Appendix E.7 Third Party Review Preliminary Design of Soil Nail System

THIRD-PARTY ENGINEERING REVIEW
PRELIMINARY DESIGN OF SOIL NAIL WALL SYSTEM

For Soil Nail Walls around Proposed Parking Structure

APNS 2385-018-001, -002, -003 and -011; 2384-007-005,2385-019-016, -015, -014, -013, -017, -049, -050, and -051;Arbs 1 and 2, Fraction of Lot 35, Tract 6293, Arbs 1 and 2, Lot 1111, and Arb 45, Portion of Lot 1112, Tract 1000, and Arbs 1 and 2, Lot 65, and Lots 63, 64, 66, 67, 68 and 69, Tract 7442; 3675, 3693, 3703, 3709, 3707, 3717, 3719, 3705, and 3700 N. Coldwater Canyon Avenue; 12908, 12916, 12924 and 12930 W. Hacienda Drive; and 3686 and 3678 N. Potosi Avenue, Studio City, California.

For

HARVARD-WESTLAKE SCHOOL

November 4, 2016

Carlos A. Lazarte, PhD, PE, GE

Consulting Engineer

PO Box 34219, Bethesda, Maryland, 20817-9996

INTRODUCTION

The Harvard-Westlake School (HWS) is planning to construct a new three-story parking structure at the lots identified on the cover of this report, at 3700 and 3701 Coldwater Canyon Avenue, Studio City, California. The work will include an athletic (practice-only) field on the roof of the parking structure and a pedestrian bridge spanning over Coldwater Canyon Avenue to connect with the main campus.

HWS retained DRS Engineering, Inc. (DRS) to design several soil nail walls to allow grading at the site and the creation of a building pad for the parking structure. DRS has developed, to date, a preliminary design of the soil nail walls, which is part of the Environmental Impact Report (EIR) required by the City of Los Angeles.

TERMS OF REFERENCE

This letter report presents the results of a third-party engineering review conducted by the undersigned of the document titled, “Preliminary Permanent Soil Nail Wall Design,” which was prepared by DRS and is dated May 18, 2015. The third-party engineering review was requested by HWS to obtain an independent professional opinion about the adequacy of the preliminary soil nail wall design.

As part of this third-party engineering review, the undersigned also assessed the scope and manner in which the soil nail wall design addresses the potential geotechnical and related risks in the project; namely, the hillside stability during and after construction and use of soil nail walls, the safety of future occupants and users of the planned structures, the safety of neighbors and their properties, and the impact on Coldwater Canyon Avenue as a commuter thoroughfare.

In addition to the review of the DRS preliminary design package, the undersigned reviewed a geologic and soil engineering report prepared by Byer Geotechnical, Inc. (BG) and dated May 18, 2015. This latter effort was conducted with the purpose of gaining familiarity with the project and obtaining geotechnical background for the development site, and did not constitute a technical peer review of the BG report.

DESCRIPTION OF PLANNED SOIL NAIL WALLS

The soil nail walls in this project are being planned to support the permanent excavation along the south, southwest, west, northwest, and north limits of the project. The maximum height of the soil nail wall system is approximately 90 feet (including a 3 foot fence to sit atop the soil nail retaining walls), with an average height of approximately 40 feet. The total length of the soil nail wall system is approximately 1,650 feet and the total wall area is about 62,000 square feet. The soil nail walls will be permanent structures at the site. Most soil nail walls will be two-tier structures, with only the north wall being planned to be a single-tier structure.

BASIS OF THE PRELIMINARY DESIGN

DRS preliminary design is based on the design guidelines contained in the Federal Highway Administration (FHWA) Geotechnical Engineer Circular No. 7 (GEC 7) titled "Soil Nail Walls" and dated 2003; as well as on the California Soil Nail Committee document titled "Recommended Guidelines for Permanent Soil Nails" of August 23, 2000.

The DRS preliminary design includes the following components:

- Selection of various factors of safety (FOS) in agreement with GEC 7;
- Selection of eight representative design cross sections;
- Adoption of engineering parameters as defined by BG for the various subsurface strata in the design cross sections;
- Adoption of a seismic coefficient as defined by BG;
- Selection of basic soil nail geometry, such as soil nail horizontal and vertical spacing, soil nail inclination, and wall batter;
- Selection of structural components, such as type and diameter of soil nail steel tendons, thickness and properties of wall facing, corrosion protection, and bearing plates;
- Estimation of allowable tensile resistances of soil nails for static and seismic conditions;
- Estimation of allowable resistances at the soil nail wall facing (i.e., soil nail head resistances) for static and seismic conditions;
- Estimation of allowable pullout resistances of soil nails for static and seismic conditions;
- Selection of the most critical soil nail resistances based on the above-listed estimations;
- Development of trial designs of soil nails by modifying the soil nail lengths and other variables;
- Calculation of global FOS for static and seismic conditions using a limit-equilibrium analysis (i.e., slope stability) computer program; and
- Verification that the selected preliminary designs meet or exceed the FOS, as defined previously.

