Appendix H

Updated Geotechnical Exploration Report

UPDATED GEOTECHNICAL EXPLORATION REPORT
2ND AND PCH RETAIL CENTER
CITY OF LONG BEACH, CALIFORNIA

Prepared for:

PCH Property, LLC

1600 East Franklin Avenue
El Segundo, California 90245

Project No. 11232.002

December 2, 2016

Leighton Consulting, Inc.

A LEIGHTON GROUP COMPANY

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PCH Property, LLC
1600 East Franklin Avenue
El Segundo, California 90245

Attention: Mr. Steve Shaul

Subject: **Updated Geotechnical Exploration Report**
2nd and PCH Retail Center
City of Long Beach, California

In response to your request and authorization, Leighton Consulting, Inc. has prepared this updated geotechnical exploration report for the proposed 2nd and PCH retail center in the city of Long Beach, California. The purpose of our services was to evaluate the geotechnical conditions of the site, identify geologic and seismic hazards, and provide geotechnical recommendations to aid in the design and construction. This report has been updated to include additional borings and CPT soundings requested by Whole Foods Market and our additional analyses of the collected data.

The project site is underlain by artificial fill generally associated with the construction of the existing buildings and improvements and consisting mainly of silty sand and sandy silt. The fill is underlain by alluvial deposits that generally consisted of interlayered loose to medium dense sand, silty sand, sandy silt, and soft to medium stiff silty to sandy clay. Groundwater was encountered in our borings during drilling at depths of 15 to 18½ feet. Groundwater was measured in utility potholes by others at depths of 5 to 11 feet.

No known active or potentially active faults are mapped to cross the site and the site is not located within an Alquist-Priolo Special Studies Zones. However, significant ground shaking should be anticipated at the site during the expected design life of the proposed structures. Review of the *Seismic Hazard Zone Report for the Los Alamitos Quadrangle* (CGS, 1998) indicated that the subject site is located within an area that has been identified as being potentially susceptible to the occurrence of liquefaction, requiring a

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liquefaction evaluation. Therefore, we have performed a liquefaction evaluation using Cone Penetrometer Test (CPT) soundings that were advanced to depths of 60 and 80 feet below existing grade. Based on our analyses, layers of sand and silt mainly between 5 to 10 feet and 15 to 40 feet below the existing grade are susceptible to liquefaction during a strong local earthquake, with a potential for surficial settlement in the range of 1½ to 4 inches. Since the liquefiable layers are shallow and relatively thick, the potential for surface manifestation of liquefaction may also include sand boils and ground fissures.

We recommend that the proposed structures be supported on a deep foundation system that extends through liquefiable zones into competent material. As an alternative, ground improvement, such as stone columns, ramped aggregate piers or deep soil mixing, may be performed within the proposed structure footprints or footing footprints to mitigate the liquefaction potential of the subsurface soils. If ground improvement is performed, the proposed structures may be supported on a mat foundation or conventional shallow foundation system.

Presented in this report are our findings and recommendations for the proposed project based on the reviewed geotechnical aspects of the site and the anticipated behavior of the soils during and after construction.

We appreciate the opportunity to be of service to you on this project. If you have any questions or if we can be of further service, please contact us at your convenience.

Respectfully submitted,

LEIGHTON CONSULTING, INC.

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TABLE OF CONTENTS

Section Page

1.0 INTRODUCTION 1

1.1 Site Location and Proposed Project 1
1.2 Purpose and Scope 1

2.0 GEOTECHNICAL FINDINGS 5

2.1 Geologic Setting 5
2.2 Subsurface Soil Conditions 5
2.3 Expansive Soil Characteristics 6
2.4 Soil Compressibility 6
2.5 Soil Corrosivity 6
2.6 Groundwater Conditions 6
2.7 Infiltration Rate 7
2.8 Faulting 8
2.9 Seismicity and Ground Shaking 8
2.10 Secondary Seismic Hazards 8

2.10.1 Liquefaction Potential 8
2.10.2 Lateral Spreading 10
2.10.3 Seismically Induced Landslides 11
2.10.4 Ground Lurching 11
2.10.5 Seiches and Tsunamis 12

3.0 GEOTECHNICAL RECOMMENDATIONS 13

3.1 Design Considerations 13
3.2 Deep Foundation 13
3.3 Ground Improvement 16
3.4 Shallow Foundations 17
3.5 Slabs-on-Grade 19

3.5.1 Building Floor Slabs 19
3.5.2 Concrete Flatwork 19

3.6 Site Grading 20

3.6.1 Site Preparation 20
3.6.2 Excavation and Recompaction 21
3.6.3 Fill Materials 21
3.6.4 Fill Placement and Compaction 22

3.7 Seismic Design Parameters 22
3.8 Lateral Earth Pressures 22
3.9 Pavement Design 24
3.10 Cement Type and Corrosion Protection 25
3.11 Temporary Excavation 25
3.12 Trench Backfill 26

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TABLE OF CONTENTS (Continued)

3.13 Dewatering 26
3.14 Additional Geotechnical Services 26

4.0 LIMITATIONS 28

5.0 REFERENCES 29

LIST OF ATTACHMENTS

Important Information About Your Geotechnical Engineering Report — Rear of Text

Figures

Figure 1 – Site Location Map — Rear of Text
Figure 2 – Boring and CPT Location Map — Rear of Text
Figure 3 – Axial Capacities of Driven Concrete Pile — Rear of Text
Figure 4 – Recommended Ground Improvement Depths — Rear of Text

Appendices

Appendix A – Geotechnical Boring Logs
Appendix B – CPT Logs
Appendix C – Laboratory Test Results
Appendix D – Percolation Test Results
Appendix E – Liquefaction Analysis

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1.0 INTRODUCTION

1.1 Site Location and Proposed Project

The 2nd and PCH site is an approximately 10½-acre parcel located between Pacific Coast Highway (PCH) and Marina Drive, south of 2nd Street. The site is relatively flat and currently occupied by several existing buildings, including Seaport Marina Hotel and parking areas. The existing improvements will be demolished to accommodate construction of the proposed development. The site location and immediate vicinity are shown on Figure 1, *Site Location Map*.

The development will include Whole Foods Market that will be located on the northeastern portion of the site, at the southwest corner of PCH and 2nd Street. It will be a one-story building with a footprint of approximately 45,000 square feet. A surface parking is planned in front or west of the building. Rooftop of the building will be designed as a parking deck that will also extend over the surface parking.

In addition, a 4-level parking structure is planned on the southern portion of the site. The rest of the site will be developed for retail stores, restaurants, plaza, and other associated improvements. The rooftop of the retail stores/restaurants fronting PCH will also be designed as a parking deck, connected to the rooftop of Whole Foods Market by a bridge that goes over the main entry off of PCH. The parking deck will also be connected by a bridge to the parking structure.

1.2 Purpose and Scope

The purpose of our services was to evaluate the general geotechnical conditions of the site relative to the proposed development and provide geotechnical recommendations to aid in the project planning, design and construction. The scope of this geotechnical evaluation included the following tasks:

- *Background Review* – In preparation of this report, we performed a background review of readily available, relevant, geotechnical and geological literature pertinent to the site. References used in preparation of this report are listed in Section 5.0.

- *Field Exploration* – Prior to performing subsurface exploration, a site reconnaissance was carried out by Leighton personnel to mark locations of

the proposed borings and CPT soundings and coordinate with Seaport Marina Hotel for site access and utility clearance. Underground Service Alert (USA) was also notified for marking of any underground utility lines.

Our previous field exploration, performed on February 1 and 2, 2016, included two deep hollow-stem auger borings (LB-1 and LB-2) to a depth of 81½ feet and 16 CPT soundings (CPT-1 through CPT-16) to depths of 60 and 80 feet. One of the borings (LB-2) and four of the CPTs (CPT-1 through CPT-4) were located within footprint of the proposed Whole Foods Market. As requested by Whole Foods Market, we have performed an additional field exploration on November 9, 2016, consisting of one 60-foot deep boring (LB-3) and four 60-foot deep CPTs (CPT-17 through CPT-20) within the building footprint and two 10-foot deep borings (LB-4 and LB-5) in the parking area. Approximate locations of the borings and CPTs are shown on Figure 2, *Boring and CPT Location Map*.

Soils encountered in the borings were logged in the field by a Leighton representative and described in accordance with the Unified Soil Classification System (ASTM D 2488). During drilling, bulk and relatively undisturbed drive samples were obtained from the borings for geotechnical laboratory testing and evaluation. The relatively undisturbed samples were obtained utilizing a Shelby tube and a modified California drive sampler driven 18 inches with a 140 pound automatic hammer dropping 30 inches in general accordance with ASTM Test Method D 3550. Standard Penetration Tests (SPTs) were performed at selected depth intervals in general accordance with ASTM Test Method D 1586. The number of blow counts per 6 inches of penetration was recorded on the boring logs. After completion of drilling, the borings were backfilled with soil cuttings. Logs of the boring are presented in Appendix A, *Geotechnical Boring Logs*. Boring logs from a previous study by Converse Consultants (Converse, 2005) are also included in Appendix A.

