and Atmospheric Administration (NOAA) report on the San Fernando earthquake of 1971. At the time of the earthquake, the San Fernando Tunnel of the Metropolitan Water District was being excavated. The earthquake caused the ground to warp up seven feet in a region that included the tunnel. However, the rails in the tunnel were not sufficiently distorted to cause a derailment, and the miners drove the locomotive out from the tunnel working area, a distance of three miles. Three other tunnels in the epicentral region did not suffer damage: the SP Railroad Tunnel (1876), the City of Los Angeles Aqueduct Tunnel (1913), and the MWD Newhall Tunnel (1968).[97]

We also note that neither the BART tunnel beneath San Francisco Bay nor the Los Angeles Red Line tunnel suffered any significant damage in the Loma Prieta Quake of 1987 and the Northridge quake of 1994, respectively.[98]

1. Tunnel Benefits

When Dwight Eisenhower first sketched out his proposed system of defense highways, the original network was supposed to bypass central cities. However, to build support and pass the legislation to authorize the Interstate Highway System, Congress changed parts of the plan. The end result routed expressways directly through downtown areas. Some regions further exacerbated the problem by routing expressways between White and African-American communities or between high and low-income communities. In some cases, such as Atlanta, an expressway curve that lengthened the highway was included to separate communities. In other cases expressways were placed through the heart of neighborhoods leading to urban displacement.

Few cities want an expressway dividing communities. However, most regions developed after World War II are oriented around the car and need additional expressway capacity to reduce congestion and enhance mobility. Tunnels can provide that capacity without harming area neighborhoods. For example, Washington State DOT is replacing the SR 99 expressway with a tunnel, in part to provide area communities better access to Puget Sound.

Clearly, tunnels have significant benefits. Elevated surface expressways can be dangerous during earthquakes. Tunnels, designed to move with the earth, are some of the safest structures in an earthquake. Most importantly tunnels can reduce congestion without displacing residents, harming the economy or changing the urban feel of the communities above them. In addition to the American cities detailed below, French engineers built a tunnel below Versailles to avoid infringing upon the historic site. The tunnel has eased access while protecting the national landmark.

2. Costs

A number of site-specific factors greatly influence the construction cost of any individual tunnel project, including right-of-way restrictions, terrain, groundwater levels, soil and rock conditions, surrounding land use and local labor agreements. These factors need to be assessed in a thorough, site-specific engineering feasibility study before construction or a final decision is made to commit public funds to the project. Thus, the following estimates represent a conceptual, sketch-level estimate of construction costs for the tunnels proposed in this report, based on an evaluation of costs associated with actual tunnel projects undertaken in other areas.

In December 2007, the Cascadia Center Discovery Institute based in Seattle, Washington sponsored an international tunnel symposium that featured tunnel examples prepared by the consulting firm Arup (Table 25 below).[99] These data are from eight actual roadway tunnels constructed in Paris, Zurich, Dublin, Madrid, Hamburg, Wuhan (China), Nanjing (China) and Shanghai.

Table 25: Overview of Selected Completed Tunnel Projects

Roadway	Length (miles)	Total Cost*	Cost/Lane Mile	Total Lanes	TBM Type
Paris A86 Highway	5.25	3,797	$120.5 M	6	All Terrain
Zurich Uetliberg	2.73	1,345	$131.1M	4	Boring Extender
Dublin Sea Point	3.5	1,432	$102.2M	4	Hard Rock
Madrid M30 South Bypass	2.2	710	$53.8M	6	EPB Shield
Hamburg Elbic River	1.9	956	$167.7M	3	Mixshield
Wuhan Yangtze River	2.24	298	$33.3M	4	Slurry
Nanjing Chang Jiang	3.7	525	$23.6M	6	Slurry
Shanghai Yangtze	15.8	1,992	$21.0M	6	Slurry

* All costs adjusted to current year (2015, USD in millions) numbers

Source: Data for this analysis can be found at Cascadia Center Discovery Institute, http://www.cascadiacenter.org

Internationally, tunnel construction costs vary considerably. The city of Wuhan in Hubei Province, China built its tunnel for the lowest amount on a cost per route-mile basis ($133 million per mile) while Paris paid the most ($723 million per mile). On a per *lane-mile* basis (cost adjusted for the number of lanes), Shanghai in Yangtze Province of China reported the lowest cost (at $21 million per lane-mile) while Hamburg paid the most ($168 million).

U.S. tunnel costs vary more than international costs. Over the last 30 years, two major tunnels have been constructed in the U.S. The difference in costs between the two projects shows the importance of proper management and a detailed understanding of the political process. Many errors could have been eliminated by better planning, better communication and better management, especially in pre-construction:

- **Central Artery/Tunnel in Boston, Massachusetts:** The Central Artery/Tunnel, or the "Big Dig," was a project consisting of two tunnels: a 3.5-mile long roadway tunnel (four lanes per direction, or eight lanes total) completed in 2006 that goes underneath downtown Boston, and the 1.6-mile (two lanes in each direction, four lanes total) Ted Williams Tunnel connecting Logan International Airport to South Boston. The total project would build 34.4 lane-miles of roadway and tunnel. In 1985, based on preliminary environmental impact studies, the project cost was estimated at $2.8 billion, or $6.0 billion when converted to year 2006 dollars.[100] When the Big Dig was completed, the actual project cost was $14.6 billion ($2.8 billion per mile, or $424 million per lane-mile). The Ted Williams Tunnel alone cost $1.9 billion, or $296.9 million per lane-mile. The reasons for project cost escalation can be summarized as follows: errors and omissions during the design process, additional costs added for environmental mitigation, scope growth such as new interchanges, and inflation due to delays in construction.[101]

- **Port of Miami Tunnel, Miami, Florida:** The Port of Miami Tunnel was designed to provide a connection for trucks between the Port of Miami and I-395. It is used exclusively by trucks. The full project included building the 0.75-mile, four-lane tunnel, improving the roadway on Dodge and Watson Islands and widening the I-395 MacArthur Causeway bridge.[102] The final cost was $669 million or $223 million per lane-mile, which is about half the cost of the Central Artery/Tunnel, or "Big Dig."

Figure 36: Ted Williams Tunnel, Boston

Figure 37: Port of Miami Tunnel

One of the major differences between the two is the delivery method. The Central Artery/Tunnel was built under a design/bid/build process where separate companies handled the design and the build components. This increased the cost, the risk and the construction time of the project. The Port of Miami Tunnel was built under a P3 concession where a single private party builds and maintains all aspects of the facility. P3s decrease risk, cost and the time required to build the project. The following chapter provides more details on reducing the risks in mega-projects.

Part 8

Reducing the Risks of Tolled Mega-Projects

Building out Southern California's express lanes network and converting HOV lanes to express lanes will cost approximately $108.8 billion adjusted for inflation. Developing the managed arterial network for buses and building the six recommended expressways/tunnels will also use limited resources. Southern California transportation entities have sufficient revenue to build this transportation system without raising taxes, but doing so cost-effectively requires using long-term toll concession public-private partnerships.

A. The Role of Public Private Partnerships

Entering into long-term concession public-private partnerships (P3s) to build these projects reduces taxpayer costs and shifts risk to the private sector. While new projects in some metro areas have struggled because of insufficient early traffic volumes, P3s shift the risk of insufficient traffic and revenue from taxpayers to investors. The congested conditions on Southern California expressways have already led to three of the most heavily used express toll lanes in the country—on SR 91 in Orange County and on I-10 and I-110 in Los Angeles County.

Along with Colorado, Florida, Texas and Virginia, California has experience with the long-term toll concession model.[103] Under this approach, the private partner takes major responsibility for financing the project, investing equity for perhaps one-quarter of the project cost and financing the balance based on the projected toll revenues. The concession company takes long-term ownership responsibility for a defined period of years (e.g., 35 to 50 years), during which it must build, operate, manage and maintain the toll road or toll lanes at its own risk.

Contrast long-term concessions with building and operating a facility through availability payments or design-build methods. While availability payments are a type of P3 that include risk-transfer, they use public sector funding from gas taxes, tolls, general funds or

other revenue, which leads to two problems. First, the private party has no incentive to keep costs down since it is not providing the funding. Second, the users-pay users-benefit rationale is reduced since availability payments include gas taxes (which is a weaker user fee) and general fund revenues (which is not a user fee at all). Design-build shifts some risks, including cost overruns, to the private partner. But it does not shift traffic and revenue risk, nor does it ensure that the initial design is optimized for lowest life-cycle cost.

Limiting the state's risk by shifting much of that risk to the private-sector partner is the biggest advantage of toll concessions.[104] The Express Toll Network, whether built as a single project or a series of projects, meets the definition of being a "mega-project." The two major risks frequently seen with such projects are inaccurate forecasts, leading to cost overruns and traffic/revenue shortfalls.[105]

Recent reports by two of the leading bond rating agencies, Fitch and Standard & Poor's, point to a tendency of such forecasts to be overly optimistic, which puts the bondholders at risk.[106] Several recent toll roads, in which the private sector developed the project but did not take on ownership-type risk, have all experienced serious shortfalls in early-years' traffic and revenue: Colorado's Northwest Parkway, South Carolina's Southern Connector and Virginia's Pocahontas Parkway. While Southern California is less prone to shortfalls in traffic and revenue than smaller metro areas, risk can never be completely avoided.

Minimizing life-cycle costs is another advantage of the long-term toll concession approach. If the same enterprise that is designing and building the toll road also must operate it profitably for 50 years, it has every incentive to build it right in the first place, rather than cutting corners to get the initial cost down. Spending an extra 10 to 15% on a more durable pavement in the first instance generally pays for itself several times over in lower ongoing maintenance costs during the roadway's lifetime. But neither traditional public-sector project development nor the design-build model is able to internalize this incentive effect, since operating and maintenance costs are not the responsibility of the entity designing and building the roadway in those models.

Cost-sharing is possible under a concession agreement for those projects that cannot be fully supported by toll revenue financing. For example, in such cases the public sector (e.g., Caltrans, L.A. Metro, OCTA) would make an "equity" investment for 20–30% of the project cost, with the balance being financed out of toll revenues, and the responsibility to collect and manage these toll revenues falling to the concessionaire. In most cases, with this type of mixed funding, the concession company agrees to share toll revenue above a certain level with the state agency. This type of mixed financing is being used currently for several mega-projects in Texas (with Texas DOT and/or local Regional Mobility Agencies analogous to CalTrans and OCTA).[107]

Regardless of the type of P3, government still has an active oversight role. P3s have very specific terms on project length, pavement quality, and operating characteristics. Government monitors the concessionaire to ensure it is adhering to all parts of the contract. If the concessionaire does not adhere to all conditions in the agreement, penalties up to termination of the lease can occur. As a result, the concessionaire has a strong incentive to provide good customer service. Some P3 projects have generated controversy. The following points debunk some of the most controversial P3 practices.

- **Highway and transit projects developed by international companies increase the number of Californians employed in the construction industry.** P3 experiences in the U.S. show that international companies hire mostly U.S. workers. Transportation projects need construction workers, and workers in Spain cannot build a construction project in California. As P3s provide almost 50% of the resources for large projects, they increase local employment in the construction sector by 40%.[108] Other countries have many companies with decades of experience in P3s because those countries do not have a dedicated gasoline tax to build infrastructure. With increasing fuel efficiency of motor vehicles, the revenues produced by per-gallon gas taxes are declining, so we need to look more to toll-financed projects. U.S. engineering companies such as Parsons Brinckerhoff and HNTB Corporation are also involved in P3s. U.S.-based investment firms such as Morgan Stanley and JPMorgan Chase are creating their own infrastructure funds to invest in PPPs. Many city- and state-owned pension funds are also investing in P3s, including CalPERS and CalSTRS.
- **PPPs do not commit future generations any more than lottery, union or other state contracts.** State governments regularly make commitments that affect taxpayers for longer than 50 years. Bonding for infrastructure and changing public employee pension benefits are two examples. Because the capital costs for major infrastructure projects are so high, it is good policy to finance them over long periods of time, so that people can enjoy their benefits while paying for them as they use them. And PPP documents are flexible. All concession agreements have detailed provisions to permit changes during their term. These provisions deal with such matters as negotiating and arbitrating disputes and employing independent parties to make fair financial estimates. Typically, the only limit to changes to the concession is that neither side be financially disadvantaged by the changes. With long-term commitments come long-term benefits. In the absence of sufficient conventional transportation funding, using P3s to deliver new transportation infrastructure enhances the mobility of current and future generations and benefits the economy over the long term.
- **Today's P3 deals do not include rigid non-compete clauses that prevent state and local officials from building nearby competing roads.** While some early projects (including the original SR 91 Express Lanes) had such clauses, today's

concession agreements would allow California transportation agencies to build everything in their current long-range transportation plans, regardless of any impact on the P3 project's traffic and revenue. Political challenges and limited funding make it very difficult for Caltrans to build new non-tolled lanes in Southern California. If new lanes were built, today's P3 agreements would likely spell out a revenue-sharing formula for some portion of toll revenue.

- **Government is protected if the private party in a P3 goes bankrupt.** In the event of a bankruptcy filing by the concession company, the asset reverts back to the project lenders who, with permission from the state, would select a new operator. If the concessionaire is in ongoing violation of key provisions of the concession agreement, the ultimate remedy is for the agreement to be terminated, with the state receiving the highway for free. The lenders have strong financial incentives to continue to properly operate and maintain the road, since they risk losing the value of their investment. The state must approve any contract changes.

Part 9

A Transit Network for the 21st Century

Southern California has one of the most extensive transit networks in the U.S. Interestingly, transit ridership declined slightly from 56 trips per capita in 1985 to 51 trips per capita in 2008 even while the percentage of commuters using transit increased from 5.1% to 6.2% over roughly the same time period.[109] What explains this discrepancy in numbers? Southern California has added significant transit service over the last 30 years, so people who did not previously have access to transit can use it today, but operators have increased headways (time between transit vehicles) on certain lines. So while transit is moving more people, each rider is taking fewer trips. This part will explain how the region can increase its transit ridership per capita. First, it will examine the most effective type of transit for Southern California. Then, it will detail the region's current system. Finally, it will explore how the region can cost-effectively modify its current system to provide a more ideal transit experience.

A. Transit in Post-World War II Metropolitan Regions

Substantial research has been conducted into the best way to operate transit service in different regions. Geographical orientation of service is one key aspect. Several studies conducted over the past decade have shown that multi-destination transit networks (grid networks) are most efficient in attracting passengers and are cheaper to operate than downtown-based systems (radial networks).

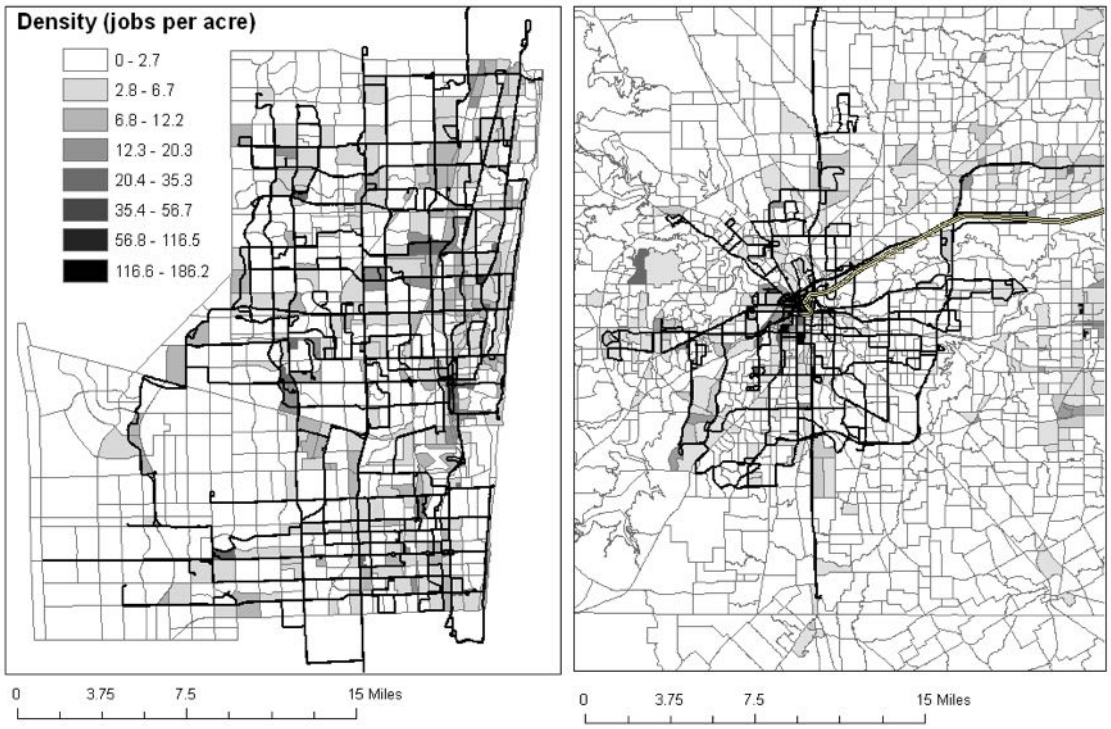
In 2008, Gregory Thompson, chair of the Transportation Research Board Light Rail Committee, and Jeffrey Brown, associate professor of transportation planning at Florida State University, studied 45 U.S. metro areas to determine whether radial or grid networks offer better service.[110] The authors also separated metro areas into those that have bus service only and those that have both rail and bus service. They found that the grid or multi-destination areas that used both rail and bus transit performed better. The radial approach connected neighborhoods to the central business district (CBD), but made reaching jobs outside of the CBD difficult. The multi-destination approach, while not as

good at connecting neighborhoods to the CBD, was much better overall because it offered reliable transit service to more parts of the metro areas. Further, from 1984 through 2004, the grid metro areas experienced much smaller productivity declines (single digit) than the radial metros (25%). (Productivity refers to the number of people using the transit system compared to the cost to operate that service.) There was also a smaller increase in per-capita costs for the grid service compared with the radial service.

Thompson and Brown studied two bus-only systems in more detail. Broward County Transit (BCT) in Fort Lauderdale, Florida, and the T in Tarrant County, Texas (Fort Worth), both cover similarly sized areas with similar growth patterns. While the T has a radial pattern, BCT has a grid focus. BCT had 31.72 boardings per hour, which was almost double the T's 16.45. Operating expenses for BCT were also substantially lower, while load factor—the percentage of seats and standing room occupied on a transit vehicle—was substantially higher.

Figure 38 shows the difference between Broward County's grid service on the left and Tarrant County's radial service on the right.

Figure 38: Transit and Employment Access
Broward County, FL and Tarrant County, TX



Source: Jeffrey Brown and Gregory Thompson, *Hubs, Spokes, the Grid, and the Future of Transit*

That study also highlights the differences between pre-World War II metro areas and post-World War II metro areas. New York, Chicago and several other major northeastern metro areas experienced their fastest period of growth before World War II. Pre-World War II metro areas developed around walking and rail. They have higher population densities and are typically more compact and more centralized. Los Angeles, Dallas, Phoenix, Miami and other southern and western metro areas experienced their fastest growth after World War II. These metro areas developed around the automobile. They have lower population densities and occupy a larger geographic area. These post-World War II metro areas are all multi-centric rather than mono-centric—i.e., they do not have a single "central business district" but have numerous business districts dotted across the metro area.

Some post-World War II cities, such as Portland, have tried to duplicate the characteristics of pre-World War II cities using urban growth boundaries. Such boundaries limit the physical area of development, creating denser communities. The downside is they also drive up housing costs.[111] Moreover, such boundaries have in fact had minimal success in increasing transit usage. Portland's transit usage is not much higher than that of Denver or Salt Lake City or San Diego—comparable cities with less-stringent land-use restrictions. Portland's usage is far lower than Los Angeles' usage. It is unlikely that Los Angeles could successfully engineer transit-supporting densities through regulation.

Another challenge is the prevalence of traditional Euclidean zoning, separating residential and commercial uses.[112] This additional factor further limits the effectiveness of rail. And while mixed-use zoning has become popular in L.A.'s urban core, the majority of Southern California is still zoned into traditional residential, commercial and industrial areas, and considerable opposition exists to changing traditional zoning. Furthermore, while some residents are content to pay higher housing prices to live in a denser area with more transit options, most residents still prefer a location in the suburbs. The upshot is that regardless of policy, Los Angeles could build a transit network similar to New York City and still have much less ridership. Instead, the region should build a transit system around its existing density and land use pattern. And while such a network will improve the region's transit system, Southern California will never have the transit ridership of New York City.

What does this mean for Southern California's transit system? For one thing, it suggests that the basic grid-type bus service already in place should remain the predominant pattern for transit, to serve this multi-centric metro area. For the same reason, we should be skeptical of expensive new rail projects and further expansions of heavy rail, light rail and commuter rail.

As of 2007 Los Angeles Metro had 495 million unlinked transit passenger trips.[113] Approximately 83% of those trips were by bus while only 17% were by heavy rail or light rail. Despite recent rail expansion, bus riders remain the vast majority of transit passengers.

However, according to SCAG, Southern California plans to spend $81 billion to add additional rail transit lines between now and 2040.[114] A total of $11.8 billion is for expanding the heavy rail purple line. A total of $16.9 billion is for expansion and construction of various light rail lines. Another $4.1 billion is for extension of the Metrolink Perris Valley Line to San Jacinto and Temecula. (Another $47.7 billion is for high-speed rail from Los Angeles to San Diego and from Los Angeles to the Antelope Valley, but since this intercity rail is not transit, we will disregard it in this discussion.). Overall, the region is planning to spend $33 billion on rail transit expansion. Further, $31 billion (94%) of these rail transit funds go to just one county—Los Angeles. The region also plans to spend $139.3 billion on transit maintenance, much of that dedicated to supporting rail and rail-related improvements. But in contrast, just $21.7 billion is dedicated to increasing bus transit service (including the initial purchase of vehicles) in all six SCAG counties, with $4.6 billion of this dedicated to bus rapid transit. While some of the existing maintenance funding supports bus services, most of the funds support inefficient rail expansions.

These plans suggest that Southern California is spending resources not for current riders but in the hopes of attracting new riders. These rail expansion plans will do little or nothing for most current riders; L.A. Metro has actually reduced bus service to pay for some rail expansions. The cutbacks in bus service may violate a court-ordered consent decree that requires Los Angeles Metro to provide sufficient bus service at reasonable prices.[115]

This report accepts the need to maintain existing rail lines and to complete lines currently under construction. But it considers any further heavy, light, and commuter rail expansion as an ineffective, cost-prohibitive method of increasing transit ridership. The major focus should instead be on attracting more people to an expanded and higher-performing bus system.

Of course, the traditional problem with buses is that traffic congestion has an impact on bus travel times and severely impacts transit's time competitiveness with the automobile. Since buses travel in the same traffic lanes as cars, automobile drivers can travel the same route in less time than bus users (avoiding the need to stop at bus stops), thus substantially diminishing time-related incentives to use transit as an alternative. Fortunately, express bus service and bus rapid transit can take advantage of toll-free access to the express lanes and managed arterials outlined earlier in this report. This allows for fast, reliable travel times and, in so doing, can significantly change commuters' cost-benefit calculations—shifting the balance toward transit, without ever penalizing motorists.

Below we outline a new approach to transit based on establishing a comprehensive network of express bus, bus rapid transit, limited-stop bus and local bus service across the Southern California metropolitan area. The proposal would replace some planned rail lines

with express bus and bus rapid transit. The great advantage of a bus-based transit system of this sort is that for the cost of three new rail lines, serving just a handful of commuter corridors, Southern California can create a comprehensive transit system for *the entire metro area.* What's more, this comprehensive system could be implemented over the plan's lifetime—decades before a rail network would be completed.

Figure 39: New Express Bus and Managed Arterial Bus Lanes

B. The Characteristics of Express Bus and Bus Rapid Transit

High-quality limited-stop bus services typically operate as express bus on expressway and other high-speed arterials, and as bus rapid transit on arterials and local streets. There are differences between these two types of services.

Express bus is a point-to-point bus service from one of many park-and-ride lots in the suburbs to various business districts throughout the metro area.[116] Metro areas have several different bus routes serving a park-and-ride area or have intermediate stops where commuters can transfer from one bus to another. Express bus service is used mostly during peak periods when choice ridership is higher. Express bus mainly operates on expressways or primary arterials, making its service characteristics similar to commuter rail.

Bus rapid transit (BRT) is an enhanced bus service that operates with characteristics of a dedicated guideway.[117] As a result BRT operates at faster speeds, provides greater service reliability and increased customer convenience.[118] BRT operates mainly on arterials, has frequent stops along the transit line (every 1⁄4 to 1⁄2 mile) and serves multiple origin and destination pairs. Its service characteristics are similar to heavy or light rail.

To more effectively differentiate from local bus, BRT often has the following features:[119]

- Running ways that give buses priority
- Unique station design
- Larger vehicles
- Electronic smart card/off-board fare collection
- Intelligent transportation systems such as priority signaling
- More frequent service especially during rush hour
- Specific branding

Since BRT runs on arterial and local streets, it may have additional features to help it fit into the community. These include land use or area-specific zoning and elevated boarding platforms level with the station.

C. BRT-Heavy, BRT-Lite and Virtual Exclusive Busways

Since the term BRT has come to encompass a considerable range of service types, a recent research report from the Federal Transit Administration sought to provide some clarity by separating BRT into two basic types:[120]

- "BRT-heavy" refers to BRT systems that operate in dedicated rights of way
- "BRT-lite" refers to BRT systems that lack dedicated rights of way. Such services have many of the components of BRT-heavy but use fewer enhancements. These services may be as basic as limited-stop arterial express service with signal priority.

Our basic premise—that express bus and BRT can produce more transit bang for the buck in Southern California—is generally valid. However, dedicating a full lane to bus service has drawbacks.

In the 1970s various state DOTs experimented by dedicating an expressway lane in each direction to express bus service. Most of these lanes operated well under capacity. This fact led to the conversion of original transitways for express bus service, such as the Shirley Highway in Northern Virginia, to HOV (high occupancy vehicle) lanes.[121] Initially, vanpools were allowed in, and when that measure failed to use all the capacity, three-person carpools were permitted. In most metro areas that took this path, the eventual result (as on I-110 in Los Angeles) was HOV lanes filled with two-person carpools. Unlimited numbers of HOV-2s led to congestion, greatly reducing the "express" nature of the bus service.

This is precisely where priced lanes (such as our proposed express lane network) can make a significant difference. Variable pricing can keep such lanes flowing at a high volume with no congestion (at LOS C). Therefore, a properly run priced lane can provide express buses with performance comparable to what they get from an exclusive busway. Because of this, some have termed a priced lane that provides guaranteed access for express bus/BRT service a "virtual exclusive busway" (VEB).[122]

VEBs have already been implemented in Southern California. Los Angeles Metro's express bus service in the express lanes on I-10 and I-110 is an example of a VEB. I-10 and I-110 are dynamically priced lanes which provide free passage to buses, vanpools and emergency vehicles but charge a variable toll based on congestion to automobiles.

While the I-10 and I-110 express lane conversions were funded by a congestion reduction grant from USDOT, there are several other ways to fund HOV to HOT conversions and new HOT lane construction. In some metro areas the DOT and transit operator enter into an agreement to build and operate the express lanes together. Texas DOT and Houston Metro's transit agency have an agreement to operate service on Houston's Katy Freeway (I-10).[123] The $250 million project added four priced lanes to the median of the expressway, replacing a single reversible HOT lane as part of a larger-scale project that rebuilt and widened the roadway. It is a public-public partnership between Harris County Toll Road Authority (HCTRA), the local transit agency (Metro) and the Texas DOT, with the approval of FHWA and FTA. HCTRA financed the priced lanes and will operate and maintain them, using the toll revenue for debt service and operation and maintenance costs. Metro is guaranteed up to 25% of the priced lanes' capacity, for any combination of buses, vanpools and carpools. In a memorandum of understanding (MOU), it agreed to increase the HOV occupancy level over time, as needed, to stay within its 25% usage. HCTRA, in turn, agreed in the MOU to use variable pricing to maintain LOS C conditions, thereby limiting the number of toll-paying vehicles using the priced lanes.

The same "empty lanes" phenomenon present in expressway HOV lanes also occurs on bus-only roadways and bus-only lanes on arterials. These lanes, exemplified by the Metro Orange and Silver Lines, have two significant drawbacks. First, obtaining an exclusive right of way is expensive, in both land costs and pavement costs. Second, since very few corridors can support more than 10 such buses per hour (one every six minutes) and usually only during peak periods, for the vast majority of the time that expensive right of way is empty and unproductive. Even with one-minute headways (60 buses per hour), an exclusive bus lane could handle at least 1,600 vehicles per hour at uncongested LOS C conditions. Thus, 1,540 spaces are going to waste every hour if that lane is used exclusively for bus service. Table 26 examines the person-throughput of the corridor with various levels of bus service.

Table 26: Hourly Directional Throughput Comparison for Constant LOS E

Transit Percentage (person trips)	GP Lanes Vehicle Capacity (vph)	Cars per Hour	Auto Throughput (persons per hour @ 1.15 persons per vehicle)	Transit Throughput (persons per hour)	Required Buses per Hour (40 person capacity)	Total Vehicles per Hour	Total Throughput (persons per hour)
0%	1,870	1,870	2,151	0	0	1,870	2,151
2%	1,870	1,870	2,151	43	2	1,872	2,194
4%	1,870	1,870	2,151	89	3	1,873	2,240
5%	1,870	1,870	2,151	113	3	1,873	2,264
10%	1,870	1,870	2,151	238	6	1,876	2,389
15%	1,870	1,870	2,151	380	10	1,880	2,531
20%	1,870	1,870	2,151	536	14	1,884	2,687
25%	1,870	1,870	2,151	715	18	1,888	2,866
30%	1,870	1,870	2,151	920	23	1,893	3,071
32%	1,870	1,870	2,151	1,010	26	1,896	3,161
33%	1,870	1,870	2,151	1,059	27	1,897	3,210
34%	1,870	1,870	2,151	1,107	28	1,898	3,258

Examining Table 26, we can see that unless transit usage in the corridor rises to 34%—far higher than is likely—converting two general purpose lanes to bus-only results in either a degraded level of service (i.e., severe LOS F conditions for the GP lanes) or a reduced throughput capacity (last column of Table 26). Neither of these conditions is a good outcome for increasing mobility. Managed lanes maximize throughput for both automobiles and buses.

The managed arterial maximizes throughput for both cars and buses. It avoids prioritizing one mode over the other. Buses using the underpasses for no charge will have more predictable schedules, increasing passenger use.

Table 27 compares the trade-offs in four alternatives for improving bus performance:

Table 27: Alternatives for Arterial Bus Rapid Transit Improvements

	Restriping	Convert GP	Add Lanes	Managed Arterial
Right of way cost	None	None	High	Low
Construction cost	Low	Low	High	Very high
Reduced left turns	Yes	Yes	Yes	Yes
Impact on auto throughput	Minor, negative	Major, negative	Minor, positive	Major, positive
Under-utilized bus lane(s)	Yes	Yes	Yes	No
Impact on congestion	Minor, negative	Major, negative	Minor, positive	Major, positive
Safety impact	Significant, negative	Some, negative	Minor, positive	Minor, positive
Revenue generation	No	No	No	Yes, significant

Each of the alternatives in Table 27 involves trade-offs. All four would restrict left turns, to avoid holding up buses operating in the inner lane(s). All but the managed arterial would use only a small fraction of the bus lanes' capacity. And the restriping alternative would eliminate the median, with buses operating directly adjacent to traffic going in the opposite direction. All things considered, we conclude that the managed arterial provides greater mobility increases than any of the bus-lane alternatives.

D. Rail/Bus Cost Numbers

To get a better idea of the cost-effectiveness of express bus and BRT networks, the Government Accountability Office compiled data from the FTA's New Starts and Small Starts programs on recent BRT, light rail (LRT) and heavy rail (HRT) projects. The average cost per route-mile was $124 million for LRT and $154 million for HRT.[124] If a metro area wanted to build a region-wide LRT or HRT system encompassing 250 route-miles, the cost would be $31 billion for LRT or $38.5 billion for HRT. A comparable virtual exclusive busway (VEB) network would require 500 lane-miles with one lane per direction. If all 500 lane-miles had to be added as new construction (i.e., if there were no HOV lanes to convert, at modest cost), the cost would be $5 billion if the average cost were $10 million per lane-mile, or $10 billion if the average cost were $20 million per lane-mile.

Thus, the capital cost of a VEB network would be between *one-sixth* and *one-fourth* that of a rail system of comparable size (though that comparison does not include the cost of additional buses to make full use of the new network). Furthermore, the LRT or HRT capital costs—$30 B to 40 B—would all have to be raised as federal, state and local tax money. Passenger fares would not cover any of that, and would cover only a portion of the operating and maintenance costs. By contrast, the VEB network's capital costs would be partly covered by motorists paying the variable-priced tolls.

Thus, transit capital funds would likely be needed only for the express bus vehicles and any off-line stations and park-and-ride lots developed to enhance the BRT on priced lanes service. Federal highway funding can be used to help fund priced lanes infrastructure, to the extent that toll revenue financing is not sufficient. And FTA grants are available for express buses, stations and park-and-ride lots.

On managed arterials, BRT-heavy has the same problems as express bus service operating in dedicated lanes: acquiring land for a dedicated lane is expensive and few corridors support more than 10 buses per hour. Instead we recommend a BRT-lite service best exemplified by the Metro Rapid program implemented by the Los Angeles County Metropolitan Transportation Authority starting in 2000.[125] It offers limited-stop express bus service in specially marked buses along major arterials. In addition to making stops about 0.7 miles apart (vs. 0.2 miles between stops on conventional bus routes), the service increasingly operates with traffic signal priority at intersections. The initial Metro Rapid line 720 increased transit ridership in that corridor by 40%. Some of the others have seen even greater increases; line 794 has increased ridership by 65% and line 770 by 70%. That success has led to the rapid expansion of the service to 20 other major arterials in Los Angeles County, as of 2014, encompassing 380 arterial-miles and 500 buses.[126]

E. Current and Future Transit Service Recommendations

The following section discusses current transit service and provides specific operating improvements and service expansion guidelines. The final table in this section provides specific suggestions for new BRT, express bus and regional bus lines in the Southern California region.

Southern California has a robust, varied transit network. The following section discusses existing operations and uses our market-oriented transit principles to recommend cost-effective, high-quality future service for the region. A complete table detailing rail, BRT and express bus service is included in Appendix E.

1. Rail

Current heavy, light and commuter rail is a component of the Los Angeles County transit network. Commuter rail is a component in Orange, Riverside, San Bernardino and Ventura Counties with the Orange County Line stretching to Oceanside in San Diego County.

Current Service

Heavy rail lines in operation include the Red and Purple.[127] The Red Line connects North Hollywood with Union Station. The Purple Line connects Wilshire and Western Streets with Union Station.

Light rail lines in operation include the Blue Line, Green Line, Gold Line and Expo Lines.[128] The Blue Line connects Long Beach and Metro Center, The Green Line connects Redondo Beach and Norwalk. The Gold Line connects Atlantic in East Los Angeles with Sierra Madre Villa in Pasadena. The Expo Line connects Culver City with Metro Center.

Commuter rail service in Southern California is operated by MetroLink.[129] MetroLink provides seven lines: Antelope Valley, Orange County-Inland Empire, Orange County, Riverside, San Bernardino, Ventura and the 91 Lines. The Antelope Valley Line connects Lancaster with Union Station; the Orange County-Inland Empire Line connects Oceanside in San Diego County with San Bernardino; the Orange County Line connects Oceanside in San Diego County with Union Station; the Riverside Line connects Riverside with Union Station; the San Bernardino Line connects San Bernardino with Union Station; the Ventura Line connects East Ventura with Union Station; and the 91 Line connects Riverside with Union Station but at different times and with different stops than the Riverside Line.

Both the Red and Purple Lines operate every 15 minutes early in the morning, 10 minutes during rush hour, 12 minutes during middays and 20 minutes during the evenings. Friday evening service departs every 10 minutes. On weekends, service is every 12-15 minutes except Saturday night when service is every 10 minutes and Sunday when service is every 20 minutes. On sections where the Red and Purple Lines overlap, service operates twice as frequently.

The Blue Line operates every 12 minutes during early mornings, 6 minutes during rush hour, 12 minutes during middays, and 10 minutes in evenings. On weekends, the Blue Line operates every 15 minutes until 10:00, then every 12 minutes until 7:00 PM and then every 10 minutes until 1:00 AM. On Saturday nights, trains operate for an additional 90 minutes at 15-minute intervals while on Sunday service ends at 1:00 AM. The Green Line operates every 12 minutes during early mornings, 6 minutes during rush hour, 15 minutes during middays, and 20 minutes during evenings. On weekends, the Green Line operates every 15 minutes except during evenings, when it operates every 20 minutes.

On weekdays, the Gold Line operates every 15 minutes during early mornings, 6 minutes during rush hour, 12 minutes during midday and 10 minutes in evenings. On weekends, the Gold Line operates every 15 minutes until 10:00 AM, then every 8 minutes until 9:00 PM and then every 10 minutes until 1:00 AM. On Saturday nights trains operate for an additional two hours at 20-minute intervals. Sunday night service ends at 1:00 AM. On weekdays, the Expo Line operates every 12 minutes until 7:00 PM and then every 10 minutes until system closing. On weekends, the Expo Line operates every 15 minutes until 9:00 AM, then every 12 minutes until 7:00 PM and then every 10 minutes until 1:00 AM. On Saturday nights, trains operate for an additional two hours at 20-minute intervals. On Sunday nights service ends at 1:00 AM.

Commuter rail trains operate every 30–60 minutes during rush hour and every 90 minutes three hours before or after rush hours. Most lines operate services in both directions but provide more service inbound in the morning and outbound in the afternoon. For example, on weekday afternoons the Antelope Valley Line offers four inbound trains and eight outbound trains.

Operating Improvements

While most Metro rail lines operate peak service during rush hour, the Expo Line operates its peak service at night. As the number of commuters traveling during rush hour is highest, Metro should increase the frequency of the Expo Line during rush hour.

Service Expansion

Los Angeles County has major rail expansion plans. Due to funding challenges and the effectiveness of BRT and express bus at ¼ the cost of light rail, Southern California should reduce its rail expansion plans. The Exposition Line Phase II is under construction so it should be completed to Santa Monica. The Gold Line extension between Pasadena and Azusa is also under construction and we recommend that it be completed. However, the second phase of the Gold Line extension between Azusa and Montclair lacks funding and should be eliminated. The Crenshaw Line that runs between the Expo Line and the Green Line is also under construction and should be completed. This line has several stations near Los Angeles International Airport but no stops at the airport itself, reducing the line's effectiveness. The Purple Line extension between Vermont and La Cienega is under construction and should be completed. However, the second phase of the line between La Cienega and the V.A. hospital, without funding, should be eliminated. The downtown Regional Connector, which builds a new light rail line in downtown Los Angeles connecting the Little Tokyo/Arts District Station on the Gold Line with the 7th Street Metro Center Station, is under construction and should be completed as cost-effectively as possible.

No other rail lines should be built. Instead we suggest building the Green Line extension to Torrance, the Eastside Phase II lines and the East San Fernando Valley Transit Connector as Bus Rapid Transit lines as discussed below. We suggest replacing future commuter rail extensions with express bus service. Southern California has already built or is building all of the rail transit lines that are feasible; no further expansions are justified.

2. Local Bus/Limited Stop Bus/Shuttles

Local buses that offer service up to 22 hours a day are the foundation of any region's transit network. Los Angeles, Orange, Riverside, San Bernardino and Ventura Counties offer local bus service. Los Angeles offers limited stop service during peak travel periods.

Current Service

Los Angeles Metro operates 119 local bus routes and 12 limited or skip stop bus routes.[130] Los Angeles Metro also offers 11 circulators or shuttles that may operate in one or two directions and connect to line-haul services. The Orange County Transportation Authority operates 41 local bus routes, 13 limited stop or skip stop routes including 12 that serve Metrolink Commuter Rail and 14 circulators or shuttles.[131] Omnitrans services the city of San Bernardino and surrounding areas with 27 local bus routes and three circulators or shuttles.[132] Victor Valley Transit Authority operates 20 local bus routes.[133] Foothill Transit provides 26 local routes.[134] Riverside County Transit provides 36 fixed route lines.[135] In Ventura County, Gold Coast Transit provides 18 local bus routes in Oxnard and Ventura.[136]

Operating Improvements

We recommend using intelligent transportation systems technology where possible to increase the quality of service. Queue jumps with priority signaling, traffic synchronization and electronic fare collection can reduce delays.

Service Expansion

L.A. Metro has $21 billion dedicated to bus expansion but does not provide details on specific routes or frequencies.[137] Other transit agencies have not specified any bus service expansions. Expanding service particularly during shoulder times can be a cost-effective way to improve bus system quality.

3. Bus Rapid Transit/Express Bus

Express bus and bus rapid transit (BRT) are major components of Southern California's transit network. BRT and express bus typically transport commuters longer distances at quicker speeds than local bus service. Express bus and BRT lines often serve as trunk lines, while local bus serves as feeder lines.

Current Service

Los Angeles Metro operates two BRT-heavy lines—the Orange and Silver Lines and 20 BRT-lite lines.[138] Orange County does not have any BRT lines but does have five intra-county express bus routes and five inter-county express bus routes.[139] Omnitrans offers one BRT route and one express route.[140] Victor Valley Transit Authority offers two express routes.[141] Foothill Transit provides eight express routes.[142] Riverside County Transit offers eight express routes that serve transit stations.[143] In Ventura County, VISTA provides six express intra-county bus routes.[144]

Operating Improvements

We recommend all BRT services implement and use the seven premium features detailed earlier in this paper:

- Running ways that give buses priority,
- Unique station design,
- Larger vehicles,
- Electronic smart card/off-board fare collection,
- Intelligent transportation systems including priority signaling and queue jumps,
- More frequent service especially during rush hour, and
- Specific branding

Of these features, intelligent transportation systems are clearly the most important. There is consensus throughout the transportation community that the most important factor in delivering high quality bus service is signal priority.[145] Yet some BRT lines in Los Angeles feature priority signaling only during peak periods. To realize the maximum benefits from BRT, such lines need to use signal priority whenever they operate.

Some express bus lines operate in general purpose expressway lanes or on congested arterials. With the implementation of express lanes on expressways and managed arterials on arterials, these buses should take advantage of the guaranteed reliable travel times free for transit vehicles in these lanes.

4. Vanpools

A vanpool consists of a commercial van and a group of seven to 15 people who ride to and from work together. Most vanpools require a small monthly charge to pay for gasoline and insurance. Since seven to 15 people share the costs, however, commuting by vanpool is substantially less expensive and less time-consuming than commuting alone. Similar to buses, vanpools can use express lanes and managed arterials free of charge, reducing commute times even further. The driver and substitute driver for most vanpools either do not have to pay or receive a significantly discounted price.

While vanpools can receive a small subsidy from the county, the subsidy is typically far less per capita than fixed-route transit. Additionally, private sector companies including Enterprise Rideshare and Veolia's vRide operate many of the vanpools in California.[146]

Computer applications are increasing the popularity of vanpools. Traditionally, vanpools are static arrangements of travelers booked in advance. Smartphones are allowing potential riders to vanpool in as little as 30 minutes in advance.[147] Some of these riders may choose to vanpool several times a week while others may vanpool as little as once a month.

Current Service

All Los Angeles counties offer some type of vanpooling service. Some counties allow potential riders to enter their addresses and be matched into a vanpooling service. Others have vanpool coordinators that arrange riders.

Planned Expansion

Any group of seven to 15 people with similar residential and commercial destinations can vanpool. The county/private sector will supply a vehicle and insurance for the drivers.

5. Casual Carpools

A casual carpool is a less organized form of vanpooling where commuters form carpools to take advantage of HOV or HOT lanes. Casual carpooling has proven successful in Houston, San Francisco and Washington, D.C., but it has not been as popular in Southern California.[148] Forming a casual carpool is a simple, quick process. A car needing additional passengers to meet the required minimum occupancy requirements of an express lane pulls up to one of the casual carpool lines. The driver usually positions the car so that potential passengers can enter on the passenger side. The driver either displays a sign with the vehicle's destination or simply lowers the passenger window to call out the destination. The passengers first in line for that particular destination then get into the vehicle. Metro agencies can encourage such casual carpool lanes by providing dedicated meeting places near highway entrances (including at park-and-ride lots). While new users sometimes have safety concerns, casual carpooling has been in effect for 20 years in Houston without a single reported incident.

6. Demand-Response Transit

With demand-response transit (DRT) service, individual passengers can request a ride from one specific location to another location at a certain time. Unlike local bus service, which offers a fixed-route service, the passenger must notify the transit operator of the need for service and the destination before he or she travels.

There are two types of DRT service. In suburban and rural areas with low populations, DRT service is offered in lieu of fixed-route transit service as a more cost-effective transit option. In denser areas, DRT service is for elderly and disabled residents who cannot use fixed-route transit services. The Americans with Disabilities Act requires that transit providers that offer fixed-route service must offer DRT service as well. Buses, taxis, vans and cars are used as DRT vehicles.[149]

As demand-response service typically has higher per capita costs than fixed-route service, most operators contract with the private sector to provide quality demand-response service at a lower cost. Most L.A. area counties contract out DRT service.

Current Service

All counties in the L.A. region provide demand-response service for the elderly and disabled. Some counties provide demand response service in low-density areas where fixed-route service would be inefficient. Omni Link in San Bernardino County provides demand-response service in low-density areas of the county while VISTA in Ventura County provides demand-response service in low density areas of the county.

Table 28: Demand-Response Transit Service in L.A. Region

County	Service Provider	Type of Service
Los Angeles	Metro	Elderly/Disabled
Orange	OCTA	Elderly/Disabled
San Bernardino	OmniLink	Low Density
San Bernardino	Access	Elderly/Disabled
Riverside	Dial-A-Ride	Elderly/Disabled
Ventura	Gold Coast Access, VISTA, VCTC Ride Share	Elderly/Disabled
Ventura	VISTA	Low Density

Expansion

Eastern Riverside, eastern San Bernardino and western Ventura Counties are very rural areas where fixed-route transit will remain unfeasible. Demand-response transit would be very effective in these areas. There is also a growing population of elderly and disabled residents who are unable to use fixed-route transit due to special medical conditions. As a result, substantial growth in demand-response transit is expected in both rural and urban areas.

Table 29: Express Bus/BRT/Regional Bus New Lines

BRT Line	Starting Point	Ending Point	Service Type
Roscoe Blvd	Roscoe Blvd at Woodlake Ave	Tujunga Canyon Blvd at Foothill Blvd	BRT
Las Tunas Dr	6th St at Flower St/Figueroa St	Live Oak Ave at I-605	BRT
Slauson Ave	SR 1 at SR 90	Carbon Canyon Rd at Chino Hills Parkway	BRT
Euclid Rd	Torrance Blvd at Palos Verde Blvd	Cannon St at Santiago Canyon Rd	BRT
Portola Parkway	SR 1 at Warner Ave	Portola Parkway at SR 133	BRT
SR 79	I-5	San Jacinto Rd	Regional
SR 1	SR 107	Chautaqua Blvd	BRT
SR 27	Burbank Blvd	Chatsworth St	BRT
La Cienega Blvd	Florence Ave	Foothill Blvd	Regional
Alameda St	Carson St	First St	BRT
SR 19	SR 1 at SR 19	E. Sierra Madre Blvd at Sierra Madre Villa Ave	BRT
Western Ave	Western Ave at SR 1	Western Ave at Century Blvd	BRT
SR 1	Beach Blvd at SR 1	Azusa Ave at Sierra Madre Ave	Regional
Euclid Ave	Euclid Ave at Eucalyptus Ave	Euclid Ave at 19th St	BRT
Sierra Ave	Van Buren Blvd at Victoria Ave.	Sierra Ave at Sierra Lakes Parkway	BRT
SR 39	SR 1 at SR 39	SR 39 at SR 72	BRT
Van Nuys Blvd	Van Nuys Blvd at Ventura Blvd	Van Nuys Blvd at Glen Oaks Blvd	BRT
Mission Blvd/Van Buren Blvd	March Air Reserve Base	Mission Blvd at Garey St	BRT
I-710/Imperial Highway	Downtown L.A.	Santa Ana Canyon Rd at Imperial Hwy	Express bus/BRT
Jamboree Rd/SR 241/SR 91	Jamboree Rd at SR 1	Main St at 6th St, Corona	Express bus/BRT
Trabuco Rd/Irvine Blvd/4th St	Marguerite Parkway	Main St at 4th St, Santa Ana	BRT
SR 55/Harbor Blvd	SR 1 at SR 55	Harbor Blvd at SR 90	BRT
Victoria Ave, Ventura	Victoria Ave at Channel Islands Blvd	Victoria Ave at Telegraph Rd	BRT
Huntington Dr/SR 66/Foothill Blvd/5th St	Santa Anita Ave, Arcadia	Boulder Ave, Highland	BRT

F. An Express Bus and BRT Transit Network

1. Express Bus Numbers

Express bus and BRT are two different transit services operating in different environments. Southern California has a number of express bus lines operating on different expressways. The following table provides details about many of the lines.

Southern California currently has more than 20 express bus lines with most transit operators in the region operating at least one line. Across the country managed lanes have increased the number of people taking bus transit and decreased the travel times. Table 30 shows the ridership in various express bus lines across the country. Table 31 shows how residents commuted prior to the express buses.

Table 30: Express Bus Ridership Before and After HOT Lanes

Agency	Line	Before Weekday Ridership	After Weekday Ridership	Percent Increase	Operates Outside Peak Hours
Gardena	2	3,672	3,916	9.8%	No
L.A. Metro	Silver	7,201	10,522	46.1%	Yes
Miami-Dade Transit	95X, Pines Express, Dade Broward Express	1,800	4,500	150.0%	No
GA Xpress	410,411,412, 413,416	3,383	3,793	12.1%	No
Minnesota DOT	I-35W	10,600	12,300	16.0%	Yes

Sources: U.S. Department of Transportation, Los Angeles Metro, Center for Urban Transportation Research, Georgia Institute of Technology

Table 31: Express Bus Ridership, Commute Mode Before

Agency	Line	Bus	Carpooled	Drove Alone	Other Transit	Other	Did Not Make Trip
Gardena	2	N/A	N/A	N/A	N/A	N/A	N/A
L.A. Metro I-10	Silver	33%	5%	11%	33%	19%	N/A
Miami-Dade Transit	95X, Pines Express, Dade Broward Express	N/A	N/A	38%	34%	N/A	N/A
GA Xpress	410,411,412, 413, 416	N/A	N/A	N/A	N/A	N/A	N/A
Minnesota DOT	I-35W	28%	4%	28%	N/A	10%	32%

Sources: U.S. Department of Transportation, Los Angeles Metro, Center for Urban Transportation Research, Georgia Institute of Technology

As the two tables show, express bus ridership in electronic toll lanes increased in all five of the above examples between 10% and 150%. The rate of increase varied based on several factors including HOV/HOT lane congestion, bus additions, gas prices, and other lane additions. While several transit agencies purchase additional buses with funds from the Urban Partnership or Congestion Reduction Demonstrations projects, those agencies have continued operating those buses even after federal funding ceased. This indicates that these buses have developed a stable following. The L.A. Metro Silver Line had the second largest increase in ridership (46%) of any of the lines studied, while the Gardena Line 2 had a more modest 10%

increase. This indicates that converting HOV lanes to express lanes and building additional express lanes will increase transit usage throughout Southern California.

Express buses also reduce the share of commuters driving alone. The numbers range from 11% in Los Angeles to 38% in Miami-Dade County. Even a small reduction in the number of vehicles on a stretch of roadway can have a big impact on congestion. Therefore, managed lanes are a true win/win proposition. Not only can they increase transit ridership in the corridor but they can also reduce congestion by decreasing the number of vehicles on the road.

We calculated the number of express bus riders on five potential new routes throughout Southern California.

Table 32: Potential Express Bus Corridors

Roadway	From	To	Primary Direction	Estimated Daily Ridership
US 101	SR 27/Woodland Hills	Downtown L.A.	E/W	10,000
SR 60	Van Buren Blvd/Jurupa Valley	Downtown L.A.	E/W	10,000
I-5	Laguna Niguel	Culver Dr/Irvine	N/S	8,000
I-210	Glendora	Pasadena	E/W	6,000
I-5, I-605	Cypress	Downtown L.A.	N/S	10,000

Daily express bus ridership on each of the corridors is estimated at between 6,000 and 10,000. While these numbers might seem underwhelming, express bus ridership has very low capital costs since buses will travel on the express lanes. Additionally, express buses operate during weekday rush hours only. Given the low costs and limited hours, express bus is a very cost-effective transit option.

2. BRT Numbers

Los Angeles currently has two BRT-heavy lines and 20 BRT-lite lines. Table 33 shows the ridership numbers from selected BRT-heavy lines around the country. BRT-heavy lines have a dedicated right-of-way for at least part of the trip.

Table 33: BRT-Heavy Ridership Across the Country (Average 2013)

Agency	Name of BRT	Transit Area Population	Urbanized Area Density	Length (mi.)	Weekday Ridership	Weekday Riders per Mile
Los Angeles County MTA	Orange Line	8,626,817	6,999	18.7	29,123	1,557
Miami-Dade Transit	South Miami-Dade Busway	5,502,379	4,442	19.9	20,000	1,047
The Greater Cleveland RTA	HealthLine	1,780,673	2,307	7.1	13,248	1,866
Lane (Eugene, OR) Transit District	Emerald Express	245,721	2,582	15.3	9,041	591
RTC of Southern Nevada	MAX	1,886,011	4,525	20.8	12,509	601
Port Authority Transit (Pittsburgh)	Busways	1,733,853	1,916	28.2	9,000	321

Source: National Transit Database, http://www.ntdprogram.gov/ntdprogram/data.htm

Table 34 shows the data from five of the 20 BRT-lite lines operating in Los Angeles.

Table 34: BRT-Lite Ridership in Los Angeles (October 2014)

Line No.	Length (mi.)	Weekday Ridership	Weekday Riders per Mile
Santa Monica	18.7	33,201	1,775
Wilshire	23.0	58,077	2,525
Venice	18.6	25,625	1,378
Vermont	12.3	47,430	3,856
Western	10.3	35,587	3,455

Source: Los Angeles Metro, https://www.metro.net/news/ridership-statistics/ and https://letsgola.wordpress.com/2014/11/16/lacmta-ridership-update-october-2014/

Looking at the first table of BRT-heavy lines across the country, there is wide variation in the ridership numbers. Smaller cities such as Eugene, Oregon tend to have lower ridership numbers per capita while larger cities such as Los Angeles tend to have higher ridership. In addition, longer lines tend to have slightly fewer riders per mile. Looking at the table of BRT-lite lines in Los Angeles, while lines vary in length from between 10 to slightly over 23 miles, each has at least 1,378 riders per mile. Comparing the tables, four of the five BRT-lite lines have more total riders and more riders per capita than the Orange Line BRT-heavy line. Since the Orange Line is considered the gold standard for U.S. BRT lines, this shows the success of the BRT-lite ridership (also called Metro Rapid) in the L.A. region.

Further, BRT operating on arterials is likely to have higher ridership estimates. First, none of the current BRT-lite lines have grade separations that buses can use to bypass congested intersections. Such intersections will likely reduce travel times up to 50% during peak hours. We estimate that this would reduce the scheduled travel time on the Wilshire BRT from 90 minutes to 40-55 minutes. Second, the current priority traffic signaling only operates during rush hours. This priority signaling could substantially reduce travel times during peak hours. Clearly, congestion is not as severe middays, evenings and weekends, but turning on signal priority 18 hours a day, seven days a week would reduce transit travel times and not adversely affect vehicle travel times. Finally, Southern California's urban areas could easily implement off-board payment for Metro Rapid, the one of the seven key features of BRT not featured.

We calculated potential ridership for eight BRT lines operating on managed arterials. Note that one of the lines mirrors an existing BRT corridor and a second line extends an existing BRT corridor. Our calculations assume that Metro uses optional priced underpasses, uses priority traffic signals 18 hours a day, and implements off-board payment. Those details are in Table 35 below.

Table 35: 2020 Estimated BRT Ridership on Selected Corridors

Managed Arterial	From	To	Primary Direction	Estimated Ridership	Miles	Ridership/ Mile
Roscoe Blvd	SR 27	SR 170	E/W	25,000	11.5	2,174
Santa Monica Blvd (Current Santa Monica Line)	Ocean Ave	Union Station	E/W	52,000	18.7	2,781
Carson St/Lincoln Ave/Taft Ave	Palos Verdes Blvd	Cannon St	E/W	39,000	35.0	1,114
Slauson Rd/ Telegraph Rd/ Imperial Hwy	SR 1	Valencia Ave	E/W	48,000	38.1	1,260
Western Ave (Current Western Line and Extension)	SR 1	Franklin Ave	N/S	72,000	22.7	3,179
Laurel Canyon Blvd	Ventura Blvd	Webb Ave	N/S	32,000	13.7	2,336
Lakewood Blvd	SR 1	Foothill Blvd	N/S	58,000	26.2	2,214
Beach Blvd, Azusa Ave	SR 1	SR 72	N/S	46,000	20.8	2,212

The table shows that managed arterials have a significant positive effect on BRT ridership. Managed arterials are forecast to increase current Santa Monica line ridership by 60%. Note that each of the lines operates with at least 1,100 riders per mile and some exceed 3,000 riders per mile. These ridership numbers would make Los Angeles BRT lines some of the most heavily used per mile in the country and set a new gold standard for bus service.

BRT-lite has significant cost advantages compared to BRT-heavy. A recent Transportation Research Board paper compared Metro Rapid service on Ventura Blvd. in L.A.'s San Fernando Valley with parallel BRT-heavy service on the area's then-new Orange Line exclusive busway. The travel times were about the same for both, but the capital cost per boarding was only $1,300 for the BRT-lite versus $16,800 per boarding for the BRT-heavy service, primarily because of the exclusive-guideway cost for the latter.[150]

BRT-lite appears to be a highly cost-effective way to expand transit service on arterials. And just as express bus is well-suited to operate on express toll lanes on expressways, BRT-lite could take advantage of managed arterials to operate faster than what is possible on ordinary arterials. This would expand the network of region-wide BRT to the corridors with managed arterials, in addition to the express lane network. BRT-lite service can be added on traditional arterial roads. Services on traditional arterial roads will not offer the same speeds as those operating on managed arterials, but will still be considerably faster than local bus.

3. Express Bus and BRT Costs

Since express buses and BRT are premium transit services that operate more quickly than typical buses, most transit agencies charge a higher fare. Metro charges $2.50 for the Silver Line express bus and between $2.50 and $3.25 or more for express buses depending on length and whether or not the bus travels on the expressway. Xpress in Georgia charges

between $3.50 and $5.00 depending on length and operating agency. Fares for BRT lines are the same as those for regular bus service. While most transit agencies have tiered pricing for express buses, all transit agencies except RTP of Southern Nevada charge the same price for BRT as local bus. Charging the same price for a traditional local bus that stops every few blocks as for a bus that operates in a semi-dedicated right of way with priority traffic signaling and service improvements that stops every ¾-1 mile is the wrong approach. We recommend Southern California transit agencies charge a higher price for both express bus and BRT. We have calculated the numbers using higher fares adjusted for inflation. The following table estimates revenue per BRT line and express bus line.

Table 36: Estimated Express Bus and BRT Revenue 2020

	Express Lane	Managed Arterial
Projected Daily Riders	8,000	40,000
Annual Weekday Ratio	250	365
Average Fare	$4.00	$2.50
Average Gross Fare Revenue	$11,680,000	$25,000,000
Farebox Coverage	90%	30%
Revenue	$10,512,000	$7,500,000

For each type of premium bus service we projected average revenue from new riders only. We first calculated average ridership per line based on current ridership in Southern California. While express bus ridership may seem a little low, each expressway could have multiple express bus lines. For example, I-5 between I-605 and downtown Los Angeles could have three lines operating, so the number of express bus riders would be 24,000. We assumed express bus would operate five days a week, not major holidays, and that bus rapid transit would operate seven days a week. We raised the average express bus fare to $4.00, comparable today to fares in Atlanta and other major cities. We raised BRT fares to $2.50 higher than current fares in Los Angeles but lower than those in Las Vegas and other large cities. We assumed that almost all new express bus riders would be new riders but that only 30% of BRT riders would be new. Due to Southern California's extensive local bus service, we expect 70% of BRT riders to switch from local service. These factors help determine the amount of new revenue per line.

Since significant numbers of BRT riders are expected to shift from local bus to BRT, some local bus funding could shift to support BRT service. We don't expect farebox revenue to cover the complete cost of providing BRT service. Value capture and transit advertising can help fund the remainder of BRT costs, although a limited amount of general fund revenue may be necessary.

While exact ridership will vary by line, the above table indicates many BRT and express lines should come close to covering their operating and potentially maintenance expenses through farebox revenue and some use of value capture. This funded ratio is two to three

times traditional local bus service. Since the running way (paved lanes) are paid for by automobile users, the only remaining cost is the capital costs of the buses themselves. While it is beyond this study's reach to determine the exact financial details of a comprehensive express bus and BRT network, calculations indicate express bus and BRT should be among the most cost-effective forms of fixed-route transit service that Southern California transit agencies offer.

4. Current Conditions and Planned Expansions

Complete details on Southern California's current transit service are available in Appendix D. We also recommend several new express bus, regional bus and BRT lines and extensions. In addition to the corridors highlighted above, we have recommended 25 other leading corridors for bus service. Line details are available in Appendix D. However, transit planners should not stop with these lines. There are probably an additional 100 lines, half of them local or limited-stop, that Southern California should add. Determining the location and headways of future lines will require a detailed travel demand survey, which we encourage local travel agencies and SCAG to pursue.

We recommend all services operate on headways of no more than 10 minutes during peak periods, 15 minutes during middays and evening, and 20 minutes during weekends. All services should operate between 5 AM and midnight on weekdays and 7 AM and midnight on weekends. Lines serving popular nightspots should operate until 2 AM Friday and Saturday nights.

G. Conclusion: Next Steps for Southern California Transit

Southern California has good transit service, but the region should consider additional expansions. Due to the region's spread-out nature and its dispersed employment locations, adding bus service will be more effective and efficient than adding rail service. We recommended additional BRT, express bus and regional bus additions earlier in this section. Local bus additions are also needed but beyond the scope of this report.

Part 10

The Smart City: Operational Strategies for Reducing Congestion

"Operations management" is the set of strategies used to maximize existing infrastructure and reduce non-recurrent congestion. Operations management alone cannot make up for needed capacity or reduce recurrent congestion. But operations management can significantly improve mobility, typically at a very low cost. For example, the California DOT (Caltrans) estimated a package of system operations measures to have a cost-benefit ratio of 8.9 to 1.[151] By contrast, the addition of conventional highway capacity had a benefit-cost ratio of 2.7 to 1. While both need to be completed, the low-hanging fruit is the system operations measures, which have the advantages of being (1) relatively inexpensive, and (2) implementable within a matter of years, rather than decades.

In many areas, operations management can substitute for some needed capacity. Using dynamic traffic management system data, ramp metering, variable speed limits, signal optimization, queue jumps and other "intelligent transportation systems (ITS)" can help increase mobility by increasing the number of cars a given stretch of pavement can accommodate.

The following section discusses the role of dynamic traffic management systems in operations management. It then details how the components of freeway operations and arterial operations reduce congestion.

A. Dynamic Traffic Management Systems and Intelligent Transportation Systems

Dynamic traffic management systems are cost-effective systems that improve traffic flow on expressways and arterials. Dynamic traffic management systems use simulation models combined with real-time traffic information to predict the effects of various management strategies.[152] Route time, travel time and departure time are collected from sources of real-time information such as loop detectors, roadside sensors and GPS devices. This travel

information is used with simulation models to predict network flow patterns and travel times on routes, given the combination of management strategies used on those routes, including incident management, ramp metering, signal control and traveler information. Based on these predictions, the system selects optimal strategies and suggests travel time predictions and route recommendations to travelers. These programs have been successfully deployed in Europe and Japan resulting in capacity improvements on major expressway corridors of up to 30% as well as significant increases in trip predictability and safety.[153]

Intelligent transportation systems (ITS) are the most popular subset of dynamic traffic management systems. U.S. engineers have been implementing ITS for over two decades and have installed vehicle sensors and message signs, as well as backbone communications systems, on many major urban expressway corridors and selected arterial highways.[154] These sensors gather data about traffic conditions on a 24/7 basis, and this information is collected, compiled and distributed to the motoring public in near real-time through a variety of public and private information channels.

Many metro areas use several ITS systems that operate in *static* mode. However, ITS systems would be even more effective if they operated in a *dynamic* mode. In "static mode" expressway incident management and service patrols quickly *observe, respond to* and *clear* accidents from travel lanes. But in "dynamic mode" ITS systems seek to *prevent* accidents by reducing speed limits and warning of congestion. Traffic signs that report congestion ahead provide valuable information to motorists. However traffic signs that detail congestion and suggest alternate routes and where to exit the highway to avoid congestion, a.k.a. "dynamic mode," are even more useful.

The California Department of Transportation (Caltrans) operates a partially dynamic traffic monitoring system called "Quickmap" that provides updated information on changeable travel signs.[155] The website provides traffic cameras and information on travel alerts, weather, road conditions, speeds, roadwork, detours and information to truckers. Caltrans also has a mobile application for smart phones, but the agency could improve its service by providing real time updates of incidents and severe congestion events. The state also uses other dynamic systems, such as converting a shoulder to a direct exit lane. However, the state needs to complete its transition from a static plan to a dynamic operations plan. The following paragraphs detail several leading dynamic ITS technologies.[156]

Ramp metering uses a traffic control device, typically a red and green traffic light, and a signal controller that regulates the flow of traffic entering expressways at current traffic conditions.[157] Ramp metering restricts the total flow of vehicles entering roadways by temporarily storing it on an on-ramp. Ramp metering decreases congestion by reducing demand and eliminating platoons of cars jamming up the right-most expressway lane. Most major metro areas use static ramp metering. Metro areas need to adopt active ramp

metering systems calibrated to adjust to traffic in a demand-responsive mode. Imagine a two-lane highway on-ramp that at 7:00 AM has 20 cars in the left lane and five in the right and at 8:00 AM has seven cars in the left lane and zero cars in the right. With a static ramp meter one car from each lane of an on-ramp would enter a highway per green signal for the entire morning rush hour. With an active ramp meter, at 7:00 AM four cars would enter from the left lane per green signal for every car that entered from the right lane per green signal. At 8:00, with a different traffic pattern, the ramp meter would turn green for the left lane but stay red for the right lane since there is no traffic in the lane. Active ramp metering does much more to reduce congestion.

Static **queue warnings** are electronic signs that detail travel speeds and travel times that may change due to congestion, traffic construction or an accident. They can be used for traffic control on congested facilities or to enhance safety during major incidents. Dynamic queue warnings offer the same features, but they also suggest alternate routes and provide detailed guidance on when the congestion starts. Dynamic signs are often placed at expressway entrances so drivers can choose an alternate route before they enter the highway.

Speed harmonization uses variable speed limits to smooth traffic flow and improve safety.[158]

Hard shoulder running involves upgrading shoulder pavement quality and opening shoulders to traffic during peak periods.[159] Some states have converted shoulders to general purpose lanes and allow traffic to use them 24 hours a day, seven days a week. Shoulder lanes are used to increase capacity on constrained highways.

Junction control uses signs, typically red and green electronic signs, to open and close lanes based on conditions.[160] For example, if there is an accident in the middle lane of three lanes, road operators may place a red X in the box over the middle lane to indicate that it is closed and drivers should move to the right or left.

The most effective active transportation systems use multiple technologies together. For example, queue warnings are used in conjunction with speed harmonization to slow speeds and warn drivers of congestion ahead.

Enforcement of these dynamic roadway systems is important. While traditional enforcement—a police officer sitting in a patrol car—is still used, automated enforcement is much cheaper and safer. Many states use automated traffic cameras to ensure drivers obey dynamically imposed operating signs. If drivers do not obey the signs, the enforcement system mails a ticket to a violator's home address.

Since comparative dynamic ITS traffic system data are limited, we have assessed Southern California's systems based on the data available. But the urban area is encouraged to upgrade to more dynamic ITS systems wherever possible.

B. Expressway Operations

The Texas Transportation Institute's annual *Urban Mobility Report* provides summary data for each urban area on operations strategy measures, estimating each one's contribution toward reducing the travel time index.[161] Four basic measures are reported, two for expressways and two for arterials. The expressway measures quantify the extent of ramp metering and the percentage of the system under active incident management efforts. The most recent expressway data for the Los Angeles region is shown in Table 37.

Table 37: Expressway Operations Management for the Los Angeles Urbanized Area

Operations Strategy	2011	2010	2009	2008
Ramp Metering				
Percent miles of roadway	100%	99%	99%	100%
Annual delay reduction, (thousands of hours)	20,316	20,155	19,904	17,944
Freeway Incident Management				
a) Cameras				
Percent miles of roadway	71%	71%	70%	71%
b) Service patrols				
Percent miles of roadway	95%	94%	94%	95%
Annual delay reduction, (thousands of hours)	18,285	18,139	17,913	16,149

Source: *2012 Urban Mobility Report*, Texas A&M Transportation Institute, Texas A&M University. The Los Angeles Urbanized Area covers portions of Los Angeles and Orange Counties.

At 100% of miles covered, virtually every on-ramp in the Los Angeles – Long Beach – Santa Ana area uses expressway metering, resulting in estimated annual delay reductions of over 18 million hours.[162] However, in other portions of Southern California, the percent of miles covered is lower (59% in Riverside-San Bernardino, and virtually no application in Oxnard-Ventura). Additional investments could reduce delay further and build on the region's current successes in this area. If Riverside/San Bernardino and Lancaster/Palmdale implement comprehensive expressway ramp metering where needed, the region might save an additional 1.1 million hours of delay. Since ramp metering costs much less than significant lane additions, this under-used tool clearly represents "low-hanging fruit" in reducing Southern California's congestion. While ramp space can be an issue in some places, most of Riverside/San Bernardino's and Lancaster/Palmdale's expressways have enough "storage" space for vehicles in on-ramp queues.

Incident management has become a popular tool used to combat non-recurrent congestion in large metropolitan areas. Typical incidents include disabled vehicles, traffic crashes, spilled cargo or other debris in the road, road construction and non-emergency special

events. Pro-active incident management in Southern California is intended to cover incident detection and verification, incident response and clearance, and site and area traffic management. One of the more obvious examples of the deployment of this strategy is the variable message signs over expressways throughout the region alerting travelers to delays and traffic accidents.

Two key elements include equipping the expressways with cameras so that incidents can be identified quickly and appropriate units dispatched, and creating and operating expressway service patrols that can respond rapidly to minor incidents (breakdowns and fender-benders). On the former, Los Angeles is ahead of the pack, with 71% of expressway-miles equipped with traffic surveillance cameras as of 2011, compared to an average of 52% for other large metropolitan areas.[163] Riverside-San Bernardino does even better at 77% and Oxnard-Ventura at 24%. However, those percentages have held steady for the past four years. Each region should try to cover the remaining expressways within the next five years.

Los Angeles also has expressway service patrols in place, covering 95% of expressway-miles. Riverside-San Bernardino covers 78%. The patrols' duties include detecting expressway incidents by patrolling metro expressways and quickly responding to and removing incidents (pushing disabled vehicles using push bumpers and removing debris) from the traffic lanes. They are also responsible for providing traffic control and scene security at crashes, assisting first responders with first aid at crash scenes and assisting motorists with emergency vehicle repairs. Service patrols also clear stalled vehicles and debris in the roadway. The congestion from these incidents is responsible for causing about 15% of all expressway crashes, known as "secondary crashes."[164] Every minute a highway lane is blocked can cause four to five minutes of additional delay, so it is critical to clear the roads as quickly as possible.[165]

Several states have analyzed the congestion created by incidents and the advantages of better incident management systems. The Washington State DOT estimates that the throughput on a six-lane expressway (three per direction) can be cut 20% by a car out of gas on the shoulder, 50% by a disabled car blocking one lane, and 85% by an accident blocking two lanes.[166] Rapid response and rapid clearance of such incidents can significantly reduce the duration of such congestion, allowing the expressway's capacity to be reclaimed. The Bay Area Toll Authority estimates a benefit/cost ratio for such projects as 8:1.[167] Such projects typically involve advanced video systems to quickly spot incidents, dispatch centers to send appropriate response crews and expressway service patrols to quickly deal with minor incidents.

Table 38 below illustrates the cost-effectiveness of the Los Angeles region's Safety Patrol program.

Table 38: Expressway Service Patrol Data

Urbanized Area	Annual Cost ($ million)	Miles Covered	# Vehicles	Benefit/Cost*
Los Angeles, CA	$23.1	411	146 tow trucks	15:1
San Francisco Bay Area, CA	$6.0	362	60 tow trucks	11:1
Chicago, IL	$5.5	80	35 tow trucks	17:1
San Diego, CA	$2.4	203	26 tow trucks	7:1
Houston, TX	$1.4	190	18 vans	6.6:1 to 23:1
Denver, CO	$1.3	60	12 tow trucks	20:1 to 23:1
Minneapolis/St.Paul, MN	$1.0	220	10 pickup trucks	15.8:1

Source: Regional Transportation Management Center

*The benefit/cost calculations are not directly comparable due to the differing assumptions and methods used between agencies. MnDOT's benefit/cost ratio was calculated more conservatively than other metro areas.

C. Institutional Conflict

One challenge with incident management is institutional conflict. Public safety agencies tend to have one set of priorities while transportation agencies have a different one. Besides tending to the injured and dealing with fuel spills, public safety agencies are concerned about thoroughly investigating and documenting major accidents, which can take considerable time.

Transportation agencies are concerned with the huge delay costs imposed on cars, buses and delivery trucks that use the highways. In most states, including California, public safety agencies are either legally or de-facto in charge at incidents, which means that minimizing delay to the traveling public does not receive priority. This is less the case on certain toll roads such as California's 91 Express Lanes, with a different approach to clearing incidents. The National Cooperative Highway Research Program published a synthesis report on safe, quick clearance of traffic incidents that detailed four steps municipalities can take to minimize the accident delays.[168]

- Quick clearance legislation;
- Hold harmless law for incident responders;
- Fatality certification law;
- Interagency agreements (open roads policy).

Quick clearance is the process of rapidly and safely removing temporary obstructions including wrecked vehicles, debris and spilled cargo. All states have some type of quick clearance legislation.

A hold harmless law is formal legislation that protects the public, emergency responders, and in many cases all on-scene responders from liability "in the absence of gross

negligence" as a result of their actions. California has one of the most comprehensive hold harmless laws in the country that protects all on-scene responders from liability. California's law in this area serves as a national model.

On the other hand, California does not permit the certification of a fatality and removal of the body by anyone other than a medical examiner—yet such policies can make a major difference in accident clearance times. A growing number of jurisdictions have such policies, including the city of Chicago and the states of Maryland, Tennessee and Texas.

Likewise, only a few states have developed enhanced interagency agreements that make quick clearance the overarching priority, commonly termed an "open roads policy." Some states including Connecticut, Florida, Georgia, Maryland, Tennessee, Washington and Wisconsin have formal open roads policies—but California does not.

California policymakers should pursue the enactment of a fatality certification law and development of an open roads policy among Caltrans, county and local DOTs and public safety agencies.

D. Operations Management and ITS in Critical Expressway Situations

ITS can help reduce congestion and increase safety on most every road in most any situation. However, there are two situations—highway construction zones and winter weather—where they are especially useful.

Highway construction zones are another key source of delay, as well as a safety concern.[169] There are two different types of highway construction: routine resurfacing and major reconstruction projects. Both can be managed in ways that minimize the delay caused to motorists. For example, Caltrans schedules and performs work during off-peak periods and at night, where possible.

Routine resurfacing must be completed periodically to maintain the life of the pavement, thereby preventing major reconstruction before it is really necessary. On highly congested expressways, such resurfacing operations should not be completed during peak traffic periods, because the loss of lane capacity imposes too great a cost on users. But since "peak" periods in California can last 12 hours or more and occur on weekends as well, this means such resurfacing must be completed at night and during the early mornings and late afternoons on weekends. The additional cost of night and weekend operations is far less than the delay costs that would otherwise be imposed on highway users.

Major reconstruction projects impact roadways for a substantial period of time—typically several months to many years. When possible, all lanes on major expressways should be kept open. This might entail building temporary lanes, narrowing lanes and/or restricting certain vehicles. If lanes must be closed, the construction work should be carried out on a round-the-clock basis (24/7), with the idea of limiting the duration of construction to as short a time as possible. When such projects are constructed under design-build contracts, it is common to include significant financial incentives to complete the work on or before a target date, and such projects are often completed significantly ahead of the targeted completion date.

ITS systems in the vicinity of construction work zones can reduce delay and improve safety by reducing accidents and the delays associated with clearing them. Using design-build contracts to build these projects can limit delays because such contracts contain financial incentives to complete the work on or before a target date.

Winter weather is another substantial concern in the mountains north and east of Los Angeles. Caltrans posts traffic congestion and weather advisories. It could augment the program by suggesting alternate routes and quickly closing local roads that cannot be speedily treated.

E. Arterial ITS Assessment

Two principal operations strategies for arterials are traffic signal coordination and arterial access management. The Texas Transportation Institute data for the Los Angeles region's use of these strategies is presented in Table 39.

Table 39: Arterial Operations Management for Los Angeles Urbanized Area

Operations Strategy	2011	2010	2009	2008
Signal Coordination				
Percent miles of roadway	91%	90%	90%	91%
Annual delay reduction, (thousands of hours)	3,223	3,197	3,158	3,059
Arterial Access Management				
Percent miles of roadway	48%	48%	47%	48%
Annual delay reduction, (thousands of hours)	4,711	4,673	4,615	4,471
Annual delay saved per Peak Auto Commuters (hours)	9	9	9	9
Annual Congestion Cost Savings (millions)	1,316	1,306	1,425	1,676

Source: Texas A&M Transportation Institute

*As the Texas A&M Transportation Institute only measures Raised Medians, this understates the amount that access management reduces congestion.

1. Arterial Signal Coordination

The factor limiting arterial capacity (and hence increasing congestion) is intersection capacity, which defines arterial capacity.[170] Traffic signals that are used to control vehicular movements at the intersection of two roadways must, by design, reduce the capacity of both roadways by reducing the number of vehicles that can travel through an intersection during a particular time period. "Green time" is the time allotted to movements through the intersection and is usually expressed as a percentage. For example, if an arterial road has a capacity of 1,800 vehicles per hour per lane with no traffic signals, that same arterial would have a capacity of 1,080 vehicles per hour per lane, with that movement receiving green time for only 60% of the hour (0.60 X 1,800). Sixty percent is a relatively large amount of green time for any one movement to have. Taking into account the cross-street through movements, protected-turning movements, and lost time for clearance intervals, the amount of green time for major movements can easily fall below 50%. It is common for an arterial lane to have less than 50% of the capacity of its uninterrupted flow counterpart.

To reduce congestion, the base traffic light cycle must offer as much green time to the peak direction as possible. Traditionally, traffic engineers have used long traffic signals to extend green time on major arterial highways. As signal timing has become more precise, some engineers have shortened cycles to reduce delays on side streets while still maintaining a higher percentage of green time on arterial highways. This has the advantage of reducing wait times on side streets. But regardless of the approach chosen, it is imperative that traffic light cycles offer a high percentage of green time to traffic on arterial highways—especially the major arterial highways suggested in this report.

One way to give the peak direction as much green time as possible is to "educate" the signal on traffic configuration at any given time, so that it can customize signal timing to serve that traffic at that time most efficiently. Effective traffic signal optimization changes traffic-light signals based on traffic conditions. Highways are fitted with traffic cameras and in-road loop detectors that monitor traffic speeds and congestion. And the pavement near most traffic lights is fitted with loop detectors to notify the traffic light when a car is on a side street. The light will then not turn green for the side street unless the loop detects a car on the side street. Engineers in traffic control centers use the data from these devices to dynamically adjust traffic signals and other traffic control devices, such as reversible-traffic lanes. The sophistication of these systems continues to increase while the cost continues to decrease.

Traffic Signal Priority: ITS systems also enable transit (or traffic) signal priority (TSP), an operational strategy that reduces the delay transit vehicles experience at traffic signals.[171] TSP enables communication between buses and traffic signals, allowing a priority green light as they approach. There are many different types of TSP. These include

extending greens on the existing phase, altering phase sequences, and adding new phases that do not interrupt the overall traffic-signal synchronization loop. TSP has a limited effect on signal timing because it adjusts to normal timing and logic to serve a specific vehicle type. TSP can improve transit reliability, efficiency and mobility. It is important to remember that with TSP, a signal change is always optional; the computer or a traffic engineer in a control center can override the request. Moreover, the light cycle will include all phases for all movements—some of these phases may be shortened, but none will be eliminated.

Queue Jumps: Most TSP systems also use queue jumps. A queue jump is a roadway feature that provides a preference to certain vehicles—often transit vehicles—enabling them to bypass long queues (lines) at signalized intersections. Queue jumps are typically paired with signal-priority treatments, which give buses an early green light or extend a green light. An intersection with a queue jump provides an additional travel lane, which can be dedicated to transit vehicles or shared with right-turning vehicles on the approach to a signal. Specifically, queue jumps:

- Help buses to re-enter the traffic stream when a bus lane is ending;
- Allow buses to jump to the front of a queue at a traffic signal after they have picked up passengers at a bus stop; and
- Assist buses in crossing lanes ahead of other traffic to reach a left-turn lane without obstructions.

How does a queue jump work? When a bus reaches a red light in the right-turn lane with a queue jump and decides to use it, the bus receives a special signal to continue through the intersection. Sometimes the signal is instantaneous; other times the bus may have to stop completely and wait for a short period of time. The signal typically precedes the signal for other traffic in the same direction. Sometimes it will interrupt a signal for cross-traffic or for traffic turning left. Optimizing traffic signal timing and installing queue jumps are particularly helpful for BRT and other bus services operating on managed arterials.

The parts of Southern California that have used traffic-signal timing optimization have seen travel times decrease by 13%, delay decline by 21%, and traffic stops decrease by 30%.[172] However, other countries have much more advanced traffic signalization methods. London, England coordinates 3,000 traffic lights using computers to change signal times by just a few seconds to keep traffic moving in the case of accidents.[173] Beijing, China monitors its traffic and posts alternate routes for drivers based on real-time tracking of travel speeds using more than 10,000 taxis.[174]

The share of arterial-miles with signal coordination in the Los Angeles – Long Beach – Santa Ana urbanized area is estimated at 91% in the year 2011, resulting in annual delay

reduction benefits of about three million hours.[175] Similar to expressway ramp metering, the Los Angeles region has been highly successful in this area. However, in other portions of the region, the percentage is lower (78% in Riverside–San Bernardino, 70% in Lancaster—Palmdale and Oxnard-Ventura). There is potential to expand the use of signal coordination in these areas. While the average score nationwide was in the low 60s, there is still room to improve in Southern California.[176]

Increasing traffic signal coordination on arterials with a large percentage of vehicles moving in the peak direction is relatively simple if authorities use progression band signal coordination. In a recent signal timing study, the Bay Area Toll Authority in Northern California found that a progression band ("rolling green") of signals in the peak direction, can significantly reduce travel times. Signal timing is less effective on highly congested arterials where traffic is heavy in both directions, but for those arterials where flow is very directional, the benefit-cost ratio can be as high as 35 to 1, according to the Bay Area Toll Authority.[177] Reducing congestion by fixing this simple problem is a very cost-effective solution.

2. Arterial Access Management

Several access management strategies reduce congestion and increase safety.

Access management consists of a set of techniques that increase safety and improve traffic flow on major arterials. It typically includes strategies such as consolidating driveways to minimize disruptions to traffic flow, adding median turn lanes or turn restrictions, adding raised medians and adding acceleration and deceleration lanes.[178]

Because of limitations in readily available highway data, the Texas A&M Transportation Institute uses only the extent of raised medians as its measure of access management. This may understate the extent of congestion reduction since actual programs in urban areas may include other features (e.g, consolidating driveways or adding turn lanes). Nevertheless, data consistency allows for comparable measures across urbanized areas for raised medians. The Los Angeles urbanized area has a fairly significant percentage of principal arterial roadways with raised medians (48%) resulting in annual delay reduction benefits of about six million hours.[179] Nevertheless, there is still ample room to expand the use of this further. Riverside-San Bernardino has raised medians in 35% of its arterials, Lancaster-Palmdale has 13% and Oxnard-Ventura has 46%.

Raised medians are often controversial. Raised medians can make it more challenging to access businesses. They prevent left-turns at certain intersections, usually those without traffic signals. From a traffic management standpoint, during heavy traffic conditions such medians can increase recurrent congestion, due to the limits on storage capacity of left-turn

bays. Once they become full, additional left-turning traffic spills into the through lanes, adding to delays. But because raised medians also increase safety by reducing the number of conflict points (thereby reducing accidents), they reduce incident-related congestion. When analysts crunch the numbers, they find a net decrease in congestion from the addition of raised medians, and the safety benefits outweigh the left-bay storage capacity and business accessibility concerns.