OTHER CALCULATIONS

The DRS preliminary design also includes the following checks for all sections and for static and seismic conditions:

- Check of sufficient combined pullout capacity of soil nails (portion extending beyond the Department of Building and Safety (LADBS)-recommended slip surface) to resist an equivalent active force;
- Check of sufficient sliding stability of the reinforced block of soil/bedrock; and
- Check of sufficient bearing capacity of the reinforced block of soil/bedrock.

The DRS package includes backup of various calculations, a detailed output of the slope stability analysis and of checks.

To help monitor the safe performance of the soil nail walls during construction and in the long term, the DRS package requires the permanent installation of geotechnical monitoring instruments to detect and measure movement of the hillside and/or soil nail retaining walls in relation to pre-defined criteria.

CONSTRUCTION DRAWINGS AND SPECIFICATIONS

Sheets SH-1.0 through SH-5.0 of the DRS design package of May 18, 2015 portray the planned work and present initial specifications. The sheets present the preliminary plan and elevation views, cross sections, typical details, as well as specifications that are reasonably expected to serve as the basis for final construction documents. Final documents will contain the necessary information for a contractor to perform quantity take-offs, bid, and to safely complete the work to meet the project requirements.

CONCLUSIONS

It is the undersigned's professional opinion that the DRS preliminary soil nail wall design of May 18, 2015 is sufficient to portray the planned soil nail work to be submitted as part of the EIR. The calculated FOS in the preliminary soil nail design are above the minimum required values of nationally accepted design guidance documents. It is also the undersigned's professional opinion that the DRS preliminary soil nail design considers the appropriate geotechnical factors for the development site, utilizes the most current modeling software, meets applicable design standards and building codes, and correctly concludes that the project can be completed and maintained safely and successfully.

LIMITATIONS

The opinions contained in this third-party engineering review are only applicable to the conditions presented in DRS preliminary design package of May 18, 2015 and in relevant and related BG documents. As the current DRS design is preliminary, it is not

unreasonable to expect that relatively minor changes will arise during the preparation of the final soil nail design. Potential changes may include refinements to length and/or inclination of soil nails. These changes might be necessary to help optimize the design, enhance constructability, and ensure long-term performance.

In addition to an adequate design based on actual development site conditions and satisfactory construction drawings and specifications, other important aspects are critical to achieve a successful project. Only qualified soil nail installers should be selected to perform the work. Acceptable and sufficient Construction Quality Control (QC)/Quality Assurance (QA) measures should be taken. In addition, the soil nail wall designer, or his/her representative, should make frequent and sufficient observations during construction to ensure that the intent of the design is realized. The preliminary construction specifications shown on Sheet SH-1.0 provide initial requirements regarding soil nail installer qualifications and Construction QA/QC activities.

Attached is my statement of qualifications.

Please contact the undersigned if you have any questions regarding this letter report.

Sincerely,

Carlos A. Lazarte, PhD, PE, GE
Consulting Engineer
CE 55785, GE 2543

cc: David Weil, Jim DeMatte - Harvard- Westlake School
Edgar Khalatian - Mayer Brown LLP

Attachment: Carlos A. Lazarte, PhD, PE, GE Qualifications (8 pages)

Carlos A. Lazarte, PhD, PE, GE
Summary of Qualifications
Earth-Retaining Structures with focus on Soil Nails – November 2016
PO Box 34219, Bethesda, Maryland, 20817-9996

Synopsis

Dr. Lazarte, a US Citizen based in the Washington, DC area, has over 28 years of professional experience working on a wide variety of infrastructure projects. He has led projects in the Washington, DC area and in over 25 US states. In addition, he has led over 40 projects in more than 20 foreign countries.

He is focused on great client service by bringing responsiveness, technical excellence, value, practical experience, and innovative solutions when new challenges emerge. He is adept at interacting or leading multi-disciplinary teams in technically-complex and challenging projects. He worked on projects in the Federal, State and local Government, Transportation and Energy sectors. Many of his Federal projects were Mission Critical or in sensitive facilities owned by the US Government across the world.