The CPT soundings were performed in accordance with ASTM Test Method D 5778 by advancing a standard 10 cm^2 electric cone. The tests consisted of pushing the instrumented cone-tipped probe into the ground while simultaneously recording the tip resistance and side friction of the soils during penetration. The CPT logs are presented in Appendix B, *CPT Logs*.

- *Field Percolation Test* – In-situ percolation testing was performed in accordance with the County of Los Angeles Department of Public Works

(LADPW) *Guidelines for Design, Investigation, and Reporting Low Impact Development Stormwater Infiltration* document (LADPW, 2014). Immediately after sampling and logging, Borings P-1 through P-3 were converted into percolation test wells. A 2-inch-diameter polyvinyl chloride (PVC) section of 0.020-inch slotted pipe was installed between 0 and 5 feet to measure percolation rates over the depth intervals. Filter pack consisting of No. 3 Sand was deposited in the annulus from the bottom of the boring to the top of slotted pipe section.

After presoaking, the test well was filled to near the top of the slotted pipe to determine the standard time interval for the percolation test. Once the 30-minute standard time interval was established, the well was filled to near the top of the slotted pipe. The water drop was then measured at 30-minute intervals using a water level sounder. At the end of each 30 minute interval, the well was refilled. Testing was terminated when the percolation rates had stabilized. Field data collected and calculated percolation rate are presented in Appendix D, *Percolation Test Results*. After conclusion of percolation testing, the well materials were removed and the test hole was backfilled with the soil cuttings.

- *Laboratory Testing* – Geotechnical laboratory tests were conducted on selected relatively undisturbed and bulk soil samples obtained during our field exploration. The laboratory testing program was designed to evaluate the engineering characteristics of the onsite soil and included in situ moisture content and dry density, percent passing No. 200 sieve, sieve analysis, Atterberg Limits, direct shear, consolidation, maximum dry density, R-value and corrosivity (sulfate and chloride content, minimum resistivity, and pH). The moisture content and dry density test results are included in the boring logs in Appendix A. Other laboratory test results are presented in Appendix C, *Laboratory Test Results*.

- *Seismic Hazards Evaluation* – We performed an engineering evaluation of seismic hazards that may impact the site. We assessed locations of active and potentially active faults near the project site and addressed the potential for primary earthquake hazards (fault rupture, seismicity and ground shaking) and secondary earthquake hazards (liquefaction potential, lateral spreading , landsliding, lurching, flooding, seiches and tsunamis) impacting the site.

- *Engineering Analysis* – The data obtained from our background review, field exploration, and laboratory testing were evaluated and analyzed to develop site-specific geotechnical recommendations for the proposed development.

- *Report Preparation* – This report presents our findings, conclusions and recommendations for the proposed project.

2.0 GEOTECHNICAL FINDINGS

2.1 Geologic Setting

The project site is located within the Long Beach Plain in the coastal portion of California's Peninsular Ranges geomorphic province that extends northwesterly from Baja California into the Los Angeles Basin and westerly into the offshore area, including Santa Catalina, Santa Barbara, San Clemente, and San Nicolas islands. The Peninsular Range is characterized by northwest/ southeast trending alignments of mountains and hills and intervening basins, reflecting the influence of northwest trending major faults and folds that control the general geologic structural fabric of the region. The site is underlain predominantly by Holocene-age alluvial fan deposits that consist generally of massive to crudely interbedded sand, silt, silty sand and clay of varying saturation and density.

2.2 Subsurface Soil Conditions

The site is underlain by artificial fill (Af) and Quaternary-aged young alluvial fan deposits (Qyf). Existing pavement sections, as encountered in our borings, consisted of 2 to 3 inches of asphalt concrete over 2 to 4 inches of aggregate base. The artificial fill across the site is generally about 2½ feet in thickness and consisted primarily of silty sand and sandy silt. Deeper fills associated with the construction of the existing buildings and improvements exist at the site. Boring LB-1 encountered up to 6 feet of fill, presumably associated with construction of the water and sewer pipelines located along the southern perimeter of the site. A previous study by others (California Environmental, 2002) also reported the presence of sumps and mud pits at the site.

Below the artificial fill, Quaternary-aged young alluvial fan deposits (Qyf) were encountered in the borings to the maximum depth explored (81½ feet). The alluvium generally consisted of interlayered loose to medium dense sand, silty sand, sandy silt and soft to medium stiff sandy to silty clay. A detailed description of the subsurface soils encountered during the field exploration is presented in the boring logs (Appendix A) and CPT logs (Appendix B). Boring logs from the previous study (Converse, 2005) are also included in Appendix A. Some of the engineering properties of these soils are described in the following sections.

2.3 Expansive Soil Characteristics

Laboratory testing performed on representative samples indicates that the near-surface soil generally exhibit “low” expansion potential. The near-surface soils are mainly sand and, therefore, the expansion potential is considered to be “low”.

2.4 Soil Compressibility

Representative samples of the native soils were subjected to consolidation testing to evaluate the compression and collapse characteristics of the materials. Based on the laboratory test results, the native soils are expected to have low to moderate compressibility for the expected loading. Local clay layers with trace of organics that are highly compressible may be encountered; however, these highly compressible layers are expected to have minor impacts if ground improvement is performed or if the proposed structures are supported on deep foundations as recommended in this report. The soils are not considered susceptible to collapse.

2.5 Soil Corrosivity

In general, soil environments that are detrimental to concrete have high concentrations of soluble sulfates and/or pH values of less than 5.5. Soils with chloride content greater than 500 ppm per California Test 532 are considered corrosive to steel, either in the form of reinforcement protected by concrete cover or plain steel substructures, such as steel pipes. Additionally, soils with a minimum resistivity of less than 1,000 Ohm-cm are considered corrosive to ferrous metal.

Based on the laboratory test results, the subsurface soils have low soluble sulfate contents. Therefore, the potential for sulfate attack on concrete is considered low. The tested soils are considered severely corrosive to buried ferrous metal in direct contact with the soils.

2.6 Groundwater Conditions

Groundwater was encountered during drilling at depths of 15 and 18½ feet below existing grade in our borings (LB-1 through LB-3). Converse (2005) reported groundwater depths ranging from 10 to 15 feet below existing grade The historically high groundwater level for this area, according to the California Geologic Survey (1998, Plate 1.2), is on the order of 10 feet below the ground

surface. Data from utility potholes by others indicated groundwater at approximately 5 to 11 feet below grade.

Due to the proximity of the site to the coastal zone, the depth of the groundwater is expected to be influenced by tidal fluctuations. Additionally, fluctuations of the groundwater level, localized zones of perched water, and an increase in soil moisture should be anticipated during and following the rainy seasons or periods of locally intense rainfall and storm water runoff. Irrigation of landscape areas and introduction of surface water will also cause localized fluctuations of groundwater levels.

2.7 Infiltration Rate

Infiltration rates at the tested locations and depths are summarized in the table below. The percolation test locations are shown on Figure 2, *Boring and CPT Location Map*. Field data and calculated infiltration rate for each percolation test well are presented in Appendix D.

Based on the percolation test results, the measured soil infiltration rates ranged from 0.3 inches/hour to 2.2 inches/hour. It should be emphasized that the infiltration test results are only representative of the tested locations and depth where they are performed. Varying subsurface conditions will exist outside of the test locations, which could alter the calculated infiltration rate indicated below.

Table 1 – Infiltration Rates

Boring No.	Drilled Depth (feet)	Screen Interval Depth (feet)	Measured Infiltration Rate (inches/hour)
P-1	5	0 to 5	2.2
P-2	5	0 to 5	0.8
P-3	5	0 to 5	0.3

As discussed later in Section 2.10.1, results of our analysis indicated that the subsurface soils at the site are susceptible to liquefaction. Due to the presence of shallow groundwater table and liquefaction potential, infiltration of surface water runoff into the ground is not recommended from a geotechnical standpoint.

2.8 Faulting

No active faults are mapped or known to cross the site and the site is not located within an Alquist-Priolo Earthquake Fault Zone (Bryant and Hart, 2007). Known regional active faults that could produce significant ground shaking at the site include the Newport-Inglewood, Palos Verdes, and Elsinore faults located approximately 0.3 miles, 8.1 miles, and 16.3 miles, respectively, from the site. The Puente Hills Blind Thrust fault is located approximately 10.2 miles from the site in the subsurface.