Another access management strategy is *consolidating driveways* to minimize disruptions to traffic flow. An Iowa State survey recommends only two to three driveways for a 500-foot city block for roads with a 35 mile-per hour speed limit.[180] Roads with higher posted speed limits should have even fewer driveways.

Adding *median turn lanes* can also improve traffic flow and safety. The Federal Highway Administration found that left-turn lanes increase roadway capacity. A shared left-turn and through lane has about 40-60% of the capacity as a standard through lane.[181] Roadways that add a left-turn lane increase capacity by 25%. The same study also reported that left-turn lanes at intersections substantially reduce rear-end crashes. The research synthesis found that exclusive left-turn lanes reduced crashes by 50% while reducing rear end collisions 60-88%.

Overall, to reduce congestion this report recommends that major primary arterial highways should feature fewer access points through *restriction of left-turning motions*. Left-turning motions should be limited to grade-separated ramps and traffic signals. Side streets should either feature a traffic signal or allow only right-turn access to the primary regional arterial highway. A median or other barrier should separate traffic traveling in different directions. To compensate for fewer turning locations, turn lanes should be lengthened and all traffic signals should allow U-turn motions. Left-turn cycles should be lengthened to reduce queue time.

Where possible, major primary arterial highways should also feature *grade separations* at major side streets. For the purpose of this study, major side streets will typically have at least four through-lanes and average annual daily traffic volumes above 30,000 vehicles. There are several potential grade separations. The first is a full interchange with direct ramps for all turning motions. While this is the best option for two extremely busy roads, costs, aesthetics and neighborhood sentiments may make building full interchanges less than desirable in most situations. Another option is to build a grade separation where the main lanes of the major primary arterial highways travel over or under the side street. Side-street movements and vehicles turning left or right from the major primary arterial highway onto the side street will use a traffic light. Since through-traffic on the major primary arterial highway will use the grade separation, the traffic light will feature longer traffic signals for all other traffic movements.

Many of the techniques discussed in this chapter have been quantified in the NHCRP report referred to in Table 40.

Table 40: Leverage of Systems Operations and Management on Congestion

Problem	Percent of Total Delay	Strategy/Tools	Potential Effect (Percent of Total Delay Relieved)
Crashes & breakdowns	20-42%	Integrated freeway service patrol, incident management program	10-20%
Work zones	8-27%	Advanced work-zone traffic control; automated speed control	4-13%
Weather impacts	5-10%	Prediction/advisory, pre-treatment	2-5%
Uncoordinated Signals	4-13%	Regionwide re-timing	2-5%

Source: Steve Lockwood, "The 21st Century Operations-Oriented State DOT."

It is clear that various operations measures and ITS systems can address incident-related congestion, which is an important element of the region's overall congestion problem. Nevertheless, they can do little to resolve the large and growing mismatch between roadway capacity and travel demand that manifests itself as recurrent congestion.

Part 11

Funding and Financing

We have presented a comprehensive plan to reduce congestion and improve mobility. We have provided approximate costs of the plan and available funding sources. This part of the study summarizes and analyzes the total costs. The first section explains the current revenues available for construction of the highway and transit network. The second section details the total costs of each of our Southern California mobility plan elements.

A. Current Revenues

For the 2015 fiscal year Southern California will spend $9.1 billion on surface transportation.[182] While SCAG is not able to build all of the necessary projects, we believe the answer is not more taxpayer funding but rather greater use of tolling, greater use of P3s and separating the needs from the wants. Our plan is able to fund all of the region's needs without raising taxes.

B. Converting Today's Revenues to Nominal Revenues

For planning long-range expenditures, most transportation agencies convert present dollars to nominal (or year of expenditure) dollars. Table 41 shows the Reason plan's expenditures for capital and operational components in current dollars and inflation-adjusted nominal dollars.

Table 41: Reason Plan's Capital and Operation Components Expenditures

Component	Total Cost (2015 dollars)	Total Cost* Over 25 Years (nominal)
New surface expressways/tunnels	$67.5B	$97.2B
Interchange reconstruction—Expressway	$2.9B	$4.1B
Interchange reconstruction—Arterial	$10.8B	$15.6B
Express toll lanes	$72.9B	$105.0B
Express toll lane interchanges	$16.7B	$24.0B
Managed arterials widening(s)	$11.5B	$16.5B
Managed arterials optional tolled grade separations	$23.4B	$33.7B
Managed arterials new alignments	$2.0B	$2.9B
Transit capital	$29.7B	$42.7B
Intelligent transportation systems	$6.9B	$10.0B
Total	**$244.3B**	**$351.7B**

C. Future Projections

Over the next 25 years, SCAG projects transportation spending will total approximately $21 billion (in nominal dollars) per year. Of the total, approximately $12 billion of the annual spending is based on revenue collected and indexed for inflation today with the remaining $9 billion per year based on assumed new revenue.[183]

Of the SCAG region's constrained spending (spending supported by current taxes and tolls), approximately 53% of the total comes from local sources, 25% comes from state sources and 22% comes from federal sources.[184]

Tables 42, 43 and 44 break down the core revenue from existing sources by level of government. Totals have then been converted to reflect a nominal dollars range for 2015-2040.

Table 42: Core Local Revenue Over 25 Years (in Nominal Dollars) in Billions

Local Programs	Funding	Percent
Local Sales Tax	$119.4	53%
Transportation Development Act	$28.7	13%
Farebox Revenue	$26.7	12%
Highway Tolls	$11.2	5%
Mitigation Fees	$9.5	4%
Gas Tax Subvention	$4.6	2%
Other Local	$25.5	11%
Total	$225.6 **($260.3)**	**100%**

Table 43: Core State Revenue Over 25 Years (in Nominal Dollars) in Billions

State Programs	Funding	Percent
State Highway Operation and Protection Program	$19.5	41%
State Gasoline Tax Swap	$11.0	24%
State Transportation Improvement Program	$9.4	20%
Prop 1B Bonds	$3.4	7%
State Transit Assistance	$2.8	6%
Other State	$0.8	2%
Total	$46.9 **($54.2)**	**100%**

Table 44: Core National Revenue Over 25 Years (in Nominal Dollars) in Billions

Federal Programs	Funding	Percent
Federal Transit Administration Formula	$14.2	43%
Surface Transportation Program	$6.7	21%
Federal Transit Administration Discretionary	$5.3	16%
Congestion Mitigation and Air Quality	$5.0	15%
Other Federal	$1.8	5%
Total	$33 **($38.1)**	**100%**

SCAG also proposes a number of new potential revenue sources. While this revenue is assumed it is by no means guaranteed. Any future revenue depends on the willingness of politicians and the taxpayers to implement new or different taxes and user fees. The

proposed programs comprising the $254 billion in new funding are detailed in the following table.

Table 45: SCAG's New Revenue Sources Over 25 Years (in Nominal Dollars) in Billions

Program	Government Level	Funding
Local Sales Tax Bond Proceeds	Local	$25.6
State and Federal Gas Excise Tax Adjustment	Federal/State	$16.9
Mileage-Based User Fees	Federal, State	$110.3
Highway Tolls	Local	$22.3
Private Equity Participation	Local	$2.7
Freight Fee/National Freight Program	Federal, State, Local	$4.2
E-Commerce Tax	State	$3.1
Interest Earnings	Local	$0.2
State Bond Proceeds	State	$33.0
Value Capture Strategies	Local	$1.2

There are several problems with this funding strategy. First, before California looks for substantial new revenue or significantly increases taxes, the region should strive to maximize its existing resources. The state is continually ranked in the bottom in terms of highest cost per mile, highest salaries and reluctance to try innovative methods. Second, many of these new revenue sources are unlikely to come to fruition. The federal government is unlikely to both increase the gas tax and enact a new freight fee. It is more likely to be one or the other. The $254 billion figure assumes that all of these transportation tax increases will pass, which is also unlikely. Third, this strategy assumes that all of these new taxes will be added to existing taxes. As a result, the expectation of $606 billion of revenue over 25 years appears extremely unrealistic.

Our mobility plan examines what can be accomplished with the existing $352 billion in current revenue. Given the uncertainty about future federal funding, we believe this is the most prudent course of action.

D. Changes to Transportation Funding and Finance

The following section will present our recommendations on how Southern California can use its existing resources to fund the suggested transportation improvements. Our Southern California Mobility plan, not including tolling, costs $361.9 billion (inflation-adjusted) funding over 25 years. However, since our plan features an extensive network of optional variably priced highway lanes and optional tolled grade separations to bypass the most congested surface street intersections, an additional $32.2 billion is provided through toll revenue. This allows the other funding sources to be stretched further, funding more critically important projects. Table 46 details each component of our plan.

Table 46: Reason Plan Components and Costs (in Nominal Dollars)

Component	Total Cost (nominal)	Cost Covered by Tolls	SCAG Projected Revenue Collection
New surface expressways/tunnels*	$97.2B	$97.2B	$0B
Expressway interchanges reconfiguration	$4.1B	$0B	$4.1B
Arterial/local road capital	$74B	$0B	$74B
Arterial interchange reconstruction	$15.6B	$0B	$15.6B
Express toll lanes	$105.0B	$105.0B	$0B
Express toll lane interchanges	$24.0B	$24.0B	$0B
Managed arterials widening(s)	$16.5B	$16.5B	$0B
Managed arterials optional tolled grade separations	$33.7B	$33.7B	$0B
Managed arterials new alignments	$2.9B	$2.9B	$0B
Contingency	$32.5B	$32.5B	$0B
Transit capital/bus	$42.7B	$0B	$42.7B
Roadway operations and maintenance	$90.5B	$0B	$90.5B
Transit operations and maintenance	$102.4B	$0B	$102.4B
Intelligent transportation systems	$10B	$0B	$10B
Active transportation	$7.7B	$0B	$7.7B
Transportation demand management	$5.2B	$0B	$5.2B
Debt service	$50.1B	$50.1B	$0B
Total	**$714.1B**	**$361.9B**	**$352.2B**

There are significant differences between Reason's plan and SCAG's existing 2012 plan. By using tolling to secure $362 billion in resources, more than half of the plan's total funding, Reason's proposal is able to stretch limited taxpayer resources further and support approximately twice as much investment as SCAG's revenue-constrained plan. Our plan does not have to choose between roadways and transit. It is able to invest significant resources in both.

Reason's funding mechanisms are both more effective and more realistic from a political point of view. Our plan fully funds these improvements with existing resources. It does not require a tax increase. In fact, by using tolls the Reason plan provides more funding without a tax increase than SCAG's plan provides with a tax increase. And since electronic toll lanes and particularly managed arterials traffic forecasts can be challenging to predict, the Reason plan includes a large contingency in case actual traffic counts are lower than projections. By including the congestion reduction components of the SCAG plan, prioritizing the construction of a complete transit network, and including additional projects that reduce congestion, our plan more effectively increases mobility. Table 48 below compares Reason's Plan with SCAG's plan per year. Table 47 compares the plans over the 25-year timeframe.

The Reason plan presents a fiscally conservative method of supporting transportation infrastructure improvements, using tolling to stretch resources further. Combining tolling with existing revenue, our plan provides more resources without a tax increase than SCAG's plan does if all the tax increases are approved.

Table 47: Reason's Plan versus SCAG's Plan Total Funding

Category	Reason	SCAG*
Roadway Capital Projects (Expressway, Arterial and Local non-tolling)	$93.7B	$102.7B
Toll Projects	$279.3B	$55.6B
Contingency	$32.5B	$0
Transit Capital Projects	$42.7B	$123.3B
Intelligent Transportation Systems	$10.0B	$8.8B
Active Transportation	$7.7B	$7.7B
Transportation Demand Management	$5.2B	$5.2B
Roadway Operations and Maintenance	$90.5B	$89.5B
Transit Operations and Maintenance	$102.4B	$160.7B
Debt Service	$50.1B	$52.0B
Total	**$714.1B**	**$605.5B**

*Uses SCAG's projected revenue with tax increases

Table 48: Reason's Plan versus SCAG's Plan Annual Funding

Category	Reason	SCAG*
Roadway Capital Projects (Arterial and Local non-tolling)	$3.8B	$4.1B
Toll Projects	$10.9B	$2.2B
Contingency	$1.3B	$0B
Transit Capital Projects	$1.7B	$4.9B
Intelligent Transportation Systems	$0.4B	$0.4B
Active Transportation	$0.3B	$0.3B
Transportation Demand Management	$0.2B	$0.2B
Roadway Operations and Maintenance	$3.6B	$3.6B
Transit Operations and Maintenance	$4.1B	$6.4B
Debt Service	$2.0B	$2.1B
Total	**$28.3B**	**$24.2B**

*Uses SCAG's projected revenue with tax increases

E. Mileage-Based User Fees

The Reason study agrees with SCAG's recommendation to transition from gas taxes to mileage-based user fees (MBUFs) to provide a sustainable long-term source of transportation funds. However, MBUFs should be used to replace—not supplement—gas taxes. While the SCAG study counts on MBUFs for significant funding (which is highly speculative at this point), our proposal calls for significant implementation of per-mile charges in the form of per-mile tolls for large fractions of the proposed new highway capacity. Appendix F includes more details on mileage-based user fees.

Part 12

Conclusions and Recommendations

This report provides a detailed framework for major mobility improvements for the entire Los Angeles metro area. With a lack of mobility remaining the Southern California's largest transportation problem, the region's productivity, economic base and quality of life are threatened by a poorly functioning transportation system.

Southern California is at a crossroads in transportation policy. Implementing the current SCAG LRP will lead to a future of higher taxes with little relief from congestion. The plan would continue to spend large amounts of resources on rail transit while starving bus transit and only marginally increasing transit ridership.

In contrast, we have proposed a comprehensive transportation system consisting of roadway and transit improvements that would reduce congestion and improve mobility far more effectively than the 2012 SCAG plan. Additionally, our plan fully funds these improvements with existing resources. It does not require tax increases. By including and supplementing the congestion reduction components of the SCAG plan and replacing the ineffective transit components with projects that cost-effectively improve transit service, our plan more effectively increases mobility.

Our plan spends $19.7 billion (in nominal dollars) to improve expressway-expressway and expressway-arterial bottlenecks. These targeted funds will reduce congestion at many of the busiest interchanges in the region. Relieving congestion at these interchanges will help reduce delay in the entire corridor and bring more reliability to bus service.

Our plan spends $105 billion (in nominal dollars) building a region-wide network of express toll lanes. All current HOV lanes, which operate with either too few or too many vehicles in them, would be converted to express toll lanes. The remainder of the network would be new construction. Direct express toll-lane-to-toll-lane ramps will be built at major interchanges to allow commuters to avoid congestion. These ramps will allow vehicles to travel on multiple expressways without having to exit the express lanes.

These toll lanes/intersections are completely voluntary. All commuters can continue to use the free general purpose lanes. All toll lanes are HOV conversions or new lanes. No general purpose lanes are converted to toll lanes.

Managed arterials, featuring optional tolled underpasses, are also a vital part of the plan. The plan devotes $33.7 billion to building 559 tolled grade separations on major arterials. It would also spend $16.5 billion widening limited sections of these arterials and converting some parking lanes to travel lanes to maximize throughput on these roadways. Finally, the plan devotes $2.9 billion to missing links on these arterials to ensure each is continuous.

As with toll lanes/interchanges, usage of these managed arterials is completely voluntary. All commuters can continue to travel through arterial intersections at grade for free. Further, some of the managed arterial upgrades will improve mobility even for vehicles that do not use the tolled grade separations.

The six major projects to close gaps in the regional expressway system invest $97.2 billion in current year dollars. These projects provide 681 new lane-miles of priced highway capacity in strategic locations throughout the region. By the year 2035, these projects would save over 1.0 million vehicle-miles traveled every weekday. The projects would generate more than $90 million in net revenue, providing 93% of the total cost of the network and 100% of the operational costs.

Our plan also outlines how to develop a comprehensive regional local bus, limited-stop bus, express bus and BRT network, all of which are critical. The region needs to build on the success of L.A. Metro BRT-lite lines by expanding the network and improving the signal priority system. The region needs to expand the number of express buses, and to more effectively integrate its existing rail services with existing and new bus services. Both express bus and BRT can take advantages of the managed lanes and managed arterials without having to pay tolls in order to decrease travel times and increase reliability. These factors should make the buses even more successful, increasing both ridership and farebox rate of return. Figure 40 presents a full map of our plan.

Increased mobility in Southern California will also require an investment in operations management, particularly active traffic management and Intelligent Transportation Systems. Active traffic management involves signal coordination, ramp metering, speed harmonization and junction control. By optimizing signal length and traffic speeds, active traffic management systems reduce congestion on expressways and surface streets. Most importantly, operations management will smooth traffic flows in the express lanes and reduce congestion on the managed arterials. Additionally, operations management systems, including queue jumps, are some of the most cost-effective transportation improvements.

Figure 40: Map of Reason's Southern California Mobility Plan Elements

The express lanes, the managed arterials and the six gap-closing expressway projects each meets the definition of a "mega-project" (a single project that costs over $500 million). Successfully managing costs and revenues is crucial to the success of such projects. Innovative financing and management strategies are needed to manage the inherent risks in building the system. The two major risks frequently seen with such projects are cost overruns and traffic/revenue shortfalls. The private sector can play a critical role in meeting these needs if contracts and long-term agreements are structured properly through public-private partnerships (PPPs).

Our plan, adjusted for inflation, costs $714.1 billion over 25 years. SCAG's plan, adjusted for inflation, costs $605.5 billion. While SCAG's plan requires significant new funding, our plan improves mobility by using tolling to provide almost half of all revenue and by focusing on needs, not wants. In fact, our plan provides more total revenue without a tax increase than SCAG's plan includes with a tax increase. Most significantly, our plan more effectively improves mobility for all transportation system users.

Congestion is strangling Southern California, destroying its viability as a place to live and work, as well as its position as a major economic center. But as former Transportation Secretary Norm Mineta said, "Congestion is not a scientific mystery, nor is it an uncontrollable force. Congestion results from poor policy choices and a failure to separate solutions that are effective from those that are not." The policy choices recommended in this report would reduce congestion and improve mobility in Southern California. The region must choose if it wants to embark on a different road to fix its transportation solutions or stay on the road to bad congestion, limited mobility and economic problems.

About the Author

Baruch Feigenbaum is assistant director of transportation policy at Reason Foundation a non-profit think tank advancing free minds and free markets. Feigenbaum has a diverse background researching and implementing transportation issues including public-private partnerships, highways, transit, high-speed rail, ports, intelligent transportation systems, land use and local policymaking.

Feigenbaum is involved with various transportation organizations. He is a member of the Transportation Research Board Bus Transit Systems and Intelligent Transportation Systems Committees. He is Vice President of Membership for the Transportation and Research Forum Washington Chapter. Feigenbaum is also a member of the American Planning Association, Institute of Transportation Engineers, and Young Professionals in Transportation. He has appeared on NBC Nightly News and CNBC. His work has been featured in the *Washington Post* and *The Wall Street Journal.*

Prior to joining Reason, Feigenbaum handled transportation issues on Capitol Hill for Representative Lynn Westmoreland. He earned his Master's degree in Transportation from the Georgia Institute of Technology.

Appendix A: Bottleneck Removal

Appendix A is a detailed listing of the components of bottleneck removal. Table A1 lists each of the components of interchange-to-interchange bottleneck improvements and their costs. Table A2 shows the expressway/arterial bottleneck improvements and the cost for each project.

Table A1: Interchange-to-Interchange Bottleneck Projects: Component Costs

Interchange	Movement	Change	Cost
I-10 at I-110	I-110N to I-10W	Eliminate loop	$75M
	I-110N to I-10E	Widen to 2 lanes	$15M
	I-110S to I-10E	Widen to 2 lanes, eliminate loop and extend merge lane	$83.6M
	I-10E to I-110S	Widen to 2 lanes	$20M
	I-10E to I-110N	Widen to 3 lanes, move exit to right side of road	$100M
	I-10W to I-110S	Widen to 2 lanes	$75M
	I-10W to I-110N	Widen to 2 lanes and extend merge lane	$28.6M
I-10 at I-405	I-10W to I-405S	Widen to 2 lanes	$75M
	I-10W to I-405N	Widen to 3 lanes and extend merge lane	$33.6M
	I-10E to I-405S	Widen to 2 lanes	$15M
	I-10E to I-405N	Widen to 2 lanes	$75M
	I-405S to I-10W	Widen to 2 lanes	$15M
	I-405S to I-10E	Widen to 3 lanes	$95M
	I-405N to I-10W	Widen to 2 lanes	$75M
	I-405N to I-10E	Widen to 2 lanes	$15M
	I-10W between I-405 and SR 1S	Add 1 lane	$51.3M
	I-10E between I-405 and SR 1S	Add 1 lane	$56.5M
I-5 at I-10, US 101 and SR 60	I-5N to I-10W	Widen to 2 lanes, move merge to right side	$85M
	I-10W merge with I-5N	Move to right side of highway	$90M
	I-5N between I-10W off-ramp and I-10E off-ramp	Add 1 lane	$17M
	I-5S between I-10E on-ramp and I-10W off-ramp	Add 1 lane	$17M
	I-5S to SR 60E	Widen to 2 lanes, move merge to right side	$75M
	I-10W to I-5N	Widen to 3 lanes	$25M
	I-10E to I-5S	Widen to 3 lanes, move merge to right side	$45M
	SR 60W to I-5N	Widen to 2 lanes	$25M
	I-10/US 101 Conn from US101 to I-5	Add 1 lane in each direction	$17M
US 101 at SR 110	SR 110N to US 101N	Widen to 3 lanes	$95M
	US 101S to SR 110S	Widen to 2 lanes	$23.6M
I-405 at US 101	I-405N to US 101N	Widen to 3 lanes, move merge to right side	$115M
	US 101S to I-405S	Widen to 3 lanes	$35M
I-5 at I-605	I-5S to I-605S	Widen to 3 lanes and extend merge	$47.1M
	I-5S to I-605N	Widen to 2 lanes, eliminate loop	$75M
	I-5N to I-605S	Widen to 2 lanes, eliminate loop	$75M
	I-5N to I-605N	Widen to 2 lanes and extend merge	$42.1M
	I-605N to I-5N	Widen to 3 lanes	$95M
I-5 at I-710	I-710N to I-5N	Widen to 3 lanes, move merge to right	$95M
	I-5S to I-710S	Widen to 3 lanes	$25M
I-10 at I-605	I-10W to I-605S	Widen to 3 lanes, extend merge and move it to the right	$103.6M
	I-10E to I-605N	Widen to 2 lanes, eliminate loop	$75M
	I-605N to I-10E	Widen to 3 lanes	$25M
	I-605N to I-10W	Eliminate loop	$75M
	I-605S to I-10W	Widen to 2 lanes and extend merge	$23.6M
I-605 at SR 60	I-605N to SR 60W	Eliminate loop	$75M
	I-605N to SR 60E	Widen to 3 lanes	$25M
	I-605S to SR 60W	Widen to 3 lanes	$25M
	I-605S to SR 60E	Widen to 2 lanes, eliminate loop	$75M

Table A1: Interchange-to-Interchange Bottleneck Projects: Component Costs

Interchange	Movement	Change	Cost
	SR 60W to I-605S	Widen to 2 lanes	$10M
	SR 60W to I-605N	Widen to 3 lanes	$95M
	SR 60E to I-605S	Widen to 3 lanes	$95M
I-5 at SR 55	I-5S to SR 55S	Widen to 3 lanes	$25M
	I-5N to SR 55N	Widen to 3 lanes	$25M
	I-5N to SR 55S	Widen to 2 lanes, eliminate loop	$75M
	SR 55S to I-5S	Widen to 3 lanes and extend merge	$112.1M
	SR 55N to I-5N	Widen to 3 lanes and extend merge	$112.1M
Total			**$3.07B**

Table A2: New and Modified Expressways and Interchanges

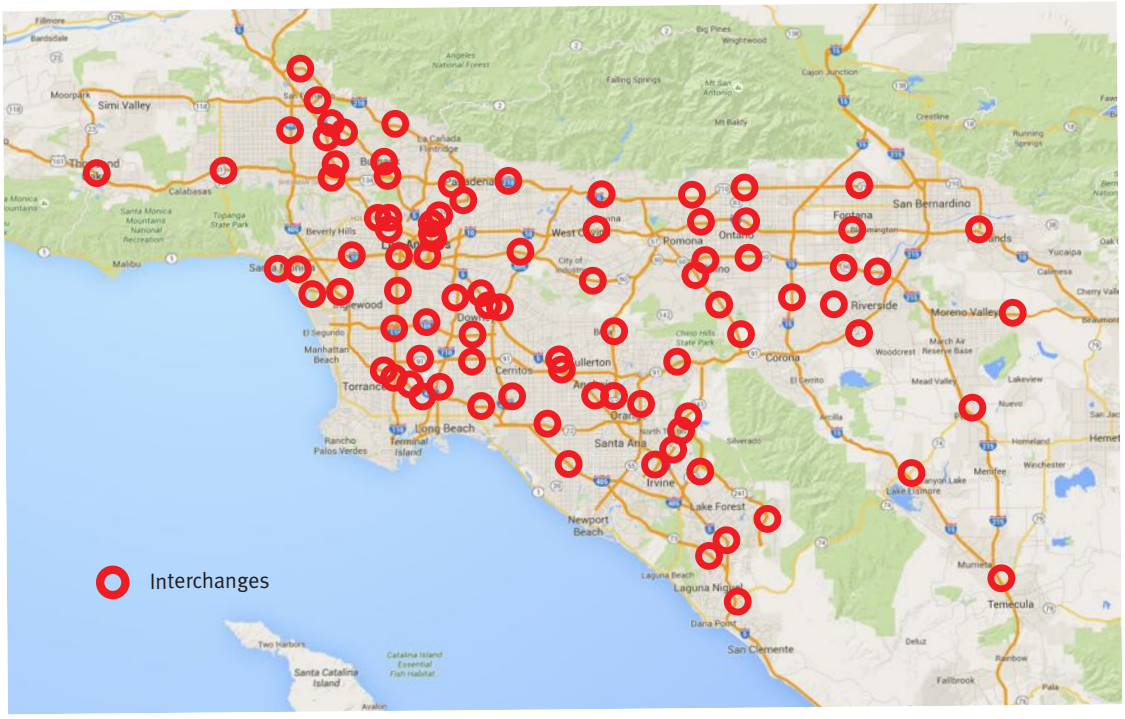
Interchange	Cost
Roscoe Blvd at I-405	$160 M
Roscoe Blvd at SR 170	$12M
Tuxford Rd at I-5	$144M
La Tuna Canyon Rd at I-210 Interchange	$120M
Santa Monica Blvd at US 101 Interchange	$160M
Sunset Blvd at SR 110 Interchange	$24M
Grevelia St at SR 110/Fair Oaks Ave	$40M
SR 90 at Mindanao Way	$48M
Slauson Ave at I-110	$160M
Slauson Ave at I-710	$208M
Slauson Ave at I-5	$160M
Telegraph Rd at I-605	$120M
Imperial Highway at SR 57	$80M
Chino Hills Parkway at SR 71	$160M
Limonite Ave at I-15	$160M
Riverview Dr at SR 60	$104M
Carson St at I-110	$160M
Carson St at I-405	$160M
Carson St at I-710	$208M
Carson St at I-605	$80M
Ball Rd at I-5	$196M
Ball Rd at SR 57	$80M
Taft Ave at SR 55	$208M
Santiago Canyon Rd at SR 241/SR 261	$40M
Warner Ave at I-405	$80M
Warner Ave at SR 55	$208M
Edinger Ave at Tustin Ranch Rd	$52M
Tustin Ranch Rd at I-5	$160M
Portola Parkway at SR 261	$160M
Portola Parkway at SR 133	$160M
Alicia Parkway at SR 73	$208M
Alicia Parkway at I-5	$80M
Santa Margarita Parkway at SR 241	$132M
SR 74 at I-5	$120M
SR 74 at I-15	$160M
SR 74W at I-215	$40M
SR 23S at US 101	$80M
SR 1 at SR 90	$80M
SR 1S at I-10	$80M
SR 27 at US 101	$12M
La Cienega Blvd at I-405	$52M
La Cienega Blvd at I-10	$160M
Laurel Canyon Blvd at US 101	$160M
Laurel Canyon Blvd at SR 170	$196M
Laurel Canyon Blvd at I-5	$160M
San Fernando Blvd at SR 118	$160M
Alameda St at I-405	$208M

Table A2: New and Modified Expressways and Interchanges

Interchange	Cost
Alameda St at SR 91	$144M
Alameda St at I-105	$208M
Alameda St at I-10	$208M
Alameda St at US 101	$208M
Broadway at I-5	$160M
Pasadena Ave at SR 110	$208M
Figueroa St at SR 134	$12M
Lakewood Blvd at SR 91	$80M
Lakewood Blvd at I-105	$112M
Lakewood Blvd at I-5	$80M
Rosemead Blvd at SR 60	$80M
Rosemead Blvd at I-210	$208M
Western Ave at I-405	$116M
Western Ave at I-105	$208M
Western Ave at I-10	$160M
Western Ave at US 101	$196M
Buena Vista St at SR 134	$172M
Buena Vista St at I-5	$144M
Glen Oaks Blvd at SR 118	$208M
Glen Oaks Blvd at I-210	$110M
Beach Blvd at SR 22	$80M
Beach Blvd at SR 91	$80M
Beach Blvd at I-5	$144M
Azusa Ave at SR 60	$80M
Azusa Ave at I-10	$80M
Azusa Ave at I-210	$80M
Fairmont Blvd at SR 91	$158M (includes bridge)
Peyton Dr at SR 71	$172M
Towne Ave at SR 60	$208M
Towne Ave at I-10	$160M
Towne Ave at I-210	$80M
Euclid Ave at SR 71	$40M
Euclid Ave at SR 60	$160M
Euclid Ave at I-10	$132M
Euclid Ave at I-210	$208M
Van Buren Blvd at SR 91	$132M
Van Buren Blvd at SR 60	$132M
Van Buren Blvd at Limonite Ave	$12M
Sierra Ave at I-10	$160M
Sierra Ave at I-210	$40M
SR 79 at I-15	$40M
Theodore St at SR 60	$52M
Tennessee St at I-10/I-210	$192M
SR 1 at San Vicente Rd	$104M
Total	**$11.6B**

Note: Current figures are in 2015 numbers. This table breaks down the projects. Some will be completed in 2020 while others may not happen until 2035. As a result there is no point in converting them all to nominal because it won't make the totals any more accurate than if they are in 2015 numbers.

Figure A1: Map of Improved Interchanges



Appendix B: Express Lane Details

Appendix B begins by delineating each of the components in the express lane network additions and conversions as well as the express lane-express lanes ramps. Table B1 lists the new lanes that need to be added to the network and the current HOV lanes that need to be converted to express lanes. Table B2 lists each of the expressway-expressway lane ramps needed. Both tables show the location of the interchange, the scope of work, and cost.

This is followed by a detailed explanation of how we arrived at and how we calculated the costs for building the express lane network and the revenue collected from the express lane tolling.

Then we address express lanes revenue and costs. Table B3 provides the revenue and Table B4 shows the cost. Both of the spreadsheets used to calculate express lane figures are included in these two tables.

Table B1: Major Express Lane Additions

County	Route	From	To	Scope	Lane- Miles	Cost
Los Angeles, Orange	I-5	San Diego North County Line	Camino Capistrano Rd	Add 1 HOT lane in each direction (2 HOT lanes total)	2 new ln (7.5) 15.0 lm	$269.3M
		Camino Capistrano Rd	San Juan Creek Rd	Add 2 HOT lanes in each direction (4 HOT lanes total)	4 new ln (1.2) 4.8 lm	$84.9M
		San Juan Creek Rd	Crown Valley Parkway	Add 1 HOT lane in each direction and convert HOV lanes to HOT lanes (4 HOT lanes total)	2 new ln (5.1) 2 exs ln (5.1) 20.4 lm	$266.2M
		Crown Valley Parkway	I-405 North	Add 2 HOT lanes in each direction and convert HOV lanes to HOT lanes (6 HOT lanes total)	4 new ln (7.5) 2 exs ln (7.5) 45.0 lm	$648M
		I-405 North	SR 261/Jamboree Rd	Add 1 HOT lane in each direction and convert HOV lanes to HOT lanes (4 HOT lanes total)	2 new ln (6.1) 2 exs ln (6.1) 24.4 lm	$476M
		SR 261/Jamboree Rd	SR 22/SR 57	Add 2 HOT lanes in each direction and convert HOV lanes to HOT lanes (4 HOT lanes total)	4 new ln (6.7) 2 exs ln (6.7) 40.2 lm	$779.2M
		SR 22/SR 57	SR 39	Add 1 HOT lane in each direction and convert existing HOV lanes to HOT lanes (4 HOT lanes total)	2 new ln (9.4) 2 exs ln (9.4) 37.6 lm	$740M
		SR 39	Artesia Blvd	Add 2 HOT lanes in each direction (4 HOT lanes total)	4 new ln (0.9) 3.6 lm	$83.9M

Table B1: Major Express Lane Additions

County	Route	From	To	Scope	Lane- Miles	Cost
		Artesia Blvd	Florence Ave	Add 1 HOT lane in each direction and convert existing HOV lanes to HOT lanes (4 HOT lanes total)	2 exs ln (6.5) 2 new ln (6.5) 26.0 lm	$507M
		Florence Ave	SR 134	Add 2 HOT lanes in each direction (4 HOT lanes total)	4 new ln (20.6) 82.4 lm	$2,027M
		SR 134	Alameda Ave	Add 1 HOT lane in each direction and convert existing HOV lanes to HOT lanes (4 HOT lanes total)	2 new ln (4.5) 2 exs ln (4.5) 18.0 lm	$351M
		Alameda Ave	Brand Blvd	Add 2 HOT lanes in each direction (4 HOT lanes total)	4 new ln (11.6) 46.4 lm	$923.3M
		Brand Blvd	I-405	Convert existing HOV lanes to HOT lanes (2 HOT lanes total)	2 exs ln (1.6) 3.2 lm	$27.7M
		I-405	SR 14	Add 1 HOT lane in each direction and convert existing HOV lanes to HOT lanes (4 HOT lanes total)	2 new ln (3.8) 2 exs ln (3.8) 15.2 lm	$198.4M
		SR 14	SR 126 West	Add 1 HOT lane in each direction (2 HOT lanes total)	2 new ln (9.8) 18.6 lm	$333.4M
Los Angeles San Bernardino	I-10	SR 1 North	New Tolled Tunnel/ Lincoln Blvd	Add 1 HOT lane in each direction (2 HOT lanes total)	2 new ln (0.8) 1.6 lm	$28.7M
		New Tolled Tunnel/ Lincoln Blvd	I-405	Add 2 HOT lanes in each direction (4 HOT lanes total)	4 new ln (3.3) 13.2 lm	$324.8M
		I-405	Crenshaw Blvd	Add 2 HOT lanes in each direction (4 HOT lanes total)	4 new ln (5.9) 23.6 lm	$580.6M
		Crenshaw Blvd	Hoover St	Add 3 HOT lanes in each direction (6 HOT lanes total)	6 new ln (2.9) 17.4 lm	$340.6M
		Hoover St	I-5 South	Add 2 HOT lanes in each direction (4 HOT lanes total)	4 new ln (4.0) 16.0 lm	$393.6M
		I-5 North	Puente Ave	Add 1 HOT lane in each direction (4 HOT lanes total)	2 new ln (14.9) 2 exs ln (14.9) 59.6 lm	$1,160.6M
		Puente Ave	SR 57/SR 71	Add 2 HOT lanes in each direction (4 HOT lanes total)	4 new ln (9.2) 36.8 lm	$905.3M
		SR 57/SR 71	I-215	Add 1 HOT lane in each direction and convert existing HOV lanes to HOT lanes (4 HOT lanes total)	2 new ln (29.8) 2 exs ln (29.8) 119.2 lm	$2,175.4M
		I-215	SR 38 North	Add 2 HOT lanes in each direction (4 HOT lanes total)	4 new ln (6.6) 26.4 lm	$467.3M
		SR 38 North	Indio Blvd	Add 1 HOT lane in each direction (2 HOT lanes total)	2 new ln (60.4) 120.8 lm	$2,168.4M
Riverside San Bernardino	I-15	SR 79 South	SR 79 North	Add 1 HOT lane in each direction (2 HOT lanes total)	2 new ln (3.2) 6.4 lm	$114.9M
		SR 79 North	I-215 North	Add 2 HOT lanes in each direction (4 HOT lanes total)	4 new ln (2.0) 8.0 lm	$141.6M

Table B1: Major Express Lane Additions

County	Route	From	To	Scope	Lane- Miles	Cost
		I-215 North	Cajalco Rd	Add 1 HOT lane in each direction (2 HOT lanes total)	2 new ln (28.1) 56.2 lm	$1,008.8M
		Cajalco Rd	SR 60	Add 2 HOT lanes in each direction (4 HOT lanes total)	4 new ln (14.7) 58.8 lm	$1,040.8M
		SR 60	I-210	Add 2 HOT lanes in each direction (4 HOT lanes total)	4 new ln (9.0) 36.0 lm	$886M
		I-210	I-215	Add 1 HOT lane in each direction (2 HOT lanes total)	2 new ln (8.3) 16.6 lm	$298M
		I-215	SR 138	Add 2 HOT lanes in each direction (4 HOT lanes total)	4 new ln (7.4) 29.6 lm	$523.9M
		SR 138	SR 18 East	Add 1 HOT lane in each direction (2 HOT lanes total)	2 new ln (20.3) 40.6 lm	$728.8M
Los Angeles	I-105	SR 1	I-405	Add 1 HOT lane in each direction (2 HOT lanes total)	2 new ln (1.6) 3.2 lm	$57.4M
		I-405	I-110	Add 1 HOT lane in each direction and convert existing HOV lanes to HOT lanes (4 HOT lanes total)	2 new ln (5.4) 2 exs ln (5.4) 21.6 lm	$281.9M
		I-110	I-710	Add 1 HOT lane in each direction and convert existing HOV lanes to HOT lanes (4 HOT lanes total)	2 new ln (7.4) 2 exs ln (7.4) 29.6 lm	$565.4M
		I-710	I-605	Add 1 HOT lane in each direction and convert existing HOV lanes to HOT lanes (4 HOT lanes total)	2 new ln (4.3) 2 exs ln (4.3) 17.2 lm	$224.5M
Los Angeles	I-110	Anaheim St	I-405	Add 1 HOT lane in each direction (2 HOT lanes total)	2 new ln (5.5) 11.0 lm	$197.5M
		I-405	½ mi. N of SR 91	Add 2 HOT lanes in each direction (4 HOT lanes total)	4 new ln (1.3) 5.2 lm	$127.9M
		1/2 mi. S of I-10	US 101	Add 2 HOT lanes in each direction (4 HOT lanes total)	4 new ln (2.5) 10 lm	$246M
		US 101	York Boulevard	Add 1 HOT lane in each direction (2 HOT lanes total)	2 new ln (5.7) 11.4 lm	$283.3M
Los Angeles, San Bernardino	I-210	I-5	I-710	Add 1 HOT lane in each direction (2 HOT lanes total)	2 new (24.9) 49.8 lm	$894M
		I-710	SR 57	Add 1 HOT lane in each direction, convert existing HOV lanes to HOT lanes (4 HOT lanes total)	2 new ln (19.7) 2 exs lan (19.7) 78.8 lm	$1,537M
		SR 57	I-215	Covert 1 HOV lane in each direction to HOT lane (2 HOT lanes total)	2 exs lan (29.5) 59.0 lm	$510.4M
		I-215	I-10	Add 1 HOT lane in each direction (2 HOT lanes total)	2 new ln (11.2) 22.4 lm	$402.1M
Riverside San Bernardino	I-215	I-15	SR 60 East	Add 1 HOT lane in each direction (2 HOT lanes total)	2 new ln (29.5) 59.0 lm	$1,059.1M

Table B1: Major Express Lane Additions

County	Route	From	To	Scope	Lane- Miles	Cost
		SR 60 East	SR 60 West	Add 1 HOT lane in each direction, convert existing HOV lanes to HOT lanes (4 HOT lanes total)	2 new ln (5.2) 2 exs ln (5.2) 20.8 lm	$405.6M
		SR 60 West	Orange Show Rd	Add 2 HOT lanes in each direction (4 HOT lanes total)	4 new ln (7.1) 28.4 lm	$698.7M
		Orange Show Rd	SR 259	Convert 1 HOV lane in each direction to HOT lane (2 HOT lanes total)	2 exs ln (3.5) 7.0 lm	$60.6M
Orange, Los Angeles	I-405	I-5	SR 73	Add 1 HOT lane in each direction, convert existing HOV lanes to HOT lanes (4 HOT lanes total)	2 exs ln (10.0) 2 new ln (10.0) 40.0 lm	$522M
		SR 73	Brookhurst St	Add 2 HOT lanes in each direction, covert existing HOV lanes to HOT lanes (6 HOT lanes total)	2 exs ln (3.5) 4 new ln (3.5) 21.0 lm	$395.9M
		Brookhurst St	SR 22 East	Add 1 HOT lane in each direction, covert existing HOV lanes to HOT lanes (4 HOT lanes total)	2 exs ln (7.0) 2 new ln (7.0) 28.0 lm	$542.5M
		SR 22 East	I-605	Add 2 HOT lanes in each direction, convert existing HOV lanes to HOT lanes (6 HOT lanes total)	2 exs ln (3.2) 4 new ln (3.2) 19.2 lm	$366.1M
		I-605	Rosecrans Ave	Add 1 HOT lane in each direction, convert existing HOV lanes to HOT lanes (4 HOT lanes total)	2 exs ln (19.2) 2 new ln (19.2) 76.8 lm	$1,482.2M
		Rosecrans Ave	Wilshire Blvd	Add 2 HOT lanes in each direction, convert existing HOV lanes to HOT lanes (6 HOT lanes total)	2 exs ln (12.4) 4 new ln (12.4) 74.4 lm	$1,422.3M
		Wilshire Blvd	SR 118	Add 1 HOT lane in each direction, convert existing HOV lanes to HOT lanes (4 HOT lanes total)	2 exs ln (15.3) 2 new ln (15.3) 61.2 lm	$1,193M
		SR 118	I-5	Convert 1 HOV lane in each direction to HOT lane (2 HOT lanes total)	2 exs ln (1.8) 3.6 lm	$31M
Los Angeles, Orange	I-605	I-405	I-10	Add 1 HOT lane in each direction, convert existing HOV lanes to HOT lanes (4 HOT lanes total)	2 exs ln (21.8) 2 new ln (21.8) 87.2 lm	$1,700M
		I-10	I-210	Add 2 HOT lanes in each direction (4 HOT lanes total)	4 new ln (5.6) 22.4 lm	$551M
Los Angeles	I-710	Pico Avenue	Shoreline Dr	Add 2 TOT lanes in each direction (4 TOT lanes)	4 new ln (0.9) 3.6 lm	$63.7M
		Shoreline Dr	Anaheim St	Add 1 HOT lane in each direction (2 HOT lanes)	2 new ln (0.3) 0.6 lm	$10.7M
		Anaheim St	I-405	Add 1 HOT lane and 1 GP lane in each direction 2 HOT lanes, 2 GP lanes)	4 new ln (3.0) 12 lm	$214.5M
		I-405	SR 60	Add 2 HOT lanes in each direction (4 HOT lanes)	4 new ln (15.2) 60.8 lm	$1,145.7M

Table B1: Major Express Lane Additions

County	Route	From	To	Scope	Lane- Miles	Cost
		SR 60	I-10	Add 1 HOT lane in each direction (2 HOT lanes)	2 new ln (1.9) 3.8 lm	$93.8M
		I-10	New Tunnel	Add 1 HOT lane in each direction (2 HOT lanes)	2 new ln (1.0) 2 lm	$49.5M
		New Tunnel	I-210	Add 1 HOT lane in each direction (2 HOT lanes)	2 new ln (0.7) 1.4 lm	$34.8M
Los Angeles, Ventura	US 101	I-5	I-10	Add 1 HOT lane in each direction (2 HOT lanes total)	2 new ln (1.8) 3.6 lm	$111.1M
		I-10	I-405	Add 2 HOT lanes in each direction (4 HOT lanes total)	4 new ln (17.2) 68.8 lm	$1,692.5M
		I-405	Tampa Ave	Add 3 HOT lanes in each direction (6 HOT lanes total)	6 new ln (5.1) 30.6 lm	$750.2M
		Tampa Ave	Wendy Dr.	Add 2 HOT lanes in each direction (4 HOT lanes total)	4 new ln (25.8) 103.2 lm	$2,538.7M
		Wendy Dr.	SR 33	Add 1 HOT lane in each direction (2 HOT lanes total)	2 new ln (23.0) 46.0 lm	$825.7M
Los Angeles	SR 2	Glendale Blvd	I-210/SR 510	Add 1 HOT lane in each direction (2 HOT lanes total)	2 new ln (8.9) 17.8 lm	$319.5M
Los Angeles	SR 14	I-5	Ave P-8	Convert 1 HOV lane in each direction to a HOT lane (2 HOT lanes total)	2 exs ln (35.8) 71.6 lm	$619.3M
		Ave P-8	Ave L	Add 1 HOT lane in each direction (2 HOT lanes total)	2 new ln (5.0) 10.0 lm	$86.5M
Orange	SR 22	I-405	SR 55	Add 1 HOT lane in each direction and convert existing HOV lanes to HOT lanes (4 HOT lanes total)	2 exs ln (12.7) 2 new ln (12.7) 50.8 lm	$1,264.9M
Orange	SR 55	19th St	I-405	Add 1 HOT lane in each direction (2 HOT lanes total)	2 new ln (4.0) 8.0 lm	$143.6M
		I-405	SR 91	Add 1 HOT lane in each direction convert existing HOV lanes to HOT lanes (4 HOT lanes total)	2 exs ln (11.8) 2 new ln (11.8) 47.2 lm	$920M
Orange, Los Angeles	SR 57	I-5	SR 60 West	Add 1 HOT lane in each direction, convert existing HOV lanes to HOT lanes (4 HOT lanes total)	2 exs ln (16.2) 2 new ln (16.2) 64.8 lm	$1,264M
		SR 60 East	I-10	Covert HOV lanes to HOT lanes (2 HOT lanes total)	2 exs ln (3.2) 6.4 lm	$55.4M
		I-10	I-210	Add 1 HOT lane in each direction, convert existing HOV lanes to HOT lanes (4 HOT lanes total)	2 exs ln (4.1) 2 new ln (4.1) 16.4 lm	$319.8M
Los Angeles, San Bernardino	SR 60	I-10	SR 57 South	Add 1 HOT lane in each direction, convert existing HOV lanes to HOT lanes (4 HOT lanes total)	2 exs ln (22.8) 2 new ln (22.8) 91.2 lm	$1,778M
		SR 57 South	SR 57 North	Add 2 HOT lanes in each direction, covert existing HOV lanes to HOT lanes (6 HOT lanes total)	2 exs ln (1.9) 4 new ln (1.9) 11.4 lm	$218M

Table B1: Major Express Lane Additions

County	Route	From	To	Scope	Lane- Miles	Cost
		SR 57 North	I-215 North	Add 1 HOT lane in each direction, covert existing HOV lanes to HOT lanes (4 HOT lanes total)	2 exs ln (26.8) 2 new ln (26.8) 107.2 lm	$2,069M
		I-215 South	Redlands Blvd	Convert HOV lanes to HOT lanes (2 HOT lanes total)	2 exs ln (7.8) 15.6 lm	$134.9M
Los Angeles, Riverside, San Bernardino	SR 71	SR 91	Butterfield Ranch Rd	Add 1 HOT lane in each direction (2 HOT lanes total)	2 new ln (3.5) 7.0 lm	$125.7M
		Butterfield Ranch Rd	SR 60	Convert existing HOV lanes to HOT lanes (2 HOT lanes total)	2 exs ln (8.3) 16.6 lm	$143.6M
		SR 60	I-10	Add 1 HOT lane in each direction (2 HOT lanes total)	2 new ln (4.4) 8.8 lm	$271.5M
Orange	SR 73	MacArthur Blvd	SR 55	Add 2 HOT lanes in each direction (4 HOT lanes total)	4 new ln (2.7) 10.8 lm	$191.2M
		SR 55	I-405	Add 1 HOT lane in each direction (2 HOT lanes total)	2 new ln (1.2) 2.4 lm	$43.1M
Orange, Riverside	SR 91	I-110	SR 55 South	Add 1 HOT lane in each direction and convert existing HOV lanes to HOT lanes (4 HOT lanes total)	2 exs ln (27.2) 2 new ln (27.2) 108.8 lm	$2,121.6M
		SR 55 South	SR 90	Add 1 HOT lane in each direction (6 HOT lanes total)	2 exs ln (2.4) 4 exs ln (2.4) 14.4 lm	$275.2M
		SR 90	I-15	2 HOT lanes in each direction	4 exs ln (14.9) 59.6 lm	$1,466.2M
		I-15	Van Buren Blvd	Add 1 HOT lane in each direction and convert existing HOV lanes to HOT lanes (4 HOT lanes total)	2 exs ln (6.6) 2 new ln (6.6) 26.4 lm	$514.8M
		Van Buren Blvd	I-215	Add 2 HOT lanes in each direction (4 HOT lanes total)	4 new ln (7.6) 30.4 lm	$419.7M
Ventura, Los Angeles	SR 118	First St	Los Angeles County Line	Add 1 HOT lane in each direction (2 HOT lanes total)	2 new ln (8.7) 17.4 lm	$312.3M
		Los Angeles County Line	Porter Ranch Rd	Convert existing HOV lanes to HOT lanes (2 HOT lanes total)	2 exs ln (3.8) 7.6 lm	$65.8M
		Porter Ranch Rd	I-5	Add 1 HOT lane in each direction and convert existing HOV lanes to HOT lanes (4 HOT lanes total)	2 exs ln (7.6) 2 new ln (7.6) 30.4 lm	$501.6M
		I-5	I-210	Add 1 HOT lane in each direction (2 HOT lanes total)	2 new ln (2.5) 5.0 lm	$171.1M
Los Angeles	SR 134	US 101	SR 2	Add 1 HOT lane in each direction and convert existing HOV lanes to HOT lanes (4 HOT lanes total)	2 exs ln (8.9) 2 new ln (8.9) 35.6 lm	$694.2M
		SR 2	I-210	Add 1 HOT lane in each direction and convert existing HOV lanes to HOT lanes (4 HOT lanes total)	2 exs ln (4.4) 2 new ln (4.4) 17.6 lm	$229.7M
Los	SR	US 101	Roscoe Blvd	Add 1 HOT lane in each	2 exs ln	$405.6M

Table B1: Major Express Lane Additions

County	Route	From	To	Scope	Lane- Miles	Cost
Angeles	170			direction and convert existing HOV lanes to HOT lanes (4 HOT lanes total)	(5.2) 2 new ln (5.2) 20.8 lm	
		Roscoe Blvd	I-5	Convert existing HOV lanes to HOT lanes (2 HOT lanes total)	2 exs ln (0.8) 1.6 lm	$49.4M
Express Lanes Total						$60.3B

Table B2: Truck Toll Lanes

County	Route	From	To	Scope	Lane- Miles	Cost
Los Angeles, San Bernardino	I-710, SR 60, I-15	Pico Ave	I-10	Add 2-4 TOT (truck-only tollway) lanes in each direction	2-4 new ln (50.8) 246.6 lm	**$12.6B**

Table B3: Interchange Movements

County	Route	Interchange	New Interchange Movements	Existing Motions	Cost
Los Angeles, Orange	I-5	SR 73	I-5N to SR 73N, SR 73S to I-5S	None	$90M
		I-405	None	I-5N to I-405N, I-405S to I-5S	$90M
		SR 133	I-5N to SR 133N, SR 133S to I-5S	None	$90M
		SR 261	I-5N to SR 261N, SR 261S to I-5S	None	$90M
		SR 55	I-5N to SR 55N, SR 55S to I-5S, I-5S to SR 55S	SR 55N to I-5N	$135M
		SR 57	SR 57N to I-5N, I-5S to SR 57S, SR57S to I-5S, I-5N to SR 57N, SR 22W to SR 57N, SR 22E to SR 57N, SR 57S to SR 22W, SR 57S to SR 22E		$360M
		SR 91	None	I-5N to SR 91W, SR 91E to I-5S, I-5S to SR 91E, SR 91W to I-5N	N/A
		I-605	I-5N to I-605N, I-5S to I-605S, I-605N to I-5N, I-605S to I-5S	None	$180M
		I-710	I-5N to I-710N, I-5S to I-710S, I-710N to I-5N, I-710S to I-5S, I-5GPS to I-710TOTS, I-710TOTN to I-5GPN	None	$270M
		I-10W, US 101N, SR 60E	I-5N to US101N, SR 60W to US101N, US101S to SR 60E, US101S to I-5S, I-10E to I-5N, I-10E to I-5S, I-5N to I-10W, I-5S to I-10W, I-5S to SR 60E, SR 60W to I-5N		$450M
		I-10E	I-5N to I-10E, I-10W to I-5S, I-5S to I-10E, I-10W to I-5N		$180M
		SR 110	I-5N to SR 110N, SR 110S to I-5S, I-5S to SR 110S, SR110N to I-5N		$180M
		SR 2	I-5N to SR 2N, SR 2S to I-5S, I-5S to SR 2S, SR 2N to I-5N		$180M
		SR 134	I-5N to SR 134W, SR 134E to I-5S, I-5S to SR 134E, SR 134W to I-5N		$180M
		SR 170	I-5S to SR 170S, SR 170N to I-5N		$90M
		SR 118	I-5S to SR 118E, I-5N to SR 118E, I-5N to SR 118W, SR 118E to I-5S, SR 118W to I-5N, SR 118E to I-5S		$270M
		I-405	I-5S to I-405S, I-405N to I-5N		$90M
		I-210	I-5S to I-210E, I-210W to I-5N		$90M
Los Angeles, Riverside, San Bernardino	I-10	SR 910	I-10W to Tunl N, Tunl S to I-10E		$90M
		I-405	I-10E to I-405S, I-10E to I-405N, I-10W to I-405S, I-10W to I-405N, I-405S to I-10E, I-405S to I-10W, I-405N to I-10E, I-405N to I-10W		$360M
		SR 410	I-10W to SR 410N, I-10W to SR 410S, I-10E to SR 410N, I-10E to SR 410S, SR 410N to I-10W, SR 410N to I-10E, SR 410S to I-10W, SR 410S to I-10E		$360M

Table B3: Interchange Movements

County	Route	Interchange	New Interchange Movements	Existing Motions	Cost
		I-110	I-10E to I-110N, I-10E to I-110S, I-10W to I-110N, I-10W to I-110S, I-110N to I-10E, I-110N to I-10W, I-110S to I-10E, I-110S to I-10W		$360M
		I-710	I-10E to I-710S, I-710N to I-10W, I-10W to I-710S, I-10W to I-710N, I-710N to I-10E, I-710S to I-10E	I-710S to I-10W, I-10E to I-710N	$270M
		I-605	I-10E to I-605N, I-10E to I-605S, I-10W to I-605N, I-10E to I-605S, I-605S to I-10E, I-605N to I-10W, I-605N to I-10E, I-605S to I-10W		$360M
		SR 57, SR 71	I-10E to SR 57N, I-10W to SR 57S, I-10E to SR 71S, I-10W to SR 57N, I-10W to SR 57S, SR 71N to I-10W, SR 71N to SR 57N, SR 57S to I-10E, SR 57S to I-10W, SR 57S to SR 71S, SR 57N to I-10E, SR 57S to I-10W		$540M
		I-15	I-10E to I-15N, I-10E to I-15S, I-10W to I-15N, I-10W to I-15S, I-15N to I-10E, I-15N to I-10W, I-15S to I-10E, I-15S to I-10W		$360M
		I-215	I-10E to I-215N, I-10E to I-215S, I-10W to I-215N, I-10W to I-215S, I-215N to I-10E, I-215N to I-10W, I-215S to I-10E, I-215N to I-10W		$360M
		I-210	I-10W to I-210N, I-210S to I-10E		$90M
Riverside, San Bernardino	I-15	I-215N	I-15N to I-215N, I-215S to I-15S		$90M
		SR 133Ext	I-15N to SR 133W, I-15S to SR 133W, SR 133E to I-15N, SR 133E to I-15S		$180M
		SR 91	I-15N to SR 91W, I-15N to SR 91E, I-15S to SR 91W, I-15S to SR 91E, SR 91E to I-15N, SR 91E to I-15S, SR 91W to I-15N, SR 91E to I-15S		$360M
		SR 60	I-15N to SR 60E, I-15N to SR 60W, I-15S to SR 60E, I-15S to SR 60W, SR 60E to I-15N, SR 60E to I-15S, SR 60W to I-15N, SR 60W to I-15S		$360M
		SR 210	I-15N to SR 210E, I-15N to SR 210W, I-15S to SR 210W, SR 210E to I-15N, SR 210E to I-15S, SR 210W to I-15S		$360M
		I-215S	I-15S to I-215S, I-215N to I-15N		$90M
		SR 315	I-15N to SR 315W, I-15S to SR 315W, SR 315E to I-15N, SR 315E to I-15S		$180M
Los Angeles	I-105	I-405	I-105W to I-405N, I-105W to I-405S, I-105E to I-405N, I-105E to I-405S, I-405N to I-105E, I-405N to I-105W, I-405S to I-105E, I-405S to I-105W		$360M
		I-110	I-105E to I-110S, I-105W to I-110S, I-110N to I-105E, I-110N to I-105W		$180M
		I-710	I-105E to I-710N, I-105E to I-710S, I-105W to I-710N, I-105W to I-710s, I-710N to I105E, I-710N to I-105W, I-710S to I-105E, I-710S to I-105W		$360M
		I-605	I-105E to I-605N, I-105E to I-605S, I-605N to I-105W, I-605S to I-105E		$180M
Los Angeles	I-110	I-405	I-110N to I-405S, I-110N to I-405N, I-110S to I-405N, I-110S to I-405S, I405N to I-110N, I-405S to I-110N, I-405N to I-110S, I -405S to I-110S		$360M
		SR 91	I-110N to SR 91E, I-110S to SR 91E, SR 91W to I-110N, SR 91W to I-110S		$180M
		SR 410	I-110N to SR 410N, SR 410S to I-110S		$90M
		US 101	I-110N to US 101N, I-110N to US 101S, I-110S to US 101N, US 101S to I-110N, US 101S to I-110S, US 101S to I-110N		$270M
Los Angeles, San Bernardino	I-210	SR 118	I-210W to SR 118W, SR 118E to I-210E		$90M
		SR 2	I-210E to SR 2S, I-210E to SR 510N, I-210W to SR 510N, SR 2N to I-210W, SR 510S to I-210E, SR 510S to I-210W		$270M
		I-710	I-210E to I-710S, I-210E to I-710N, I-210W to I-710N, I-210W to I-710S, I-710N to I-210E, I-710N to I-210W, SR 134E to I-710S SR 134E to I-210W		$360M
		I-605	I-210E to I-605S, I-210W to I-605S, I-605N to I-210E, I-605N to I-210W		$180M
		SR 57	I-210E to SR 57S, I-210W to SR 57S, SR 57N to I-210E, SR 57N to I-210W		$180M
		I-215	SR 210E to I-215S, SR 210W to I-215N, I-215N to SR 210W, I-215S to SR 210E		$180M
Riverside, San Bernardino	I-215	SR 60E	I-215N to I-215N, I-215S to I-215S, I-215N to SR 60E, SR 60W to I-215S		$180M
		SR 60W, SR 91	I-215N to I-215N, I-215N to SR 91W, SR 60E to I-215N, SR 91E to I-215S, I-215S to I-215S, I-215S to SR 60W		$270M
Los Angeles, San Bernardino	SR 315	SR 14	SR 14N to SR 315E, SR 14S to SR 315E, SR 315W to SR 14N, SR 315W to SR 14S		$180M
Orange, Los Angeles	I-405	SR 55	I-405N to SR 55S, SR 55N to I-405S,	I-405N to SR 55N, I-405S to SR 55N, SR 55S to I-405N, SR 55S to I-405S	$90M
		SR 57 Ext	I-405N to SR 57N, I-405S to SR 57N, SR 57S to I-405N, SR 57S to I-405S		$180M
		SR 73	I-405S to SR 73S, SR 73N to I-405N		$90M
		SR 22	I-405S to SR 22E, SR 22W to I-405N		$90M
		I-605	I-405N to I-605N, I-405S to I-605N, I-605S to I-405S, I-605S to I-405N		$180M
		I-710	I-405S to I-710N, I-405S to I-710S, I-405N to I-710N, I-405N to I-710S, I-710S to I-405N, I-710S to I-405S, I-710N to I-405N, I-710N to I-405S, I-405N to I-710S, I-405S to I-710S, I-710N to I-405S, I-710N to I-405N		$540M
		US 101	I-405N to US 101S, I-405N to US 101N, I-405S to US 101N, I-405S to US 101S, US 101N to I-405N, US 101N to I-405S, US 101S to I-405N, US 101S to I-405S		$360M
		SR 118	I-405N to SR 118E, I-405N to SR 118W, I-405S to SR 118W, SR 118E to I-		$270M

Table B3: Interchange Movements

County	Route	Interchange	New Interchange Movements	Existing Motions	Cost
			405N, SR 118E to I-405S, SR 118W to I-405S		
Los Angeles	SR 410	US 101	SR 410N to US 101N, SR 410N to US 101S, SR 410S to US 101N, SR 410S to US 101S, US 101N to SR 410N, US 101N to SR 410S, US 101S to SR 410N, US 101S to SR 410S		$360M
Los Angeles	SR 510	SR 14	SR 510N to SR 14S, SR 510N to SR 14N, SR 14S to SR 510S, SR 14N to SR 510S		$180M
Orange, Los Angeles	I-605	SR 91	I-605N to SR 91W, I-605N to SR 91E, I-605S to SR 91W, I-605S to SR 91E, SR 91W to I-605N, SR 91W to I-605S, SR 91E to I-605N, SR 91E to I-605S		$360M
		SR 60	I-605N to SR 60W, I-605N to SR 60W, I-605S to SR 60W, I-605S to SR 60E, SR 60W to I-605N, SR 60W to I-605N, SR 60E to I-605N, SR 60E to I-605S		$360M
Los Angeles	I-710	SR 91	I-710N to SR 91W, I-710N to SR 91E, I-710S to SR 91W, I-710S to SR 91E, I-SR 91W to I-710N, SR 91W to I-710S, SR 91E to I-710N, SR 91E to I-710S		$360M
		SR 60	I-710N to SR 60E, I-710S to SR 60W, I-710S to SR 60E, SR 60W to I-710N, SR 60E to I-710N, SR 60E to I-710S		$270M
Los Angeles	SR 910	US 101	SR 910N to US 101N, SR 910N to US 101S, US 101N to SR 910S US 101S to SR 910S		$180M
Los Angeles, Ventura	US 101	SR 134, SR 170	US 101N to US 101N, US101S to US 101S, SR 134W to SR 170N, SR 170S to SR 134E		$180M
		SR 126	US101S to SR 126WGP, SR 126EGP to US 101N		$90M
Los Angeles	SR 2	SR 134	SR 2N to SR 134W, SR 2N to SR 134E, SR 2S to SR 134W, SR 2S to SR 134E, SR 134W to SR 2N, SR 134W to SR 2S, SR 134E to SR 2N, SR 134E to SR 2S		$360M
Orange	SR 22	SR 55	SR 22E to SR 57N, SR 22E to SR 57S, SR 57N to SR 22W, SR 57S to SR 22W		$180M
Orange	SR 55	SR 73	SR 55N to SR 73S, SR 55N to SR 73N, SR 55S to SR 73S, SR 73N to SR 55N, SR 73N to SR 55S, SR 73S to SR 55S		$270M
		SR 91	SR 55N to SR 91E, SR 91W to SR 55S, SR 55N to SR 91W, SR 91E to SR 55S		$180M
Los Angeles, Orange	SR 57	SR 91	SR 57N to SR 91W, SR 57N to SR 91E, SR 57S to SR 91E, SR 91W to SR 57N, SR 91W to SR 57S, SR 91E to SR 57S	SR 57S to SR 91W, SR 91E to SR 57N	$270M
		SR 60W	SR 57N to SR 60W, SR 57N to SR 60E, SR 60W to SR 57S, SR 60E to SR 57S		$180M
		SR 60E	SR 57S to SR 60W, SR 60E to SR 57N		$90M
Los Angeles, Riverside, San Bernardino	SR 60	SR 71	SR 60W to SR 71S, SR 60E to SR 71N, SR 60E to SR 71S, SR 71N to SR 60W, SR 71N to SR 60W, SR 71S to SR 60E		$270M
Los Angeles, Riverside, San Bernardino	SR 71	SR 91	SR 71GPS to SR 91E, SR 71SGP to SR 91W, SR 91E to SR 71GPN, SR 91W to SR 71GPN		$180M
Total					**$17.8B**

1. Estimating Express Lane Toll Traffic and Revenue

The process for estimating express lane toll traffic and revenue requires several steps. First we will focus on calculating the likely toll rate. Since the SR 91 express lanes in Orange County have been operating for 20 years, the lanes provide a great starting point for calculating tolls. SR 91 operates with seven peak hours per weekday, 6 to 9 AM and 3 to 7 PM. The average weekday toll rate in the peak direction during the AM peak is $4.82 and during the PM peak it is $6.07. Since the facility is 10 miles long, the rate per mile is the total toll divided by 10. Thus, the simple average peak-direction toll rate during the seven weekday peak hours is $.553 per mile.

Our basic model computes the toll revenue produced per lane-mile of express lanes during the peak hours on a weekday. We make the following assumptions in doing this:

- The average toll charged on an express lane in the *non-peak* direction is 41% of the peak-direction toll rate (based on data from the 91 Express Lanes).
- The volume of traffic in the peak direction during peak periods is 1,600 *paying* vehicles/lane/hour (which also allows for up to 100 *non-paying* vehicles, such as buses and vanpools, for a total of 1,700). Given the projected LOS F conditions as of 2035 in every corridor for which we have proposed express lanes, our assumption is that the express lanes would be filled to the maximum traffic level possible during non-congested operation, (*peak periods in the peak direction)*.
- The express lane volume in the *non-peak* direction, paying 41% of the toll rate charged in the peak direction, is assumed to be *half* that of the peak direction, 800 vehicles/lane/hour.
- The number of peak hours in a weekday is currently 7 (3.0 in the AM and 4.0 in the PM. to 8 in 2030 (3.5 in the AM and 4.5 in the PM period), and 9 in 2050 (4.0 in the AM and 5.0 in the PM period.) We adjusted calculations on our spreadsheet accordingly.

Using the above assumptions, we next compute the average weekday toll revenue generated during peak periods. After ramp-up, the weighted average hourly traffic in a managed lane during the seven peak hours is 1,200, and the weighted average toll rate begins at $0.30 in 2020 and increases at the rate of inflation. Hence, for the express lane system, the weekday peak-period revenue in 2044 (after all the managed lanes have been constructed) is $19.0 million. With 250 weekdays per year, the annual peak-period revenue is $4.7 billion.

On the 91 Express Lanes, non-peak weekday revenue plus all weekend revenue equals 29% of peak-period revenue. Hence, the non-peak revenue for the express network can be estimated as $1.4 billion. Thus, total annual revenue in 2044 for the expressway managed lanes network is $6.2 billion in gross revenue (in 2044 dollars). We subtract 15% of the gross revenue for system operations for a total of $5.4 billion in net revenue.

Tables B4 and B5 project revenue over the lifetime of the project—40 years. Since Southern California's managed lane network is extensive, we project building it over 25 years. During the first five years, the first part of the network will be constructed. During the next five years, the next part will be constructed and so on.

Table B6 details the cost of building the network. We calculated the costs of the express lanes by taking the total net revenue over 40 years of $108B and dividing it by the number of years it will take to build the express lane network, 25. Each yearly total is then adjusted to a 2.9% annual inflation rate. The total to build the managed lanes is detailed in the left

column and the total to build the expressway-expressway ramps is detailed in the right column.

Table B4: Express Lane Toll Revenue Calculations (in dollars)

Year	Lane-miles	Weekday Peak Vol ETL	Average Peak Toll	Peak Hours	Peak Revenue Weekday	Annual Revenue Weekday	Annual Non-peak Revenue	Total Gross Revenue	Net Revenue	NPV Factor	NPV Revenue
2020	646	640	0.30	7.00	867793.92	216948480.00	62915059.20	279863539.20	237884008.32	1.00	237884008.32
2021	646	780	0.31	7.00	1088294.93	272073732.84	78901382.52	350975115.36	298328848.06	0.95	284122712.44
2022	646	920	0.32	7.00	1320855.19	330213796.67	95762001.04	425975797.71	362079428.05	0.91	328416714.79
2023	646	1060	0.33	7.00	1565988.68	391497170.20	113534179.36	505031349.56	429276647.12	0.86	370825307.96
2024	646	1200	0.34	7.00	1824229.08	456057269.59	132256608.18	588313877.77	500066796.10	0.82	411406190.71
2025	1291	920	0.35	7.00	2878268.64	719567159.95	208674476.39	928241636.34	789005390.89	0.78	618206369.25
2026	1291	990	0.36	7.00	3187088.09	796772023.39	231063886.78	1027835910.17	873660523.64	0.75	651938934.18
2027	1291	1060	0.37	7.00	3511398.45	877849612.92	254576387.75	1132426000.67	962562100.57	0.71	684074913.96
2028	1291	1130	0.38	7.00	3851838.47	962959617.37	279258289.04	1242217906.41	1055885220.45	0.68	714664678.98
2029	1291	1200	0.39	7.00	4209070.92	1052267730.56	305157641.86	1357425372.42	1153811566.56	0.64	743757223.44
2030	1937	1013	0.40	8.00	6267769.60	1566942400.25	454413296.07	2021355696.32	1718152341.87	0.61	1054796494.28
2031	1937	1060	0.41	8.00	6748772.97	1687193241.51	489286040.04	2176479281.55	1850007389.32	0.58	1081661005.19
2032	1937	1106	0.42	8.00	7245851.93	1811462982.21	525324264.84	2336787247.05	1986269159.99	0.56	1106028990.85
2033	1937	1153	0.44	8.00	7772827.15	1943206786.82	563529968.18	2506736754.99	2130726241.74	0.53	1129969618.38
2034	1937	1200	0.45	8.00	8324273.17	2081068291.73	603509804.60	2684578096.33	2281891381.88	0.51	1152510209.20
2035	2583	1060	0.46	8.00	10088464.13	2522116031.69	731413649.19	3253529680.88	2765500228.74	0.48	1330252894.80
2036	2583	1095	0.47	8.00	10723799.43	2680949857.81	777475458.77	3458425316.58	2939661519.09	0.46	1346692812.65
2037	2583	1130	0.49	8.00	11387499.79	2846874946.28	825593734.42	3672468680.69	3121598378.59	0.44	1361943032.63
2038	2583	1165	0.50	8.00	12080676.04	3020169011.04	875849013.20	3896018024.24	3311615320.60	0.42	1376044566.69
2039	2583	1200	0.52	8.00	12804479.64	3201119909.72	928324773.82	4129444683.54	3510027981.01	0.40	1389037262.16
2040	3228	1088	0.53	8.00	14932584.15	3733146038.72	1082612351.23	4815758389.95	4093394631.45	0.38	1542757385.84
2041	3228	1116	0.55	8.00	15761068.08	3940267019.86	1142677435.76	5082944455.62	4320502787.28	0.36	1550811486.90
2042	3228	1144	0.56	8.00	16625045.77	4156261442.09	1205315818.21	5361577260.29	4557340671.25	0.34	1557926320.96
2043	3228	1172	0.58	8.00	17525879.10	4381469776.24	1270626235.11	5652096011.35	4804281609.65	0.33	1564136237.07
2044	3228	1200	0.60	8.00	18464979.11	4616244777.90	1338710985.59	5954955763.50	5061712398.97	0.31	1569474586.00
2045	3228	1200	0.61	8.00	19000463.51	4750115876.46	1377533604.17	6127649480.64	5208502058.54	0.30	1538085094.28
2046	3228	1200	0.63	8.00	19551476.95	4887869236.88	1417482078.70	6305351315.58	5359548618.24	0.28	1507323392.40
2047	3228	1200	0.65	8.00	20118469.78	5029617444.75	1458589058.98	6488206503.73	5514975528.17	0.27	1477176924.55
2048	3228	1200	0.67	8.00	20701905.40	5175476350.65	1500888141.69	6676364492.34	5674909818.49	0.26	1447633386.06
2049	3228	1200	0.69	8.00	21302260.66	5325565164.82	1544413897.80	6869979062.61	5839482203.22	0.24	1418680718.34
2050	3228	1200	0.71	9.00	24660029.50	6165007373.92	1787852138.44	7952859512.36	6759930585.50	0.23	1564095491.96
2051	3228	1200	0.73	9.00	25375170.35	6343792587.76	1839699850.45	8183492438.22	6955968572.48	0.22	1532813582.13
2052	3228	1200	0.75	9.00	26111050.29	6527762572.81	1893051146.11	8420813718.92	7157691661.09	0.21	1502157310.48
2053	3228	1200	0.77	9.00	26868270.75	6717067687.42	1947949629.35	8665017316.77	7365264719.26	0.20	1472114164.27
2054	3228	1200	0.79	9.00	27647450.60	6911862650.36	2004440168.60	8916302818.96	7578857396.12	0.19	1442671880.99
2055	3228	1200	0.82	9.00	28449226.67	7112306667.22	2062568933.49	9174875600.71	7798644260.60	0.18	1413818443.37
2056	3228	1200	0.84	9.00	29274254.24	7318563560.57	2122383432.56	9440946993.13	8024804944.16	0.17	1385542074.50
2057	3228	1200	0.86	9.00	30123207.62	7530801903.82	2183932552.11	9714734455.93	8257524287.54	0.16	1357831233.01
2058	3228	1200	0.89	9.00	30996780.64	7749195159.03	2247266596.12	9996461755.15	8496992491.88	0.16	1330674608.35
2059	3228	1200	0.91	9.00	31895687.27	7973921818.65	2312437327.41	10286359146.05	8743405274.14	0.15	1304061116.18
Total								188060876459.57	159851744990.64		46854019378.50

Table B5: Truck Toll Lanes Revenue Calculations

Year	Lane-miles	Weekday Peak Vol ETL	Average Peak Toll	Peak Hours	Peak Revenue Weekday	Annual Revenue Weekday	Annual Non-peak Revenue	Total Gross Revenue	Net Revenue	NPV Factor	NPV Revenue
2020	49.40	320.00	0.70	7.00	77459.20	19364800.00	5615792.00	24980592.00	21233503.20	1.00	21233503.20
2021	49.40	390.00	0.72	7.00	97141.10	24285274.65	7042729.65	31328004.30	26628803.65	0.95	25360765.38
2022	49.40	460.00	0.74	7.00	117899.40	29474851.03	8547706.80	38022557.83	32319174.16	0.91	29314443.68
2023	49.40	530.00	0.76	7.00	139780.00	34944998.93	10134049.69	45079048.62	38317191.33	0.86	33099830.54
2024	49.40	600.00	0.78	7.00	162830.51	40707627.06	11805211.85	52512838.90	44635913.07	0.82	36722076.14
2025	98.80	460.00	0.81	7.00	256913.98	64228493.97	18626263.25	82854757.22	70426543.64	0.78	55181039.75
2026	98.80	495.00	0.83	7.00	284479.17	71119792.49	20624739.82	91744532.31	77982852.46	0.75	58192005.18
2027	98.80	530.00	0.86	7.00	313427.08	78356770.16	22723463.35	101080233.51	85918198.48	0.71	61060459.58
2028	98.80	565.00	0.88	7.00	343814.72	85953680.79	24926567.43	110880248.22	94248210.99	0.68	63790899.00
2029	98.80	600.00	0.91	7.00	375701.26	93925314.20	27238341.12	121163655.31	102989107.02	0.64	66387696.66
2030	148.20	507.00	0.93	8.00	560012.78	140003194.84	40600926.50	180604121.34	153513503.14	0.61	94243974.17
2031	148.20	530.00	0.96	8.00	602394.81	150598702.90	43673623.84	194272326.74	165131477.73	0.58	96548955.00
2032	148.20	553.00	0.99	8.00	646764.03	161691007.74	46890392.24	208581399.98	177294189.98	0.56	98724039.01
2033	148.20	577.00	1.02	8.00	694403.52	173600880.82	50344255.44	223945136.26	190353365.82	0.53	100948454.06
2034	148.20	600.00	1.04	8.00	743023.80	185755951.16	53869225.84	239625177.00	203681400.45	0.51	102872947.99
2035	197.60	530.00	1.07	8.00	900495.32	225123829.08	65285910.43	290409739.51	246848278.58	0.48	118738242.63
2036	197.60	548.00	1.11	8.00	958079.44	239519860.81	69460759.63	308980620.44	262633527.37	0.46	120315444.95
2037	197.60	565.00	1.14	8.00	1016447.11	254111777.87	73692415.58	327804193.46	278633564.44	0.44	121566901.22
2038	197.60	583.00	1.17	8.00	1079245.55	269811388.19	78245302.58	348056690.77	295848187.15	0.42	122931032.47
2039	197.60	600.00	1.21	8.00	1142926.59	285731648.49	82862178.06	368593826.55	313304752.57	0.40	123985329.49
2040	247.00	544.00	1.24	8.00	1332880.99	333220248.47	96633872.06	429854120.53	365376002.45	0.38	137706372.62
2041	247.00	558.00	1.28	8.00	1406831.39	351707846.89	101995275.60	453703122.48	385647654.11	0.36	138425280.88
2042	247.00	572.00	1.31	8.00	1483949.95	370987487.78	107586371.46	478573859.24	406787780.36	0.34	139060350.27
2043	247.00	586.00	1.35	8.00	1564358.25	391089561.55	113415972.85	504505534.40	428829704.24	0.33	139614646.78
2044	247.00	600.00	1.39	8.00	1648182.22	412045555.13	119493210.99	531538766.11	451807951.19	0.31	140091147.28
2045	247.00	600.00	1.43	8.00	1695979.50	423994876.22	122958514.10	546953390.33	464910381.78	0.30	137289324.33
2046	247.00	600.00	1.47	8.00	1745162.91	436290727.63	126524311.01	562815038.65	478392782.85	0.28	134543537.84
2047	247.00	600.00	1.51	8.00	1795772.63	448943158.74	130193516.03	579136674.77	492266173.55	0.27	131852667.09
2048	247.00	600.00	1.56	8.00	1847850.04	461962510.34	133969128.00	595931638.34	506541892.59	0.26	129215613.75
2049	247.00	600.00	1.60	8.00	1901437.69	475359423.14	137854232.71	613213655.85	521231607.47	0.24	126631301.47
2050	247.00	600.00	1.65	9.00	2201151.81	550287952.21	159583506.14	709871458.35	603390739.60	0.23	139611009.87
2051	247.00	600.00	1.70	9.00	2264985.21	566246302.83	164211427.82	730457730.64	620889071.05	0.22	136818789.67
2052	247.00	600.00	1.75	9.00	2330669.78	582667445.61	168973559.23	751641004.83	638894854.11	0.21	134082413.88
2053	247.00	600.00	1.80	9.00	2398259.21	599564801.53	173873792.44	773438593.97	657422804.88	0.20	131400765.60
2054	247.00	600.00	1.85	9.00	2467808.72	616952180.77	178916132.42	795868313.20	676488066.22	0.19	128772750.29
2055	247.00	600.00	1.90	9.00	2539375.18	634843794.02	184104700.26	818948494.28	696106220.14	0.18	126197295.28
2056	247.00	600.00	1.96	9.00	2613017.06	653254264.04	189443736.57	842698000.62	716293300.52	0.17	123673349.38
2057	247.00	600.00	2.02	9.00	2688794.55	672198637.70	194937604.93	867136242.63	737065806.24	0.16	121199882.39
2058	247.00	600.00	2.07	9.00	2766769.59	691692398.19	200590795.48	892283193.67	758440714.62	0.16	118775884.74
2059	247.00	600.00	2.13	9.00	2847005.91	711751477.74	206407928.54	918159406.29	780435495.34	0.15	116400367.05
Total								16787247939.46	14269160748.54		4182580790.58

Table B6: Express Lane Cost Components per Year	
Express Toll Lanes per Year over 25 Years	Express Toll Lanes Interchanges per Year over 25 Years
2355720000	667800000
2424035880	687166200
2494332921	707094019.8
2566668575	727599746.4
2641101964	748700139
2717693921	770412443.1
2796507045	792754403.9
2877605749	815744281.6
2961056316	839400865.8
3046926949	863743490.9
3135287830	888792052.1
3226211177	914567021.6
3319771301	941089465.3
3416044669	968381059.8
3515109965	996464110.5
3617048154	1025361570
3721942550	1055097055
3829878884	1085694870
3940945372	1117180021
4055232787	1149578242
4172834538	1182916011
4293846740	1217220575
4418368295	1252519972
4546500976	1288843051
4678349504	1326219499
84769022061	24030340164
58893000000 (Total)	16695000000 (Total)

Appendix C: Managed Arterials Details

The managed arterials routings and components are listed in several tables in this appendix. Table C1 details the overall alignment of the managed arterial. Some managed arterials reflect one street name, such as SR 23. Others can have 10 different street names. Multiple alignments are caused by multiple factors including changing street names, missing alignments, differing travel direction and more.

Most managed arterials are a minimum of three lanes in each direction, with some sections consisting of two. Some managed arterials need new lane additions or conversions. One type of conversion is making a travel lane out of a parking lane. Table C2 has a comprehensive list of additions and conversions.

Table C3 includes the complete list of 559 grade separations. Each grade separation and its cost is listed. Where a managed arterial intersects with a typical surface street, the grade separation is estimated to cost $42 million. However, when two managed arterials intersect, both will need grade separations. Constructing two managed grade separations at the same intersection is estimated to cost $78 million.

Several managed arterials need new alignments in certain locations. Often time streets dead end near rivers or other physical landmarks. When necessary and if cost-effective, we suggested new alignments to complete a managed arterial. These are detailed in Table C4.

Tables C2, C3 and C4 list the components by type (widening, grade separation, new alignments, etc.). Table C5 lists each component for each managed arterial in geographical order (grade separation, widening, new alignment, etc). Table C5 includes all components of all Southern California managed arterials.

Table C6 includes the complete revenue and cost calculations for building the managed arterial network. The roadway widenings, tolled grade separations and new alignments are listed separately and combined. Revenue and costs were calculated in a similar method to the express lane network. Those calculations are detailed in Appendix B.