Experience Summary

His professional experience encompasses numerous geotechnical engineering topics, including, but not limited to: earth-retaining structures, geotechnical instrumentation, performance monitoring during construction and operation, preparation of construction documents, tunneling and forensic geotechnical engineering, geotechnical earthquake engineering, and foundation engineering (including several deep foundation types). He is nationally recognized as an expert in soil nailing, an area where he has published extensively.

Dr. Lazarte participated in various forensic engineering projects. In litigation cases, he provided expert testimony, prepared expert opinions reports, participated in depositions, and assisted clients in resolving construction claims.

He also led the preparation of numerous geotechnical engineering manuals and/or guidance documents on soil nail walls, design and construction of continuous-flight auger piles, lateral loads on deep foundations, and Load and Resistance Factor Design (LRFD) for soil nail walls for the Federal Highway Administration (FHWA), the National Cooperative Highway Research Program (NCHRP), and other agencies.

He has extensive experience in evaluating seismic hazards and providing engineering design solutions to counter these hazards. His work in this field includes: Probabilistic Seismic Hazard Assessments (PSHA) conducted in many US and international locations with a high seismic risk, site response analysis, characterization of dynamic soil parameters, seismic site classification per national codes, estimation of lateral earth seismic loads on earth-retaining structures, determination of foundation spring constants, foundation design under seismic or vibratory loads, dynamic soil-structure interaction, deformation analysis of earth dams and landfills, post-seismic damage reconnaissance, fault rupture, liquefaction evaluation, seismic strengthening concepts, and mitigation of liquefaction effects.

Professional History

- Independent Geotechnical Engineering Consultant, Potomac, MD, 2016-present
- Schnabel Engineering, Rockville, MD, Sr. Vice President, 2010-2016
- Geosyntec Consultants, Columbia, MD, Sr. Engineer, 2001-2010
- Woodward Clyde (then URS and now AECOM), Oakland, CA, Sr. Project Manager, 1996-2001
- University of California, Berkeley, CA, Research Assistant, 1993-1996
- Independent Geotechnical Engineering Consultant, West Lafayette, IN, 1992
- Purdue University, West Lafayette, IN, Research Assistant, 1991-1993
- Independent Structural Engineering Consultant, Argentina, 1987-1991

Education

- Ph.D., University of California, Berkeley, Geotechnical Engineering, 1996
- M.S.C.E., Purdue University, Geotechnical Engineering, 1993
- Civil Engineer (focus on Structural Engineering), Tucuman National University, Tucuman, Argentina, 1987

Professional Licenses

- Licensed Professional Engineer (PE, Civil) – Maryland – Registration Number 47286
- Professional Engineer (PE, Civil) – California – License Number C5578524593
- Geotechnical Engineer (GE) – California – License Number 2543
- Licensed Professional Engineer (PE, Civil) - Virginia (in process)
- Licensed Professional Engineer (PE, Civil) - Pennsylvania (in process)
- National Council of Examiners for Engineering and Surveying (NCEES) (in process)

Certifications

- OSHA - Certified Supervisor for Hazardous Waste-Related Operations
- OSHA - Certified for Work at Hazardous Waste Sites
- National Highway Institute - Instructor

Affiliations and Professional Activities

- American Society of Civil Engineers (ASCE) Geo-Institute
- ASCE – National Capital Section
- American Waste Water Association (AWWA)
- Seismological Society of America
- Transportation Research Board (TRB)-AFS30 Committee on Foundations of Bridges & Other Structures (friend of committee)
- Earthquake Engineering Research Institute (past)
- US Society on Dams, Earthquake Committee (past)
- Editorial Board Member - Online Journal of ASTM International (Geotechnical), 2005-2010
- Journal Reviewer - ASCE Journal of Geotechnical and Geonvironmental Engineering, ASTM - Geotechnical Testing Journal, Geosynthetics International Journal, Earthquake Engineering and Structural Dynamics, and various GeoCongresses.

Adjunct Professor

Johns Hopkins University – Advanced Foundation Engineering
George Washington University – Geotechnical Earthquake Engineering (past)

Publications

A list of Dr. Lazarte's publications is attached.