2.9 Seismicity and Ground Shaking

The principal seismic hazard to the site is ground shaking resulting from an earthquake occurring along any of several major active and potentially active faults in southern California, including those mentioned above. The intensity of ground shaking at a given location depends primarily upon the earthquake magnitude, the distance from the source, and the site response characteristics. Peak horizontal ground accelerations are generally used to evaluate the intensity of ground motion. Using the United States Geological Survey (USGS) Seismic Design Maps (USGS, 2013), the peak ground acceleration for the Maximum Considered Earthquake (MCE_G) adjusted for the Site Class effects (PGA_M) is 0.60g. Per the 2013 CBC, the peak ground acceleration for Design Earthquake ground motion is two-thirds of PGA_M or 0.40g. Based on the USGS online interactive deaggregation program (USGS, 2008), the modal seismic event is Moment Magnitude (M_W) 7.0 at a distance of 0.6 miles.

2.10 Secondary Seismic Hazards

Secondary seismic hazards in the region could include soil liquefaction and the associated surface manifestation, lateral spreading, seismically-induced landsliding, ground lurching, seiches, and tsunamis. The potential for these seismic hazards at the site is discussed below.

2.10.1 Liquefaction Potential

Liquefaction is the loss of soil strength or stiffness due to a buildup of pore-water pressure during severe ground shaking. Liquefaction is associated primarily with loose (low density), saturated, fine-to-medium grained, cohesionless soils. As the shaking action of an earthquake progresses, the soil grains are rearranged and the soil densifies within a

short period of time. Rapid densification of the soil results in a buildup of pore-water pressure. When the pore-water pressure approaches the overburden pressure, the soil reduces greatly in strength and temporarily behaves similarly to a fluid. Effects of liquefaction can include sand boils, settlement, and bearing capacity failures below structural foundations.

Review of the *Seismic Hazard Zone Report for the Los Alamitos Quadrangle* (CGS, 1998) indicates that the subject site is located within an area that has been identified by the State of California as being potentially susceptible to the occurrence of liquefaction.

We performed liquefaction analysis of the soil profiles from the CPTs. The liquefaction evaluation was conducted using a peak horizontal ground acceleration of 0.60g, a Moment Magnitude (Mw) of 7.0, and historically high groundwater of 5 feet below grade. Our analysis, presented in Appendix E, *Liquefaction Analysis*, identifies layers of liquefiable soils mainly at depths between approximately 5 to 10 feet and 15 to 40 feet below the existing grade. The potential for surface manifestation in the form of sand boils and ground fissures is high based on the thickness and depth at which liquefaction potential occurs.

Seismically-induced settlement consists of dry dynamic settlement (above groundwater) and liquefaction-induced settlement (below groundwater). These settlements occur primarily within loose to medium dense sandy soil due to reduction in volume during, and shortly after, an earthquake event. The settlements of these strata were estimated to result in a cumulative settlement ranging from 1½ to 4 inches as summarized in Table 2, with a differential settlement of approximately one half of the total settlement.

Due to the potential for surface manifestation associated with liquefaction, mitigation measures, such as supporting the structures on piles or ground improvement, are recommended.

Table 2 – Summary of Liquefaction-Induced Settlement

CPT ID	Vertical Settlement (inches)
CPT-1	1.8
CPT-2	3.1
CPT-3	3.8
CPT-4	3.0
CPT-17	2.1
CPT-18	1.9
CPT-19	3.2
CPT-20	2.3
CPT-5	1.5
CPT-6	2.5
CPT-7	1.7
CPT-8	1.3
CPT-9	1.6
CPT-10	2.6
CPT-11	2.4
CPT-12	2.3
CPT-13	2.4
CPT-14	3.6
CPT-15	2.7
CPT-16	2.4

Note: CPT-1 through CPT-4 and CPT-17 through CPT-20 are located within Whole Foods Market building footprint.

2.10.2 Lateral Spreading

Seismically-induced lateral spreading involves primarily lateral movement of earth materials due to ground shaking. For lateral spreading to occur, the liquefiable zone must be continuous, unconstrained laterally, and free to move along gently sloping ground toward an unconfined area. Lateral spreading results in near-vertical cracks with predominantly horizontal movement of the soil mass involved.

The presence of Los Alamitos Bay marina to the west of the site presents a potential unconfined area for lateral spreading to occur. As such, we performed analysis to evaluate the potential for lateral spreading at the

site. The liquefaction layers were conservatively assumed to be continuous and the analysis was performed using the computer program *SLIDE v6.008* (Rocscience, 2011) that uses two-dimensional (2D) limit equilibrium techniques based on vertical slice equilibrium. Shear strength parameters used in the analyses were derived from interpretation of laboratory data generated from direct shear tests on representative samples of material encountered during exploration. The strength parameters were also developed by interpretation of the test boring and CPT data where specific shear strength testing was not performed. Strength parameters used to model post-liquefaction/residual strength were developed from review of the methodology/correlations presented in EERI Monograph MNO-12 (Idriss and Boulanger, 2008). These relationships calculate residual strength as function of effective overburden pressure (prior to liquefaction) using either the corrected SPT N-value [$(N_1)_{60,cs}$] or corrected CPT tip resistance [$(q_{c1N})_{cs}$] and regression equations.

The pseudo-static analysis was performed considering the presence of liquefiable soil layers and inertial forces (k_h= 0.15). The calculated factor of safety was greater than the minimum required of 1.1 for the strata identified as being potentially liquefiable.

2.10.3 Seismically Induced Landslides

The potential for seismically-induced landsliding is considered low due to the absence of slopes at the site. Proposed slopes, if any, should be engineered and constructed at a gradient of 2:1 (horizontal:vertical) or flatter.

2.10.4 Ground Lurching

Ground lurching is defined as movement of low density soil materials on a bluff, steep slope, or embankment due to earthquake shaking. Since there are no significant slopes at the site, it is our opinion that the potential for ground lurching as a result of nearby or distant seismic events is low.

2.10.5 Seiches and Tsunamis

Seiches are large waves generated in enclosed bodies of water in response to ground shaking. The project site is located in the proximity of water bodies of the Los Alamitos Bay marina. There is potential for limited seiche effects to occur in these water bodies during a large seismic event; however, it is not expected that the project site would experience flooding given the distance and elevation of the site relative to the water bodies.

Tsunamis are waves generated in large bodies of water by fault displacement or major ground movement. The project site could experience tsunami effects. The presence of harbor breakwater and intervening urban development may limit potential effects at this location.

3.0 GEOTECHNICAL RECOMMENDATIONS

Presented below are the geotechnical recommendations for the proposed development. These recommendations are based upon the exhibited geotechnical engineering properties of the soils and their anticipated response both during and after construction. These recommendations are considered minimal and may be superseded by more restrictive requirements of the civil and structural engineers and the City of Long Beach.

3.1 Design Considerations

The soils at the site contain layers that are susceptible to liquefaction that may result in liquefaction-induced settlement and surface manifestation. Additionally, there are local clay layers that may experience consolidation when subjected to loading from the structures. Therefore, we recommend that the proposed structures be supported on a deep foundation system. Alternatively, ground improvement techniques be performed to reduce the liquefaction and consolidation potential of the subsurface soils. If ground improvement is performed, the structures may be supported on a mat foundation or a conventional shallow foundation system.

3.2 Deep Foundation

A deep foundation system may be used for support of the structures. Cast-In-Drilled-Hole piles may encounter difficulties during construction due to the relatively shallow groundwater and potential for caving sand. From an engineering and construction standpoint, driven precast concrete piles appear to be the preferred choice for the deep foundation system.

Driven piles should be embedded below the compressible and liquefiable soils. Based on our boring and CPT data, the driven piles should be embedded a minimum 5 feet below the liquefaction zones. The actual pile length should be determined by the structural engineer based on loads from the superstructure and the axial pile recommendations presented on Figure 4. The axial capacities of 12-inch and 14-inch precast concrete piles for frequently applied dead plus live load are presented on Figure 3. Uplift capacity can be taken as 40 percent of the downward capacity. A factor of safety of 2.0 may be used to obtain the allowable pile capacities and the capacities may be increased by one-third for transient loads such as wind or seismic forces. To avoid group effects, the pile on-center spacing should be at least three times its largest dimension.

The potential downdrag force due to liquefaction-induced settlement on the pile is presented in the footnote on Figure 4. This downdrag force should be considered in the seismic design of the structures and considered as an additional load demand on the pile foundations.

Settlement of piles, generally resulting from settlement of the supporting soils and elastic compression of piles, is expected to be on the order of ¼ inch. The settlement analysis should be evaluated when the actual structural load and pile cap configuration become available.

Lateral load analyses for the piles were conducted using the computer program LPILE^{plus} (Reese and Wang, 2000). The analyses were conducted for a pile-top deflection of ¼, ½ and 1 inch for a fixed-head and a free-head condition. The results for a 12-inch and 14-inch square pile are summarized in Tables 4 and 5, respectively. It should be noted that no safety factor has been incorporated in the lateral capacity values.