Table C1: Managed Arterials, Overall Alignments

No.	Suggested Alignment	Dir.	From	To	Relieves Traffic
1.	Overall	E-W	Valley Circle Blvd	Foothill Blvd	SR 118, US 101, SR 134
	Roscoe Blvd		Valley Circle Blvd	Lankershim Blvd	
	Tuxford St		Lankershim Blvd	Tuxford St NE	
	La Tuna Canyon Rd		Tuxford St NE	Tujunga Canyon Blvd	
	Tujunga Canyon Blvd		La Tuna Canyon Blvd	Foothill Blvd	
2.	Overall	E-W	SR 1	I-605	I-10, I-210, US 101
	San Vicente Blvd		SR 1	Wilshire Blvd	
	Wilshire Blvd		San Vicente Blvd	Santa Monica Blvd	
	Santa Monica Blvd		Wilshire Blvd	Sunset Blvd	
	Sunset Blvd		Santa Monica Blvd	SR 110	
	SR 110		Sunset Blvd	Grevelia St	
	Grevelia St		SR 110	Garfield Ave	
	Garfield Ave		Grevelia St	E. Main St	
	E Main St.		Garfield Ave.	Vega St	
	Las Tunas Dr		Vega St	Live Oak Ave	
	Live Oak Ave		Las Tunas	I-605	
3.	Overall	E-W	SR 1	Mission Blvd	I-10, I-105, SR 60, SR 91,
	SR 90		SR 1	Slauson Ave.	
	Slauson Ave		SR 90	Telegraph Rd	
	Telegraph Rd,		Slauson Ave	Imperial Highway	
	Imperial Highway,		Telegraph Rd	Valencia Ave	
	Valencia Ave,		Imperial Highway	Carbon Canyon Rd	
	Carbon Canyon Rd,		Valencia Ave	Chino Hills Parkway	
	Chino Hills Parkway,		Carbon Canyon Rd	New Alignment	
	New Alignment,		Chino Hills Parkway	Merrill Ave	
	Merrill Ave,		New Alignment	Archibald Ave	
	Archibald Ave,		Merrill Ave	Limonite Ave	
	Limonite Ave/Riverview Dr		Archibald Ave	Mission Blvd	
	New Alignment		Mission Blvd	SR 60	
4.	Overall	E-W	Catalina Ave	SR 241	I-405, SR 22, SR 91
	Torrance Blvd Euclid Rd		Catalina Ave	Palos Verde Blvd	
	Palos Verdes Blvd		Torrance Blvd	Carson St	
	Carson St		Palos Verde Blvd	Santa Fe Ave	
	New Alignment		Santa Fe Ave	Intersection of Carson St/Long Beach Blvd	
	Carson St/Lincoln Ave		Intersection of Carson St/Long Beach Blvd	Euclid Rd	
	Euclid Rd		Carson St/Lincoln Ave	Ball Rd/Taft Ave	
	Ball Rd/Taft Ave		Euclid Rd	Cannon St	
	Cannon St		Ball Rd/Taft Ave	Santiago Canyon Rd	
	Santiago Canyon Rd		Cannon St	Santiago Canyon Rd S. of Lolita St	
	New Alignment		Santiago Canyon Rd S. of Lolita St.	SR 241	
5.	Overall	E-W	SR 1	Eastern Transportation Corridor	I-5, I-405, SR 241, SR 261
	Warner Ave, Tustin		SR 1	Euclid St	
	Euclid St		Warner Ave	Edinger Ave	
	Edinger Ave		Euclid St	Tustin Ranch Rd	
	Tustin Ranch Rd		Euclid St	Portola Parkway	
	Portola Parkway		Tustin Ranch Rd	SR 241	
6.	Overall	E-W	SR 1	Plano Trabuco Rd	I-5, SR 133
	Crown Valley Parkway		SR 1	Alicia Parkway	
	Alicia Parkway		Crown Valley Parkway	Santa Margarita Parkway	
	Santa Margarita Parkway		Alicia Parkway	Plano Trabuco Rd	

Table C1: Managed Arterials, Overall Alignments

No.	Suggested Alignment	Dir.	From	To	Relieves Traffic
7.	SR 74	E-W	I-5	San Jacinto Rd	SR 60, SR 91
8.	Overall	N-S	SR 1	SR 118	SR 23
	SR 23		SR 1	US 101	
	West Lake Blvd		US 101	West Lake Blvd west of Oak Valley Lane	
	New Alignment		West Lake Blvd west of Oak Valley Lane	Wood Ranch Parkway at Long Canyon Rd	
	Wood Ranch Parkway		Wood Ranch Parkway at Long Canyon Rd	Madera Rd	
	Madera Rd		Wood Ranch Parkway	SR 118	
9.	Overall	N-S	SR 107	SR 118	I-110, I-405, SR 23
	SR 1		SR 107	SR 27	
	SR 27		SR 1	SR 118	
10.	Overall	N-S	I-405	I-210	I-5, I-110, I-210 I-405, US 101, SR 170, SR 170
	La Cienega Blvd		I-405	Sunset Blvd	
	Sunset Blvd		La Cienega Blvd	Laurel Canyon Blvd	
	Laurel Canyon Blvd		Sunset Blvd	Sheldon St	
	Sheldon St		Laurel Canyon Blvd	Wentworth St	
	Wentworth St		Sheldon St	McBroom St	
	McBroom St Extension		Wentworth St	I-210	
11.	Overall	N-S	SR 103	SR 134	I-110, I-710, SR 2
	SR 47		SR 103	Alameda St	
	Alameda St		SR 47 South	Spring St	
	Spring St		Alameda St	Broadway	
	Broadway		Spring St	Daly St	
	Daly St		Broadway	Pasadena Ave	
	Pasadena Ave		Daly St	Figueroa St	
	Figueroa St		Pasadena Ave	SR 134	
12.	Overall	N-S	Livingston Dr.	East Sierra Madre Blvd	I-605, I-710, SR 110
	Ximeno Ave		Livingston Dr	Traffic Circle	
	Lakewood Blvd		Traffic Circle	Telegraph Rd	
	Rosemead Blvd		Telegraph Rd	Sierra Madre Villa Ave	
	Sierra Madre Villa Ave		Rosemead Blvd	East Sierra Madre Blvd	
13.	Overall	N-S	W 25th St.	I-210	I-5, I-110, I-210, I-405, US 101
	Western Ave		W 25th St.	Western Ave at Los Feliz Blvd	
	New Alignment		Western Ave at Los Feliz Blvd	Buena Vista St at SR 134	
	Buena Vista St		SR 134	Glen Oaks Blvd	
	Glen Oaks Blvd		Buena Vista St	I-210	
14.	Overall	N-S	SR 1	Sierra Madre Ave	SR 57, I-405, I-605
	Beach Blvd		SR 1	Gregory Lane	
	New Alignment		Gregory Lane	Whittier Blvd	
	Hacienda Rd		Whittier Blvd	Colima Rd	
	Colima Rd		Hacienda Rd	Azusa Ave	
	Azusa Ave		Colima Rd	Sierra Madre Ave	
15.	Overall	N-S	SR 91	Base Line Rd	SR 57, SR 71
	Fairmont Blvd		SR 91	Fairmont Blvd E of Quarter House Rd	
	New Alignment		Fairmont Blvd E of Quarter House Rd	Carbon Canyon Rd E of Beryl St	
	Carbon Canyon Rd		Carbon Canyon Rd E of Beryl St	Chino Hills Parkway	

Table C1: Managed Arterials, Overall Alignments

No.	Suggested Alignment	Dir.	From	To	Relieves Traffic
	Chino Hills Parkway		Carbon Canyon Rd	Peyton Dr	
	Peyton Dr		Chino Hills Parkway	Garey Ave	
	Riverside Dr		Garey Ave	Towne Ave	
	Towne Ave		Riverside Dr.	Base Line Rd	
16.	Euclid Ave	N-S	SR 71	W 24th St	I-15, SR 57, SR 71
17.	Overall	N-S	SR 74 ½ mi. E of I-15	SR 210	I-15, I-215
	El Toro Cut Off Rd		SR 74 ½ mi. E of I-15	El Toro Rd at El Toro Rd Cutoff	
	El Toro Rd		El Toro Rd at El Toro Cutoff	El Mineral Rd	
	Piedras Rd		El Mineral Rd	Santa Rosa Mine Rd	
	Santa Rosa Mine Rd		Piedras Rd	Lake Matthews Dr	
	Gavilan Rd		Lake Matthews Dr	Cajalco Rd	
	Cajalco Rd		Gavilan Rd	El Sobrante Rd	
	El Sobrante Rd		Cajalco Rd	Mockingbird Canyon Rd	
	Mockingbird Canyon Rd		El Sobrante Rd	Van Buren Blvd	
	Van Buren Blvd		Mockingbird Canyon Rd	Jurupa Rd	
	Jurupa Rd		Van Buren Blvd	Sierra Ave	
	Sierra Ave		Jurupa Rd	I-15	
18.	Overall	N-S	I-15	I-10	I-15, I-215
	SR 79		I-15	SR 74	
	New Alignment		SR 74	Juniper Springs Curve from E/W to N/S	
	Juniper Springs Rd		Juniper Springs Curve from E/W to N/S/	Juniper Flats Rd	
	Juniper Flats Rd		Juniper Springs Rd	Contour Ave	
	Contour Ave		Juniper Flats Rd	Hansen Ave	
	Hansen Ave		Contour Ave	Ramona Expressway	
	Davis Rd		Ramona Expressway	South of Alessandro Blvd	
	Theodore St		South of Alessandro Blvd	Ironwood Ave	
	Ironwood Ave		Theodore St	Highland Blvd	
	Highland Blvd		Ironwood Ave	Redlands Blvd	
	Redlands Blvd		Highland Blvd	San Timoteo Canyon Rd	
	San Timoteo Canyon Rd		Redlands Blvd	Alessandro Rd	
	Alessandro Rd		San Timoteo Canyon Rd	Crescent Ave	
	Crescent Ave		Alessandro Rd	San Jacinto St	
	San Jacinto St		Crescent St	Highland St	
	Highland St		San Jacinto St	San Mateo St	
	San Mateo St.		Highland St.	Tennessee St	
	Tennessee St		San Mateo St	I-10	

Table C2: Arterial Additions and Conversions

Road	From	To	Scope	Cost
Roscoe Blvd	Valley Circle Blvd	SR 27	Convert parking lanes to travel lanes (2.3 miles, 4.6 lane miles)	$26.7M
Roscoe Blvd	Haskell Ave	Landon Ave	Add 1 lane in each direction (0.4 miles, 0.8 lane miles)	$10.2M
Tuxford St	SR 170	Sunland Canyon Blvd	Convert parking lanes to travel lanes (2.8 miles, 5.6 lane miles)	$32.5M
La Tuna Canyon Rd	Sunland Canyon Blvd	Elbon St	Add 1 lane in each direction, Convert parking lanes to travel lanes (1.8 miles, 7.2 lane miles)	$66.7M
La Tuna Canyon Rd	Elbon St	I-210	Convert parking lane to travel lanes (2.5 miles, 5.0 lane miles)	$29M
Tujunga Canyon Rd	La Tuna Canyon Rd	Foothill Blvd	Add 1 lane in each direction (1.0 mile, 2.0 lane miles)	$25.4M
San Vicente Blvd	26th St	Wilshire Blvd	Add 1 lane in each direction (2.0 miles, 4.0 lane miles)	$50.8M
Santa Monica Blvd	Wilshire Blvd	Doheny Dr	Add 1 lane in each direction (1.5 miles, 3.0 lane miles)	$17.4M
Santa Monica Blvd	Doheny Dr	Sunset Blvd	Add 1 lane total, convert parking lane to travel lane (6.5 miles, 13.0 lane miles)	$120.2M

Table C2: Arterial Additions and Conversions

Road	From	To	Scope	Cost
Sunset Blvd	Santa Monica Blvd	SR 110	Convert parking lanes to travel lanes (3.0 miles, 6.0 lane miles)	$34.8M
Grevalia St	SR 110	Stratford Ave	Add 2 lanes in each direction (0.3 miles, 1.2 lane miles)	$15.2M
Garfield Ave	Stratford Ave	Huntington Dr	Add 2 lanes in each direction (1.1 miles, 4.4 lane miles)	$55.9M
Garfield Ave	Huntington Dr	Main St	Add 1 lane in each direction (0.9 mile, 1.8 lane miles)	$22.9M
Main St/Las Tunas Dr	Garfield Ave	San Gabriel Blvd	Convert parking lanes to travel lanes (2.2 miles, 4.4 lane miles)	$25.5M
Las Tunas Dr	Rosemead Blvd	Longden Ave	Convert parking lanes to travel lanes (4.4 miles, 8.8 lane miles)	$51M
Slauson Ave	Alviso St	Ruthelen St	Add 1 lane total, convert parking lanes to travel lanes (1.8 miles, 3.6 lane miles)	$33.3M
Slauson Ave	Ruthelen St	Santa Fe Ave	Add 1 lane in each direction (4.7 miles, 9.4 lane miles)	$119.4M
Slauson Ave	Santa Fe Ave	Alamo Ave	Convert parking lanes to travel lanes (3.2 miles, 6.4 lane miles)	$37.1M
Slauson Ave	Alamo Ave	I-710	Add 1 lane in each direction (0.3 miles, 0.6 lane miles)	$7.6M
Slauson Ave	Garfield Ave	Greenwood Ave	Convert parking lanes to travel lanes (0.7 miles, 1.4 lane miles)	$8.1M
Telegraph Rd	Slauson Ave	Tweedy Ln	Add 1 lane in each direction (0.5 mile, 1.0 lane mile)	$12.7M
Telegraph Rd	True Ave	I-605	Add 1 lane in each direction (0.3 mile, 0.6 lane mile)	$7.6M
Valencia Ave	SR 90	Carbon Canyon Rd	Add 1 lane in each direction (1.0 mile, 2.0 lane miles)	$25.4M
Carbon Canyon Rd	Valencia Ave	Olinda Dr	Add 1 lane in each direction (2.8 miles, 5.6 lane miles)	$63.5M
Carbon Canyon Rd	Olinda Dr	Chino Hills Parkway	Add 2 lanes in each direction (5.6 miles, 22.4 lane miles)	$284.4M
Chino Hills Parkway	Carbon Canyon Rd	Central Ave	Add 1 lane in each direction (3.0 miles, 6.0 lane miles)	$76.2M
Merrill Ave	Central Ave	Cypress Ave. North	Add 2 lanes in each direction (0.9 miles, 3.6 lane miles)	$49.5M
Cypress Ave/Merrill Ave	Cypress Ave North	Archibald Ave	Add 2 lanes in each direction (5.9 miles, 23.6 lane miles)	$299.7M
Archibald Ave	Merrill Ave	Limonite St	Add 2 lanes in each direction (0.5 miles, 2.0 lane miles)	$25.4M
Limonite St	Archibald Ave	Wineville Ave	Add 1 lane in each direction (3.0 miles, 6.0 lane miles)	$76.2M
Limonite St	Wineville Ave	Homestead St	Add 2 lanes in each direction (2.7 miles, 10.8 lane miles)	$137.2M
Limonite St	Homestead St	Mission Blvd	Add 1 lane in each direction (5.2 miles, 10.4 lane miles)	$132.1M
Riverview Dr	Mission Blvd	SR 60	Add 2 lanes in each direction (0.4 mile, 1.6 lane miles)	$20.3M
Torrance Blvd	Catalina Ave		Add 1 lane in each direction (1.5 miles, 3.0 lane miles)	$38.1M
Carson St	Hawthorne Blvd	Del Amo Circle Blvd	Add 1 lane in each direction (0.2 miles, 0.4 lane miles)	$17.8M
Carson St	Madrona Ave	Via Oro Ave	Convert parking lanes to travel lanes (7.6 miles, 15.2 lane miles)	$88.2M
Bixby Rd	Country Club Rd	Atlantic Ave	Add 1 additional lane in each direction, Convert parking lane to travel lane in each direction (0.8 miles, 1.6 lane miles))	$29.6M
Atlantic Ave	Bixby Rd	Carson St	Add 1 lane in each direction (0.4 miles, 0.8 lane-miles)	$10.2M
Carson St	Atlantic Ave	Orange Ave	Convert parking lane to travel lane in each direction (1.0 converted-miles)	$5.8M
Carson St	Orange Ave	Cherry Ave	Add 1 lane in each direction (1.0 lane-miles)	$12.7M
Carson St	Los Coyotes Diagonal	LB Towne Center Dr	Add 1 lane in each direction (1.0 lane-miles)	$12.7M
Carson St /Lincoln Ave	Pioneer Blvd	Euclid St	Add 1 lane in each direction (16.2 lane miles)	$205.7M
Euclid St	Broadway	Ball Rd/Taft Ave	Add 1 lane in each direction (1.4 lane miles)	$17.8M
Ball Rd	Euclid St	Hampstead St	Add 1 lane in each direction (0.5 mile—1.0 lane miles)	$12.7M
Ball Rd	State College Blvd	Sunkist Rd	Convert parking lane to travel lane in each direction (1.0 converted-miles)	$5.8M
Taft Ave	SR 57	Tustin St	Add 1 lane in each direction (4.8 lane miles)	$61M
Taft Ave	Santiago Blvd	Center Dr	Convert parking lane to travel lane in each direction Add 1 additional lane in each direction (2.4 lane-miles)	$22.2M
Taft Ave	Center Dr	Cannon St	Add 2 lanes in each direction (4.0 lane miles)	$50.8M
Cannon St	Taft Ave	Santiago Canyon St	Add 1 lane in each direction (0.8 lane miles)	$10.2M
E Santiago Canyon	Cannon St	Jamboree Rd	Add 1 lane in each direction (5.8 lane miles)	$73.7M
Jamboree Rd	E Santiago Canyon Rd	E Santiago Canyon Rd	Add 1 lane in each direction (0.4 lane miles)	$5.1M
E Santiago Canyon Rd	Chapman Ave	SR 241/SR 261	Add 1 lane in each direction (2 lane miles)	$25.4M
Warner Ave	SR 1	Algonquin St	Add 1 lane each direction (0.9 miles, 1.8 lane miles)	$22.9M
Warner Ave	Raitt St	Bristol St	Convert westbound parking lane to travel lane (0.6 converted miles)	$3.5M
Warner Ave	Bristol St	Grand Ave	Add one lane each direction (8.0 lane miles)	$101.6M
Warner Ave	Grand Ave	Wright St	Add one lane to westbound through lane (0.4 lane miles)	$5.1M
Portola Parkway	Jefferey Rd	SR 241	Add 1 lane in each direction (6.8 lane miles)	$86.4M
Crown Valley Parkway	SR 1	Sea Island Dr	Add 1 lane in each direction (0.8 lane mile)	$10.2M
Crown Valley Parkway	Sea Island Dr	Camino Del Avion	Add 1 lane in each direction (0.4 lane miles)	$5.1M

Table C2: Arterial Additions and Conversions

Road	From	To	Scope	Cost
SR 74	Camino Capistrano	Hunt Club Dr	Add 1 lane in each direction (3.0 lane miles)	$38.1M
SR 74	Hunt Club Dr	Reata Rd	Add 2 lanes in each direction (3.6 lane miles)	$45.7M
SR 74	Reata Rd	Le Harve St	Add 1 lanes in each direction (54.6 lane miles)	$693.4M
SR 74	Le Harve St	Hunco Way	Add 2 lanes in each direction (12.0 lane miles)	$152.4M
SR 74	Hunco Way	I-15	Add 1 lane in each direction (1.0 lane miles)	$12.7M
SR 74	Dexter Ave	I-215	Add 1 lane in each direction (20.6 lane miles)	$261.6M
SR 74	Case Rd	¼ mile E of San Jacinto Rd	Add 1 lane in each direction (33.8 lane miles)	$429.3M
SR 1	Ocean Ave	Herondo St	Add 2 lanes in each direction (9 lane miles)	$114.3M
SR 1	Jefferson Blvd	Fiji Way	Add one southbound lane (0.5 lane mile)	$6.4M
SR 1	Washington Blvd	I-10	Add 1 lane each direction (5.6 lane miles)	$71.1M
SR 1/SR 27	Temescal Canyon Rd	Avenue St. Louis	Add one lane in each direction (29.4 lane miles)	$373.4M
SR 27	Parthenia St	Prarie St	Convert Parking Lanes to Travel Lanes (1.6 lane miles)	$20.3M
SR 27	Marilla St	SR 118	Convert parking lanes to travel lanes (4.2 lane miles)	$53.3M
SR 23	SR 1	Triunfo Canyon Rd	Add 2 lanes in each direction (22 lane miles)	$279.4M
Westlake Blvd	Hillcrest Dr	Eagle Claw Ave	Add one lane in each direction (7.2 lane miles)	$91.4M
Westlake Blvd	Eagle Claw Ave	Oak Valley Lane	Add 2 lanes in each direction (1.2 lane mile)	$15.2M
Wood Ranch Parkway	Long Canyon Rd	Madera Rd	Add 1 lane in each direction (4 lane miles)	$50.8M
Madera Rd	Wood Ranch Parkway	MaCaw Lane	Convert (south-westbound parking lane to travel lane (1.1 converted lane miles)	$5.3M
La Cienega Blvd	I-405	Glenway Dr	Convert southbound parking lane to travel lane (0.7 miles, 0.7 lane miles)	$3.4M
La Cienega Blvd	Beverly Blvd	Santa Monica Blvd	Convert parking lanes to travel lanes (0.4 lane miles)	$1.9M
Sunset Blvd	La Cienega Blvd	Marmont Lane	Add 1 lane in each direction (0.5 mile, 1 lane mile)	$12.7M
Laurel Canyon Blvd	Sunset Blvd	Mt. Olympus Dr	Add 1 lane in each direction (0.8 lane miles)	$10.2M
Laurel Canyon Blvd	Mt. Olympus Dr	Mulholland Dr	Add 2 lanes in each direction (7.2 lane miles)	$91.4M
Laurel Canyon Blvd	Mullholland Dr	Maxwellton Rd	Add 1 lane in each direction (3.8 lane miles)	$48.3M
Laurel Canyon Blvd	Maxwellton Rd	Webb Ave	Convert parking lanes to travel lanes (15.4 lane miles)	$73.9M
Laurel Canyon Blvd	Webb Ave	Sheldon St	Add 1 lane in each direction (0.6 mile, 1.2 lane miles)	$15.2M
SR 47	Anaheim St	Alameda St	Convert parking lanes to travel lanes (0.4 mile, 0.8 lane miles)	$3.8M
Alameda St	Alameda St	SR 1	Convert northbound parking lane to travel lane (0.3 mile, 0.3 lane mile)	$1.4M
Alameda St	Sepulveda Blvd	223rd St	Add 1 lane in each direction (1.2 miles, 2.4 lane miles)	$30.5M
Alameda St	I-405	SR 91	Convert parking lanes to travel lanes (3.2 miles, 6.4 lane miles)	$30.7M
Alameda St	SR 91	Nadeau St	Add 1 travel lane in each direction (6.6 miles, 13.2 lane miles)	$167.6M
Alameda St	Nadeau St	E 76th St	Add 1 travel lane northbound, convert parking lane southbound (0.3 miles, 0.6 lane miles)	$7.6M
Alameda St	E 76th St	US 101	Add 1 lane in each direction (5.7 miles, 11.4 lane miles)	$144.8M
Alameda St	Main St	Elmyra St	Add 1 lane in northbound direction (0.5 miles, 0.5 lane miles)	$6.4M
Spring St	Elmyra St	Mesnagers St	Add 1 lane in each direction (0.3 miles, 0.6 lane miles)	$7.6M
Spring St	Mesnagers St	18th Ave	Add 2 lanes in each direction (0.4 miles, 1.6 lane miles)	$20.3M
Daly St	Broadway	Pasadena Ave	Add 1 lane in each direction (0.2 miles, 0.4 lane miles)	$5.1M
Pasadena Ave	Daly St	French Ave	Add 2 lanes in each direction (0.8 miles, 3.2 lane miles)	$40.6M
Pasadena Ave	French Ave	Figueroa St	Add 1 lane in each direction (0.2 miles, 0.4 lane miles)	$8.9M
Figueroa St	Pasadena Ave	York Blvd	Convert parking lanes to travel lanes (2.4 miles, 4.8 lane miles)	$27.8M
Figueroa St	York Blvd	Colorado Blvd	Add 1 lane in each direction (1.7 miles, 3.4 lane miles)	$43.2M
Figueroa St	Colorado Blvd	Ramp to SR 134E	Add 2 lanes in each direction (0.1 miles, 0.4 lane miles)	$5.1M
Figueroa St	Ramp to SR 134E	SR 134 Interchange	Add 1 lane in each direction (0.2 miles, 0.4 lane miles)	$5.1M
Sheldon St	Laurel Canyon Rd	San Fernando Blvd	Add 1 lane in each direction (1.6 lane miles)	$20.3M
San Fernando Blvd	Sheldon St	La Rue St	Add 1 lane in each direction (7.2 lane miles)	$91.4M
San Fernando Blvd and Truman St	La Rue St	Bleeker St	Convert two-way streets to two one way streets (1.4 miles, 11.2 lane miles)	$32.5M
San Fernando Blvd	Bleeker St	I-5	Add 1 lane in each direction (5.4 lane miles)	$68.6M
Ximeno Ave	Livingston St	Anaheim St	Add 1 new lane in each direction, convert parking lanes to travel lanes (1.4 miles, 5.6 lane miles)	$51.8M
Ximeno Ave	Anaheim St	15th St	Add 1 northbound lane, convert parking lanes to travel lanes (0.2 miles, 0.4 converted miles, 0.2 lane miles	$4.9M
Ximeno Ave	15th St	Las Coyotes Diagonal	Convert parking lanes to travel lanes (0.5 miles, 1.0 lane mile)	$5.8M
Rosada St	Las Coyotes Diagonal	Lakewood Blvd	Add 2 new lanes in each direction (0.2 miles, 0.8 lane miles)	$10.2M
Lakewood Blvd	Traffic Circle	E. Stearns St	Convert northbound parking lane to travel lane (0.3 miles, 0.3 lane miles)	$1.7M
Lakewood Blvd	Carson St	Del Amo Blvd	Add 1 new lane in each direction (1.6 miles, 3.2 lane miles)	$40.6M

Table C2: Arterial Additions and Conversions

Road	From	To	Scope	Cost
Lakewood Blvd	Park St	I-105	Convert parking lanes to travel lanes (3.8 miles, 7.6 lane miles)	$44.1M
Lakewood Blvd	Florence Ave	I-5	Convert parking lanes to travel lanes (1.0 miles, 2.0 lane miles)	$11.6M
Rosemead Blvd	E Telegraph Rd	Gallatin Rd	Convert parking lanes to travel lanes (4.3 miles, 8.6 lane miles)	$49.9M
Rosemead Blvd	Gallatin Rd	SR 60	Add 1 lane in each direction (4.5 miles, 9.0 lane miles)	$114.3M
Rosemead Blvd	Marshall Ave	Sierra Madre Villa Ave	Convert parking lanes to travel lanes (5.9 miles, 11.8 lane miles)	$68.4M
Sierra Madre Villa Ave	Rosemead Blvd	E Sierra Madre Blvd	Add 1 lane in each direction (0.2 miles, 0.4 lane miles)	$5.1M
Western Ave	Paseo Del Mar	25th St	Add 1 lane in each direction (0.5 mile, 1.0 lane mile)	$12.7M
Western Ave	25th St	9th St	Convert northbound parking lane to travel lane and add 1 lane in southbound direction (1.1 new lanes, 1.1 converted lanes, 2.2 lane miles)	$20.4M
Western Ave	9th St	Carson St	Convert parking lanes to travel lanes (6.9 miles, 13.8 lane miles)	$80M
Western Ave	Carson St	Del Amo St	Convert northbound parking lane to travel lane (1.1 miles, 1.1 lane miles)	$6.4M
Western Ave	I-405	Franklin Ave	Convert parking lanes to travel lanes (17.0 miles, 34.0 lane miles)	$197.2M
Buena Vista St	SR 134	San Fernando Valley	Convert parking lanes to travel lanes (6.7 miles, 13.4 lane miles)	$77.7M
Buena Vista St	San Fernando Blvd	Glen Oaks Blvd	Add 1 lane in each direction (0.5 miles, 1.0 lane mile)	$12.7M
Glen Oaks Blvd	Buena Vista St	I-210	Convert parking lanes to travel lanes (10.9 miles, 21.8 lane miles)	$126.4M
Hacienda Rd	Whittier Blvd	Sansinena Lane	Add 1 lane in each direction (0.4 miles, 0.8 lane miles)	$10.2M
Hacienda Rd	Sansinena Lane	Glenmark Dr	Add 2 lanes in each direction (2.6 miles, 10.4 lane miles)	$132.1M
Hacienda Rd	Glenmark Dr	Colima Rd	Add 1 lane in each direction (0.4 miles, 0.8 lane miles)	$10.2M
Colima Rd	Hacienda Rd	Azusa Ave	Add 1 lane in each direction (2.6 miles, 5.2 lane miles)	$66M
Azusa Ave	W Francisquito Ave	E Garvey Ave	Convert southbound parking lane into travel lane (1.4 miles, 1.4 lane miles)	$8.1M
Azusa Ave	Workman Ave	1st Street	Convert parking lanes into travel lanes (3.2 miles, 6.4 lane miles)	$37.1M
Fairmont Blvd	Village Center Dr	Singingwood Dr	Add 1 lane in each direction (5.5 miles, 11.0 lane miles)	$139.7M
Fairmont Blvd	Singingwood Dr	San Antonio Rd	Add 2 lanes in each direction (0.9 miles, 3.6 lane miles)	$45.7M
Peyton Dr	Chino Hills Parkway	Morningfield Dr	Add 1 lane in each direction, convert parking lanes to travel lanes (0.2 miles, 0.8 lane miles)	$10.2M
Peyton Dr	Morningfield Dr	Eucalyptus Ave	Add 2 lanes in each direction (0.3 miles, 1.2 lane miles)	$15.2M
Riverside Dr	SR 71	Towne Ave	Add 1 lane in each direction (0.2 miles, 0.4 lane miles)	$5.1M
Towne Ave	Riverside Dr	Baseline Rd	Convert parking lanes to travel lanes (7.2 miles, 14.4 lane miles)	$83.5M
Euclid Ave	SR 71	Pomono Rincon Rd	Add 1 lane in each direction (0.5 miles, 1.0 lane miles)	$12.7M
Euclid Ave	Pomono Rincon Rd	Johnson Ave	Add 2 lanes in each direction (0.5 miles, 2.0 lane miles)	$25.4M
Euclid Ave	Johnson Ave	Merion St	Add 1 lane in each direction (2.0 miles, 4.0 lane miles)	$50.8M
Euclid Ave	Merion St	H Street	Convert parking lanes to travel lanes (3.5 miles, 7.0 lane miles)	$40.6M
Euclid Ave	Foothill Blvd	24th St	Add 1 lane in each direction (3.0 miles, 6.0 lane miles)	$76.2M
El Toro Cutoff Rd	SR 74	El Toro Rd	Add 2 lanes in each direction (1.3 miles, 5.2 lane miles)	$66M
El Toro Rd	El Toro Cutoff Rd	Fort Lander Lane	Add 2 lanes in each direction (8.8 miles, 35.2 lane miles)	$223.5M
El Toro Rd	Fort Lander Rd	El Mineral Rd	Add 2 lanes in each direction (0.5 miles, 2.0 lane miles)	$25.4M
Piedras Rd	El Mineral Rd	Santa Rosa Mine Rd	Add 2 lanes in each direction (0.9 miles, 3.6 lane miles)	$45.7M
Santa Rosa Mine Rd	Piedras	Lake Matthews Dr	Add 2 lanes in each direction (1.0 mile, 4.0 lane miles)	$50.8M
Gavilian Rd	Lake Matthews Dr	Cajalco Rd	Add 2 lanes in each direction (2.9 miles, 11.6 lane miles)	$147.3M
Cajalco Rd	Gavilian Rd	El Sobrante Rd	Add 2 lanes in each direction (0.3 miles, 1.2 lane miles)	$15.2M
El Sobrante Rd	Cajalco Rd	Mockingbird Canyon Rd	Add 2 lanes in each direction (1.1 miles, 4.4 lane miles)	$55.9M
Mockingbird Canyon Rd	El Sobrante Rd	Van Buren Blvd	Add 2 lanes in each direction (3.5 miles, 14.0 lane miles)	$177.8M
Van Buren Blvd	Mockingbird Canyon Rd	Rudcill St	Add 1 lane in each direction (2.6 miles, 5.2 lane miles)	$66M
Van Buren Blvd	Garfield St	Cypress Ave	Add 1 lane in each direction (1.8 miles, 3.6 lane miles)	$45.7M
Van Buren Rd	Jurupa Ave	Jurupa Rd	Add 1 lane in each direction (3.1 miles, 6.2 lane miles)	$78.7M
Jurupa Rd	Van Buren Rd	Valley Way	Add 2 lanes in each direction (2.7 miles, 10.8 lane miles)	$137.2M
Valley Way	Jurupa Rd	Mission Blvd	Add 2 lanes in each direction (0.4 miles, 1.2 lane miles)	$15.2M
Armstrong Rd	Mission Blvd	Sierra Ave	Add 1 lane in each direction (1.0 mile, 2.0 lane miles)	$25.4M
Sierra Ave	Armstrong Rd	Santa Ana Ave	Add 1 lane in each direction (2.6 miles, 5.2 lane miles)	$66M
Sierra Ave	San Bernardino Rd	Miller Ave	Convert parking lanes to travel lanes (1.5 miles, 3.0 lane miles)	$17.4M
Sierra Ave	Miller Ave	Baseline Rd	Add 1 lane in each direction (3.0 miles, 6.0 lane miles)	$76.2M
Sierra Ave	Summit Ave	I-15	Add 2 lanes in each direction (2.0 miles, 8.0 lane miles)	$101.6M
SR 79	Hunter Rd	Pourroy Rd	Add 1 lane in each direction (3.9 miles, 7.8 lane miles)	$99.1M
SR 79	Pourroy Rd	SR 74	Add 2 lanes in each direction (9.3 miles, 37.2 lane miles)	$472.4M
Juniper Springs Rd	Juniper Springs Curve	Juniper Flat Rd	Add 2 lanes in each direction (3.5 miles, 14.0 lane miles)	$177.8M
Juniper Flats Rd	Juniper Springs Rd	Contour Ave	Add 2 lanes in each direction (2.8 miles, 11.2 lane miles)	$142.2M
Contour Ave	Juniper Flats Rd	Hansen Ave	Add 2 lanes in each direction (1.1 miles, 4.4 lane miles)	$55.9M
Hansen Ave	Contour Ave	Ramona Expressway	Add 2 lanes in each direction (2.1 miles, 8.4 lane miles)	$106.7M

Table C2: Arterial Additions and Conversions

Road	From	To	Scope	Cost
Davis Rd	Ramona Expressway	Alessandro Blvd	Add 2 lanes in each direction (5.9 miles, 23.6 lane miles)	$299.7M
Theodore St	Alessandro Blvd	Ironwood Ave	Add 2 lanes in each direction (2.0 miles, 8.0 lane miles)	$101.6M
Ironwood Ave	Theodore St	Redlands Blvd	Add 2 lanes in each direction (1.0 mile, 4.0 lane miles)	$50.8M
Redlands Blvd	Ironwood Ave	San Timoteo Canyon Rd	Add 2 lanes in each direction (3.3 miles, 13.2 lane miles)	$167.6M
San Timoteo Canyon Rd	Redlands Blvd	Alessandro Rd	Add 2 lanes in each direction (2.2 miles, 8.8 lane miles)	$111.8M
Alessandro Rd	San Timoteo Canyon Rd	Crescent Ave	Add 2 lanes in each direction (1.6 miles, 6.4 lane miles)	$81.3M
Crescent Ave	Alessandro Rd	San Jacinto St	Add 2 lanes in each direction (.01 miles, .04 lane miles)	$0.5M
San Jacinto St	Crescent Ave	Highland Ave	Add 2 lanes in each direction (0.2 miles, 0.8 lane miles)	$10.2M
Highland Ave	San Jacinto St	San Mateo St	Add 2 lanes in each direction (0.2 miles, 0.8 lane miles)	$10.2M
San Mateo St	Highland Ave	Clifton Ave	Add 1 lane in each direction, convert parking lanes to travel lanes (0.4 miles, 1.6 lane miles)	$14.8M
San Mateo St	Clifton Ave	I-10/I-210	Convert parking lanes to travel lanes (2.1 miles, 4.2 lane miles)	$24.4M

Table C3: Managed Arterial Grade Separated Interchanges

Grade Separation	Cost	Grade Separation	Cost
Roscoe Blvd at Fallbrook Ave	$42M	San Fernando Blvd at Branford St	$42M
Roscoe Blvd at SR 27 (Dual)	$78M	San Fernando Blvd at Osborne St	$42M
Roscoe Blvd at Canoga Ave	$42M	San Fernando Blvd at Van Nuys Blvd	$42M
Roscoe Blvd at De Soto Ave	$42M	San Fernando Blvd at Paxton St	$42M
Roscoe Blvd at Mason Ave	$42M	San Fernando Blvd/Truman St at Hubbard St	$42M
Roscoe Blvd at Winnetka Ave	$42M	San Fernando Blvd at Polk St	$42M
Roscoe Blvd at Corbin Ave	$42M	San Fernando Blvd at Roxford St	$42M
Roscoe Blvd at Tampa Ave	$42M	Alameda St at Anaheim St	$42M
Roscoe Blvd at Wilbur Ave	$42M	Alameda St at Santa Fe Ave.	$42M
Roscoe Blvd at Reseda Blvd	$42M	Alameda Ave at Greenleaf Blvd	$42M
Roscoe Blvd at Lindley Ave	$42M	Alameda Ave at Alondra Blvd	$42M
Roscoe Blvd at Balboa Blvd	$42M	Alameda Ave at Compton Blvd	$42M
Roscoe Blvd at Woodley Ave	$42M	Alameda Ave at El Segundo Blvd	$42M
Roscoe Blvd at Sepulveda Blvd	$42M	Alameda Ave at Imperial Highway	$42M
Roscoe Blvd at Van Nuys Blvd	$42M	Alameda Ave at Fernwood Ave	$42M
Roscoe Blvd at Woodman Ave	$42M	Alameda Ave at Southern Ave	$42M
Roscoe Blvd at Goldwater Canyon Ave.	$42M	Alameda Ave at Firestone Blvd	$42M
Roscoe Blvd at Whitsett Ave	$42M	Alameda Ave at Nadeau St	$42M
Roscoe Blvd at Laurel Canyon Blvd (Dual)	$78M	Alameda Ave at Florence St	$42M
Roscoe Blvd/Tuxford Street at Webb Ave	$42M	Alameda Ave at Gage Ave	$42M
Tuxford St at Lankersham Blvd	$42M	Alameda Ave at Slauson Ave	$42M
Tuxford St at San Fernando Rd	$42M	Alameda Ave at Vernon Ave	$42M
Tuxford St at Glenoaks Blvd (dual)	$78M	Alameda Ave at Washington Blvd	$42M
La Tuna Canyon Rd at Sunland Blvd	$42M	Alameda Ave at Olympic Blvd	$42M
San Vicente Blvd at 26th St	$42M	Alameda Ave at 7th St	$42M
San Vicente Blvd at Barrington Ave	$42M	Alameda Ave at 6th St	$42M
San Vicente Blvd/Wilshire Blvd at Federal Ave	$42M	Alameda Ave at 4th St	$42M
Wilshire Blvd at Veteran Ave	$42M	Alameda Ave at 3rd St	$42M
Wilshire Blvd at Westwood Blvd	$42M	Alameda Ave at 1st St	$42M
Wilshire Blvd at Beverly Glen Blvd	$42M	Alameda Ave at Cesar Chavez Ave	$42M
Wilshire Blvd at SR 2/Santa Monica Blvd	$42M	Alameda Ave at College St	$42M
Santa Monica Blvd at Beverly Dr	$42M	Broadway at Daly St	$42M
Santa Monica Blvd at Doheny Dr	$42M	Pasadena Ave at Figueora St	$42M
Santa Monica Blvd at San Vicente Blvd	$42M	Figueroa St at 52nd Ave.	$42M
Santa Monica Blvd at La Cienega Blvd	$42M	Figueora St at York Blvd	$42M
Santa Monica Blvd at Crescent Heights Blvd	$42M	Figueora St at Colorado Blvd	$42M
Santa Monica Blvd at Fairfax Ave	$42M	Ximeno Ave at Broadway	$42M
Santa Monica Blvd at La Brea Ave	$42M	Ximeno Ave at 3rd Street	$42M
Santa Monica Blvd at Highland Ave	$42M	Ximeno Ave at 4th St	$42M
Santa Monica Blvd at Cahuenga Blvd	$42M	Ximeno Ave at 7th St	$42M
Santa Monica Blvd at Vine St	$42M	Ximeno Ave at Anaheim St	$42M
Santa Monica Blvd at Wilton Place	$42M	Ximeno Ave at SR 1	$42M

Table C3: Managed Arterial Grade Separated Interchanges

Grade Separation	Cost	Grade Separation	Cost
Santa Monica Blvd at Western Ave	$42M	Ximeno Ave at Atherton St	$42M
Santa Monica Blvd at Normandie Ave	$42M	Ximeno Ave at Los Coyotes Diagonal	$42M
Santa Monica Blvd at Vermont St	$42M	Lakewood Blvd at Stearns St	$42M
Sunset Blvd at Silver Lake Blvd	$42M	Lakewood Blvd at Willow St	$42M
Sunset Blvd at Alvarado St	$42M	Lakewood Blvd at Spring St	$42M
Sunset Blvd at Glendale Blvd	$42M	Lakewood Blvd at Carson St	$42M
San Vicente Blvd at Huntington Dr	$42M	Lakewood Blvd at Del Amo Blvd	$42M
Garfield Ave at Atlantic Blvd / Huntington Dr	$42M	Lakewood Blvd at Candlewood St	$42M
Garfield Ave at Main St	$42M	Lakewood Blvd at South St	$42M
Las Tunas Dr at San Gabriel Blvd	$42M	Lakewood Blvd at Ashworth St	$42M
Las Tunas Dr at Rosemead Dr	$42M	Lakewood Blvd at Flower St	$42M
Las Tunas Dr at Temple City Blvd	$42M	Lakewood Blvd at Alondra Blvd	$42M
Las Tunas Dr at Baldwin Ave	$42M	Lakewood Blvd at Somerset Blvd	$42M
Live Oak Ave at Santa Anita Ave	$42M	Lakewood Blvd at Rosecrans Blvd	$42M
Live Oak Ave at Myrtle Ave	$42M	Lakewood Blvd at Imperial Blvd	$42M
Slauson Ave at La Cienega Blvd (dual)	$42M	Lakewood Blvd at Stewart and Gray Rd	$42M
Slauson Ave at South La Brea Ave	$42M	Lakewood Blvd at Firestone Blvd	$42M
Slauson Ave at Overhill Dr	$42M	Lakewood Blvd at Florence Ave	$42M
Slauson Ave at Crenshaw Blvd	$42M	Rosemead Blvd at Slauson Ave	$42M
Slauson Ave at Van Ness Ave	$42M	Rosemead Blvd at Washington Blvd	$42M
Slauson Ave at Western Ave (dual)	$78M	Rosemead Blvd at Mines Ave	$42M
Slauson Ave at Normandie Ave	$42M	Rosemead Blvd at Whittier Blvd	$42M
Slauson Ave at Vermont Ave	$42M	Rosemead Blvd at E. Beverly Blvd	$42M
Slauson Ave at Hoover St	$42M	Rosemead Blvd at Durfee Ave	$42M
Slauson Ave at Figueroa St.	$42M	Rosemead Blvd at Garvey Ave	$42M
Slauson Ave at Broadway	$42M	Rosemead Blvd at Valley Blvd	$42M
Slauson Ave at Main St	$42M	Rosemead Blvd at Mission Drive	$42M
Slauson Ave at San Pedro St	$42M	Rosemead Blvd at Las Tunas Dr	$42M
Slauson Ave at Avalon Blvd	$42M	Rosemead Blvd at Longden Ave	$42M
Slauson Ave at Central Ave	$42M	Rosemead Blvd at Duarte Rd	$42M
Slauson Ave at Hooper Ave	$42M	Rosemead Blvd at Huntington Dr	$42M
Slauson Ave at Compton Ave	$42M	Rosemead Blvd at California Blvd	$42M
Slauson Ave at Alameda St	$42M	Rosemead Blvd at Colorado Blvd	$42M
Slauson Ave at Santa Fe Ave	$42M	Rosemead Blvd at Foothill Blvd	$42M
Slauson Ave at Pacific Blvd	$42M	Rosemead Blvd at Sierra Madre Villa Ave	$42M
Slauson Ave at Miles Ave	$42M	Sierra Madre Villa Ave at Sierra Madre Villa Blvd	$42M
Slauson Ave at Maywood Ave	$42M	Western Ave at Miraleste Drive	$42M
Slauson Ave at Atlantic Blvd	$42M	Western Ave at First St.	$42M
Slauson Ave at Eastern Ave	$42M	Western Ave at Palos Verdes Dr.	$42M
Slauson Ave at Garfield Ave	$42M	Western Ave at SR 1	$42M
Slauson Ave at Telegraph Rd	$42M	Western Ave at Lomita Blvd	$42M
Telegraph Rd at Paramount Blvd	$42M	Western Ave at Sepulveda Blvd	$42M
Telegraph Rd at Rosemead Blvd/Lakewood Blvd (dual)	$78M	Western Ave at 223rd St	$42M
Telegraph Rd at Orr and Day Rd	$42M	Western Ave at Carson St	$42M
Telegraph Rd at Pioneer Blvd	$42M	Western Ave at Torrance Blvd	$42M
Telegraph Rd at Norwalk Ave	$42M	Western Ave at 190th St.	$42M
Telegraph Rd at Bloomfield Ave	$42M	Western Ave at 182nd St.	$42M
Telegraph Rd at Greenleaf Ave	$42M	Western Ave at Artesia Blvd	$42M
Telegraph Rd at Carmentia Rd	$42M	Western Ave at 166th St	$42M
Telegraph Rd at Florence Ave	$42M	Western Ave at Redondo Beach Blvd	$42M
Telegraph Rd at Colima Rd	$42M	Western Ave at Marine Ave	$42M
Telegraph Rd at Leffingwell Rd	$42M	Western Ave at Rosecrans Ave.	$42M
Imperial Highway at La Mirada Blvd	$42M	Western Ave at 135th St	$42M
Imperial Highway at Santa Gertrudes Ave	$42M	Western Ave at El Segundo Blvd	$42M
Imperial Highway at SR 39	$42M	Western Ave at Imperial Highway	$42M
Imperial Highway at Idaho St	$42M	Western Ave at 108th St	$42M
Imperial Highway at Euclid St	$42M	Western Ave at Century Blvd	$42M
Imperial Highway at Harbor Blvd	$42M	Western Ave at 92nd St.	$42M
Imperial Highway at Brea Blvd	$42M	Western Ave at Manchester Ave	$42M
Imperial Highway at State College Blvd	$42M	Western Ave at Florence Ave.	$42M
Imperial Highway at Associated Road	$42M	Western Ave at Gage Ave.	$42M
Imperial Highway at Kraemer Blvd	$42M	Western Ave at 54th St.	$42M

Table C3: Managed Arterial Grade Separated Interchanges

Grade Separation	Cost	Grade Separation	Cost
Imperial Highway at Valencia Ave	$42M	Western Ave at 48th St.	$42M
Valencia Ave at Birch St	$42M	Western Ave at Vernon Ave.	$42M
Chino Hills Parkway at Peyton Dr (Dual)	$78M	Western Ave at Martin Luther King Jr. Blvd	$42M
Chino Hills Parkway at Pipeline Ave	$42M	Western Ave at Exposition Blvd	$42M
Chino Hills Parkway at Ramona Ave	$42M	Western Ave at Jefferson Blvd	$42M
Chino Hills Parkway at Central Ave	$42M	Western Ave at Adams Blvd	$42M
Merrill Ave at Euclid Ave	$42M	Western Ave at Washington Blvd	$42M
Limonite Ave at Sumner Ave	$42M	Western Ave at Venice Blvd	$42M
Limonite Ave at Hamner Ave	$42M	Western Ave at W. Pico Blvd	$42M
Limonite Ave at Wineville Ave	$42M	Western Ave at Olympic Blvd	$42M
Limonite Ave at Etiwanda Ave	$42M	Western Ave at Oxford Ave.	$42M
Riverview Dr at Mission Blvd	$42M	Western Ave at Wilshire Blvd	$42M
Torrance Blvd at SR 1	$42M	Western Ave at 6th St.	$42M
Torrance Blvd at Prospect Ave	$42M	Western Ave at 3rd St.	$42M
Torrance Blvd at Anza Ave	$42M	Western Ave at Beverly Blvd	$42M
Torrance Blvd at Hawthorne Blvd	$42M	Western Ave at Melrose Ave.	$42M
Hawthorne Blvd at Carson St	$42M	Western Ave at Santa Monica Blvd	$42M
Carson St at Madrona Ave	$42M	Western Ave at Fountain Ave	$42M
Carson St at Maple Ave	$42M	Western Ave at Sunset Dr.	$42M
Carson St at Crenshaw Blvd	$42M	Western Ave at Prospect Ave	$42M
Carson St at Carbillo Ave	$42M	Western Ave at Franklin Ave	$42M
Carson St at Western Ave	$42M	Buena Vista Rd at Alameda Ave	$42M
Carson St at Normandie Ave	$42M	Buena Vista Rd at Olive Ave	$42M
Carson St at Vermont Ave	$42M	Buena Vista Rd at Magnolia Blvd	$42M
Carson St at Figueroa St	$42M	Buena Vista Rd at Burbank St.	$42M
Carson St at Main St	$42M	Buena Vista Rd at Victory Rd	$42M
Carson St at Delores St	$42M	Buena Vista Rd at Empire Ave.	$42M
Carson St at Avalon Blvd	$42M	Buena Vista Rd at San Fernando Blvd	$42M
Carson St at Wilmington Ave	$42M	Buena Vista Rd at Glen Oaks Blvd	$42M
Carson St at Santa Fe Ave	$42M	Glen Oaks Blvd at Sunland Blvd	$42M
Bixby Rd at Long Beach Blvd	$42M	Glen Oaks Blvd at Penrose St	$42M
Bixby at Atlantic Ave	$42M	Glen Oaks Blvd at Sheldon St	$42M
Carson St at Orange Ave	$42M	Glen Oaks Blvd at Osbourne St	$42M
Carson St at Cherry Ave	$42M	Glen Oaks Blvd at Van Nuys Blvd	$42M
Carson St at Paramount Blvd	$42M	Glen Oaks Blvd at Paxton St	$42M
Carson St at Lakewood Blvd	$42M	Glen Oaks Blvd at Vaughn St	$42M
Carson St at Clark Ave	$42M	Glen Oaks Blvd at Arroyo St.	$42M
Carson St at Bellflower Blvd	$42M	Glen Oaks Blvd at Macclay St	$42M
Carson St at Woodruff Ave	$42M	Glen Oaks Blvd at Hubbard St	$42M
Carson St at Palo Verde Ave	$42M	Glen Oaks Blvd at Sayre St.	$42M
Carson St at Pioneer Blvd	$42M	Glen Oaks Blvd at Polk St.	$42M
Lincoln Ave at Norwalk St	$42M	Glen Oaks Blvd at Tyler St.	$42M
Lincoln Ave at Moody St	$42M	Glen Oaks Blvd at Bledsoe St	$42M
Lincoln Ave at Walker St	$42M	Glen Oaks Blvd at Roxford St	$42M
Lincoln Ave a Valley View St	$42M	Beach Blvd at Atlanta Ave	$42M
Lincoln Ave at Knott Ave	$42M	Beach Blvd at Indianapolis Ave.	$42M
Lincoln Ave at Western Ave	$42M	Beach Blvd at Adams Ave	$42M
Lincoln Ave at Beach Blvd (dual)	$78M	Beach Blvd at Indianapolis Ave	$42M
Lincoln Ave at Dale Ave	$42M	Beach Blvd at Adams Ave	$42M
Lincoln Ave at Magnolia St	$42M	Beach Blvd at Yorktown Ave	$42M
Lincoln Ave at Gilbert St	$42M	Beach Blvd at Garfield Ave	$42M
Lincoln Ave at Brookhurst St	$42M	Beach Blvd at Ellis Ave	$42M
Lincoln Ave at Euclid St	$42M	Beach Blvd at Talbert Ave	$42M
Euclid St at Broadway	$42M	Beach Blvd at Slater Ave	$42M
Euclid St at Ball Rd	$42M	Beach Blvd at Heil Ave	$42M
Ball Rd at Disneyland Dr	$42M	Beach Blvd at Edinger Ave	$42M
Ball Rd at Harbor Blvd	$42M	Beach Blvd at Center Ave	$42M
Ball Rd at Anaheim Blvd	$42M	Beach Blvd at McFadden Ave	$42M
Ball Rd at State College Blvd	$42M	Beach Blvd at Bolsa Ave	$42M
Taft Ave at N Batavia St	$42M	Beach Blvd at Hazard Ave.	$42M
Taft Ave at Glassell St	$42M	Beach Blvd at Westminster Ave	$42M
Taft Ave at Cambridge St	$42M	Beach Blvd at Trask Ave.	$42M

Table C3: Managed Arterial Grade Separated Interchanges

Grade Separation	Cost	Grade Separation	Cost
Taft Ave at Tustin St	$42M	Beach Blvd at Garden Grove Blvd	$42M
Taft Ave at Santiago Blvd	$42M	Beach Blvd at Lampson Ave	$42M
E Santiago Canyon Rd at Cannon Rd	$42M	Beach Blvd at Chapman Ave	$42M
E Santiago Canyon Rd at Chapman Rd	$42M	Beach Blvd at Orangewood Ave	$42M
Warner Ave at Graham St	$42M	Beach Blvd at Katlia Ave	$42M
Warner Ave at Springdale St	$42M	Beach Blvd at Cerritos Ave	$42M
Warner Ave at Edwards St	$42M	Beach Blvd at Bali Rd	$42M
Warner Ave at Goldenwest St	$42M	Beach Blvd at Orange Ave	$42M
Warner Ave at Gothard St	$42M	Beach Blvd at Crescent Ave	$42M
Warner Ave at Beach Blvd (dual)	$78M	Beach Blvd at La Palma Ave.	$42M
Warner Ave at Newland St	$42M	Beach Blvd at Artesia Blvd	$42M
Warner Ave at Magnolia St	$42M	Beach Blvd at Malvern Ave	$42M
Warner Ave at Bushard St	$42M	Beach Blvd at Rosecrans Ave	$42M
Warner Ave at Brookhurst St	$42M	Beach Blvd at Imperial Highway	$42M
Warner Ave at Euclid St	$42M	Beach Blvd at Lambert Rd	$42M
Warner Ave at Newhope St	$42M	Beach Blvd at El Camino Real	$42M
Warner Ave at Harbor Blvd	$42M	Beach Blvd at Whittier Blvd	$42M
Warner Ave at Fairview St	$42M	Beach Blvd at Gregory Lane	$42M
Warner Ave at Raitt St	$42M	Hacienda Rd at Colima Rd	$42M
Warner Ave at Bristol St	$42M	Azusa Ave at Colima Rd	$42M
Warner Ave at Flower St	$42M	Azusa Ave at Gale Ave	$42M
Warner Ave at Main St	$42M	Azusa Ave at Arenth Ave	$42M
Warner Ave at Grand Ave	$42M	Azusa Ave at Valley Blvd	$42M
Red Hill Ave at Edinger Ave	$42M	Azusa Ave at Temple Ave	$42M
Tustin Ranch Rd at Walnut Ave	$42M	Azusa Ave at Amra Rd	$42M
Tustin Ranch Rd at El Camino Real	$42M	Azusa Ave at Merced Ave	$42M
Tustin Ranch Rd at Bryan Ave	$42M	Azusa Ave at Vine St	$42M
Tustin Ranch Rd at Irvine Blvd	$42M	Azusa Ave at Cameron Ave	$42M
Portola Parkway at Jamboree Rd	$42M	Azusa Ave at Workman Ave	$42M
Crown Valley Parkway at Camino Del Avion	$42M	Azusa Ave at Rowland St	$42M
Alicia Parkway at Niguel Rd	$42M	Azusa Ave at Puente Ave	$42M
Alicia Parkway at Aliso Creek Rd	$42M	Azusa Ave at Badillo St	$42M
Alicia Parkway at Pacific Park Dr	$42M	Azusa Ave at San Bernardino Rd	$42M
Alicia Parkway at Moulton Parkway	$42M	Azusa Ave at Cypress St	$42M
Alicia Parkway at Paseo De Valencia	$42M	Azusa Ave at Arrow Highway	$42M
Alicia Parkway at Muirlands Blvd	$42M	Azusa Ave at Gladstone St	$42M
Alicia Parkway at Jeronimo Rd	$42M	Azusa Ave at 1st St	$42M
Alicia Parkway at Trabuco Rd	$42M	Azusa Ave at 5th St	$42M
Alicia Parkway at Marguerite Parkway	$42M	Azusa Ave at Foothill Blvd	$42M
Alicia Parkway at Olympiad Rd	$42M	Azusa Ave at Sierra Madre Ave	$42M
Santa Margarita Parkway at Avenida De Las Flores	$42M	Fairmont Blvd at La Palma Ave	$42M
Santa Margarita Parkway at Antonio Parkway	$42M	Fairmont Blvd at Esperanza Rd	$42M
SR 74 at Perris Blvd	$42M	Fairmont Blvd at Yorba Linda Blvd	$42M
SR 74 at SR 79 (Dual)	$78M	Fairmont Blvd at Bastanchury Rd	$42M
SR 74 at Warren Rd	$42M	Carbon Canyon Rd at Chino Hills Parkway	$42M
SR 74 at Sanderson Ave	$42M	Chino Hills Parkway at Grand Ave	$42M
SR 74 at Kirby St	$42M	Peyton Dr at Eucalyptus Ave	$42M
SR 74 at Lyon Ave	$42M	Peyton Dr at Grand Ave	$42M
SR 74 at Palm Ave	$42M	Peyton Dr at Chino Ave	$42M
SR 74 at State St	$42M	Towne Ave at Philadelphia St	$42M
SR 74 at San Jacinto Rd	$42M	Towne Ave at Lexington Ave	$42M
SR 23 at Agoura St	$42M	Towne Ave at Franklin Ave	$42M
SR 23S at US 101	$42M	Towne Ave at Phillips Blvd	$42M
Westlake Blvd at Thousand Oaks Rd	$42M	Towne Ave at Mission Blvd	$42M
Madera Rd at Tierra Rejada Rd	$42M	Towne Ave at Holt Ave	$42M
Madera Rd at Easy St	$42M	Towne Ave at Arrow Highway	$42M
SR 1/27 at SR 107	$42M	Towne Ave at Bonita Ave	$42M
SR 1/27 at Calle Mayor	$42M	Towne Ave at Foothill Blvd	$42M
SR 1/27 at Palos Verdes Blvd	$42M	Euclid Ave at Pine Ave	$42M
SR 1/27 at Torrance Blvd	$42M	Euclid Ave at Edison Ave	$42M
SR 1/27 at Diamond St	$42M	Euclid Ave at Schaefer Ave	$42M
SR 1/27 at Herondo St	$42M	Euclid Ave at Chino Ave	$42M

Table C3: Managed Arterial Grade Separated Interchanges

Grade Separation	Cost	Grade Separation	Cost
SR 1/27 at Artesia Blvd	$42M	Euclid Ave at Riverside Dr	$42M
SR 1/27 at Manhattan Beach Blvd	$42M	Euclid Ave at Walnut St	$42M
SR 1/27 at Rosecrans Ave	$42M	Euclid Ave at Philadelphia St	$42M
SR 1/27 at El Segundo Blvd	$42M	Euclid Ave at Francis St	$42M
SR 1/27 at Grand Ave	$42M	Euclid Ave at Phillips St	$42M
SR 1/27 at Imperial Highway	$42M	Euclid Ave at W. Mission Blvd	$42M
SR 1/27 at Manchester Ave	$42M	Euclid Ave and E Holt Blvd	$42M
SR 1/27 at Jefferson Blvd	$42M	Euclid Ave at D St	$42M
SR 1/27 at Washington Blvd	$42M	Euclid Ave at 4th St	$42M
SR 1/27 at Venice Blvd	$42M	Euclid Ave at 6th St	$42M
SR 1/27 at Rose Ave	$42M	Euclid Ave at 8th St	$42M
SR 1/27 at Ocean Park Blvd	$42M	Euclid Ave at Arrow Highway	$42M
SR 1/27 at Pico Blvd	$42M	Euclid Ave at Foothill Blvd	$42M
SR 1/27 at Chautauqua Blvd and Channel Rd	$42M	Euclid Ave at 13th St	$42M
SR 1/27 at Ventura Blvd	$42M	Euclid Ave at 16th St	$42M
SR 1/27 at Burbank Blvd	$42M	Euclid Ave at 19th St	$42M
SR 1/27 at Oxnard St	$42M	Piedras Rd at Santa Rosa Mine Rd	$42M
SR 1/27 at Victory Blvd	$42M	Van Buren Blvd at Victoria Ave	$42M
SR 1/27 at Vanowen St	$42M	Van Buren Blvd at Indiana Ave	$42M
SR 1/27 at Sherman Way	$42M	Van Buren Blvd at Magnolia Ave	$42M
SR 1/27 at Saticoy St	$42M	Van Buren Blvd at California Ave	$42M
SR 1/27 at Plummer St	$42M	Van Buren Blvd at Jackson St	$42M
SR 1/27 at Larson St	$42M	Van Buren Blvd at Arlington Ave	$42M
SR 1/27 at Devonshire St	$42M	Van Buren Blvd at Jurupa Rd	$42M
La Cienega Blvd at Centinela Ave	$42M	Jurupa Rd at Pedley Rd	$42M
La Cienega Blvd at La Tijera Blvd	$42M	Jurupa Rd at Camino Real	$42M
La Cienega Blvd at Rodeo Rd	$42M	Pedley Rd at Mission Blvd	$42M
La Cienega Blvd at Jefferson Blvd	$42M	Sierra Ave at Santa Anna Ave	$42M
La Cienega Blvd at Washington Blvd	$42M	Sierra Ave at Slover Ave	$42M
La Cienega Blvd at Venice Blvd	$42M	Sierra Ave at Valley Blvd	$42M
La Cienega Blvd at Cadillac Ave	$42M	Sierra Ave at San Bernardino Ave	$42M
La Cienega Blvd at at Pico Blvd	$42M	Sierra Ave at Randall Ave	$42M
La Cienega Blvd at Olympic Blvd	$42M	Sierra Ave at Merrill Ave	$42M
La Cienega Blvd at Wilshire Blvd	$42M	Sierra Ave at Arrow Blvd	$42M
La Cienega Blvd at San Vicente Blvd	$42M	Sierra Ave at Foothill Blvd	$42M
La Cienega Blvd at 3rd St	$42M	Sierra Ave at Miller Ave	$42M
La Cienega Blvd at Beverly Blvd	$42M	Sierra Ave at Baseline Rd	$42M
La Cienega Blvd at Melrose Ave	$42M	Sierra Ave at Highland Ave	$42M
La Cienega Blvd at Santa Monica Blvd	$42M	Sierra Ave at Sierra Lakes Parkway	$42M
Laurel Canyon Blvd at Mulholland Dr	$42M	SR 79 at Margarita Rd	$42M
Laurel Canyon Blvd at Ventura Blvd	$42M	SR 79 at Murrieta Hot Springs Rd	$42M
Laurel Canyon Blvd at Moorpark St	$42M	SR 79 at Leon Rd	$42M
Laurel Canyon Blvd at Riverside Dr	$42M	SR 79 at Scott Rd	$42M
Laurel Canyon Blvd at Magnolia Blvd	$42M	SR 79 at Domenigoni Parkway	$42M
Laurel Canyon Blvd at Chandler Blvd	$42M	SR 79 at Simpson Rd	$42M
Laurel Canyon Blvd at Burbank Blvd	$42M	Hansen Road at Ramona Expressway	$42M
Laurel Canyon Blvd at Oxnard St	$42M	San Mateo St at Brookside Ave	$42M
Laurel Canyon Blvd at Victory Blvd	$42M	Tennessee St at Slate St.	$42M
Laurel Canyon Blvd at Vanowen St	$42M	Tennessee St at Redlands Blvd	$42M
Laurel Canyon Blvd at Sherman Way	$42M	Tennessee St at Colton St	$42M
Laurel Canyon Blvd at Saticoy St	$42M	**Total**	**$24.3B**
Laurel Canyon Blvd at Strathern St	$42M		
Sheldon St at San Fernando Blvd	$42M		

Table C4: New Roadway Sections/New Bridges (New Alignments)

Road	From	To	Cost
I-710 - Bixby Rd. Connector (1.5 miles, 9 lane miles)	I-710	Bixby Rd at Country Club Rd	$216.9M
Tustin St - N. Highland St Connector (0.2 miles, 1.2 lane miles)	Taft Ave and Tustin St	Taft Ave and N. Highland St	$29.9M
Westlake Blvd – Wood Ranch Parkway Connector (2.0 miles, 8.0 lane miles)	Westlake Blvd 0.1 mile west of Oak Valley Lane	Wood Ranch Parkway at Long Canyon Rd	$192.8M
Rosecrans Connector (0.2 miles, 0.8 lane miles)	Alameda St	Rosecrans Blvd	$19.3M
Western Ave Missing Link (7.6 miles, 30.4 lane miles)	Los Feliz Blvd	Buena Vista St at SR 134	$732.6M
Hacienda Ave Extension (0.4 miles, 2.4 lane miles)	Beach Blvd at Gregory Lane	Whittier Blvd and Hacienda Ave	$53.3M
Fairmont Blvd Extension (2.5 miles, 15.0 lane miles)	Fairmont Blvd at Quarter House Rd	Carbon Canyon Rd at Olindo Dr	$361.5M
Juniper Springs Extension (2.5 miles, 15.0 lane miles)	SR 74	Juniper Springs Curve	$361.5M
SR 90 bridge (0.4 miles, 2.4 lane miles)	West of Mindanao Way	East of Mindanao Way	$57.8M
Total			**$2.0B**

Table C5: List of Managed Lane Components

Managed Arterial	Improvement	Managed Arterial	Improvement
Roscoe Blvd	From Valley Circle Blvd to SR 27 convert parking lanes to travel lanes (2.3 miles, 4.6 lane miles)	Sheldon St	Build managed grade separation at San Fernando Rd
Roscoe Blvd	Build managed grade separation at Fallbrook Ave	Sheldon St	Build managed grade separation at Branford St
Roscoe Blvd	Add 1 lane in each direction from Haskell Ave to Landon Ave	Sheldon St	Build managed grade separation at Osborne St
Roscoe Blvd	Build managed grade separation at SR 27	Sheldon St	Build managed grade separation at Van Nuys Blvd
Roscoe Blvd	Build managed grade separation at Canoga Ave	San Fernando Rd	From Sheldon St to La Rue St add 1 lane in each direction (3.6 miles, 7.2 lane miles)
Roscoe Blvd	Build managed grade separation at De Soto Ave	San Fernando Rd	Build managed grade separation at Paxton St
Roscoe Blvd	Build managed grade separation at Mason Ave	San Fernando Rd	Rebuild SR 118 Interchange
Roscoe Blvd	Build managed grade separation at Winnetka Ave	San Fernando Rd/Truman St	Build managed grade separation at Hubbard St
Roscoe Blvd	Build managed grade separation at Corbin Ave	San Fernando Rd/Truman St	From La Rue St to Bleeker St convert two-way streets to two way one streets (1.4 miles, 11.2 lane miles)
Roscoe Blvd	Build managed grade separation at Tampa Ave	San Fernando Rd	Build managed grade separation at Polk St
Roscoe Blvd	Build managed grade separation at Wilbur Ave	San Fernando Rd	Build managed grade separation at Roxford St
Roscoe Blvd	Build managed grade separation at Reseda Blvd	San Fernando Rd	From Bleeker St to I-5 add 1 lane in each direction (2.7 miles, 5.4 lane miles)
Roscoe Blvd	Build managed grade separation at Lindley Ave	SR 47	Build managed grade separation at Anaheim St
Roscoe Blvd	Build managed grade separation at Balboa Blvd	SR 47	From Anaheim St to Alameda St (convert parking lanes to travel lanes 0.4 mile, 0.8 lane miles)
Roscoe Blvd	Build managed grade separation at Woodley Ave	Alameda St	From Alameda St to SR 1 Convert northbound parking lane to travel lane (0.3 miles, 0.3 lane miles)
Roscoe Blvd	Build managed grade separation at I-405 Interchange	Alameda St	From north of Sepulveda Blvd to South of 223rd St. Add 1 lane in each direction (1.2 miles, 2.4 lane miles)
Roscoe Blvd	Build managed grade separation at Sepulveda Blvd	Alameda St	Rebuild I-405 Interchange
Roscoe Blvd	Build managed grade separation at Van Nuys Blvd	Alameda St	From north of I-405 to SR 91 convert parking lanes to travel lanes (3.2 miles, 6.4 lane miles)
Roscoe Blvd	Build managed grade separation at Woodman Ave	Alameda St	Build managed grade separation at Santa Fe Ave
Roscoe Blvd	Build managed grade separation at Goldwater Canyon Ave.	Alameda St	Rebuild SR 91 Interchange
Roscoe Blvd	Rebuild SR 170 Interchange	Alameda St	From SR 91 to Nadeau St add 1 travel lane in each direction 6.6 miles, 13.2 lane miles)
Roscoe Blvd	From SR 170 to Sunland Canyon Blvd convert parking lanes to travel lanes (2.8 miles, 5.6 lane miles)	Alameda St	Build managed grade separation at Greenleaf Blvd
Roscoe Blvd	Build managed grade separation at Whitsett Ave	Alameda St	Build managed grade separation at Alondra Blvd
Roscoe Blvd	Build managed grade separation at Laurel Canyon Blvd	Alameda St	Build managed grade separation at Compton Blvd
Roscoe Blvd	Build managed grade separation at Webb Ave	Alameda St	Build new connector intersecting with Rosecrans Dr
Roscoe Blvd	Build managed grade separation at Lankershim Blvd	Alameda St	Build managed grade separation at El Segundo Blvd
Roscoe Blvd	Rebuild I-5 Interchange	Alameda St	Build new Interchange at I-105
Roscoe Blvd	Build managed grade separation at San Fernando Rd	Alameda St	Build managed grade separation at Imperial Highway
Roscoe Blvd	Build managed grade separation at Glenoaks Blvd	Alameda St	Build managed grade separation at Fernwood Ave
Roscoe Blvd	Build dual managed grade separations at Sunland Blvd	Alameda St	Build managed grade separation at Southern Ave
Roscoe Blvd	From Sunland Canyon Blvd to Elbon St add 1 lane in each direction, convert parking lanes to travel lanes (1.8	Alameda St	Build managed grade separation at Firestone Blvd

Table C5: List of Managed Lane Components

Managed Arterial	Improvement	Managed Arterial	Improvement
	miles, 7.2 lane miles)		
Roscoe Blvd	From Elbon St to I-210 convert parking lanes to travel lanes (2.5 miles, 5.0 lane miles)	Alameda St	Build managed grade separation at Nadeau St
Roscoe Blvd	Rebuild I-210 Interchange	Alameda St	From Nadeau St to E 76th St, add 1 travel lane northbound, convert parking lane southbound (0.3 miles, 0.3 new lane miles, 0.3 converted lane miles)
Tujunga Canyon Rd	From La Tuna Canyon Rd to Foothill Blvd add 1 lane in each direction (1.0 mile, 2.0 lane miles)	Alameda St	From E 76th St to US 101 add 1 lane in each direction, (5.7 miles, 11.4 lane miles)
San Vicente Blvd	Build managed grade separation at 26th St	Alameda St	Build managed grade separation at Florence St
San Vicente Blvd	From 26th St to Wilshire Blvd (add 1 lane in each direction, 1.0 mile, 2.0 lane miles)	Alameda St	Build managed grade separation at Gage Ave
San Vicente Blvd	Build managed grade separation at Barrington Ave	Alameda St	Build managed grade separation at Slauson Ave
Wilshire Blvd	Build managed grade separation at Federal Ave	Alameda St	Build managed grade separation at Vernon Ave
Wilshire Blvd	Build managed grade separation at Veteran Ave	Alameda St	Build managed grade separation at Washington Blvd
Wilshire Blvd	Build managed grade separation at Westwood Blvd	Alameda St	Rebuild I-10 Interchange
Wilshire Blvd	Build managed grade separation at Beverly Glen Blvd	Alameda St	Build managed grade separation at Olympic Blvd
Wilshire Blvd	Build managed grade separation at SR 2/Santa Monica Blvd	Alameda St	Build managed grade separation at 7th St
Santa Monica Blvd	From Wilshire Blvd to Doheny Dr add 1 lane in each direction (1.5 miles, 3.0 lane miles)	Alameda St	Build managed grade separation at 6th St
Santa Monica Blvd	Build managed grade separation at Beverly Dr	Alameda St	Build managed grade separation at 4th St
Santa Monica Blvd	Build managed grade separation at Doheny Dr	Alameda St	Build managed grade separation at 3rd St
Santa Monica Blvd	From Doheny Dr to Sunset Blvd, add 1 lane total, convert parking lane to travel lane (6.5 miles, 13.0 lane miles)	Alameda St	Build managed grade separation at 1st St
Santa Monica Blvd	Build managed grade separation at North San Vicente Blvd	Alameda St	Rebuild US 101 Interchange
Santa Monica Blvd	Build managed grade separation at La Cienega Blvd	Alameda St	Build managed grade separation at Cesar Chavez Ave
Santa Monica Blvd	Build managed grade separation at Crescent Heights Blvd	Alameda St	From Main St to Elmyra St (0.5 miles, 0.5 lane miles) add 1 lane in northbound direction
Santa Monica Blvd	Build managed grade separation at Fairfax Ave	Alameda St	Build managed grade separation at College St
Santa Monica Blvd	Build managed grade separation at La Brea Ave	Spring St	From Elmyra St to Mesnagers St, add 1 lane in each direction (0.3 mile, 0.6 lane miles)
Santa Monica Blvd	Build managed grade separation at Highland Ave	Spring St	From Mesnagers St to 18th Ave Add 2 lanes in each direction (0.4 mile, 1.6 lane miles)
Santa Monica Blvd	Build managed grade separation at Cahuenga Blvd	Broadway	Rebuild I-5 Interchange
Santa Monica Blvd	Build managed grade separation at Vine St	Broadway	Build managed grade separation at Daly Ave
Santa Monica Blvd	Build managed grade separation at Wilton Place	Daly St	From Broadway to Pasadena Ave (0.2 mile, 0.4 lane mile) add 1 lane in each direction
Santa Monica Blvd	Build managed grade separation at Western Ave	Pasadena Ave	From Daly St to French Ave (0.8 mile, 3.2 lane mile) add 2 lanes in each direction
Santa Monica Blvd	Rebuild US 101 Interchange	Pasadena Ave	Build Interchange at SR 110
Santa Monica Blvd	Build managed grade separation at Normandy Ave	Pasadena Ave	From French Ave to Figueroa St (0.2 mile, 0.4 lane mile) add 1 lane in each direction
Santa Monica Blvd	Build managed grade separation at Vermont St	Pasadena Ave	Build managed grade separation at Figueroa St
Sunset Blvd	From Santa Monica Blvd to SR 110 convert parking lanes to travel lanes (3.0 miles, 6.0 lane miles)	Figueroa St	From Pasadena Ave to York Blvd (2.4 miles, 4.8 lane miles) convert parking lanes to travel lanes
Sunset Blvd	Build managed grade separation at Silver Lake Blvd	Figueroa St	Build managed grade separation at 52nd Ave
Sunset Blvd	Build managed grade separation at Alvarado St	Figueroa St	Build managed grade separation at York Blvd
Sunset Blvd	Build managed grade separation at Glendale Blvd	Figueroa St	Build managed grade separation at Colorado Blvd
Sunset Blvd	Rebuild SR 110 Interchange	Figueroa St	From York Blvd to Colorado Blvd (1.7 mile, 3.4 lane miles) add 1 lane in each direction
Grevalia St	Rebuild SR 110 Interchange at Fair Oaks Ave	Figueroa St	From Colorado Blvd to ramp to SR 134E add 2 lanes in each direction (0.1 mile, 0.4 lane miles)
Grevalia St	From SR 110 to Stratford Ave add 2 lanes in each direction (0.3 mile, 1.2 lane mile)	Figueroa St	From ramp to SR 134E to SR 134 interchange, add 1 lane in each direction
Garfield Ave	From Stratford Ave to Huntington Dr add 2 lanes in each direction (1.1 miles, 4.4 lane miles)	Figueroa St	Rebuild Interchange at SR 143
Garfield Ave	Build managed grade separation at Huntington Dr	Ximeno Ave	From Livingston St to Anaheim St (1.4 miles, 2.8 converted lane miles, 2.8 new lane miles) convert parking lanes to travel lanes,

Table C5: List of Managed Lane Components

Managed Arterial	Improvement	Managed Arterial	Improvement
			add 1 new lane in each direction
Garfield Ave	Build managed grade separation at Atlantic Blvd	Ximeno Ave	Build managed grade separation at Broadway
Garfield Ave	Build managed grade separation at Main St	Ximeno Ave	Build managed grade separation at 3rd St.
Main St/Las Tunas Dr	From Garfield Ave to San Gabriel Blvd convert parking lanes to travel lanes (2.2 miles, 4.4 lane miles)	Ximeno Ave	Build managed grade Separation at 4th St.
Las Tunas Dr	Build managed grade separation at San Gabriel Blvd	Ximeno Ave	Build managed grade separation at 7th St
Las Tunas Dr	Build managed grade separation at Rosemead Dr	Ximeno Ave	Build managed grade separation at Anaheim St
Las Tunas Dr	From Rosemead Blvd to Longden Ave convert parking lanes to travel lanes (4.4 miles, 8.8 lane miles)	Ximeno Ave	From Anaheim St to 15th St convert parking lanes to travel lanes, Add 1 new northbound travel lane 0.2 miles, 0.4 converted lane miles, 0.2 new lane miles)
Las Tunas Dr	Build managed grade separation at Temple City Blvd	Ximeno Ave	From 15th St to Los Coyotes Diagonal convert parking lanes to travel lanes (0.5 miles, 1.0 converted lanes, 0 new lane miles)
Las Tunas Dr	Build managed grade separation at Baldwin Ave	Ximeno Ave	Build managed grade separation at SR 1
Live Oak Ave	Build managed grade separation at Santa Anita Ave	Ximeno Ave	Build managed grade separation at Atherton St
Live Oak Ave.	Build managed grade separation at Myrtle Ave	Ximeno Ave	Build managed grade separation at Los Coyotes Diagonal
SR 90	Build interchange at Mindanao Way	Rosada St	Add 2 new travel lanes in each direction from Los Coyotes Diagonal to Lakewood Blvd (0.2 miles, 0.8 new lane miles)
Slauson Ave	Build managed grade separation at South La Brea Ave	Lakewood Blvd	Convert northbound parking lane to travel lane from Traffic Circle to E Stearns St (0.3 miles, 0.3 converted lane miles, 0 new lane miles)
Slauson Ave	Build managed grade separation at Overhill Dr	Lakewood Blvd	Build managed grade separation at Stearns St
Slauson Ave	From Alviso St to Ruthelen St add 1 lane total, convert parking lane to travel lane (1.8 miles, 3.6 lane miles)	Lakewood Blvd	Build managed grade separation at Willow St
Slauson Ave	Build managed grade separation at Crenshaw Blvd	Lakewood Blvd	Rebuild I-405 Interchange
Slauson Ave	Build managed grade separation at Van Ness Ave	Lakewood Blvd	Build managed grade separation at Spring St
Slauson Ave	From Ruthelen St to Santa Fe Ave add 1 lane in each direction (4.7 miles, 9.4 lane miles)	Lakewood Blvd	Build managed grade separation at Carson St
Slauson Ave	Build dual managed grade separation at Western Ave	Lakewood Blvd	Convert parking lanes to travel lanes from Carson St to Del Amo Blvd (1.6 miles, 3.2 converted lane miles, 0 new lane miles)
Slauson Ave	Build managed grade separation at Normandie Ave	Lakewood Blvd	Build managed grade separation at Del Amo Blvd
Slauson Ave	Build managed grade separation at Vermont Ave	Lakewood Blvd	Build managed grade separation at Candlewood St
Slauson Ave	Build managed grade separation at Hoover St	Lakewood Blvd	Build managed grade separation at South St
Slauson Ave	Build managed grade separation at Figueroa St	Lakewood Blvd	Build managed grade separation at Ashworth St
Slauson Ave	Rebuild I-110 Interchange	Lakewood Blvd	Rebuild SR 91 Interchange
Slauson Ave	Build managed grade separation at Broadway	Lakewood Blvd	Convert parking lanes to travel lanes From Park St to I-105 (3.8 miles, 7.6 converted lane miles, 0 new lane miles)
Slauson Ave	Build managed grade separation at Main St	Lakewood Blvd	Build managed grade separation at Flower St
Slauson Ave	Build managed grade separation at San Pedro St	Lakewood Blvd	Build managed grade separation at Alondra Blvd
Slauson Ave	Build managed grade separation at Avalon Blvd	Lakewood Blvd	Build managed grade separation at Somerset Blvd
Slauson Ave	Build managed grade separation at Central Ave	Lakewood Blvd	Build managed grade separation at Rosecrans Blvd
Slauson Ave	Build managed grade separation at Hooper Ave	Lakewood Blvd	Rebuild I-105 Interchange
Slauson Ave	Build managed grade separation at Compton Ave	Lakewood Blvd	Build managed grade separation at Imperial Highway
Slauson Ave	Build managed grade separation at Alameda St	Lakewood Blvd	Build managed grade separation at Stewart and Gray Rd
Slauson Ave	Build managed grade separation at Santa Fe Ave	Lakewood Blvd	Build managed grade separation at Firestone Blvd
Slauson Ave	From Santa Fe Ave to Alamo Ave convert parking lanes to travel lanes (3.2 miles, 6.4 lane miles)	Lakewood Blvd	Build managed grade separation at Florence Ave
Slauson Ave	Build managed grade separation at Pacific Blvd	Lakewood Blvd	Convert parking lanes to travel lanes from Florence to I-5 (1.0 miles, 2.0 converted lane miles, 0 new lane miles)
Slauson Ave	Build managed grade separation at Miles Ave	Lakewood Blvd	Rebuild I-5 Interchange
Slauson Ave	Build managed grade separation at Maywood Ave	Rosemead Blvd	Convert parking lanes to travel lanes from E Telegraph Rd to Gallatin Rd (4.3 miles, 8.6 converted lane miles, 0 new miles)
Slauson Ave	Build managed grade separation at Atlantic Blvd	Rosemead Blvd	Build managed grade separation at Slauson Ave
Slauson Ave	From Alamo Ave to I-710 add 1 lane in each direction (0.3 miles, 0.6 lane miles)	Rosemead Blvd	Build managed grade separation at Washington Blvd
Slauson Ave	Rebuild I-710 Interchange	Rosemead Blvd	Build managed grade separation at Mines Ave
Slauson Ave	Build managed grade separation at Eastern Ave	Rosemead Blvd	Build managed grade separation at Whittier Blvd
Slauson Ave	Build managed grade separation at Garfield Ave	Rosemead Blvd	Build managed grade separation at East Beverly Blvd
Slauson Ave	From Garfield Ave to Greenwood Ave convert parking lanes to travel lanes (0.7 miles, 1.4 lane miles)	Rosemead Blvd	Add 1 travel lane in each direction from Gallatin Rd to SR 60 (4.5 miles, 9.0 new lane miles)
Slauson Ave	Rebuild I-5 Interchange	Rosemead Blvd	Build managed grade separation at Durfee Ave
Slauson Ave	Build managed grade separation at Telegraph Rd	Rosemead Blvd	Rebuild SR 60 Interchange
Telegrpah Rd	From Slauson Ave to Tweedy Ln add 1 lane in each direction (0.5 mile, 1.0 lane mile)	Rosemead Blvd	Build managed grade separation at Garvey Ave
Telegraph Rd	Build managed grade separation at Paramount Blvd	Rosemead Blvd	Rebuild I-10 Interchange
Telegraph Rd	Build dual managed grade separation at Rosemead Blvd	Rosemead Blvd	Convert parking lanes to travel lanes from Marshall St to Sierra