Representative Project Experience

Dr. Lazarte has significant experience in various topics related to the design and construction of earth-retaining systems including:

- Design, including structural design, of various types of temporary and permanent earth-retaining systems for stabilizing excavations, cuts and slopes, as well as fill areas, including, but not limited to: soil nail walls, ground anchor walls, mechanically earth stabilized (MES) walls, cantilever walls, and gabion walls.
- Structural design of shallow and deep foundations supporting earth-retaining systems, as applicable.
- Evaluation of lateral earth-pressures and seismic effects affecting earth-retaining systems.
- Evaluation of ground corrosion potential and mitigation for the design of metallic elements included in earth-retaining systems.
- Assessment of soil-structure interaction, including deformation of earth-retaining systems, underground pipes, tunnels, bridge abutments, and culverts under static and dynamic conditions using numerical methods.
- Load testing of reinforcement elements of earth-retaining systems.
- Geotechnical instrumentation and monitoring of earth-retaining systems and related construction elements to evaluate deflections, settlements, cracks, among other manifestations, and to assess stability and performance during construction and operation.
- Development of recommendations for construction of the above named earth-retaining systems.
- Value engineering.
- Preparation of specifications and drawings for construction.
- Construction QA/QC services.
- Forensic evaluations.

His distinctive projects with a focus on soil nail walls include:

- **New US Government Facility, Beirut, Lebanon [Design Excellence Project] (US Department of State).** He served as Task Manager/Geotechnical Lead for this D/B/B procurement, which included the design of ***soil nail walls, Mechanically Stabilized Earth (MSE) walls, secant pile walls, hybrid SNW/MSE walls, and several types of cantilever walls.*** For these earth-retaining systems, he was also in charge of assessing large seismic lateral-earth pressures, developing requirements for proof/verification testing, developing construction specs and drawings, providing value engineering, preparing a geotechnical Project Risk Registry, and developing the scope for construction quality assurance (CQA) services.

- **Purple Line Transit Line, Montgomery and Prince George's Counties, Maryland (Maryland Transit Authority).** Dr. Lazarte served as the Technical Lead for the bid design on this P3 project for all geotechnical aspects, and led the interaction with the D/B team's contractor and design firms. He worked on bid-level designs of ***soil nail walls (SNWs), Mechanical Stabilized Earth (MSE) walls, hybrid soil nail/MSE walls, secant pile walls*** and made design recommendations for various types of ***cantilevered walls*** for the structural engineer. He also recommended cost-effective concepts for sequence of wall/foundation construction to optimize construction, and reduce risks during wall construction. He created a risk registry with geotechnical factors that may potentially affect design, construction, and long-term performance of these earth-retaining systems, as well of numerous other construction elements of this megaproject.

- **Brownhouse Lofts, Madison, Wisconsin (Owner's name withheld).** Dr. Lazarte served as peer reviewer, provided design recommendations, and performed additional design for ***soil nail walls***.

- **Memorial Hermann Hospital, Houston, Texas (The Texas Medical Center).** He provided support of the Contractor's design of ***soil nail walls*** for the expansion of this facility.

- **Mixed-Used Building, San Diego, California (Owner's name withheld).** Dr. Lazarte was the expert witness for the plaintiff in a construction claim involving the partial failure of ***a soil nail wall***. He provided

expert opinion of causation and testimony during binding arbitration, while remaining as the expert witness on this claim and working with four different law firms.

- **Parking Structure, Hospital Expansion, Bryn Mawr, Pennsylvania (Main Line Health).** Dr. Lazarte was retained by the developer as an external senior reviewer of performance of ***soil nail walls*** that had experienced excessive deformation. He investigated causation and provided recommendations for mitigation and future monitoring.

Dr. Lazarte has worked extensively on applied research for soil nailing and related systems. In this area, he served as Technical Lead, Main Author, Co-Author, Principal Investigator, and/or Project Manager for the preparation of design manuals and similar guidance documents. Examples of his published work include:

- **Federal Highway Administration (FHWA), Washington, DC**:
  - Lazarte, C.A.; Robinson, H.; Gómez, J.E.; Baxter, A.; Cadden, A.W.; and Berg, R.R (2015). "***Soil Nail Walls - Reference Manual***," Geotechnical Engineering Circular No. 7, FHWA, Department of Transportation, Washington, DC.
  - Liang. R. and Lazarte, C.A. (2007). "Laterally Loaded Piles," Geotechnical Engineering Circular No. 9, FHWA, Department of Transportation, Washington, DC. Unpublished draft.
  - Brown, D.A.; Dapp, S.D.; Thompson, W.R. III; and Lazarte, C.A. (2007). "Design and Construction of Continuous Flight Auger (CFA) Piles," Geotechnical Engineering Circular No. 8, FHWA, Department of Transportation, Washington, DC.
  - Lazarte, C.A.; Elias, V.; Espinoza, R.D.; and Sabatini, P.J. (2003). "***Soil Nail Walls***," Geotechnical Engineering Circular No. 7, FHWA, Department of Transportation, Washington, DC.