Vibrations associated with pile driving may potentially cause distress to adjacent improvements. Noise during pile driving may also cause disturbance to people occupying the nearby buildings. The pile driving contractors should be informed about the potential concerns so that they can use equipment and/or implement measures, if necessary, that will minimize noise and vibration during the pile driving. The conditions of existing adjacent improvements should be documented by surveying, video recording, photographs, and other means before, during and after the pile driving.

An indicator pile-driving program should be performed to verify the pile capacity and driveability prior to production of foundation piles. We recommend the indicator pile-driving program be observed and monitored by the geotechnical consultant.

Table 3 – Lateral Capacities of 12-inch Square Pile

Free Head			
Pile Head Deflection (inches)	Shear Force at Pile Top (kips)	Maximum Bending Moment (kips-ft)	Depth to Maximum Moment (feet)
¼	5	17	6
½	10	31	6
1	17	51	7

Fixed Head			
Pile Head Deflection (inches)	Shear Force at Pile Top (kips)	Maximum Bending Moment (kips-ft) at Top of Pile	Depth to Zero Moment (feet)
¼	13	48	5
½	22	84	5
1	30	137	6

Table 4 – Lateral Capacities of 14-inch Square Pile

Free Head			
Pile Head Deflection (inches)	Shear Force at Pile Top (kips)	Maximum Bending Moment (kips-ft)	Depth to Maximum Moment (feet)
¼	7	25	7
½	12	44	7
1	19	72	7

Fixed Head			
Pile Head Deflection (inches)	Shear Force at Pile Top (kips)	Maximum Bending Moment (kips-ft) at Top of Pile	Depth to Zero Moment (feet)
¼	16	68	6
½	27	121	6
1	40	206	7

3.3 Ground Improvement

In-place ground improvement techniques, such as stone columns, ramped aggregate piers or deep soil mixing, may be used to mitigate the potentially liquefiable soils and reduce settlement potential. These techniques basically improve the strength of the soils and/or provide drainage paths for pore water pressure dissipation. The columns or piers are installed in a grid pattern and mainly intended to reduce the potential for liquefaction and foundation settlement. Design of the ground improvement will require consulting with a specialty contractor.

The proposed structures may be supported on a mat foundation or a shallow foundation system if seismically-induced settlement and surface manifestation are reduced to an acceptable level upon implementation of the ground improvement. Based on our liquefaction analysis (Appendix E), the preliminary target depth of the soils to be treated is recommended to range from 25, 30 to 40 feet below the existing grade. Figure 4 delineates areas of the recommended ground improvement depths based on the available CPTs. The following table summarizes the potential liquefaction-induced settlement upon implementation of ground improvement to the target depths mentioned above. Design, layout and/or configuration of the ground improvement will affect the post-mitigation settlement and determine the type of foundation feasible for the structures (see Section 3.4). The ground improvement should be designed by the specialty contractor with input from the geotechnical and structural engineers.

The ground improvement contractor should perform a pilot program to evaluate the effectiveness of the proposed mitigation measure prior to full implementation. The geotechnical engineer should constantly monitor the effectiveness of any testing/evaluation program and modify the program if necessary.

Table 5 – Estimated Settlement with Ground Improvement

CPT ID	Recommended Ground Improvement Depth (feet)	Vertical Settlement (inches)
CPT-1	25	0.5
CPT-2	25	0.9
CPT-3	25	0.6
CPT-4	25	0.9
CPT-17	25	1.2
CPT-18	25	0.9
CPT-19	25	0.6
CPT-20	25	0.7
CPT-5	25	0.7
CPT-6	30	1.0
CPT-7	30	0.5
CPT-8	30	0.2
CPT-9	30	1.0
CPT-10	30	0.8
CPT-11	30	0.8
CPT-12	30	0.2
CPT-13	30	0.6
CPT-14	40	0.6
CPT-15	40	0.2
CPT-16	40	0.3

Note: CPT-1 through CPT-4 and CPT-17 through CPT-20 are located within Whole Foods Market building footprint.

3.4 Shallow Foundations

Following ground improvement recommended above and site grading recommended later in Section 3.6, the proposed structures may be supported on a mat foundation or a conventional shallow foundation system. A mat foundation tends to distribute the structural load relatively evenly. The zone of ground improvement for mat foundation should cover the structure footprints and extend a minimum horizontal distance of 10 feet beyond the footprints, where feasible. We understand the available horizontal distance between the building footprint

and Chevron easement along the eastern boundary of the site ranges from approximately 2 to 10 feet. It is acceptable to extend the ground improvement to the easement. The mat foundation may be designed using an allowable bearing capacity of 1,500 psf and a modulus of subgrade reaction of 115 pci.

Shallow footings, if used, will require a closely spaced ground improvement within and beyond footprint of the footings. Design of the ground improvement by the specialty contractor would require layout of the footings and coordination with the geotechnical and structural engineers. Shallow footings may be designed using an allowable bearing capacity of 2,500 psf based on a minimum width of 12 inches and embedment depth of 18 inches below the lowest adjacent grade. This value may be increased by 300 psf for each additional foot of width or each additional foot of embedment to a maximum value of 4,000 psf.

The bearing capacity values presented above may be increased by one-third for wind or seismic loading. The allowable bearing capacity incorporates a factor of safety of 3.0 and is based on a differential settlement of ½ inch over a horizontal distance of 30 feet and 1 inch over the entire building footprint. Since settlement is a function of footing size and contact bearing pressure, differential settlement can be expected between adjacent columns or walls where a large differential loading condition exists. The settlement estimate should be reviewed by Leighton Consulting when final foundation plans and loads for the proposed structures become available.

Resistance to lateral loads will be provided by a combination of friction between the soil and foundation interface and passive pressure acting against the vertical portion of the foundation. A friction coefficient of 0.35 may be used at the soil-concrete interface for calculating the sliding resistance. A passive pressure based on an equivalent fluid pressure of 360 pounds per cubic foot (pcf) may be used for calculating the lateral passive resistance. The lateral passive resistance can be taken into account only if it is ensured that the soil against embedded structures will remain intact with time. The above values do not contain an appreciable factor of safety, so the structural engineer should apply the applicable factors of safety and/or load factors during design.

3.5 Slabs-on-Grade

3.5.1 Building Floor Slabs

If mat foundation is not used, building floor slabs may consist of slabs-on-grade or structural slabs. Slabs-on-grade without ground improvement may experience cracking and may require repair and/or maintenance if liquefaction occurs during a strong earthquake. Slabs-on-grade should be placed on properly moisture conditioned and compacted structural fill as described in Section 3.6 of this report, and designed and constructed as promulgated by the Portland Cement Association. Design may be performed using a modulus of subgrade reaction of 115 pci. The floor slabs for appurtenant structures are recommended to be at least 5 inches in thickness and include No. 3 bars at a maximum on-center spacing of 18 inches each way. The design of the floor slabs should be performed by the project structural engineer based upon actual load demands.

Structural slabs are designed to be supported by grade beams connected to footings or pile caps. Since they are not directly supported by the underlying soils, they are not susceptible to liquefaction. Design of structural slabs should be performed by the structural engineer.

Floor slabs are recommended to be underlain by a synthetic sheeting to serve as a retarder to moisture vapor transmission in areas where moisture-sensitive floor covering or equipment is planned. The sheeting is recommended to be a minimum 10 mil thick and consist of polyethylene or similar material. The sheeting may be underlain by a 2-inch thick layer of clean fine to medium sand to protect it from puncture. The sheeting should be evaluated prior to installation for the presence of punctures or tears. Installation of the sheeting should include proper overlap and taping of seams.

3.5.2 Concrete Flatwork

Exterior concrete slabs such as sidewalks, courtyards and pedestrian access ramps often crack after concrete placement and curing. Inclusion of joints at frequent intervals and reinforcement will help control the locations of the cracks, and thus improve aesthetic appearance. When cracking occurs, repairs may be needed to mitigate a trip hazard and/or improve the appearance.

A number of actions can be taken during construction to reduce the amount of cracking or its consequences. These steps include, but are not limited to, the following. As a minimum, exterior concrete slabs should be at least 4 inches thick. Construction or weakened plane joints should be spaced at intervals of 8 feet or less. We suggest concrete slabs be reinforced using No. 3 rebar, 18 inches on center in both directions, placed at mid-thickness.

Cracking of concrete is often not due to settlement or heave of soils, but often due to other factors such as the use of too high a water/cement ratio and/or inadequate steps taken to prevent moisture loss during curing. These causes of concrete distress can be reduced by proper design of the concrete mix and by proper placement and curing of the concrete.

3.6 Site Grading

All site grading should be performed in accordance with the applicable local codes and in accordance with the project specifications that are prepared by the appropriate design professionals.