Table C5: List of Managed Lane Components

Managed Arterial	Improvement	Managed Arterial	Improvement
			Madre Villa Ave (5.9 miles, 11.8 converted lane miles)
Telegraph Rd	From True Ave to I-605 add 1 lane in each direction (0.3 miles, 0.6 lane miles)	Rosemead Blvd	Build managed grade separation at Valley Blvd
Telegraph Rd	Rebuild I-605 Interchange	Rosemead Blvd	Build managed grade separation at Mission Dr
Telegraph Rd	Build managed grade separation at Orr and Day Rd	Rosemead Blvd	Build managed grade separation at Las Tunas Dr
Telegraph Rd	Build managed grade separation at Pioneer Blvd	Rosemead Blvd	Build managed grade separation at Longden Ave
Telegraph Rd	Build managed grade separation at Norwalk Ave	Rosemead Blvd	Build managed grade separation at Duarte Rd
Telegraph Rd	Build managed grade separation at Bloomfield Ave	Rosemead Blvd	Build managed grade separation at Huntington Drive
Telegraph Rd	Build managed grade separation at Greenleaf Ave	Rosemead Blvd	Build managed grade separation at California Blvd
Telegraph Rd	Build managed grade separation at Carmentia Rd	Rosemead Blvd	Build managed grade separation at Colorado Blvd
Telegraph Rd	Build managed grade separation at Florence Ave	Rosemead Blvd	Rebuild I-210 Interchange
Telegraph Rd	Build managed grade separation at Colima Rd	Rosemead Blvd	Build managed grade separation at Foothill Blvd
Telegraph Rd	Build managed grade separation at Leffingwell Rd	Rosemead Blvd	Build managed grade separation at Sierra Madre Villa Blvd
Imperial Highway	Build managed grade separation at La Mirada Blvd	Sierra Madre Villa Ave	Build managed grade separation at East Sierra Madre Villa Blvd
Imperial Highway	Build managed grade separation at Santa Gertrudes Ave	Sierra Madre Villa Ave	Add 1 lane to both ways From Rosemead Blvd to East Sierra Madre Blvd (0.2 miles, 0.4 miles, 0.4 new lane miles)
Imperial Highway	Build managed grade separation at SR 39	Western Ave	Build managed grade separation at S Miraleste Drive
Imperial Highway	Build managed grade separation at Idaho St	Western Ave	From 25th to 15th street convert northbound parking lane to travel lane and add 1 southbound travel lane (26.6 miles, 26.6 converted miles, 26.6 new lane miles)
Imperial Highway	Build managed grade separation at Euclid St	Western Ave	From 15th to 1st street (2.0 miles, 4.0 new lane miles) add 1 travel lane to each direction
Imperial Highway	Build managed grade separation at Harbor Blvd	Western Ave	Build managed grade separation at 1st street
Imperial Highway	Build managed grade separation at Brea Blvd	Western Ave	Build managed grade separation at Palos Verdes Dr N
Imperial Highway	Build managed grade separation at State College Blvd	E Western Ave	Build managed grade separation at SR 1
Imperial Highway	Rebuild SR 57 Interchange	Western Ave	Build managed grade separation at Lomita Blvd
Imperial Highway	Build managed grade separation at Associated Road	Western Ave	Build managed grade separation at Sepulveda Blvd
Imperial Highway	Build managed grade separation at Kraemer Blvd	Western Ave	From 228th St to Carson Street (0.9 miles, 0.9 converted miles, 0 new lane miles) convert parking lanes into travel lanes
Imperial Highway	Build managed grade separation at Valencia Ave	Western Ave	Build managed grade separation at 223rd St
Imperial Highway	Build managed grade separation at Birch St	Western Ave	Build managed grade separation at Carson St
Valencia Ave	From Imperial Highway to Carbon Canyon Rd add 1 lane in each direction (1.0 mile, 2.0 lane miles)	Western Ave	From Carson to Del Amo Blvd (1.1 miles, 1.1 converted miles, 0 new lane miles) convert northbound parking lanes into travel lanes
Carbon Canyon Rd	From Valencia Ave to Olinda Dr add 1 lane in each direction (2.8 miles, 5.6 lane miles)	Western Ave	Build managed grade separation at Torrance Blvd
Carbon Canyon Rd	From Olinda Dr to Chino Hills Parkway add 2 lanes in each direction (5.6 miles, 22.4 lane miles)	Western Ave	Build managed grade separation at 190th St
Chino Hills Parkway	From Carbon Canyon Rd to Central Ave add 1 lane in each direction (3.0 miles, 6.0 lane miles)	Western Ave	From 186th to Franklin Ave convert parking lanes to travel lanes 45.4 miles, 90.8 converted miles, 0 new lane miles)
Chino Hills Parkway	Build managed grade separation at Peyton Dr	Western Ave	Rebuild I-405 Interchange
Chino Hills Parkway	Build managed grade separation at Pipeline Ave	Western Ave	Build managed grade separation at 182nd St
Chino Hills Parkway	Rebuild SR 71 Interchange	Western Ave	Build managed grade separation at Artesia Blvd
Chino Hills Parkway	Build managed grade separation at Ramona Ave	Western Ave	Build managed grade separation at 166th St
Chino Hills Parkway	Build managed grade separation at Central Ave	Western Ave	Build managed grade separation at Redondo Beach Blvd
Merrill Ave	From Central Ave to Cypress Ave North add 2 lanes in each direction (0.9 miles, 3.6 lane miles)	Western Ave	Build managed grade separation at Marine Ave
Cypress Ave/Merrill Ave	Cypress Ave North to Archibald Ave add 2 lanes in each direction (5.9 miles, 23.6 lane miles)	Western Ave	Build managed grade separation at Rosecrans Ave
Archibald Ave	From Merrill Ave to Limonite St add 2 lanes in each direction (0.5 miles, 2.0 lane miles)	Western Ave	Build managed grade separation at 135th St
Merrill Ave	Build managed grade separation at Euclid Ave	Western Ave	Build managed grade separation at El Segundo Blvd
Limonite Ave	From Archibald Ave to Wineville Ave add 1 lane in each direction (3.0 miles, 6.0 lane miles)	Western Ave	Rebuild I-105 Interchange
Limonite Ave	Build managed grade separation at Sumner Ave	Western Ave	Rebuild managed grade separation at Imperial Highway
Limonite Ave	Build managed grade separation at Hamner Ave	Western Ave	Build managed grade separation at 108th St
Limonite Ave	Rebuild I-15 Interchange	Western Ave	Build managed grade separation at Century Blvd
Limonite Ave	Build managed grade separation at Wineville Ave	Western Ave	Build managed grade separation at 92nd St

Table C5: List of Managed Lane Components

Managed Arterial	Improvement	Managed Arterial	Improvement
Limonite Ave	From Wineville Ave to Homestead St add 2 lanes in each direction (2.7 miles, 10.8 lane miles)	Western Ave	Build managed grade separation at Manchester Ave
Limonite Ave	From Homestead St to Mission Blvd add 1 lane in each direction (5.2 miles, 10.4 lane miles)	Western Ave	Build managed grade separation at Florence Ave
Limonite Ave	Build managed grade separation at Etiwanda Ave	Western Ave	Build managed grade separation at Gage Ave
Limonite Ave	Build managed grade separation at Mission Blvd	Western Ave	Build managed grade separation at 54th St
Riverview Dr	From Mission Blvd to SR 60 add 2 lanes in each direction (0.4 miles, 1.6 lane miles)	Western Ave	Build managed grade separation at 48th St
Riverview Dr	Build Interchange at SR 60	Western Ave	Build managed grade separation at Vernon Ave
Torrance Blvd	Build managed grade separation at SR 1	Western Ave	Build managed grade separation at Martin Luther King Jr Blvd
Torrance Blvd	Build managed grade separation at Prospect Ave	Western Ave	Build managed grade separation at Exposition Blvd
Torrance Blvd	From Catalina Ave to Anza Ave add 1 lane in each direction (1.5 miles, 3.0 lane miles)	Western Ave	Build managed grade separation at Jefferson Blvd
Torrance Blvd	Build managed grade separation at Anza Ave	Western Ave	Build managed grade separation at Adams Blvd
Torrance Blvd	Build managed grade separation at Hawthorne Blvd	Western Ave	Build managed grade separation at Washington Blvd
Hawthorne Blvd	Build managed grade separation at Carson St	Western Ave	Build managed grade separation at Venice Blvd
Carson St	From Hawthorne Blvd to Del Amo Circle Blvd add 1 lane in each direction (0.7 miles, 1.4 lane miles)	Western Ave	Build managed grade separation at W Pico Blvd
Carson St	Build managed grade separation at Madrona Ave	Western Ave	Build managed grade separation at W Olympic Blvd
Carson St	From Madrona Ave to Via Oro Ave convert parking lanes to travel lanes (7.6 miles, 15.2 lane miles)	Western Ave	Build managed grade separation at Oxford Ave
Carson St	Build managed grade separation at Maple Ave	Western Ave	Build managed grade separation at Wilshire Blvd
Carson St	Build managed grade separation at Crenshaw Blvd	Western Ave	Build managed grade separation at 6th St
Carson St	Build managed grade separation at Carbillo Ave	Western Ave	Build managed grade separation at 3rd St
Carson St	Build managed grade separation at Western Ave	Western Ave	Build managed grade separation at Beverly Blvd
Carson St	Build managed grade separation at Normandie Ave	Western Ave	Build managed grade separation at Melrose Ave
Carson St	Build managed grade separation at Vermont Ave	Western Ave	Build managed grade separation at Santa Monica Blvd
Carson St	Rebuild I-110 Interchange	Western Ave	Rebuild US 101 Interchange
Carson St	Build managed grade separation at Figueroa St	Western Ave	Build managed grade separation at Fountain Ave
Carson St	Build managed grade separation at Main St	Western Ave	Build managed grade separation at Sunset Blvd
Carson St	Build managed grade separation at Delores St	Western Ave	Build managed grade separation at Prospect Ave
Carson St	Build managed grade separation at Avalon Blvd	Western Ave	Build managed grade separation at Franklin Ave
Carson St	Rebuild I-405 Interchange	New Alignment	New road connecting Western Ave and Los Feliz Blvd with Buena Vista St and SR 134 (7.6 miles, 45.6 new lane miles)
Carson St	Build managed grade separation at Wilmington Ave	Buena Vista St	Rebuild SR 134 Interchange
Carson St	Build managed grade separation at Santa Fe Ave	Buena Vista St	From SR 134 to San Fernando Blvd convert parking lanes to travel lanes (6.7 miles, 13.4 converted miles, 0 new added lane miles)
Carson St	Build Intersection with I-405 and I-710	Buena Vista St	Build managed grade separation at Alameda Ave
New Alignment	Build 6-lane alignment from I-710 to Bixby Rd at Country Club Rd	Buena Vista St	Build managed grade separation at Olive Ave
Bixby Rd	From Country Club Rd to Atlantic Ave convert parking lanes to travel lanes and add 1 additional lane each direction (0.8 mile, 3.2 lane miles)	Buena Vista St	Build managed grade separation at Magnolia Blvd
Bixby Rd	Build managed grade separation at Long Beach Blvd	Buena Vista St	Build managed grade separation at Burbank St
Bixby Rd	Build managed grade separation at Atlantic Ave	Buena Vista St	Build managed grade separation at Victory Rd
Atlantic Ave	Add one lane each direction between Bixby Rd and Carson St (10.8 lane miles)	Buena Vista St	Build managed grade separation at Empire Ave
Carson St	From Atlantic Ave to Orange Ave, convert parking lanes to travel lanes (1.0 lane mile)	Buena Vista St	Build managed grade separation at San Fernando Blvd
Carson St	Build managed grade separation at Orange Ave	Buena Vista St	From San Fernando Blvd to Glen Oaks Blvd add 1 travel lanes in each direction (0.5 miles, 1.0 miles, 1.0 new added lane miles)
Carson St	From Orange Ave to Cherry Ave add one lane each direction (1.0 lane mile)	Buena Vista St	Rebuild I-5 Intersection
Carson St	Build managed grade separation at Cherry Ave	Buena Vista St	Build managed grade separation at Glen Oaks Blvd
Carson St	Build managed grade separation at Paramount Blvd	Glen Oaks Blvd	From Buena Vista to I-210 convert parking lanes into travel lanes (10.9 miles, 21.8 converted miles, 0 new lane miles)
Carson St	Build managed grade separation at Lakewood Blvd	Glen Oaks Blvd	Build managed grade separation at Sunland Blvd
Carson St	Build managed grade separation at Clark Ave	Glen Oaks Blvd	Build managed grade Separation at Penrose St
Carson St	Build managed grade separation at Mayflower Blvd	Glen Oaks Blvd	Build managed grade separation at Sheldon St
Carson St	Build managed grade separation at Woodruff Ave	Glen Oaks Blvd	Build managed grade separation at Osbourne St
Carson St	Build managed grade separation at Palo Verde Ave	Glen Oaks Blvd	Build managed grade separation at Van Nuys Blvd
Carson St	From Los Coyotes Diagonal to LB Towne Center Dr Add 1 lane in each direction (0.5 mile, 1 lane mile)	Glen Oaks Blvd	Build managed grade separation at Paxton St

Table C5: List of Managed Lane Components

Managed Arterial	Improvement	Managed Arterial	Improvement
Carson St	Rebuild I-605 Interchange	Glen Oaks Blvd	Rebuild SR 118 Interchange
Carson St	Build managed grade separation at Pioneer Blvd	Glen Oaks Blvd	Build managed grade separation at Vaughn St
Lincoln Ave	Build managed grade separation at Norwalk Blvd	Glen Oaks Blvd	Build managed grade separation at Arroyo St
Lincoln Ave	From Pioneer Blvd to Euclid St, add 1 lane each direction (8.1 miles-16.2 lane miles)	Glen Oaks Blvd	Build managed grade separation at Maclay St
Lincoln Ave	Build managed grade separation at Moody St	Glen Oaks Blvd	Build managed grade separation at Hubbard St
Lincoln Ave	Build managed grade separation at Walker St	Glen Oaks Blvd	Build managed grade separation at Sayre St
Lincoln Ave	Build managed grade separation at Valley View St	Glen Oaks Blvd	Build managed grade separation at Polk St
Lincoln Ave	Build managed grade separation at Knott Ave	Glen Oaks Blvd	Build managed grade separation at Tyler St
Lincoln Ave	Build managed grade separation at Western Ave	Glen Oaks Blvd	Build managed grade separation at Bledsoe St
Lincoln Ave	Build managed grade separation at Beach Blvd (dual)	Glen Oaks Blvd	Build managed grade separation at Roxford St
Lincoln Ave	Build managed grade separation at Dade Ave	Glen Oaks Blvd	Rebuild I-210 Interchange
Lincoln Ave	Build managed grade separation at Magnolia St	Beach Blvd	Build managed grade separation at Atlanta Ave
Lincoln Ave	Build managed grade separation at Gilbert St	Beach Blvd	Build managed grade separation at Indianapolis Ave
Lincoln Ave	Build managed grade separation at Brookhurst St	Beach Blvd	Build managed grade separation at Adams Ave
Lincoln Ave	Build managed grade separation at Euclid St	Beach Blvd	Build managed grade separation at Yorktown Ave
Lincoln Ave	Build managed grade separation at Broadway	Beach Blvd	Build managed grade separation at Garfield Ave
Lincoln Ave	From Broadway to Ball Rd add 1 lane in each direction (0.7 mile-1.4 lane miles)	Beach Blvd	Build managed grade separation at Ellis Ave
Lincoln Ave	Build managed grade separation Ball Rd	Beach Blvd	Build managed grade separation at Talbert Ave
Ball Rd	From Euclid St to Hampstead St add 1 lane in each direction (0.5 mile—1.0 lane miles)	Beach Blvd	Build managed grade separation at Slater Ave
Ball Rd	Build managed grade separation at Disneyland Dr	Beach Blvd	Build managed grade separation at Heil Ave
Ball Rd	Rebuild I-5 interchange	Beach Blvd	Build managed grade separation at Edinger Ave
Ball Rd	Build managed grade separation at Harbor Blvd	Beach Blvd	Build managed grade separation at Center Ave
Ball Rd	Build managed grade separation at Anaheim Blvd	Beach Blvd	Build managed grade separation at McFadden Ave
Ball Rd	Build managed grade separation at State College Blvd	Beach Blvd	Build managed grade separation at Bolsa Ave
Ball Rd	From State College Blvd to Sunkist Rd convert parking lanes to through lanes (0.5 mile-1 lane mile)	Beach Blvd	Build managed grade separation at Hazard Ave
Ball Rd	Rebuild SR 57 Interchange	Beach Blvd	Build managed grade separation at Westminster Ave
Taft Ave	Between SR 57 and Tustin St add 1 lane in each direction (2.4 miles-4.8 lane miles)	Beach Blvd	Build managed grade separation at Trask Ave
Taft Ave	Build managed grade separation at N Batavia St	Beach Blvd	Rebuild SR 22 Interchange
Taft Ave	Build managed grade separation at Glassell St	Beach Blvd	Build managed grade separation at Garden Grove Blvd
Taft Ave	Build managed grade separation at Cambridge St	Beach Blvd	Build managed grade separation at Lampson Ave
Taft Ave	Build managed grade separation at Tustin St	Beach Blvd	Build managed grade separation at Chapman Ave
Taft Ave	Build new 6 lane alignment connecting intersection of Taft Ave and Tustin St with Taft Ave and N. Highland St (0.2 miles, 1.2 lane miles)	Beach Blvd	Build managed grade separation at Orangewood Ave
Taft Ave	Rebuild SR 55 Interchange	Beach Blvd	Build managed grade separation at Katelia Ave
Taft Ave	Build managed grade separation at Santiago Blvd	Beach Blvd	Build managed grade separation at Cerritos Ave
Taft Ave	From Santiago Blvd to Center Dr convert parking lanes and add 1 lane in each direction (0.6 miles) (1.2 converted lane miles) (1.2 new lane miles)	Beach Blvd	Build managed grade separation at Ball Rd
Taft Ave	From Center Dr to Cannon St add 2 lane in each direction (1.0 mile-4.0 lane miles)	Beach Blvd	Build managed grade separation at Orange Ave
Cannon St	From Taft Ave to E. Santiago Canyon Rd add 1 lane in each direction (0.4 miles-0.8 lane miles)	Beach Blvd	Build managed grade separation at Crescent Ave
E. Santiago Canyon Dr	From Cannon St to Jamboree Rd add 1 lane in each direction (2.9 miles-5.8 lane miles)	Beach Blvd	Build managed grade separation at La Palma Ave
Jamboree Rd	From E Santiago Canyon Rd NW to E Santiago Canyon Rd SW, add 1 lane in each direction (0.2 miles-0.4 lane miles)	Beach Blvd	Rebuild SR 91 Interchange
E. Santiago Canyon Rd	Build managed grade separation at Chapman Ave	Beach Blvd	Rebuild I-5 Interchange
E. Santiago Canyon Rd	From Chapman Ave to SR 241/SR 261 add 1 lane in each direction (1.0 mile-2 lane mils)	Beach Blvd	Build managed grade separation at Artesia Blvd
E. Santiago Canyon Rd	Rebuild Interchange at SR 241/SR 261	Beach Blvd	Build managed grade separation at Malvern Ave
Warner Ave	Add 1 lane in each direction between SR 1 and Algonquin St (0.9 miles, 1.8 lane miles)	Beach Blvd	Build managed grade separation at Rosecrans Ave
Warner Ave	Build managed grade separation at Graham St	Beach Blvd	Build managed grade separation at Imperial Hwy
Warner Ave	Build managed grade separation at Springdale St	Beach Blvd	Build managed grade separation at Lambert Rd
Warner Ave	Build managed grade separation at Edwards St	Beach Blvd	Build managed grade separation at El Camino Real
Warner Ave	Build managed grade separation at Goldenwest St	Beach Blvd	Build managed grade separation at Whittier Blvd

Table C5: List of Managed Lane Components

Managed Arterial	Improvement	Managed Arterial	Improvement
Warner Ave	Build managed grade separation at Gothard St	Beach Blvd	Build managed grade separation at Gregory Lane
Warner Ave	Build managed grade separation at Beach Blvd (dual)	New Alignment	From Gregory Lane And Beach Blvd to Whittier Blvd and Hacienda Ave, (0.4 miles, 2.4 new lane miles)
Warner Ave	Build managed grade separation at Newland St	Hacienda Rd	From Whittier Blvd to Sansinena Ln add 1 lane in each direction (0.4 miles, 0.8 new lane miles)
Warner Ave	Build managed grade separation at Magnolia St	Hacienda Rd	From Sansinena Ln to Glenmark Drive add 2 lanes in each direction (2.6 miles, 5.2 new lane miles)
Warner Ave	Rebuild I-405 Interchange	Hacienda Rd	From Glenmark Drive to Colima Rd add 1 lane in each direction (0.4 miles, 0.8 new lane miles)
Warner Ave	Build managed grade separation at Bushard St	Hacienda Rd	Build managed grade separation at Colima Rd
Warner Ave	Rebuild managed grade Separation at Brookhurst St	Colima Rd	From Hacienda Rd to Azusa Ave add 1 lane in each direction (2.6 miles, 5.2 new lane miles)
Warner Ave	Rebuild managed grade separation at Euclid St	Azusa Ave	Build managed Grade Separation at Colima Rd
Warner Ave	Build managed grade Separation at New Hope St	Azusa Ave	Rebuild SR 60 Interchange
Warner Ave	Build managed grade separation at Harbor Blvd	Azusa Ave	Build managed grade separation at Gale Ave
Warner Ave	Build managed grade separation at Fairview St	Azusa Ave	Build managed grade separation at Arenth Ave
Warner Ave	Build managed grade separation at Raitt St	Azusa Ave	Build managed grade separation at Valley Blvd
Warner Ave	Between Raitt St and Bristol St convert westbound parking lane to travel lane (0.6 mile, 0.6 lane miles)	Azusa Ave	Build managed grade separation at Temple Ave
Warner Ave	Build managed arterial at Bristol St	Azusa Ave	Build managed grade separation at Amar Rd
Warner Ave	Between Bristol St and Grand Ave add one lane in each direction (2.0 miles, 8.0 lane miles)	Azusa Ave	From W Francisquito Ave to E Garvey Ave S Convert southbound parking lane into travel lane (1.4 miles, 1.4 converted lanes)
Warner Ave	Build managed grade separation at Flower St	Azusa Ave	Build managed grade separation at Merced Ave
Warner Ave	Build managed grade separation at Main St	Azusa Ave	Build managed grade separation at Vine Ave
Warner Ave	Build managed grade separation at Grand Ave	Azusa Ave	Build managed grade separation at Cameron Ave
Warner Ave	Convert middle lane to westbound through lane between Grand Ave and Wright St (0.2 miles, 0.4 lane miles)	Azusa Ave	Rebuild I-10 Interchange
Warner Ave	Rebuild SR 55 Interchange	Azusa Ave	Build managed grade separation at Workman Ave
Red Hill Ave	Build managed grade separation at Edinger Ave	Azusa Ave	From Workman Ave to 1st Street convert parking lanes into travel lanes (3.2 miles, 6.4 converted miles)
Edinger Ave	Build interchange at Tustin Ranch Rd	Azusa Ave	Build managed grade separation at Rowland St
Tustin Ranch Rd	Build managed grade separation at Walnut Ave	Azusa Ave	Build managed grade separation at Puente Ave
Tustin Ranch Rd	Rebuild I-5 Interchange	Azusa Ave	Build managed grade separation at Badillo St
Tustin Ranch Rd	Build managed grade separation at El Camino Real	Azusa Ave	Build managed grade separation at San Bernardino Rd
Tustin Ranch Rd	Build managed grade separation at Bryan Ave	Azusa Ave	Build managed grade separation at Cypress St
Tustin Ranch Rd	Build managed grade separation at Irvine Blvd	Azusa Ave	Build managed grade separation at Arrow Highway
Portola Parkway	Build managed grade separation at Jamboree Rd	Azusa Ave	Build managed grade separation at Gladstone St
Portola Parkway	Rebuild SR 261 Interchange	Azusa Ave	Rebuild I-210 Interchange
Portola Parkway	Between Jeffrey Rd and SR 241 add 1 lane in each direction (3.4 miles, 6.8 lane miles)	Azusa Ave	Build managed grade separation at 1st St
Portola Parkway	Rebuild SR 133 Interchange	Azusa Ave	Build managed grade separation at 5th St
Crown Valley Parkway	From SR 1 to Sea Island Dr add 1 lane in each direction (0.4 mile, 0.8 lane mile)	Azusa Ave	Build managed grade separation at Foothill Blvd
Crown Valley Parkway	From Sea Island Dr. to Camino Del Avion (0.4 mile, 0.4 lane miles)	Azusa Ave	Build managed grade separation at W Sierra Madre Ave
Crown Valley Parkway	Build managed grade separation at Camino Del Avion	Fairmont Blvd	Build New Interchange at SR 91
Alicia Parkway	Build managed grade separation at Niguel Rd	Fairmont Blvd	Build managed grade separation at La Palma Ave
Alicia Parkway	Build managed grade separation at Aliso Creek Rd	Fairmont Blvd	Build managed grade separation at Esperanza Rd
Alicia Parkway	Build managed grade separation at Pacific Park Dr	Fairmont Blvd	From Village Center Drive to Singingwood Drive add 1 lane to both directions (5.5 miles, 11.0 new lane miles)
Alicia Parkway	Rebuild SR 73 Interchange	Fairmont Blvd	Build managed grade separation at Yorba Linda Blvd
Alicia Parkway	Build managed grade Separation at Moulton Parkway	Fairmont Blvd	Build managed grade separation at Bastanchury Rd
Alicia Parkway	Build managed grade separation at Paseo De Valencia	Fairmont Blvd	From Singingwood Drive to San Antonio Rd add 2 lanes in both directions (0.9 miles, 3.6 new lane miles)
Alicia Parkway	Rebuild I-5 Interchange	New Alignment	From Fairmont Blvd E of Quarter House Rd to Carbon Canyon Rd E of Beryl St add new roadway (4.0 miles 24.0 lane miles)
Alicia Parkway	Build managed grade separation at Muirlands Blvd	Peyton Dr	From Chino Hills Parkway to Eucalyptus Ave Add 2 lanes in both directions (0.5 miles, 2.0 new lane miles)
Alicia Parkway	Build managed grade separation at Jeronimo Rd	Peyton Dr	Build managed grade separation at Eucalyptus Ave
Alicia Parkway	Build managed grade separation at Trabuco Rd	Peyton Dr	Build managed grade separation at Grand Ave
Alicia Parkway	Build managed grade separation at Marguerite Parkway	Peyton Dr	Build managed grade separation at Chino Ave
Alicia Parkway	Build managed grade separation at Olympiad Rd	Peyton Dr	Rebuild SR 71 Interchange

Table C5: List of Managed Lane Components

Managed Arterial	Improvement	Managed Arterial	Improvement
Santa Margarita Parkway	Rebuild SR 241 Interchange	Riverside Dr	From Garey Ave to Baseline Ave add 1 travel lane in each direction (0.2 miles, 0.4 new lane miles)
Santa Margarita Parkway	Build managed grade separation at Avendida De Las Flores	Riverside Dr	Build managed grade separation at Garey Ave
Santa Margarita Parkway	Build managed grade separation at Antonio Parkway	Riverside Dr	Build managed grade separation at Towne Ave
SR 74	Rebuild I-5 Interchange	Towne Ave	Convert parking lanes into travel lanes from Towne Ave to E Baseline Rd (7.2 miles, 14.4 lane miles)
SR 74	From Camino Capistrano to Hunt Club Dr add 1 lane in each direction (1.5 miles, 3.0 lane miles)	Towne Ave	Rebuild SR 60 Interchange
SR 74	From Hunt Club Dr to Reata Rd add 2 lanes in each direction (0.9 miles, 3.6 lane miles)	Towne Ave	Build managed grade separation at Philadelphia St
SR 74	From Reata Rd to Le Harve St (27.3 miles, 54.6 lane miles) add 1 lane in each direction	Towne Ave	Build managed grade separation at Lexington Ave
SR 74	From Le Havre St to Hunco Way, Add 2 lanes in each direction (3.0 miles, 12.0 lane miles)	Towne Ave	Build managed grade separation at Franklin Ave
SR 74	From Hunco Way to I-15 add 1 lane in each direction (1.0 lane mile)	Towne Ave	Build managed grade separation at Philip Blvd
SR 74	Rebuild I-15 Interchange	Towne Ave	Build managed grade separation at E Mission Blvd
SR 74	From Dexter Ave to I-215 Add 1 lane in each direction (20.6 lane miles)	Towne Ave	Build managed grade separation at Holt Ave
SR 74	Build managed grade separation at Perris Blvd	Towne Ave	Rebuild I-10 Interchange
SR 74W	Rebuild I-215 Interchange	Towne Ave	Build managed grade separation at Arrow Highway
SR 74	Build managed grade separation at Case Rd	Towne Ave	Build managed grade separation at Bonita Ave
SR 74	Build managed grade separation at SR 79 S (Dual)	Towne Ave	Build managed grade separation at Foothill Blvd
SR 74	Build managed grade separation at Warren Rd	Towne Ave	Rebuild I-210 Interchange
SR 74	Build managed grade separation at Sanderson Ave	Euclid Ave	From SR 71 to Pomono Rincon Rd Add 1 travel lane in each direction (0.5 mile, 1.0 lane miles)
SR 74	Build managed grade separation at Kirby St	Euclid Ave	From Pomono Rincon Rd to Johnson Ave add 2 travel lanes in each direction (0.5 miles, 1.0 lane miles)
SR 74	Build managed grade separation at Lyon Ave	Euclid Ave	From Johnson Ave to Merion St (add 1 travel lanes in each direction 2.0 miles, 4.0 lane miles)
SR 74	Build managed grade separation at Palm Ave	Euclid Ave	Build managed grade separation at Pine Ave
SR 74	Build managed grade separation at State St	Euclid Ave	Build managed grade separation at Edison Ave
SR 74	Build managed grade separation at San Jacinto St	Euclid Ave	Build managed grade separation at Schaefer Ave
SR 74	Add one lane in each direction from Case Rd to ¼ mile E of San Jacinto Rd (33.8 lane miles)	Euclid Ave	Build managed grade separation at Chino Ave
SR 1, SR 27	Build managed grade separation at SR 107	Euclid Ave	Build managed grade separation at Riverside Dr
SR 1, SR 27	Build managed grade separation at Calle Mayor	Euclid Ave	From Merion St to E H St convert parking lanes to travel lanes (3.5 miles, 7.0 lane miles)
SR 1, SR 27	Add 2 lanes between Ocean Ave and Herondo St (4.5 miles, 9 lane miles)	Euclid Ave	Build managed grade separation at Walnut St
SR 1, SR 27	Build managed grade separation at Palos Verdes Blvd	Euclid Ave	Rebuild SR-60 Interchange
SR 1, SR 27	Build managed grade separation at Torrance Blvd	Euclid Ave	Build managed grade separation at Philadelphia St
SR 1, SR 27	Build managed grade separation at Diamond St	Euclid Ave	Build managed grade separation at Francis St
SR 1, SR 27	Build managed grade separation at Herondo St	Euclid Ave	Build managed grade separation at Philips St
SR 1, SR 27	Build managed grade separation at Artesia Blvd	Euclid Ave	Build managed grade separation at Mission Blvd
SR 1, SR 27	Build managed grade separation at Manhattan Beach Blvd	Euclid Ave	Build managed grade separation at Holt Blvd
SR 1, SR 27	Build managed grade separation at Rosecrans Ave	Euclid Ave	Build managed grade separation at D St
SR 1, SR 27	Build managed grade separation at El Segundo Blvd	Euclid Ave	Build managed grade separation at 4th St
SR 1, SR 27	Build managed grade separation at Grand Ave	Euclid Ave	Build managed grade separation at 6th St
SR 1, SR 27	Build managed grade separation at Imperial Highway	Euclid Ave	Rebuild I-10 Interchange
SR 1, SR 27	Rebuild I-105 Interchange	Euclid Ave	Build managed grade separation at 8th St
SR 1, SR 27	Build managed grade separation at Manchester Ave	Euclid Ave	Build managed grade separation at Arrow Highway
SR 1, SR 27	Build managed grade separation at Jefferson Blvd	Euclid Ave	Build managed grade separation at Foothill Blvd
SR 1, SR 27	From Jefferson Blvd to Fiji Way Add one southbound lane (0.5 mile, 0.5 lane mile)	Euclid Ave	From Foothill Blvd to 24th St add 1 travel lane in each direction (3.0 miles, 6.0 new lane miles)
SR 1, SR 27	Build Interchange at SR 90	Euclid Ave	Build managed grade separation at 13th St
SR 1, SR 27	Build managed grade separation at Washington Blvd	Euclid Ave	Build managed grade separation at 16th St
SR 1, SR 27	From Washington Blvd to I-10 add 1 lane each direction (2.8 miles, 5.6 lane miles)	Euclid Ave	Build managed grade separation at 19th St
SR 1, SR 27	Build managed grade separation at Venice Blvd	Euclid Ave	Rebuild I-210 Interchange
SR 1, SR 27	Build managed grade separation at Rose Ave	El Toro Cut Off Rd	From SR 74 to El Toro Rd at El Toro Rd add 2 lanes in each direction (1.3 miles, 5.2 lane miles)
SR 1, SR 27	Build managed grade separation at Ocean Park Blvd	El Toro Rd	From El Toro Cut Off Rd to Fort Lander Ln add 2 lanes in each

Table C5: List of Managed Lane Components

Managed Arterial	Improvement	Managed Arterial	Improvement
			direction (8.8 miles, 35.2 lane miles)
SR 1, SR 27	Build managed grade separation at Pico Blvd	El Toro Rd	From Fort Lander Ln to El Mineral Rd add 2 travel lanes in each direction (0.5 miles, 2.0 new road lanes)
SR 1, SR 27	Rebuild SR 1 at I-10/Olympic Blvd Interchange	Piedras Rd	Build managed grade separation at Santa Rosa Mine Rd
SR 1, SR 27	Build managed grade separation at SR 1 at Channel Blvd and Chautauqua Blvd	Piedras Rd	From El Mineral Rd to Santa Rosa Mine Rd add 2 travel lanes in each direction (0.9 miles, 3.6 new lane miles)
SR 1, SR 27	Build managed grade separation at SR 1/SR 27	Santa Rosa Mine Rd	From Piedras to Lake Matthews Dr add 2 travel lanes in each direction (1.0 miles, 4.0 new lane miles)
SR 1, SR 27	From Temescal Canyon Rd to Avenue St. Louis Add one lane in each direction (14.7 miles, 29.4 lane miles)	Gavilan Rd	From Lake Matthews Dr to Cajalco Rd (2.9 miles, 11.6 new lane miles) add 2 travel lanes in each direction
SR 1, SR 27	Build managed grade separation at Ventura Blvd	Cajalco Rd	From Gavilan Rd to El Sobrante Rd (0.3 miles, 1.2 new lane miles) add 2 travel lanes in each direction
SR 1, SR 27	Rebuild US 101 Interchange	El Sobrante Rd	From Cajalco Rd to Mockingbird Canyon Rd add 2 travel lanes in each direction (1.1 miles, 4.4 new lane miles)
SR 1, SR 27	Build managed grade separation at Burbank Blvd	Mockingbird Canyon Rd	From El Sobrante Rd to Van Buren Blvd add 2 travel lanes in each direction (3.5 miles, 14.0 new lane miles)
SR 1, SR 27	Build managed grade separation at Oxnard St	Van Buren Blvd	From Mockingbird Canyon Rd to Rudcill St add 1 travel lane in each direction (2.6 miles, 5.2 new lane miles)
SR 1, SR 27	Build managed grade separation at Victory Blvd	Van Buren Blvd	Build managed grade separation at Victoria Ave
SR 1, SR 27	Build managed grade separation at Vanowen St	Van Buren Blvd	Build managed grade separation at Indiana Ave
SR 1, SR 27	Build managed grade separation at Sherman Way	Van Buren Blvd	Rebuild SR 91 Interchange
SR 1, SR 27	Build managed grade separation at Saticoy St	Van Buren Blvd	Build managed grade separation at Magnolia Ave
SR 1, SR 27	Build managed grade separation at Roscoe Blvd	Van Buren Blvd	From Garfield St to Cypress Ave add 1 travel lane in each direction (1.8 miles, 3.6 new lane miles)
SR 1, SR 27	From Parthenia St to Prarie St convert Parking lanes to travel lanes (0.8 miles, 1.6 lane miles)	Van Buren Blvd	Build managed grade separation at California Ave
SR 1, SR 27	Build managed grade separation at Plummer St	Van Buren Blvd	Build managed grade separation at Jackson St
SR 1, SR 27	From Marilla St to SR 118 convert parking lanes to travel lanes (2.1 miles, 4.2 lane miles)	Van Buren Blvd	Build managed grade separation at Arlington Ave
SR 1, SR 27	Build managed grade separation at Larson St	Van Buren Blvd	From Jurupa Ave to Jurupa Rd add 1 lane in each direction (3.1 miles, 6.2 lane miles)
SR 1, SR 27	Build managed grade separation at Devonshire St	Van Buren Blvd	Build managed grade separation at Jurupa Rd
SR 23	SR 1 to Triunfo Canyon Rd add 2 lanes in each direction (11.0 miles, 22 lane miles)	Jurupa Rd	From Van Buren Blvd to Valley Way add 2 lanes in each direction (2.7 miles, 10.8 lane miles)
SR 23	Build managed grade separation at Agoura Rd	Jurupa Rd	Build managed grade separation at Pedley Rd
SR 23	Rebuild Interchange at US 101	Jurupa Rd	Build managed grade separation at Camino Real
Westlake Blvd	Build managed grade separation at Thousand Oaks Rd	Valley Way	From Jurupa Rd to Mission Blvd add 2 lanes in each direction (0.4 miles, 1.6 lane miles)
Westlake Blvd	From Hillcrest Dr to Eagle Claw Ave add one lane in each direction (3.6 miles, 7.2 lane miles)	Valley Way	Build managed grade separation at Mission Blvd
Westlake Blvd	From Eagle Claw Ave to 0.1 mi W of Oak Valley Lane add 2 lanes in each direction (0.3 mile, 1.2 lane mile)	Armstrong Rd	From Jurupa Rd to Sierra Ave add 1 lane in each direction (1.0 miles, 2.0 new lane miles)
New Alignment	From Westlake Blvd 0.1 mile west of Oak Valley Lane to Wood Ranch Parkway at Long Canyon Rd (2.0 miles, 8.0 lane miles)	Sierra Ave	From Armstrong Rd to Santa Ana Ave add 1 lane in each direction (2.6 miles, 5.2 lane miles)
Wood Ranch Parkway	From Long Canyon Rd to Madera Rd add 1 lane in each direction (2.0 miles, 4 lane miles)	Sierra Ave	Build managed grade separation at Santa Ana Ave
Madera Rd	From Wood Ranch Parkway to MaCaw Lane convert southwestbound parking lane to travel lane (1.1 miles, 1.1 lane miles)	Sierra Ave	Build managed grade separation at Slover Ave
Madera Rd	Managed grade separation at Tierra Rejada Rd	Sierra Ave	Rebuild I-10 Interchange
Madera Rd	Managed grade separation at Easy St	Sierra Ave	Build managed grade separation at Valley Blvd
La Cienega Blvd	Rebuild I-405 Interchange Reconstruction	Sierra Ave	Build managed grade separation at San Bernardino Ave
La Cienega Blvd	From I-405 to Glenway Dr convert southbound parking lane to travel lane (0.7 miles, 0.7 lane miles)	Sierra Ave	From San Bernardino Ave to Baseline Ave, convert parking lanes to travel lanes (3.0 miles, 3.0 lane miles)
La Cienega Blvd	Build managed grade separation at Centinela Ave	Sierra Ave	Build managed grade separation at Randall Ave
La Cienega Blvd	Build managed grade separation at La Tijera Blvd	Sierra Ave	Build managed grade separation at Merrill Ave
La Cienega Blvd	Build managed grade separation at Rodeo Rd	Sierra Ave	Build managed grade separation at Arrow Blvd
La Cienega Blvd	Build managed grade separation at Jefferson Blvd	Sierra Ave	Build managed grade separation at Foothill Blvd
La Cienega Blvd	Build managed grade separation at Washington Blvd	Sierra Ave	Build managed grade separation at Miller Ave
La Cienega Blvd	Build managed grade separation at Venice Blvd	Sierra Ave	Build managed grade separation at Baseline Rd
La Cienega Blvd	Rebuild I-10 interchange	Sierra Ave	From Summit Ave to I-15 (2.0 miles, 8.0 new lane miles) add 2 travel lanes in each direction
La Cienega Blvd	Build managed grade separation at Cadillac Ave	Sierra Ave	Build managed grade separation at Highland Ave
La Cienega Blvd	Build managed grade separation at at Pico Blvd	Sierra Ave	Rebuild I-210 Interchange
La Cienega Blvd	Build managed grade separation at Olympic Blvd	Sierra Ave	Build managed grade separation at Sierra Lakes Parkway
La Cienega Blvd	Build managed grade separation at Wilshire Blvd	SR 79	Rebuild I-15 Interchange

Table C5: List of Managed Lane Components

Managed Arterial	Improvement	Managed Arterial	Improvement
La Cienega Blvd	Build managed grade separation at San Vicente Blvd	SR 79	Build managed grade separation at Margarita Rd
La Cienega Blvd	Build managed grade separation at 3rd St	SR 79	Build managed grade separation at Murrieta Hot Springs Rd
La Cienega Blvd	Build managed grade separation at Beverly Blvd	SR 79	From Hunter Rd to Pourroy Rd add 1 travel lane in each direction (3.9 miles, 7.8 new lane miles)
La Cienega Blvd	Build managed grade separation at Melrose Ave	SR 79	Build managed grade separation at Leon Rd
La Cienega Blvd	From Beverly Blvd to Santa Monica Blvd convert parking lanes to travel lanes (0.2 miles, 0.4 lane miles)	SR 79	From Pourroy Rd to SR 74 add 2 travel lanes in each direction (9.3 miles, 37.2 new lane miles)
La Cienega Blvd	Build managed grade separation at Santa Monica Blvd	SR 79	Build managed grade separation at Scott Rd
Sunset Blvd	From La Cienega Blvd to Marmont Lane add 1 lane in each direction (0.5 mile, 1 lane mile)	SR 79	Build managed grade separation at Domenigoni Parkway
Laurel Canyon Blvd	From Sunset Blvd to Mt. Olympus Dr add 1 lane in each direction (0.4 mile, 0.8 lane miles)	SR 79	Build managed grade separation at Simpson Rd
Laurel Canyon Blvd	From Mt. Olympus Dr to Mulholland Dr add 2 lanes in each direction (1.8 miles, 7.2 lane miles)	Juniper Springs Rd Extension	From SR 74 to Juniper Springs Curve build new roadway (2.5 miles, 15.0 lane miles)
Laurel Canyon Blvd	Build managed grade separation at Mulholland Dr	Juniper Springs Rd	From Juniper Springs Curve to Juniper Flats Rd Add 2 travel lanes in each direction (3.5 miles, 14.0 new lane miles)
Laurel Canyon Blvd	From Mullholland Dr to Maxwellton Rd add 1 lane in each direction (1.9 miles, 3.8 lane miles)	Juniper Flats Rd	From Juniper Spring Rd to Contour Ave add 2 travel lanes in each direction (2.8 miles, 11.2 new lane miles)
Laurel Canyon Blvd	Build managed grade separation at Ventura Blvd	Contour Ave	From Juniper Flats Rd to Hansen Ave (1.1 miles, 4.4 new lane miles) add 2 travel lanes in each direction
Laurel Canyon Blvd	From Maxwellton Rd to Webb Ave convert parking lanes to travel lanes (7.7 miles, 15.4 lane miles)	Hansen Ave	From Contour Ave to Ramona Expressway add 2 travel lanes in each direction (2.1 miles, 4.2 new lane miles)
Laurel Canyon Blvd	Build managed grade separation at Moorpark St	Hansen Ave	Build managed grade separation at Ramona Expressway
Laurel Canyon Blvd	Rebuild US 101 interchange	Davis Rd	From Ramona Expressway to South of Alessandro Blvd add 2 travel lanes in each direction (5.9 miles, 23.6 new lane miles)
Laurel Canyon Blvd	Build managed grade separation at Riverside Dr	Theodore St	From south of Alessandro Blvd to Ironwood Ave add 2 travel lanes in each direction (2.0 miles, 4.0 new lane miles)
Laurel Canyon Blvd	Build managed grade separation at Magnolia Blvd	Ironwood Ave	From Theodore St to Redlands Blvd add 2 lanes in each direction (1.0 mile, 4.0 lane miles)
Laurel Canyon Blvd	Build managed grade separation at Chandler Blvd	Redlands Blvd	From Ironwood Ave to San Timoteo Canyon Rd Add 2 lanes in each direction) 3.3 miles, 13.2 lane miles)
Laurel Canyon Blvd	Build managed grade separation at Burbank Blvd	San Timoteo Canyon Rd	From Redlands Blvd to Alessandro Rd add 2 lanes in each direction (2.2 miles, 8.8 lane miles)
Laurel Canyon Blvd	Build managed grade separation at Oxnard St	Alessandro Rd	From San Timoteo Canyon Rd to Crescent Ave add 2 lanes in each direction (1.6 miles, 6.4 lane miles)
Laurel Canyon Blvd	Rebuild SR 170 interchange	Crescent Ave	From Alessandro Rd to San Jacinto Rd add 2 lanes in each direction (.01 miles, .04 lane miles)
Laurel Canyon Blvd	Build managed grade separation at Victory Blvd	San Jacinto St	From Crescent Ave to Highland Ave add 2 lanes in each direction (0.2 miles, 0.8 lane miles)
Laurel Canyon Blvd	Build managed grade separation at Vanowen St	Highland Ave	From San Jacinto St to San Mateo St add 2 lanes in each direction (0.2 miles, 0.8 lane miles)
Laurel Canyon Blvd	Build managed grade separation at Sherman Way	San Mateo St	From Highland Ave to Clifton Ave add 1 lane in each direction, convert parking lanes to travel lanes (0.4 miles, 1.6 lane miles)
Laurel Canyon Blvd	Build managed grade separation at Saticoy St	San Mateo St	From Clifton Ave to I-10/I-210 convert parking lanes to travel lanes (2.1 miles, 4.2 lane miles)
Laurel Canyon Blvd	Build managed grade separation at Strathern St	San Mateo St	Build managed grade separation at Brookside Ave
Laurel Canyon Blvd	Build managed grade separation at Roscoe Blvd	Tennessee St	Build managed grade separation at State St
Laurel Canyon Blvd	From Webb Ave to Sheldon St add 1 lane in each direction (0.6 mile, 1.2 lane miles)	Tennessee St	Build managed grade separation at Redlands Blvd
Laurel Canyon Blvd	Rebuild I-5 Interchange	Tennessee St	Build managed grade separation at Colton St
Sheldon St	From Laurel Canyon Rd to San Fernando Rd add 1 lane in each direction (0.8 mile, 1.6 lane miles)		

Table C6: Managed Arterial Revenue and Cost Calculations

Years	Inflation	Total Gross Revenue	Total Net Revenue		Years	Lane Additions	Grade Separations	New Alignments	Total
2020		1559379972	1325472976		2015	458080000	935,280,000	81040000	1474400000
2021	1.03	1604601991	1363911693		2016	471364320	962403120	83390160	1517157600
2022	1.03	1651135449	1403465132		2017	485033885.3	990312810.5	85808474.64	1561155170
2023	1.03	1699018377	1444165620		2018	499099868	1019031882	88296920.4	1606428670
2024	1.03	1748289910	1486046423		2019	513573764.1	1048583807	90857531.1	1653015102
2025	1.03	1798990317	1529141770		2020	528467403.3	1078992737	93492399.5	1700952540
2026	1.03	1851161036	1573486881		2021	543792958	1110283526	96203679.08	1750280163
2027	1.03	1904844707	1619118001		2022	559562953.8	1142481749	98993585.78	1801038288
2028	1.03	1960085203	1666072423		2023	575790279.4	1175613719	101864399.8	1853268398
2029	1.03	2016927674	1714388523		2024	592488197.5	1209706517	104818467.4	1907013182
2030	1.03	2075418576	1764105790		2025	609670355.3	1244788006	107858202.9	1962316564
2031	1.03	2135605715	1815264858		2026	627350795.6	1280886858	110986090.8	2019223745
2032	1.03	2197538281	1867907539		2027	645543968.6	1318032577	114204687.4	2077781233
2033	1.03	2261266891	1922076857		2028	664264743.7	1356255522	117516623.4	2138036889
2034	1.03	2326843631	1977817086		2029	683528421.3	1395586932	120924605.4	2200039959
2035	1.03	2394322096	2035173782		2030	703350745.5	1436058953	124431419	2263841118
2036	1.03	2463757437	2094193821		2031	723747917.1	1477704663	128039930.2	2329492510
2037	1.03	2535206403	2154925442		2032	744736606.7	1520558098	131753088.1	2397047793
2038	1.03	2608727388	2217418280		2033	766333968.3	1564654283	135573927.7	2466562179
2039	1.03	2684380483	2281723410		2034	788557653.4	1610029257	139505571.6	2538092482
2040	1.03	2762227517	2347893389		2035	811425825.3	1656720105	143551233.2	2611697164
2041	1.03	2842332115	2415982297		2036	834957174.3	1704764989	147714218.9	2687436382
2042	1.03	2924759746	2486045784		2037	859170932.3	1754203173	151997931.3	2765372037
2043	1.03	3009577779	2558141112		2038	884086889.4	1805075065	156405871.3	2845567826
2044	1.03	3096855534	2632327204		2039	909725409.2	1857422242	160941641.5	2928089293
2045	1.03	3186664345	2708664693			16483705035	33,655,430,591	2916170660	53055306287
2046	1.03	3279077611	2787215969						
2047	1.03	3374170861	2868045232		Category	Total Costs in FY 2015 Dollars*			
2048	1.03	3472021816	2951218544		Lane Additions	11,452,000,000			
2049	1.03	3572710449	3036803882		Grade Separations	23,382,000,000			
2050	1.03	3676319052	3124871194		New Alignments	2,026,000,000			
2051	1.03	3782932304	3215492459			36,860,000,000			
2052	1.03	3892637341	3308741740						
2053	1.03	4005523824	3404695251						
2054	1.03	4121684015	3503431413						
2055	1.03	4241212852	3605030924						
2056	1.03	4364208024	3709576821						
2057	1.03	4490770057	3817154548						
2058	1.03	4621002389	3927852030						
2059	1.03	4755011458	4041759739						
		1.14949E+11	97706820531						

Note: These are the numbers in 2015 while the ones above are in nominal dollars.

Table C7: Managed Arterial Usage and Revenue

	Traffic	Percent Using	Rate	Number	Total
Peak	43800	0.5	0.35	559	4284735
Shoulder	21500	0.35	0.25	559	1051618.75
Off	21500	0.2	0.15	559	360555
					5696908.75
Weekend	52560	0.2	0.2	559	1175241.6
					6872150.35
Weekdays	250	1424227188			
Weekends/Holidays	115	135152784			
Total		1559379972			

Appendix D: New Expressway/Tunnel Details

We presented an overview of the tunnel calculations in the main body of the report. This first part of this appendix has more detail on the modeling and model components.

The second part of this appendix provides the full details for the revenue and costs of each of the new expressway/tunnel projects. Tables D7 through D13 show the revenue for the I-710T, GPT, DBT, HDC, ICE and XMT projects. Table D14 lists the costs for each of the individual projects and a composite total of the projects together. Revenue and costs were calculated in a similar method to the express lane network. Those calculations are detailed in Appendix B.

A. Method

We used the SCAG demographic forecasts extrapolated to 2035 and then ran traffic assignments on the two combinations of projects using the optimal toll and facility size as determined in the original assessments. This appendix documents the results of these assignments. To adjust SCAG's data to the years of our plan, we extrapolated 2040 projections from 2035 data.

This assessment uses TransCAD© multi-class traffic assignment as its underlying methodology.[185] Working with the region's MPO, the Southern California Association of Governments (SCAG), we first obtained the 2035 traffic model, the 2035 road network (with planned routes) and 2035 and 2003 origin-destination matrices for six vehicle classes. We concentrated on the PM peak hours (4–7 PM); time constraints did not permit separate assessment of the AM peak or off-peak, so results are expanded to account for those hours.

The SCAG modeling system calculates road capacities and other necessary statistics internally. However, since some internal calculations are not available to us, we approximated them using estimated capacity parameters from the literature. Specifically, we used a modified volume-capacity decay function, using a variant of the familiar (Bureau of Public Roads) BPR curve, rather than SCAG's Acelik function. Our results compare reasonably well, but not exactly, with 2035 traffic flows in the SCAG model. At the regional level, they are quite close, but for individual links they vary, sometimes

significantly. Model output includes link volumes, vehicle-miles and vehicle-hours of travel for each link, speed, V/C ratio and other statistics.

Of the seven projects, only the I-710 Tolled Tunnel (I-710T) and the High Desert Corridor (HDC) were included in the SCAG 2035 network, so we treated these facilities differently. For the I-710T, we assigned a fixed toll to key links and for the HDC, we used the proposed five toll gantry segments as key links and assigned a per-mile toll based on highway length in the vicinity of each toll gantry. For the other five projects we assigned per-mile tolls to the main facility links, excluding ramps. As in the original assessments, we ran PM traffic assignments to determine the volume of traffic, the Vehicle-Miles Traveled (VMT) and Vehicle-Hours Traveled (VHT), and the toll revenues generated. We allowed only single-occupant driver, shared ride 2, shared ride 3, and light trucks to use most facilities; medium and heavy trucks were "tolled off" (except the HDC) using an excessive toll of $1,000/mile. We employed "user equilibrium" principles for all assignments. We then expanded the PM peak results to daily estimates, assuming that the AM peak is similar to the PM and that the remaining off-peak traffic is about 46% of the AM and PM peaks; this leads to a PM-to-Day expansion factor of 2.92.

We are concerned with the combined effects of the optimal tolls as previously determined (and noted in the table above) for the year 2035 only. To complete the analysis, however, we did need to run several other toll assignments. These include a $0 (no toll) for 2035, a $1,000 toll (which effectively provided data on network traffic without the facilities being built) for 2035,[186] $0 toll for 2003 (the base year) and a derived optimal toll for 2003. For vehicle values of time, we used $25/hour (current $) for drive-alone cars (DA), $35/hour for carpools with two occupants (SR2), $45/hour for carpools with three occupants (SR3), $45/hour for light trucks (LT), $50/hour for medium trucks (MT) and $75/hour for heavy trucks (HT); these are generally consistent with the values of time used in other studies, which account for both saved time and improved reliability.[187]

User benefits are computed using $25/hour as the average vehicle value of time saved, $0.20 per vehicle-mile as the average operating cost, and $5.8 million per life saved as the value of a fatality avoided. Total user benefits are computed on the basis of 40 years.[188] Inflation is assumed at 2.9% per year, and the discount rate (value of money) is assumed to be 5% per year.

B. Findings

The following tables summarize major findings from our analysis.

Combo 3: I-710T, GPT and DBT

Table D1 summarizes the results of the three facilities separately and in combination.

Table D1: Summary Results for Combo 3

Item	Totals Separately	Totals in Combination	Separate to Combo, % Change
2035 Avg Daily Traffic with Toll, New Facilities	71,271	83,745	17.5
2035 Avg PM Level of Service (LOS)	C	E	
2035 Avg Percent Capacity Used, PM	53	89	
2035 Daily VMT, New Facilities	2,382,388	2,683,245	12.6
2035 Daily VHT, New Facilities	68,977	70,101	1.6
Daily Regional VMT Saved	-1,108,366	-1,079,505	-2.6
Daily Regional VHT Saved	-242,024	-298,410	23.3

There is a significant cumulative effect for these three facilities when operated in combination rather than separately. On average, traffic on the new facilities increases more than 17%, which increases toll revenues almost 11%. Both VMT and VHT on the new facilities also increase. However, the region-wide savings in VMT is not as great in combination, as people drive farther to take advantage of the new facilities, but region-wide savings in VHT increases over 23%. Since most of the user benefits derive from travel time-savings, user benefits increase over 22%. This increase in facility use, however, comes with a downside. As more people are using the new facilities, the level of service (LOS) decreases, in this case significantly, dropping from LOS C to E. The percent of highway capacity used increases from 53% to 89%, which suggests that either additional capacity or higher tolls will be needed in future years to provide users a smoothly flowing facility in exchange for their toll dollar.

In particular, the I-710 tunnel experiences a significant growth in traffic when operated in combination, increasing from 118,000 to 169,000 daily. This increases the percent of capacity used in the PM peak from 75% to 106% and drops the LOS from D to F. Perhaps this is because we used an optimal toll ($2.00 in 2015 dollars) well below the maximum revenue toll, which was in the $3.00 range. We model tolls as increasing with inflation, but this increase might not be large enough to ensure LOS D or better.

Combo 7

Our research of Southern California's mobility problems led us to study seven potential expressways/tunnels. However, one of the projects—the Santa Ana Connector extending SR 57 southward from I-5 to I-405—had a low cost-benefit relationship. As a result, we eliminated this project from our plan. In this section, we included the modeling for the seven projects to illustrate how the projects work individually and as part of a network. The following table summarizes the results of the three facilities separately and in combination.

Table D2: Summary Results for Combo 7

Item	Totals Separately	Totals in Combination	Separate to Combo, % Change
2035 Avg Daily Traffic with Toll, New Facilities	57,063	58,452	2.4
2035 Avg PM Level of Service (LOS)	C	D	
2035 Avg Percent Capacity Used, PM	50	72	
2035 Daily VMT, at Toll on New Facilities	5,762,106	5,826,623	1.1
2035 Daily VHT, at Toll on New Facilities	139,569	134,204	-3.8
Daily Regional VMT Saved	-1,445,472	-1,215,552	-15.9
Daily Regional VHT Saved	-472,652	-518,001	9.6

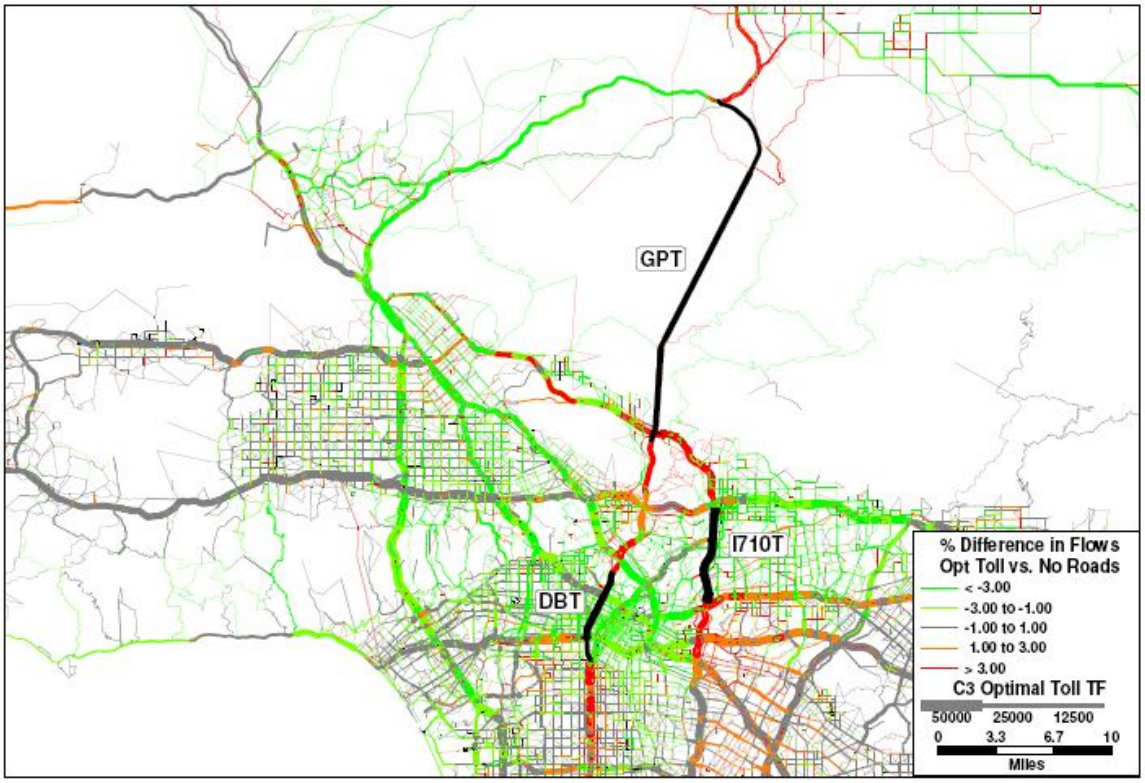
The cumulative effect of the combination of seven projects is not as significant as the combination of three. Facility use when operated in combination is comparable to that when operated individually. Traffic is up slightly (2.4%), VMT is up slightly (1.1%) and VHT is down slightly (3.8%). Toll revenues are also up slightly (1.0%) while user benefits are up a more significant 8.8%. The higher increase in user benefits is caused by the increase in region-wide VHT savings of 9.6%; however, region-wide VMT savings is down almost 16% as drivers increase their travel to take advantage of the new facilities. The lower increase in average facility use, as compared to the three-project combination, means that there is less degradation in LOS. Percent capacity used in the PM peak increases from 50% to 72% and LOS declines from C to D. This indicates that capacity additions or toll increases will be needed in the out years to maintain good travel speed across the tolled facilities, but on average, such additions/increases will be needed later than for the combination of three.

As in the combination of three, the I-710 tunnel experiences the largest increase in traffic and hence the most significant decline in LOS, going from D to F when operated in combination. As noted above, this could be because of the use of an optimal toll well below the maximum revenue toll, which, if so, suggests that toll rates could be increased on this facility in the out years to divert some traffic and improve LOS levels.

C. Impacts on the Network

When new facilities are introduced into the network, there are diversions from existing routes to the new facility to take advantage of the increased accessibility offered by the new project. Generally, a new road will reduce traffic on parallel routes, and increase traffic on feeder (end point) and crossing (perpendicular) routes. The maps below show changes in traffic on existing routes if the combinations of facilities were built and the stated tolls levied. Colors represent the traffic gains and losses; "greens" lose 1% or more of traffic flow, while "reds" gain 1% or more. (High percent changes far from the facilities are likely caused by anomalies in TransCAD©, including convergence and OD patterns and are generally ignored.[189]) Most roads, however, see only minor traffic shifts in the -1.0% to 1.0% range and are shaded in gray.

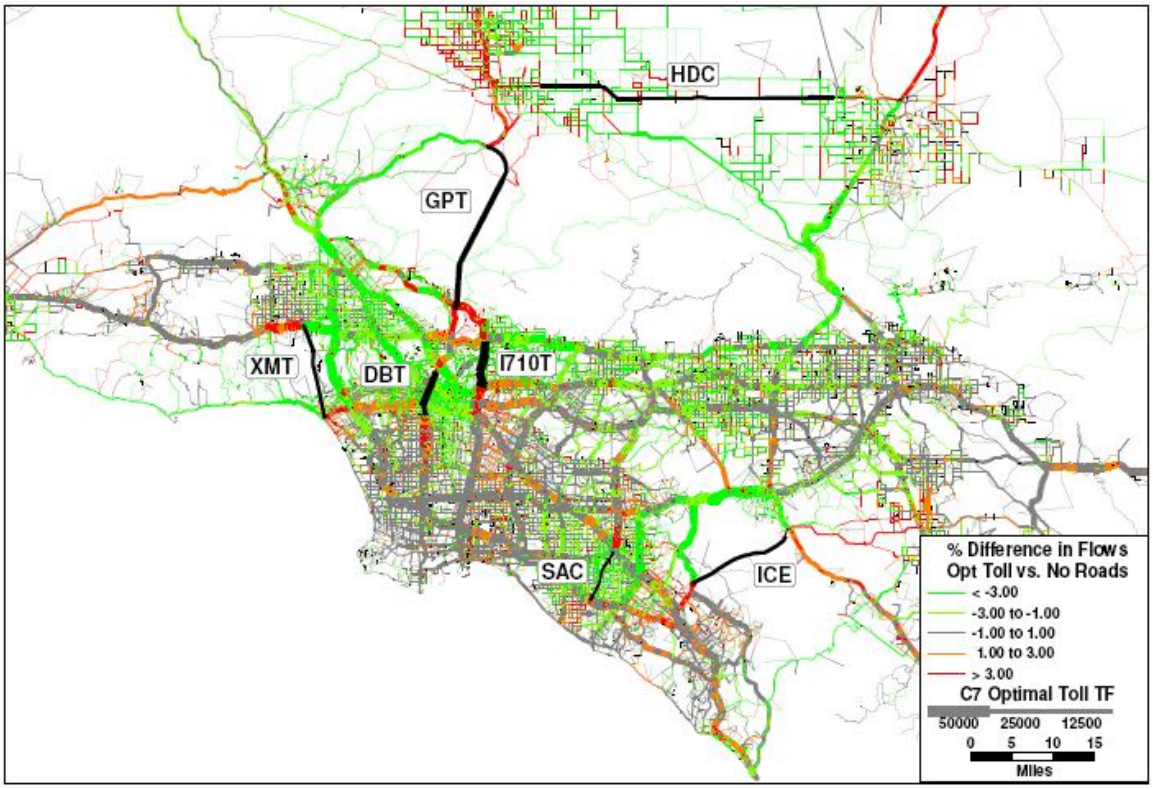
Figure D1: Combo 3 Impacts on the Regional Network



In the combination of three projects, as expected, the key feeder routes along the DBT-GPT axis (SR-14 in the far north, the Glendale Freeway in the center, and I-110 in the south) and along I710T (I-210 in the north and I-710 in the south) see the largest increases in traffic. Alternate routes (SR-14 to the northwest of the three facilities, I-405, US-101 and I-5 to the west, the I-10/I-5 "loop" in the midst of the three, and I-210 to the east) see the largest decreases. Elsewhere in the general area are slight increases and decreases as

people alter their driving patterns to take advantage of these facilities themselves or the new alternate pathways opened up by the shifts in traffic.

Figure D2: Combo 7 Impacts on the Regional Network



The above map shows all seven projects. The impacts in and around the DBT, GPT and I-710T are similar to the impacts of the combination of just the three, noted above. The XMT adds some traffic to US-101 west of the junction and diverts some traffic east of the junction, and has a similar but reverse effect at its southern junction with I-10; traffic to the east increases while traffic to the west decreases. The feeder routes north and south of the SAC see increases while most other roads in the vicinity see decreases. The ICE carries a lot of the traffic originally on I-15, SR-91, and I-5 north of the facility, but causes traffic increases south of its junctions with I-5 in the west and I-15 in the east. And finally, the HDC shifts traffic from parallel routes, improving their flow, but adds some traffic at the feeder routes.

Table D3: Vehicle Classifications, Values of Time, and Toll Strategies

	Vehicle Class					
	Drive Alone	Shared Ride 2	Shared Ride 3	Light Trucks	Medium Trucks	Heavy Trucks
Value of Time/ hour	$25.00	$35.00	$45.00	$45.00	$50.00	$75.00
Value of Time/ minute	$0.42	$0.58	$0.75	$0.75	$0.83	$1.25
Average Toll						
I-710 Tunnel - $2.00 Flat	$2.00	$2.00	$2.00	$2.00	$1000.00	$1000.00
GPT - $0.90/mile	$0.90	$0.90	$0.90	$0.90	$1000.00	$1000.00
DBT - $1.00/mile	$1.00	$1.00	$1.00	$1.00	$1000.00	$1000.00
HDC - $0.40/mile	$0.40	$0.40	$0.40	$0.40	$0.40	$0.40
ICE - $0.70/mile	$0.70	$0.70	$0.70	$0.70	$1000.00	$1000.00
XMT - $0.60/mile	$0.60	$0.60	$0.60	$0.60	$1000.00	$1000.00
SAC - $0.40/mile	$0.40	$0.40	$0.40	$0.40	$1000.00	$1000.00

- **Network description**: The above table shows the data used in the SCAG Regional Planning Model, based on the following files, provided by SCAG:
  - Model input and output files from *08R35f_PL_run4*, to include the 2035 network links file with LRTP projects coded (*08r35pl_links*)
  - The 2035 Origin-Destination matrix file for six modes (*DA, SR2, SR3, Lt Trucks, Med Trucks, Heavy Trucks)* for the PM period only (*PM OD, 2035*).
  - The 2035 PM traffic assignment flows, by mode (*08r35pl_links+MMA_LinkFlow*)
  - The TAZ data layer
  - SCAG Planning Model files (*scagnew_ui*)
  - The User's Guide for the SCAG Regional Planning Model, containing assignment method (user equilibrium), delay functions used (Akcelik), input parameters, etc.

- **Delay function modification:** We used a modified Bureau of Public Roads (BPR) function rather than the SCAG Acelik function (which was not available to us).
  - We ran an initial traffic assignment using the BPR coefficients generated in the Initialization Step of the SCAG Model. These coefficients were separated by functional class.
  - We calculated the differences in flows, VMT and VHT between the initial run and the traffic assignment results provided by SCAG. While our results were close to SCAG's in flows and VMT, our model predicted a higher VHT than the SCAG model.
  - We determined the issue with our model was on the expressways and the arterials; the other classes were within an acceptable range.
  - We then modified the alpha coefficients to "speed up" travel and re-ran the assignment.
  - The differences on the arterials were closer, but not on the expressways. So we made one more change, which brought VHT on the expressways in line.
  - The resulting coefficients by functional class are noted below.

The following tables and values use SCAG model data and explain the missing parameters.

Table D4: Modifications to SCAG BPR Coefficients

Facility Type	BPR Alpha	BPR Beta	Modified BPR Alpha	Beta
1 – Freeways (All)	1.1600	4.3300	0.4633	0.4040
2 – HOV (All)	1.1600	4.3300		
3 – Expressway/Parkway (All)	1.0718	1.6000		
4 – Principal Arterial				
40 – Undivided	1.0718	1.6000	0.6786	
41 – Divided	1.0718	1.6000	0.5667	
42 – Continuous Left Turn	1.0718	1.6000	0.5484	
5 – Minor Arterial				
50 – Undivided	1.0718	1.6000	0.5222	
51 – Divided	1.0718	1.6000	0.5137	
52 – Continuous Left Turn	1.0718	1.6000	0.6145	
6 – Major Collector (All)	1.0718	1.6000		
7 – Minor Collector (All)	1.0718	1.6000		
8 – Ramps (All)	1.1600	4.3300		
9 – Trucks (All)	1.1600	4.3300		
10– Centroid connector	0.0100	4.0000		

- **Miscellaneous parameters:**
  - Future year: **2035**
  - Operating cost: **$0.20/mile** (for all traffic)
  - Accident cost: **$ 5.8** million/fatality
  - Accident rate: **1.15** fatalities/100 million vehicle-miles

Table D5: Project Data for Combo 3 Projects, Considered in Combination

Projects by Themselves In Combo 3	I-710T	HDC	GPT	ICE	XMT	SAC	DBT	Combo 3
2035 Daily Traffic at Toll	170,941		57,139				96,772	83,745
2035 PM Level of Service	F		B				D	E
2035 Percent Capacity Used, PM	107		48				81	89
2035 Daily VMT at Toll	970,451		1,208,791				504,002	2,683,245
2035 Daily VHT at Toll	31,293		26,516				12,292	70,101
Daily VMT Saved	NA		NA				NA	-1,079,505
Daily VHT Saved	NA		NA				NA	-298,410

Note: Data based on traffic assignments in Combo 3 assessment.

Table D6: Project Data for Combo 7 Projects, Considered in Combination

Projects by Themselves In Combo 7	I-710T	HDC	GPT	ICE	XMT	SAC	DBT	Combo 7
2035 Daily Traffic at Toll	169,100	51,509	54,120	46,008	47,596	31,973	94,366	58,452
2035 PM Level of Service	F	B	B	C	B	B	D	D
2035 Percent Capacity Used, PM	106	43	45	58	40	40	79	72
2035 Daily VMT at Toll	959,999	1,889,809	1,144,934	570,248	538,689	231,470	491,474	5,826,623
2035 Daily VHT at Toll	30,586	36,617	24,856	12,147	12,538	5,641	11,819	134,204
Daily VMT Saved	NA	NA	NA	NA	NA	NA	NA	-1,215,552
Daily VHT Saved	NA	NA	NA	NA	NA	NA	NA	-518,001

Note: Data based on traffic assignments in Combo 7 assessment.

Table D7: Project Data for All Projects, Considered Individually

Projects by Themselves Alone	I-710T*	HDC*	GPT*	ICE*	XMT*	SAC*	DBT*	C7 Totals**	C3 Totals**
2035 Daily Traffic at Toll	118,665	53,985	53,137	48,200	51,262	34,023	93,271	57,063	71,271
2035 PM Level of Service	D	B	B	C	B	B	D	C	C
2035 Percent Capacity Used, PM	75	45	44	60	39	43	78	50	53
2035 Daily VMT at Toll	772,653	1,955,806	1,123,947	597,412	580,184	246,316	485,788	5,762,106	2,382,388
2035 Daily VHT at Toll	33,061	38,165	24,347	12,864	13,548	6,016	11,569	139,569	68,977
Daily VMT Saved	34,368	-52,997	-1,143,710	-228,022	-41,230	-14,857	975	-1,445,472	-1,108,366
Daily VHT Saved	-33,944	-98,075	-159,699	-66,361	-62,040	-4,151	-48,382	-472,652	-242,024

* Based on traffic assignments in original assessments.

** Calculated (sums or weighted averages) from project data in table.

Note: As we mentioned previously, due to the poor performance (high cost, low toll revenue, limited congestion relief) in our traffic demand model of the proposed SR 57 extension southward from I-5 to I-405 (abbreviated as SAC), we dropped the project from our final report. This increased the effects of the combination of three projects significantly. Without SAC, the new Combo 6 performs almost as well as Combo 3 (costs, toll revenue, congestion relief).

Table D8: I-710 Expressway Extension/Tunnel

Year	Toll Rate	Infla-tion	Traffic Count	Revenue	Days of Year	Total Gross Revenue	Net Revenue	NPV Factor	NPV Revenue	NPV	Net Gross
2020	2.31	1.03	97525.79	225284.58	365.25	82285192.64	69942413.75	1.0000	69942413.75	225284.58	82285192.64
2021	2.38	1.03	98501.05	234136.01	365.25	85518177.86	72690451.18	0.9524	69229001.13	227537.43	83108044.57
2022	2.45	1.03	99486.06	243335.21	365.25	88878187.07	75546459.01	0.9070	68522865.32	229812.80	83939125.02
2023	2.52	1.03	100480.92	252895.86	365.25	92370211.04	78514679.39	0.8638	67823932.09	232110.93	84778516.27
2024	2.59	1.03	101485.73	262832.13	365.25	95999436.63	81599521.14	0.8227	67132127.98	234432.04	85626301.43
2025	2.66	1.03	102500.59	273158.81	365.25	99771254.50	84805566.32	0.7835	66447380.28	236776.36	86482564.44
2026	2.74	1.03	103525.59	283891.22	365.25	103691267.09	88137577.02	0.7462	65769617.00	239144.12	87347390.09
2027	2.82	1.03	104560.85	295045.30	365.25	107765296.97	91600502.43	0.7107	65098766.90	241535.56	88220863.99
2028	2.90	1.03	105606.46	306637.63	365.25	111999395.49	95199486.17	0.6768	64434759.48	243950.92	89103072.63
2029	2.99	1.03	106662.52	318685.43	365.25	116399851.74	98939873.98	0.6446	63777524.94	246390.43	89994103.36
2030	3.07	1.03	107729.15	331206.58	365.25	120973201.91	102827221.63	0.6139	63126994.18	248854.33	90894044.39
2031	3.16	1.03	108806.44	344219.68	365.25	125726239.02	106867303.16	0.5847	62483098.84	251342.87	91802984.83
2032	3.26	1.03	109894.50	357744.07	365.25	130666022.95	111066119.51	0.5568	61845771.23	253856.30	92721014.68
2033	3.35	1.03	110993.45	371799.84	365.25	135799890.99	115429907.34	0.5303	61214944.37	256394.87	93648224.83
2034	3.45	1.03	112103.38	386407.85	365.25	141135468.71	119965148.40	0.5051	60590551.93	258958.81	94584707.08
2035	3.55	1.03	113224.42	401589.82	365.25	146680681.27	124678579.08	0.4810	59972528.30	261548.40	95530554.15
2036	3.65	1.03	114356.66	417368.28	365.25	152443765.24	129577200.45	0.4581	59360808.52	264163.89	96485859.69
2037	3.76	1.03	115500.23	433766.68	365.25	158433280.78	134668288.66	0.4363	58755328.27	266805.53	97450718.29
2038	3.86	1.03	116655.23	450809.38	365.25	164658124.38	139959405.72	0.4155	58156023.92	269473.58	98425225.47
2039	3.98	1.03	117821.78	468521.68	365.25	171127542.08	145458410.77	0.3957	57562832.48	272168.32	99409477.72
2040	4.09	1.03	119000.00	486929.89	365.25	177851143.21	151173471.73	0.3769	56975691.58	274890.00	100403572.50
2041	4.21	1.03	120190.00	506061.37	365.25	184838914.63	157113077.43	0.3589	56394539.53	277638.90	101407608.23
2042	4.33	1.03	121391.90	525944.52	365.25	192101235.58	163286050.25	0.3418	55819315.23	280415.29	102421684.31
2043	4.46	1.03	122605.82	546608.88	365.25	199648893.13	169701559.16	0.3256	55249958.21	283219.44	103445901.15
2044	4.59	1.03	123831.88	568085.14	365.25	207493098.14	176369133.42	0.3101	54686408.64	286051.64	104480360.16
2045	4.72	1.03	125070.20	590405.21	365.25	215645501.97	183298676.67	0.2953	54128607.27	288912.15	105525163.76
2046	4.86	1.03	126320.90	613602.23	365.25	224118213.74	190500481.68	0.2812	53576495.48	291801.27	106580415.40
2047	5.00	1.03	127584.11	637710.66	365.25	232923818.36	197985245.60	0.2678	53030015.22	294719.29	107646219.56
2048	5.14	1.03	128859.95	662766.31	365.25	242075395.18	205764085.90	0.2551	52489109.07	297666.48	108722681.75
2049	5.29	1.03	130148.55	688806.40	365.25	251586537.46	213848556.84	0.2429	51953720.15	300643.14	109809908.57
2050	5.45	1.03	131450.03	715869.60	365.25	261471372.52	222250666.64	0.2314	51423792.21	303649.58	110908007.65
2051	5.60	1.03	132764.53	743996.12	365.25	271744582.74	230982895.33	0.2204	50899269.53	306686.07	112017087.73
2052	5.77	1.03	134092.18	773227.73	365.25	282421427.40	240058213.29	0.2099	50380096.98	309752.93	113137258.61
2053	5.93	1.03	135433.10	803607.84	365.25	293517765.28	249490100.49	0.1999	49866219.99	312850.46	114268631.19
2054	6.11	1.03	136787.43	835181.60	365.25	305050078.28	259292566.54	0.1904	49357584.55	315978.97	115411317.51
2055	6.28	1.03	138155.31	867995.88	365.25	317035495.85	269480171.48	0.1813	48854137.18	319138.76	116565430.68
2056	6.46	1.03	139536.86	902099.44	365.25	329491820.49	280068047.41	0.1727	48355824.98	322330.14	117731084.99
2057	6.65	1.03	140932.23	937542.93	365.25	342437554.11	291071921.00	0.1644	47862595.57	325553.45	118908395.84
2058	6.85	1.03	142341.55	974378.99	365.25	355891925.61	302508136.77	0.1566	47374397.09	328808.98	120097479.80
2059	7.04	1.03	143764.97	1012662.34	365.25	369874919.37	314393681.46	0.1491	46891178.24	332097.07	121298454.59
Total						7689542181.42	6536110854.21		2259925049.36	11013346.06	4022624649.52

Table D9: High Desert Corridor

Year	Toll Rate	Infla-tion	Traffic Count	Revenue	Days of Year	Total Gross Revenue	Net Revenue	NPV Factor	NPV Revenue	NPV	Net Gross
2020	16.94	1.03	44243.11	749478.25	365.25	273746932.07	232684892.26	1.00	232684892.26	749478.25	273746932.07
2021	17.43	1.03	44685.54	778925.25	365.25	284502449.03	241827081.67	0.95	230311506.36	756973.04	276484401.39
2022	17.94	1.03	45132.39	809529.23	365.25	295680550.25	251328467.71	0.91	227962328.99	764542.77	279249245.40
2023	18.46	1.03	45583.72	841335.63	365.25	307297839.07	261203163.21	0.86	225637113.24	772188.19	282041737.86
2024	18.99	1.03	46039.56	874391.71	365.25	319371571.17	271465835.49	0.82	223335614.68	779910.08	284862155.23
2025	19.54	1.03	46499.95	908746.56	365.25	331919680.20	282131728.17	0.78	221057591.41	787709.18	287710776.79
2026	20.11	1.03	46964.95	944451.21	365.25	344960804.43	293216683.77	0.75	218802803.98	795586.27	290587884.55
2027	20.69	1.03	47434.60	981558.70	365.25	358514314.44	304737167.27	0.71	216571015.38	803542.13	293493763.40
2028	21.29	1.03	47908.95	1020124.14	365.25	372600341.85	316710290.58	0.68	214361991.02	811577.55	296428701.03
2029	21.91	1.03	48388.04	1060204.82	365.25	387239809.29	329153837.89	0.64	212175498.71	819693.33	299392988.04
2030	22.55	1.03	48871.92	1101860.26	365.25	402454461.39	342086292.18	0.61	210011308.63	827890.26	302386917.93
2031	23.20	1.03	49360.64	1145152.35	365.25	418266897.18	355526862.60	0.58	207869193.28	836169.16	305410787.10
2032	23.87	1.03	49854.24	1190145.39	365.25	434700603.57	369495513.03	0.56	205748927.51	844530.86	308464894.98
2033	24.56	1.03	50352.78	1236906.20	365.25	451779990.28	384012991.74	0.53	203650288.45	852976.16	311549543.93
2034	25.28	1.03	50856.31	1285504.25	365.25	469530426.10	399100862.19	0.51	201573055.50	861505.93	314665039.36
2035	26.01	1.03	51364.88	1336011.71	365.25	487978276.54	414781535.06	0.48	199517010.34	870120.98	317811689.76
2036	26.76	1.03	51878.52	1388503.61	365.25	507150943.03	431078301.58	0.46	197481936.83	878822.19	320989806.66
2037	27.54	1.03	52397.31	1443057.92	365.25	527076903.58	448015368.04	0.44	195467621.08	887610.42	324199704.72
2038	28.34	1.03	52921.28	1499755.66	365.25	547785755.12	465617891.85	0.42	193473851.34	896486.52	327441701.77
2039	29.16	1.03	53450.50	1558681.06	365.25	569308257.44	483912018.83	0.40	191500418.06	905451.39	330716118.79
2040	30.01	1.03	53985.00	1619921.64	365.25	591676378.88	502924922.05	0.38	189547113.79	914505.90	334023279.98
2041	30.88	1.03	54524.85	1683568.36	365.25	614923343.80	522684842.23	0.36	187613733.23	923650.96	337363512.77
2042	31.77	1.03	55070.10	1749715.76	365.25	639083681.98	543221129.68	0.34	185700073.15	932887.47	340737147.90
2043	32.69	1.03	55620.80	1818462.09	365.25	664193279.85	564564287.87	0.33	183805932.41	942216.34	344144519.38
2044	33.64	1.03	56177.01	1889909.47	365.25	690289433.81	586746018.74	0.31	181931111.90	951638.51	347585964.58
2045	34.62	1.03	56738.78	1964164.01	365.25	717410905.67	609799269.82	0.30	180075414.56	961154.89	351061824.22
2046	35.62	1.03	57306.17	2041336.02	365.25	745597980.15	633758283.13	0.28	178238645.33	970766.44	354572442.46
2047	36.65	1.03	57879.23	2121540.11	365.25	774892524.79	658658646.07	0.27	176420611.15	980474.11	358118166.89
2048	37.72	1.03	58458.02	2204895.42	365.25	805338052.09	684537344.28	0.26	174621120.91	990278.85	361699348.56
2049	38.81	1.03	59042.60	2291525.76	365.25	836979784.15	711432816.53	0.24	172839985.48	1000181.63	365316342.04
2050	39.94	1.03	59633.03	2381559.81	365.25	869864719.87	739385011.89	0.23	171077017.63	1010183.45	368969505.46
2051	41.10	1.03	60229.36	2475131.29	365.25	904041704.72	768435449.01	0.22	169332032.05	1020285.29	372659200.52
2052	42.29	1.03	60831.65	2572379.20	365.25	939561503.30	798627277.80	0.21	167604845.32	1030488.14	376385792.52
2053	43.51	1.03	61439.97	2673447.98	365.25	976476874.76	830005343.55	0.20	165895275.90	1040793.02	380149650.45
2054	44.78	1.03	62054.37	2778487.75	365.25	1014842651.17	862616253.49	0.19	164203144.08	1051200.95	383951146.95
2055	46.07	1.03	62674.91	2887654.54	365.25	1054715818.93	896508446.09	0.18	162528272.01	1061712.96	387790658.42
2056	47.41	1.03	63301.66	3001110.48	365.25	1096155603.46	931732262.94	0.17	160870483.64	1072330.09	391668565.01
2057	48.78	1.03	63934.67	3119024.11	365.25	1139223557.12	968340023.55	0.16	159229604.71	1083053.39	395585250.66
2058	50.20	1.03	64574.02	3241570.57	365.25	1183983650.68	1006386103.08	0.16	157605462.74	1093883.92	399541103.16
2059	51.66	1.03	65219.76	3368931.88	365.25	1230502368.32	1045927013.07	0.15	155997887.02	1104822.76	403536514.19
Total						25581620623.54	21744377530.01		7674331734.02	36639273.72	13382494726.88