  As friend of the Transportation Research Board (TRB)-AFS30 Committee on Bridge Foundations, he served as senior reviewer of several chapters of the final draft of GEC 11 "Driven Piles."
- **National Research Council, Transportation Research Board, National Cooperative Highway Research Program, Washington, D.C**. Development of design/construction LRFD specifications for ***soil nail walls*** in upcoming versions AASHTO LRFD Bridge Design Specifications.
- **National Highway Institute.** Consultant. Guidance and review of the ***soil nail*** training manual, which is based on Geotechnical Engineering Circular No. 7 (2015) that he co-wrote with others.
- **American Association of State Highway and Transportation Officials (AASHTO).** Reviewer of ballot items related to ***soil nail walls*** considered for inclusion in the chapter of earth-retaining structures in upcoming versions of the AASHTO LRFD Bridge Design Specifications.
- **Maryland Department of the Environment, Baltimore/Annapolis, Maryland.** Technical Lead and Co-Author for the preparation of a Guidance Manual related to Engineering Uses of Scrap Tires to be used at the state level. The design guidelines presented several geotechnical applications of scrap tires, including their use as engineered backfill behind ***earth-retraining systems***.

Some of his distinctive projects involving earth-retaining systems, other than soil nail walls, include:

- **New US Government Office Building, Moscow, Russia (US Department of State).** He served as Geotechnical Lead for design and Construction Administration (CA) services in a D/B/B procurement, which included preliminary and/or conceptual design of earth-retaining systems such as ***tie-back retaining walls***. He led all geotechnical aspects, worked on specs and drawings (geotechnical aspects), reviewed submittals and RFIs created by the contractor's design engineer for the tie-back retaining wall, evaluated monitoring results, including wall deflections. He also conducted a site visit and assessed on-site damages caused during wall construction, and provided recommendations for resolution.
- **Cherry Island Landfill Expansion in Wilmington, Delaware (Delaware Solid Waste Authority).** He served as Technical Lead for the vertical expansion of an existing landfill built over thick deposits of very soft sediments and man-deposited dredge. He worked on the design for the staged construction of an

85-ft high, 1-mile long ***Mechanically Stabilized Earth (MSE) wall*** built over about 90,000 prefabricated vertical drains (PVDs). He led the construction monitoring in support of Peck's observational method used in the project. This project was an ASCE OPAL Award Finalist Project of the Year.