3.6.1 Site Preparation

Prior to construction, the site should be cleared of any vegetation, trash and/or debris within the area of proposed grading. These materials should be removed from the site. Efforts should be made to locate any existing utility lines and underground obstructions, such as remnants of footings and vaults, within the proposed construction area. Those lines or obstructions should be removed or rerouted if they interfere with the proposed construction and the resulting cavities should be properly backfilled and compacted. After the site is cleared, the soils should be carefully observed for the removal of unsuitable deposits. Unsuitable deposits and undocumented fill, including mud pits and sumps that may potentially be present at the site, should be excavated and removed from the proposed building footprints prior to fill placement. Removal of these unsuitable deposits and undocumented fill should be as recommended by Leighton Consulting during grading and further evaluated based on the selected ground improvement method and foundation system.

3.6.2 Excavation and Recompaction

Following ground improvement, subgrade for the footings or mat foundation should be overexcavated and recompacted to provide a uniform support and reduce potential for differential settlement. The overexcavation and recompaction should extend a minimum two feet below the foundation and to a minimum three feet laterally beyond the edges of proposed foundation, where feasible.

If a structural slab is used, no overexcavation and recompaction are considered necessary. Slab-on-grade, if used without ground improvement, should be supported on a minimum 24 inches of engineered fill established on competent soils.

Subgrade for parking areas, driveways, sidewalks, curbs, gutters and other concrete flatwork should be scarified to a depth of 12 inches and recompacted.

Local conditions may be encountered that could require additional overexcavation beyond the above noted minimum to obtain an acceptable subgrade. The actual depths and lateral extents of remedial grading will be determined by Leighton Consulting, based on subsurface conditions encountered during grading. Unstable excavation bottom may be encountered due to the high moisture content of the soils. Prior to placement of compacted fill, the excavation bottom may be stabilized by pushing layers of crushed rock into the subgrade until a firm working surface is achieved, by placement of geofabric, and/or by mixing the soils with cement.

3.6.3 Fill Materials

The on-site soil free of organics and construction debris is suitable to be used as fill. Any imported soils should have an Expansion Index less than 50 and should be approved by the geotechnical engineer prior to placement as fill. Existing pavement sections that are removed should be either stripped from the site or the material crushed and stockpiled for later use. With proper processing, the existing pavement and aggregate base in the paved parking area may be used as structural fill or possibly as the base course below new pavement. Reuse as base course will require

additional testing to verify the pavement support characteristics of the processed material and conformance with material specifications.

3.6.4 Fill Placement and Compaction

Fill soils should be placed in loose lifts not exceeding 8 inches, moisture-conditioned to above optimum moisture content, and compacted to a minimum of 90 percent of the maximum dry density as determined by ASTM Test Method D 1557. Soils with high moisture content may be encountered and will require air drying prior to placement of fill.

3.7 Seismic Design Parameters

The proposed structures will be supported on a deep foundation system or mat/shallow foundation on ground-improved soils and the building period is anticipated to be less than 0.5 second. To accommodate effects of ground shaking produced by regional seismic events, seismic design can, at the discretion of the designing Structural Engineer, be performed in accordance with the 2013 edition of the California Building Code (CBC). Table 6 lists seismic design parameters based on the 2013 CBC methodology.

Table 6 – 2013 CBC Based Seismic Design Parameters

Categorization/Coefficient	Design Value
Site Class	D
Adjusted (5% damped) spectral response acceleration parameter at short period, S_{MS}	1.564g
Adjusted (5% damped) spectral response acceleration parameter at a period of 1 sec, S_{M1}	0.877g
Design (5% damped) spectral response acceleration parameter at short period, S_{DS}	1.043g
Design (5% damped) spectral response acceleration parameter at a period of 1 sec, S_{D1}	0.585g

3.8 Lateral Earth Pressures

The following lateral earth pressures may be used for the design of retaining walls with a level backfill.

Table 7 – Lateral Earth Pressures

Condition	Equivalent Fluid Unit Weight for Level Backfill (psf/ft)
Active	40
At-Rest	60
Passive	360
Coefficient of Friction	0.30

Retaining structures should be provided with a drainage system to prevent buildup of hydrostatic pressure behind the wall. Hydrostatic pressure should be included in the retaining wall design if a drainage system is not provided. The above values do not contain an appreciable factor of safety, so the structural engineer should apply the applicable factors of safety and/or load factors during design.

To design an unrestrained retaining wall, such as a cantilever wall, the active earth pressure may be used. For a restrained retaining wall, such as a basement wall, curved walls without joints or restrained-wall corners, the at-rest pressure should be used. If tilting of wall segments are acceptable and construction joints are provided at all angle points and frequently along curved-wall segments, preferably not exceeding 20 feet, the active pressure may be used.

For sliding resistance, a friction coefficient of 0.35 may be used at the soil-concrete interface. The lateral passive resistance can be taken into account only if it is ensured that the soil against embedded structures will remain intact with time.

In addition to the above lateral forces due to retained earth, surcharge due to improvements, such as an adjacent structure, should be considered in the design of the retaining wall. Loads applied within a 1:1 projection from the surcharging structure on the stem of the wall shall be considered as lateral surcharge. For lateral surcharge conditions, we recommend utilizing a horizontal load equal to 50 percent of the vertical load, as a minimum. This horizontal load should be applied below the 1:1 projection plane. To minimize the surcharge load from an adjacent building, deepened building footings may be considered.

3.9 Pavement Design

Driveways and parking areas can be constructed using conventional asphalt concrete (AC) over aggregate base (AB). We have designed the pavement sections using a design R-value of 40 for different Traffic Indices (TI) and the minimum pavement thickness is presented in Table 8 below. R-value of the near-surface soils ranged from 38 to 77 based on our laboratory testing and previous testing by Converse Consultants (2005). The pavement design was performed using the method in Caltrans *Highway Design Manual*.

Table 8 - Pavement Sections

Traffic Index	Flexible Pavement (inches)	
	AC	AB
5 or less	3.0	5.0
6	3.5	6.0
7	4.5	6.5
8	5.0	8.0

Concrete truck aprons and ramps should have a minimum thickness of 6 inches placed on a minimum of 4 inches of aggregate base. As with any concrete slab, it is important to provide for concrete cracking by constructing weakened plane and/or construction joints at frequent intervals. The minimum joint spacing and reinforcement for the concrete should be determined by the structural engineer for any special loading.

All pavement construction should be performed in accordance with the *Standard Specifications for Public Works Construction*. Field inspection and periodic testing, as needed during placement of the base course materials, should be undertaken to ensure that the requirements of the standard specifications are fulfilled. Prior to placement of aggregate base, the subgrade soil should be processed to a minimum depth of 8 inches, moisture-conditioned, as necessary, and recompacted to a minimum of 90 percent relative compaction. Localized areas of loose soils may be encountered that require deeper removal and recompaction. The actual extent of the removal depth will be best determined during construction when direct observation of the subgrade soils can be made.

Aggregate base should be moisture conditioned, as necessary, and compacted to a minimum of 95 percent relative compaction.

Aggregate base and asphalt materials should conform to assocs 200-2 and 203, respectively, of the *Standard Specifications for Public Works Construction*. PCC should conform to Section 201 of the *Standard Specifications for Public Works Construction*.

3.10 Cement Type and Corrosion Protection

Based on the results of laboratory testing, concrete structures in contact with the onsite soil are expected to have negligible exposure to water-soluble sulfates in the soil. Since the site is located in a marine environment, we recommend Type V cement be used for concrete construction onsite and the concrete should be designed in accordance with 2013 CBC requirements.

Based on the available laboratory test results, the onsite soil is considered severely corrosive to ferrous metals. Ferrous pipe should be avoided by using high-density polyethylene (HDPE), polyvinyl chloride (PVC) or other non-ferrous pipe when possible. Ferrous pipe, if used, should be protected by polyethylene bags, tap or coatings, di-electric fittings or other means to separate the pipe from onsite soils.

3.11 Temporary Excavation

All temporary excavations, including utility trenches and foundation excavations, should be performed in accordance with project plans, specifications and all OSHA requirements.

No surcharge loads should be permitted within a horizontal distance equal to the height of cut or 5 feet, whichever is greater from the top of the slope, unless the cut is shored appropriately. Excavations that extend below an imaginary plane inclined at 45 degrees below the edge of any adjacent existing site foundation should be properly shored to maintain support of the adjacent structures.

During construction, the soil conditions should be regularly evaluated to verify that conditions are as anticipated. The contractor should be responsible for providing the "competent person" required by OSHA standards to evaluate soil conditions. Close coordination between the competent person and the geotechnical engineer should be maintained to facilitate construction while providing safe excavations

3.12 Trench Backfill

Utility trenches can be backfilled with the onsite material, provided it is free of debris, organic material and oversized material (greater than 6 inches in diameter). Prior to backfilling the trench, pipes should be bedded in and covered with sand that exhibits a Sand Equivalent (SE) of 30 or greater. The pipe bedding should be densified in-place by using mechanical compaction equipment with care to not damage the pipe. Backfill material should be placed in loose lifts, moisture conditioned as necessary to achieve moisture content of above optimum, and mechanically compacted using a minimum standard of 90 percent relative compaction (ASTM D1557). The maximum lift thickness should also be determined based on the compaction equipment used in accordance with the latest edition of the *Standard Specifications for Public Works Construction*. Where utility trenches cross underneath building footing, the trenches should be plugged by a minimum of 2 feet of impermeable clayey soils or sand/cement slurry to reduce the potential for water intrusion underneath the slab.