Table D10: Glendale-Palmdale Expressway

Year	Toll Rate	Infla-tion	Traffic Count	Revenue	Days of Year	Total Gross Revenue	Net Revenue	NPV Factor	NPV Revenue	NPV	Net Gross
2020	21.97	1.03	43548.13	956752.52	365.25	349453856.25	297035777.82	1.00	297035777.82	956752.52	349453856.25
2021	22.61	1.03	43983.62	994343.32	365.25	363183898.27	308706313.53	0.95	294006012.88	966320.04	352948394.82
2022	23.26	1.03	44423.45	1033411.07	365.25	377453393.63	320835384.58	0.91	291007151.55	975983.24	356477878.76
2023	23.94	1.03	44867.69	1074013.79	365.25	392283537.46	333441006.85	0.86	288038878.60	985743.07	360042657.55
2024	24.63	1.03	45316.36	1116211.79	365.25	407696357.65	346541904.00	0.82	285100882.04	995600.50	363643084.13
2025	25.35	1.03	45769.53	1160067.76	365.25	423714747.54	360157535.41	0.78	282192853.05	1005556.51	367279514.97
2026	26.08	1.03	46227.22	1205646.82	365.25	440362499.97	374308124.98	0.75	279314485.95	1015612.07	370952310.12
2027	26.84	1.03	46689.49	1253016.68	365.25	457664342.60	389014691.21	0.71	276465478.19	1025768.19	374661833.22
2028	27.62	1.03	47156.39	1302247.71	365.25	475645974.62	404299078.43	0.68	273645530.31	1036025.88	378408451.55
2029	28.42	1.03	47627.95	1353413.02	365.25	494334104.96	420183989.22	0.64	270854345.90	1046386.14	382192536.07
2030	29.24	1.03	48104.23	1406588.62	365.25	513756491.95	436693018.15	0.61	268091631.57	1056850.00	386014461.43
2031	30.09	1.03	48585.28	1461853.48	365.25	533941984.51	453850686.84	0.58	265357096.93	1067418.50	389874606.04
2032	30.96	1.03	49071.13	1519289.71	365.25	554920565.09	471682480.32	0.56	262650454.54	1078092.68	393773352.10
2033	31.86	1.03	49561.84	1578982.60	365.25	576723394.09	490214884.98	0.53	259971419.91	1088873.61	397711085.62
2034	32.78	1.03	50057.46	1641020.82	365.25	599382856.24	509475427.81	0.51	257319711.42	1099762.34	401688196.48
2035	33.73	1.03	50558.03	1705496.53	365.25	622932608.66	529492717.36	0.48	254695050.37	1110759.97	405705078.45
2036	34.71	1.03	51063.61	1772505.49	365.25	647407630.86	550296486.23	0.46	252097160.85	1121867.57	409762129.23
2037	35.72	1.03	51574.25	1842147.23	365.25	672844276.68	571917635.17	0.44	249525769.81	1133086.24	413859750.52
2038	36.75	1.03	52089.99	1914525.20	365.25	699280328.31	594388279.06	0.42	246980606.96	1144417.11	417998348.03
2039	37.82	1.03	52610.89	1989746.89	365.25	726755052.40	617741794.54	0.40	244461404.77	1155861.28	422178331.51
2040	38.92	1.03	53137.00	2067924.05	365.25	755309258.41	642012869.65	0.38	241967898.44	1167419.89	426400114.82
2041	40.05	1.03	53668.37	2149172.78	365.25	784985359.18	667237555.30	0.36	239499825.88	1179094.09	430664115.97
2042	41.21	1.03	54205.05	2233613.78	365.25	815827433.94	693453318.85	0.34	237056927.65	1190885.03	434970757.13
2043	42.40	1.03	54747.10	2321372.47	365.25	847881293.82	720699099.75	0.33	234638946.99	1202793.88	439320464.70
2044	43.63	1.03	55294.58	2412579.19	365.25	881194549.85	749015367.37	0.31	232245629.73	1214821.82	443713669.35
2045	44.90	1.03	55847.52	2507369.43	365.25	915816683.72	778444181.16	0.30	229876724.31	1226970.04	448150806.04
2046	46.20	1.03	56406.00	2605883.97	365.25	951799121.22	809029253.04	0.28	227531981.72	1239239.74	452632314.10
2047	47.54	1.03	56970.06	2708269.15	365.25	989195308.69	840816012.39	0.27	225211155.51	1251632.13	457158637.24
2048	48.92	1.03	57539.76	2814677.05	365.25	1028060792.37	873851673.52	0.26	222914001.72	1264148.46	461730223.62
2049	50.34	1.03	58115.15	2925265.71	365.25	1068453300.90	908185305.77	0.24	220640278.90	1276789.94	466347525.85
2050	51.80	1.03	58696.31	3040199.40	365.25	1110432831.10	943867906.43	0.23	218389748.06	1289557.84	471011001.11
2051	53.30	1.03	59283.27	3159648.84	365.25	1154061737.03	980952476.47	0.22	216162172.63	1302453.42	475721111.12
2052	54.84	1.03	59876.10	3283791.44	365.25	1199404822.68	1019494099.28	0.21	213957318.47	1315477.95	480478322.23
2053	56.43	1.03	60474.86	3412811.60	365.25	1246529438.16	1059550022.44	0.20	211774953.82	1328632.73	485283105.46
2054	58.07	1.03	61079.61	3546900.97	365.25	1295505579.79	1101179742.82	0.19	209614849.29	1341919.06	490135936.51
2055	59.75	1.03	61690.41	3686258.71	365.25	1346405994.02	1144445094.91	0.18	207476777.83	1355338.25	495037295.88
2056	61.49	1.03	62307.31	3831091.82	365.25	1399306285.52	1189410342.69	0.17	205360514.69	1368891.63	499987668.83
2057	63.27	1.03	62930.38	3981615.41	365.25	1454285029.48	1236142275.06	0.16	203265837.44	1382580.55	504987545.52
2058	65.10	1.03	63559.69	4138053.08	365.25	1511423888.29	1284710305.04	0.16	201192525.90	1396406.35	510037420.98
2059	66.99	1.03	64195.29	4300637.19	365.25	1570807732.86	1335186572.93	0.15	199140362.14	1410370.42	515137795.19
Total						32656424342.76	27757960691.35		9796730134.55	46772160.68	17083531688.51

Table D11: Irvine-Corona Expressway

Year	Toll Rate	Infla-tion	Traffic Count	Revenue	Days of Year	Total Gross Revenue	Net Revenue	NPV Factor	NPV Revenue	NPV	Net Gross
2020	8.67	1.03	39502.04	342482.72	365.25	125091812.34	106328040.49	1.00	106328040.49	342482.7169	125091812.3
2021	10.00	1.03	39897.06	398970.64	365.25	145724025.91	123865422.03	0.95	117967068.60	345907.5441	126342730.5
2022	10.29	1.03	40296.03	414646.20	365.25	151449522.89	128732094.46	0.91	116763804.50	349366.6195	127606157.8
2023	10.59	1.03	40698.99	430937.64	365.25	157399974.65	133789978.45	0.86	115572813.69	352860.2857	128882219.3
2024	10.90	1.03	41105.98	447869.18	365.25	163584219.65	139046586.70	0.82	114393970.99	356388.8885	130171041.5
2025	11.21	1.03	41517.04	465465.96	365.25	170011443.64	144509727.09	0.78	113227152.49	359952.7774	131472752
2026	11.54	1.03	41932.22	483754.12	365.25	176691193.26	150187514.27	0.75	112072235.53	363552.3052	132787479.5
2027	11.87	1.03	42351.54	502760.82	365.25	183633390.24	156088381.71	0.71	110929098.73	367187.8283	134115354.3
2028	12.22	1.03	42775.05	522514.29	365.25	190848346.15	162221094.22	0.68	109797621.92	370859.7065	135456507.8
2029	12.57	1.03	43202.80	543043.88	365.25	198346777.67	168594761.02	0.64	108677686.18	374568.3036	136811072.9
2030	12.93	1.03	43634.83	564380.08	365.25	206139822.56	175218849.18	0.61	107569173.78	378313.9866	138179183.6
2031	13.31	1.03	44071.18	586554.57	365.25	214239056.19	182103197.76	0.58	106471968.21	382097.1265	139560975.5
2032	13.70	1.03	44511.89	609600.30	365.25	222656508.71	189258032.40	0.56	105385954.13	385918.0978	140956585.2
2033	14.09	1.03	44957.01	633551.49	365.25	231404682.93	196693980.49	0.53	104311017.40	389777.2788	142366151.1
2034	14.50	1.03	45406.58	658443.73	365.25	240496572.93	204422086.99	0.51	103247045.02	393675.0515	143789812.6
2035	14.92	1.03	45860.65	684313.99	365.25	249945683.28	212453830.78	0.48	102193925.16	397611.8021	145227710.7
2036	15.35	1.03	46319.25	711200.68	365.25	259766049.17	220801141.80	0.46	101151547.13	401587.9201	146679987.8
2037	15.80	1.03	46782.45	739143.76	365.25	269972257.24	229476418.66	0.44	100119801.34	405603.7993	148146787.7
2038	16.26	1.03	47250.27	768184.72	365.25	280579467.23	238492547.15	0.42	99098579.37	409659.8373	149628255.6
2039	16.73	1.03	47722.77	798366.69	365.25	291603434.50	247862919.32	0.40	98087773.86	413756.4356	151124538.1
2040	17.21	1.03	48200.00	829734.52	365.25	303060533.44	257601453.42	0.38	97087278.57	417894	152635783.5
2041	17.71	1.03	48682.00	862334.79	365.25	314967781.80	267722614.53	0.36	96096988.33	422072.94	154162141.3
2042	18.23	1.03	49168.82	896215.92	365.25	327342865.95	278241436.05	0.34	95116799.05	426293.6694	155703762.7
2043	18.76	1.03	49660.51	931428.25	365.25	340204167.15	289173542.08	0.33	94146607.70	430556.6061	157260800.4
2044	19.30	1.03	50157.11	968024.06	365.25	353570788.88	300535170.54	0.31	93186312.30	434862.1722	158833408.4
2045	19.86	1.03	50658.68	1006057.73	365.25	367462585.17	312343197.40	0.30	92235811.91	439210.7939	160421742.5
2046	20.44	1.03	51165.27	1045585.74	365.25	381900190.14	324615161.62	0.28	91295006.63	443602.9018	162025959.9
2047	21.03	1.03	51676.92	1086666.80	365.25	396905048.61	337369291.32	0.27	90363797.56	448038.9308	163646219.5
2048	21.64	1.03	52193.69	1129361.94	365.25	412499447.97	350624530.78	0.26	89442086.83	452519.3201	165282681.7
2049	22.27	1.03	52715.63	1173734.57	365.25	428706551.28	364400568.59	0.24	88529777.54	457044.5133	166935508.5
2050	22.91	1.03	53242.79	1219850.60	365.25	445550431.68	378717866.93	0.23	87626773.81	461614.9585	168604863.6
2051	23.58	1.03	53775.21	1267778.53	365.25	463056108.14	393597691.92	0.22	86732980.72	466231.1081	170290912.2
2052	24.26	1.03	54312.97	1317589.55	365.25	481249582.63	409062145.24	0.21	85848304.31	470893.4191	171993821.3
2053	24.96	1.03	54856.10	1369357.64	365.25	500157878.74	425134196.92	0.20	84972651.61	475602.3533	173713759.6
2054	25.69	1.03	55404.66	1423159.70	365.25	519809081.79	441837719.52	0.19	84105930.56	480358.3769	175450897.2
2055	26.43	1.03	55958.70	1479075.65	365.25	540232380.61	459197523.52	0.18	83248050.07	485161.9606	177205406.1
2056	27.20	1.03	56518.29	1537188.53	365.25	561458110.85	477239394.22	0.17	82398919.96	490013.5802	178977460.2
2057	27.99	1.03	57083.47	1597584.67	365.25	583517800.02	495990130.02	0.16	81558450.98	494913.716	180767234.8
2058	28.80	1.03	57654.31	1660353.77	365.25	606444214.39	515477582.23	0.16	80726554.78	499862.8532	182574907.1
2059	29.63	1.03	58230.85	1725589.07	365.25	630271407.57	535730696.43	0.15	79903143.92	504861.4817	184400656.2
Total						13087951197.95	11124758518.26		3917988505.65	16742737.97	6115285042.33

Table D12: Cross Mountain Tunnel

Year	Toll Rate	Inflation	Traffic Count	Revenue	Days of Year	Total Gross Revenue	Net Revenue	NPV Factor	NPV Revenue
2020	7.83	1.03	42011.49	328949.96	365.25	120148971.44	102126625.73	1.00	102126625.73
2021	8.06	1.03	42431.60	341874.40	365.25	124869624.53	106139180.85	0.95	101084934.14
2022	8.29	1.03	42855.92	355306.64	365.25	129775752.08	110309389.27	0.91	100053867.82
2023	8.53	1.03	43284.48	369266.64	365.25	134874641.38	114643445.17	0.86	99033318.36
2024	8.78	1.03	43717.32	383775.13	365.25	140173866.04	119147786.13	0.82	98023178.52
2025	9.03	1.03	44154.50	398853.65	365.25	145681297.23	123829102.65	0.78	97023342.10
2026	9.30	1.03	44596.04	414524.61	365.25	151405115.40	128694348.09	0.75	96033704.01
2027	9.56	1.03	45042.00	430811.29	365.25	157353822.39	133750749.03	0.71	95054160.23
2028	9.84	1.03	45492.42	447737.86	365.25	163536254.07	139005815.96	0.68	94084607.79
2029	10.13	1.03	45947.35	465329.48	365.25	169961593.49	144467354.47	0.64	93124944.79
2030	10.42	1.03	46406.82	483612.28	365.25	176639384.50	150143476.82	0.61	92175070.36
2031	10.72	1.03	46870.89	502613.40	365.25	183579545.92	156042614.03	0.58	91234884.64
2032	11.03	1.03	47339.60	522361.08	365.25	190792386.28	162173528.33	0.56	90304288.81
2033	11.35	1.03	47812.99	542884.65	365.25	198288619.13	168545326.26	0.53	89383185.07
2034	11.68	1.03	48291.12	564214.59	365.25	206079378.98	175167472.13	0.51	88471476.58
2035	12.02	1.03	48774.03	586382.58	365.25	214176237.78	182049802.11	0.48	87569067.52
2036	12.37	1.03	49261.77	609421.55	365.25	222591222.16	189202538.84	0.46	86675863.03
2037	12.73	1.03	49754.39	633365.73	365.25	231336831.28	196636306.59	0.44	85791769.23
2038	13.10	1.03	50251.94	658250.66	365.25	240426055.38	204362147.07	0.42	84916693.18
2039	13.48	1.03	50754.46	684113.33	365.25	249872395.10	212391535.83	0.40	84050542.91
2040	13.87	1.03	51262.00	710992.15	365.25	259689881.50	220736399.27	0.38	83193227.37
2041	14.27	1.03	51774.62	738927.03	365.25	269893096.94	229409132.40	0.36	82344656.45
2042	14.69	1.03	52292.37	767959.47	365.25	280497196.72	238422617.21	0.34	81504740.96
2043	15.11	1.03	52815.29	798132.60	365.25	291517931.58	247790241.84	0.33	80673392.60
2044	15.55	1.03	53343.44	829491.23	365.25	302971671.11	257525920.45	0.31	79850524.00
2045	16.00	1.03	53876.88	862081.94	365.25	314875428.07	267644113.86	0.30	79036048.65
2046	16.46	1.03	54415.65	895953.14	365.25	327246883.64	278159851.09	0.28	78229880.96
2047	16.94	1.03	54959.80	931155.14	365.25	340104413.70	289088751.64	0.27	77431936.17
2048	17.43	1.03	55509.40	967740.22	365.25	353467116.11	300447048.70	0.26	76642130.42
2049	17.94	1.03	56064.49	1005762.74	365.25	367354839.10	312251613.24	0.24	75860380.69
2050	18.46	1.03	56625.14	1045279.15	365.25	381788210.73	324519979.12	0.23	75086604.81
2051	18.99	1.03	57191.39	1086348.17	365.25	396788669.53	337270369.10	0.22	74320721.44
2052	19.55	1.03	57763.30	1129030.79	365.25	412378496.36	350521721.90	0.21	73562650.08
2053	20.11	1.03	58340.94	1173390.41	365.25	428580847.48	364293720.36	0.20	72812311.05
2054	20.70	1.03	58924.35	1219492.92	365.25	445419788.98	378606820.63	0.19	72069625.48
2055	21.30	1.03	59513.59	1267406.80	365.25	462920332.49	393482282.61	0.18	71334515.30
2056	21.91	1.03	60108.73	1317203.21	365.25	481108472.35	408942201.50	0.17	70606903.24
2057	22.55	1.03	60709.81	1368956.12	365.25	500011224.23	425009540.59	0.16	69886712.83
2058	23.20	1.03	61316.91	1422742.41	365.25	519656665.23	441708165.44	0.16	69173868.36
2059	23.88	1.03	61930.08	1478641.96	365.25	540073975.61	459062879.26	0.15	68468294.90
Total						11227908136.01	9543721915.61		3368304650.55

Table D13: Downtown Bypass Tunnel

Year	Toll Rate	Inflation	Traffic Count	Revenue	Days of Year	Total Gross Revenue	Net Revenue	NPV Factor	NPV Revenue
2020	6.01	1.03	76439.73	459402.79	365.25	167796869.44	142627339.03	1.00	142627339.03
2021	6.18	1.03	77204.13	477452.73	365.25	174389608.44	148231167.18	0.95	141172540.17
2022	6.36	1.03	77976.17	496211.84	365.25	181241376.16	154055169.73	0.91	139732580.26
2023	6.55	1.03	78755.93	515708.01	365.25	188362349.83	160107997.35	0.86	138307307.94
2024	6.74	1.03	79543.49	535970.18	365.25	195763106.55	166398640.57	0.82	136896573.40
2025	6.93	1.03	80338.93	557028.44	365.25	203454639.01	172936443.16	0.78	135500228.35
2026	7.13	1.03	81142.32	578914.09	365.25	211448371.78	179731116.01	0.75	134118126.02
2027	7.34	1.03	81953.74	601659.63	365.25	219756178.30	186792751.56	0.71	132750121.14
2028	7.55	1.03	82773.28	625298.83	365.25	228390398.55	194131838.77	0.68	131396069.90
2029	7.77	1.03	83601.01	649866.82	365.25	237363857.31	201759278.71	0.64	130055829.99
2030	8.00	1.03	84437.02	675400.09	365.25	246689883.26	209686400.77	0.61	128729260.52
2031	8.23	1.03	85281.39	701936.56	365.25	256382328.77	217924979.46	0.58	127416222.06
2032	8.47	1.03	86134.20	729515.65	365.25	266455590.47	226487251.90	0.56	126116576.60
2033	8.72	1.03	86995.55	758178.32	365.25	276924630.62	235385936.03	0.53	124830187.52
2034	8.97	1.03	87865.50	787967.14	365.25	287804999.36	244634249.45	0.51	123556919.60
2035	9.23	1.03	88744.16	818926.37	365.25	299112857.78	254245929.11	0.48	122296639.02
2036	9.50	1.03	89631.60	851101.99	365.25	310865001.96	264235251.67	0.46	121049213.31
2037	9.77	1.03	90527.91	884541.79	365.25	323078887.89	274617054.71	0.44	119814511.33
2038	10.05	1.03	91433.19	919295.43	365.25	335772657.40	285406758.79	0.42	118592403.31
2039	10.35	1.03	92347.52	955414.55	365.25	348965165.11	296620390.34	0.40	117382760.80
2040	10.65	1.03	93271.00	992952.79	365.25	362676006.44	308274605.48	0.38	116185456.64
2041	10.95	1.03	94203.71	1031965.90	365.25	376925546.74	320386714.73	0.36	115000364.98
2042	11.27	1.03	95145.75	1072511.85	365.25	391734951.47	332974708.75	0.34	113827361.26
2043	11.60	1.03	96097.20	1114650.84	365.25	407126217.71	346057285.05	0.33	112666322.18
2044	11.94	1.03	97058.18	1158445.47	365.25	423122206.80	359653875.78	0.31	111517125.69
2045	12.28	1.03	98028.76	1203960.79	365.25	439746678.31	373784676.56	0.30	110379651.01
2046	12.64	1.03	99009.05	1251264.41	365.25	457024325.30	388470676.51	0.28	109253778.57
2047	13.00	1.03	99999.14	1300426.59	365.25	474980811.04	403733689.39	0.27	108139390.03
2048	13.38	1.03	100999.13	1351520.35	365.25	493642807.11	419596386.04	0.26	107036368.25
2049	13.77	1.03	102009.12	1404621.58	365.25	513038033.00	436082328.05	0.24	105944597.29
2050	14.17	1.03	103029.21	1459809.16	365.25	533195297.32	453216002.72	0.23	104863962.40
2051	14.58	1.03	104059.50	1517165.07	365.25	554144540.55	471022859.46	0.22	103794349.98
2052	15.00	1.03	105100.10	1576774.48	365.25	575916879.55	489529347.61	0.21	102735647.61
2053	15.44	1.03	106151.10	1638725.95	365.25	598544653.74	508762955.68	0.20	101687744.01
2054	15.89	1.03	107212.61	1703111.49	365.25	622061473.19	528752252.21	0.19	100650529.02
2055	16.35	1.03	108284.74	1770026.74	365.25	646502268.47	549526928.20	0.18	99623893.62
2056	16.82	1.03	109367.58	1839571.10	365.25	671903342.60	571117841.21	0.17	98607729.91
2057	17.31	1.03	110461.26	1911847.84	365.25	698302424.93	593557061.19	0.16	97601931.06
2058	17.81	1.03	111565.87	1986964.35	365.25	725738727.20	616877918.12	0.16	96606391.37
2059	18.33	1.03	112681.53	2065032.17	365.25	754253001.80	641115051.53	0.15	95621006.17
Total						15680598951.24	13328509108.55		4704085011.30

Table D14: All Expressway Extension/Tunnel Projects Costs

Inflation Rate	Year	IH-710T	HDC	GPT	ICE	XMT	DBT	Total
	2009	6.3	9.8	19	7.4	10.2	4.7	57.4
1.029	2010	6.426	9.996	19.38	7.548	10.404	4.794	
1.029	2011	6.612354	10.285884	19.94202	7.766892	10.705716	4.933026	
	2012	6.804112266	10.58417464	20.52033858	7.992131868	11.01618176	5.076083754	
	2013	7.001431522	10.8911157	21.1154284	8.223903692	11.33565104	5.223290183	
	2014	7.204473036	11.20695806	21.72777582	8.462396899	11.66438492	5.374765598	
	2015	7.413402754	11.53195984	22.35788132	8.707806409	12.00265208	5.530633801	67.5443362
		67.5443362						
		Toll	Toll	Toll	Toll	Toll		
		2.00	14.68	8.67	19.04	6.79	5.21	
	2016	2.06	15.11	8.92	19.59	6.99	5.36	
	2017	2.12	15.54	9.18	20.16	7.19	5.52	
	2018	2.18	15.99	9.45	20.74	7.40	5.68	
	2019	2.24	16.46	9.72	21.35	7.61	5.84	
	2020	2.31	16.94	10.00	21.97	7.83	6.01	
	Revenue	Revenue	Revenue	Revenue	Revenue	Revenue		
	296536110.00	461278392.00	894315252.00	348312256.40	480106084.00	221225352.00	2701773446.40	
	305135657.19	474655465.37	920250394.31	358413311.84	494029160.44	227640887.21		
	313984591.25	488420473.86	946937655.74	368807297.88	508356006.09	234242472.94		
	323090144.39	502584667.61	974398847.76	379502709.52	523098330.27	241035504.65		
	332459758.58	517159622.97	1002656414.34	390508288.09	538268181.84	248025534.29		
	342101091.58	532157252.03	1031733450.36	401833028.45	553877959.12	255218274.78		
	352022023.24	547589812.34	1061653720.42	413486186.27	569940419.93	262619604.75		
	362230661.91	563469916.90	1092441678.31	425477285.67	586468692.11	270235573.29		
	372735351.11	579810544.49	1124122486.98	437816126.96	603476284.18	278072404.91		
	383544676.29	596625050.28	1156722039.11	450512794.64	620977096.42	286136504.66		
	394667471.90	613927176.74	1190266978.24	463577665.69	638985432.22	294434463.29		
	406112828.59	631731064.86	1224784720.61	477021417.99	657516009.75	302973062.73		
	417890100.61	650051265.74	1260303477.51	490855039.11	676583974.03	311759281.55		
	430008913.53	668902752.45	1296852278.36	505089835.25	696204909.28	320800300.71		
	442479172.02	688300932.27	1334460994.43	519737440.47	716394851.65	330103509.43		
	455311068.01	708261659.31	1373160363.27	534809826.24	737170302.35	339676511.20		
	468515088.99	728801247.43	1412982013.80	550319311.20	758548241.12	349527130.03		
	482102026.57	749936483.60	1453958492.20	566278571.23	780546140.11	359663416.80		
	496082985.34	771684641.63	1496123288.47	582700649.79	803181978.17	370093655.89		
	510469391.91	794063496.23	1539510863.84	599598968.64	826474255.54	380826371.91		
	525273004.28	817091337.63	1584156678.89	616987338.73	850442008.95	391870336.69		
	540505921.40	840786986.42	1630097222.58	634879971.55	875104827.21	403234576.46		
	556180593.12	865169809.02	1677370042.03	653291490.73	900482867.20	414928379.17		
	572309830.32	890259733.48	1726013773.25	672236943.96	926596870.35	426961302.17		
	588906815.40	916077265.76	1776068172.68	691731815.33	953468179.59	439343179.93	Total	
	10670655277.54	16598797050.41	32181341299.50	12533785571.63	17276299061.90	7960647591.43	97221525852.42	

Appendix E: Transit System Details

Appendix E provides details on specific transit components beyond what is included in the body of the report. It is intended to provide more details on specific aspects of transit service.

A. Existing Transit Service Guide

The following table provides detail on current heavy rail, light rail, commuter rail, express bus, and bus rapid transit services operating in Southern California.

Table E1: Primary Rail and Bus Service Guide

Line	Mode	Origin	Destination	Rush Headway	Midday Headway	Evening Headway	Weekend	Weekend Night
Red	HRT	Union Station	North Hollywood	10	12	20	12-15	10 Sat 20 Sun
Purple	HRT	Union Station	Wilshire/ Western	10	12	20	12-15	10 Sat 20 Sun
Green	LRT	Redondo Beach	Norwalk	6	15	20	15	20
Blue	LRT	Metro Center	Long Beach	6	12	10	12-15	10
Expo	LRT	Metro Center	Culver City	12	12	10	12-15	10
Gold	LRT	East Los Angeles	Pasadena	6	12	10	8-15	10
Orange	BRT	North Hollywood	Chatsworth	5	8	15-30	10	15-30
Silver	BRT	Harbor Gateway	El Monte	5	15	15-20	20	40
Antelope Valley	CRT	Union 15Station	Lancaster	30 peak 60 rev	60	N/A	90-120	N/A
Inland Empire Orange County	CRT	Oceanside	San Bernardino	30 peak 45 rev	150	N/A	120*	N/A
Orange County	CRT	Oceanside	Union Station	30 peak 90 rev	180	N/A	180	N/A
Riverside	CRT	Riverside	Union Station	40 peak 1 train rev	N/A	N/A	N/A	N/A
San Bernardino	CRT	Riverside	Union Station	30 peak 120 rev	60	90	120	120 Sat. only
Ventura	CRT	East Ventura	Union Station	30 peak 30 rev	180	N/A	N/A	N/A
91	CRT	Riverside	Union Station	40 peak 45 rev	240	N/A	120	N/A
704	BRT	Downtown L.A.	Santa Monica	15 morn 10 aftn	20	N/A	20	N/A
705	BRT	Vernon	West Hollywood	10 morn 15 aftn	30	N/A	N/A	N/A
710	BRT	Wilshire Center	South Bay Galleria	10 morn 15 aftn	18	30	20	20
720	BRT	Santa Monica	Commerce	10 morn 5 aftn	8	10	15	10
728	BRT	Downtown Los Angeles	Century City	12	30	30	N/A	N/A
733	BRT	Downtown Los Angeles	Santa Monica	7 morn 12 aftn	15	30	15-20	30
734	BRT	Sherman Oaks	Sylmar Station	12 morn 18 aftn	35	30	N/A	N/A

Table E1: Primary Rail and Bus Service Guide

Line	Mode	Origin	Destination	Rush Headway	Midday Headway	Evening Headway	Weekend	Weekend Night
740	BRT	Jefferson Park	South Bay Galleria	15	30	25	20 Sat. Only	20 Sat. Only
741	BRT	Northridge	Tarzana	16	30	30-60	N/A	N/A
745	BRT	Downtown Los Angeles	Harbor Freeway Station	5 morn 10 aftn	22	30	12-20	30
750	BRT	Warner Center Transit Hub	Universal City Station	10	30	24	N/A	N/A
751	BRT	Cypress Park	Huntington Park	15	20	30	N/A	N/A
754	BRT	Hollywood	Athens	6	15	20	15-20	20-25
757	BRT	Hawthorne	Hollywood	8	15	20	N/A	N/A
760	BRT	Downtown Los Angeles	Artesia Station	10 morn 15 aftn	25	30	24 Sat. Only	30 Sat. Only
761	BRT	Pacoima	Westwood	10 morn 15 aftn	20	30	30	30
762	BRT	Pasadena	Artesia Blue Line Station	18 morn 25 aftn	30	45-60	N/A	N/A
770	BRT	Downtown Los Angeles	El Monte Station	12	15	30	20 Sat. Only	20 Sat. Only
780	BRT	Washington/Fairfax	Pasadena	10-12	25	25	N/A	N/A
794	BRT	Downtown Los Angeles	Sylmar Station	20	30	50	N/A	N/A
442	Express	Downtown Los Angeles	Hawthorne/ Lennox Station	30-40	N/A	N/A	N/A	N/A
450	Express	Artesia Transit Center	Downtown Los Angeles	16	60	60	40 Sat 60 Sun	40 Sat 60 Sun
460	Express	Downtown Los Angeles	Disneyland	18	27	40	25-30	25-30
485	Express	Downtown Los Angeles	Altadena	35	50	60	N/A	N/A
487	Express	Downtown Los Angeles	El Monte Station	25	40	60	55	55
489	Express	Downtown Los Angeles	Rosemead & Huntington	20	N/A	N/A	N/A	N/A
534	Express	Malibu	Washington/ Fairfax Transit Hub	12	30	50	30-50	55
550	Express	Exposition Park	San Pedro	30	60	60	60	60
577X	Express	El Monte Station	Long Beach VA Medical Center	35	45	55	N/A	N/A
OCTA 206	Express	Santa Ana	Lake Forest	30	N/A	N/A	N/A	N/A
OCTA 211	Express	Seal Beach	Irvine	25-30	N/A	N/A	N/A	N/A
OCTA 212	Express	Irvine	San Juan Capistrano	30 morn 75 aftn	N/A	N/A	N/A	N/A
OCTA 213	Express	Brea	Irvine	20-25	N/A	N/A	N/A	N/A
OCTA 216	Express	San Juan Capistrano	Costa Mesa	N/A	N/A	N/A	N/A	N/A
OCTA 701	Express	Huntington Beach	Los Angeles	25	N/A	N/A	N/A	N/A
OCTA 721	Express	Fullerton	Los Angeles	45	N/A	N/A	N/A	N/A
OCTA 757	Express	Pomona	Santa Ana	23 morn 40 aftn	N/A	N/A	N/A	N/A
OCTA 758	Express	Chino	Irvine	20 morn 30 aftn	N/A	N/A	N/A	N/A
OCTA 794	Express	LA Sierra Metrolink	South Coast Plaza	25 morn 40 aftn	N/A	N/A	N/A	N/A
sbX Green Line	BRT	Palm	VA Hospital	10	15	N/A	N/A	N/A
Omnitran Express	Express	Riverside Transcenter	4th Street Transfer Center	20	30	30	N/A	N/A
VV 15	Express Bus	Barstow Hospital	Fontana Metrolink	120	120	N/A	N/A	N/A
NTC Commuter	Express Bus	Hesperia Park and Ride	Fort Irwin	30	N/A	N/A	N/A	N/A
Foothill Silver Streak	BRT	Montclair	Downtown Los Angeles	8	20	30	30	30
Foothill 481	Express	El Monte	Downtown Los Angeles	10-20	N/A	N/A	N/A	N/A
Foothill 493	Express	Diamond Bar	Rowland Heights	10	N/A	N/A	N/A	N/A
Foothill 495	Express	Industry	Downtown Los Angeles	30	N/A	N/A	N/A	N/A
Foothill 497	Express	Chino	Downtown Los Angeles	15-30	N/A	N/A	N/A	N/A
Foothill 498	Express	Azusa	West Covina	5-10	N/A	N/A	N/A	N/A
Foothill 499	Express	San Dimas	Downtown Los Angeles	10	N/A	N/A	N/A	N/A
Foothill 690	Express	Montclair	Lake Metro Station	20-30	N/A	N/A	N/A	N/A
Foothill 699	Express	Montclair	Downtown Los Angeles	7	N/A	N/A	N/A	N/A
RTA 202	Express	Oceanside	Murrieta	40-60	N/A	N/A	N/A	N/A
RTA 204	Express	Riverside	Montclair	45-50	N/A	N/A	N/A	N/A
RTA 206	Express	Temecula	Corona	20-100	N/A	N/A	N/A	N/A
RTA 208	Express	Temecula	Riverside	30-50	N/A	N/A	N/A	N/A

Table E1: Primary Rail and Bus Service Guide

Line	Mode	Origin	Destination	Rush Headway	Midday Headway	Evening Headway	Weekend	Weekend Night
RTA 210/220	Express	Riverside	Palm Desert	40-50	N/A	N/A	N/A	N/A
RTA 212	Express	Hemet	Riverside	30-45	N/A	N/A	N/A	N/A
RTA 216	Express	Riverside	Village at Orange	60-90	55	N/A	180	N/A
RTA 217	Express	San Jacinto	Escondido	30	N/A	N/A	N/A	N/A
Vista Coastal Express	Express	Ventura	Goleta	10-20	50	60	90	N/A
Vista Highway 101 & Conejo Connection	Express	Woodland Hills	Ventura	30-110	60-120	90	70-120 Sat. Only	N/A
Vista Highway 126	Express	Piru	Ventura	20-40	60	N/A	60	N/A
Vista East County	Express	Thousand Oaks	Simi Valley	60-75	60	N/A	90-110 Sat. Only	N/A
Vista CSUCI-Oxnard	Express	Centerpoint Mall	California State University, Channel Islands	60	60	60	60 Sat. Only	N/A
Vista CSUCI-Camarillo	Express	California State University, Channel Islands	Camarillo Metrolink Station	30	30	30	30 Sat. Only	N/A

*rev stands for reverse direction

Appendix F: Mileage-Based User Fees

Mileage-based user fees (MBUFs) are a new method of funding transportation by charging drivers by the distance they travel, not the fuel efficiency of their vehicles. While the gas tax has been the primary funding method over the past 50 years, increasing fuel efficiency standards and the development of hybrid and electric vehicles have reduced gas tax revenue per mile driven. In 10 years the gas tax will no longer be a reliable revenue source for building and maintaining U.S. roadways.

Two national blue-ribbon commissions were tasked with examining solutions to the gas tax. The panels studied a range of options including general revenue funds, sales taxes, special use taxes and other options. Both panels came to the unanimous conclusion that mileage-based user fees were the best solution.

The rest of this appendix has more details on MBUFs, with a focus on Southern California.

A. Mileage-Based User Fees

As part of its long-term plan, SCAG recommends California transition from per-gallon fuel taxes to mileage-based user fees. The agency is ahead of the curve in this regard. Currently, Oregon has a permanent MBUF program while several other states including California are engaged in pilot programs and trials.

There are several reasons to switch to mileage-based user fees. California leads the country in the number of alternative fuel vehicles that pay little or no gas tax. Further, conventional vehicles are increasingly becoming more fuel-efficient. The gasoline-electric hybrid Prius averages 46 miles per gallon, twice the 2014 new vehicle average of 23.[190] As a result, the Prius pays half of the gasoline tax of an average new vehicle. The electric Nissan Leaf does not use gasoline so the Leaf pays no fuel tax at all, yet still wears out roadway pavement like any other vehicle. Over the last 20 years, vehicle fleet fuel efficiency has increased by 25%, resulting in less gas purchased and thereby less gasoline tax incurred.[191] In this way, fuel efficiency improvements have eroded the purchasing power of the gasoline tax. By 2025, average corporate fuel economy must meet a 54.5 miles per gallon standard, significantly worsening the problem.

Inflation has also reduced the purchasing power of the gas tax. California's gasoline tax is not indexed to inflation, necessitating continual fuel tax adjustments. Further, so much of California's gas tax supports non-highway infrastructure, road users justifiably complain that the gasoline tax is no longer a user fee.

As a result, increasing the gas tax is not the best solution. Owners of hybrids and electric vehicles, who tend to be wealthier than the average vehicle owner, will continue to pay less than owners of traditional vehicles, introducing both economic and equity issues. As well, politicians will be tempted to use gas taxes for non-roadway expenses. Further, gas taxes are not the best proxy for roadway usage. Tractor-trailers and other heavy vehicles wear out the road 10 times faster than cars, yet they do not pay 10 times the diesel taxes. Finally, even if gas taxes were increased, they would have to be increased every 10 to 15 years, a political impossibility at the federal level.

With mileage-based user fees (MBUF), drivers pay a per-mile fee to use a certain section of road. The fee could vary based on the type of road; Interstates and expressways would have the highest rate per mile followed by arterials, and then local streets. The fee could vary by time of day. Driving during the height of rush hour would be the most expensive, followed by driving during shoulder periods, and then off-peak hours. The fee varies by type of vehicle. For example, passenger vehicles would pay far less than tractor-trailers.

MBUFs are not intended to be an additional tax. Most states are planning to replace fuel taxes with MBUFs, although the two may co-exist during a transition period. MBUFs are a replacement of the existing revenue source, not an additional revenue source. Some have questioned whether MBUFs will increase the burden on the poor and elderly residents. Studies have found MBUFs are actually more equitable than gas taxes.[192]

There are several types of MBUFs being tested and in operation.[193] They typically fall into one of four categories. The first is a plan that provides unlimited mileage for an annual fee. This option does not require an annual inspection or odometer reading. Vehicle owners pay a flat fee with their vehicle registration. The second is based on a required annual odometer reading. A third, more advanced system would use wireless reporting to monitor miles driven on state roads. This system tracks mileage and uses variable pricing, which charges drivers a higher price during peak hours and a lower price during non-peak hours, but it does not track location. The fourth and most advanced system would use mileage data and vehicle location data. Since these plans have location data, they do not charge for out-of-state or off-road usage. These systems also enable safety warnings and road conditions to be communicated to drivers.

In Oregon, where an extensive pilot program was tested and a permanent MBUF program is being implemented, users are allowed to opt-in to the program.[194] This opt-in process

has increased public acceptance, as the current MBUF option allows drivers to save by driving less and no participant pays more than currently paid in fuel taxes.

As part of the Western Road Usage Charge Consortium, California has been studying mileage-based user fees for the past six years. In October 2014, CalTrans and SCAG held a MBUF conference in Glendale.[195] SCAG continues to support MBUF study, development and demonstration of technology related to the Southern California region.[196] As mentioned earlier, SCAG's plan calls for supplementing its transportation funding with revenue from mileage-based user fees, which is contrary to nearly all pilot programs and implementation proposals nationwide. Instead, SCAG should dedicate all revenue from its MBUFs to roadways. As such, MBUFs would be a modern replacement for the gas tax. Funding for transit and active transportation should come from the general fund supplemented with sales tax revenue only where needed.

Endnotes

[1] Texas A&M Transportation Institute, *2012 Urban Mobility Report,* (College Station, TX, 2013), p. 18.

[2] Carolyn Nguyen, "Los Angeles Tops List of Cities with Worst Traffic Report Says," *ABC 7 Los Angeles*, March 5, 2014, http://abclocal.go.com/kabc/story?id=9455311

[3] Andrew Soergel, "Bad Commute? Blame the Job Market," *U.S. News and World Report*, April 17, 2015, http://www.usnews.com/news/articles/2015/04/17/major-metros-set-job-growth-pace-post-recession

[4] David Hartgen, M Gregory Fields, Anthony Layzell, Elizabeth San Jose and Baruch Feigenbaum, *Employer Views on Traffic Congestion*, Policy Brief No. 115 (Los Angeles: Reason Foundation, February 2014), pp. 4-12, http://reason.org/files/employer_views_traffic_congestion.pdf

[5] Tiffany Hsu, "California's Shrinking Workforce has Troubling Implications," *Los Angeles Times*, December 4, 2014, http://www.latimes.com/business/la-fi-shrinking-workforce-20141204-story.html

[6] Gabe Holland and Sam Quinones, "California Demographic Shift: More People Leaving than Moving in," November 27, 2011, http://articles.latimes.com/2011/nov/27/local/la-me-california-move-20111127

[7] Paul Sorensen, "Moving Los Angeles," *Access Magazine*, No. 35, Fall 2009, http://uctc.net/access/35/access35_Moving_Los_Angeles.pdf, pp. 16-24.

[8] Los Angeles County Metropolitan Transportation Authority, *2001 Long Range Transportation Plan for Los Angeles County Executive Summary,* (Los Angeles, CA 2001), *http://media.metro.net/images/LRTP%20Executive%20Summary.pdf*, cover page.

[9] Dowell Myers and John Pitkin, *The Generational Future of Los Angeles: Projections to 2030 and Comparison to Recent Decades, USC Sol Price School of Public Policy*, (Los Angeles, University of Southern California, March 2013), page iii-v, https://www.usc.edu/schools/price/research/popdynamics/futures/2013_Myers-Pitkin_LA-Projections.pdf

[10] Joel Kotkin and Wendel Cox, "Southern California Stuck in Drive," *Orange County Register*, October 26, 2014.

[11] Texas A&M Transportation Institute, *2015 Urban Mobility Report*, p. 22.

[12] Texas A&M Transportation Institute, 2015 Urban Mobility Spreadsheet.

[13] Ibid.

[14] Ibid.

[15] Texas A&M Transportation Institute, *2015 Urban Mobility Report, p. 18,*

[16] Ibid.

[17] Joel Kotkin, "The Great Train Robbery," Forbes Magazine, http://www.newgeography.com/content/001714-mass-transit-the-great-train-robbery.

[18] United States Department of Transportation Federal Highway Administration Office of Operations, *Traffic Congestion and Reliability,* accessed from www.ops.fhwa.dot.gov/congestion_report/executive_summary.htm., 2005

[19] The Texas A&M Transportation Institute has defined both a Buffer Index and a Planning Time Index to measure these effects. (http://mobility.tamu.edu/mmp)

[20] Texas A&M Transportation Institute, *2012 Urban Mobility Report*, p. 1.

[21] Jack Wells, Chief Economist, U.S. Department of Transportation, "The Role of Transportation in the U.S. Economy," presentation to the National Surface Transportation Policy and Revenue Study Commission (Washington D.C., June 26, 2006).

[22] U.S. Department of Transportation *National Cooperative Highway Research Program Report 463 Economic Implications of Congestion* (Washington, D.C, Federal Highway Administration, 2001).

[23] Ibid.

[24] Remy Prud'homme and Chang-Woon Lee, "Size, Sprawl, Speed and the Efficency of Cities," *Urban Studies* Vol. 36, No. 11 (October 1999), pp. 1849-1858.

[25] David T. Hartgen and M. Gregory Fields, *Gridlock and Growth: The Effect of Traffic Congestion on Regional Economic Performance,* Policy Study No. 371 (Los Angeles: Reason Foundation, August 2009), http://reason.org/files/ps371_growth_gridlock_cities_full_study.pdf, pp. iii-iv,

[26] Southern California Association of Governments, *2008 Regional Transportation Plan*, (Los Angeles, CA, 2008) pp. 2-6.

[27] U.S. Department of Commerce, *American FactFinder Table P1*, (Washington, DC 2014), http://factfinder.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t#none

[28] Les Christie, "More Jobs Mean Worse Traffic Congestion," *CNN Money*, March 4, 2011, http://money.cnn.com/2011/03/04/autos/worst_traffic_congestion/

[29] "Commuters Suffer Extreme Stress," *BBC News*, November 30, 2004, http://news.bbc.co.uk/1/hi/uk/4052861.stm.

[30] Helena Oliviero, "Looking for love in all the close places," *Atlanta Journal-Constitution*, October 15, 2002.

[31] Matthew Barth and Kanok Borisboonsomsin, "Traffic Congestion and Greenhouse Gases," *Access*, No. 35, Fall 2009.

[32] Dominic Minadeo, *Price Premiums and Mixed Use Development*, (Nashville, TN: NAIOP Research Foundation 2009), pp. 9-22.

[33] Atlantic Station, *Space For You and Your Guests*, *Parking*, (Atlanta, GA, 2015), http://atlanticstation.com/parking/

[34] U.S. Department of Transportation, *National Cooperative Highway Research Program Report 684, Enhancing Internal Trip Capture Estimation for Mixed use Developments*, (Washington, D.C, Federal Highway Administration, 2011), http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_684.pdf, pp. 25-83,

[35] David Ellis et. al., *Shaping the Competitive Advantage of Texas Metropolitan Regions*, (Austin, TX: Texas Business Leadership Council, 2006), http://www.txblc.org/reports/shaping-the-competitive-advantage-of-texas-metropolitan-regions/

[36] Arizona Department of Transportation, *Phoenix Metro Area Projects*, http://azdot.gov/projects/phoenix-metro-area,

Presidio Parkway-San Francisco Gateway, *Project Overview*, http://www.presidioparkway.org,

California Department of Transportation District 4, *Updates and News Releases*, http://www.dot.ca.gov/dist4/

[37] Southern California Association of Governments, *Programs—Transit Resources and Links*, (Los Angeles, CA 2012), http://www.scag.ca.gov/programs/Pages/TransitResourcesLinks.aspx

[38] Southern California Association of Governments, *2012 Regional Transportation Plan* (Los Angeles, CA 2012), pp. 29-31.

[39] Transportation Demand Management is a set of strategies aimed at reducing single-occupant vehicle travel. The eight most popular TDM strategies are road pricing, parking pricing, pay as you drive insurance, carpooling, transit incentives, transit improvements and telework.

[40] Note the citation for footnote 40: U.S. Government Accountability Office, "Bus Rapid Transit: Projects Improve Transit Service and Can Contribute to Economic Development," (July, 2012), available at http://www.gao.gov/assets/600/592973.pdf

[41] Stephen J. Smith, "Even in Cities with Large Rail Networks Buses Still Rule," *NextCity*, December 19, 2013, http://nextcity.org/daily/entry/even-in-cities-with-large-rail-networks-buses-still-usually-rule

[42] Southern California Association of Governments, *2012 Regional Transportation Plan*, pp. 170-178.

[43] United States Department of Transportation, Federal Highway Administration, Office of Planning, Environment and Reality, *What is Sustainability*, (Washington, DC 2014), https://www.fhwa.dot.gov/livability/

[44] Tax Foundation, *Center for State Tax Policy, California*, http://taxfoundation.org/state-tax-climate/california

[45] United States Department of Labor, Bureau of Labor Statistics, *Labor Underutilization of States Second Quarter of 2014 through First Quarter of 2015 Averages*, (Washington, DC, 2015) http://www.bls.gov/lau/stalt.htm

[46] R. Warren Flint and W. L. Houser, *Living a Sustainable Lifestyle for Our Children's Children*, (San Jose, CA, Author's Choice Press, 2001), pp. 10-14.

[47] "Bill Witte on Housing Affordability: A Supply and Demand Problem," *The Planning Report*, May 28, 2014, http://www.planningreport.com/2014/05/28/bill-witte-housing-affordability-supply-and-demand-problem

[48] Mark Garrett and Brian Taylor, "*Reconsidering Social Equity in Public Transit*, *Berkeley Planning Journal*, Version 13, 1999, pp. 6-27.

[49] Fermin Leal, "California Students Rank 47th in Science," *The Orange County Register*, September 1, 2014, http://www.ocregister.com/articles/students-353581-state-scores.html,

Steven Carroll et. al., *California's K-12 Public School's: How Are They Doing*, (Santa Monica, CA Rand Corporation, 2005), pp. 109-140, http://www.rand.org/content/dam/rand/pubs/monographs/2004/RAND_MG186.pdf

[50] Pricing reduces GHGs just as much as urban growth boundaries.

[51] U.S. Energy Information Administration, *State Level Energy-Related Carbon Dioxide Emissions*, May 27, 2015, http://www.eia.gov/environment/emissions/state/analysis/

[52] Hamilton County Ohio Department of Transportation, *Idling: Frequently Asked Questions*, Updated September 16, 2012, http://www.hcdoes.org/airquality/anti-idling/idlefaq.htm

[53] Bernice Yeung, "California Air Pollution: Report Shows Decrease in Unhealthy Air," *Huffington Post*, http://www.huffingtonpost.com/2012/04/20/california-air-pollution-_n_1440705.html

[54] Bill Vlassic, U.S. Sets Higher Fuel Efficiency Standards, *The New York Times*, August, 28, 2012, http://www.nytimes.com/2012/08/29/business/energy-environment/obama-unveils-tighter-fuel-efficiency-standards.html?_r=0

[55] Wendell Cox and Adrian Moore, *Reducing Greenhouse Gases from Personal Mobility: Opportunities and Possibilities*, Policy Study No. 338, (Los Angeles, Reason Foundation, November 2011), http://reason.org/files/reducing_greenhouse_gases_mobility_development.pdf, p. 23.

[56] David Brownstone, Mark Hansen and Samar Mandanat, *Review of Bay Area/California High-Speed Rail Ridership and Revenue Forecasting Study*, ITS Berkeley, Research Report UCB-ITS-RR-2010-1, http://www.its.berkeley.edu/publications/UCB/2010/RR/UCB-ITS-RR-2010-1.pdf

[57] Robert Cervero, "Induced Demand: An Urban and Metropolitan Perspective," paper presented at Policy Forum: Working Together to Address Induced Demand, (Washington, DC 2001), http://www.uctc.net/papers/648.pdf

[58] Adam Gropman, "$1.1 Billion and Five Years Later, the 405 Congestion Relief Project is a Fail," *Los Angeles Weekly*, March 4, 2015, http://www.laweekly.com/news/11-billion-and-five-years-later-the-405-congestion-relief-project-is-a-fail-5415772

[59] Robert Poole, *Reducing Congestion in Atlanta: A Bold New Approach to Increasing Mobility*, Policy Study No. 351, (Los Angeles, Reason Foundation, November 2006), pp. 15–16, http://reason.org/files/d1553a97e45b89fd4de254a121184c4b.pdf

[60] http://mobility.tamu.edu/corridors

[61] United States Department of Transportation, Federal Highway Administration, *Managed Lanes*, (Washington DC, 2012) http://ops.fhwa.dot.gov/freewaymgmt/managed_lanes.htm

[62] Ibid.

[63] Raytheon, *The Phantom Tollbooth: How Do Automated Toll Lanes Work*, (Waltham, MA 2014), http://www.raytheon.com/news/feature/electronic_tolling.html

[64] United States Department of Transportation, Federal Highway Administration, *Managed Lanes*.

[65] European Conference of Ministers of Transport, *Managing Urban Traffic Congestion*, (Brussels Belgium 2007), http://www.internationaltransportforum.org/Pub/pdf/07Congestion.pdf, pp. 167-173.

[66] United States Department of Transportation Federal Highway Administration, Managed Lanes.

[67] Peter Samuel, "Colorado's Third Toller Is All-Electronic," Tollroadsnews.com, Jan. 1, 2010 (www.tollroadsnews.com/node/4523).

[68] Hideo Konishi and Si-il Mun, *Carpooling and Congestion Pricing HOV and HOT Lanes*, (Seoul, South Korea, 2008).

[69] Robert W. Poole, Jr. and Ted Balaker, *Virtual Exclusive Busways: Improving Urban Transit while Relieving Congestion*," Policy Study No. 337, (Los Angeles: Reason Foundation, September 2005).

[70] Email from Jon Ramirez, Cofiroute USA, the operator of the 91 Express Lanes, Sept. 16, 2005.

[71] Email from Chris Tomlinson, GA State Road and Toll Authority, Executive Director SRTA, October 20, 2013.

[72] Southern California Association of Governments, 2008 Draft Long Range Transportation Plan, p. 12.

[73] HNTB, *Priced Managed Lanes*, http://news.hntb.com/images/9055/Collateral/HC108_PricedManagedLanes.pdf, 2012,

Colorado Department of Transportation, High Performance Transportation Enterprise, *Express Lane Corridors*, https://www.codot.gov/programs/high-performance-transportation-enterprise-hpte/projects, 2015,

Joe Rouse, "Managed Lanes in California: Where We Have Been and Where We Are Going, presentation delivered at the Bay Area Meeting of the Institute of Transportation Engineers (San Francisco, CA January 2015)..

[74] Transportation Research Board, *Commuting in America Version III*, (Washington, DC: 2006), pp. 87-88.

[75] American Association of State Highway and Transportation Officials, *A Policy of Geometric Design of Highways and Streets*, (Washington D.C., 2004), pp. 1-12.

[76] Chris Swenson and Robert Poole, *Reducing Congestion in Lee County Florida*, Policy Study 374, (Los Angeles, Reason Foundation, February 2009), p. 18.

[77] Ibid.

[78] U.S. Department of Transportation, Federal Highway Administration, *2010 Status of the Nation's Highways, Bridges, and Transit: Conditions and Performance, Chapter 6* (Washington D.C. June 2011).

[79] Mark Burris, Margie Byers and Chris Swenson, *Lee County Queue Jump Study*, (Washington, DC, 2003), http://www.ltrc.lsu.edu/TRB_82/TRB2003-000678.pdf

[80] Transportation Research Board, Transportation Research Record, *Managed Arterials: New Application of Managed Lanes Concept*, (Washington, DC 2012), p. 66.

[81] Southern California Association of Governments, *2012 Regional Transportation Plan Project List Appendix*, (Los Angeles, CA April 2012), pp. 2-473, http://rtpscs.scag.ca.gov/Documents/2012/final/SR/2012fRTP_ProjectList.pdf

[82] Ibid.

[83] Robert Poole, *Building For The Future Easing California's Transportation Crisis With Tolls and Public-Private Partnerships,* Policy Study No. 324, (Los Angeles, Reason Foundation, March 2005), pp. 13-16.

[84] Southern California Association of Governments, *State Route 14 Corridor Improvement Alternatives Study* (Los Angeles: SCAG, October 2000).

[85] Southern California Regional Rocks and Roads, *Beverly Hills Freeway*, March 1, 2015, http://socalregion.com/highways/la_highways/beverly-hills-freeway/

[86] Southern California Association of Governments, *2008 Regional Transportation Plan: Project List*, p. 194.

[87] Ibid.

[88] The "low" tunnel construction cost of $80 million per lane-mile is based roughly on the actual per lane-mile tunnel construction cost in Dublin, Ireland (tunnel costs reported in China and Madrid, Spain of between $19 million and $48 million per lane-mile were deemed too low to be representative of construction costs in the United States). The "high" tunnel construction cost of $300 million per lane-mile is based roughly on the construction cost estimate of the Alaskan Way Viaduct tunnel option in Seattle, WA (the construction cost of the Big Dig in Boston, MA of $521 million per lane-mile is not used for the cost range due to exceptional conditions associated with that project).

[89] American Association of State Highway and Transportation Officials (ASHTO), *Recommendations for Bridge and Tunnel Security*, The Blue Ribbon Panel on Bridge and Tunnel Security, AASHTO Transportation Security Task Force, Washington, D.C., 2003.

[90] Automobile Association Developments Limited, *Going Underground, Tunnels: What Role in Town and Country,* PA 150 (London, England, June 2001), https://www.theaa.com/public_affairs/reports/going_underground.pdf

[91] Robert Poole and Peter Samuel, *Transportation Mega-Projects and Risk*, Policy Brief No. 97 (Los Angeles, Reason Foundation, February 2011, http://reason.org/files/transportation_mega_projects_risk_big_dig.pdf, p. 8.

[92] A. Dix, "Facilitators Report: Tunnels," paper presented at International Workshop on Tunnel Ventilation, (Sydney, Australia, 2000).

[93] Lindvall, Richter and Associates, "Possible Earthquake Hazards of Tunneling," letter written to the chief engineer of the Southern California Rapid Transit District, (New York, NY January 9, 1978).

[94] American Society of Civil Engineers, Geotechnical Division Journal, (Washington, DC 1978).

[95] Kiyoshi Kanai, Teiji Tanaka and Shizuyo Yoshizawa, Comparative Studies of Earthquake Motions on the Ground and Underground, (Tokyo, Japan: Earthquake Research Institute, 1966).

[96] Charles Richter, *Elementary Seismology*, (New York, New York: WH Freeman and Co., 1958), pp. 21-45.

[97] National Oceanic and Atmospheric Administration (NOAA), 1971 San Fernando Earthquake, (Washington, DC, 1973), Vol. III, p. 214.

[98] Lindvall, Richter and Associates, "Possible Earthquake Hazards of Tunneling."

[99] Cascadia Center, *Large Diameter Soft Ground Bored Tunnel Review*, (Seattle, WA, November 2008), pp. 2-3, http://www.discovery.org/scripts/viewDB/filesDB-download.php?command=download&id=3591

[100] Massachusetts Department of Transportation, *Official Statement for 2010 Sale of Bonds*, (Boston MA, 2009), pp. 32-45, https://www.massdot.state.ma.us/portals/0/docs/InfoCenter/financials/2009AnnualReportDisclosureStatementMHSFYJune2009.pdf

[101] Joanlin Hsu, Shannon McKay, and Markques McKnight, *Cost-Benefit Analysis of Boston's Central Artery/Tunnel*, paper presented at Regional Transportion Workshop (Boston, MA, 2003), slides 12-24.

[102] Florida Department of Transportation District 6, *Port of Miami Tunnel—Project Overview*, (Miami, FL, 2014), http://www.portofmiamitunnel.com/project-overview/project-overview-1/

[103] U.S. Department of Transportation, Federal Highway Administration, *Public-Private Partnership Concessions for Highway Projects: A Primer*, (Washington DC, 2010) http://www.fhwa.dot.gov/ipd/pdfs/p3/p3_concession_primer.pdf.

[104] Ibid, p 39.

[105] Bent Flyvbjerg, et al, Megaprojects and Risk, Cambridge (U.K.): Cambridge University Press, 2003.

[106] Fitch Ratings, *Global Infrastructure and Project Finance*, http://ibtta.org/sites/default/files/documents/IBTTA%20Publications/Fitch%20Ratings%20Global%20PPP%20Lessons%20Learned%202013.pdf, October 2013.

[107] Texas A&M Transportation Institute, *Texas Toll Road Primer Final Report*, (College Station, TX 2014), pp. 20-29, http://d2dtl5nnlpfr0r.cloudfront.net/tti.tamu.edu/documents/PRC-14-3-F.pdf

[108] Leonard Gilroy and Robert Poole, *Ten Myths and Facts on Transportation Public-Private Partnerships* (Los Angeles: Reason Foundation, 2012), pp. 2–6, http://reason.org/files/ten_myths_and_facts_on_transportation_p3s_(final).pdf.

[109] Randal O'Toole, *Defining Success: The Case Against Rail Transit*, Policy Analysis No. 663 (Washington, D.C., Cato Institute, March 2010), http://object.cato.org/sites/cato.org/files/pubs/pdf/pa663.pdf, p 6

[110] Jeffrey Brown and Gregory Thompson, "Hub Spoke, the Grid, and the Future of Transit: The Importance of System Planning for Public Transit's Success," paper presented at the Future of Transportation Conference, (Tallahassee, FL, September 15-17, 2012.)

[111] "The Effects of Urban Growth Boundaries in Oregon," American Planning Association National Conference, (Seattle, WA, April 19, 2015).

[112] Robert Cervero and Michael Duncan, "Which Reduces Vehicle Travel More," *Journal of the American Planning Association*, vol. 72, no. 4 (Autumn, 2006), pp. 475-490, http://www.uctc.net/papers/825.pdf

[113] Thomas Rubin and Fatma Mansour, "Transit Utilization and Traffic Congestion: Is There a Connection?" Policy Study No. 427, (Los Angeles: Reason Foundation, December 2014), pp. 22-28.

[114] Southern California Association of Governments, *2012 Regional Transportation Plan*, pp. 20-24.

[115] Special Master Donald T Bliss, *Labor/Community Strategy Center et al v Los Angeles County Metropolitan Transportation Authority et al*, No. 94-5936 TJH (MCX, L/CSC *v* MTA, (Los Angeles, CA, January 2004).

[116] Baruch Feigenbaum, *Bus Rapid Transit and Managed Lanes*, Policy Study 432 (Los Angeles, CA., Reason Foundation, January 2014), http://reason.org/files/bus_rapid_transit_and_managed_lanes.pdf, p. 18.

[117] National Bus Rapid Transit Institute, *What is Bus Rapid Transit?* (Tampa, FL, 2006), http://www.nbrti.org

[118] Federal Transit Administration, *Bus Rapid Transit,* (Washington, DC 2011), http://www.fta.dot.gov/about/12351_4240.html

[119] U.S. Department of Transportation, Federal Transit Administration, *Characteristics of Bus Rapid Transit for Decision Makers 2009 Update*, (Washington, DC, 2009), http://www.fta.dot.gov/documents/CBRT_2009_Update.pdf

[120] United States Department of Transportation, Federal Transit Administration, *2008 Bus Rapid Transit Vehicle Demand & System*s, CALSTART Inc, Analysis Report No. FTA-CA-26-7074-2008.1, (Washington, DC, August 2008).

[121] Poole and Balaker, *Virtual Exclusive Busways*, pp. 10-14.

[122] Ibid.

[123] Ginger Goodin et al., *KATY Freeway*: *An Evaluation of a Second Generation Managed Lanes Project*, (Texas A&M Transportation Institute, September 2013), http://d2dtl5nnlpfr0r.cloudfront.net/tti.tamu.edu/documents/0-6688-1.pdf, pp. 141–147.

[124] U.S. Government Accountability Office, *Bus Rapid Transit: Projects Improve Transit Service and Can Contribute to Economic Development,* (Washington, DC July, 2012), http://www.gao.gov/assets/600/592973.pdf

[125] Los Angeles Metro, *Metro Rapid*, (Los Angeles, CA, 2013), http://www.metro.net/projects/rapid/.

[126] Email from Rex Gephart of Los Angeles County Metropolitan Transportation Authority to Robert Poole, August 25, 2008.

[127] Los Angeles Metropolitan Transportation Commission, *Lines and Timetables*, (Los Angeles, CA, 2014), http://www.metro.net/riding/maps/

[128] Ibid.

[129] Metrolink, *Routes*, (Los Angeles, CA 2014), http://www.metrolinktrains.com/routes/

[130] Los Angeles Metropolitan Transportation Commission, *Lines and Timetables*.

[131] Orange County Transportation Authority, *Bus Transit Routes and Schedules*, (Santa Ana, CA, 2014), http://www.octa.net/Bus-Transit/Routes-and-Schedules/Overview/

[132] OmniTrans, *Schedules and Maps*, (San Bernardino, CA, 2014), http://www.omnitrans.org/schedules/

[133] Victor Valley Transit Authority, *Bus Routes and Schedules*, (Barstow, CA, 2014), http://vvta.org/bus

[134] Foothill Transit, *Lines and Schedules*, (Ontario, CA, 2014), http://foothilltransit.org/lines-and-schedules/

[135] Riverside Transit Agency, *Maps and Schedules*, (Riverside, CA, 2014), http://www.riversidetransit.com/index.php/riding-the-bus/maps-schedules

[136] Gold Coast Transit, *Current Schedules: Bus Book*, (Oxnard, CA, 2014), http://www.goldcoasttransit.org/schedules/schedules-eff-august24

[137] Los Angeles Metropolitan Transportation Commission, *Grow: Projects and Programs*, (Los Angeles, CA, 2014), http://www.metro.net/riding/maps/

[138] Los Angeles Metropolitan Transportation Commission, *Lines and Timetables*.

[139] Orange County Transportation Authority, *Bus Transit Routes and Schedules*.

[140] OmniTrans, *Schedules and Maps*.

[141] Victor Valley Transit Authority, *Bus Routes and Schedules*.

[142] Foothill Transit, *Lines and Schedules*.

[143] Riverside Transit Agency, *Maps and Schedules*.

[144] Ventura County: VISTA Transit System, *GoVentura*, (Ventura, CA, 2014), http://www.goventura.org/?q=travel-ventura

[145] Priority Signaling was rated as the most important feature by surveys conducted by the Transportation Research Board Bus Rapid Transit Systems Committee, American Public Transit Association Bus Conference and USDOT Secretary of Policy Peter Rogoff.

[146] Rideshare by Enterprise, *Start Vanpooling*, www.enterprisirideshare.com/vanpool/en.html, vRide, *Why vRide,* www.vride.com/why-vride-overview, January 2013.

[147] Casey Phillips, " How Smartphones Revolutionized Society in Less than a Decade," *Chattanooga Times*, November 20, 2014, http://www.govtech.com/products/How-Smartphones-Revolutionized-Society-in-Less-than-a-Decade.html

[148] SF Casual Carpool, *What is Casual Carpool*, (San Francisco, CA, 2014), http://sfcasualcarpool.com

[149] U.S. Department of Transportation, Federal Transit Administration, *Demand Response Service Explained*, (Washington, DC, February 2013).

[150] William Vincent and Lisa Callaghan, "A Preliminary Evaluation of the Metro Orange Line Bus Rapid Transit Project," paper presented at the 2007 Transportation Research Board Annual Meeting, (Washington, DC, January 2007, www.gobrt.org.

[151] Transportation Research Board, National Cooperative Research Program, *The 21st Century Operations-Oriented State DOT*, (Washington DC, 2005), p. 18.

[152] California Center for Innovative Transportation, *Traffic Management, Dynamic Traffic Management Systems*, (Berkeley, CA 2005), http://fresno.ts.odu.edu/newitsd/ITS_Serv_Tech/traff_manag/dyn_trafficmangmt_summary.html

[153] United States Department of Transportation Federal Highway Administration, *Safety Application of Intelligent Transportation Systems in Europe and Japan,* International Technology Scanning Program, (Washington, DC 2006) http://international.fhwa.dot.gov/ipsafety/,

[154] Intelligent Transportation Society of America, *Knowledge Center,* (Washington, DC 2013), http://www.itsa.org/knowledgecenter/knowledge-center-20,

[155] Quickmap, developed by the California Department of Transportation in 2012, provides real time updates on traffic and travel conditions. It is available at http://quickmap.dot.ca.gov

[156] United States Department of Transportation, Federal Highway Administration, *Safety Application of Intelligent Transportation Systems in Europe and Japan*, (Washington, DC 2013), http://www.ops.fhwa.dot.gov/congestion_report/chapter2.htm,

[157] California Department of Transportation, Operations Division, *Frequently Asked Questions*, (Sacrmaneto, 2014) http://www.dot.ca.gov/hq/paffairs/faq/faq66.htm,

[158] United States Department of Transportation, *Synthesis of Active Traffic Management Experiences in Europe and the U.S.,3.3 Hard Shoulder Running,* (Washington, DC, 2013), http://ops.fhwa.dot.gov/publications/fhwahop10031/sec3.htm

[159] United States Department of Transportation, *Synthesis of Active Traffic Management Experiences in Europe and the U.S., 3.4 Speed Harmonization,* (Washington, DC, 2013), http://ops.fhwa.dot.gov/publications/fhwahop10031/sec3.htm

[160] United States Department of Transportation, *Synthesis of Active Traffic Management Experiences in Europe and the U.S., 3.5 Junction Control,* (Washington, DC, 2013), http://ops.fhwa.dot.gov/publications/fhwahop10031/sec3.htm

[161] Texas A&M Transportation Institute, *2012 Annual Urban Mobility Report*, p. 51.

[162] Ibid.

[163] Texas A&M Transportation Institute, *2010 Annual Urban Mobility Report*, (College Station, TX 2011), p. B-28.

[164] Minnesota Department of Transportation, *FAQ—Freeway Incident Response Safety Team (FIRST)*, (St. Paul, MN 2008).

[165] Ibid, citing ITE Journal, March 1992.

[166] Doug MacDonald, "Highway Congestion: What Is to Be Done*?"* briefing to the Washington State Senate Transportation Committee, (Olympia, WA January 17, 2006), www.wsdot.wa.gov/secretary

[167] Steve Hemminger, "Metropolitan Transportation Commission Presentation," presentation at the International Bridge, Tunnel and Turnpike Association Conference (Santa Monica, CA, March 21, 2006).

[168] National Cooperative Highway Research Program, Safe and Quick Clearance of Traffic Incidents, Synthesis 318, (Washington, DC, 2003), http://trb.org/publications/nchrp/nchrp_syn_318.pdf

[169] United States Department of Transportation, Federal Highway Administration, *Traffic Congestion and Reliability: Causes, How They Are Measured and Why They Matter*, (Washington, DC: USDOT, 2014).

[170] United States Department of Transportation, Federal Highway Administration, *Traffic Analysis Toolbox Volume VI: Chapter 4.0 Calculation of MOEs by Traffic Analytical Tools*, (Washington, DC 2014), http://ops.fhwa.dot.gov/publications/fhwahop08054/sect4.htm

[171] Ibid.

[172] These examples are drawn from Samuel Staley and Adrian Moore, *Mobility First: A New Vision for Transportation in a Globally Competitive Twenty-First Century*, (Washington, DC: Rowman and Littlefield, 2008), p. 131.

[173] Staley and Moore, *Mobility First*.

[174] Staley and Moore, *Mobility First*.

[175] Texas A&M Transportation Institute, *2012 Annual Urban Mobility Report*, p. 50.

[176] National Surface Transportation Policy and Study Revenue Committee, "National Traffic Signal Report Card," presentation made at The Atlanta Regional Traffic Operations Task Force, (Atlanta, GA March 17, 2005).

[177] Ibid.

[178] Although raised medians are often a principal element in access management, under heavy traffic conditions they can increase recurring congestion due to the limits on storage capacity of left-turn bays. Once these turn bays become full, additional left-turning traffic spills into the through lanes adding to delays. But because raised medians also increase safety by reducing the number of conflict points (thereby reducing accidents) they reduce incident-related congestion. When analysts crunch the numbers, they find a net decrease in congestion from the addition of raised medians, as the latter effect outweighs the former.

[179] Texas A&M Transportation Institute, *2012 Annual Urban Mobility Report*, p. 50.

[180] Iowa State University, *Access Management Frequently Asked Questions, Driveway Density and Driveway Consolidation*, (Ames, IA 2014), http://www.ctre.iastate.edu/research/access/toolkit/3.pdf

[181] United States Department of Transportation Federal Highway Administration, *Signalized Intersections An Informational Guide*, Chapter 2-2 Human Factors: Motorists, (Washington, DC 2013) http://safety.fhwa.dot.gov/intersection/signalized/13027/ch2.cfm.

[182] California State Assembly, Legislative Analyst's Office, Overview of Transportation Funding, (Sacramento, CA, March 13, 2014).

[183] Southern California Association of Governments, *2012 Regional Transportation Plan*, pp. 9–11.

[184] Ibid.

[185] "Traffic assignment" is a widely used method in transportation planning, in which future traffic on a proposed road is estimated by 'assigning' traffic from an assumed origin-destination pattern, such that traffic uses the fastest-time route, subject to traffic congestion. TransCAD© (www.caliper.com) is a widely available traffic assignment software package used by SCAG.

[186] This has the effect of slightly overestimating traffic, since the OD pairs used would be slightly high.

[187] K.L. Killough, "Value Analysis of Truck Toll Lanes in Southern California," paper presented at the Transportation Research Board, (Washington DC, 2007).

Kenneth Small et al., *Differentiated Road Pricing, Express Lanes and Carpools: Exploiting Heterogeneity Preferences in Policy Design*, (Washington D.C: Brookings Institute, 2006). This analysis, for the SR 91 express lanes in the nearby San Diego area, found a median value of time of $ 19.63/hour and a median value of reliability of $20.76/hour.

[188] United States Department of Transportation, Office of the Secretary, *Treatment of the Economic Value of a Statistical Life in a Departmental Analysis*, (Washington, DC Feb 2, 2008). The memo recommends a value of $ 5.8 M, from a range of $ 3.2-8.4 M. We used $5.8 M for this study. This is not, strictly speaking, the "value of a life" but rather the per-life cost of all traffic accidents including injuries and property-damage-only.

[189] Howard Slavin, *What TransCAD Users Should Know about New Static Traffic Assignment Methods*, (Caliper Corporation, May 14, 2010).

[190] U.S. Department of Energy, Energy Efficiency and Renewable Energy, *Compare Side by Side: Fuel Economy*, https://www.fueleconomy.gov/feg/Find.do?action=sbs&id=33324

[191] U.S. Department of Transportation Bureau of Transportation Statistics, Table 4-23: *Average Fuel Efficiency of U.S. Light Duty Vehicles*, (Washington, D.C.: USDOT, 2012), http://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/publications/national_transportation_statistics/html/table_04_23.html

[192] Brian Weatherford, *Mileage-Based User Fees Winners and Losers: An Analysis of the Distributional Implications of Taxing Vehicle Miles Traveled, with Projections, 2010–2030*, (Santa Monica, CA: RAND Corporation, 2012), http://www.rand.org/pubs/rgs_dissertations/SD295.html

[193] Oregon Department of Transportation, *Oregon Mileage Fee Concept and Road User Fee Pilot Program Preliminary Findings February 2013*, (Salem, OR, 2014), http://www.oregon.gov/ODOT/HWY/RUFPP/docs/RUCPilotPrelimFind_Feb13.pdf

[194] Oregon Department of Transportation, *Road User Fee Task Force, Item I RUCP Implementation Status Report,* (Salem, OR 2014), http://www.oregon.gov/ODOT/HWY/RUFPP/docs/Item%20I%20-%20RUCP%20Implementation%20Status%20Report.pdf

[195] Nick Vyas, "California Infrastructure Outlook," presentation delivered at the California Sustainable Transportation Funding Workshop, (Glendale, CA, October 7, 2014).

[196] Southern California Association of Governments, *Transportation Finance, Mileage-Based User Fee*, (Los Angeles, CA 2014), http://transfin.scag.ca.gov/Pages/Mileage-Based-User-Fee.aspx

5737 Mesmer Ave.
Los Angeles, CA 90230
310-391-2245
reason.org

THE MYTH OF RAPID MASS TRANSIT

by Richard Lee Abrams

May 30, 2005

The idea that rapid, mass transit can solve L.A.'s transportation problems is a myth. **This delusion harms us!** By pretending that the present traffic and parking problem will be solved by either reviving the Red Car or by building more subways, we allow more and more high density development. **In reality, L.A. will never have rapid, mass transit.**

The demise of L.A.'s prior rapid mass transit system was caused by L.A.'s increased density and increased affluence during the post WW II years. While people are enamored with conspiracy theories such as the oil industry destroyed the Red Car, the truth is quite different. People chose the auto over the Red Car and as more and more people could afford to buy cars, they ceased to need the Red Car. Also, as vehicle density increased on the surface streets, the trolleys interfered with traffic.

The Red Car system might have survived side by side with the autos if the **residential density per square mile had not dramatically increased in 1950's**. Take a walk up and down the streets between Sunset and Franklin and see how many single family craftsmen home were torn down for large apart-ment

complexes. Instead of each lot having one or two cars, there were up to thirty cars per lot. *Below* Post WWII crowded apartments

When one comes upon East Hollywood after 2000, one can see how beautiful Hollywood became a overly congested traffic nightmare. Some photographs allow us to glimpse what occurred. Thousands of stately single family homes like this one were demolished. Those that survived were turned into boarding houses and butted up against mega-apartment complexes as shown below. Where there had been on family, now there were 15 to 30 families, all owning automobiles. With a 15 to 30 increase in the number of vehicles, no wonder Hollywood's air became foul and the streets congested.

The Hollywood Freeway was constructed to alleviate the congestion on the surface streets as they went over the Cahuenga Pass into the San Fernando Valley. The trolley tracks take up one lane in each direction. Notice that the trolleys are not sufficient as there already is a city bus going in the same direction. The masses of large apartment complexes cannot be seen in the distance because they have not been built.

1949-1950: Hollywood Freeway under construction at Hollywood Blvd.

Of course, much of the demand for the San Fernando Valley came from the influx of people after WW II. That immigration, however, was no excuse for the destruction of Hollywood. L.A. City Planners were still two and three thousands years behind in their thinking, harkening back to ancient times when farmers and other merchants needed a single central plaza to bring their produce and wares for sale. By the end of WW II, there was no need to treat the entire L.A. area as if it were a small village in Mesopotamia. There was no rational reason for businessmen to congregate in a singe downtown area. The men who worked on the 5th floor of One Wilshire seldom, if ever, conversed with the men on the 7th floor. If they did speak, it was probably by telephone; the same way they spoke to colleagues in New York and San Francisco.

By 1950's, L.A. County's court system had realized that they had to build branches **where the people lived**. At the same time the courts were being spread around the entire county from Santa Monica to Pomona, law firms were behind the razing of Bunker Hill and the construction of 20 and 30 storey office buildings in downtown L.A. Why did the lawyers and other businessmen need to huddle together? A lawyer was as likely to have a case in Van Nuys as he was to have one in the Central Courthouse downtown. In fact, having an office downtown when your lived in Woodland Hills and tried cases in Van Nuys or San Fernando was an extreme inconvenience. Of all the designs one could envision for the L.A. area, the most foolish was to concentrate business in a downtown area. Why did L.A. chose the worse plan?

Real estate developers! If a developer can make $1,000 by renting out a one storey building, he doubles his income with a two storey building, he triples his income with a 3 storey building, he quadruples his income by a 4 storey building, etc. A 20 storey building makes for a 2,000% increase in profit.

That same philosophy applies universally; so, it was no wonder that developers applied it to Hollywood. The best way to destroy a stable middle class neighborhood of single family homes is to build a ugly apartments in the middle of the block. That puts the owners of the single family homes in a situation with one realistic choice: sell to the developers.

Few people chose to remain in a neighborhood were large apartment complexes dominate the streets. When the homeowners can sell their small lot for double, triple of quadruple its value, they flee the deterioration and crime. Those homes that do not sell to developers soon become rooming houses. Then, people wonder why Hollywood filled up with transients.

As this photo shows, the post WW II apartment complexes consumed the entire lot. They were built along streets which had been designed for single family homes.

As a result the high density development over burdened the local transportation system. These apart- ments stuffed 30 or more units onto the same lots that had only one family.

This 30 fold increase in population density is what turned Hollywood into a slum in the 1970's. Due to the efforts of many people, this portion of Hollywood has struggled back from corner of Hollywood-Western being identified as the country's most dangerous intersection – only to be ravaged by an atrocious high density CRA monstrosity.

Notice the small windows. The color blotches were used to deceive the eye into not noticing that the CRA used tiny windows to increase the developer's profit to the occupants' detriment.

Homes similar to these were torn down,

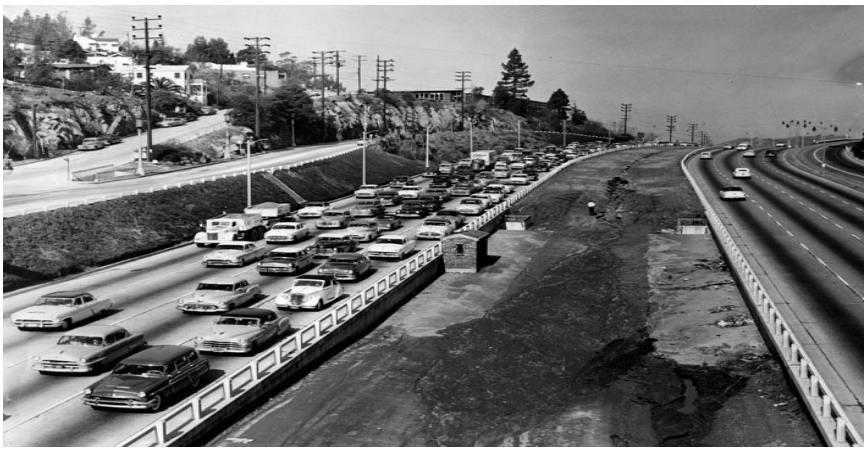
Notice how L.A. allowed tall apartments
to tower over people's backyards.

and in place of these large and small single family craftsmen homes, we found large apartment complexes. How did L.A.'s City planners respond? More and more high density developments in Hollywood, driving thousands more people into the suburbs.

As you will see, the high density building in Hollywood made it impossible for Hollywood to continue its trolleys which require much lower density due to the mathematical relationship between population density and road width.

The construction of the Hollywood Freeway shows what everyone knows. After WW II people could afford to buy automobiles, making freeways necessary. The trolleys interfered with traffic, in part due to their fixed rails, which provided no flexibility and took up an entire lane in each direction. Buses were already necessary. No oil company conspiracy caused the end of the Red Car.

As this photograph from 1940 shows, the spacious boulevard over Cahuenga Pass adequately handled the traffic burden. Within a decade, however, the increased population density required a freeway.



It does not take a genius to figure out that the more people who have to go from point A to point B, the more traffic. More traffic means wider roads. Simple math tells us that there is a traffic saturation point.

Rather than learn from history, logic or sound planning practices, L.A. it used the freeways as a pretext to increase square mile density through the city – a folly that continues to this day.

Traffic Saturation Cannot Be Ignored

The City and its developer cohorts do not discuss traffic saturation. If they told the people, the traffic saturation points, people would demand reduced population density.

What is the Traffic Saturation Point?

Although the Traffic Saturation Point can be mathematically calculated, the decision of where to place the Traffic Saturation point is political. Most people would agree that total gridlock would be a Traffic Saturation Point, i.e. a surface street Sig-Alert. Since the 1930's Hollywood has experienced these traffic nightmares rather regularly.

As one can see from the traffic congestion and the smog, there are too many cars on the street for the health of Hollywood. Developing a political consensus on the Traffic Saturation Point is complex. Basically, it should begin with a ratio of the flow of traffic at the speed limit to the flow of traffic in reality. Television and radio traffic reporters are using this concept, advising us that normally it should take 10 minutes to go from the Cahuenga Pass to downtown but during a particular rush hour it takes 45 minutes.

The essence of a Traffic Saturation Point is that traffic moves much slower than the speed limit.

When traffic backs up along Hollywood Boulevard creating gridlock, one should not increase density. Of course, this spot is where Los Angeles chose to place it new Fire station #82

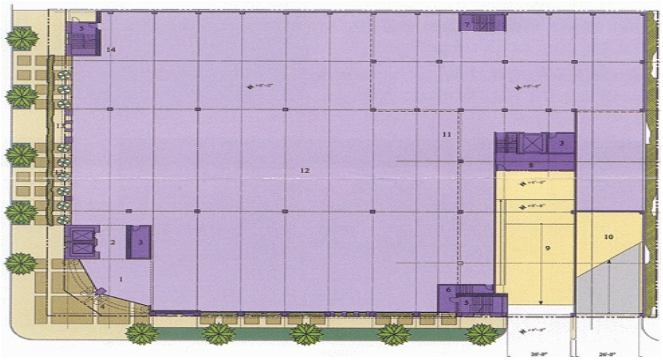
When drivers who would take Los Feliz Boulevard from Western to the 5 Freeway instead take Franklin Avenue to Vermont or Hillhurst, Los Feliz is beyond its Traffic Saturation Point. Yet, the developers still increase population density. The cause of Hollywood's reaching its Traffic Saturation Points is not a mystery – all one has to do is LOOK!

Sunset & Western Apts. ☞

☜ Metro Apts; Hollywood & Western

People who live in The Oaks know that the time for trips from the Westside to their doorstep have doubled over the last 10 years, the Traffic Saturation Point has been reached. Yet, the developers still press to increase population density.

Until recently, developers wanted to put a 52,000 square foot mega-store at the corner of Hollywood-Garfield; the lot was only 42,000 sq. ft. In an area already past its Traffic Saturation Point, they wanted to construct a mega-store **with no ground level parking!**



Purple shows the floor area; brown is the sidewalk. The yellow portions are (1) the single unloading dock which required the semi-tractor trailers to back into the underground dock and (2) the ramp to store-top parking.

As the developer's floor plan (*right side above*) shows, the store was going to consume the lot's entire footprint, which was about $42,000 sq. ft, which was 10,000 sq. **feet less** than the 52,000 sq. ft store itself. There was no ground level parking for customers and a significant portion of the two levels of parking were going to be taken by the store's employees. The delivery vehicles and the sole customer ingress-egress was on Garfield, a residential street which also has over 240 buses per hour. Thus, the store's sole loading dock and customer entrance was going to clog one of the MTA's primary bus turn-around streets. Buses turning right of Hollywood Boulevard would have backed up along Hollywood, extending the congestion into the intersection of Hollywood and Western.

This nightmare was fine with the City, despite the fact it violated almost every applicable provision of the Specific Area Plan.

After the Whole Foods discovered that the developer planned that:

1. There was no street level parking,

2. Employee parking was going to take up customer parking,

3. A 52,000 sq. ft store was planned with one loading docket

4. The sole customer entrance was right next to the sole loading dock where the semi-tractor-trailers would be parked waiting to unload

5. there were going to be only two elevators from the roof to the store requiring all the customers to wait and wait with their full grocery carts to get to the roof top parking,

6. The surrounding streets were at their Traffic saturation Points for much of the day,

the Whole Foods itself changed its mind and withdrew from the site.

Aristotle's Golden Mean applies to people and out-sized developments

Had Whole Foods not learned about the myopic nature of project being pushed through City Council in its name, Hollywood would have been left with a huge empty mega-store. A 52,000 sq. foot store on a 42,000 sq. ft lot is like **stuffing a sumo wrestler into bikini briefs**.

SUMMARY TO EXPLORING
THE MYTH OF RAPID, MASS TRANSIT

Unlike cities where rapid transit functions, e.g. Manhattan [2.7 sq, mi.], the Los Angeles County spans four thousand eighty [4,084] square miles spreading out virtually in endlessly in all directions. Thousands of people who live in L.A. County need to travel to Orange, San Bernardino, and Ventura Counties on a daily basis. Thus, residents need a transportation system will take them from Hollywood to Santa Ana or from Alhambra to Thousand Oaks. Presently, we have a system which accomplishes this result, but with ever decreasing efficiency. The demise of our transit system is the myth that rapid, mass transit will overcome all the ills created by ever increasing population density. The converse is true: **increased density makes all transit systems, freeways, fixed rail, buses a congested nightmare**. Mega-density can overburden any transportation system to the point of being a daily nightmare for inhabitants.