- **Yeager Airport, Charleston: West Virginia (Central West Virginia Regional Airport Authority).** He was Technical Lead for the design of geotechnical monitoring system for the repairs of a massive slide that occurred at a ***reinforced soil slope (RSS)***, once the world's largest RSS.
- **Turf Reconstruction on National Mall, Washington, DC (National Park Service).** He served as Project Manager and Lead Engineer in charge of geotechnical-related design services. His work included assessment of issues arising during construction including evaluation of damage caused to ***walls of underground cisterns***, review of contractor's design of ***temporary support of excavations***, providing recommendations for ***stability of excavations***, and assessing the performance and deformation of ***sheet pile walls*** (temporary support of excavation) after installation.
- **Flight Simulator, Aberdeen Proving Ground, Aberdeen, Maryland (US Army).** He was the Lead Geotechnical Engineer on this project with a complex scope of work, which included analysis of foundation vibrations and design of foundations to eliminate vibrations potentially affecting extremely sensitive equipment. His work also included the design of ***cantilever walls*** to retain soils around a massive concrete block to support the equipment. USACE and several consultants provided technical oversight and third-party peer review.
- **New US Government Compound, Guatemala City, Guatemala (US Department of State).** He was the Lead Geotechnical Earthquake Engineer. Dr. Lazarte recommended lateral earth-pressures for extremely large seismic loading for ***various types of earth-retaining structures.***
- **National Gateway Project, Shenandoah Junction, West Virginia (CSX).** The National Gateway project entails the improvement of rail traffic by using double-stack trains linking Mid-Atlantic and Midwestern locations. On this D/B project, Dr. Lazarte served as the Lead Earth-Retaining System Engineer and evaluated abutment conditions of a historic rail bridge spanning over existing CSX tracks, assessed geotechnical conditions and developed stabilization alternatives, including ***soil nails, rock bolts and cantilever walls*** for bridge abutments and slopes beyond.
- **Arch Cape Tunnel, Oregon (Oregon DOT).** Dr. Lazarte performed finite element-based analysis to evaluate the stability and deformation of a concrete liner, worked on the structural design of ***rock bolts and shotcrete*** to stabilize the liner, and developed recommendations during construction.
- **Sunset Tunnel, Oregon (Oregon DOT).** Dr. Lazarte led the failure analysis; the deformation evaluation of an existing ***tunnel-support system*** using finite elements; and the stability assessment, all conducted as an emergency response.
- **La Grande Tunnel Portal, Washington (Oregon DOT).** Dr. Lazarte led the characterization of rock discontinuities at the portal, conducted analysis, and developed design recommendations for the ***tunnel-support system***.
- **Pottstown Landfill, Pottstown, Pennsylvania (Waste Management).** Dr. Lazarte served as Technical Lead for the assessment of a ***reinforced soil slope (RSS)*** built as part of a landfill expansion, and of ***soldier pile walls*** built at adjacent facilities, all of which had been experiencing inadequate performance. He identified causes of distress and developed recommendations for redesign, repairs and monitoring.
- **Spanish Hills Development, California (Owner's name withheld).** He supported the design of a ***Mechanically Stabilized Earth (MSE) wall*** by estimating via non-linear finite elements the wall deformation that would be caused by the hypothetical rupture of a nearby potentially active fault.
- **Parking lot, Shopping Center, Vienna, Virginia (Owner's name withheld).** Dr. Lazarte led the evaluation of a distressed ***cantilever wall*** during due diligence of a site purchase. To aid in transactions,

he provided expert opinion and preliminary recommendations and rough order-of-magnitude (ROM) costs for wall repairs.

- **Federal Campus, Bethesda, Maryland (Federal Agency's name withheld).** He served as Project Manager and Technical Lead on this D/B project. As part of a complex scope of work, he worked closely with the D/B team's contractor and design firms to develop concepts for earth-retaining systems. He also developed design recommendations for these systems, including for ***cantilever walls***. USACE and several consultants provided technical oversight and third-party peer review.
- **River Green Filtration Plant, Palmer, Washington (City of Tacoma).** He provided peer senior review, client consultation, and re-design during construction of ***temporary soldier pile support of excavation (SOE)*** for the upgrade and expansion of a large water treatment and filtration plant built over glacial soils and high groundwater.
- **Watchung Square Mall, Watchung, New Jersey (Owner's name withheld).** Dr. Lazarte conducted several engineering evaluations and provided expert opinion for the plaintiff in a construction claim involving the failure of a ***tied-back retaining wall.***
- **Woodfield Glen Development, Rayleigh, North Carolina (Owner's name withheld).** Dr. Lazarte evaluated on-site the damages caused to a ***proprietary earth-retaining, anchored system*** during construction. In support of due diligence, he evaluated failure causation, identified risks for one of the parties, and recommended potential actions for repairing the wall.
- **Guadalupe River Project, San Jose, California (USACE).** To provide 100-year level flood protection to downtown, the project included the construction of an approximately 3,000-ft long, underground, concrete box culvert. Dr. Lazarte was technical reviewer of geotechnical aspects for the design of this system, including the development of static and seismic lateral earth- pressures for the selected ***shoring system***, and design of ***retaining walls***.
- **Fresh Kills Landfill, Staten Island, New York (NY City Parks).** Senior reviewer for the geotechnical evaluation/design of ***gabion walls*** and related foundation systems for this landfill redevelopment.
- **Stoneybrook Drive Bridge, Kensington, Maryland (Montgomery County).** Project manager and senior reviewer of geotechnical services, including development of slope stabilization concepts using ***gabion walls*** to protect the abutment and slopes around a county bridge crossing over CSX tracks.
- **Glenn Echo Creek Tunnel, Oakland, California (Alameda County Public Works).** Dr. Lazarte conducted an independent review and assessment of the contractor's proposed ***shoring system*** at the tunnel portal.
- **Pond Influent Pump Station, Hopper Street Wastewater Treatment Plant, Petaluma, California (City of Petaluma).** Dr. Lazarte provided recommendations for the design of ***cantilever walls***.