3.13 Dewatering

Excavation for footings, pile caps and deep utility trenches that extend below the groundwater table will require groundwater control, such as dewatering, to improve stability of the excavation and aid placement of concrete, pipeline and backfill. Dewatering procedures and methods should be selected by the contractor based on actual groundwater conditions encountered during construction and based on the contractor's chosen means-and-methods of construction. However, deep groundwater drawdown should be avoided, to reduce the potential for damaging adjacent structures/improvements.

3.14 Additional Geotechnical Services

Leighton Consulting should review the grading plans, foundation plans, and specifications when they are available to verify that the recommendations presented in this report have been properly interpreted and incorporated. Additionally, geotechnical observation and testing should be provided during the following activities:

- Grading and excavation of the site;
- Subgrade Preparation;

- Compaction of all fill materials;
- Utility trench backfilling and compaction;
- During ground improvement operations, if any;
- During installation of pile foundations including indicator pile program, if any;
- Foundation excavation and slab-on-grade preparation;
- Pavement subgrade and base preparation;
- Placement of asphalt concrete and/or concrete; and
- When any unusual conditions are encountered.

4.0 LIMITATIONS

This report was based in part on data obtained from a limited number of observations, site visits, soil excavations, samples, and tests. Such information is, by necessity, incomplete. The nature of many sites is such that differing soil or geologic conditions can be present within small distances and under varying climatic conditions. Changes in subsurface conditions can and do occur over time. Therefore, the findings, conclusions, and recommendations presented in this report are only valid if Leighton Consulting has the opportunity to observe subsurface conditions during grading and construction, to confirm that our preliminary data are representative for the site. Leighton Consulting should also review the construction plans and project specifications, when available, to comment on the geotechnical aspects.

An information sheet prepared by ASFE (the Association of Engineering Firms Practicing in the Geosciences) is included at the end of the report text. We recommend that all individuals using this report also read the attached information sheet.

This exploration was performed using the degree of care and skill ordinarily exercised, under similar circumstances, by reputable geotechnical consultants practicing in this or similar localities. The findings, conclusion, and recommendations included in this report are considered preliminary and are subject to verification. We do not make any warranty, either expressed or implied. The report may not be used by others or for other projects without the expressed written consent of our client and our firm.

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Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a civil engineer may not fulfill the needs of a constructor — a construction contractor — or even another civil engineer. Because each geotechnical- engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. No one except you should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply this report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical-engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

Geotechnical Engineers Base Each Report on a Unique Set of Project-Specific Factors

Geotechnical engineers consider many unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk-management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical-engineering report that was:

- not prepared for you;
- not prepared for your project;
- not prepared for the specific site explored; or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical-engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical-engineering report is based on conditions that existed at the time the geotechnical engineer performed the study. *Do not rely on a geotechnical-engineering report whose adequacy may have been affected by*: the passage of time; man-made events, such as construction on or adjacent to the site; or natural events, such as floods, droughts, earthquakes, or groundwater fluctuations. *Contact the geotechnical engineer before applying this report to determine if it is still reliable.* A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ — sometimes significantly — from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide geotechnical-construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are Not Final

Do not overrely on the confirmation-dependent recommendations included in your report. *Confirmation-dependent recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations *only* by observing actual subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's confirmation-dependent recommendations if that engineer does not perform the geotechnical-construction observation required to confirm the recommendations' applicability.*

A Geotechnical-Engineering Report Is Subject to Misinterpretation

Other design-team members' misinterpretation of geotechnical-engineering reports has resulted in costly

problems. Confront that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Constructors can also misinterpret a geotechnical-engineering report. Confront that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing geotechnical construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical-engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make constructors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give constructors the complete geotechnical-engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise constructors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure constructors have sufficient time* to perform additional study. Only then might you be in a position to give constructors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and constructors fail to recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Environmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform an *environmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold-prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, many mold- prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical- engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; *none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.*

Rely, on Your GBC-Member Geotechnical Engineer for Additional Assistance

Membership in the Geotechnical Business Council of the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project. Confer with you GBC-Member geotechnical engineer for more information.

GEOTECHNICAL BUSINESS COUNCIL
of the Geoprofessional Business Association

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Project: 11232.001	Eng/Geol: DJC
Scale:1 " = 2,000 '	Date: February 2016

Base Map: ESRI ArcGIS Online 2016
Thematic Information: Leighton
Author: Leighton Geomatics (btran)

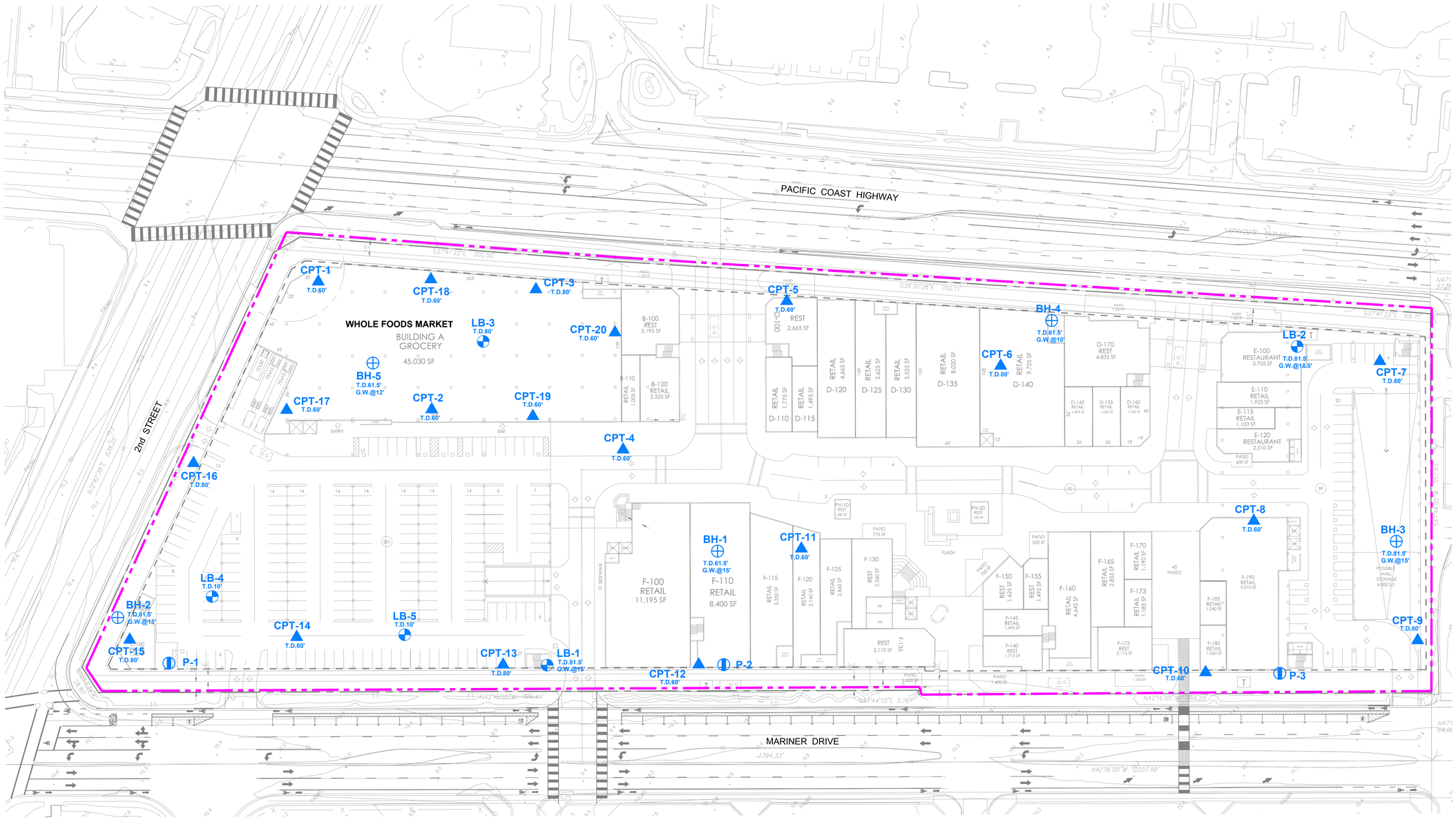
SITE LOCATION MAP

6400 East Pacific Coast Highway
Long Beach, California

Figure 1

Leighton

Map Saved as P:\Drafting\11232\001\Maps\11232-001_F01_SLM_20160222.mxd on 2/22/2016 11:35:22 AM