Because the developers know rapid, mass transit is a delusion, they propose Mixed-Use Complexes. In brief, some people will be crowded into high density neighborhoods where driving to the store or anywhere else for that matter will be too time consuming and aggravating. Thus, they want to build the apartments over the grocery stores. Before, we discuss the hidden agenda behind Mixed Use Development, we will additional reasons that rapid, mass transit is a myth.

1. The First Goal of Mass Transit Is That it must Go Where People Need to Go.

This goal is a geographic impossibility. A lawyer from Los Feliz cannot walk seven blocks down the hill to the Metro Station and take the subway to the courthouse and walk back up the hill in 80 degree hat or when it is raining. He certainly cannot carry 3 or 4 boxes of trial documents. A construction worker who lives in Hollywood cannot take the subway or a bus to Pomona or Pacific Palisades.

2. The Second Goal Is That the Trip Must Be Accomplished Within a Reasonable Time Frame.

A bus trip from Long Beach to Claremont can take five hours, but can be driven in 45 minutes.

The logic of geography shows that **rapid, mass transit** cannot function in the Los Angles-Orange County basin. The basin does not even include the area from Arcadia-Pasadena over to Glendale onto to the San Fernando Valley and out to Thousand Oaks. Who would take a bus from Hollywood to Warner Ranch – a trip which can be accomplished by car in 30 minutes?

High Density Over-Burdens The Freeway System

Contrary to fashionable P.C. rhetoric, the freeway way system functioned very well for Southern California, but any system which is **habitually abused** breaks down. The proponents of higher and higher density development have been abusing the freeway system since its inception. If a freeway is designed to carry 2,000 cars per hour, it cannot handle 10,000 vehicles per hour. The problem is not the freeways; **the problem is the abuse of the freeways.** The problem is not cars; the problem is high density developments which dump more cars per hours onto the streets and freeways.

The Ruse of Mixed Use Development

The developers know that higher density buildings will bring the freeways to a halt and turn the surface streets into gridlock — and they have a "solution" – Mixed Use Development.

People old enough to remember the slums of the Eastern Cities of the 1950's remember Mixed Use Development. That's where the storekeeper lives over his shop; where women bring home piece work. Those with memories know what Mixed Use Development means – SLUMS!

There is nothing new about Mixed Use Development. It's back and uglier than ever.

Over crowding is not a new phenomenon. We've been there before and we known people's response – to flee.

☜ This mixed-use CRA project still has ½ its retail space empty after 7 years.

When people are crammed into small apartments over stores, then they can get their groceries and dry cleaning from the bottom floor. Kids can play in the hallways. For this reason, the City is concentrating high density public housing projects into East Hollywood. The result is blocks of buildings filled with Default Tenants, that is, people who cannot afford to live in a better place. For these pockets of the Disadvantaged, there is the subway for going to work downtown. They have no need to go to the beach or visit relatives; they have no need for a car. They can survive on the stores within walking distance of their high rise apartments. Don't expect any of the developers to live in the tenements along with the Default Tenants.

In brief, the plan is to trap people in their crowded high rise apartments. Without a viable transit system, the only solution of ever increasing population density is Mixed Use Development. People will be expected to be happily segregated in their own little areas, except when they venture out to the office towers downtown and factory zones to the east and south of downtown.

Why Subways Will Never Solve Traffic Congestion

The subway system can never solve the problem of Hollywood's traffic being past the traffic saturation points for a few simple reason. The main reason is subway does not go where people want to go.

The assumption that cramming people into ultra-high density projects near subway stations will force people to use the subways is foolish. The vast majority of travel decisions are for non-work purposes. When one wants to go to the gym and then shop at the grocery on his way home from work, the subway is useless. Not only cannot one carry all the stuff he/she needs, but the likelihood that the gym or store is even along the subway route.

Assuming the unlikely situation where a person works downtown and lives within two blocks of the Hollywood-Western Metro Station and his gym and grocery store are along the Metro Line, the subway is virtually useless. One has to take the subway to the station nearest to the gym or store, and then walk t the surface and then two or three blocks to the gym or store. Returning from the gym may be easy, but returning from the grocery store with the bags or groceries in addition to one's brief case and gym bag is unrealistic. Of course, the extra time it takes to exit the subway, get to the street level and walk and to and from the gym and grocery all consume a lot of time.

What alternative have Angelenos chosen since WW II? They drive their cars. As the 2001 Report from San Jose State University, A New Planning Template for Transit-Oriented Development, shows the practicality and versatility of the auto is so great that it is the logical choice for most transportation needs in California.

Angelenos are being scammed by City Hall to provide hundreds of millions of taxpayer dollars to these developers, whose only plans are to make the city denser and denser and hence more dysfunctional. It is a myth – or perhaps the correct word is "lie" – that subways will improve the situation.

So Much For The Death Of Sprawl: America's Exurbs Are Booming

November 3, 2015, FORBES, by Joel Kotkin

Reformatted from Forbes Article without photos and advertisements

It's time to put an end to the urban legend of the impending death of America's suburbs. With the aging of the millennial generation, and growing interest from minorities and immigrants, these communities are getting a fresh infusion of residents looking for child-friendly, affordable, lower-density living.

We first noticed a takeoff in suburban growth in 2013, following a stall-out in the Great Recession. This year research from Brookings confirms that peripheral communities — the newly minted suburbs of the 1990s and early 2000s — are growing more rapidly than denser, inner ring areas.

Peripheral, recent suburbs accounted for roughly 43% of all U.S. residences in 2010. Between July 2013 and July 2014, core urban communities lost a net 363,000 people overall, Brookings demographer Bill Frey reports, as migration increased to suburban and exurban counties. The biggest growth was in exurban areas, or the "suburbiest" places on the periphery.

Homes stand in this aerial photograph taken above New Jersey, U.S., on Wednesday, June 10, 2015. Photographer: Craig Warga-Bloomberg ADVERTISING

How could this be? If you read most major newspapers, or listened to NPR or PBS, you would think that the bulk of American job and housing growth was occurring closer to the inner core. Yet more than 80% of employment growth from 2007 to 2013 was in the newer suburbs and exurbs. Between 2012 and 2015, as the economy improved, occupied suburban office space rose from 75% of the market to 76.7%, according to the real estate consultancy Costar.

These same trends can be seen in older cities as well as the Sun Belt. Cities such as Indianapolis and Kansas City have seen stronger growth in the suburbs than in the core.

This pattern can even be seen in California, where suburban growth is discouraged by state planning policy but seems to be proceeding nevertheless. After getting shellacked in the recession, since 2012 the Inland Empire — long described as a basket case by urbanist pundits — has logged more rapid population growth than either Los Angeles and even generally healthy Orange County. Last year the metro area ranked third in California for job growth, behind suburban Silicon Valley and San Francisco.

To those who have been confidently promoting a massive "return to the city," the resurgence of outer suburbs must be a bitter pill. In 2011, new urbanist pundit Chris Leinberger suggested outer ring suburbs were destined to become "wastelands" or, as another cheerily described them, "slumburbs" inhabited by the poor and struggling minorities chased out of the gentrifying city.

In this worldview, "peak oil" was among the things destined to drive people out of the exurbs . So convinced of the exurbs decline that some new urbanists were already fantasizing that suburban three-car garages would be "subdivided into rental units with street front cafés, shops, and other local businesses," while abandoned pools would become skateboard parks.

This perspective naturally appeals to people who write most of our urban coverage from such high-density hot spots as Brooklyn, Manhattan, Washington, D.C., or San Francisco. And to be sure, all these places continue to attract bright people and money from around the world. Yet for the vast majority, particularly families, such places are too expensive, congested and often lack decent public schools. For those who can't afford super-expensive houses and the cost of private education, the suburbs, particularly the exurbs, remain a better alternative.

Even as Houston, like other Sun Belt cities, has enjoyed something of a renaissance in its inner core, nearly 80% of the metro area's new homebuyers last year purchased residences outside Beltway 8, which is far to west of the core city.

If you want to know why people move to such places, you can always ask

them. On reporting trips to places like Irvine, California, Valencia, north of Los Angeles, or Katy, out on the flat Texas prairie 31 miles west of Houston, you get familiar answers: low crime, good schools and excellent access to jobs. Take Katy's Cinco Ranch. Since 1990, the planned community has grown to 18,000 residents amid a fourfold expansion in the population of the Katy area to 305,000.

To some, places like Cinco Ranch represents everything that is bad about suburban sprawl, with leapfrogging development that swallows rural lands and leaves inner city communities behind. Yet to many residents, these exurban communities represent something else: an opportunity to enjoy the American dream, with good schools, nice parks and a thriving town center.
Recommended by Forbes

Nor is this a story of white flight. Roughly 40% of the area's residents are non-Hispanic white; one in five is foreign born, well above the Texas average. Barely half of the students at the local high school are Caucasian and Asian students have been the fastest-growing group in recent years, with their parents attracted to the high-performing schools.

"We have lived in other places since we came to America 10 years ago," says Pria Kothari, who moved to Cinco with her husband and two children in 2013. "We lived in apartments elsewhere in big cities, but here we found a place where we could put our roots down. It has a community feel. You walk around and see all the families. There's room for bikes –that's great for the kids."

Here Come The Millennials

Potentially, the greatest source of exurban and peripheral revival lies with the maturation of the millennial generation. Millennials — born between 1982 and 2002 — are widely portrayed as dedicated city dwellers. That a cohort of young educated, affluent people should gravitate to urban living is nothing new. The roughly 20% who, according to an analysis by demographer Wendell Cox, live in urban cores may be brighter, and certainly more loquacious, than their smaller town counterparts, dominating media coverage of millennials. But the

vast majority of millennials live elsewhere — and roughly 90% of communities' population growth that can be attributed to millennials since 2000 has taken place outside of the urban core.

To be sure, millennials are moving to the suburbs from the city at a lower rate than past generations , but this is more a reflection of slower maturation and wealth accumulation.

According to U.S. Census Bureau data released last month, 529,000 Americans ages 25 to 29 moved from cities out to the suburbs in 2014 while 426,000 moved in the other direction. Among younger millennials, those in their early 20s, the trend was even starker: 721,000 moved out of the city, compared with 554,000 who moved in.

This may well reflect rising cost pressures, as well as lower priced housing many millennials can afford. Three-quarters, according to one recent survey, want a single-family house, which is affordable most often in the further out periphery .

Future trends are likely to be shaped by an overlooked fact: as people age, they change their priorities. As the economist Jed Kolko has pointed out, the proclivity for urban living peaks in the mid to late 20s and drops notably later. Over 25% of people in their mid-20s, he found, live in urban neighborhoods; but by the time they move into their mid-30s, it drops to 18% or lower. In 2018, according to Census estimates, the number of millennials entering their 30s will be larger than those in their 20s, and the trend will only get stronger as the generation ages.

Some might argue that millennials will be attracted to more urban suburbs, places like Bethesda, Md.; Montclair, N.J.; or the West University or Bellaire areas of Houston, all of them located near major employment centers with many amenities. These suburban areas are also among the most expensive areas in the country, with home prices often in the millions. And a number of older inner ring suburbs, as we saw in the case of Ferguson, are troubled and have lost population — even as the number of residents in downtown areas have grown.

So when millennials move they seem likely to not move to the nice old suburbs, or the deteriorating one, but those more far-flung suburban communities that offer larger and more affordable housing, good schools, parks and lower crime rates.

Among the research that confirms this is a study released this year by the Urban Land Institute, historically hostile to suburbs, which found that some 80% of current millennial homeowners live in single-family houses and 70% of the entire generation expects to be living in one by 2020.

The Future Of Exurbia

Far from being doomed, exurbia is turning into something very different from the homogeneous and boring places portrayed in media accounts. For one thing exurbs are becoming increasingly ethnically diverse. In the decade that ended in 2010 the percentage of suburbanites living in "traditional" largely white suburbs fell from 51% to 39%. According to a 2014 University of Minnesota report, in the 50 largest U.S. metropolitan areas, 44% of residents live in racially and ethnically diverse suburbs, defined as between 20% and 60% non-white.

And how about the seniors, a group that pundits consistently claim to be heading back to the city? In reality, according to an analysis of Census data, as seniors age they're increasingly unlikely to move, but if they do, they tend to move out of urban cores as they reach their 60s, and to less congested, often more affordable areas out in the periphery. Seniors are seven times more likely to buy a suburban house than move to a more urban location. A National Association of Realtors survey found that the vast majority of buyers over 65 looked in suburban areas, followed by rural locales.

Trends among millennials, seniors and minorities suggest that demographics are in the exurbs' favor. The movement to these areas might be accelerated by their growing sophistication, as they build amenities long associated with older cities, such as town centers, good ethnic restaurants and shops, diverse religious institutions and cultural centers. At the same time, the

growth of home-based business — already larger than transit ridership in two-thirds of American metropolitan areas and growing much faster — increases the need for larger homes of the sort found most often in the outer rings.

Rather than regard these communities as outrages to the urban form, planners and developers need to appreciate that peripheral developments remain a necessary part of our evolving metropolitan areas. With a new generation looking for affordable homes, good schools and low crime, it seems logical that many will eventually leave core cities that offer none of the above. The future of exurbia is far from dead; it's barely begun.

End

California Demographic Futures

The Los Angeles Projections

The Generational Future of Los Angeles: Projections to 2030 and Comparisons to Recent Decades

USC Price

Sol Price School of Public Policy

Dowell Myers
John Pitkin

March 2013

Suggested citation

Dowell Myers and John Pitkin. 2013. The Generational Future of Los Angeles: Projections to 2030 and Comparisons to Recent Decades. Produced by the Population Dynamics Research Group, Sol Price School of Public Policy, University of Southern California. Text and supporting materials are published at: http://www.usc.edu/schools/price/research/popdynamics

A short descriptive title for the projection series is:
Pitkin-Myers 2012 Los Angeles Generational Projections.

About the Projections

The first projection report in the series on California Demographic Futures was issued in 2001, followed by a second in 2005. Additional generational projections that follow this general model have been prepared for the United States and selected subareas of California. This specialized program of research is conducted through the USC Population Dynamics Research Group. A number of reports and supporting special studies carried out in preparation for the post-2010 census series of projections can be found on the project website: http://www.usc.edu/schools/price/futures

About the Authors

Dowell Myers, professor of policy, planning, and demography in the USC Price School of Public Policy, is director of the Population Dynamics Research Group. He is author of the books Analysis with Local Census Data and also Immigrants and Boomers: Forging a New Social Contract for the Future of America.

John Pitkin, demographer, is a senior research associate in the Population Dynamics Research Group of the USC Price School of Public Policy. He also is President of Analysis and Forecasting, Inc., located in Cambridge, Mass. He is the principal designer of the population projection models.

Acknowledgements

The research underlying this report on the Los Angeles population projections was conducted with principal sponsorship by First 5 LA. Additional background research was supported by the Haynes Foundation, and report production and dissemination was assisted by the USC Price School of Public Policy. The authors gratefully acknowledge these organizations for their generous support. Michelle Decker provided outstanding research assistance and managed the report production. Additional contributors were Ying Mao, Susie Choi, and Sarah Mawhorter.

The Generational Future of Los Angeles: Projections to 2030 and Comparisons to Recent Decades

Executive Summary

Authors

Dowell Myers, John Pitkin

Sponsors

First 5 Los Angeles

Haynes Foundation

March 2013

USC Price

Sol Price School of Public Policy

This report reveals a dramatic generational change in the Los Angeles population. Comparing the last 20 years to the next 20 years, sweeping changes are found on many fronts. Explicit comparison to past decades highlights the magnitude of transition now under way. These include major changes in the immigrant origins of the population and rapidly slowing rates of racial and ethnic change. Of greatest importance are changes in the age mix of the residents, including shrinking numbers of children and dramatically higher numbers of seniors.

These demographic changes reverse some long-established trends and overturn old assumptions about Los Angeles and its residents. The reversals have already begun and can be observed in census data of 2010. But they are best understood when viewed over both a 20-year historical and 20-year future horizon.

Foresight on the current decade and coming years is drawn from detailed demographic projections newly developed after the 2010 census and presented in this report. The new Pitkin-Myers 2012 Generational Projections for Los Angeles are benchmarked to related projections completed in 2012 for California as a whole. This projection series, under development for more than a decade, includes details about immigrants and residents born in California that are not reported in other projections.

Ten major findings emerge from the 2012 Los Angeles generational projections. They reflect population dynamics whose changes may be surprising and which have very consequential impacts. (All data are for the greater Los Angeles population that resides in Los Angeles county.)

1. Continuing Low Population Growth. Much slower population growth is foreseen in these projections than was expected in the early 2000s. In fact, we now expect total population growth in each of the coming decades to resemble what was experienced in 4 of the last 5 census decades. The lone exception of high growth in the 1980s is increasingly viewed as an anomaly that has confused many observers about what is normal for a county as large and fully settled as Los Angeles.

2. Declining Number of Children. From 1990 to 2000, the number of children under age 10 had grown by 11.4%, but after 2000 the numbers of children turned steeply downward, falling 16.9% by 2010. The projection for the current decade is a further decline of 14.6% by 2020, with only a small further decline (4.0%) by 2030. Birth data show this decline commenced well prior to the onset of the recession in 2007, and in fact births in Los Angeles county in 2011 are fully 35% lower than in their peak year of 1990.

3. Annual Flow of New Immigrants is Plunging. Whereas the flow of new immigrants into Los Angeles soared upward in the 1970s and 80s, peaking in 1990 with a volume that is 234% higher than in 1970, after 1990 the inflow began to turn downward. In the last

decade the immigrant inflow has plunged to a level that is only 61% higher than in 1970. This drop-off has been much steeper in Los Angeles than in the whole of California.

4. Foreign-Born Peaked or Declining. What most distinguishes the Pitkin-Myers 2012 Generational Projections is the rich detail added about the immigrant or California-born origins of the population. The total foreign-born share of the Los Angeles population peaked at 36.2% in 2000 and is expected to remain stabilized at that level or slightly lower through 2030. This closely mirrors the trend foreseen for the whole of California. The expectation in earlier decades had been for a much larger foreign-born share in the population, although the 2001 edition of the Pitkin-Myers projections projected a leveling off, as has since occurred.

5. Long-Settled Foreign-Born. At the same time that the foreign-born have ceased growing as a share of the Los Angeles population, relatively fewer are newcomers and many more of the foreign-born will be long settled (20 or more years of residence in the U.S.). The share of local residents who are long-settled is expected to rise in 2030 to 22.5% of all foreign-born, compared to 17.3% in 2010 and 5.9% in 1990. Conversely, the share of foreign-born who are arrived in only the last decade is expected to fall from 9.2% in 2010 to 6.1% in 2030 (compared to 17.2% in 1990). The highpoint for the share that are newcomers was reached in 1990.

6. Rise of the Immigrant Second Generation. Barely 5% of children in Los Angeles are foreign-born, and yet the majority of children (60%) have immigrant parents. Thus a new second generation is being raised in Los Angeles, accounting for 21.5% of the local residents in addition to the 36% who are first-generation immigrants.

7. Slower Racial and Ethnic Change. Given the reduced rate of immigration, lower fertility, and slower overall population growth, the pace of racial and ethnic change is rapidly slowing. The growth of the Latino population was extremely rapid in the 1980s, increasing its share of Los Angeles residents by 10.2 percentage points, but that rate of increase sharply decelerated after 1990, so that the Latino share of the total population only rose 6.8 percentage points in the 1990s and even less, 3.2 percentage points, in the 2000s. Nonetheless, Latinos are still destined to achieve a majority of the county's population, but that date has been substantially delayed from what might have been expected back in 1990. Los Angeles will continue in a prolonged period of racial balance when all groups are minorities.

8. A Soaring Senior Ratio. At the same time as children are declining in number, the ranks of those aged 65 and older are growing dramatically after 2011 when the baby boomers began aging past 65. Growth in the number of seniors in the coming 20 years amounts to 867 thousand in Los Angeles county, quadruple the growth in the previous 20 years (212 thousand). Meanwhile, with the ranks of young adults depleted by shrinking numbers of grown children, the ratio between seniors ages 65 and older and adults in prime working ages (25 to 64), is expected to rise dramatically. After remaining virtually constant in Los Angeles for 30 years at 18 or 19 seniors per 100 working age, the ratio is projected to soar from 18.7 in 2000 to 26.2 in 2020 and 36.4 by 2030. The senior ratio doubles in Los Angeles by 2030.

9. The Homegrown Revolution. The number of residents who are native-Californians is rising, as opposed to residents born in other states or immigrants from outside the U.S. These homegrown sons and daughters are already a majority of residents age 20 or younger and they are projected to play a rapidly growing majority role in the future of Los Angeles and California. That future will depend on children who are being raised here today, a smaller group than before, and a group that is the product of our state's education system.

10. A Rising Index of Children's Importance. Children already have taken on a dramatically increased importance, due to their fewer numbers relative to the greater social and economic burdens they will carry as adults. The Index of Children's Importance began to rise for children born in Los Angeles after 1985 (children who reached age 25 in 2010), for whom the Index stood at 1.00. When new children are born in 2015, the Index is expected to have reached 2.20, indicating that these children will carry twice the social and economic responsibility when they are grown as did children born before 1985.

The overarching conclusion reached in this study is that the 10 major dynamics of change require dramatic rethinking of old assumptions about Los Angeles. Through these data trends we come to

realize how greatly the generations depend on one another, and especially how much more Los Angeles will depend on its smaller number of grown children to replace the aging baby boomers. The boomers are beginning to retire from the most productive period of their lives, creating enormous replacement needs in the workforce, among the taxpayers, and in the housing market. The data presented here provide foresight on the epic transition ahead that deserves to be broadly shared. The future of the city, region and state will depend on how well we manage the inter-generational partnership that is so greatly magnified.

1 Introduction and Overview: New Data for Los Angeles

This report describes the changing people of greater Los Angeles, looking forward 20 years from 2010 to 2030, and comparing that to the decades before. New information is summarized from the census and from our recently completed projections of population change, the Pitkin-Myers LA 2012 Generational Projections. The new trends suggest a major change is required in how we should think about the people of Los Angeles. Throughout this report, "Los Angeles" refers to the broad realm of Los Angeles county and its nearly 10 million residents.

Much of the current thinking about Los Angeles follows from the dramatic changes in earlier decades, centering on the explosive growth of the 1980s, which included a large influx of immigrants and rapid ethnic change. Local governments were hard-pressed to keep up, and both scholars and critics decried the emergence of great disparities in wealth and growing racial divisions. Inequality persists in Los Angeles today but its form has changed. And looking ahead, we foresee new and greater challenges ahead, more between generations than between races.[1]

Today, at the beginning of 2013, we stand at a moment of historic change that is overturning many longstanding perceptions about Los Angeles and its problems. The boom period that peaked in the 1980s created a lasting impression about the nature of Los Angeles as a place with a great many newcomers, but now as a place being transformed by immigration and full of children and young adults who were ethnically different. The older residents were especially reluctant to pay the higher taxes required to support their growth.

That was the Los Angeles of the late-twentieth century, but how well do those trends describe our current decade?

Today we have entered a new era that is revolutionizing our assumptions and expectations about immigrants—there are many fewer new arrivals and many more who are long settled. Today, our outlook on the generations in Los Angeles also is in revolution—the numbers of children are declining and those of the elderly are multiplying. Even the notions of rootedness and belonging in Los Angeles are being transformed. Our city has shifted from a place of transplants to a home where the majority are native Californians, a new homegrown generation on which the future will rest. What is revolutionary is not the change in behavior, because the city, region and whole of California have steadily entered this new era of demographic maturity.[2] What is new is the change in outlook that may be triggered by this radical demographic realignment.

The review of past and future trends offered in these pages identifies 10 major findings, as summarized in the Executive Summary. But all these can be described as elements of the growing demographic maturity of Los Angeles, characterized by a pervasive slowdown in population growth and ethnic change. Three specific, major transformations are reshaping the population for the future. First is the surprising downturn in immigration toward many fewer new arrivals and a steady upturn in the foreign-born presence made up of long-settled residents. Second is a multifaceted generational transformation, including changes among both young and old. And third is a homegrown revolution that increases urgency and the sense of responsibility and dependence.

Certainly these major transformations create new problems, even as they solve old ones, but they also yield new opportunities, even as they pose new challenges. What is essential is that we grasp the scope of the change, so that we might gain the greatest advantage for building a better city and a better future for all the residents.

New Trends and New Challenges

The surest sign of the growing maturity of greater Los Angeles is that children are a declining presence. Their numbers are shrinking even more rapidly than they are statewide. Children may not be disappearing, but after decades of rapid growth it is jolting to see their numbers in such decline. Whereas before we may have taken for granted an ample supply of children who would grow up to be our future workers, taxpayers, and consumers, today we face the prospect of a shortage that could make the local economy much less attractive to business.

A second alarming change—a burgeoning elderly population—underscores the urgency of the children shortage. Dramatic increases in the senior population began when the first of the massive Baby Boom generation reached age 65 in 2011. The ratio of seniors to working age residents has held constant for nearly 40 years, but now it is slated to nearly double and continue to grow larger when today's children reach their adult years.

Yet another trend deplored by some is that Los Angeles is drawing much less migration from other states and nations than it once did. This decline in newcomers is said to reflect the lowered attractions of Los Angeles, and it implies that residents hold a position in a diminished asset. The new arrivals also keep us young, and without them we have aged. Without them our city has fewer new workers and fewer potential parents to raise a new generation. Previously, when migration was booming, we disparaged newcomers for crowding our lives and raising our cost of living. Now that growth has subsided we wish it were back.

Certainly the scarcity of children is not unique to LA, even if it may be more extreme here than in most other places. The number of babies is declining statewide, nationwide, and even more rapidly in other parts of the globe. Only part of the downturn is attributable to falling birth rates. A larger portion of the downturn is due simply to a declining number of young women in the prime ages for childbearing. The slowdown in immigration and the maturing of the baby bust generation that followed the baby boomers have both reduced the number of potential parents. Now that the children of the baby boomers, the baby boom"echo"(who also are called the millennial generation), are coming of age, the number of potential parents is increasing. If they are willing and able to take on the responsibilities of parenthood, and if parenting lifestyles are made easier in Los Angeles, it is possible that the population of children will rebound.

Here lies another trend that could prove even more challenging. For its continued economic success, Los Angeles is going to have to make the most of all its children, with no one ever again allowed to drop out of school, and with all the youth trained to their maximum capabilities. In the new state of demographic maturity, the challenge for Los Angeles is that the majority of growth in workers, taxpayers and home buyers will be coming from within, by virtue of children who are born here and who we have raised in our own schools and communities.

This homegrown revolution is changing the political and economic calculus in the entire state. Historically in this land of the Gold Rush, the majority of residents have always been transplants from afar. A statewide majority of native Californians emerged for the first time only in the last decade. Today we find that Los Angeles county is also on the threshold of joining this homegrown majority. Los Angeles can no longer be so reliant on new residents imported from other states and nations. Instead, the greater Los Angeles area is becoming increasingly dependent on its homegrown workforce. Policy makers and the voter-taxpayers have yet to recognize the implications: Nurturing the next generation is now a matter of urgent necessity.

The New Generational Projections for Los Angeles

A close examination of the trends, past and future, has rarely been so necessary or revealing. All of the trends that shape the future were already visible by

2010. Yet it is difficult to fully appreciate emerging trends until we see them played out over a period of decades and contrast those changes to earlier decades. In this regard, population projections can help us see and understand our situation much more clearly.

Population projections may seem to some like dry statistics needed to estimate the total population at future dates. But those projections also contain details of age, race and sex, revealing changes that contain a lot of drama in many places. Our study of Los Angeles, defined broadly as the county, is made even more relevant by additional rich detail revealed in the Pitkin-Myers 2012 Generational Projections for Los Angeles. This new edition of projections is an extension of a series on California's demographic future, first initiated in 1999, and publically tested against the results of two censuses with considerable success.[3]

Crucial elements added by the Pitkin-Myers series of projections are not reported by the standard method of population projections used by the Census Bureau, the State of California Department of Finance, and other demographers. Whereas standard population projections are restricted to age, sex, and race or Hispanic origin, the Pitkin-Myers projections also break out population groups based on immigrant generation—foreign-born, the second generation (children of immigrants), and the third or higher generation (native-born whose grandparents or distant ancestors were immigrants). These demographic categories have rich significance and they are especially meaningful in a place as diverse as Los Angeles.

The new Los Angeles projections provide other details that may also prove meaningful. For the native-born, we can distinguish those born in California from those born in other states. Neglected by other population researchers, the native Californians have added policy significance. These homegrown, native sons and daughters of California, when grown to adults in future years, will be the products of California, of our schools, and of our communities and local cultures. Native Californians are more locally rooted, bound in networks of parents, siblings, and school friends, and they are less likely to migrate away from the state.

Further, the new Los Angeles projections include added details about the foreign-born. They detail the future population by decade of arrival in the U.S. With these data it is possible, for example, to distinguish within the growing Latino population, how many are recently arrived immigrants or longer-settled immigrants, how many are native Californians and how many are other U.S. born. Additional explanation about the model and assumptions used to make the new projections can be found in the report prepared on the statewide California projections.[4]

We juxtapose the projections with trends recorded by census data for past decades to draw vividly detailed portraits of past and future changes in the people of Los Angeles. Recent changes are substantially different from what is remembered from 1990, and the changes foreseen in coming decades are even more striking. Many of the changes summarized in following sections are extraordinary, almost a complete reversal of the recent past.

The new projections and their comparisons with the past provide a vital antidote to the limitations of presentism. Our human consciousness and all our judgments reside in the present. Too easily we focus on present-day differences, to the neglect of changes that are evident in the life of every family. The new data on normal life changes over time helps us to craft a narrative that links the children of one decade to the young adults 20 years later. Those who were once dependent grow up and enter their most productive adult years. In turn, those who were once fully employed and major taxpayers, rotate to a new position as retirees, enjoying their pensions and other earned entitlements. Although the projections cannot trace individuals over time, they do estimate the future of groups, and by comparing these changes to what has occurred before we can learn much about the new realities of Los Angeles.

The State of California Department of Finance (DOF) has newly released its own set of projections for the state and all its counties, a very substantial revision from the last series they released in 2007. Although these have limited content coverage, the DOF projections are very professionally executed and they are the official projections for state policy making. In portions of the analysis that follow, we will compare the overall growth projections issued by the DOF and also make use of some of the age data they provide for future dates.

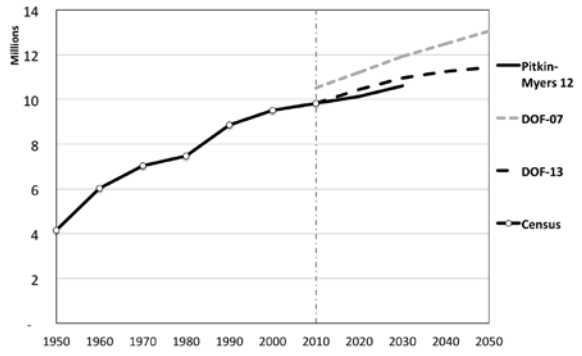
In sections that follow, we first describe how much the population growth and ethnic change have slowed in Los Angeles. After that we examine the declining numbers of children and explore the homegrown

revolution that is making the majority of residents native Californians. Next we delve into the changing nature of the foreign-born in Los Angeles—fewer new arrivals and more longer-settled, also older in age. Finally we consider how the surging senior ratio implies new importance for today's children. The conclusion takes up the meaning of Los Angeles's maturing population and its implications for setting policy priorities.

2 Slowing Population Growth & Ethnic Change

Population growth and change in Los Angeles has been inconsistent over the decades, proceeding by fits and starts. Decades of slow growth have been followed by decades of high growth, and vice versa. This has proven a major challenge to demographic forecasts, as shown in Exhibit 1. The mounting poplation total in Los Angeles county since 1950 serves as the base for a series of alternative projections, one prepared in 2007 by the State of California Department of Finance (DOF), their revised projection issued in January 2013, and the Pitkin-Myers 2012 LA Generational Projections. As can be seen, the 2007 projections foresaw much higher population growth than justified after 2000. In fact, the 2010 census count for Los Angeles county was well below what had been projected just three years earlier. The census count of 9,818,605 was only 299,267 higher than the census in 2000. In contrast, the DOF had expected a 2010 population with three times the growth (995,325) in the decade just completed.[5] Accordingly, the DOF issued new projections in 2013 that revised their projections substantially downward.[6] These new projections are still higher than what is foreseen in the Pitkin-Myers 2012 projections.

Exhibit 1 LA County population projections, 1950 to 2050



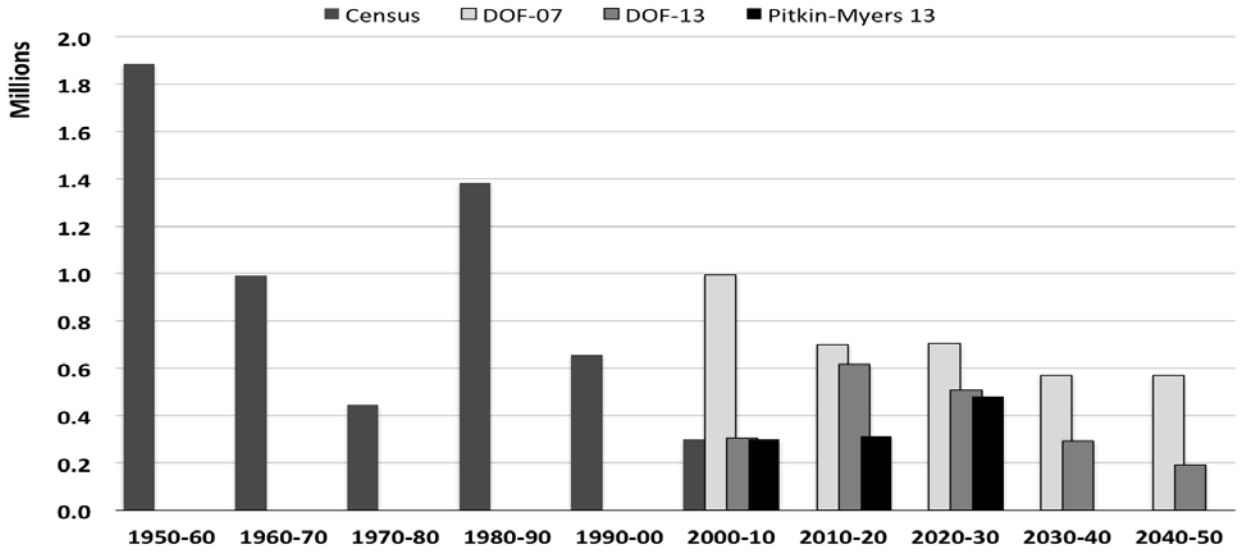
Source: US Census Bureau, CA Department of Finance, Pitkin-Myers LA 2012 Generational Projections

The outcome of greatest interest to businesses, government, and citizens alike is projected population growth, which has been extraordinarily volatile over the decades, with rapid increases in some decades and slow increases in others (see Exhibit 2). Growth of 1.9 million in the 1950s fell by half in each of the next two decades, falling to 993 thousand and then 445 thousand, before rebounding to 1.4 million growth in the 1980s. Thereafter, population growth plunged again, falling to 656 thousand and then 299 thousand. In fact, the extraordinary growth of the 1980s stands out as a single anomaly in the last 5 decades, although it often seems that some observers cling to that decade's boom as a wishful standard to be repeated. What now should be expected, realistically, for coming decades?

The projections revised by the DOF in 2013 make a sharp correction compared to their 2007 series for the decade just completed, but the revised projections then continue through 2030 at much the same growth rate as in the 2007 projections. In contrast, the new Pitkin-Myers projections foresee continued slow growth until 2030, the end date for this series of projections.

This slower rate of population growth results from many factors, including principally lower birth rates and reduced migration to Los Angeles, as described

Exhibit 2 Recorded and expected growth each decade

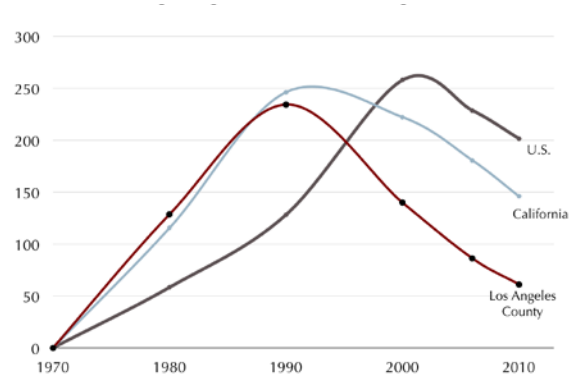


Source: US Census Bureau, California Department of Finance, Pitkin Myers LA 2012 Generational Projections

in the explanation of the Pitkin-Myers projections.[7] More than just a reduced total population, the slower growth also contributes to other important demographic changes, all of which were already visible by 2010 and will continue or intensify in coming decades. These changes include rapid aging of the overall population, much reduced immigration into Los Angeles county, greater reliance on homegrown members of the population, and also slower rates of racial and ethnic change.

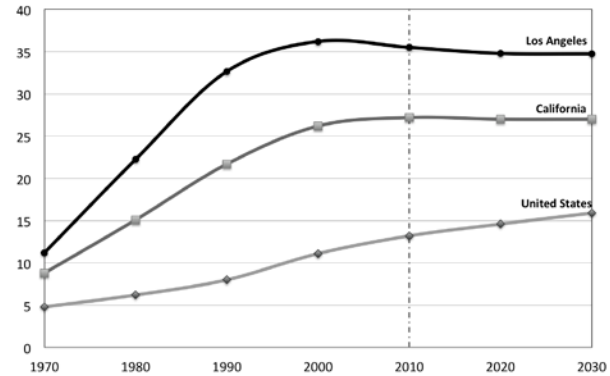
Reduced immigration. The slowing pace of immigration to Los Angeles deserves special attention. Immigration was a major driver of the rapid population growth of the 1980s, but it has slowed markedly in recent years. In fact, immigration has dropped off more rapidly in Los Angeles county than in the whole of California, and more than in the whole of the United States. Exhibit 3 traces the expanding and shrinking flow of new immigrant arrivals, comparing the rate of newcomers each year to the rate observed in 1970. The increase in the nation as a whole was much delayed behind the rise in Los Angeles and California, peaking in 2000 and falling thereafter. In Los Angeles, the peak rate of inflow was achieved by 1990, dropping markedly thereafter. In fact, by 2010,

Exhibit 3 Percentage Change Since 1970 in Annual Immigrant Arrivals



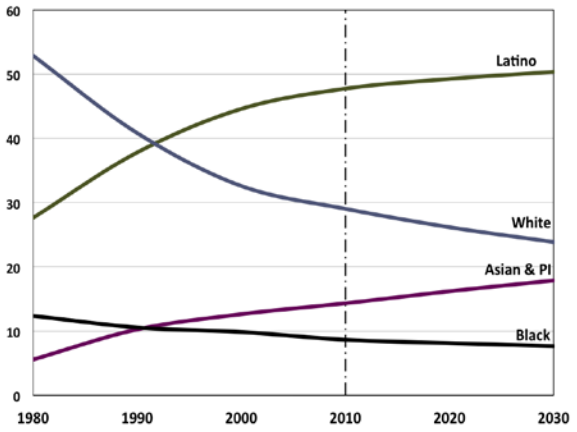
Source: U.S. Census, 1970, 1980, 1990, 2000; American Community Survey, 2006, 2010

Exhibit 4 Percent Foreign Born from 1970-2030



Source: US Census Bureau; Pitkin-Myers Generational Projections for LA, California, and US

Exhibit 5 Racial Composition of Los Angeles Residents



Source: US Census Bureau, Pitkin-Myers LA 2012 Generational Projections

the estimated rate of inflow by new immigrants had fallen back to a level last seen in Los Angeles in the mid-1970s.

Fewer foreign-born residents. As a result of the slowing rate of immigrant arrivals, the total share of the population that is foreign born has stopped rising and may even be declining in Los Angeles. This trend is displayed in Exhibit 4, showing that the foreign born share peaked in 2000 at 36.2% of the population in Los Angeles county. The Los Angeles trend closely matches that for California, while the foreign born share in the United States continues to rise from a much lower level.

Reduced ethnic change. Another consequence of the slowing population growth, and of the slower pace of immigration, is much reduced racial and ethnic change in Los Angeles. During the 1980s, rapid changes in racial/ethnic shares of the total population were witnessed, but those slowed in the 1990s, and slowed even more in the 2000s (Exhibit 5). In particular, the growth of the Latino population was extremely rapid in the 1980s, increasing its share of Los Angeles residents by 10.2 percentage points, but that rate of increase sharply decelerated after 1990, so that the Latino share of the total population only rose 6.8 percentage points in the 1990s and even less, 3.2 percentage points, in the 2000s. Growth in the Latino share tapers even further in coming decades, rising only 2 percentage points per decade.

Latinos are still destined to achieve a majority of the county's population, but that date has been substantially delayed from what might have been expected after the rapid growth and change of earlier decades. A similar slowdown in rates of change are observed in Exhibit 5 for every race and ethnic group.[8] The slowdown has already occurred and is projected to continue in the next two decades. Simply stated, Los Angeles is continuing in a period of prolonged racial balance when all groups are minorities.

Next we address the declining population of children, which heightens their expected future importance to the region's economy and communities when they are adults.

3 Declining Numbers of Children

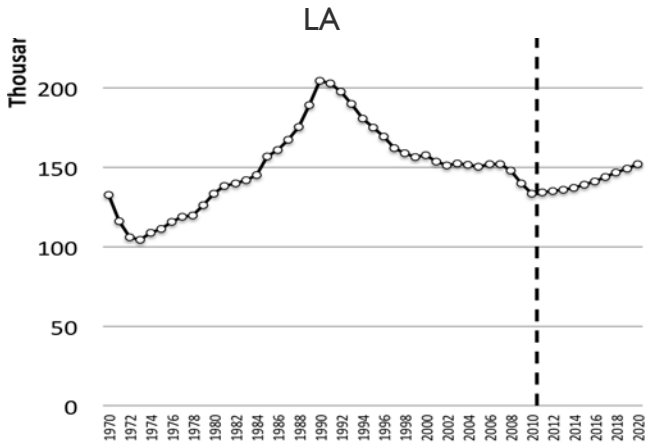
Evolving changes for age groups living in Los Angeles could be even more consequential than the slowdown in growth and ethnic change. The decline in the children's population is the greatest social and economic impact related to slower growth. The number of births has declined since 1990, with the number of children of all ages peaking around 2000. Thereafter the total number of children has declined and their share of the population is expected to continue falling through 2030 or beyond. Later in this section we compare the lagging growth in children to the swelling numbers in each of the older age groups.

One-third Fewer Births

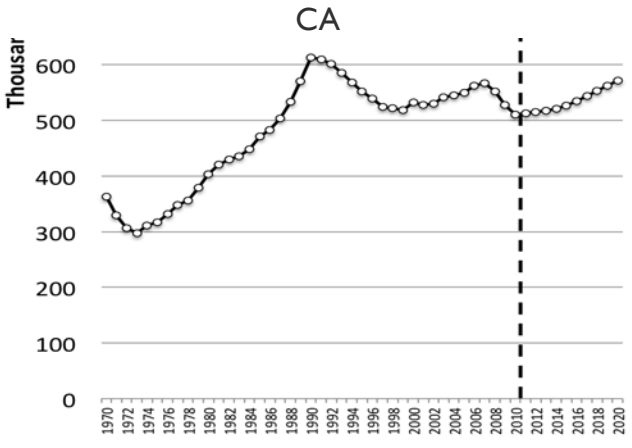
One view of the declining number of children is provided through a count of births delivered in Los Angeles county, compared here to births in California over the same time span, 1970 to 2020 (see Exhibit 6).[9] The number of babies born in Los Angeles roughly doubled in number between 1970 and 1990, peaking that year at 204 thousand. Local residents had grown accustomed to a steady increase in the number of children born and their burgeoning demand for new schools and other services. It may have been natural to assume this growth trend would continue, but it sharply reversed after 1990.

By 2010, the number of births had fallen to 133 thousand, 35% lower than at the peak. The drop off escalated after 2006 due to the recession effects, but the California Department of Finance does not project substantial recovery by 2020. Births in California also peaked in 1990, but the subsequent decline was not as deep as in Los Angeles. The cumulative effect after so many years of low births is a reduced number

Exhibit 6 Annual Births in Los Angeles County and California, 1970-2020



Source: CA Department of Finance



Source: CA Department of Finance

Exhibit 7 Nativity of Parents and Children, 2011

	Los Angeles Co.	California	U.S.
Children percent foreign born	5.9	5.4	3.5
Parents percent foreign born	59.5	49.6	24.3
Percent of children who are native born and with foreign born parents	53.8	44.4	21.2

Source: 2011 American Community Survey

of children of all ages, because the losses incurred at young ages steadily work their way into teen years. The loss of children is a direct product of two demographic factors. First is the declining birth rate in every ethnic group, defined as the ratio of children born per woman of each age. This decline has been very gradual, but it takes on added impact when the lower per capita rates of fertility are applied to smaller numbers of women in the key ages for having babies. That has been the second and more important factor in the declining number of children.

Since 1990 there have been fewer women in their 20s, due to the arrival of the "baby bust" generation (born after the baby boomers) in these prime ages for childbearing. In addition, as will be described in a later section, the number of newly arrived immigrant women also has been reduced, so that further depletion has been absorbed among potential mothers in their 20s. These two demographic factors may have been further aggravated by local economic conditions that discouraged young adults from raising families in Los Angeles. Those deterrents include the high rental and purchase costs of housing that have prevailed since the late 1990s, together with high unemployment rates that prevailed in the early 1990s and late 2000s. However, those factors are beyond the scope for consideration in this study.

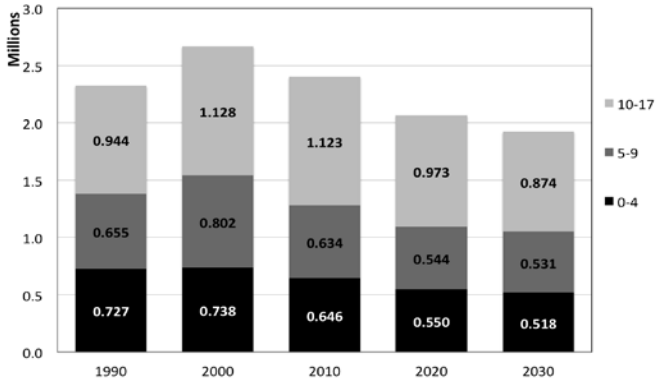
Nativity of Parents and Their Children

We note here that immigrant parents have been extremely important to maintaining a sustained population of children. The majority of children in Los Angeles as of 2011 have at least one parent who is foreign born (59.5%). That frequency is higher than in the whole of California (49.6%) and more than twice as high as in the nation as a whole (24.3%). At the same time, almost all these children with foreign-born parents are U.S.-born themselves (Exhibit 7). Thus we see that the children of Los Angeles are 94.1% native-born, even though 59.5% of all the children have foreign-born parents. A crucial discovery is that without the contributions of immigrant parents, the declining number of children in Los Angeles and California would be much more severe than it is.

Shrinking Numbers and Declining Share of Children

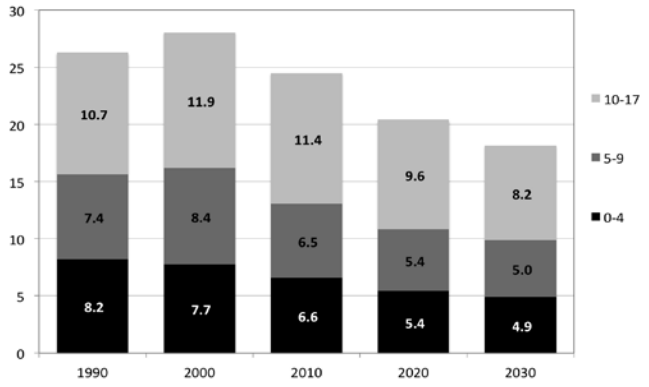
The 2010 census clearly revealed how much the number of children had declined. At that time, a total of 2,325,773 children under the age of 18 resided in Los Angeles, of which 646,145 were under age 5. From 1990 to 2000, the number of children had grown by 14.7%, but after 2000 the numbers of children turned steeply downward, falling by 10.0% for all children under age 18, declining by 12.4% for children under 5 and plunging by 21.0% among children ages 5-9. These absolute declines are summarized in Exhibit 8. The percentage share of the population that is comprised of children has declined even more than the absolute number, given that the total population has continued to grow while the number of

Exhibit 8 Declining Number of Children By Age Group (in millions)



Source: US Census Bureau, Pitkin-Myers LA 2012 Generational Projections

Exhibit 9 Declining Share of Children By Age Group In the Los Angeles Population



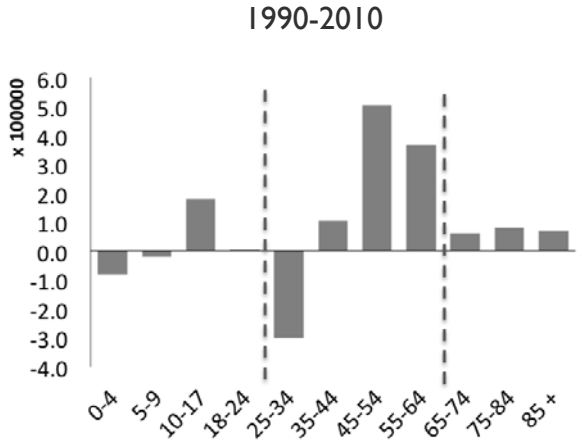
Source: US Census Bureau, Pitkin-Myers LA 2012 Generational Projections

children has declined in each age group (Exhibit 9). Projections are that the children's share will be only roughly two-thirds as large in 2030 as it was in 2000. The cumulative losses in each age group add up to a population share under age 18 in 2030 that is 10 percentage points lower than the 28% children's share of the total population in 2000.

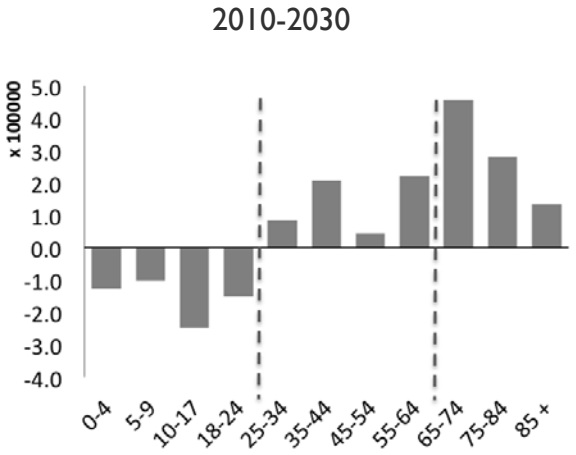
Reversals in Growth Trends in Specific Age Groups

What especially makes the decline in children stand out is that other age groups are swelling in number. The diminishing presence of children in the county's population is best seen in comparison to older age groups. Even more stark is the comparison of growth in each age group in the coming 20 years to growth observed in the preceding 20 years (Exhibit 10). The small declines in children that were already observed from 1990 to 2010 are now expected by the Pitkin-Myers projections to deepen to losses of nearly half a million (478 thousand) spread across all children's ages in the decades ahead. It should be acknowledged that these losses are greater than those foreseen in the recent projections prepared for Los Angeles county by the California Department of Finance. The most likely explanation for this difference is that

Exhibit 10 Growth in Age Groups, Last 20 Years versus Next 20 Years



Source: US Census Bueau, Pitkin-Myers LA 2012 Generational Projections



Source: US Census Bureau, Pitkin-Myers LA 2012 Generational Projections

the DOF projections address each ethnic group as a whole, while the Pitkin-Myers projections separate the immigrant and native-born components. [10] Of all the age groups younger than 35, only teenagers experienced any growth between 1990 and 2010, and, in fact, a deep decline of 300 thousand was registered among young adults ages 25-34. Looking ahead, we observe some recovery in the number of young adults who are potential parents, but the large decline of those ages 18 to 24 may be more disrupting. Compounding this weak growth in adults of parent ages, continued low birth rates will lead to a lower number of births than in 1990 or 2010.

The overwhelming feature of growth in Los Angeles over the coming 20 years will be losses of 630 thousand people under age 25, contrasted at the opposite end of the age spectrum by gains of 867 thousand elderly. This age imbalance will dominate all of the policy issues in Los Angeles for the coming decade and longer. Indeed, this problem will plague the state and nation as a whole. We return later to these concerns and a discussion of how children can be assisted to provide greater help.

4 The Senior Ratio and the New Importance of Children

The most direct indicator of the evolving new maturity of Los Angeles is the aging of its population. What was once in the early post-WWII era a youthful population of settlers from the Midwestern states and the west south central region (Texas, Oklahoma, and Louisiana) has now grown much older. Their early post-war children, comprising the baby boom generation, have also grown older and now are passing into their 60s. The immigrant newcomers of the 1970s, 80s, and 90s have also aged the longer they reside in California. Now that migration into Los Angeles has been reduced from all sources, fewer young adults are moving in to replace the thinning numbers of young adults.

Not only is the number of seniors now rapidly growing, but the children are declining in number. Thus we find that the importance of children is being magnified by their increasing scarcity. The growing population of retirees will depend on the grown children whose numbers are dwindling. Two indicators are described that help to highlight this long-term continuing shift in the relationship between older and younger generations older and younger generations.

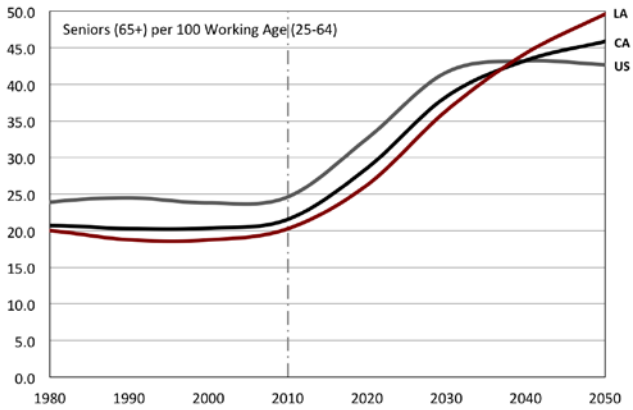
The "Senior Ratio"

The proportion of the Los Angeles county population that is comprised of people ages 65 and older, sometimes referred to as seniors, elders or elderly, is anticipated to nearly double from 9.7% in 2000 to 18.2% in 2030. The importance of this rising share is better captured by a ratio between elders and the working age adults who are the principal taxpayers, workers, and home buyers. The "senior ratio" is derived from a traditional demographic measure, a "dependency ratio," that contrasts the number of elders, ages 65 and older, with prime working age residents, assumed to be ages 25 to 64. Even though some people may be working before or after these ages, the ratio defined here better captures the main relationship between people of entitlement ages and their principal supporters.[11]

The crucial importance for our society and economy is this ratio between the number of seniors and the working age people who will support them in different ways, as replacement workers, taxpayers to fund pensions and health care, and as home buyers that support the value of seniors' homes.[12] More significant may be the fact that the ratio is now rising after many decades of remaining at a relatively constant level. For lack of experience with such a top-heavy age structure, there is a serious question whether society will be prepared to adjust as quickly as needed.

The long-expected rapid increase in elderly has finally commenced. As displayed here for Los Angeles county, all of California, and the whole of the United

Exhibit 11 The Rising Senior Ratio



Source: US Census Bureau, Department of Finance 2013 Projections, Pitkin-Myers LA 2012 Generational Projections

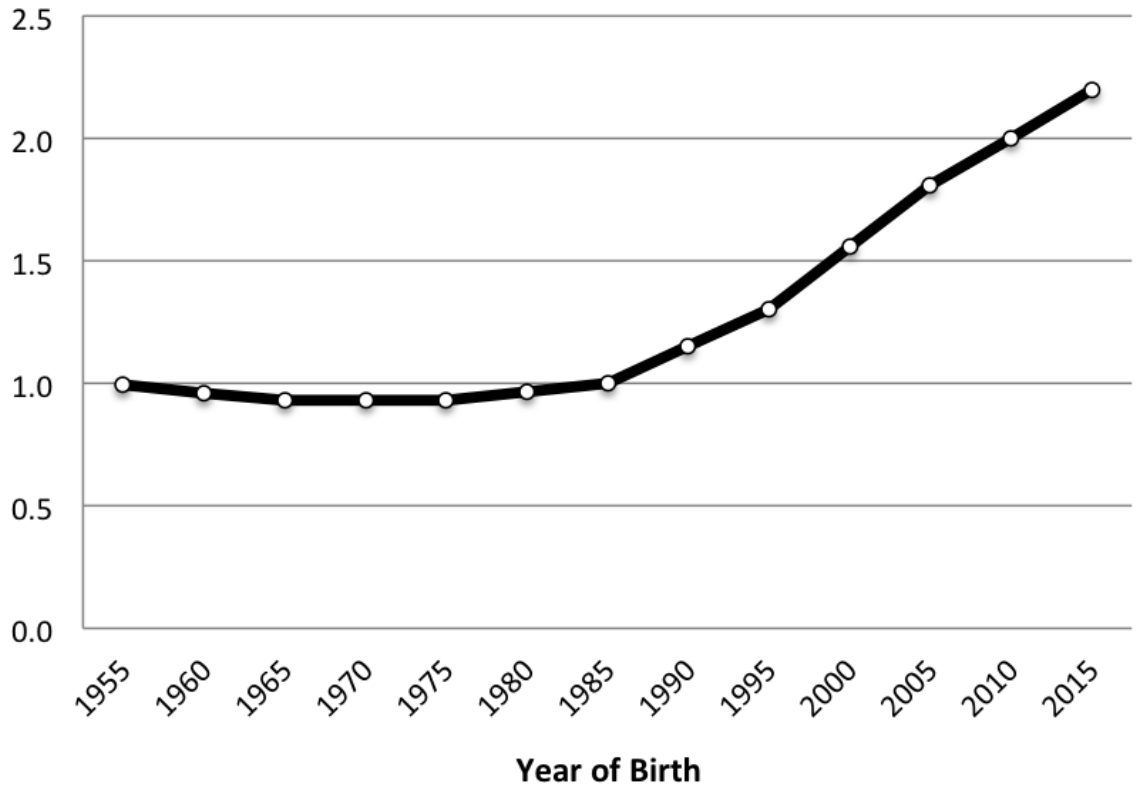
States, the senior ratio is now beginning to escalate because the baby boomers (oldest born in 1946) began to reach age 65 in 2011 (Exhibit 11). Because the presence of the baby boom generation is so pervasive, similar changes are underway nationwide. In California, what had been 20.4 seniors per 100 working-age residents in 2000 is projected to climb to 28.6 in 2020 and then to 38.3 in 2030. Los Angeles had a somewhat lower ratio, only 18.7 in 2000, but this also will climb steeply to 26.2 in 2020 and 36.4 by 2030. In California the senior ratio increases by more three-quarters from 2000 to 2030, and in Los Angeles the senior ratio nearly doubles.[13]

The three-quarters increase in the senior ratio by 2030 reflects the rising burdens of elderly needs placed on working age residents. This includes support for the old-age "entitlements" of pensions, Social Security, and Medicare, as well as the rising need to find adequate replacement workers for retirees. The old-age burden also includes the need to find young home buyers who can offer good prices to a rising number of older sellers. Given that older people have stored much of their wealth and retirement savings in their home equity, a substantial threat is posed by the swelling ratio of potential older sellers relative to the smaller ranks of potential home buyers. A lot is riding on the shoulders and wallets of the new generation of young adults.

Measuring Children's Growing Importance

Today's declining number of children is thinning the ranks of future supporters for the giant retiring generation. As the senior ratio rises, the number of children grows more important. Even at birth, each child enters the world with some heavy expectations already waiting. The relative importance ascribed each child depends on the relative scarcity of their fellow children, a fact established by the number born

Exhibit 12 Index of Children's Importance in Los Angeles



Source: Authors' construction (see text)

in the same birth year, some 25 years before they will grow up to become supporters of the senior ratio. Thinking ahead to this future role, how can we best measure children's importance today?

The method developed for highlighting the statewide importance of children in California proves useful in Los Angeles as well.[14] Benchmarked on the birth year of 1985, marking children who would reach age 25 in 2010, when the senior ratio in Los Angeles county stood at 20.1 seniors per 100 working age, we can measure the growing importance of children by the proportionally higher senior ratio expected in future years when today's children come of age and also reach 25. The results calculated for the index are displayed in Exhibit 12. This Index of Children's Importance (iCi) shows that a child born in 2010 in Los Angeles (destined to reach age 25 in 2035) carries fully twice the importance (index of 2.20) of a child who was born in 1985 (index of 1.00) or earlier.[15]

The implication of this increased importance is that each child cannot escape carrying more of the load—a heavier per capita share—of supporting the growing number of seniors. This echoes a prescient observation made a quarter century ago by David Hayes-Bautista and associates at UCLA, who stressed that a burden of aging population, largely white, would be thrust upon the shoulders of youth who are largely Latino.[16] The new iCi measurement can be said to reflect that growing burden. The index also can be interpreted to represent the growing intensity of investment needed to enhance the skills and future productivity of each child so that he or she might carry this heavier economic load. In essence, we need to redouble our efforts to invest in the education of children of all ethnicities. None can be allowed to drop out of school and none can be afforded to be neglected. In a more general interpretation, the Index of Children's Importance also can be viewed as depicting the magnified importance of the intergenerational partnership linking children, adults of working age, and the seniors of entitlement age.

5 Homegrown Revolution: Changes in Place of Birth

Underscoring the fresh importance of making these investments in the next generation is that the majority of California's future workers will be homegrown, raised and educated in California. This was not always the case. Los Angeles area has always been a city of transplants, people who have decided to strike out for adventure in a new economy with better opportunities and in a place with less inclement weather and a more pleasant style. The whole of California has been a magnet for migrants from other states and nations ever since the days of the Gold Rush. The explosive growth of the population in the state and in Los Angeles during the 20th century was fueled by migration from outside.

Even though the number of children born in the state rose with the growing population, the great majority of the population, especially adults who were middle-aged and older, were born elsewhere. Over time, as Los Angeles has matured as a community, less of the growth has been from migration and more from children born to those previous migrants.

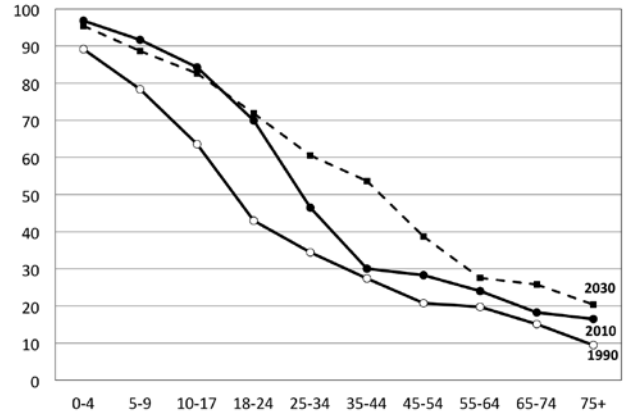
A homegrown transition is now underway. One of the clearest indicators of the new maturity of Los Angeles is found in the birthplace origins of residents in the census. Residents can be classified as California-born, born elsewhere in the U.S., or foreign born. In the last decade we have discovered that a majority of Californians are native sons and daughters, first reported by the USC Population Dynamics Research Group.[17] A subsequent study investigated the counties of Southern California, finding that all had crossed into homegrown majority status save Los Angeles. [18] We now anticipate that Los Angeles county will have advanced to majority homegrown status in the present year—2013.[19]

Importance of Homegrown or Out-of-State Status

The significance of native Californian or Angeleno status is many-fold. Certainly all who grow up in Los Angeles and experience life here from a young age can feel at home regardless of their parents' place of birth or origin. And those who migrate as young adults also grow deep attachments. However, the native Angelenos have deeper family roots, with parents and siblings also likely to share residence. They have networks of school friends and others with shared lifelong commitments. As evidence of their deeper attachments, statistical data show that the native Californians are one-third as likely to migrate out of state as are other U.S.-born residents.[20]

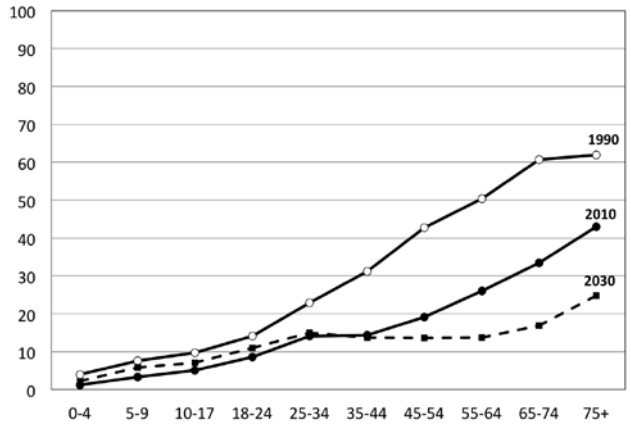
Homegrown residents carry a special political significance, first, because their development from birth is assisted by state taxpayers, through education and other services. Second, in return, when grown to adulthood the homegrown children will repay the taxpayers through future tax payments, repaying the public investment in higher education 4-to-1.[21] Living their full lives in the state, the homegrown not only are the major recipients of state and local tax dollars, but they also are destined to be the workers, taxpayers, and home buyers on whom all will rely. Indeed, Hans Johnson and colleagues at the

Exhibit 13 Percentage California Born by Age 1990, 2010, and 2030



Source: US Census Bureau, Pitkin-Myers LA 2012 Generational Projections

Exhibit 14 Percentage Other US Born, By Age, 1990, 2010, and 2030



Source: US Census Bureau, Pitkin-Myers LA 2012 Generational Projections

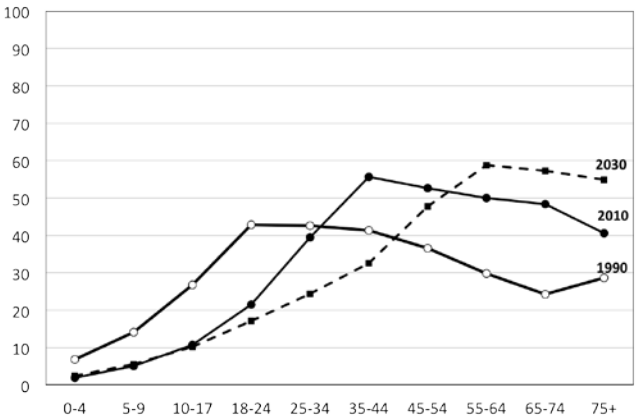
Public Policy Institute of California have concluded that California cannot import all the skilled workers that the state's economy will demand and that there is likely to be a one million shortfall in college educated workers unless education opportunities are expanded.[22]

Thus we can imagine how the homegrown revolution portends a new conception of self-reliance for a state that must increasingly depend on its own children. As the California population becomes more self-contained, we discover new responsibilities. Unlike before, the state now has to make it on its own, relying more on the people it already has in residence.[23]

Homegrown share of age groups. The share of the Los Angeles population that is homegrown, always high among children, has markedly increased among middle-aged and older residents. As shown in Exhibit 13, the homegrown share at age 25 to 34 has rapidly increased since 1990, rising from 34% to 46% in 2010, with 61% expected to be homegrown in 2030. Similar large increases are seen at older ages.

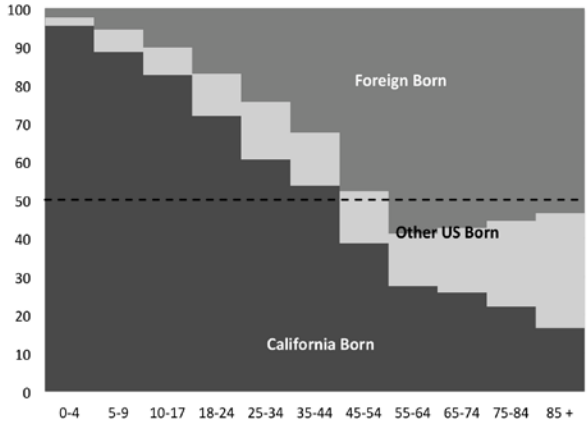
Share born in other states. Meanwhile the percentage of the population that was born in other parts of the U.S. and later migrated to California is plunging at older ages. In 1990, fully half (50%) of all residents in Los Angeles age 55 to 64 had migrated from some

Exhibit 15 Percentage Foreign Born by Age 1990, 2010, and 2030



Source: US Census Bureau, Pitkin-Myers LA 2012 Generational Projections

Exhibit 16 LA County Residents by Age Group & Birthplace, 2030



Source: Pitkin-Myers LA 2012 Generational Projections

other state. By 2010, this share had fallen to 26% and in 2030 we expect it could be only 14% (Exhibit 14). This remarkably low number is foretold by the equally low number 20 years earlier in the age group 20 years younger. That cohort already is composed of very few migrants from other states and, unless migration heats up in highly unusual ways at older ages, it is unlikely that many migrants will be added. In fact, the opposite is occurring. As the cohort grows older it is slowly losing members who are migrating out of California, likely back to states from which they came or where they have contacts from earlier in their lives.

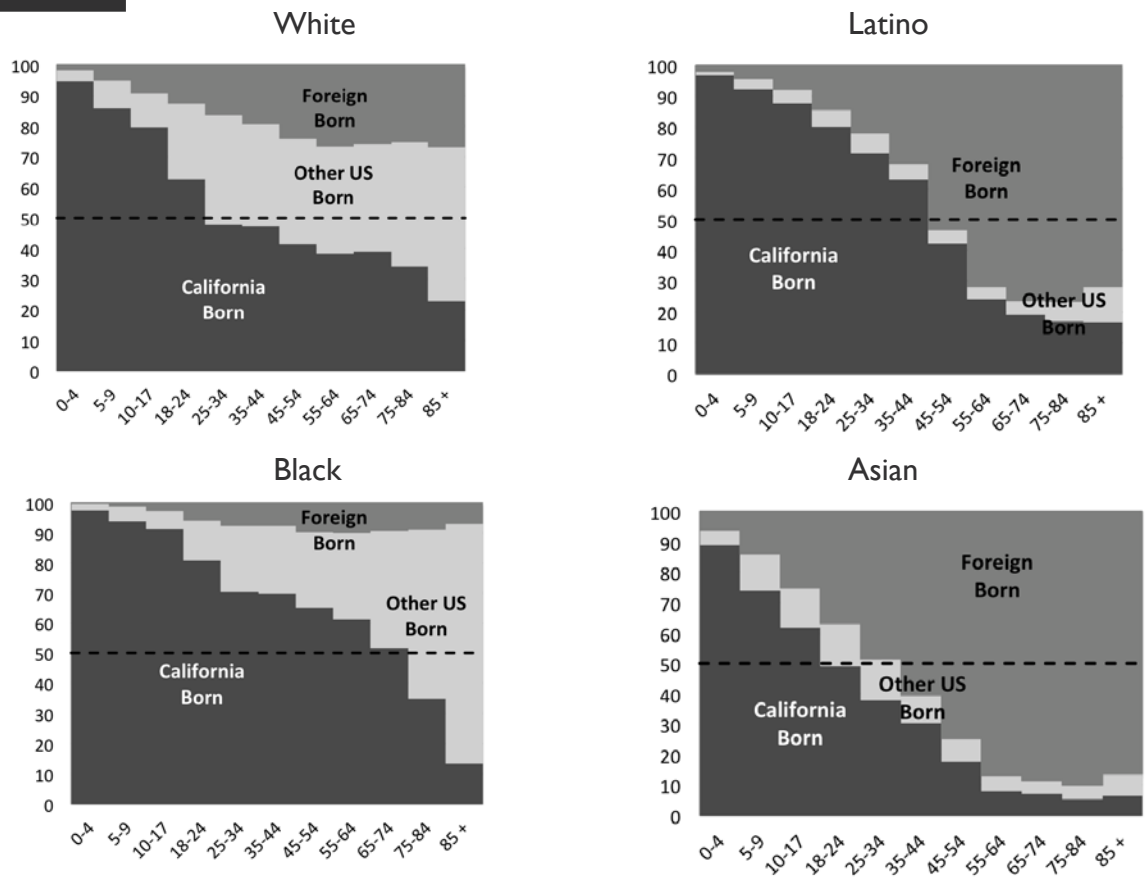
Foreign-born share of age groups. The changes among the foreign-born population are most dramatic and complex. The share of younger age groups that are composed of immigrants is falling (Exhibit 15). Leading up to 1990 the flow of immigrants reached its peak volume, mostly concentrated in ages 18 to 24 and 25 to 34. In 2020, the cohort formed by that peak flow was now aged 35 to 44 (with 56% foreign-born), and in 2030 it will be aged 55 to 64. As a result, the foreign born share is rising at older ages, such as 55 to 64, from 30% in 1990 to 50% in 2010, and 59% in 2030. But at young ages the foreign born share is shrinking, to be replaced by the growing homegrown generation, a majority of whom are the children of immigrants.

Combined Place-of-Birth Profiles of Age Groups

How this all stacks up in 2030 is presented in a combined profile (Exhibit 16). Within each age, the homegrown share is at the bottom, comprising more than half of all residents for the age groups under 45. The small segment displayed in the middle represents the other U.S.-born migrants, only appreciably large among residents over the age of 65. And the foreign-born residents are at the top, with the largest shares, all exceeding 50%, confined to ages older than 55.

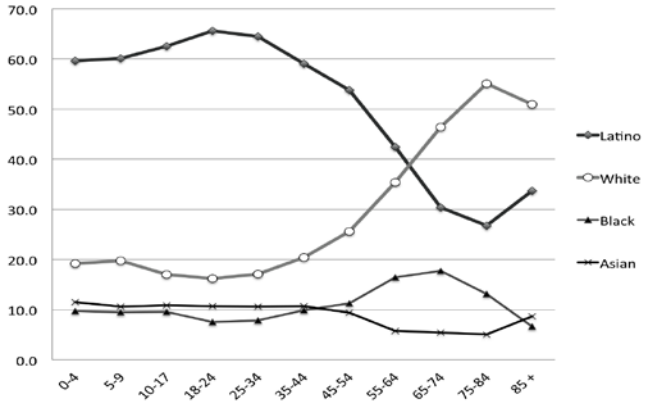
More intriguing may be how this age pattern of birthplace differs by race and Hispanic origin. Each of the major population groups in Los Angeles has a different migration history, which is imprinted in

Exhibit 17 Birthplace of Age Groups by Race and Hispanic Origin, 2030



Source: Pitkin-Myers LA 2012 Generational Projections

Exhibit 18 Ethnic Share of the Homegrown at Each Age, 2030



Source: Pitkin-Myers LA 2012 Generational Projections

their birthplace profile. Looking ahead to 2030, what can we expect to find? We choose this time point because it combines both the new patterns, visible among the young, and the earlier patterns, visible among the old.

Separate profiles of birthplace by age have been prepared for each race/ethnic group in Exhibit 17. Whites and blacks have very large shares that were born in other states, especially among older ages. Latinos and Asians have very large shares that are foreign born, also more concentrated at older ages. But the homegrown comprise the dominant share of younger ages among all race/ethnic groups. The native, California-born are the majority of all African-Americans younger than 75, among all Latinos younger than 45, among all whites younger than 25, and among all Asians younger than 18.

African-Americans. The outstanding feature of African-Americans is their high proportions homegrown, despite birth rates nearly as low as for whites. Black migration into Los Angeles and California is extremely low, dropping abruptly after 1980 and the end of the Great Migration from the south. Traces of the old migration are still visible in the high proportion of people born in other states among blacks older than 75 in 2030 (accordingly, people who in 1980 and earlier were in the prime migration ages of 20 to 35).

Whites. The reason that the homegrown are not more prominent among whites above age 25 is that Los Angeles is continuing to draw high migration among whites, largely from other states, but also including white foreign-born, such as Armenians, Iranians, and Canadians. In addition, the lower birth rates of whites means that they have not generated as many homegrown children in the past, so there are relatively fewer who would carry their homegrown status into middle age and beyond.

Asian & Pacific Islanders. Residents of Asian or Pacific Islander descent have an even smaller proportion homegrown among those over age 25, due to very high rates of immigration and also due to low birth rates in this country. And there are relatively few in-movers from other states. Instead, the foreign-born share of middle-aged Asians is extraordinarily high—at age 45-54, in 2010, 87.9%, with 74.7% still anticipated in 2030.

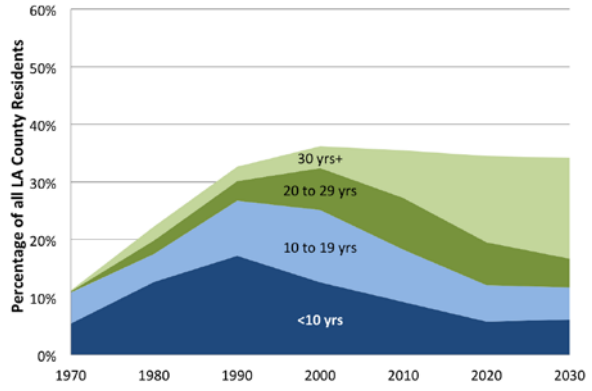
Latinos. The place of birth profile of Latinos is less migration heavy than for Asians and Pacific Islanders but much more so than for whites or blacks. And very few Latinos were born in other states. Instead, it is the homegrown share of Latinos that is growing very large, especially among younger adults.

Latinos, in fact, account for a very large share of the homegrown population in Los Angeles. This stems from the large size of the Latino population combined with their high propensity to be California-born (Exhibit 18). In 2030, 60% or more of native Californians at all ages under 35 are expected to be Latinos. Whites are more numerous at older ages and will comprise the majority of the homegrown in elderly age groups. At younger ages, whites are expected to account for just under 20% of the homegrown, while blacks and Asians each contribute about 10%.

6 A Longer Settled and Older Immigrant Population

The immigrant population of Los Angeles county is comprised of all residents who are foreign born (and not born to U.S. citizens abroad). Immigrants include all of the foreign born, whether or not they are citizens, legal permanent residents, or foreign-born with unauthorized residence status. The Los Angeles immigrant population grew tremendously for three decades and then leveled off at about 3.5 million after 2000. In 1970, only 788 thousand foreign-born individuals resided in Los Angeles county, but that number nearly quadrupled to 2,895 thousand (2.90 million) by 1990. As shown previously in Exhibit 3, the annual rate of immigrant inflow to Los Angeles surged to a peak in the late 1980s, more than 200% greater than in 1970, before the inflow of new arrivals plunged sharply in the 1990s. Nonetheless, the immigrant population still expanded slowly, reaching 3.45 million in 2000, after which it grew by only 40 thousand more, reaching 3.49 million in 2010.

Exhibit 19 All LA County Residents by Duration of Residence in US



Source: US Census Bureau, Pitkin-Myers LA 2012 Generational Projections

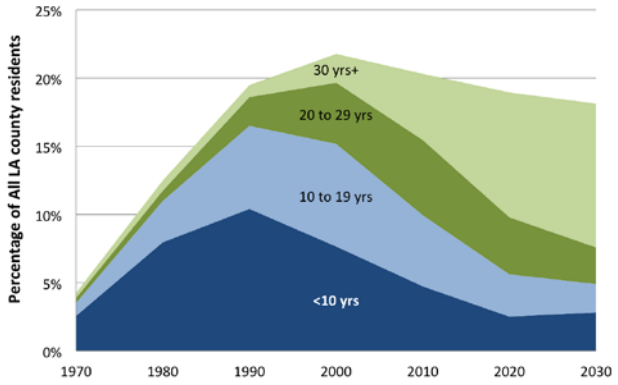
Looking ahead, we project the foreign-born population will slowly increase to 3.71 million by 2030. Of course, it needs to be emphasized that projections of immigrant arrivals in future decades are highly uncertain. Even if those projections are benchmarked to a consensus of expert opinion, there is still great uncertainty. Major immigration policy changes in the U.S. or unforeseen disruptions in source countries are two of the many factors that could cause expansion or reduction of immigration flows. What is more certain is the aging of immigrants who are already resident in Los Angeles, and most of the future population of foreign-born is composed of those who have already arrived.

Immigrant Shares of the Los Angeles Population

Not all immigrants arrive in the same year, and at any point in time the foreign-born population is a composite of new arrivals and longer-settled residents, as shown in Exhibit 19. The most effective way to understand the prominence of immigrants in Los Angeles is as a percentage of all the local residents. The total foreign-born share of the population peaked at 36.2% in 2000, but the share of all Los Angeles residents who were recently arrived (within the last 10 years) peaked a decade sooner, with 17.2% of county residents. In 1990, 1-in-6 residents of Los Angeles was a new immigrant, an extraordinarily high ratio.

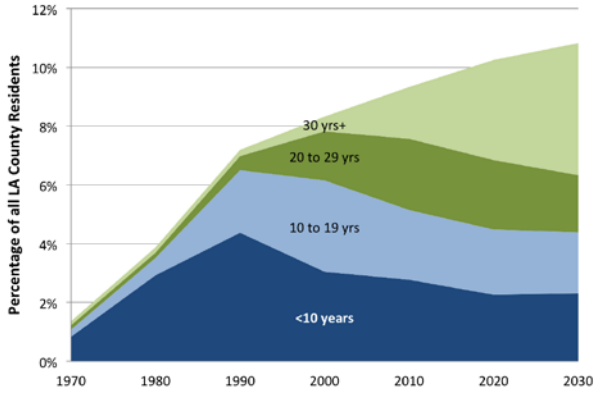
The subsequent slowdown in immigrant arrivals meant that, by 2010, the new immigrant share of the county's total residents had fallen to 9.2%, little more than half of the 1990 peak share. Instead, what was

Exhibit 20 Latino Foreign Born Share of All LA County By Duration of Residence in US



Source: US Census Bureau, Pitkin-Myers LA 2012 Generational Projections

Exhibit 21 Asian Foreign Born Share of All LA County By Duration of Residence in US



Source: US Census Bureau, Pitkin-Myers LA 2012 Generational Projections

outstanding in 2010 was the large share of residents who were immigrants who had resided for more than 20 years in the U.S., 17.3%, compared to only 5.9% in 1990. At the same time that the inflow of newcomers had subsided, the previous immigrants were settling in and filling the ranks of long-settled Angelenos.

This settlement dynamic is underway among all groups, as highlighted for Latinos (Exhibit 20) and Asian and Pacific Islanders (Exhibit 21). Latinos represent such a large share of the foreign-born (57.2% in 2010) that their pattern of duration of residence closely mirrors that of all foreign born. Nonetheless, the peak and decline of the Latino foreign-born share of Los Angeles population is more pronounced: the Latino new arrivals' share fell from 10.2% of total Los Angeles population in 1990 to only 4.7% in 2010, and the total Latino foreign-born share also slumped more noticeably between 2000 and 2010, declining from 21.8% to 20.3% of the total Los Angeles population.

Asian and Pacific Islander foreign born are responsible for upholding more of the foreign born growth in the last decade. Their new arrivals' share of total county population only fell from 4.4% in 1990 to 2.8% in 2010, with a projected share of 2.3% in 2030. As a result their total foreign-born share of all county residents continued to grow from 8.3% in 2000 to 9.3% in 2010, with further increase to 10.8% projected in 2030. Meanwhile, the long-settled share (20 or more years) increased from only 0.7% in 1990 to 4.7% in 2010, then growing to a projected 6.3% of all Los Angeles residents in 2030.

Age Waves of Long-Settled Immigrants

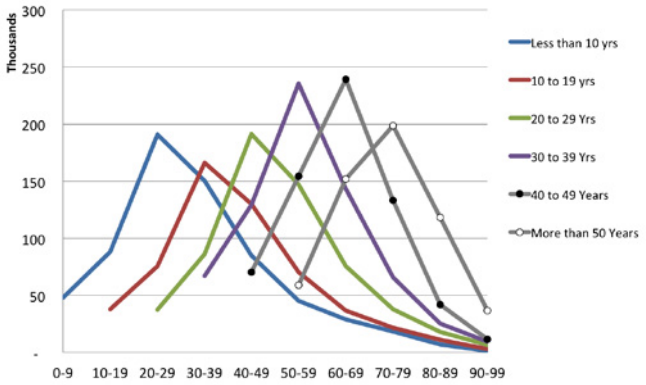
As time passes and immigrants reside longer in Los Angeles, they also grow older in age. Any children born after settling in the U.S. are not classified as foreign-born or immigrants. They become members of the immigrant second generation, as discussed below. Thus the age wave formed by new arrivals is capped at the lower end by their date of arrival and can never fill in behind, only grow older. And since most immigrants arrive in their 20s or 30s, the age wave is compressed into a narrow age range. As time passes, the former new arrivals grow older at the same time as they reach a longer duration of residence.

The result of this aging in place is that members of immigration waves from further in the past become concentrated in older age brackets. This is illustrated in Exhibit 22, a projection of the number of foreign born in 2030 by their age, based on their period of arrival and length of time in the United States.