Carlos A. Lazarte, PhD, PE, GE – Publications

1. Lazarte, C.A.; Robinson, H.; Cadden, A.W. (2016). “Soil Nailing in the 2010s – Its Evolution and Coming of Age,” ASCE Geostrata, March/April.

2. Lazarte, C.A.; Robinson, H.; Cadden, A.W.; Berg, R.R; Siel, B.D.; and Nichols, S. (2015). “FHWA GEC 7- 2015: A new platform for LRFD Soil Nail Design,” Deep Foundations Institute (DFI). Deep Foundations Magazine, May/June.

3. Lazarte, C.A.; Robinson, H.; Gómez, J.E.; Baxter, A.; Cadden, A.W.; and Berg, R.R (2015). “Soil Nail Walls - Reference Manual, “Geotechnical Engineering Circular No. 7, FHWA-NHI-14-007, Federal Highway Administration, Department of Transportation, Washington, DC.

4. Lazarte, C.A.; Kazmi, Q. (2014). “Subdrainage for Buildings and Retaining Walls,” Schnabel Engineering. Unpublished Internal Design Guidance.

5. Lazarte, C.A. (2013). “Calibration of LRFD-Based Resistance Factors for Soil Nail Pullout,” ASCE GeoCongress, San Diego, California.

6. Lazarte, C.A. (2012). “Proposed Specifications for LRFD Soil-Nailing Design and Construction,” NCHRP Report 701, National Cooperative Highway Research Program, Washington, DC.

7. Houlihan, M.F.; Lazarte, C.A.; Espinoza, R.D.; Germain, A.M.; and Li, C. (2010). “Use of Reliability Methods as a Project Management Tool: The Cherry Island Landfill Project,” GeoFlorida Conference, West Palm Beach, Florida.

8. Li, C.; Lazarte, C.A; Steier, W.; and Espinoza, R.D. (2008). “Guidance Manual for Engineering Uses of Scrap Tires,” Maryland Department of the Environment.

9. Lazarte, C.A. and Bonaparte, R. (2008). “Evaluation of Ground Movement Due to COPR Expansion.” Proceedings, GeoCongress 2008, Geotechnics of Waste Management and Remediation, ASCE Geotechnical Special Publication No. 177, pp. 840-847.

10. Espinoza, R. D.; Lazarte, C.A.; Germain, A.; and Houlihan, M.F. (2008). “Design Considerations for Expansion of an Existing Landfill Over Extremely Compressible Soils,” Geo-Strata —Geo Institute of ASCE, Vol. 8, No. 2, March/April 2008, pp. 38-39,41-43.

11. Liang. R. and Lazarte, C.A. (2007). “Laterally Loaded Piles,” Geotechnical Engineering Circular No. 9, Federal Highway Administration, Washington, DC. Unpublished draft.

12. Brown, D.A.; Dapp, S.D.; Thompson, W.R. III; and Lazarte, C.A. (2007). “Design and Construction of Continuous Flight Auger (CFA) Piles,” Geotechnical Engineering Circular No. 8, Federal Highway Administration, Department of Transportation, Washington, DC.

13. Opdyke, S.M.; Lazarte, C.A.; Espinoza, R.D.; and Germain, A.M. (2006). “Use of CPT Resistivity and Dissipation Tests for Delineating Liquid Levels in a Landfill,” GeoCongress 2006: Geotechnical Engineering in the Information Technology Age. pp. 1-5.

14. Morris, J.W.F.; Lazarte, C.A.; Pendleton, C.H.; Bachus, R.C.; Espinoza, R.D.; Stokoe, K.H.; and Germain, A.M. (2006). “Comparison of Approaches to Characterize the Unit Weight of MSW in Landfills,” J. Solid Waste Tech. Manag. Vol. 32, No. 3, August.

15. Lazarte, C.A.; Opdyke, S.M.; and Germain, A.M. (2005). “Landfill Performance Evaluation with Geotechnical Instrumentation Monitoring.” Proc. of International Solid Waste Association Congress, Buenos Aires, Argentina.

16. Lazarte, C.A.; Steier, W.M; Bonaparte, R.; French, C.; Kaouris, M.; and Briggs, R. (2005). “Monitoring Of COPR Movement at Dundalk Marine Terminal Area 1501,” Abstract, Proceedings of the 8th International In-Situ and On-Site Bioremediation Symposium, Baltimore, Maryland, Jun 6-9.