LEGEND

CPT-20 T.D.60'	APPROXIMATE LOCATION OF PROPOSED CONE PENETRATION TEST (CPT) SHOWN WITH TOTAL DEPTH (T.D.) IN FEET
LB-5 T.D.10'	APPROXIMATE LOCATION OF PROPOSED HOLLOW-STEM AUGER BORING SHOWN WITH TOTAL DEPTH (T.D.) AND DEPTH TO GROUNDWATER (G.W.) IN FEET
P-3	APPROXIMATE LOCATION OF PERCOLATION TEST WELL
BH-5 T.D.61.5' G.W.@12'	APPROXIMATE LOCATION OF HOLLOW-STEM AUGER BORING BY OTHERS SHOWN WITH TOTAL DEPTH (T.D.) AND DEPTH TO GROUNDWATER (G.W.) IN FEET (CONVERSE CONSULTANTS, 2005)
	APPROXIMATE SITE BOUNDARY

40' 20' 0' 40' 80'

GRAPHIC SCALE

Note: For reduced sized prints, original scale is in inches

FIGURE 2

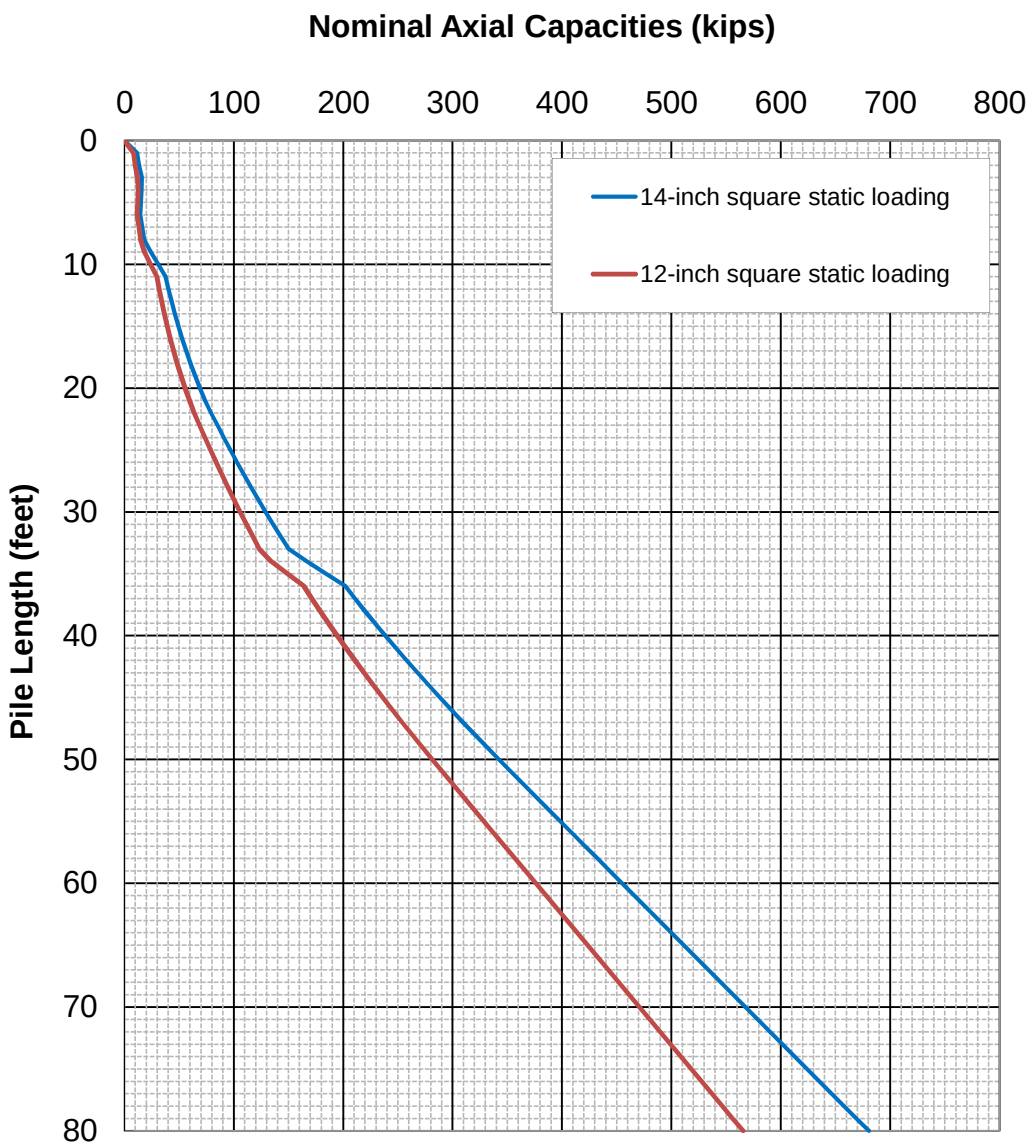
Leighton

BORING AND CPT LOCATION MAP

2nd and PCH Retail Center
Long Beach, California

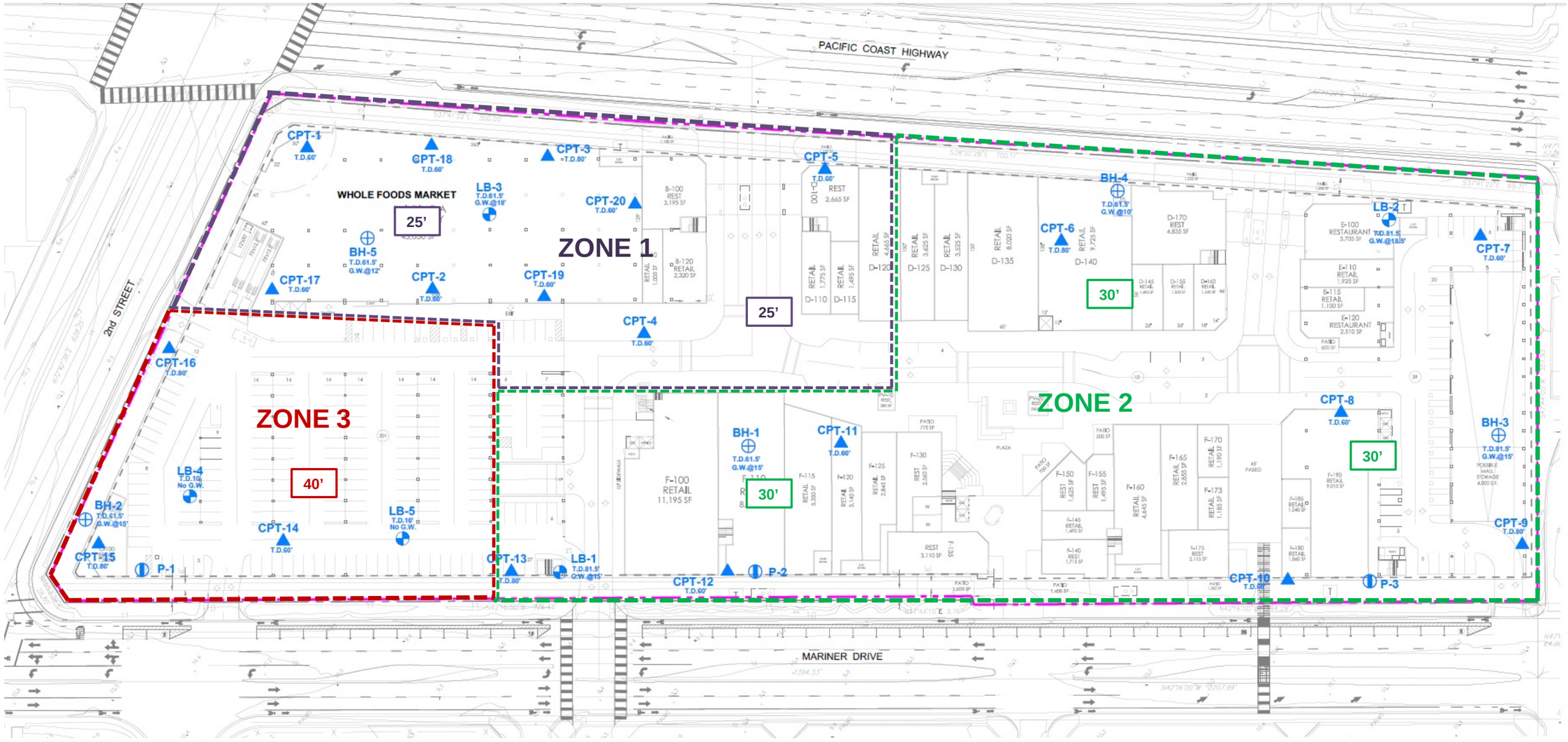
Proj: 11232.002	Eng/Geol: DJC
Scale: 1"=40'	Date: December 2016

Drafted By: BQT | Checked By: BQT | V:\DRAFTING\11232\002\2016-11-29\11232-002_FIG_BLM_2016-11-29.DWG (11-29-16 9:39:52AM) Plotted by: bhan



Note:
1. A minimum factor of safety (FS) of 2.0 should be applied to estimate allowable capacities .
2. Nominal capacity in tension should be 40% of the nominal capacity in compression.
3. For seismic loading condition, downdrag loads (see Note 4) should be added to the structural loads.
4. Downdrag loads for 12-inch square pile: Zone 1= 67 kips; Zone 2= 100 kips; and Zone 3= 178 kips
   Downdrag loads for 14-inch square pile: Zone 1= 77 kips; Zone 2= 115 kips; and Zone 3= 208 kips
5. Delineation of Zones 1, 2, and 3 are shown on Figure 4.