Here is how the duration recorded in 2030 corresponds to the decade of arrival:

Duration in 2030	Decade of Arrival
Less than 10 years	2020 to 2029
10 to 19 years	2010 to 2019
20 to 29 years	2000 to 2009
30 to 39 years	1990 to 1999
40 to 49 years	1980 to 1989
50 years or longer	Before 1980

Exhibit 22 Older Age of Longer Settled Immigrants 2030

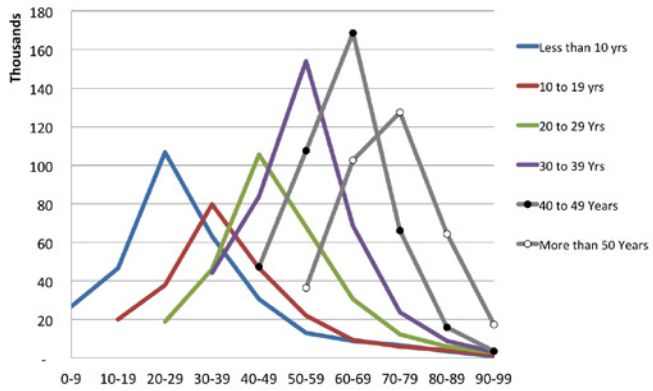


Source: US Census Bureau, Pitkin-Myers LA 2012 Generational Projections

The peak decade for immigration—the 1980s—remains visible in the large number of older Angelenos who have resided for 40 to 49 years as of 2030. Likewise, the very low decade for immigration in the 2010s is also reflected in the low numbers of residents—concentrated in their 30s— who are projected in 2030 to have resided for 10 to 19 years.

The aging profiles of Latinos and Asian and Pacific Islanders are very different (Exhibit 23 and Exhibit 24). First, the size of the immigrant waves are much larger for earlier decades of Latino arrivals than for more recent decades. That means that in 2030, the elderly age groups will contain many more Latino immigrants than the middle aged or younger groups. In contrast, the waves of Asian immigrants are more evenly sized over time, even growing in size rather than shrinking.

Exhibit 23 Older Age of Latino Immigrants Who Are Longer Settled in 2030



Source: US Census Bureau, Pitkin-Myers LA 2012 Generational Projections

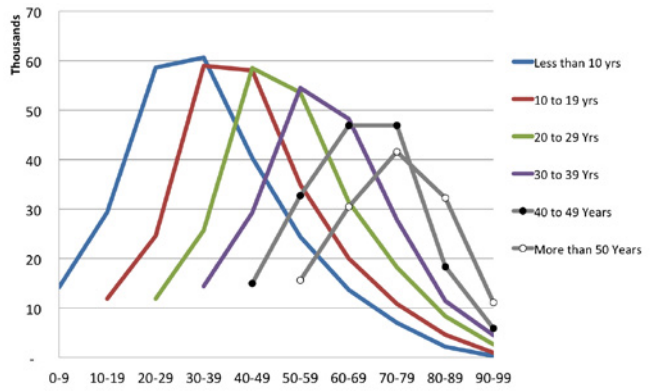
Growth of the Second and Third Immigrant Generation

The foreign-born are the first generation of their families to live in the United States. Children who were born outside the United States are also first generation. However, children born in the U.S. after their foreign-born parents assume residence become members of the second generation.

As reported earlier, very few young children living in Los Angeles are foreign born. The great majority are native Californians (see the previous Exhibit 16). Roughly half of children under age 10 in 2010 belong to the second generation, given that they have a foreign-born parent (Exhibit 25).[24]At ages 25 to 34, barely 20% belong to the second generation; only 10% at ages 35 to 44. Instead, the peak foreign-born share in 2010 is found at ages 35 to 44. By 2030, it is anticipated that the peak foreign-born share will have shifted 20 years older, then situated at ages 55 to 64. Meanwhile at younger ages the foreign-born share will have declined.

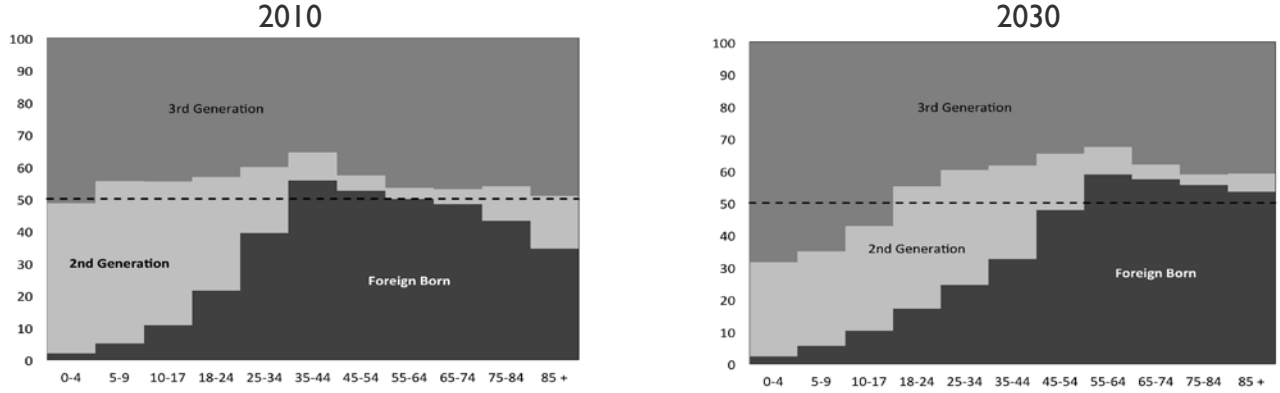
Instead, by 2030, second generation status will have increased markedly among young adults. These children of today's immigrants will be filling one-third or more of the ranks at ages 35 to 44 and among those that are younger (see Exhibit 25). The change from 2010 to 2030 is particularly striking at ages 25 to 34, a near doubling from 20.4% to 35.7% that are second generation.

Exhibit 24 Older Age of Asian Immigrants Who Are Longer Settled in 2030



Source: US Census Bureau, Pitkin-Myers LA 2012 Generational Projections

Exhibit 25 Immigrant Generations in Los Angeles, 2010 and 2030



Source: US Census Bureau, Pitkin-Myers LA 2012 Generational Projections 2012

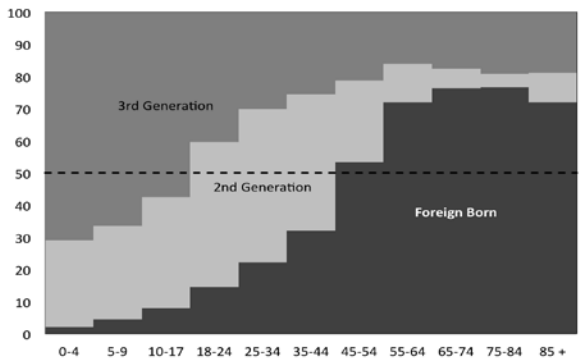
Source: Pitkin-Myers LA 2012 Generational Projections 2012

What might be surprising to find in 2030 is that the second generation is expected to decline among children and teens. What is growing instead is the third or higher generation, for example, expanding from 44.5% of children ages 5 to 9 in 2010 to 65.4% in 2030. This expansion of the third generation is a direct consequence of the second-generation growth in 2010, because the new third generation is formed by the children born to parents who themselves belong to the second generation.

In sum, the overall picture from the Pitkin-Myers Los Angeles generational projections is one of an aging population of immigrants and children. At the same time as the high concentration of foreign-born is shifting into elderly years, the second generation is spreading into middle age, and their children are forming a new third generation. This true third generation is merged with other Los Angeles residents who are of fourth or higher generation descent, forming a broad category of third or higher generation that is composed of people who have immigrant grandparents, great-grandparents, and even longer descent.

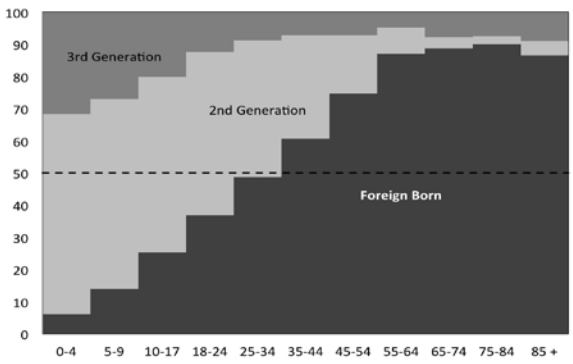
Although following a similar process, some important differences exist between the Latino and Asian immigrant generations. The second generation in 2030 will be a much smaller share among Latino children than it is among children of Asian and Pacific Islanders (Exhibit 26 and Exhibit 27). For example, among children under age 10, roughly 30% of Latinos and

Exhibit 26 Latino Immigrant Generations in Los Angeles, 2030



Source: Pitkin-Myers LA 2012 Generational Projections 2012

Exhibit 27 Asian Immigrant Generations in Los Angeles, 2030



Source: Pitkin-Myers LA 2012 Generational Projections 2012

just over 60% of Asians are members of the second generation. Instead, the third generation in these ages has grown to account for more than two-thirds of Latinos, but less than one-third of Asians. This pattern reverses in the middle age range: Latinos still hold a larger share in the second generation than is true of Asians. Instead, the latter are much more likely to be foreign born.

A clear pattern of generational settlement is evident from the succession of parents and children by 2030. High concentrations of foreign-born Asian and Pacific Islanders in middle age are matched to the large concentration of second-generation residents among those who are younger by 30 years or more. In the case of Latinos, however, immigrant settlement has progressed to later generations, thanks in large part to their early average age of child bearing. We find a high concentration of foreign-born in senior years matched to a large concentration of second generation in middle age, and, in turn, those second generation residents are responsible for the burgeoning growth of the third generation among children.

7 Conclusions and Policy Implications: Intergenerational Partnership For The Future

The generational future of Los Angeles is marked by a new demographic maturity, many of whose trends appear to be a reversal of what we are accustomed to. Unprecedented in living memory, the trends are as yet only dimly understood. Yet, when viewed in future perspective, the ongoing changes can be better understood for the historic transformation that is under way.

An older view of the Los Angeles population, one dated from 1990, near the end of the great boom in population growth and change, must now give way to the new outlook. By 2010, many of the older trends had already been completely played out. Yet, only by looking forward to 2030 can we begin to understand where the new trends might lead, and only then can we appreciate how our policy priorities must shift today if we are to capture the benefits of the emerging opportunities.

The outlook ahead is for slower and more deliberate growth in Los Angeles, something more akin to the 1960s and 70s, rather than the boom years of the 1980s. With that slower growth, many of the rapid changes in demographic make-up that took off in the 1980s, such as rapid increases in immigration or racial change, have settled down to a more gradual pace of change. Latino and Asian groups are still increasing their presence, but the slower pace of change lends a greater stability of ethnic balance for the coming decades.

With slower growth also we may find it easier, certainly less frantic, to keep up with public needs for new services and private demands for new development. With more time to plan and prepare, we can focus better on building the highest quality of life in Los Angeles.

This slower pace of growth is important in its own right, but the character of the residents in Los Angeles is being reshaped by three key transformations. Together these are revolutionizing the outlook for the future of Los Angeles.

The most surprising transformation highlighted in this study may be with regard to immigration. Whereas once it seemed that the immigrant numbers in the city were doubling and that newcomers filled a large share of the population, today we find a much smaller inflow. Our immigrant residents have not left the Los Angeles area but rather have settled in, set down roots, and achieved much greater success. The transformation of the foreign-born population has been from mostly newcomers to mostly older and long-settled residents.

A second, more-sweeping transformation pertains to generations and is many faceted. This includes the rise of a new "second" generation born to immigrant parents, but more acutely it also embodies a precipitous decline in the number of children. Today we find that one-third fewer children are born in Los Angeles

each year than at the peak of the boom in 1990. And the last census showed major declines in the number of children living in Los Angeles, a 20% loss in the last 10 years in some age groups. Similar declines are occurring statewide, and in a few other states like New York and Illinois, but none as intensively as in Los Angeles. Certainly we must wonder what has happened to children in Los Angeles.

At the same time, the generation revolution also includes an unprecedented rise in the number of residents older than 65. Although this transformation has yet to occur, it is one change about which we can be absolutely certain. The massive baby boom generation will grow 20 years older between 2010 and 2030, when all will have aged past 65, so many in fact that the ratio of seniors to working age residents will have doubled. This trend is nationwide and will dominate the policy agenda at all levels of government for the next two decades. Yet we should not lose sight that part of the solution for the senior problem rests with children.

Who are the future working age residents of Los Angeles who will need to support twice as many seniors as before? The children of today will also be 20 years older in 2030 and they will comprise the great majority of new workers, taxpayers, and housing consumers. The younger generation is a multi-ethnic blend, the majority Latino. Their energy can be a tremendous boost to the economic fortunes of the city, if the children are well-groomed for their future roles. Given the urgency of the changes ahead, has enough been done to prepare?

Here is the importance of the third, major transformation, the homegrown revolution. Immigrant and native-born parents together are raising a new, California-born generation, accounting for more than 90% of all the children living in Los Angeles. Already, today, for the first time in recorded history, the majority of all California residents, including the young adults, are homegrown, and Los Angeles county is estimated to also reach majority homegrown in 2013.

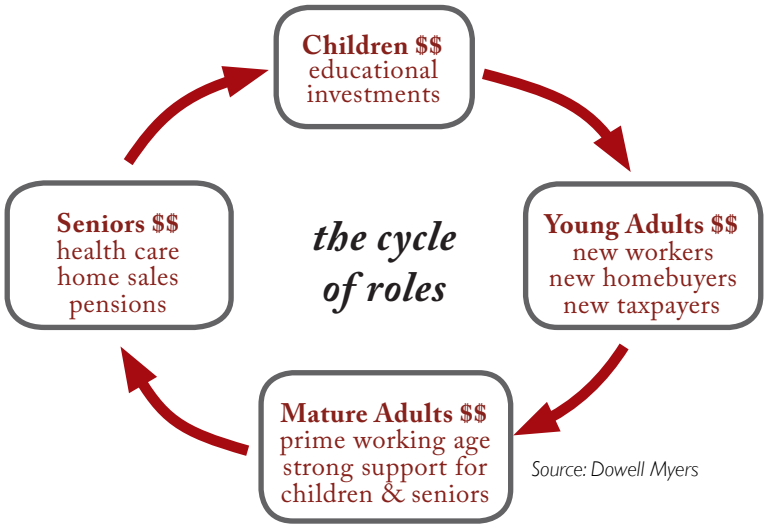
The reason for public urgency is that the downward trend in children is running opposite to the rising numbers of seniors who the children will need to grow up to support. With migration to Los Angeles so reduced from the high levels of earlier decades, the meaning of the homegrown revolution is a new recognition that the children of today are the ones we will depend upon once they reach adulthood. The elected officials and citizen leaders of Los Angeles—the taxpayers and voters—need to care for our remaining children as if our future lives depended on it.

How well do Los Angeles residents recognize their mutual dependence? Certainly those of middle age may not feel as much interest in children, now that their own are grown. And these middle-aged residents are the peak earners and largest taxpayers we have. The children, for their part, are the greatest tax beneficiaries. It might seem that we can ill-afford them in this period of economic malaise and fiscal stress. In our present-focused debates, have we lost sight of the most basic truths? Over time everyone changes position, taking turns being economically dependent and highly productive. We should be reminded that the different stages of life are linked together in a life-cycle of roles, as illustrated by a simple diagram (Exhibit 28).[25] Certainly, we would be well advised to recognize the implicit partnership that ties the generations together, linking interest groups and spanning ethnic or immigrant divides. We are all in this together.

One of the most basic facts of life is that children grow up. The cycle of roles calls for adults who are the main economic earners to pay into support systems for both children (principally their education) and the elderly (pensions and health care). Those children in turn grow into the new adult taxpayers, workers, and home buyers. Young adults buy homes from older adults, passing economic benefits to their elders. Eventually the middle-aged adults become seniors themselves and draw benefits from others who are younger. These generational connections are vital to every person and to the economy as a whole. For their part, the seniors leave a lasting legacy through their support of the newest generation in a continuing cycle.

The new maturity of Los Angeles, as for all of California, underscores the critical importance of children. Because the number of elderly is growing so dramatically, each child will need to carry greater proportionate weight when he or she enters adulthood. Our Index of Children's Importance for Los Angeles doubles in magnitude between children born before 1985 and those born in 2010 and later. For our mutual success, society will want children to deliver their absolute fullest possible economic contribution

Exhibit 28 Intergenerational Partnership



Source: Dowell Myers

when they grow into adulthood. The clear conclusion is that we must redouble our efforts to nurture the children of Los Angeles and of all of California so that each child can develop to his or her fullest potential.

The one great uncertainty about the future of Los Angeles is whether our leaders and citizens will have the political maturity required to embrace their present responsibility both to the next generation and to their future selves. Better information might help shed light on the path ahead.

The great hope behind the present report is that better data describing the future can help local citizens and leaders to visualize more realistically how things are changing. By looking ahead, and then back to the present, it is possible for all to better assess what is at stake. The projection data illuminate both our generational responsibilities and also the great opportunities for building on the new generation. The future will depend on the past, but the possibilities today are better than before. The key question is whether we will choose to seize the opportunity and make the future better than today.

End Notes

1. The transition from a racial or immigrant outlook to a generational outlook on social problems and solutions was described in Dowell Myers, Immigrants and Boomers: Forging a New Social Contract for the Future of America (New York: Russell Sage, 2007). A recent statement of the generational strategy for California is offered by Steve Levy, "Workforce Challenges and Generational Connections," Issues in the News, Center for Continuing Study of the California Economy, Palo Alto, 2012; www.ccsce.com.

2. This demographic "new maturity" was first identified for the city of Los Angeles but its features can be seen more widely. Dowell Myers, Janna Goldberg, Sarah Mawhorter, and Seong Hee Min (2010), "Immigration and the New Maturity of Los Angeles," pp. 12-27 in Ali Modarres, ed., Los Angeles 2010: State of the City, Pat Brown Institute, California State University, Los Angeles.

3. The Los Angeles county projections were produced by using the California Demographic Futures (CDF) model, the chief designer of which is John Pitkin, a senior research associate in the USC Population Dynamics Research Group and president of Analysis and Forecasting, Inc., Cambridge, Massachusetts. The Los Angeles projections are also part of the "Generational Projections" series that includes California (Pitkin and Myers, 2012) and the U.S. (Pitkin and Myers, 2011). Earlier editions of the projections and a number of preliminary studies can be found on the project website: www.usc.edu/schools/price/research/popdynamics/projections.html.

4. John Pitkin and Dowell Myers (2012), "Generational Projections of the California Population by Nativity and Year of Immigrant Arrival," special report, USC Population Dynamics Research Group.

5. In fact, the over-projection was statewide, but the eventual California count fell in the middle of a target range that had been predicted by John Pitkin and Dowell Myers in 2010 before the Census Bureau announcement. See "A Predictive Estimate of the 2010 Census Count for California," http://www.usc.edu/schools/price/research/popdynamics/futures/2010_Pitkin-Myers_Predictive-Estimate-CA.pdf.

6. California Department of Finance (DOF), Demographic Research Unit, State and County Total Population Projections, 2010-2060. Sacramento, California, January 2013 (www.dof.ca.gov/research/demographic/reports/projections/view.php). The Demographic Research Unit has the difficult task of projecting all the counties in the state, not just Los Angeles.

7. General explanation of the innovative methodology behind the Pitkin-Myers Generational Projections can be found in Section 8 of the California projection report, with specific details about Los Angeles posted in a project memo, "Methods and Assumptions in the Population Projections of Los Angeles County by the California Demographic Futures Model," both of which may be found on the project website: www.usc.edu/schools/price/research/popdynamics/projections.html.

8. White decline in the share of total population has also slowed its pace. Whereas the share of the population made up of non-Hispanic whites fell 12.0 percentage points in the 1980s, that decline moderated to –8.2 points in the 1990s and –3.6 points in the 2000s. Decline continues in the next two decades by 2 or 3 percentage points per decade.

9. The birth projections to 2020 and the historical record of births are provided by the Department of Finance: "Historical and Projected State and County Births, 1970-2021, with Actual and Projected Fertility Rates by Mother's Age and Race/Ethnicity, 2000-2021," www.dof.ca.gov/research/demographic/reports/projections/births/.

10. The Pitkin-Myers projections model fertility separately for immigrant and native-born women within each ethnic group. Immigrants who generally have higher fertility are projected to be reduced in number, and many more young women are second generation, a group that has lower fertility than immigrants. Thus the total number of births is trending toward a much lower level than was common before 2000. The Department of Finance projections, like almost all others, do not segment the population in sufficient detail to detect these trends in childbearing. The total number of Latinas, for example, are all treated the same, without distinction between immigrants, second or third generations.

11. The "senior ratio" is adapted from a traditional demographic concept known as the "old age dependency ratio." That traditional measure includes people as young as 15 or 18 in the definition of working age, which is more appropriate for farm labor than a modern, information-based economy. Instead, young people ages 18-to-24 are not included in the prime working age population because they often are engaged in part-time work, schooling, apprenticeships or other training

12. Dowell Myers and SungHo Ryu, "Aging Baby Boomers and the Generational Housing Bubble: Foresight and Mitigation of an Epic Transition," Journal of the American Planning Association 74, 1 (Winter 2008): 17-33.

13. Given the extreme policy significance of this trend, these calculations are based on the latest (2012) projections for the U.S. by the Census Bureau and on the 2013 projections for California and Los Angeles by the California DOF. Similar trends are yielded by the Pitkin-Myers series of projections, but the trend is so consequential that we rely here on the official government projections that are most accepted for policy making.

14. Dowell Myers, "California's Diminishing Resource: Children," special report, Lucile Packard Foundation for Children's Health, 2013.

15. The future burden on a newborn would be lessened, of course, if more young people migrated into Los Angeles to help carry the load. However, the future senior ratio is calculated based on all members of the age groups that are expected to reside in future years. Not enough young migrants are forecast to prevent the increase in the senior ratio, which after all is a statewide and nationwide event. Thus the child is born into a world that holds these expectations.

16. David Hayes-Bautista, Werner Schenk, and Jorge Chapa, Burden of Support, Stanford, CA: Stanford University Press, 1988.

17. Dowell Myers, John Pitkin and Ricardo Ramirez (2009), "The New Homegrown Majority in California: Recognizing the New Reality of Growing Commitment to the Golden State," Special Report, Population Dynamics Research Group, University of Southern California. The milestone discovery of a first-time homegrown majority in California was reported in the Los Angeles Times, April 21, 2009, San Francisco Chronicle, April 21, 2009, and New York Times, April 28, 2009.

18. Dowell Myers and John Pitkin, with Sarah Mawhorter, Janna Goldberg, and Seong Hee Min (2010), "The New Place of Birth Profile of Los Angeles and California Residents in 2010," Special Report, Population Dynamics Research Group, University of Southern California.

19. The most recent Census Bureau data, reported in fall 2012 and covering the year 2011, revealed that Los Angeles county remains just below majority status, with 49.9% California-born, 35.1% foreign-born, and 15.0% born elsewhere in the U.S. The comparable figures for California are 54.3% homegrown, 27.1% foreign-born, and 18.6% born in other states. Date are from American Community Survey, 2011, table B05002.

20. Comparison of these migration rates are controlled for age and race/ethnicity. Details are reported in Myers, Pitkin and Ramirez (2009).

21. Jon Stiles, Michael Hout, and Henry Brady (2012) "California's Fiscal Returns On Investments In Higher Education," Research & Occasional Paper Series: CSHE.15.12, Center for Studies in Higher Education, University of California, Berkeley, October 2012.

22. Hans Johnson and Ria Sengupta, "Closing the Gap: Meeting California's Need for College Graduates," San Francisco: Public Policy Institute of California, 2009; Deborah Reed, "California's Future Workforce: Will There Be Enough College Graduates?" San Francisco: Public Policy Institute of California, 2008.

23. Joe Mathews and Mark Paul highlight the political significance of the new homegrown majority—creating a new self-reliance and responsibility—in their work on the dysfunctions of California politics and governance, California Crackup, Berkeley: University of California Press, 2010.

24. The Pitkin-Myers generational projections determine second-generation status based on the nativity status of the mothers. Birth records are more complete for mothers, and children are more likely to reside with mothers than with fathers, so that better precision of analysis is afforded by a mother-based definition. Nativity status of the mother is also a stronger influence than the father's on the child's cultural adaptation.

25. This model was introduced in Dowell Myers, Immigrants and Boomers; Forging a New Social Contract for the Future of America (New York: Russell Sage Foundation).

USC Price

Sol Price School of Public Policy

for more information...

Copies of all project reports are downloadable from the website of the Population Dynamics Research Group, Sol Price School of Public Policy

http://www.usc.edu/schools/price/research/popdynamics/

Questions on technical details should be directed to Research Director, popdynam@usc.edu

THE RISE OF THE CORPORATE LANDLORD

THE INSTITUTIONALIZATION OF THE SINGLE-FAMILY RENTAL MARKET AND POTENTIAL IMPACTS ON RENTERS

A Report by the Homes For All Campaign of Right To The City Alliance

July 2014

THE RIGHT TO THE CITY ALLIANCE

The Right To The City Alliance seeks to create regional and national impacts in housing, human rights, urban land, community development, civic engagement, criminal justice, immigrant rights and environmental justice. Right To The City was born out of a desire by members, organizers and allies around the country to have a stronger movement for urban justice. The Right To The City Alliance asserts that everyone — particularly the disenfranchised — not only has a right to the city, but that all inhabitants have a right to shape it, design it, and operationalize an urban human rights agenda.

HOMES FOR ALL CAMPAIGN

This report was written as part of Homes For All, a national campaign that is broadening the conversation of the housing crisis beyond foreclosure and putting forth a comprehensive housing agenda that also speaks to issues affecting public housing residents, homeless families, and the growing number of renters in American cities. The growing influence of Wall Street firms and big banks, as well as the rise of the corporate landlord in the single-family market, is central to understanding the housing crisis renters face today.

Homes For All works to protect, defend, and expand housing that is truly affordable and dignified for low-income and very low-income communities. The campaign engages those most directly impacted by this crisis through local and national organizing, winning strong policies that protect renters and homeowners, and shifting the national debate on housing. Right To The City is working collaboratively across sectors to develop national housing policy that ensures that our communities and future generations have homes that are truly affordable, stable, and dignified. Homes For All has grown to include 25 grassroots community organizations in 19 cities and 14 states across the country. The National Low Income Housing Coalition is a campaign partner.

Visit us online at righttothecity.org and homesforall.org

DESIREE FIELDS, the principal author of this report, is Assistant Professor of Urban Studies at Queens College of the City University of New York. Trained as an environmental psychologist and urbanist, Fields studies finance as a process of contemporary urban change. Her past research examined the social, policy and public health implications of the U.S. foreclosure crisis. Fields' more recent work addresses how private equity investment in New York City's rent-regulated housing market reshapes geographies of urban inequality, social and political struggles over urban space, and the sphere of social reproduction. Her research has been supported by the National Science Foundation and published in the Journal of Urban Affairs, Housing Policy Debate, Housing, Theory and Society, the Journal of Urban Health, and Emotion, Space and Society. As of August 2014, Fields will be lecturer in the Department of Geography at the University of Sheffield, UK.

Learn more at ***desireefields.org***

ACKNOWLEDGEMENTS

This report was principally authored by Desiree Fields with the collective efforts of members and staff of the Homes For All (HFA) campaign and Right To The City Alliance (RTC). We would like to thank everyone who provided feedback on the drafts and those who shared their stories and experiences.

SUPPORT WRITERS

Rob Call	Lead Organizer, Occupy Our Homes Atlanta
Rachel Laforest	Executive Director, Right To The City Alliance
Tony Romano	Organizing Director, Right to the City Alliance
Tony Roshan Samara	Senior Program Director for Land Use and Housing, Urban Habitat

REVIEWERS & CONTRIBUTORS

Maria Christina Blanco	City Life/Vida Urbana
Yasmeen Perez	Development Director, Right To The City Alliance
Kevin Stein	California Reinvestment Coalition
Mark Swier	Operations Manager, Right To The City Alliance

PRODUCTION

Design: Jed Brandt

Copy Edit: Suzy Subways, Sonny Singh

Infographic Design: Rehanna Azimi Right to the City Alliance Intern

Management: Lenina Nadal Communications Director, Right To The City Alliance

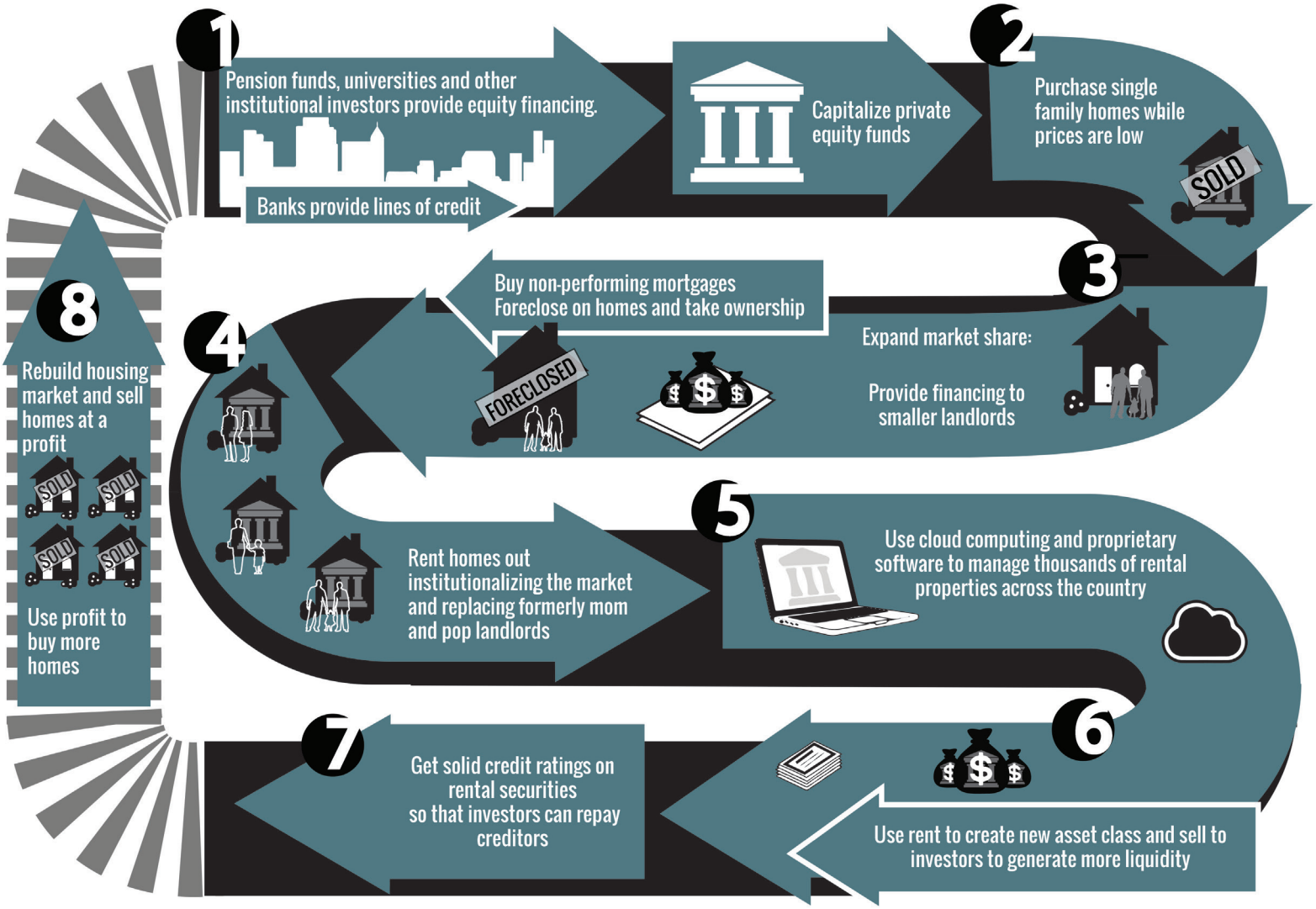
Comments and questions to: *info@homesforall.org*
To purchase this report in hardcopy format: *homesforall.org*

This report was made possible through the generous support of RTC's funders including: The Ben & Jerry's Foundation, Jessie Smith Noyes Foundation, Marguerite Casey Foundation, and The Unitarian Universalist Veatch Program at Shelter Rock, as well as the support of individual donors and RTC member organizations.

CONTENTS

THE RISE OF THE CORPORATE LANDLORD

The Institutionalization of the Single-Family Rental Market and Potential Impacts on Renters



Since 2007, millions of American families have lost their homes and the equity therein to foreclosure.

In the wake of the foreclosure crisis, rental demand has increased as former homeowners became renters, and economic strain and tightened morgage credit delay others from buying homes. The combination of increased rental demand and the large inventory of single-family homes under bank ownership has created an opportunity for large, well-capitalized investors to purchase these properties while values are low, and then convert them to rental housing.

Aided by financing from institutional investors like pension funds and credit from many of the same banks (such as JPMorgan Chase and Wells Fargo) that contributed to the foreclosure crisis, private equity firms like Blacksone have poured over $20 billion into the single-family rental market, institutionalizing what has long been a "mom and pop" industry.

So far, these new "corporate landlords" have purchased about 200,000 homes, or roughly 1.5% of single-family rental properties, but their presence in the market is expected to expand. Purchasing activity has not been evenly distributed throughout the U.S.; rather, firms have undertaken fast-paced, high-volume purchases, picking selected Sunbelt markets such as Phoenix and Atlanta clean.

Heralded by some as a housing market recovery, the institutionalization of the single-family rental market stands to primarily benefit the same kinds of financial interests that brought down the housing market in the first place.

by Desiree Fields, Ph.D.

THE RISE OF THE CORPORATE LANDLORD

THE INSTITUTIONALIZATION OF THE SINGLE-FAMILY RENTAL MARKET AND POTENTIAL IMPACTS ON RENTERS

EXECUTIVE SUMMARY

A $1.5 TRILLION OPPORTUNITY

Since 2012, large investment companies, mainly private equity firms, have raised and/or invested $20 billion to purchase as many as 200,000 single-family homes throughout the United States.[1] This investment space opened up as a result of the foreclosure crisis, which lowered property values, tightened mortgage credit, increased rental demand, and consolidated unprecedented amounts of single-family homes under the ownership of banks and government-sponsored enterprises. While local "mom and pop" ownership has long characterized the single-family rental market, these post-crisis conditions created new opportunities for firms like Blackstone and Colony Capital to enter the market. Within just a few years, single-family rental housing has become a new institutional asset class. The recent rollout of the first rent-backed securities has some analysts estimating the market as a $1.5 trillion opportunity.[2]

RISE OF THE CORPORATE LANDLORD

As part of our Homes For All campaign, the Right To The City Alliance aims to broaden the conversation about the housing crisis beyond foreclosure. This generation's crisis of affordable housing will impact renters the most — especially low-income people of color living in urban areas.[3] The rise of the corporate landlord in the single-family market is central to understanding the housing crisis renters face today. The need to bring public attention to this paradigm shift is particularly important in light of intensifying housing cost-burden for renters and surging post-crisis rental demand, which together have brought chronic housing insecurity for low-income renters to crisis proportions.

This report outlines a policy agenda based on the potential impacts of the new single-family rental market on renters' housing affordability, access, quality, stability, and ability to hold landlords accountable.

Although a wide range of investors are active in distressed property, we focus on the role of large, well-capitalized private equity firms, such as Blackstone, because its activities have so rapidly developed and institutionalized the single-family rental market. Since 2012, their strategy, initially described as "REO-to-rental" (REO, or real estate owned, the term for properties under bank ownership after foreclosure), has already undergone a number of innovations, including:

Leveraged purchasing

Leveraged purchasing: Global investment banks like Deutsche Bank and JPMorgan Chase have provided credit facilities (ranging from hundreds of millions to over a billion dollars) to boost property acquisition.[4] The securitization of rental income streams, first offered (in high demand) by Blackstone in late 2013 and later by Colony Capital and American Homes 4 Rent, also provides greater liquidity to fuel additional purchasing.[5] Firms have also leveraged capital by taking their new rental companies public as real estate investment trusts (REITs),[6] with Starwood Waypoint being the first single-family REIT to issue public stock offerings.[7]

Private-label lending

Larger firms have also started providing blanket mortgages to smaller investors, which they can also securitize. Blackstone's B2R (Buy to Rent) Finance offers loans to those looking to buy anywhere from five to 1,000 houses.[8]

Nonperforming loan acquisition

As the REO inventory begins to dry up in key markets like Atlanta, Phoenix, Los Angeles, and Tampa, firms have also begun to acquire nonperforming loans. Starwood Waypoint, American Homes 4 Rent, and Altisource Residential have led the turn toward nonperforming loans as a means of improving their financial flexibility and financing additional growth.[9]

Innovations like leveraged purchasing, private label-lending, and acquiring nonperforming loans expand large firms' presence in the single-family market and build a pipeline for financial products like rental bonds. While such institutional investors currently own less than 2 percent of single-family

rental properties, the fact that many of the same institutions and practices implicated in the global financial crisis now figure strongly in the single-family rental market should give us pause.

POTENTIAL IMPLICATIONS FOR RENTERS

Affordability

Tenants could face higher rental costs due to pressure for private equity funds to deliver returns to investors, particularly with the advent of rental bonds. Among Invitation Homes tenants we interviewed in Atlanta, Los Angeles, and Riverside, rents often exceeded the HUD Fair Market Rents for the area; lease renewals increased rents by 37 to 53 percent.[10] The long-distance nature of the tenant-landlord relationship and the practicalities of investment strategies may also increase corporate landlords' reliance on financial penalties, potentially limiting tenants' opportunities to seek recourse in cases of hardship.

Accessibility

Corporate landlords' limited experience means they may fail to comply with fair housing law in how they market their properties, who they rent to, and whether they make accommodations for people with disabilities. Overall, less than 1 percent of the properties owned by Invitation Homes are occupied by tenants with Section 8 vouchers.[11] In our surveys of Invitation Homes tenants in Los Angeles and Riverside, only one of 50 respondents received a Section 8 subsidy. We must also consider how shifting investment priorities could contribute to housing instability for low-income renters over the medium and long term. What are the ramifications of the government subsidizing such cases of speculation?

Quality

Since institutional investors are not experienced in property management and maintenance, housing quality can easily be compromised. Many Invitation Homes tenants in Atlanta expressed concern about shoddily completed renovations.[12] Recently, a Los Angeles family sued the company for its failure to quickly respond to water leaks, mold, and cockroaches, which adversely affected their health.[13] Greater reliance on leveraged purchasing increases the potential for investors to experience financial distress, adding to the risk of property neglect.

Stability and accountability

Situated in the footprint of the foreclosure crisis, a major concern about the new single-family rental market is the potential for another speculative cycle that could end in a bust, subjecting communities to yet another round of destabilization.[14] Tenants may be forced to move out or adjust to new policies and practices when their home is flipped to a new investor-landlord. There is also a need to consider how renters can hold distant corporate landlords accountable. Invitation Homes tenants in Atlanta, Los Angeles and Riverside report they have never seen anyone from the company since they moved in and are not in regular contact with their landlord.

The crisis of affordable housing over the next generation will be concentrated among renters. At the center of this crisis are low-income people of color living in urban areas.

SETTING AN AGENDA

The entrance of corporate investors as landlords represents a fundamental change in the nature of the tenant-landlord relationship in the single-family context. It is critical for policymakers to know about and understand this shift. We urge policymakers to take proactive measures to monitor and regulate the single-family rental market. These policy measures should include the following:

1. Support research and access to information about the paradigm shift.

i) **Offer greater transparency into the single-family rental market:** The government should evaluate the results of the bulk sales and make them available to the public. It should also conduct further research on the bulk sales related to affordability, quality, security/permanence, and access. This can be achieved with greater transparency into the Federal Housing Finance Agency's 2012 bulk sales under the REO Pilot Initiative.

ii) **Fund and support extensive research on investor impact:** Given the unprecedented nature of an institutionalized single-family rental market, an urgent priority is research on the impact institutional investors have on local rental markets and renters, especially around issues of affordability, access, and influence on traditional landlords. This research is also critical given that private equity players are currently more thinly regulated and opaque than conventional landlords and undertake riskier investment strategies.

2. Enhance support for tenants' rights in a changing rental landscape.

i) **Create a national tenant clearinghouse:** Tenants of landlords such as American Homes 4 Rent and Invitation Homes have already begun to use consumer review sites like Yelp and Zillow to share their experiences with one another. This suggests the utility of a national tenant clearinghouse to protect consumers renting from corporate landlords and disseminate publicly funded research on the single-family rental market. The Consumer Financial Protection Bureau (CFPB),

given its mission to protect Americans from abuses by financial companies, should play a role in creating and maintaining the clearinghouse.

ii) **Ensure a baseline of information and protection for tenants at the local, state, and national levels:** Tenants' rights vary significantly from state to state; therefore, government at the local and state levels should work proactively to ensure that tenants, especially former homeowners who may be unfamiliar with the rental market, have access to information about their rights. Wherever federal support is given to the industry, tenants should have a guarantee of a minimum set of rights. The Protecting Tenants at Foreclosure Act of 2009 is one example of this.

iii) **Rethink tenants' rights for the era of "big data":** Support for tenants' rights should explicitly address the "right to research" as part of consumer protection. For example, tenants should know and have a say in how investor-landlords collect and use data and what impact it has on their credit scores.

3. Develop proactive regulations to promote the common good.

i) **Clarify and/or establish a federal role in regulating single-family rental:** The Senate Committee on Banking, Housing and Urban Affairs should explore existing oversight and whether it is adequate for this new market. The Consumer Financial Protection Bureau (CFPB), Department of Justice, and Department of Housing and Urban Development (HUD) all have roles to play in ensuring corporate landlords do not violate federal fair housing and fair lending laws in tenant selection, eviction policies, disability access, and property maintenance. Baseline protections for tenants is needed, but there appears to be no agency that is providing oversight.

ii) **Ensure affordability and accessibility:** Guided by rigorous, publicly supported research on the short- and long-term impacts the institutionalized single-family rental market has on housing costs for low- and moderate-income (LMI) households, affordability requirements should be put in place for institutional investor-landlords. Such requirements could require institutional investor-landlords to make a certain number of affordable units available to LMI households depending on their local market share.

iii) **Promote greater community control of housing and diversity of ownership structures:** The REO-to-rental market should not only be a paradigm shift for investors. Government should work to promote greater diversity of ownership and control over land and housing in order to prevent the dominance of high-risk financial practices in the single-family rental market. Community land trusts are especially compelling because they stake participants in their local communities, while offering less vulnerability to foreclosure than traditional, individualized ownership.

4. Generate resources to support lower income households.

i) **Implement a financial transaction fee on rental bonds:** Rental securitizations continue to be rolled out (there have now been four issuances of rental bonds) to strong market reception, making more such transactions a strong possibility. High investor demand for returns from rental bonds could have an adverse impact on housing affordability, especially for low-income renters, who already face an affordability crisis. Without a significant burden on investors, instituting a small tax of 0.1 or 0.2 percent on rental bond transactions would create significant resources for the National Housing Trust Fund.

ii) **Introduce local and/or state taxes to ensure community benefits from investments:** Progressive tax measures on corporate landlords' profits could apply to investors and associated subsidiaries with large local inventories and on profits above a certain threshold. Funds generated could be earmarked for creating or preserving permanently affordable housing (such as community land trusts) at the local level. In this way, local and state government can promote the common good by ensuring that the financial benefits associated with the changing face of the single-family rental market don't come at the expense of tenants.

CALL FOR ACTION

In drawing attention to this paradigm shift in the single-family rental market and its potential impacts on renters, this report aims to set an agenda for action by housing advocates and policymakers. The transformation of single-family rental housing from a local, "mom and pop" industry to a global investment class should be closely studied, subject to proactive regulation to promote the common good, accompanied by enhanced support for tenants' rights, and generate resources that will benefit lower-income households most vulnerable to housing insecurity. We must recognize that land and housing are not simply financial assets, but resources that are fundamental to the well-being of families across the economic spectrum, communities and society, and we must act on this insight.

INTRODUCTION

The foreclosure crisis has added to the long-term and unmet need for affordable rental housing as former homeowners become renters, and economic strain and tightened mortgage credit delay others from buying homes. Even before the influx of new renters, the longstanding decline in rental housing affordability had become more acute due to rising rents associated with the housing boom, increasing energy costs, and lower real incomes. From 2001 to 2009 the share of renters paying more than 30% of their income to rent and utilities combined rose from 41.2% to 48.7%.[15] At the same time, the consolidation of millions of single-family homes under the ownership of banks and government-sponsored enterprises (these foreclosed properties are known as REO, or real estate owned) has created new opportunities for large investors, who have been purchasing the properties with the intention of operating the formerly owner-occupied homes as rental housing. This "REO-to-rental" market has grown rapidly since 2012, with global investment banks like Deutsche Bank and JPMorgan Chase providing credit lines to fund acquisitions by investment firms like Blackstone, and the rollout of the first rent-backed security in November 2013.

At first glance, such investments appear to offer positive outcomes such as bolstering property values of owner-occupied homes (the total value of which remains $3.2 trillion below 2006 levels, despite rising values in many parts of the country),[16] re-occupying vacant properties, and easing strained local fiscal conditions. However, the rapid development of the single-family rental space by large private equity firms and many of the same banking institutions that contributed to the financial crisis should also give us pause. This is particularly important in light of intensifying housing cost-burden for renters and surging post-crisis rental demand, which together have brought chronic housing insecurity for lower income renters to crisis proportions.[17] Policymakers and advocates must carefully consider the risks and concerns renters may face in an institutionalized single-family rental market.

The institutionalization of the single-family rental market raises questions about housing access, affordability, quality and stability. The entrance of corporate investors as landlords represents a fundamental change in the nature of the tenant-landlord relationship in the single-family context, potentially complicating tenants' ability to communicate with and hold landlords accountable. Moreover, this market has developed in the footprint of the foreclosure crisis, in places that the housing collapse has left deeply unsettled for half a decade or more. Thus beyond the potential implications for renter households, the institutionalization of the single-family rental market must also be considered in terms of the consequences for homeowners (nearly 1 in 5 of whom owe more on their mortgage than their homes are worth)[18] and the risk to communities, cities and regions.

For investors, the advent of securities backed by rental income signals a new institutional asset class, one that also means a paradigm shift for the U.S. housing market. Policymakers must not be caught off guard or left behind by this shift. Instead they should take proactive measures to monitor and regulate the single-family rental market so as to prevent another acute housing crisis. Meanwhile, lawmakers must also take meaningful steps to address the ongoing crisis renters in need of affordable housing experience every day, which we consider more comprehensively in our report "Rise of the Renter Nation: Solutions to the Housing Affordability Crisis."[19]

This report provides an overview of the growth and development of the single-family rental market, from the activities of small investors in 2009 to the offering of the first rent-backed security in late 2013 and the advent of private-label lending and acquisition of nonperforming loans in early 2014. It traces the structure of the industry, highlighting key players and the scale and geography of their activities, and presents some of the key concerns about the institutionalization of the single-family rental market from the perspective of renters. The report also draws on pilot research on tenants living in properties owned by Invitation Homes, a subsidiary of global private equity leader The Blackstone Group. In closing we provide policy proposals and questions to guide further research and advocacy on the single-family rental market.

The institutionalization of the single-family rental market raises questions about housing access, affordability, quality and stability. Policymakers must not be caught off guard or left behind by this shift.

PARADIGM SHIFT FOR THE SINGLE-FAMILY RENTAL MARKET

As a result of the U.S. foreclosure crisis and the impact of the Great Recession, the national homeownership rate fell from its 2005 peak of 69.1% to 65.2% at the end of 2013.[20] In turn, rental demand has increased as former homeowners become renters and as unemployment, underemployment, bad credit and tighter mortgage underwriting prevent others from entering homeownership.

Renting is often associated with multifamily apartment buildings, but a significant share of renters, typically families, has always lived in single-family homes. This share has recently expanded: whereas 30.8% of all renters lived in single-family homes in 2005, 34.1% did in 2011.[21] The nation's housing bust has also expanded the supply of single-family rental housing: from 2007 to 2011, 2.4 million single-family homes were converted from owner-occupied to rental tenure, compared to just under a million such conversions between 2003 and 2007.[22] This brings the total number of single-family rental homes to 14 million, which represents about a third of the nation's rental housing inventory.[23]

While single-family housing makes up a good portion of the total rental housing stock, local investors and individual "mom and pop" style owners have traditionally dominated this market segment. However, increased rental demand, plus the consolidation of massive amounts of single-family homes under bank ownership and continuing high levels of foreclosure and nonperforming loans, have created new market opportunities for larger investors to purchase single-family homes for conversion to rental housing.

Based on data from the National Association of Realtors, investors accounted for almost a fifth (19%) of home sales from 2010 to 2013.[24] Recent research from the Federal Reserve suggests that business investors buying three or more homes accounted for 6.5% of home sales in 2012, up from less than 1% in 2004; purchases by private equity-funded institutional investors buying 200+ homes a year have jumped significantly in the past two years.[25] Institutional investors' entrance to the single-family rental sector represents a paradigm shift for what has long been a fragmented and highly differentiated market.

DEVELOPMENT OF THE MODEL

Starting as early as 2008 with smaller private equity firms like Waypoint in California and American Residential Homes in Arizona,[26] institutional investors have been developing a "buy to rent" strategy (as opposed to a buy to sell strategy). This strategy was initially called "REO-to-rental" because it was based on buying distressed properties at a discount and renting them out pending home value recovery, or forming single-family real estate investment trusts.[27] However, the actors and tactics involved in buy to rent have evolved rapidly over the past few years, with market innovations that have extended the strategy beyond REO properties to include nonperforming loans.

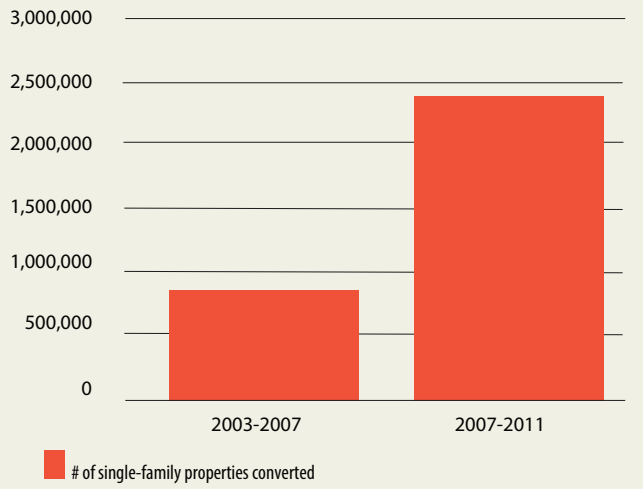
The government also got into the game: in 2012 the Federal Housing Finance Agency began piloting bulk sales of pools of REO Fannie Mae properties to investors as a means of getting these assets off the GSE balance sheets, with a focus on properties in hard-hit metropolitan areas including Atlanta, Chicago, Las Vegas, Los Angeles, Phoenix, and parts of Florida.[28] The REO Pilot Initiative was meant to show whether it was possible to stimulate private investment in single-family rental markets by attracting large investors with bulk sales.[29] The Initiative came with a comprehensive and demanding application process, requirement for both property and asset management experience, inability to 'cream' pools for the best properties, and other stipulations, e.g. that operators have worked in the geographies in which properties are located.

Given FHFA's relatively smaller share of the REO market, the future benefit of such sales would be more applicable to private market players. Government agencies hoped the Initiative would serve as a model for private sector participants, and that they would maintain the high standards implemented by FHFA.[30] Indeed, By 2012, large, well-capitalized institutional investors, including industry leader Blackstone, had begun to partner with smaller firms, who could provide better knowledge of local markets.[31] For example, last fall the Starwood mortgage real estate investment trust (REIT) purchased Waypoint's management division to operate its new single-family

FIGURE 1

NET CONVERSIONS TO RENTAL FROM OWNER-OCCUPIED HOUSING

2003-2007 and 2007-2011



SOURCES: Jount Center for Housing Studies, State of the Nation's Housing, 2013

REIT.[32] The recent rollout of the first rent-backed security offerings and public offerings on single-family REITs suggests that single-family rental has matured quickly from its status as "emerging" institutional asset class.[33]

Alternative investment companies like private equity funds are generally opaque, thinly regulated, and typically undertake riskier investment strategies. While government agencies hoped private sector participants would adopt the high standards of the REO Pilot Initiative, the defining characteristics of private equity present a challenge to this objective. This creates a corresponding need for sunlight on the institutionalization of single-family rental housing.

At around 200,000 properties, the overall scale of their purchasing is still small compared to buying by smaller and individual investors,[34] but institutional investors enjoy market advantages over would-be competitors. In-house expertise and resources enable institutional investors to hire in-house staff and develop proprietary software to manage property renovations and rentals.[35] Larger investors' scale and pace of activity in target markets also offers them the potential to secure exclusive arrangements with local real estate agents and contractors.[36]

But their chief advantage is the ability to bypass today's tighter mortgage requirements through raising cash cheaply on capital markets,[37] allowing institutional investors to outspend and out-scale smaller outfits. Indeed, although REO-to-rental started out as a an un-levered industry, several large banks, including Deutsche Bank, JPMorgan Chase, Wells Fargo, Citigroup and Bank of America now offer financing for acquisitions by institutional investors.[38] Along with a syndicate of other lenders (including JPMorgan Chase, Goldman Sachs, Wells Fargo), Deutsche Bank provided approximately $3.6 billion to fund Blackstone's acquisitions; it also arranged a $100 million credit facility for Five Ten Capital and a $200 million credit line for Apollo to support their single-family acquisition strategies.[39] Bank of America and JPMorgan Chase made a $200 million line of credit available to Silver Bay Realty Trust; Wells Fargo provided a $500 million line of credit (expandable to $1 billion) to American Homes 4 Rent.[40]

Recently, private equity firms have also benefited from an influx of capital from investors like pension funds and mutual funds seeking yield in the context of interest rates held close to zero. Tasked with investing this "impatient capital," the greater opacity of alternative investment approaches like private equity also allows firms to pursue risky strategies (such as highly leveraged deals) and frequently reconfigure their tactics in order to meet the demand for yield. This demand by equity coming in and the availability of debt leverage, combined with the status of single-family rental housing as an incomplete market, has created several opportunities for market innovation.

MARKET INNOVATIONS: FROM REO-TO-RENTAL TO SINGLE-FAMILY RENTAL

An important feature of the entrance of institutional investors to the single-family sector is the rapid development of an array of market strategies. These offer large, well-capitalized firms multiple ways of expanding their property holdings. In turn, expanded property holdings provide inputs for financial instruments, such as stock shares and rental bonds. For example, in 2012, Silver Bay Realty Trust was the first single-family operator to go public as a REIT, raising $245 million with the initial public offering on its 2,450-unit portfolio, which it planned to plow back into acquiring 3,100 more properties.[41] Since then, American Homes 4 Rent and American Residential Properties have also entered this relatively uncharted territory with similar public offerings.[42] Going public allows investment companies to raise additional capital and enlarge their portfolios of single-family rental properties.

Most recently, securitization has emerged as a new opportunity for corporate investors to undertake leveraged acquisitions. In November 2013, Blackstone's single-family rental arm Invitation Homes issued the first security backed by rental income, much of it rated AAA. Structured by Deutsche Bank, the securitization included 3,207 homes and yielded proceeds of $479 million after attracting six times as many investors as it could accept; rental bonds could total $7 billion in 2014 and reach $22 billion annually.[43] In March of this year, Colony Capital began to market the industry's second-ever REO-to-rental bond, a $500 million pool.[44] American Homes 4 Rent, "the largest publicly-traded U.S. single-family landlord," also began marketing its own rental bond.[45] Both invitation Homes and Colony American Homes have each issued a second rental securitization.

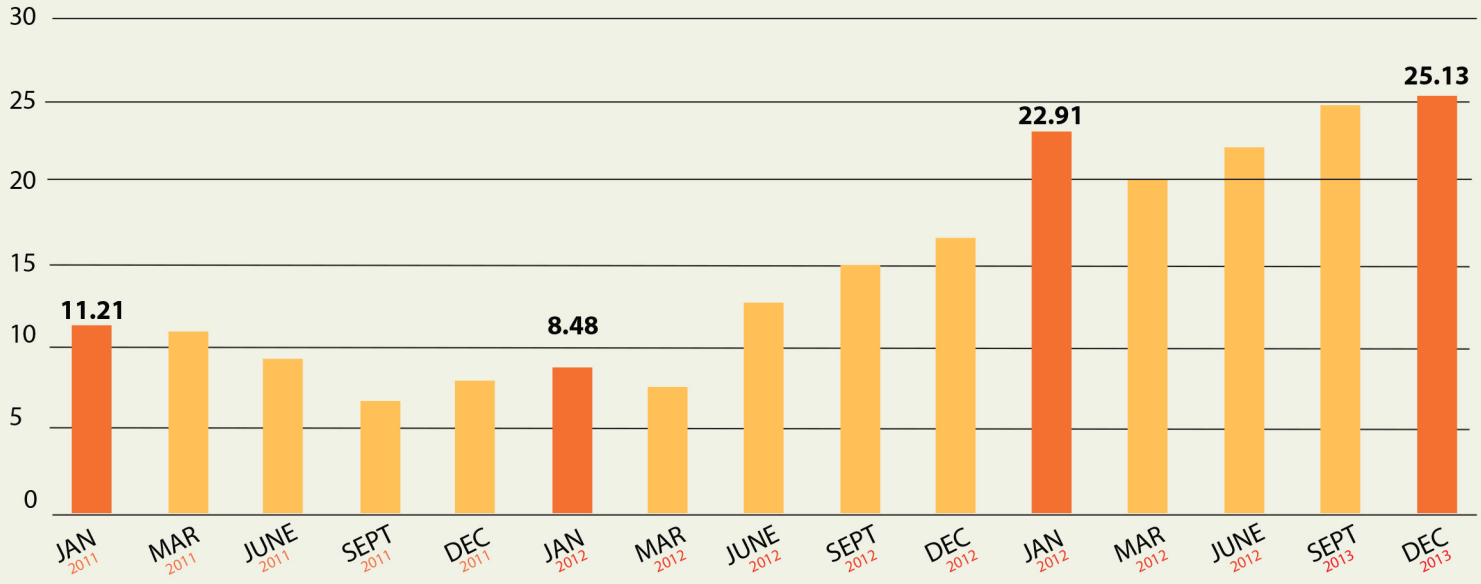
Rental bonds offer investors like mutual funds and insurance companies a stream of payments based on monthly rental income, while giving corporate landlords leverage to buy more homes and increasing their profits by lowering the cost of borrowing. The leverage securitization offers could double or triple returns on equity from 5-7% annually to more than 15% a year.[46] Analysts estimate that up to $5 billion in rental bonds may be issued this year.[47] Of course, as we saw in the financial crisis, investor demand for such products helped drive high-risk lending practices in order to create the inputs (new mortgage debt) for mortgage-backed securities. Thus a fundamental question about rental securitization is whether renters, who are more vulnerable to unemployment, underemployment and economic downturns, will be able to make timely rental payments.

The role of major credit rating agencies in the meltdown is also well-documented, with their flawed models and drive for market share and fees accounting for inflated ratings of instruments backed by risky loans.[48] The eager market demand with which Blackstone's first rental securitization was met suggests they could be the rating agencies' new golden goose, raising concerns about the data and motivations underlying rental bond ratings. For example, there is incom-

FIGURE 2: **PERCENTAGE OF ATLANTA-AREA HOME PURCHASES BY INSTITUTIONAL INVESTORS**

In Atlanta, one of the metropolitan areas institutional investors have targeted most heavily, such buyers accounted for 17-25% of monthly home purchases in 2013

JANUARY 2011 — DECEMBER 2013



plete historical data on single-family rents and vacancies over economic cycles, with Morningstar relying on limited proxies for rents (with only four years of data) and vacancies (using multifamily vacancy and capitalization rates going back to 1990) in its AAA rating of this new asset class.[49]

Despite the lack of historical data on the single-family rental market and the limited track record of large investment companies in managing large, geographically dispersed property holdings, the liquidity gained with the use of leverage has allowed firms like Blackstone to develop spin-off strategies that expand their presence in the single-family market and continue building a pipeline for financial products. One example is the creation of specialized private lending institutions to provide smaller investors with financing to scale up their portfolios. Blackstone's B2R (Buy to Rent) Finance is one such unit, offering loans starting at $10 million.[50] In turn, these blanket mortgages may also be securitized, further increasing returns for the issuer. With the addition of debt aggregated from smaller operators (multi-borrower deals), the market for rental bonds could reach $20 billion annually.[51]

Now that foreclosure starts have dropped to their lowest levels since 2006, another innovation is emerging in the single-family rental model: to expand their property holdings, investors have started acquiring nonperforming loans.[52] While the Federal Housing Finance Agency has completed a small number of bulk sales of distressed loans,[53] investors have mainly acquired properties at bank auctions, trustee sales, and from smaller investors, a tactic allowing them to more precisely target properties meeting their investment criteria.[54] However, banks are now making more nonperforming loans available for bulk sales due to new federal rules that make it more expensive to hold them.[55]

Starwood Waypoint, American Homes 4 Rent, and Altisource Residential have led the turn toward nonperforming loans as a means of improving their financial flexibility and financing additional growth. Starwood Waypoint recently completed the purchase of its sixth pool of nonperforming loans, achieving significant cost savings compared to buying properties themselves.[56] Given the drive to expand rental property holdings and proliferate new financial products backed by rental income, such acquisitions raise a clear concern that investors have a greater incentive to pursue foreclosure and rent properties back to their former owners than to modify troubled loans.[57]

SCALE AND GEOGRAPHY OF CORPORATE INVESTMENT

Institutional investor activity in the single-family market increased from 5.18% of all home purchases in January 2011 to a peak of 8.11% in January 2013; as of December 2013 their activity had fallen to just under 8% of all home purchases.[58] Overall, major institutional players including Blackstone Group/Invitation Homes, American Homes 4 Rent, and Oaktree Capital/Carrington Holding Company have raised and/or invested $20 billion to purchase approximately 150,000 single-family homes, representing 6-12% of distressed home sales from 2012 through mid-2013.[59]

Although institutional investors currently hold only 1.5% of single-family rental properties, with the introduction of rent-backed securities and other forms of leverage, their presence in the single-family rental market is expected to continue expanding through 2015.[60] Moreover, activity has not been evenly distributed throughout the U.S. Rather, institutional investors descend on selected markets to undertake fast-paced, high-volume purchases that pick the market clean.[61] For example, Blackstone/Invitation Homes purchased more than 1,500 properties at foreclosure auction in Atlanta last spring.[62] After starting in markets in the western U.S., investors shifted eastward as inventory decreased and prices began to shift upwards in markets like Phoenix, and because more inventory at lower prices became available in the Midwest and eastern U.S. as the shadow inventory has worked through the foreclosure pipeline.[63] In addition to low price-to-rent ratios and large volumes of distressed homes that allow them to achieve scale, investors are drawn to markets with a strong outlook for economic and employment and larger properties in neighborhoods with good schools.[64]

Thus far, institutional investor activity has been most dramatic in the Atlanta, Phoenix, Los Angeles, Chicago, Las Vegas, Tampa, and Charlotte metropolitan areas. According to data from CoreLogic, in 2012 institutional investors accounted for more than 20% of home sales in Phoenix and Charlotte; and approximately 19% of sales in Las Vegas, 18% in Atlanta; 16% in Tampa; and 12% in Los Angeles.[65] More recent estimates using RealtyTrac data suggest that in 2013 institutional investors were responsible for 17-25% of all home purchases each month in Atlanta, and 10-31% of monthly home purchases in Las Vegas.[66]

POTENTIAL CONSEQUENCES FOR RENTERS & COMMUNITIES

Despite the relatively small number of single-family rentals institutional investors currently own, their tactics stand to have a large impact on local housing markets because of the concentration of the highest levels of investment activity in a handful of markets. The institutionalization of the single-family rental market in the footprint of the foreclosure crisis merits consideration of impacts on renters as well as broader consequences on community stability and security.

The implications of this shift in the rental market are of special significance for people of color, women and immigrants. African-American and Latino households experienced a dramatic loss of wealth as a result of the foreclosure crisis, with their ejection from homeownership into the rental market contributing to intensified competition for affordable rental housing. Reflecting racialized disparities in homeownership declines, people of color, particularly Hispanics, will account for the majority of the anticipated growth in rental demand over the next decade.[67] The burden of eviction and lack of housing access, as well as the health impacts of overcrowded and poor-quality housing, fall disproportionately on people of color, women and immigrants.[68] The commodification of single-family rental housing by financial actors threatens to intensify the ongoing rental crisis for these populations.

Yet because this market has emerged so recently and is developing so rapidly, we lack adequate information about its consequences. Could converting formerly owner-occupied single-family homes to rental housing alleviate affordability pressures by adding to the housing supply? Will gentrification result as investors upgrade properties and increase rents, thus worsening affordability issues and contributing to displacement? Could investors' lack of management experience and investment practices contribute to housing decline and neighborhood instability?[69] These potential outcomes are not mutually exclusive, and will depend to a great extent on how local, state and federal government and regulatory agencies, consumer protection groups, housing advocates, and communities themselves respond to and engage with the newly institutionalized single-family rental market.

The growth of the rental securitization market may increase investors' appetite for yield, resulting in higher rents.

In this section of the report we draw on pilot research with Invitation Homes tenants in Atlanta and Los Angeles and Riverside,[70] media accounts, and reports from financial analysts and credit rating agencies to consider the potential consequences of an institutionalized single-family rental market for renters and communities. This analysis in turn shapes our recommendations for setting a policy and advocacy agenda for the single-family rental market.

AFFORDABILITY

The U.S. rental affordability crisis, now going strong for more than 25 years (cf. NLIHC Out of Reach 2014), has only worsened since the end of the Great Recession, with median rents outpacing median incomes in 90 metropolitan areas[71] and half of all renters paying more than 30% of income for housing (up from 38% in 2007).[72] Given this ongoing and worsening affordability crisis in the U.S. rental market, any sea change in the private rental market should be scrutinized for its impact on housing affordability. Of particular concern here is the advent of the same kinds of financial engineering that contributed to the scope and severity of the mortgage and financial crises of recent years, such as the securitization of rental income streams and how pressure to deliver returns to investors could translate to higher rental costs and other fees for tenants. As the Center for American Progress[73] has pointed out, the growth of the rental bond market may also increase investors' appetite for yield, and encourage higher rents as a result. An important question is the extent to which rental securitization of geographically dispersed properties creates new interdependencies among renters in different markets. For example, if returns are lower than expected in one market, could renters in other parts of the portfolio face increased housing costs?

Affordability concerns in the single-family rental market are not limited to rental securitization. The ability for institutional investors to quickly penetrate and establish a large inventory in local markets may allow them to corner the market and raise overall rents: in Tampa, almost all of the properties owned by Blackstone subsidiary Invitation Homes are more

expensive than the average Tampa rental.[74] While median rents in the Atlanta metropolitan area are $1,050, among a group of 25 tenants of Invitation Homes interviewed recently, the typical rent was $1,300 a month; in February 2014 a number of its tenants received lease renewal offers that would set monthly rent at $1,785 for the first year (37% increase) and $1,856 for the second year (43% increase), or $2,050 for a month-to-month lease (53% increase).[75] Surveys of Invitation Homes tenants in Los Angeles found that at $1,843, the median rent paid was slightly less than 2013 HUD Fair Market Rents of $1,921 for a three-bedroom (the most common size home of survey respondents) in LA County; however, nearly half of respondents reported they were paying more than they had expected for rent.[76] Given the terms of lease renewals in Atlanta, these tenants could easily face rents exceeding $2,500 a month upon renewal. In Riverside, Invitation Homes tenants surveyed were paying $1,663 a month, which exceeds 2013 HUD Fair Market Rents of $1,577 for a three-bedroom home for the county. This is a concern given that 30% of renters in Riverside devoted more than half of their income to rent in 2012 (up from 21% in 2007), and because victims of the housing crisis in Los Angeles have been migrating further inland in search of lower housing costs.[77]

If other types of landlords follow the lead of institutional investors, this could set a 'new normal' of higher rents. In addition, the entrance of industry leaders like Blackstone to local markets can draw in other investors, generating competition and heightened turnover. The growth of investor demand for rental properties, and the not-unrelated housing recovery, increases acquisition costs, which in turn may affect affordability for tenants.[78]

In addition to higher rents, responsibility for landscaping, washer-dryers, pest control and other maintenance costs associated with single-family rental housing may add to tenants' housing cost burden. Furthermore the need for investors to produce a steady income stream from their rental holdings means tenants are also subject to financial penalties for being on a month-to-month lease and paying rent late ($250 and $200 per month respectively, according to a lease from an Atlanta-area Invitation Homes tenant). Late charges are not uncommon, but the corporate structure of institutional investors, the non-local nature of the tenant-landlord relationship, and the exigencies of investment strategies may increase corporate landlords' reliance on such penalties and limit tenants' opportunities to seek recourse in cases of hardship. To wit, a former homeowner renting from Invitation Homes in Los Angeles explained she wished her landlord were "more willing to make arrangements" and had "more empathy."

Corporate ownership may increase landlords' reliance on financial penalties and limit tenants' opportunities to seek recourse in cases of hardship.

ACCESSIBILITY

The extent to which the institutionalization of single-family rental housing will affect housing accessibility is another concern about the impact this new market stands to have on renters. As corporate practices formalize the tenant-landlord relationship, renters who do no not conform to investors' risk criteria may be excluded from access to housing on the basis of their immigration status, criminal record, or eligibility for housing subsidy. While any landlord in the private rental market may exclude tenants based on such factors, when landlords with large property holdings engage in such biased behavior, the barriers to access may be greater.

Reports have been mixed on the extent to which tenants with Section 8 vouchers have been able to access homes owned by institutional investors. Overall, less than 1% of the properties owned by Invitation Homes are occupied by tenants with Section 8 vouchers.[79] An Atlanta realtor working on behalf of tenants with the government subsidy reported that large corporate landlords had repeatedly rebuffed her inquiries about units for Section 8 tenants.[80] However, recent research out of Phoenix indicates that over time, institutional investors in the area have increasingly rented to those with Section 8 vouchers.[81] In our own surveys of Invitation Homes tenants in Los Angeles and Riverside, only one of 50 respondents received Section 8 subsidy.

Corporate landlords' limited experience means they may be failing to comply with fair housing law in how they market their properties, who they rent to, and whether they make accommodations for people with disabilities. Clearly, corporate landlords must be in compliance with fair housing laws in order to ensure equitable access to housing. However, this issue is complex and must also be

considered against the potential for how a shift in investment priorities could contribute to housing instability for low-income renters over the medium and long term, and the ramifications of government subsidizing such cases of speculation.

A related concern is the potential role data and technology may play in housing access. Invitation Homes tenants are pre-screened for a minimum 2.5:1 gross rent-to-income ratio and a minimum 25% net income after rent and bills; negative credit accounts and unpaid collections; history of foreclosure and eviction; and criminal history, with Atlanta-area standards excluding not only felons, but those with a history of misdemeanors.[82] Credit and criminal background checks are standard practice in the rental industry, but some tenant screening bureaus also provide information from a wider range of sources, including whether prospective tenants have ever been involved in litigation with a landlord. Regardless of the nature of the case or its outcome, this can lead tenants to be "blacklisted" by landlords, even if they were using tenant law to protect themselves from discrimination or to advocate for their rights.[83] The rise of "alternative credit scores" based on rental, utility, and cell phone payment history[84] add even more potential data points to the screening process. For example, in a recent partnership, Riverstone Residential, which carries out property management for Blackstone's single-family rentals, will contribute its data on rental payment history to credit rating agency Experian, making it the first to include such data in its credit reports.[85]

The importance of data on tenants and prospective tenants to price risk and project returns is likely to grow as investors advance rental securitization and public offerings,[86] generating questions about the potential for data to narrow housing access on possibly questionable grounds. Moreover, investors' data systems are still in development, and renters in Atlanta have reported on-time rent payments being mistakenly flagged late in the system. Such data collection practices and computerized interfaces in the newly institutionalized single-family rental market could affect how tenants fare on alternative credit scoring mechanisms, potentially impacting future access to both rental housing and homeownership opportunities.

A lot of the repairs seem like rush jobs.
– Invitation Homes tenant in Atlanta

HOUSING QUALITY

Another set of concerns for renters and communities relates to the potential for institutional investors to affect housing quality. Large investors are engaged in ongoing acquisition across multiple markets, and their portfolios are in various stages of renovation, leasing and maintenance as they build up their property management infrastructure and processes.[87]

As many observers have noted, institutional investors do not have a track record in property management and maintenance, and there is no industry precedent for large-scale single-family renting.[88] These factors create many potential openings for housing quality to fall through the cracks. For example, a majority of Invitation Homes tenants in Atlanta had experienced maintenance problems, expressing concern about shoddily completed renovations before they moved in, lack of responsiveness to requests for repairs, and difficulty getting clarity about who is accountable when repairs and maintenance are needed. This is especially concerning when maintenance problems have clear ramifications for health, such as failing to respond adequately to issues like mold, something Invitation Homes tenants in Atlanta and Los Angeles have experienced.[89] In fact, a Los Angeles family recently filed a lawsuit, alleging that their health suffered as a result of the rental company's failure to quickly respond to water leaks, mold, and cockroaches.[90]

With fewer ties to the community, non-local investors may invest less in property renovation and upkeep than local owners and be more likely to ruthlessly abandon the property once it is no longer profitable.[91] This kind of "dumping" is particularly relevant to bulk purchases and large buying sprees, in which investors may later dump properties deemed uneconomical for their market strategy.[92]

Indiscriminate buying by institutional investors can threaten housing quality: the Federal Reserve Bank cautions that overestimating rental demand and/or spending more on improving, leasing, or managing homes than comes in from rental payments may lead investors to cut back on property maintenance.[93] Greater reliance on leverage, such as securitization, further increases the potential for investors to experience financial distress, adding to the risk of property

neglect and pressure to liquidate properties.[94] Compared to smaller or local investors, large institutional investors may be less vulnerable to the reputational threat associated with poorly maintained properties — and therefore more difficult for tenants to hold accountable for housing quality.

STABILITY AND ACCOUNTABILITY

The potential for property dumping, neglect and liquidation due to financial concerns also raises the question of housing stability for renters. If indiscriminate buying by institutional investors pushes up prices and ultimately makes the value of investments fall, the pressure for investors to flip property will grow, potentially creating another speculative cycle that could end in a bust, subjecting communities to yet another round of destabilization.[95] These processes may force tenants to move, or they may find themselves having to adjust to new policies and practices, e.g. for reporting maintenance requests, when their home is flipped to a new investor-landlord (much as homeowners often found their mortgage servicer changing frequently as loans changed hands among financial actors). Some tenants, such as those renting properties from Key Properties/BLT Homes, which sold 1,400 Atlanta-area homes to Blackstone last spring in the single-family rental industry's largest bulk acquisition, have already undergone this challenge.[96] Low-income renters, including those with Section 8 vouchers, may be especially vulnerable to housing instability caused by property dumping and portfolio selloffs.

Beyond the implications for housing stability at the household level, we must also attend to the risks to stability, recovery and accountability that neighborhoods and communities face in connection with corporate investment practices in the single-family rental market. As firms like Blackstone, Colony Capital, American Homes 4 Rent and Starwood Waypoint eagerly develop this market, another speculative bubble could destabilize the same communities struggling to recover from the foreclosure crisis and recession, which were largely brought on by high-risk financial practices. When a handful of investors control broad swaths of local communities, it is critical that these communities have opportunities to hold investors accountable for the local impacts of their business practices. Given that Invitation Homes tenants in Los Angeles and Riverside uniformly agreed they did not have regular contact with their landlord, and many had never met their landlord in person at all, the institutionalization of single-family renting clearly poses challenges to tenant-landlord accountability. Such concerns were echoed by Invitation Homes tenants in Atlanta, who commented on the company's impersonal "corporate" style, reporting that they had never seen anyone from Invitation Homes since the day they moved in.[97]

Invitation Homes should have more dedication toward tenant needs.

– Invitation Homes tenant in Riverside

They don't care about tenants.

– Invitation Homes tenant in Los Angeles

SETTING AN AGENDA FOR THE SINGLE-FAMILY RENTAL MARKET

Because the institutionalization of the single-family rental market is such a new phenomenon, developing relevant policies is a challenge, although it seems clear that additional information and ongoing monitoring is needed. Moving forward, policymakers and housing advocates should focus their efforts on research, rights and regulation to ensure this rental market paradigm shift does not worsen the rental affordability crisis and destabilize communities still contending with the effects of the foreclosure crisis and economic downturn.

1.PUBLIC SUPPORT FOR RESEARCH TO GET OUT AHEAD OF THIS PARADIGM SHIFT

Given the thin precedent for an institutionalized single-family rental market, a major and immediate priority is federal support of more extensive research on the impact institutional investors have on local rental markets and renters.

i. Offer greater transparency into the single-family rental market

The Federal Housing Finance Agency's REO Pilot Initiative has completed three bulk sales: 699 properties in the Central, Northeast, Southeast and West Coast areas of Florida; 94 properties in Chicago; and 970 properties in Arizona, Florida and California. However, the bid process was sealed and while the initiative includes extensive reporting requirements for investors, FHFA has not provided updated information since November 2012. A 2013 audit by the Office of the Inspector General recommended improved oversight of the program.[98]

FHFA has not clarified how the goals and objectives of the pilot program will be achieved, or how the agency intends to monitor and assess the performance of the pilot.

– 2013 Office of the Inspector General audit of the Federal Housing Finance Agency's REO Pilot Initiative

There is a need for greater transparency from REO Pilot Initiative activity to date, which could be achieved through additional public disclosure of information about the bidding process, releasing data from required reports, and opening up further research opportunities on the Initiative. This would afford comparison of a more tightly regulated, publicly controlled approach to REO disposition with the buying sprees of deep-pocketed investors in the same markets, particularly when examining factors like evictions and rent increases. Evaluation and additional research on bulk sales may provide important early results that help policymakers get out ahead of this paradigm shift and develop effective policies for the new single-family rental market. Greater transparency into sales, management and business strategy is desirable throughout the single-family rental market, particularly because of the opacity enjoyed by alternative investors like private equity funds.

ii. Provide public funding for research on impact of investor activity

Beyond the REO Pilot Initiative, the federal government should support research on how investor activity affects local rental markets and renters, especially around issues of housing affordability, quality, security, stability, and access. Because many of the institutional investors involved in the REO-to-rental market are private equity players — who invest in private property and companies, are not required to disclose their returns, and often undertake riskier investment strategies — the need for sunlight on this market is great. This is especially important because the REO-to-rental model has taken off most in the areas struggling to recover from the foreclosure crisis, making due caution and careful monitoring a key concern. For example, information on the ability of renters with Section 8 vouchers to access properties owned by institutional investors is mixed[99] and should be evaluated over the long-term in tandem with the development of the market and investment strategies.

Public support for research is also imperative given the recent establishment of the National Home Rental Council by investors Blackstone, Starwood Waypoint, American Homes 4 Rent, and Colony Capital.[100] The NHRC plans to "represent the interests of the owner-operators of professionally managed single-family rental homes, their employees and the residents and families who rent from them" in their mission to "educate the public, the media and policymakers about the economic value of the industry."[101] This advocacy push from within the industry makes it critical that observers from outside the industry also have opportunities to educate the public, media and policymakers. Ideally, a research council on the single-family rental market should be assembled, with a priority for meaningful participation and agenda-setting by social scientists and urban planners as well as renters, homeowners and community-based organizations within the largest REO-to-rental markets (including Atlanta, Phoenix, Los Angeles, Tampa, Las Vegas, and Charlotte).

2. ENSURE A BASELINE OF PROTECTIONS FOR TENANTS

Because of concerns about housing quality, stability, and accessibility associated with the paradigm shift toward an institutionalized single-family rental market, there is also a need for more robust support of tenant rights at the national, state and local levels.

i. Create a national tenant clearinghouse to discern broader patterns in tenant experiences

Industry leaders like Blackstone and Colony Capital have purchased extensively in hard-hit markets across the West, Southwest, Southeast and Midwest U.S. Given the wide-ranging geography of corporate landlords' investments in single-family rental housing, a major question about the REO-to-rental model moving forward is tenants' ability to hold potentially distant landlords accountable for housing conditions and related issues. Renters have started using consumer review sites like Yelp[102] and Zillow[103] to share their experiences with corporate landlords and warn other renters about issues with overcharges and difficulty resolving maintenance requests.

This suggests the utility of a national tenant clearinghouse where tenants, housing advocates and grassroots organizations can access data (e.g. on rent increases and evictions) from publicly funded research on the single-family rental market and information about national, state and local tenants' rights. Such a clearinghouse could also provide a means for tenants in disparate cities to connect with each other to document their experiences, allowing them to discern broader patterns by aggregating issues and problems. There is some precedent for this: tenant activists formed the National Tenants Union in 1980; never able to secure adequate funding, it soon faded away.[104] However, the national scope of private equity investment in single-family housing requires careful attention to how tenants and rental housing in all target markets fare under this new business model.

> **They constantly lost our payments, mis-filed them or mis-posted them.**
>
> **I have placed numerous maintenance tickets, none of them were ever taken care of.**
>
> **Invitation Homes is not willing to put out the money for a DECENT and SAFE job, they hire the cheapest company they can to do 'patch up' jobs.**
>
> –Yelp reviews by Invitation Homes tenants in Woodland Hills, California.

The Consumer Financial Protection Bureau (CFPB), with its mission to protect Americans from abuses by financial companies, should play a role in creating and maintaining a national tenant clearinghouse to protect the rights of consumers renting from corporate landlords. Information tenants provide to the clearinghouse might be used to document relationships between particular investors and housing distress. This could promote awareness of the role of banks in financing such investments, and be taken into consideration by federal and state banking regulators. Data that tenants and grassroots groups access from the database could be used to advocate for local level tenant protection laws.

ii. Clarify tenant rights and remediation process at the local, state and national level

Tenants rights also vary significantly from state to state; therefore, government at the local and state level can also work proactively to ensure that tenants, especially former

homeowners who may be unfamiliar with the rental market, have access to information about their rights. In areas private equity funds have targeted most aggressively, local government should reach out to tenants with information about their rights and the process to follow if they believe their rights have been violated, and also post this information in a highly visible place online. This process should also include information about how to document and report housing code violations, how landlords are required to respond and in what time frame, and what recourse tenants have if landlords do not comply with these requirements. Such measures offer a safeguard against potential harassment and support housing stability, quality, access, and affordability. Moreover, they reinforce the role of the public sector in these concerns.

iii. Rethink tenants' rights for the era of "big data"

Furthermore, support for tenants' rights should explicitly address the "right to research" as part of consumer protection. Advances in technology have integrated data collection and research into everyday life. Indeed, the development of rent-backed securities depends on the ability to accurately price risk, including tenants' nonpayment of rent, which requires systematic data on the tenant pool. With more lenders using this kind of big data to develop "predictive risk" credit ratings based on nontraditional payment histories, such as rent and utility payments,[105] tenants should have the right to know and participate in how investor landlords like Blackstone use such data. Technical errors that mistakenly log on-time rental payments as late are not only inconvenient, but could create difficulties in accessing future housing, mortgage credit, and car loans. However, consumers face ongoing difficulties in correcting errors in their credit histories and credit rating agencies have no incentive to change this aspect of their business model.[106] Corporate misjudgement associated with recent high-profile consumer data breaches highlights additional vulnerabilities and the need to rethink consumer protection for the era of big data.[107]

3. DEVELOP PROACTIVE REGULATION TO PROMOTE THE COMMON GOOD

Lawmakers should also develop effective oversight and consider avenues for regulating an institutionalized single-family rental market. Federal, state and local government can all play a role in promoting the common good by attending to concerns around housing affordability, quality, accessibility, and stability in the single-family rental market.

Because the institutionalization of the single-family rental market is such a new phenomenon, developing relevant policies is a challenge. One place to start is clarifying the federal role in regulating the single-family rental market, especially around concerns related to the securitization of rental income. Secondly, lawmakers should move to develop affordability requirements for these owners if research shows that large investors hamper rental affordability in local markets. Finally, regulators should undertake efforts to promote affordable and sustainable community ownership of distressed properties that enhances local control and wealth creation by keeping capital circulating within the community.

i. Develop the federal role in regulating single-family rental

While oversight for private rental housing is typically the responsibility of local and state government, REO-to-rental significantly changes the paradigm of this market. There is a need to clarify what role, if any, the federal government currently plays in regulating the market for single-family rental housing (beyond extant rules under the Fair Housing Act and the Section 8 program). The Senate Committee on Banking, Housing and Urban Affairs should explore existing oversight and whether it is adequate for this new market. In this process, Congress should conduct field hearings and engage local government, housing advocates, and tenants in "feeding ground" cities and regions to gain a deeper understanding of where and how new regulations might intervene, or how existing policies can be brought to bear in new ways. For instance, it would be useful to shed light on whether Community Reinvestment Act (CRA) provisions apply to credit facilities that CRA-regulated institutions such as JPMorgan Chase provide to institutional investors to fund acquisitions. This could provide an important avenue for tenants and advocates to register concerns about how banks' funding of property acquisition by institutional investors affects local communities. If not via CRA, we need a means by which investors and banks can be held accountable for neighborhood impacts resulting from their business practices.