17. Dermatas, D.; Chrysochoou, M.; Moon, D.H.; Christodoulatos, C.; Lazarte, C.A.; Pendleton, C.; Bonaparte, R.; Briggs, R.; Myers, M.; French, C.; Morris, J.; and Kaouris, M. (2005). “Mineralogical characterization of COPR at Dundalk Marine Terminal area 1800 to elucidate heave mechanism,”

Proc. of 8th International In-Situ and On-Site Bioremediation Symposium, Baltimore, Maryland, Jun 6-9.

18. Lazarte, C.A; Bonaparte, R.; Pendleton; C.H.; Dermatas, D.; French, C.; Kaouris, M.; and Briggs, R. (2005). "Trench Testing and Characterization of COPR at Dundalk Marine Terminal Area 1800," Poster in 8th International In-Situ and On-Site Bioremediation Symposium, Baltimore, Maryland, Jun 6-9.

19. Lazarte, C.A.; Baecher, G.B.; and Withiam, J.L. (2003). "New Directions in LRFD for Soil Nailing Design and Specifications," International Workshop on Limit State Design in Geotechnical Engineering practice; Cambridge, Massachusetts; 26 June.

20. Lazarte, C.A.; Elias, V.; Espinoza, R.D.; and Sabatini, P.J. (2003). "Soil Nail Walls," Geotechnical Engineering Circular No. 7, Federal Highway Administration, Department of Transportation, Washington, DC.

21. Lazarte, C.A. and Mejia, L.H. (2001). "Review of the Performance of Rockfill Dams during Past Earthquakes," URS Woodward Clyde, Unpublished Internal Report.

22. Mejia, L.H. and Lazarte, C.A. (2001). "Review of Topographic Effects to Ground Motions in Canyons," URS Woodward Clyde, Unpublished Internal Report.

23. Forrest, M.; Bureau, G.; Lazarte, C.A.; and Hutchins, S. (2000). "Seismic Rehabilitation of Weber Dam," in Western Regional Annual Conference and Technical Seminar, Association of State Dam Safety Officials, May 15-19, Portland, Oregon.

24. Lazarte, C.A. and Bray, J.D. (1996). "A Study of Strike-Slip Faulting using Small-Scale Clay Models," ASTM Geotechnical Testing Journal, Vol. 19, No. 2 (June).

25. Lazarte, C.A. (1996). "The Response of Earth Structures to Surface Fault Rupture," Ph.D. Dissertation, Department of Civil and Environmental Engineering, University of California, Berkeley, California, 561 pp.

26. Lazarte, C.A.; Bray, J.D.; Johnson, A.M.; and Lemmer, R.E. (1994). "Surface Breakage of the 1992 Landers Earthquake and Its Effects on Structures," Bulletin of the Seismological Society of America. Vol. 84, No. 3, pp. 547-561.

27. Lazarte, C.A. and Bray, J.D. (1995). "Observations of Surface Breakage due to Strike-Slip Faulting," Third International Conference on Recent Advances in Geotechnical Earthquake Engineering and Soil Dynamics, St. Louis, April 2-6.

28. Espinoza, R.D.; Taylor, R.L.; Bray, J.D.; Soga, K.; Lok, T.; Rathje, E.M.; Zornberg, J.G.; and Lazarte, C.A. (1995). "GeoFEAP: Geotechnical Finite Element Analysis Program. PART I - User's Guide," Geotechnical Research Report No. UCB/GT/95-02, Department of Civil and Environmental Engineering, University of California, Berkeley, California, 124 p.

29. Murbach, D.; Rockwell, T.K.; Bray, J.D.; and Lazarte, C.A. (1994). "On the Response of Standard Foundations to Fault Rupture during the Landers Earthquake," 1994 GSA Meeting. Geological Society of America.

30. Lazarte, C.A. (1994). "Chapter 4: Ground Failure," (Co-author) in Preliminary Report on the Principal Geotechnical Aspects of the January 17, 1994 Northridge Earthquake, (Stewart, J. et al., Eds.), Earthquake Engineering Research Center, UCB/EERC-94-08, pp. 71-146.

31. Lemmer, R.E. and Lazarte, C.A. (1993). "Preliminary Site Assessment of the Effects of Ground Displacement from the Landers Earthquake of June 28, 1992," in "Landers: earthquake and aftershocks," Reynolds, E.(Compiler), Quarterly of the San Bernardino County Museum Association, Redlands, California, Vol. 40, No.1, pp. 44-51.