The CFPB, Department of Justice, and HUD all have a role to play in ensuring corporate landlords do not violate federal fair housing and fair lending laws in tenant selection, eviction policies, disability access, property maintenance, etc. But there appears to be no agency that is providing over-

sight. The CFPB should evaluate whether it has the authority to intervene in this arena, where large corporations stand to have a substantial impact on a great number of consumers. If the CFPB has no authority to provide this oversight role, Congress should give it authority to do so, or create another agency to fill that gap. There is a need to ensure a baseline of protections for tenants. The Protecting Tenants at Foreclosure Act offers a good precedent; it should be extended and include a private right of action in its protections, and the federal government should designate the CFPB as the agency to oversee it, develop any necessary regulations, and enforce its protections.

This is also a time to consider how the federal government might open pathways for regulation at the local level. For example, single-family homes are frequently exempt from rent control laws; moreover, in many places state law preempts the possibility of rent regulations at the local level. In the interest of housing that meets the needs not only of investors but also residents and communities, the federal government could create an exemption allowing local jurisdictions to enact rent regulations for single-family homes that underwent foreclosure between 2008 and 2013.

ii. Ensure affordability and accessibility of single-family rental housing

Guided by rigorous, publicly supported research on the near- and longer-term impact the institutionalized single-family rental market has on housing costs for low- and moderate-income (LMI) households, affordability requirements should be put in place for institutional investor-landlords. It would be important to use a measure of affordability in sync with neighborhood income levels, rather than those of the larger metropolitan area. Such requirements could peg responsibility to serve LMI households to institutional investor-landlords' market share (e.g. proportion of local single-family rental market controlled by investors corresponds to number of LMI households they are required to serve). This would help to offset the potential for investors with large holdings to exercise undue influence on local rental prices.

Lawmakers must also carefully consider the relationship between extant affordable housing programs, particularly Section 8, and the institutionalization of the single-family rental market. The expansion of single-family rental housing would seem to offer a new source of housing for those with Section 8 vouchers, potentially broadening the base of affordable rental housing (provided investors comply with fair housing laws, which regulators should monitor closely). While one avenue to pursue here could be requiring new corporate landlords to set aside a portion of single-family units for Section 8 voucher recipients, this would also represent a significant government subsidy for investors, offering them a steady flow of rental income to pay off bondholders and continue to fuel acquisitions. Rather, corporate landlords' profits might be subject to a progressive tax that could be used to support the National Housing Trust Fund and/or efforts that support local control of land and housing, e.g. community land trusts.

iii. Promote greater community control of housing and diversity of ownership structures

The REO-to-rental market represents the concentration of properties once owned by residents in the hands of large, well-capitalized private equity firms. Alternative investment approaches like private equity are less transparent than traditional approaches, and often pursue risky strategies to meet demands on equity coming into the deal. With this in mind, we should be cautious about concentrating large amounts of property under private equity ownership. The rapid pace of market innovation and the rush of many of the same financial institutions responsible for the foreclosure crisis to fund private equity's property acquisition also suggest troubling parallels to the dynamics that created the mid-2000s housing bubble. It took less than two years from the time industry leader Blackstone entered the market at the start of 2012 for foreclosed, single-family homes to be transformed into a new institutional asset class by securitizing rental income in late 2013.

The REO-to-rental market should not only be a paradigm shift for investors; government should work to promote greater diversity of ownership and control over land and housing in order to prevent the dominance of potentially high-risk financial practices in the single-family rental market. Community land trusts are especially compelling because they stake participants in their local communities while offering less vulnerability to foreclosure than traditional, individualized ownership.[108] It is the proper role of government to intervene during times of crisis. Now the government has the opportunity to act to prevent a crisis before it happens, while also addressing the longer-term crisis of housing security and affordability for renters. We should take this opportunity to develop alternatives that lift up housing as home, rather than pursuing the same kinds of marketized approaches that destabilized communities in the first place.

4. GENERATE RESOURCES TO SUPPORT LOWER-INCOME HOUSEHOLDS

Finally, policymakers should ensure that investors are not the only ones benefiting from the institutionalization of the single-family rental market. With the introduction of leverage, investors see single-family rental as a potentially $1.5 trillion opportunity.[109] Given the size of this market opportunity for investors, lawmakers should move to ensure that the public more broadly and renters, especially lower-income households, also benefit. This should be an especially high those of the larger metropolitan area post-crisis rental demand has worsened the longstanding rental affordability crisis.[110]

i. Implement a financial transaction fee on rental bonds

Rental securitizations continue to be rolled out (there have now been four issuances of rental bonds) to strong market reception, making more such transactions a strong possibility[111] despite a lack of clarity about whether the market will continue to grow based on fundamental demographic shifts (e.g. preference for rental, stagnant wages, tight mortgage credit, increased labor mobility) or decline as home prices approach normal levels.[112] However, as discussed in Section II, high investor demand for returns from rental bonds could have an adverse impact on housing affordability, especially for low-income renters, who already face an affordability crisis. One way to intervene here would be to implement a financial transaction fee on rental bonds. Since the financial crisis, many countries have debated and/or introduced such fees, and civil society groups argue that a small tax of less than half of 1% could help restore a frayed social safety net.[113] A number of such bills have been introduced in the U.S. Congress, but have made little headway thus far.[114] However, it is critical that the financial sector not be allowed to pillage the single-family sector without being held to account for how its activities affect the housing security of renters (many of whom are former homeowners). Without a significant burden on investors, instituting a small tax of perhaps 0.1% or 0.2% on rental bond transactions could create a significant amount of resources for the National Housing Trust Fund, which is targeted to rental housing and extremely low-income households, but has not been fully funded since being established in 2008.[115]

ii. Develop state and local level requirements for corporate landlords to add to affordable housing inventory

State and local government can also intervene in the single-family rental market to generate resources for lower-income households. While corporate investors currently own only a small share of single-family rental properties nationwide, their strategy has been highly segmented geographically. This means that some investors and their subsidiaries have large property holdings in a small number of markets, including Atlanta, Los Angeles, Phoenix and Tampa. Lawmakers should work to counterbalance the outsize influence investors may have on rental affordability in such markets. State and/or local government could explore establishing requirements that investors (and their subsidiaries) with a local inventory of 100 or more single-family rental properties set aside a portion of their holdings to be affordable to renters making below 50% of area median income.

iii. Introduce local and/or state taxes for corporate landlords to ensure that the community benefits from investments

Finally, city, county, and/or state governments should ensure that the profits corporate landlords generate through their investments in single-family rental housing also serve to benefit local communities. Because of the existing rental affordability crisis as well as concerns about how the institutionalization of single-family rental will affect housing security, state and local government should institute progressive tax measures on corporate landlords' profits. Such measures could apply to investors and associated subsidiaries with large local inventories, on profits above a certain threshold, with funds generated earmarked for creating or preserving permanently affordable housing (such as community land trusts) at the local level. In this way, local and state government can promote the common good by ensuring that the financial benefits associated with the changing face of the single-family rental market don't come at the expense of worsening rental affordability concerns.

CALL FOR ACTION

The foreclosure crisis and Great Recession have substantially increased rental demand as former homeowners become renters and others are barred from home purchase by poor credit and tightened underwriting standards. The communities hardest hit by foreclosure have endured years of decline and social and economic instability in the wake of the crisis, and today nearly one out of every five homeowners with a mortgage owes more than their homes are worth.[116] Since 2012, leaders in the alternative investment industry, such as Blackstone and Colony Capital, have poured over $20 billion into purchasing foreclosed properties and converting them to rental use. This could appear to be a win-win, providing supply for new rental demand and stabilizing local property values. However, the institutionalization of the single-family rental market by private equity funds, aided by the same global banking giants implicated in the fraud and excesses that shaped the worldwide financial crisis, should be viewed with caution.

In just a few years, large investment companies have rapidly developed not only the single-family rental market, but also new institutional asset classes like single-family REITs and rent-backed securities. The loss of millions of properties to foreclosure and the possibility of a shift from an "ownership society" to a "rentership society" represents an opportunity for investors but may threaten the housing security of renters and further undermine communities still struggling to recover from the 2008 crisis. As outlined in this report, the institutionalization of single-family rental housing could translate to higher housing costs for tenants as new corporate landlords strive to deliver returns to shareholders and investors in rental bonds, while also raising concerns about the impact financial risks may have on housing quality and stability. The implications of having large swaths of land under monopoly control by non-local owners, who may be difficult to hold accountable, and whose objectives may conflict with those of the community, is a greater question still.

In drawing attention to this paradigm shift in the single-family rental market and its potential impacts on renters, this report aims to set an agenda for action by housing advocates and policymakers. The transformation of single-family rental housing from a local, "mom and pop" industry to a global investment class should be closely studied, subject to proactive regulation to promote the common good, accompanied by enhanced support for tenants' rights, and generate resources that will benefit lower-income households most vulnerable to housing insecurity. We must recognize that land and housing are not simply financial assets, but resources that are fundamental to the well-being of families across the economic spectrum, communities and society, and we must act on this insight.

ENDNOTES

1 Rahmani, J., George, B. and O'Steen, R. (2013). Single-Family REO: An Emerging Asset Class (3rd edition). North America Equity Research: Mortgage Finance Industry Update (September 10). Keefe, Buryette and Woods.

2 Rahmani, J., George, B., Tomasello, R. (2014). Securitization of Single-Family Rentals. North America Equity Research: Mortgage Finance Industry Update (January 14). Keefe, Bruyette and Woods.

3 Samara, T. (2014). Rise of the Renter Nation: Solutions to the National Affordability Crisis. Right To The City Alliance.

4 Gittelsohn, J. and Perlberg, H. (2013, December 20). Wall Street Unlocks Profits from Distress with Rental Revolution. Bloomberg. http://www.bloomberg.com/news/2013-12-20/wall-street-unlocks-profits-from-distress-with-rental-revolution.html; Rahmani et al., supra note 1.

5 Corkery, Michael (2014, January 29). Wall Street's New Housing Bonanza. The New York Times. http://dealbook.nytimes.com/2014/01/29/wall-streets-new-housing-bonanza/; Rahmani et al, supra note 2.

6 Gittelsohn, J. (2012, December 14). Silver Bay Raises $245 Million in Single-Family REIT IPO. Bloomberg. http://www.bloomberg.com/news/2012-12-14/silver-bay-raises-245-million-in-single-family-reit-ipo.html

7 Gittelsohn, J. (2013, October 31). Starwood to Spin Off Rental-Home Division into New REIT. Bloomberg. http://www.bloomberg.com/news/2013-10-31/starwood-said-to-plan-reit-ipo-buy-way-point-management.html

8 Rahmani, supra note 1.

9 Perlberg, H. and Gittelsohn, J. (2014, February 21). Wall Street Landlords Buy Bad Loans for Cheaper Homes. Bloomberg. http://www.bloomberg.com/news/2014-02-21/wall-street-landlords-buy-bad-loans-for-cheaper-homes-mortgages.html

10 Call, R., Powell, D. and Heck, S. (2014). Blackstone: Atlanta's Newest Landlord. The New Face of the Rental Market. Occupy Our Homes Atlanta. http://occupyourhomesatl.org/blackstone-atlantas-newest-landlord/

11 Perlberg, H. and Gittelsohn, J. (2013, August 29). Wall Street's Rental Bet Brings Quandary to Housing Poor. Bloomberg. http://www.bloomberg.com/news/2013-08-29/wall-street-s-rental-bet-brings-quandary-housing-poor.html

12 Call et al., supra note 10.

13 Khouri, A. (2014, May 5). Blackstone Unit Invitation Homes Sued Over Rental House's Condition. Los Angeles Times. http://www.latimes.com/business/la-fi-blackstone-lawsuit-20140506-story.html

14 Gilani, S. (2013, April 4). Are "Wall Street Buyers" Like Blackstone Group Creating Another Housing Bubble? Money Morning. http://moneymorning.com/2013/04/04/are-wall-street-buyers-like-blackstone-group-creating-another-housing-bubble/; Goldstein, M., & Ablan, J. (2012, October 18). Some Hedge Funds Throwing in Keys as "Landlords." Reuters. http://blogs.reuters.com/unstructured-finance/2012/10/18/some-hedge-funds-throwing-in-keys-as-landlords/; Bristor, A. (2013). REO Declines are Not Always a Good Thing. The MarketPulse, 2(3), CoreLogic.

15 Joint Center for Housing Studies. (2011). Rental Market Stresses: Impacts of the Great Recession on affordability and multifamily lending. Cambridge, MA: Harvard University.

16 Dreier, P., Bhatti, S., Call, R., Schwartz, A. and Squires, G. (2014). Underwater America: How the So-called Housing "Recovery" is Bypassing Many American Communities. Haas Institute for a Fair and Inclusive Society, University of California, Berkeley.

17 Joint Center for Housing Studies. (2013). The State of the Nation's Housing. Cambridge, MA: Harvard University; Samara, supra note 3.

18 Dreier et al., supra note 16.

19 Samara, supra note 3.

20 Callis, R. and Kresin, M. (2014). Residential Vacancies and Homeownership in the Fourth Quarter 2013. U.S. Census Bureau News, CB14-09. U.S. Department of Commerce.

21 Joint Center for Housing Studies, supra note 17.

22 Ibid.

23 Kurth, Ryan (2012). Single-family Rental Housing: The fastest growing component of the rental market (data note). Economic and Strategic Research, 2(1), 1-5. Fannie Mae.

24 Rahmani, et al, supra note 1.

25 Molloy, R. and Zarutskie, R. (2013). Business Investor Activity in the Single-Family Housing Market. FEDS Notes (December 5). Federal Reserve Bank.

26 Brennan, M. (2013, June 4). Wall Street Buying Adds to Housing Boom. Is a New Bubble on the Way? Forbes. http://www.forbes.com/sites/morganbrennan/2013/06/04/wall-street-buying-leads-to-housing-boom-is-a-new-bubble-on-the-way/

27 Gittelsohn, J. (2012, January 31). Foreclosures Draw Private Equity as U.S. Sells Homes. Bloomberg. http://www.bloomberg.com/news/2012-01-31/foreclosures-draw-private-equity-as-u-s-selling-200-000-homes-mortgages.html

28 Federal Housing Finance Agency (2012). Fannie Mae SFR REO 2012-1: Highlights of the REO Pilot Transactions. Accessed March 10, 2014 at www.fhfa.gov/webfiles/24720/SFREO2012dealtermF0.pdf (Link no longer live as of April 21, 2014.)

29 Burns, M. (2012). Statement to the House, Committee on Financial Services, Subcommittee on Capital markets and Government-Sponsored Enterprises. An Examination of the Federal Housing Finance Agency's Real Estate Owned (REO) Pilot Program, Field hearing, May 7, 2012 (Serial no. 112-120). Accessed May 13, 2014 at: http://financialservices.house.gov/uploadedfiles/112-120.pdf

30 Burns, supra note 29; Stegman, M. (2012). Statement to the House, Committee on Financial Services, Subcommittee on Capital markets and Government-Sponsored Enterprises. An Examination of the Federal Housing Finance Agency's Real Estate Owned (REO) Pilot Program, Field hearing, May 7, 2012 (Serial no. 112-120). Accessed May 13, 2014 at: http://financialservices.house.gov/uploadedfiles/112-120.pdf

31 Whelan, R. (2011, August 4). Big Money Gets Into Landlord Game. The Wall Street Journal. http://online.wsj.com/news/articles/SB10001424053111904292504576484571234105448; Gittelsohn, J. (2012, June 13). Private Equity Has Too much Money to Spend on Homes. Bloomberg. http://www.bloomberg.com/news/2012-06-13/private-equity-has-too-much-money-to-spend-on-homes-mortgages.html

32 Gittelsohn, J. and Perlberg, H. (2013, September 17). Starwood Said to Buy Waypoint Homes Management. Bloomberg. http://www.bloomberg.com/news/2013-09-17/starwood-property-said-to-plan-to-buy-waypoint-management.html; Sichelman, L. (2013, November 6). How Long Will Single-Family Rentals Stay Viable? Urban Land: Market Trends. http://urbanland.uli.org/news/how-long-will-single-family-rentals-stay-viable/

33 Fleming, M. (2013). Slow Money is Replacing Fast Money: The single-family residential rental asset class is maturing quickly. The MarketPulse, 2(12), 4-6. CoreLogic.; Rahmani et al., supra note 1.

34 Brennan, M. (2013, March 18). Wall Street Institutions Behind Home Price Surges in Markets Like Phoenix. Forbes. http://www.forbes.com/sites/morganbrennan/2013/03/18/wall-street-institutions-behind-home-price-surges-in-markets-like-phoenix/; Khater, S. (2013). The Rise of Institutional Investors and the Decline of REOs. The MarketPulse, 2(3), 4-5. CoreLogic.

35 Gittelsohn, supra note 27; Brennan, M. (2012, April 3). Investors Flock to Housing, Looking to Buy Thousands of Homes in Bulk. Forbes. http://www.forbes.com/sites/morganbrennan/2012/04/03/investors-flock-to-housing-aspiring-to-own-thousands-of-homes/; Harwell, D. (2013, March 24). Land Rush: Blackstone, other investors snap up thousands of Tampa Bay rental homes. Tampa Bay Times. http://www.tampabay.com/news/business/realestate/blackstone-other-investors-snap-up-thousands-of-tampa-bay-rental-homes/2110744

36 Ibid.

37 Molly and Zarutskie, supra note 25.

38 Gittelsohn and Perlberg, supra note 4; Samara, supra note 3; Rahmani et al, supra note 1.

39 Gittelsohn, J., & Banerjee, D. (2013, June 7). Apollo Said to get $200 Million Deutsche Bank Loan to Buy Homes. Bloomberg. http://www.bloomberg.com/news/2013-06-07/apollo-said-to-get-200-million-deutsche-bank-loan-to-buy-homes.html; Gittelsohn, J. and Perlberg, H. (2013, October 23). Blackstone Funding Largest U.S. Single-Family Rentals. Bloomberg. http://www.bloomberg.com/news/2013-10-23/blackstone-creating-rental-home-bonds-after-buying-spree.html

40 Gittelsohn, J., & Perlberg, H. (2013, April 25, 2013). Blackstone Buys Atlanta Homes in Largest Rental Trade. Bloomberg. http://www.bloomberg.com/news/2013-04-25/blacktone-buys-atlanta-homes-in-largest-bulk-rental-trade.html

41 Gittelsohn, supra note 6.

42 Hoak, A. (2014, March 3). Investing in Farm, Single-family Home REITs. MarketWatch: The Wall Street Journal. http://www.marketwatch.com/story/investing-in-farm-single-family-home-reits-2014-03-03

43 Corkery, supra note 5; Rahmani et al, supra note 2.

44 Tempkin, A. and Williams, C. (2014, March 19). Colony Capital Markets Industry's Second-Ever REO-to-rental bond. Reuters. http://www.reuters.com/article/2014/03/19/colony-rmbs-reo-idUSL2N-0MG1UG20140319

45 Gittelsohn, J. and Perlberg, H. (2014, May 6). American Homes 4 Rent to Start Offer of Rental-Home Bonds. Bloomberg. http://www.bloomberg.com/news/2014-05-06/american-homes-4-rent-to-start-offer-of-rental-home-bonds.html

46 Rahmani et al, supra note 2.

47 Ibid.

48 Financial Crisis Inquiry Commission (2011). The CDO Machine. In: The Financial Crisis Inquiry Report (p. 127-155). New York: Public Affairs; Taibbi, M. (2013, June 19). The Last Mystery of the Financial Crisis. Rolling Stone. http://www.rollingstone.com/politics/news/the-last-mystery-of-the-financial-crisis-20130619

49 Morningstar Credit Ratings (2014, May 1). Morningstar Single-Family Rental Securitization Frequently Asked Questions. Research reports.

50 Rahmani, supra note 1.

51 Gittelsohn, supra note 27.

52 Perlberg and Gittelsohn, supra note 9.

53 Federal Housing Finance Agency, supra note 28.

54 Gittelsohn, supra note 31; Gopal, P., & Gittelsohn, J. (2012, October 17). Phoenix Picked Clean, Private Equity Descends on Atlanta. Bloomberg. http://www.bloomberg.com/news/2012-10-17/private-equity-in-atlanta-after-picking-phoenix-clean-mortgages.html; Call et al, supra note 10.

55 Perlberg and Gittelsohn, supra note 9.

56 Starwood Waypoint Residential Trust (2014, March 13). Starwood Waypoint Residential Trust Acquires Pool of Approximately 500 Non-Performing Loans. http://investors.starwoodwaypoint.com/file.aspx?IID=4423541&FID=22532194

57 Perlberg and Gittelsohn, supra note 9.

58 Klein, M. (2014, February 25). Bubble to Bust to Recovery. Bloomberg View. http://www.bloomberg.com/dataview/2014-02-25/bubble-to-bust-to-recovery.html

59 Rahmani et al., supra note 1.

60 Ibid.

61 Gopal and Gittelsohn, supra note 54; Brennan, supra note 26; Khater, supra note 34.

62 Federal Reserve Bank of Atlanta (2013). A Cottage Industry Goes Big: Institutional Investors Flock to Single-Family Homes. EconSouth, Second Quarter 2013, 6-11. http://www.frbatlanta.org/documents/pubs/econsouth/13q2_institutional_investors.pdf

63 Dobbyn, K. (2013, November 9). Institutional Investing: The Race for the Next Big Deal. CoreLogic. http://www.corelogic.com/blog/authors/kathryn-dobbyn/2013/11/institutional-investing-the-race-for-the-next-big-deal.aspx#.U1QkOOZdUY8

64 Molloy and Zarutskie, supra note 25.

65 Federal Reserve Bank of Atlanta, supra note 62.

66 Klein, supra note 58.

67 Joint Center for Housing Studies, supra note 17.

68 Eckholm, E. (2010, February 18). A Sight All Too Familiar in Poor Neighborhoods. The New York Times. http://www.nytimes.com/2010/02/19/us/19evict.html?pagewanted=all; Saegert, S. and Evans, G. (2003). Poverty, Housing Niches and Health in the United States. Journal of Social Issues, 59(3), 569-589; Rolnik, R. (2010). Report of the Special Rapporteur on adequate housing as a component of the right to an adequate standard of living, and on the right of non-discrimination in this context. Addendum: Mission to the United States of America. United Nations General Assembly: Human Rights Council, Thirteenth session. http://daccess-dds-ny.un.org/doc/UNDOC/GEN/G10/107/39/PDF/G1010739.pdf?OpenElement; Shaw, M. (2004). Housing and Public Health. Annual Review of Public Health, 25, 397-418.

69 Pfeiffer, D. and Tumpson-Molina, E. (2013). The Trajectory of REOs in Southern California Latino Neighborhoods: An uneven geography of recovery. Housing Policy Debate, 23(1), 81-109; Fields, D. and Uffer, S. (forthcoming). The Financialization of Rental Housing: A comparative analysis of New York and Berlin. Urban Studies.

70 Call et al., supra note 10; Strategic Actions for a Just Economy, forthcoming.

71 Dewan, S. (2014, April 14). In Many Cities, Rent is Rising Out of Reach of Middle Class. The New York Times. http://www.nytimes.com/2014/04/15/business/more-renters-find-30-affordability-ratio-unattainable.html

72 Joint Center for Housing Studies (2013). America's Rental Housing: Evolving Markets and Needs. Cambridge, MA: Harvard University

73 Edelman, S., Gordon, J. and Sanchez, D. (2014). When Wall Street Buys Main Street: The implications of single-family rental bonds for tenants and housing markets. Center for American Progress. http://www.americanprogress.org/issues/housing/report/2014/02/27/84750/when-wall-street-buys-main-street-2/

74 Harwell, supra note 35.

75 Call et al, supra note 10.

76 Strategic Actions for a Just Economy, supra note 70.

77 Takano, M. (2014). Rent on the Rise in Riverside. U.S. House of Representatives. Accessed on March 15, 2014 at: http://takano.house.gov/sites/takano.house.gov/files/Riverside_Rental_Report_-_FINAL.pdf; Medina, J. (2014, May 9). Hardship Makes a New Home in the Suburbs. The New York Times. http://www.nytimes.com/2014/05/10/us/hardship-makes-a-new-home-in-the-suburbs.html?hpw&rref=us

78 Edelman et al, supra note 73; Rahmani et al, supra note 2.

79 Perlberg, and Gittelsohn, supra note 11.

80 Ibid.

81 Pfeiffer, D. and Lucero, J. (2014). Low-income Renters in the Phoenix Foreclosure Crisis. Paper presented at the annual meeting of the Urban Affairs Association, San Antonio, TX.

82 Cao, B. and Alan, B. (2013). Pre-sale Report: Invitation Homes 2013-SFR1. Morningstar Rating Agency. https://ratingagency.morningstar.com/PublicDocDisplay.aspx?i=wCk8Sv3HLVs%3D&m=i0Pyc%2Bx7qZZ4%2BsXnymazBA%3D%3D&s=LviRtUKXqs8kml5dHt7FTeE2SZmY0Fvqd4iX49Mk%2F9UapyiFTEO6TA%3D%3D

83 Richman, V. (2002). Landlords Blacklist Activist Tenants. Shelterforce, Issue 124. http://www.shelterforce.com/online/issues/124/blacklist.html

84 Bundrick, H. (2014, January 27). How Lenders Use Your Hidden Credit Score. U.S. News and World Report. http://money.usnews.com/money/blogs/my-money/2014/01/27/how-lenders-use-your-hidden-credit-score

85 Snyder, K. (2012). Experian RentBureau to Receive Rental Payment History from Riverstone Residential Group. Experian News Blog. http://www.experian.com/blogs/news/2012/05/30/riverstone/

86 Neumann, J. (2012, September 16). Boost for Foreclosure Market. The Wall Street Journal. http://online.wsj.com/news/articles/SB10000872396390443720204578000570020723746

87 Edelman et al., supra note 73.

88 Moody's Investors Service (2012, August 23). Moody's Identifies Key Risk Factors in Securitizations of Single-Family Rental Properties. Division of Global Credit Research. https://www.moodys.com/research/

Moodys-identifies-key-risk-factors-in-securitizations-of-single-family--PR_253840; Rich, M. (2012, April 2). Investors Are Looking to Buy Homes by the Thousands. The New York Times. http://www.nytimes.com/2012/04/03/business/investors-are-looking-to-buy-homes-by-the-thousands.html?pagewanted=all; Brennan, supra note 26.

89 Call et al., supra note 10.

90 Khouri, supra note 8.

91 Immergluck, D. and Law, J. (2013). Speculating in Crisis: The intrametropolitan geography of investing in foreclosed homes in Atlanta. Urban Geography, 35(1), 1-24; Fisher, L. and Lambie-Hanson, L. (2012). Are Investors the Bad Guys? Tenure and neighborhood stability in Chelsea, Massachusetts. Real Estate Economics, 40(2), 351-386.

92 Immergluck, D. (2013). The Role of Investors in the Single-family Market in Distressed Neighborhoods: The case of Atlanta. Joint Center for Housing Studies. Cambridge, MA: Harvard University. http://www.urban.org/UploadedPDF/412743-The-Role-of-Investors-in-the-Single-Family-Market-in-Distressed-Neighborhoods.pdf; Edelman, S. (2013, September 5). Cash for Homes: Policy implications of an investor-led housing recovery. Issue brief. Center for American Progress. http://www.americanprogress.org/issues/housing/report/2013/09/05/73471/cash-for-homes-policy-implications-of-an-investor-led-housing-recovery/

93 Molloy and Zarutskie, supra note 25.

94 Ibid.

95 see supra note 14.

96 Gittelsohn and Perlberg, supra note 45.

97 Call et al, supra note 10.

98 Office of Inspector General (2013, September 27). Additional FHFA Oversight Can Improve the Real Estate Owned Pilot Program. Audit report: AUD-2013-012.

99 Perlberg and Gittelsohn, supra note 11; Pfeiffer and Lucero, supra note 81.

100 Logan, T. (2014, March 26). Single-family Rental Home Giants Form Trade Group in Washington. Los Angeles Times. http://www.latimes.com/la-fi-mo-rental-giants-plant-flag-in-washington-20140326,0,7368877.story#axzz2zj8BZQKD

101 National Home Rental Council (2014). The trade group states it is non-partisan, and enhances this framing by providing downloadable infographics, links to academic research, and a ".org" domain name: www.rentalhomecouncil.org

102 See, for example, reviews from Woodland Hills, CA http://www.yelp.com/biz/invitation-homes-woodland-hills and Alpharetta, GA, Yelp, 2014 http://www.yelp.com/biz/invitation-homes-alpharretta-2

103 See, for example, thread "Is American Homes 4 Rent a Scam", Zillow, 2013. http://www.zillow.com/advice-thread/is-american-homes-4-rent-a-scam/498040/

104 Ceraso, K. (1999). Whatever Happened to the Tenants Movement? Shelterforce, Issue 105. http://www.nhi.org/online/issues/105/ceraso.html

105 Bundrick, supra note 84.

106 Riepenhoff, J. and Wagner, M. (2012, May 6). Credit scars: Credit reporting agencies' failure to address damaging errors plaguing thousands of Americans prompts call for action. The Columbus Dispatch. http://www.dispatch.com/content/stories/local/2012/05/06/credit-scars.html; Bernard, T. (2013, August 2). An $18 Million Lesson in Handling Credit Report Errors. The New York Times. http://www.nytimes.com/2013/08/03/your-money/credit-scores/credit-bureaus-willing-to-tolerate-errors-experts-say.html

107 Harris, E. and Perlroth, N. (2014, March 14). Target Missed Signs of a Data Breach. The New York Times. http://www.nytimes.com/2014/03/14/business/target-missed-signs-of-a-data-breach.html

108 Stable Home Ownership in a Turbulent Economy: Delinquencies and foreclosures remain low in community land trusts. Working Paper: WP11ET1. Lincoln Institute of Land Policy.

109 Rahmani et al, supra note 2.

110 Joint Center for Housing Studies, supra note 15.

111 Goodman, L. (2014). Single-Family Securitized Financing: A Blueprint for the Future? The Urban Institute. http://www.urban.org/url.cfm?ID=412992&renderforprint=1

112 Raymond, E. (2014, May 16). Are Single-Family Rental Securitizations Here to Stay? Real Estate Research. Federal Reserve Bank of Atlanta. http://realestateresearch.frbatlanta.org/rer/2014/05/are-single-family-rental-securitizations-here-to-stay.html

113 Robin Hood Tax (2014). How it Works. The Robin Hood Tax. www.robinhoodtax.org

114 Scott, J. (2013, September 19). The Faltering Financial Transaction Tax and the Future of Wall Street. Forbes. http://www.forbes.com/sites/taxanalysts/2013/09/19/the-faltering-financial-transaction-tax-and-the-future-of-wall-street/

115 National Low-Income Housing Coalition (2014). National Housing Trust Fund. http://nlihc.org/issues/nhtf

116 Dreir et al, supra note 16.

LA WEEKLY

CITY HALL'S "DENSITY HAWKS" ARE CHANGING L.A.'S DNA

Bitter homes & gardens?

BY STEVEN LEIGH MORRIS, Wednesday, February 27, 2008

http://www.laweekly.com/index3.php?option=com_content&task=view&id=18410&Itemid=2&pop=1&page=0

Soon after taking the job of director of the Los Angeles Department of City Planning in 2006, Gail Goldberg made a declaration that let slip how City Hall is allowing developers to pursue a building frenzy straight out of the storied tale *Chinatown*.

"What have you done? The whole thing's a fraud." —County Supervisor Zev Yaroslavsky, on City Hall's claim that high-rises create affordable housing

"There's really no secret plan here." —City planner Jane Blumenfeld

“All I ask is, don’t scare people into paralysis.” —City Planning Director Gail Goldberg, about media coverage of her office’s activities

Said Goldberg, newly arrived here from a similar post in San Diego:

"In every city in this country, the zone on the land establishes the value of the land. In Los Angeles, that's not true.

"The value of the land is not based on what the zone says ... It's based on what [the] developer believes he can change the zone to.

"This is disastrous for the city.

"Disastrous.

"Zoning has to mean something in this city."

Goldberg probably wishes she hadn't said that, not necessarily because she got reprimanded by L.A.'s famously vindictive Mayor Antonio Villaraigosa, but because Los Angeles County Supervisor Zev Yaroslavksy has repeated her words in public, over and over. Yaroslavsky, who represented the city's affluent Westside District 5 as a councilman until 1994, has been staging a one-man campaign to slow City Hall's feverish promotion of density — a quiet war on the large swaths of suburbia and few hunks of countryside remaining inside the city limits.

With little debate, a trio of new "density enabling" ordinances (a real mouthful, known as the Downtown Ordinance, the Parking Reduction Ordinance and the Senate Bill 1818 Implementation Ordinance) has rolled through Goldberg's Planning Department and ended up in the ornate council chambers on City Hall's second floor.

The first two were easily approved, and the SB 1818 Implementation Ordinance passed on February 20, with only council members Dennis Zine, Janice Hahn, Bill Rosendahl and Tom LaBonge opposed. On paper, the three ordinances will let developers bypass the city's fundamental zoning protections — and profoundly alter the livability, look and essence of L.A.

This is no small thing. The rules for how Angelenos wanted to fashion their city were arduously, sometimes bitterly, negotiated among homeowners, developers, environmentalists and politicians in the mid-'80s, led by then city councilmen Joel Wachs, Marvin Braude and Yaroslavsky. Those core rules today hold tremendous power, creating a blueprint that dictates which Los Angeles neighborhoods should be preserved — and which should be dramatically built up.

Yet in contrast to the boisterous civic debate launched by city and community leaders in the 1980s, the Villaraigosa administration has grown accustomed to only tepid public interference and awareness. Through aide Gil Duran, the mayor has for five months ducked *L.A. Weekly*'s routine questions about his agenda's potential consequences citywide — much taller and fatter residential buildings than zoning law allows, significantly less green space, obliteration of residential parking in some complexes and removal of older, less expensive housing. (Hours before the *Weekly* went to press, Deputy Mayor Helmi Hisserich finally responded, lashing out at "heads in the sand" sentiments and warning that "the city is not going to stop growing.")

On the City Council itself, the likes of Wachs and Braude are long gone, replaced by avidly prodensity council members such as Jan Perry, Council President Eric Garcetti and Wendy Gruel, who rarely say no to grand construction plans and work in tandem with obscure

regional planning commissions that routinely override zoning rules in favor of developers and property owners.

Yaroslavsky, silent for the first two years of Villaraigosa's reign, now snaps, "These density hawks at City Hall are trying to undo 20 years of our work."

The constant overriding of zoning protections has indeed been relentless — a binge of "zoning variances" and "zone changes" granted by longtime Zoning Administrator Michael LoGrande, a little-known official who is the rear admiral of a prodensity flotilla inside City Hall that long predates Villaraigosa's administration.

The variances and zone changes — quite simply, permissions to skirt existing rules — are granted on a case-by-case basis, and LoGrande hands them out like candy. LoGrande did not return numerous phone calls from the *Weekly*. Four biweekly Planning Department reports, randomly selected by the *Weekly* from March, June, September and December 2007, show that requests to increase housing density or square footage rolled in at about 260 annually, slowing only as the mortgage crisis hit. Retired Zoning Administrator Jon Perica explains that while the sought-after density increases are subjected to design, environmental and compatibility review, "the Planning Department historically approves about 90 percent."

For anyone paying attention, and very few people are, LoGrande's decisions — buttressed by the rulings of seven area planning commissions populated with Villaraigosa's appointees — are why some corners of the city are taller and more congested than 10 years ago, even neighborhoods whose legally binding zoning plans were supposed to achieve the opposite.

In the 1960s, a city growth cap of 4.2 million was established as the peak load for Los Angeles' infrastructure and services. This allowed for urban centers like Century City, Warner Center and downtown, while protecting single-family neighborhoods. Three years ago, Perica warned, "growth beyond 4.2 million people would require that existing single-family neighborhoods and lower-density residential areas would have to be 'up-zoned' in the future for more intense multistory density." He added pointedly, "Residents didn't want Los Angeles to look like other higher-density Eastern cities, like Chicago and New York."

Nonetheless, the agendas of builders, land speculators, the chambers of commerce, the Planning Department and elected leaders have produced a virtually nondebated tectonic shift since the residential real estate turnaround of 2002, much increased under Villaraigosa. The shift is pushing L.A. from its suburban model of single-family homes with gardens or pools — the reason many come here — toward an urban template of shrinking green patches and multistory buildings of mostly renters.

To be sure, not everyone sees this in the negative light that people such as *The New Geography* author and social critic Joel Kotkin ("We remain an increasingly suburban nation") and Yaroslavsky do. Downtown developer Tom Gilmore scoffs that Kotkin and other defenders of suburbia and single-family dwellings "take that notion of urbanism and say, 'Oh my god, they're going to do that to your neighborhood too! They're going to make everything a "heat island"!'"

To Gilmore, the attitude in Ventura County and cities such as Santa Barbara, Rohnert Park, Sonoma, Healdsburg, Tracy and Dublin, all of which have enacted residential-growth limits to stop urbanization, denies the inevitable.

“Oh my god, they’re going to do that to your neighborhood!” —Developer Tom Gilmore, mocking those who are worried

"Growth is not an option," says Gilmore. "We can grow with care, with thought and creativity, or we can grow the way we've grown for 150 years. I don't think the Planning Department has got it all right, but I'm happy they've got a template we can argue about."

But his notion of a grand civic debate under way is a facade. The public have little idea what is being allowed even in their immediate area. Downtown insiders such as Ed Reyes — a city councilman and chairman of the powerful Planning and Land Use Management Committee — working with Villaraigosa's handpicked department heads like Goldberg and mayoral appointees like former Councilman Mike Woo (on the Planning Commission) aren't engaging Angelenos in any serious discussion of their "template." And the mayor is assiduously avoiding a public debate in which he might be forced to justify his vision.

Their template could force urbanism onto all but the most protected enclaves of Los Angeles. The truly protected spots are "R1-zoned" — or single-family-residential only — 318,602 of the city's roughly 1.4 million housing units. The other 75-plus percent of housing units in Los Angeles — including thousands of homes in single-family neighborhoods that residents assume are R1 when they are not — could potentially be "up-zoned" for apartment towers and condos. Some of the most vulnerable areas are the eastern and western ends of the San Fernando Valley — the last quadrants containing some open space.

Of 16,874 housing units built the year after Villaraigosa was elected, 86 percent were multifamily — the vast majority of those rentals. Established homeowner neighborhoods — the glue that historian and former California State Librarian Kevin Starr once noted helped hold L.A. together, even in bad times — are an afterthought; the Brookings Institute reports that L.A. is suffering a middle-class decline more pronounced than in any other urban area in America.

To be fair, some of the mayor's focus has been on truly "underutilized" areas — nearly 100 developments of 100,000 square feet or larger are proposed or approved on sites like the old Sears warehouse in Boyle Heights, land in Marlton Square in South Los Angeles, and the aging Valley Plaza in North Hollywood. Councilwoman Gruel and Council President Garcetti tout this "proactive lead from the mayor."

But there's another side: Around Vanowen and Balboa in the San Fernando Valley over the past decade, ranch homes on spacious lots have made way for apartments, condos or McMansions. Hillsides from Hollywood to Mount Washington are so overbuilt that cars are ordered off the streets on "red-flag days." Along Miracle Mile, beautiful Spanish Colonial duplexes that since the 1920s have housed middle-class families sit unprotected from the urbanization steamroller.

Zev Yaroslavsky is a shrewd, politically left-of-center politician and a "slow growth" advocate with two adult children. Now 59, he's been married to health-care and child-care activist Barbara Yaroslavsky for 36 years. Born in Boyle Heights, then home to Jewish immigrants, Yaroslavsky grew up in the Fairfax District, ran track at Fairfax High, and put himself through UCLA (he has a master's in British imperial history) by teaching Hebrew in Long Beach — and playing professional poker.

He knew the gambling had to stop when he was elected to the City Council in 1975. Before he was sworn in, he paid a last visit to his favorite Gardena casino, the Normandie, sidling up to a group of Jewish matrons who said, "Zev, we know you're going to be an honest politician because you never bluff." He remembers thinking, "No, I just look like I never bluff."

Today, he says Los Angeles desperately needs a subway to the sea. But 23 years ago, he and others raised safety concerns about tunneling under the Westside after a 1985 explosion of naturally occurring methane gas ripped through the Ross Dress for Less near Fairfax. Although Yaroslavsky is sometimes blamed for halting federal funds for the line, he called for further safety studies, while Westside Congressman Henry Waxman led the fight to stop federal funds.*

For his part, Yaroslavsky in 1998 led a successful ballot effort that stopped local sales taxes from being used on the increasingly pricey subway being built under Hollywood. He instead pushed to use those funds for non-subway transit projects.*

Longtime Westsiders remember it was Yaroslavsky who ushered through the huge expansion of the Westside Pavilion in 1986, despite community outrage over gridlock. Developer Gilmore is one of many pro-growthers who blame "Zev" for so disrupting the old mass-transit scheme that today the Westside is "incredibly dense" and has "the worst traffic in the city," but Yaroslavsky tires of getting blamed for inevitable development pressures in his former Council District 5.

It is, after all, some of the city's priciest and most sought-after housing real estate, running from Palms to Encino and including Westwood and UCLA. It's something of a City Hall tradition to blame Yaroslavsky: Even back in 1987, Mayor Tom Bradley's spokesman Fred MacFarlane, in *The New York Times*, blamed the congestion on him. In the same story, an L.A. businessman noted, "Right now, any slow-growth candidate who does not get arrested for molesting children can get elected." But how times have changed.

Yaroslavsky counters today's dominant voice of pro-growthers in City Hall by saying that had he not halted the $300-million-per-mile subway, Los Angeles could never have afforded to create the popular Orange Line bus lanes in the Valley or the Gold Line light rail from downtown to Pasadena. Sounding like the old Yaroslavsky, he tells the *Weekly*, "In all corners of the city, a revolution is brewing against the pack mentality at City Hall."

One of the issues that most sticks in his craw is the aforementioned SB 1818 Implementation Ordinance. Not exactly a household phrase, the ordinance lets developers build new apartment buildings 35 percent larger than the protective local zoning allows — if developers agree to include some below-market "affordable" units in these buildings.

But does it actually produce cheaper housing — its main aim? Yaroslavsky points to a development on Sepulveda in Westwood where a developer wiped out 31 apartments rented mostly to UCLA students for $1,500, erecting 59 condos with mortgages of about $3,000 a month. He recalls scornfully, "The developer says to me, 'Those [$1,500-a-month] units weren't affordable anyway.'" Yaroslavsky retorted, "How many of those students can afford your condos after they graduate?" And the trend is spreading. In Miracle Mile, he says, "On

Ridgeley and Sixth, there's four parcels of rent-controlled units. One day I'm jogging there, and they're gone!"

Under the SB 1818 Implementation Ordinance, the now-destroyed lower-cost apartments on Ridgeley and Sixth can be replaced with a luxury tower that ignores low-growth zoning — as long as the owner agrees to rent 10 to 20 percent of the apartments at "affordable" prices. The developer can now charge the current market rate (of about $2,300 a month for a two-bedroom apartment) for the rest of the units he builds at Ridgeley and Sixth — far higher than the rents in the now-destroyed building, and enough for a mortgage in most cities.

Fumes Yaroslavsky of this "affordable" housing, "The whole thing's a fraud. It's a wolf in sheep's clothing."

Yaroslavky's passion dates from the mid-'80s, when homeowners associations howled at a wave of construction from Hauser Boulevard to La Brea Avenue on both sides of Sixth Street in Miracle Mile that destroyed beloved, picturesque Spanish Colonial rentals boasting wrought-iron staircases, cozy alcoves and tile work from the 1920s.

The Bradley administration's urbanization frenzy ushered in shoddy, higher-density, four- and five-story apartment blocks with quickly decaying stucco veneers that looked like they'd been airlifted from Beirut. Indignation generated a wave of grassroots activism. Groups such as the Detroit Street Coalition and Not Yet New York pressured avidly pro-growth City Council President John Ferraro, and Bradley, to protect neighborhoods.

Angry citizens won a huge victory with approval of 35 legally binding land-use plans citywide, now known as "Community Plans." Largely shaped by residents, Community Plans made it harder for developers to roll through medium-density neighborhoods such as Miracle Mile. Community Plans protected the suburban character of low-density areas being eyed by developers near big streets like Florence, Reseda, Vanowen, La Brea and South Broadway.

But here's the clincher: SB 1818 trumps restrictions built into the Community Plans because it's state law. Each Community Plan is slowly being revisited by the Planning Department in negotiations among homeowners, renters, business owners and city planners, so that neighborhoods conform to projected growth. Right now, 12 city planners (plus support staff) are redoing a big batch of Community Plans including Boyle Heights, Central City, Granada Hills, Hollywood, San Pedro, South Central (redubbed Southeast), South L.A., Sunland-Tujunga, Sylmar, West Adams, West L.A. and Westlake.

In this top-down process, the Planning Department contacts each affected neighborhood council (after notifying the City Council member who oversees that neighborhood) that changes are in the wind — usually to densify the neighborhood.

Some areas face unusually dramatic growth, not because their Community Plan calls for it, but because city planners got $1 million from the prodevelopment Southern California Association of Governments, combined with Proposition A transportation funds and property taxes, to research and plan extremely dense new neighborhoods near train stations in mostly poor areas along Exposition Boulevard in South Los Angeles, along Soto and Indiana streets on the Eastside, and near Gold Line stations in Chinatown, Lincoln Heights and Cypress Park.

Wes Joe, of the Silver Lake Neighborhood Council, says that his Community Plan was rewritten in 2004, just before Goldberg got here from San Diego, so Silver Lake won't be up for review for some time. Joe says city officials contacted one in five Silver Lake households that year to help redo the Community Plan, and those meetings drew the "usual array of Anglo homeowners" in a neighborhood that's also heavily Latino. Steve Leffert, the president

of Lake Balboa Neighborhood Council in the Valley, says that Lake Balboa's two adjacent Community Plans were rewritten in 1993 and 1994, and he's heard nothing from the Planning Department — yet.

The ostensible purpose of Community Plans is to manage the growth that is now officially capped at 4.2 million before city services — like sewerage and local roads — are strained beyond capacity. Perica points out that the current population of 3.9 million doesn't include the 300,000 to 400,000 undocumented residents who make up 10 percent of the city, some living in 50,000 to 70,000 illegally adapted garages and storage spaces, according to the Department of Building and Safety. "Keep that in mind the next time you're stuck in traffic," Perica says. And the planning that exists for that shadow population doesn't begin to address the scale of the problem.

Some residents are stunned by the way the city is trying to circumvent the intent of the Yaroslavksy-sponsored slow-growth measure known as Proposition U, embraced in a landslide vote in 1986, which cut in half the size of buildings allowed on commercial strips adjacent to residential areas.

Voters ushered in Prop. U after then Mayor Bradley, Council President Ferraro and prodeveloper council members like Pat Russell embraced wildly inappropriate projects. Westwood Village was targeted for massive growth, and a huge trash-burning facility, Lancer, was pushed in South L.A. One flash point came with the $43 million, six-story Encino Terrace Center office tower, which now looms over an attractive Encino neighborhood, wiping out privacy below and casting a permanent shadow.

Prop. U aside, North Hollywood and Hollywood are now targeted for 20-to-35-story skyscrapers that include a mix of residential on the upper floors and commercial on the bottom. The 35-story Columbia Square building will tower over Sunset Boulevard at Gower Street. Such skyscrapers represent dramatic — and virtually undebated — departures for Hollywood and the Valley. Neither skyscraper site is protected by Prop. U, which doesn't apply to Hollywood, downtown or the Metro Rail site in North Hollywood.

Beyond what's in store for Hollywood and the Valley, Yaroslavsky also believes that the SB 1818 Implementation Ordinance places treasured, low-slung neighborhoods such as the Fairfax District's historic rental corridor at risk. But since the mayor is ducking public discussion, Yaroslavsky, a powerful elected official, finds himself instead debating two little-known, if influential, city employees who serve at Villaraigosa's pleasure — Goldberg and Senior City Planner Jane Blumenfeld.

"This is where Gail Goldberg is missing the boat," Yaroslavsky explains of the threats to established, steady neighborhoods. For example, in the Fairfax District, where SB 1818's incentives allow developers to blow past existing zoning, "You've just increased the chance of demolition and redevelopment from impossible to probable."

Though Goldberg counters that the new law doesn't threaten the Fairfax District, in a moment of candor she agrees that SB 1818 is an unavoidable state law that's "a terrible fit for Los Angeles." Blumenfeld, too, concedes that it's "draconian ... but we're trying to make it work."

But Yaroslavsky says it was Blumenfeld, not the state, who pushed the new densities well beyond the state requirements to "35 percent more density," and Blumenfeld then "laid out all the 'findings' to approve it."

Villaraigosa isn't part of this growing rancor. His own views are unknown, aside from his repetitive claim that the "construction crane is the official bird" for Los Angeles.

Meet Jane Blumenfeld, the object of Yaroslavsky's scorn and senior planner for the city of Los Angeles. After receiving her bachelor's in history from the University of Wisconsin, and then a master's in city planning from the University of Pennsylvania, she came here in 1978, working as a planning adviser for Mayor Bradley, just as young Councilman Yaroslavsky was ushering through Prop. U to halt commercial high-rises near homes.

After spending some years in the real estate business, Blumenfeld worked as chief of staff to former Councilman Mike Feuer, then rejoined the Planning Department in 2001. A small woman with a quick wit propelled by spurts of sarcasm, Blumenfeld appears a bit stunned by the charges Yaroslavsky lodges against her, like an elf reacting to the roar of a bear.

"All right ... all right," she says calmly. "Let's just take a look at *his* work."

Blumenfeld leads me through a maze of hallways in City Hall, to an inner office where she points to a color-coded map. "See that?" she says, pointing out that 83 percent of the commercial parcels in the city are marked — indicating Prop. U is in force. "It's not physically possible to build growth there, because Zev has blocked it with Proposition U."

But that's not true. In 2002, under Mayor James Hahn and with virtually no public scrutiny, the City Council watered down Prop. U, creating a new land zone confusingly dubbed "Residential Accessory Services." In such zones, projects can be doubled in size if the developer merely agrees to mix housing units with businesses. In another nod to developers, and calling it "smart growth," the council decided that projects with "affordable" housing can be one-third bigger than permitted if they are within 1,500 feet of a bus stop. Together with SB 1818, much of L.A. is now open to multistory construction. (Click here to download PDF of the map.)

To Blumenfeld, those neighborhoods are underutilized "transit corridors." She also denies Yaroslavsky's charge that Fairfax — as well as other stable villages that make up L.A. — is threatened by SB 1818. Developers still find that "land is expensive, lumber is expensive. The [state] law's been in effect for almost three years, but we've not seen any projects on Fairfax."

"So why write these incentives into the new law?" Yaroslavsky retorts. "The city can't keep talking out of both sides of its mouth."

City leaders first learned of plans to mandate denser California cities in a 1996 memo from the State Department of Housing and Community Development. But Yaroslavsky insists he didn't hear about SB 1818 until last summer, when a mole from the city's Planning Department leaked him a draft of the plan for apartment buildings 35 percent bigger than allowed.

"We were appalled," Yaroslavsky says. So the county supervisor again became the town crier. Prodensity groups begrudgingly credit him for pressuring the council to ban these higher buildings next to or across alleys from R1 (single family) homes. But other neighborhood protections, such as a lengthy appeals process, were stripped away.

"This all comes from the stupidity of doing these things behind closed doors," Yaroslavsky says. "Now everybody's weighing in. They didn't know what was going on. Now the Silver Lake Neighborhood Council is picking this all apart, and rightly so."

On hearing Yaroslavsky's version, Blumenfeld rolls her eyes.

"There's really no secret plans here," she says. "We don't do anything in this department that's not superpublic and transparent, and nobody knows better than Zev the steps we go through to adopt an ordinance. There were many, many public hearings."

She cites a series of committee meetings, describing them as poorly attended: "'Wow! A plan to implement SB 1818! Let me give up my Saturday to go to this!'"

In fact, Angelenos don't have a clue what's been happening, or what's coming. In the 32 months since Villaraigosa was elected, for example, the *Los Angeles Times* and the *Daily News* have written only four stories about a plan to allow apartments without parking in order to squeeze in more units. The phrase "SB 1818" has appeared in just 14 articles. The mayor's czar of zoning variances, Michael LoGrande, is virtually unknown — mentioned just six times in Los Angeles print media in the past two years. And the "superpublic" hearings cited by Blumenfeld were attended almost exclusively by lobbyists, a few activists and the occasional curious neighbor.

"There should be a debate!" Yaroslavsky wheezes, a victim of allergies, dabbing his nose with a handkerchief.

"The proponents of the density hawks, including the director of the Planning Department, and the real estate industry, and the L.A. Area Chamber of Commerce — they had the audacity to say that they negotiated the plan [with homeowners]. Not true, there wasn't one neighborhood group that knew about it!"

Now meet Gail Goldberg, Blumenfeld's boss and philosophical cousin, and the other object of Yaroslavsky's discontent. On a Friday at 8:20 a.m., I step out of a City Hall elevator on the fifth floor, walking down an imposing corridor. There stand the double doors to the offices of the director of the Planning Department, Goldberg.

More than 30 feet back from the unattended public counter sits Goldberg's assistant, Lily Quan, the only person in the vast reception area at that hour. She looks up. "May I help you?"

"I'm with the *L.A. Weekly*, and I just got stood up by the planning director for an 8 a.m. meeting at Starbucks."

Quan offers an expression of withering condescension. "I think you're confused," she says slowly, as if to a mentally impaired person. "Your meeting is scheduled for next Friday."

"I have a copy of the e-mail, sent by you, confirming the meeting for this morning."

Quan consults her computer, tapping buttons.

"Looks like we made a mistake," she concedes. "Sorry ... She's got a 9 a.m. appointment, so you'd only have half an hour."

"That," I say, "would be a good start," pondering how the Planning Department could have so much trouble planning a cup of coffee.

At 8:35, Quan ushers me down a small hallway. Goldberg graciously rises from the seat behind her desk to apologize, greeting me in a manner that is both warm and — since we are in City Hall — imperious.

"So what have I read of yours lately?" she asks.

"You would probably have a better idea of that than me."

"What I mean is, what have you written that might have annoyed me?"

In fact, I had recently authored a piece on the city's "Parking Reduction Ordinance," which lets developers of apartments and condos near train stations and bus stops get a waiver from the city's minimum parking-space requirements. In a radical departure, the city could allow big apartments to be constructed without parking spaces. The developer need only prove he is providing a vaguely imagined "alternative means" of transportation — potentially, anything from carpool programs to bicycle racks to walking canes and foot balm — that a local city-zoning administrator feels is a "viable alternative" to driving.

The "public-transit promoting" Parking Reduction Ordinance is not going over well with some of the very few Los Angeles residents who have heard of it.

The Silver Lake Neighborhood Council says that, among other things, the reduced-parking ordinance will eventually punish the working poor (who actually use public transit), helping to prod them out of neighborhoods where hipster, "transit-oriented" projects lacking parking would almost inevitably be paired with luxury rentals.

Developer Gilmore insists the parking-reduction waiver isn't aimed at "what's happening in Silver Lake today, but what it will look like in 20 to 30 years." Yaroslavsky responds, "I don't think Gail [Goldberg] has a clue as to the impact of what these 'incentives' will be."

When residents of Los Angeles hammered out 35 Community Plans to direct what should happen in the city's loosely connected villages, those plans did not include luxury apartments without parking or skyscraper apartments looming over neighborhoods.

"Good planning has to lead, not follow," Goldberg explains, of City Hall's quiet push to amend those Community Plans, a process she insists will emphasize the need to work together. "We need to get in front of the process with Community Plans, which we're creating right now."

Twenty years ago, Robin Kramer, then chief of staff to Eastside City Councilman Richard Alatorre, told *The New York Times*, in an almost identical comment, that the key question was how City Hall could "best manage the growth and lead it." Now Kramer is back, again as a chief of staff — but this time to Villaraigosa.

At 9 a.m., as Goldberg is preparing to greet members of the Downtown Planning Commission, she advises me of my civic responsibility as a journalist regarding the density debate:

"All I ask is that you don't scare people into paralysis."

The apartment-construction binge began in 2002 but dates to 1993, when the Planning Department, under newly elected Mayor Richard Riordan, rolled out the new-housing component of its General Plan. Although dozens of Community Plans attempted to mute its more dire effects, the General Plan claimed that two-thirds of the city — already the fourth most densely populated in the nation — was "underutilized."

Many found the General Plan laughable and unlikely to ever unfold. But then demographers from California's State Department of Finance and the Southern California Association of Governments (SCAG) prophesied that an inevitable county population increase of 2.5 million people by 2025 had to be met in Los Angeles by the building of far more housing.

That's when city planners started redesigning the very DNA of Los Angeles.

Goldberg says that SCAG bureaucrats want to see 16,000 new housing units per year — in a city many residents view as already overbuilt and grossly congested. (City Hall listens to SCAG, but some cities are sick of SCAG's density drumbeat. Irvine is involved in a bitter lawsuit against SCAG; Palmdale and La Mirada tried to stop SCAG and lost in court.)

SCAG "population projections" of massive, inevitable growth in L.A. are notoriously unreliable, says demographer James Allen, professor emeritus of geography at California State University Northridge.

"I personally don't put any stake in the accuracy of projections from SCAG or anyone else," Allen says. In his college classes, Allen assigns his students to make such projections — showing them how easy it is to manipulate theoretical circumstances to get whatever "population growth" results they desire.

It's a game, Allen explains, with outcomes "all based on assumptions that can't be known." A crash in the local economy, the subprime mortgage debacle, a flood or earthquake, major job growth in the U.S. South — all can send hundreds of thousands of people to other regions.

"But let's say they're accurate," Yaroslavsky conjectures. "Are we being told that we need to rebuild the entire city to facilitate another 2.5 million people in the next 17 years? Good luck. It's not going to happen — economically or politically ... It's preposterous. The deal is that there are a number of developers who see an opportunity here to make a killing."

The actual growth statistics fly in the face of the luxury-apartment future envisioned by the Villaraigosa administration. The U.S. Census says that between 1990 and 2000, 400,000 more residents fled Los Angeles County than moved in from other states and California counties. And significantly, the people who moved here earn an average of $3,000 less per year than the 400,000 who fled.

Yet the population is expanding, and the two key causes are illegal immigration and the high birth rate among the poor and working poor. Local Latino birth rates are driving it, and in Los Angeles, that means families with a median annual income circling $25,000.

Who is going to snap up thousands of luxury apartments on the drawing boards, at $2,500 a month? A few foreign nationals from Stuttgart and London, Dubai and Moscow? Even if Villaraigosa's team comes up with 16,000 new units per year in order to please land speculators, developers and bureaucrats at SCAG, it's highly unlikely that L.A.'s new residents — not hipsters but low-income families — could afford them.

"There's never been the market to support what they've been building," says Joel Kotkin, who notes that L.A. planners mistakenly believe they are creating the next New York or Chicago, when, Kotkin believes, it's more likely they are erecting a dense new Third World city.

There are, to be sure, arguments supporting high-density cities. Peter Gleick, director of Pacific Institute, an ecology-research foundation in San Francisco, says, "In single-family suburban homes, more than half the tap-water supply is spent on lawns and gardens. ... With

the expected radical decline in the Sierra Nevada snowpacks, cities like Los Angeles and Las Vegas cannot continue to grow in the 21st century the way they did in the 20th."

But density also breeds much more crime — something "density hawks" never mention. A report by the National Center for Policy Analysis says crime rates in dense cities outpace by up to 20 percent the crime in more sprawling, spacious cities. So-called "smart growth" Portland and Seattle lead the pack in property crime.

These colliding issues — of water usage, crime peaks, birth rates, developer greed (or hardship, according to Gilmore), statistical manipulation and City Hall transparency — could and should be the subject of public debate in Los Angeles.

But they're not.

Think of the current process as the urban-planning equivalent of termites gnawing away at the city's crossbeams. Each time a zoning-change application is considered, it must be heard in public in front of a volunteer committee of a regional Planning Commission — all political appointees of Villaraigosa.

The Planning Department is supposed to send notifications to the relevant "certified neighborhood council," and to all neighbors within 500 feet of the property at issue, or to post a notice in any local newspaper. And in addition, the agenda for all such hearings is posted at www.cityplanning.lacity.org.

That's how the Planning Department claims to be engaging the public. But a wall of silence between the public and the city is built into the incremental nature of the process.

Few residents know what to make of the strangely worded notifications they suddenly receive in the mail — just 10 days before a hearing. (Some notices, as in the Lake Balboa district in the Valley, arrived after a key hearing had occurred.) There's very rarely media interest, and in a city where few residents know the name of their city-council member (Los Angeles City Council districts contain about 280,000 people, the largest such districts — and many say the least responsive — in the U.S.), fighting City Hall is daunting.

Planning Commission hearings are held during business hours, handy for developers but not for residents. When no residents appear to oppose a developer's plan, the regional commissioners — often local residents, theoretically more invested in the area's welfare than downtown planners — usually go along with the developer. Usually, after the developer completes an environmental report and addresses a few problems, the zoning change or variance is granted.

The Woodland Hills-Warner Neighborhood Council's chairperson, Joyce Pearson, wrote this warning in a recent newsletter to her Valley area: "The public often waits until it's too late to do anything to enhance major developments or to impact any potential problems that may be caused."

Yet the public isn't "waiting," as Pearson puts it. The public is out of the loop — often until the demolition fence is already up.

That seems fine with City Hall. With a few pockets of 1980s-style activism developing at the feistier monthly neighborhood-council meetings in Los Angeles, City Hall has begun responding — by attacking the locals.

For example, the often-clamoring North Hills West Neighborhood Council, in a far-flung Valley area that was a hotbed of secession-movement sentiment, is so distrustful of City Hall that its members attend city Planning Commission hearings en masse. The North Hills group has defeated a series of high-density housing proposals on its rustic fields and meadows.

For their trouble, City Hall came down hard on these citizens. According to homeowner Peggy Burgess, the Neighborhood Council was subjected to an official barrage of blistering, trumped-up charges — even including racism — that originated from a cadre of pro-growthers. The accusers were allowed to file complaints anonymously with the city's somewhat ironically named Department of Neighborhood Empowerment (DONE).

Burgess says that, during a vitriolic December meeting, Manuel Durazo, a city project coordinator for DONE, conceded that he simply forwarded the ugly charges to the Board of Neighborhood Commissioners, and official "decertification" proceedings of the Neighborhood Council got under way - with no city official bothering to investigate the accusations, or allowing the neighborhood council to refute them.

Durazo finally admitted the charges were unsubstantiated. He sent out a letter congratulating the Neighborhood Council on its victory - adding that he'd requested that the city transfer him to a different district.

Since 2005, Villaraigosa has been tirelessly cheerleading for a taller city. He has often pointed to the frenzied construction of mixed-use buildings (apartments, shops and offices) as proof that he is probusiness.

In fact, some counter that L.A. is antibusiness, a city that drives big and small companies to neighboring Pasadena, Calabasas, Glendale, Culver City and elsewhere, earning itself special attention each year in the Kosmont Report on urban areas with backward business policies.

Villaraigosa appears to believe that edifices equate with business, and that the buildings themselves will lure in an educated work force and quality companies. "If we're not creating wealth, if we're not bringing in investment, if the official bird of Los Angeles isn't the crane, then we won't be able to do all the good things we would like to do for our people," Villaraigosa told the *Los Angeles Business Journal* in 2006.

His narrow emphasis on high-density housing construction might cost L.A. if a recession has really arrived. "The burst housing bubble has hit us pretty hard," says Joseph Linton, policy associate for Livable Spaces, a nonprofit developer that's completed mixed-income, transit-oriented residences in Long Beach and Lincoln Heights. The affordable units are selling, "but our market-rate units are going very slowly." Adds Gary Toebben, president of the L.A. Area Chamber of Commerce, "New market-rate housing is just not moving."

Nonetheless, Blumenfeld imagines dense urban villages built around subway stations, populated by the young and old, neighbors who shop on the ground floor and use rail or buses to get about.

Gail Goldberg looks out across the city and imagines residents and developers working side by side, with her department's firm leadership dedicated to the integrity of neighborhoods.

But from his County Hall of Administration office just a few blocks away, Yaroslavsky, his voice rumbling in a basso profundo, waves off Blumenfeld's and Goldberg's utopian plans: "I watched the demolition derby in this town 20 years ago ... I have a platform. I have some credibility. I have something to say. [But] I shouldn't be the one to say it."

Also read Julia Cooke's article on urban similarities between L.A. and Mexico City.

And What's Smart About Smart Growth? by David Zahniser

***Editor's Note:** This story incorrectly stated that Los Angeles County Supervisor Zev Yaroslavsky fought federal funding for subways after a methane explosion in 1985. In fact, Yaroslavsky called for more study of methane gas dangers while Congressman Henry Waxman championed the federal ban. Later, Yaroslavsky led a ballot effort that prevented local sales taxes from being used on the subway being tunneled under Hollywood, allowing that tax money to go to other transit projects. This story was corrected Feb. 29.

Guest Commentary

Why Older Millennials Are Leaving the Urban Core and Younger Millennials Aren't Far Behind

Contrary to popular opinion among many in the multifamily industry, Gen Y is already starting to abandon city living. Here's why.

By Ryan Severino

Flickr: Ian Sane/Creative Commons/https://www.flickr.com/photos/31246066@N04/

Millennials are going to shun material goods, never own a car, and live in small spaces in utopian urban cores riding their bicycles or taking public transportation to their green, open-space offices. Forever!

This, or something like it, is the conventional wisdom in the market and wishful thinking in the apartment industry. Although some surveys results seem to agree with this popular opinion, research shows that people's needs and preferences change over time and that people are terrible at thinking about and planning for the future, especially when they're young.

Imagine what the baby boomers would have said in such surveys when they were that young! Moreover, the conventional wisdom is already proving untrue. The older tranches of Gen Y are already moving out of urban cores and into the suburbs. While you might be shocked to read that, let's examine why this is true based on

ABOUT THE AU

of research at real e
analysis firm Reis,
also an adjunct pro
University and NYU

data, and not conjecture.

First, the portion of Gen Y that's been living in urban cores is getting married and having children. Wait, what about the death of marriage in the United States and the rise of the single-person household? While that claim is undoubtedly true to an extent, it reflects a rather sophomoric understanding of the data.

The reality is that marriage and children continue to be popular among the well-educated—exactly the kind of Gen Yer living in urban cores. The marriage rate for males with a bachelor's degree is 76%, while for those with a high school diploma, it falls below 50%.

Make no mistake—millennials are the best-educated generation in history and have similar goals as prior generations. They want to get married, be good parents, and send their kids to college. Living in urban cores is incompatible with that lifestyle for most of them. All of the arguments that follow derive from this fact.

The Quest for Space

Let's start with the size of the living area.

If Gen Yers are going to rear their 2.1 kids (the replacement rate, which is approximately the rate at which nonimmigrant domestic couples reproduce in the U.S.), they're going to need more than the 861 square feet that can be found in the average apartment in urban cores. Believe it or not, Gen Y doesn't actually enjoy having their bed in their kitchen! And as anyone with children knows, one spends more time at home with their kids than without them. It's not so easy to set up camp at a Starbucks for hours at a time with toddlers in tow.

Although there's been a construction boom in urban areas over the past few years, most of the units being constructed are too small for a family of four. Families are not the source of demand for apartments today, and so units aren't being built to suit their preferences.

Once they start reproducing, or at least thinking about it, Gen Yers are going to seriously consider the quality of the school system where they live. Of course, most urban cores have notoriously bad school systems. Sure, there are some bright spots, but, by and large, they're few and far between, and rolling the dice on one's children's education is something most responsible parents won't do.

Despite a renewed focus on education in urban areas, it's highly unlikely standards are going to increase significantly in the next five to 10 years—certainly not to the level of the nearby, beckoning suburbs that are well funded through local property taxes.

Additionally, many cities are sitting on massively underfunded pensions. As we've recently seen in Detroit, while public obligations might be scaled back a bit, they aren't going away completely, and they're indeed massive.

Morningstar estimates, for example, that Chicago's unfunded pension liability is $18,596 per inhabitant; New York's, $9,842 per inhabitant. So, one of two things, or some combination thereof, will have to occur: Either taxes are going to have to increase, or services are going to have to be cut.

As anyone who has studied basic urban economics knows, a sure way to get people to move out of a municipality is to either raise taxes without a commensurate increase in services or cut services without a

Urban Lite

Gen Yers might be young and idealistic, but they're not stupid. The closer they get to marriage and having children, the more they'll begin thinking about these things, just as previous generations did. Surely, some of them, likely the best paid (who can afford private schools), will stick around urban areas. But that's always been true, even during the 1970s and 1980s, when cities were rather dirty, dangerous places.

When Gen Y disembarks for the suburbs, it won't be to the strip-center–ridden dystopia you're likely imagining. Rather, they'll look for places that have urbanlike downtowns and excellent access to infrastructure (especially public transportation) that can take them in and out of the urban cores where the jobs are located.

These "diet urban" nodes are already popular with the Gen Xers and older Gen Yers that have already fled for the suburbs. This, of course, will mean owning a car. But don't worry—Gen Y actually bought more new cars than Gen X in the first half of 2014.

Believe in hard facts and data, not what some 20-somethings say they might do 10 years from now.

Keywords:

Subject:

Multifamily Trends Millennials

MORE FROM MFE

Chicago's Large Residential Buildings to Report Energy Use

MFE 2009 State of the Industry Address

JOIN THE DISCUSSION

Please read our Content Guidelines before posting

Close X

Post

13 Comments

RSS | Subscribe

Munish Gandhi 136 days ago

Great article, Ryan. It has some excellent points that helped me with a recent piece. I credit you here: http://linkd.in/1gs9TD5. Just wanted to say thanks and keep up the good work.

Reply 0

Don Miller CPM Emeritus 229 days ago

After managing apartments thru 5 generations i never thought millenials would be much different than any other generation. Great article!

Reply 1 reply 0

Ryan Severino, CFA 229 days ago

Thanks Don! I agree and people saying that they will be different are wishing for them to be different.

Reply 0

AmeriSus 230 days ago

Good article. We see a trend (by millennials & empty nesters) towards smaller suburban single family homes rather than larger multi-unit structures. The opportunity here is small subdivisions where one can place cottage homes at say 10-12 per acre. This size is easy to afford and easy to care for while at the same time being less expensive to build (for the developer). The end result is a detached house, a real porch or patio, backyard and garden all for a price that can't be beat. Throw in a picket fence or two and you do have the American dream.

Reply 1 reply 0

Ryan Severino, CFA 230 days ago

That makes a lot of sense. The American dream is still alive and well. It is a cultural norm that everyone aspires to, even after the Great Recession. The majority of the older Millenials that don't own a home can't because of the stringent residential mortgage underwriting standards. However, that is not permanent condition.

Reply 0

Judy Brower Fancher 231 days ago

Thank you, Ryan! Your article points out the clear facts. Millennials are not from another planet, the simply extended their childhood into their late 20s. As soon as they start having families, they want a house and a yard. They also want a car, as it's not so easy to take the groceries for two adults and one or two children and just throw them onto an electric scooter!

Reply 1 reply 0

Ryan Severino, CFA 231 days ago

Thanks Judy! The industry often acts like they are from another planet, or as if Millenials discovered downtowns and Gen X didn't know they existed. Urban core is flooded with young

Close X

davidngaines 235 days ago

Ryan, Excellent article as always

Reply 1 reply 0

Ryan Severino, CFA 233 days ago

Thanks David. Appreciate that!

Reply 0

Ray Connell 236 days ago

Great points. Follow up question: What type of housing will they desire? Will they replace the "861 square feet" of urban apartment living with 1,100 sqft of suburban apartment living? Or will they shake off the home ownership fears the industry pundits have referenced over the past couple of years?

Reply 3 replies 0

Ryan Severino, CFA 235 days ago

They will likely own homes. There is nothing to indicate that they won't. Homeownership is a cultural norm in the US and is still what most people, especially the well-educated households, want for their lives. Even the surveys, which I am always a bit skeptical of, show that most people, even current younger renters, aspire to home ownership.

Reply 2 replies 0

Katherine W 222 days ago

what about student debt? that won't hamper people's homeownership dreams? are their parents/grandparents helping them pay for that home?

Reply 1 reply 0

Ryan Severino, CFA 221 days ago

The Gen Yers who can afford to live in expensive urban cores are well educated and well compensated. They won't have any trouble paying off their debt and buying a home. The kind of people who are going to struggle to pay back their student loans are not living in urban cores working in high-caliber service sector jobs.

Reply 0

Close X

Splacer Brings Commercial Space into the Sharing Economy

Product Spec: Improving Insulation

October Architecture Billings Index Reflects Sustained Growth in Design Market

High Design Meets High Function

Seven Sustainable Products from the 2015 Greenbuild International Conference and Expo

FINANCE

How to Make the Case for Affordable Housing in Washington

Rent Power Loses Mojo as New Deals Come On Line

The Next Chapter

People on the Move 11.16.15

Groundbreaking Development Opens for Deaf Residents

Raymond James Syndicates Its Largest Fund

Comfort is Measured by More than Energy Efficiency

When Is Housing's Black Friday?

Berlin Shows Cities How To Maintain Affordable Housing

Existing Single-Family Sales Down in October, but Up 4.6% Year-Over-Year

A Shea Foray: The Az. Condo Market Beckons

What Will Millennials Invest In?

2015 DI

The 201

Subscrib

MULTIFAMILY EXECUTIVE Relevant Sites | Housing Finance | eBuild | Architect | EcoBuilding Pulse | Metrostudy | residential architect

About | Magazine

Close X

Millennials Will Live In Cities Unlike Anything We've Ever Seen Before

Alissa Walker
Filed to: URBANISM 7/16/15 1:45pm

It's actually hard to know what to believe about millennials, the Americans born after 1980 who make up the largest generation in history. Every week there's a new ground-shattering revelation about their lifestyles—but the most conflicting reports have to do with *where* they live.

Over the last few years, across the country—around the world, too—people of all ages, including millennials, have been moving into cities at an astonishing rate. Now more than half of the world's population is urban. So here's the big question: Are today's 20- and 30-somethings really going to live more urban lifestyles than Gen Xers or Boomers? Or are they going to eventually vacate cities for the 'burbs, just like every generation before them?

Then came some interesting data, pegged to the release of 2014 Census information this spring: Millennials have indeed started moving out of big city downtowns—but not necessarily in favor of a quiet rural or suburban life.

GIZMODO

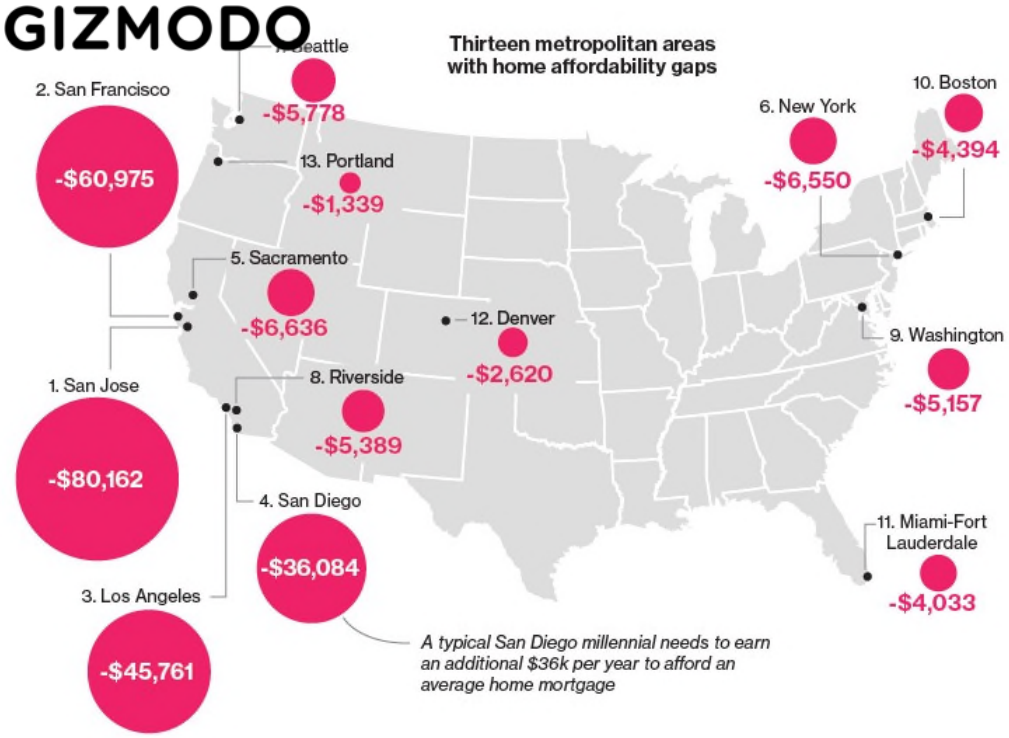
Instead, we're seeing a brand new trend: Thanks to the generation's size and influence, millennials are moving to new places made just for them, by them—revitalizing smaller cities or opting for hybridized urban-burb enclaves where quality of life is the driving force.

The Rent Is Too Damn High

As the first wave of millennials started to take jobs, it seemed that this generation was dedicated to living and working downtown. According to different studies, millennials were prioritizing dense neighborhoods, helping to fuel the biking boom, even—whoa!—refusing to get their driver's licenses. Companies luring millennials promoted their downtown locations with transit proximity, bike-commuting amenities, and other perks which aligned with these lifestyles.

But it turns out that many millennials weren't ever planning on settling in cities for good—they were just putting off the move to the suburbs for a few more years. A report in May discovered that fund managers are betting on millennial 'burb living by investing in car companies and single-family home builders. "Especially in the older millennials, we're seeing a move towards more traditional patterns, just on a delayed time frame," Sarah House, an economist at Wells Fargo, told Reuters.

But it's not only about following "traditional" patterns, it's also about being priced out of an insanely expensive housing market. Last month, Bloomberg crunched the most recent US Census data and came up with the Millennial Housing Affordability Index, declaring 13 cities completely unaffordable for home ownership based on estimated earnings for the millennials living there.



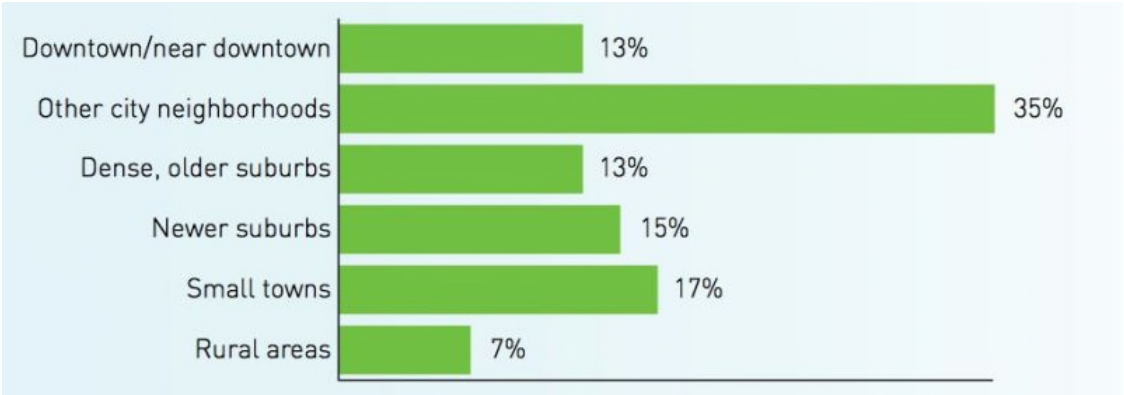
Bloomberg.com chart using data from US Census, Zillow.com and Bankrate.com

What's happening with millennials and cities is really just part of a larger issue around the rising cost of housing that's pricing out plenty of people in already-expensive cities. Of course moving into a city is going to be extra-unattainable, financially, for someone just starting out in their career. Maybe millennials are actually way smarter than everyone else for not staying in places they can't realistically afford.

But it turns out that millennials are different in the sense that they're coming up with innovative ideas for how to live well wherever they are—which sometimes means bringing the urban experience with them.

Urbanizing the Suburbs

According to a recent study by the Urban Land Institute, "Gen Y and Housing: What They Want and Where They Want It," a nationwide survey of millennials aged 19 to 36 showed that most of them were never living the glamorous downtown life that most stories like to describe. Only 13 percent of millennials in the survey lived in or near downtowns—the rest lived in other city neighborhoods—or in the suburbs.



Where millennials said they lived, based on the ULI's survey

The kinds of places that millennials want to live share a lot of the same characteristics with urban centers—they're looking for amenities like walkability and public transit. But according to the study, it's more about relationships and having the time to enjoy those relationships, which doesn't necessarily mean working long hours to pay the rent in a big city.

"Gen Yers want to live where it's easy to have fun with friends and family, whether in the suburbs or closer in," says M. Leanne Lachman, one author of the study. "This is a generation that places a high value on work-life balance and flexibility. They will switch housing and jobs as frequently as necessary to improve their quality of life."

Chicago has always been a haven for young professionals. Its suburbs are also some of the most famous in the country, a sprawling bedroom community that ripples out from the urban core. But just like the way that Chicago's inner city is focusing on making a lot of the changes that supposedly attract those young professionals—improving public spaces, redesigning pedestrian connections, and building more biking infrastructure—its suburbs are undergoing their own renaissance, too.

1 2

Midtown Square opened this year as a dense, transit-accessible, mixed-use development in Glenview, Illinois, a suburb of Chicago

These places once known for their large yards and reliance on cars are changing. According to a piece in this month's *Chicago Magazine*, development is radically shifting in suburbs, mostly to accommodate millennials:

> For example, in Wilmette, a town that's historically limited rentals, the village board preliminarily approved a plan in May to build a 75-unit luxury apartment building with ground-floor stores on Green Bay Road, across from the Metra station. Units will average about $2,250 a month for 1,000 square feet. The village courted the project in concert with its master plan, which in 2014 raised height limits downtown from three to five stories.

These kinds of compact, livable communities that crop up in less-dense areas have all sorts of names, like New Urbanism and "walkable urban places," but the one that's stuck recently is "urban burbs"—and the urban burbs are a new kind of hybridized place made just for millennials.

Millennials might not be staying in the urban cores, but rather, they're helping to remake the urban-like enclaves that allow easy access to the city when they want it. These places where millennials are choosing to live still have the qualities of downtowns—dense housing, transit connections, walkability, good food, great bars—without the high prices of downtowns.

Revitalizing Smaller Cities

I wanted to know if any of this rang true to actual millennials. So I talked to participants of the Millennial Trains Project, a nonprofit which selects a group of millennial entrepreneurs to travel across the country on an Amtrak train, stopping in cities along the way to meet with civic-minded startups. Each of the participants are required to crowdfund $5000 to pay for their own participation on the trip, and many end up forming relationships which spin off into new urban-minded projects.

Millennial Trains took 25 young innovators on an Amtrak journey across the country in the spring of 2015

There seemed to be a different trend for millennial living that was well-represented by the group. Instead of settling in big, expensive urban centers like New York, San Francisco, and Los Angeles, many of these millennials were leaving to look for opportunities in smaller cities. Nicole Behnke is 24 and works at what she calls a "social architecture agency" in Milwaukee called NEWaukee, where she organizes events for young professionals. She has a car, although she doesn't like to drive it. She has noticed some of her friends moving out into suburbs, but that's not what she personally wanted out of a living situation: She recently closed on a condo in downtown Milwaukee.

For her, the choice to live in Milwaukee instead of, say, Chicago, or even its urban burbs, came down to more than just price (although that was a big factor). While visiting San Antonio during the

Millennial Trains adventure—a place she had always perceived to be in the shadow of Austin—she saw the incredible opportunity offered by her move to Milwaukee. She realized that moving to a smaller city was allowing her to help shape a community.

NEWaukee hosts Milwaukee events like networking mixers, neighborhood tours and even a night market to gather millennials and rally civic pride

"There is an energy of millennials who are coming together and galvanizing and they want to be the creators," says Behnke. "Not to take away from what they are doing in places like Austin and Brooklyn, but do you want to participate in their culture, or do you want to be like San Antonio or Milwaukee and be the creator of the culture? A lot of us want to be the creators—we want to be the ones making the change."

After traveling to so many cities and seeing this generation in action, Behnke believes that millennials want to be invested in where they live in a way that their parents were not. Whether it's driving changes in the suburbs or revitalizing a smaller city, 79 million Americans who want to make their communities even a little bit better is a very good thing for the country—and there might not be a better legacy for any generation in history.

Illustration by Pete Ryan

Follow the author at @awalkerinLA