NOMINAL AXIAL CAPACITY 12-INCH AND 14-INCH SQUARE CONCRETE PILE 2ND AND PCH RETAIL CENTER	PROJECT NAME : 2nd and PCH PROJECT NUMBER : 11232.002 DESIGNED/CHECKED BY: CD/SP/DJC DATE: 12/2/2016	**Figure 3**



LEGEND

40' Recommended Ground Improvement Target Depths

RECOMMENDED GROUND IMPROVEMENT DEPTHS
2ND and PCH Retail Center
City of Long Beach, California

Project No.: 11232-002
Engineer: DJC
Date: 12/2016
Figure No. 4

Leighton

APPENDIX A

GEOTECHNICAL BORING LOGS

Leighton

GEOTECHNICAL BORING LOG LB-1

Project No.	11232.001	**Date Drilled**	2-1-16
Project	2nd and PCH Retail Center	**Logged By**	CD
Drilling Co.	2R Drilling, Inc.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	10'
Location	See Figure 2 - *Boring and CPT Location Map*	**Sampled By**	CD

Elevation Feet	Depth Feet	Graphic Log	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
									This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.	
10	0	N S								
				B-1				SM	@ Surface: 3 inches of asphalt concrete over 2 inches of aggregate base **Artificial fill (Af)** @ 0.4': Silty SAND, olive brown, slightly moist, fine sand	CR
5	5			R-1	15 22 24	111	14		@ 5': Silty SAND, dense, dark brown, slightly moist	
								CL	**Quaternary-aged young alluvial fan deposits (Qyf)** @ 6': Sandy CLAY, medium stiff, dark brown, moist, low plasticity	
0	10			R-2	1 2 3	64	59	CH	@ 10': Silty CLAY, very soft, dark gray, moist, high plasticity, trace of organics	AL, CN
-5	15			R-3	1 4 9	92	30	SM	@ 15': Silty SAND, medium dense, bluish gray, wet, trace of organics, trace of clay	AL, PP
-10	20			R-4	3 10 10	98	26		@ 20': Silty SAND, medium dense, bluish gray, wet, fine sand	DS, PP
-15	25			S-5	2 5 9				@ 25': shell fragments	-200
-20	30									

SAMPLE TYPES:

- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:

- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

*** * * This log is a part of a report by Leighton and should not be used as a stand-alone document. * * ***

GEOTECHNICAL BORING LOG LB-1

Project No.	11232.001	**Date Drilled**	2-1-16
Project	2nd and PCH Retail Center	**Logged By**	CD
Drilling Co.	2R Drilling, Inc.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	10'
Location	See Figure 2 - *Boring and CPT Location Map*	**Sampled By**	CD

Elevation Feet	Depth Feet	Graphic Log (N / S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION *This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.*	Type of Tests
-20	30			S-6	2 5 8			SM	@ 30': Silty SAND, medium dense, bluish gray, wet, fine sand	-200
-25	35			S-7	3 7 11					
-30	40			S-8	6 11 14				@ 40': Silty SAND, medium dense, bluish gray, interlayered, fine sand	-200
-35	45			R-9	17 36 50/4"	100	24	SP	@ 45': Poorly-graded SAND, dense, gray, wet, fine sand	-200, DS
				S-10	4 14 26					
-40	50			R-11	20 50/5"					
-45	55			S-12	2 4 12				@ 55': Poorly-graded SAND, dense, gray, wet, fine to medium sand, trace of subrounded gravel	CR
-50	60									

SAMPLE TYPES:

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- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:

- -200 % FINES PASSING
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GEOTECHNICAL BORING LOG LB-1

Project No.	11232.001	**Date Drilled**	2-1-16
Project	2nd and PCH Retail Center	**Logged By**	CD
Drilling Co.	2R Drilling, Inc.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	10'
Location	See Figure 2 - *Boring and CPT Location Map*	**Sampled By**	CD

Elevation Feet	Depth Feet	Graphic Log (N / S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
-50	60			S-13	7 21 35			SP	@ 60': Poorly-graded SAND, dense, gray, wet, fine sand	
-55	65			S-14	4 25 34				@ 65': trace of subrounded gravel	
-60	70			S-15	2 4 19				@ 70': medium dense	
-65	75			S-16	3 10 30					
-70	80			S-17	8 39 50/5"				@ 80': Poorly-graded SAND, very dense, gray, wet, fine sand	
-75	85								Total Depth of Boring: 81.5 feet bgs Groundwater encountered at 15 feet bgs during drilling Boring backfilled with soil cuttings and capped with cold mix asphalt upon completion of drilling	
-80	90									

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

SAMPLE TYPES:
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- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
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- CN CONSOLIDATION
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- SA SIEVE ANALYSIS
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GEOTECHNICAL BORING LOG LB-2

Project No.	11232.001	**Date Drilled**	2-1-16
Project	2nd and PCH Retail Center	**Logged By**	CD
Drilling Co.	2R Drilling, Inc.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	10'
Location	See Figure 2 - *Boring and CPT Location Map*	**Sampled By**	CD

Elevation Feet	Depth Feet	Graphic Log	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
10	0	N S							@ Surface: 3 inches of asphalt concrete over 2 inches of aggregate base	
				B-1				SM-SC	**Artificial fill (Af)**	CR, RV
								SM	@ 0.7': Silty SAND to Clayey SAND, olive gray, moist, fine-grained	
									Quaternary-aged young alluvial fan deposits (Qyf) @ 2':Silty SAND, bluish gray, moist, fine sand, trace of clay	
5	5			R-1	3 4 4	91	30	CL	@ 5': Sandy CLAY, soft, bluish gray, moist, fine sand	DS
0	10			R-2	1 2 3	81	40		@ 10': Silty CLAY, soft, bluish gray, very moist, low platicity, trace organics	AL, CN
-5	15			R-3	1 3 5	90	32	ML	@ 15': Sandy SILT, loose, bluish gray, moist, very fine sand, non-plastic	-200, PP
-10	20			R-4	2 3 6	87	35		@ 20': Sandy SILT, loose, bluish gray, very moist, non-plastic, trace of clay	AL, PP
-15	25			S-5	2 3 7			SP	@ 25': Poorly-graded SAND, medium dense, bluish gray, wet, medium sand	
								SM	@ 26': Silty SAND, medium dense, bluish gray, moist, medium sand	-200
-20	30									

SOIL DESCRIPTION: This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
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GEOTECHNICAL BORING LOG LB-2

Project No.	11232.001	**Date Drilled**	2-1-16
Project	2nd and PCH Retail Center	**Logged By**	CD
Drilling Co.	2R Drilling, Inc.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	10'
Location	See Figure 2 - *Boring and CPT Location Map*	**Sampled By**	CD

Elevation Feet	Depth Feet	Graphic Log (N / S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION *This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.*	Type of Tests
-20	30			S-6	7 14 25			SP-SM	@ 30': Poorly-graded SAND with Silt, dense, gray, wet, dense, fine sand	
-25	35			S-7	7 7 8			SP	@ 35': Poorly-graded SAND, medium dense, gray, wet, fine sand, local silty clay	-200
-30	40			S-8	6 16 26			SM	@ 40': Silty SAND, dense, bluish gray, wet, fine sand	
-35	45			R-9 S-10	10 16 50 3 10 22	102	23		@ 45': local silty clay, pockets of sand	-200, DS
-40	50			R-11	19 50/5"			SP-SM	@ 50': Poorly-graded SAND with Silt, dense, bluish gray, wet, fine sand	-200
-45	55			S-12	4 12 32					
-50	60									

SAMPLE TYPES:

- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
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GEOTECHNICAL BORING LOG LB-2

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Project	2nd and PCH Retail Center	**Logged By**	CD
Drilling Co.	2R Drilling, Inc.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	10'
Location	See Figure 2 - *Boring and CPT Location Map*	**Sampled By**	CD

Elevation Feet	Depth Feet	Graphic Log (N / S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION *This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.*	Type of Tests
-50	60			S-13	14 36 36			SP	@ 60': Poorly-graded SAND, dense to very dense, bluish gray, wet, fine to medium sand	
-55	65			S-14	14 20 34			SP-SM	@ 65': Poorly-graded SAND with Silt, dense, bluish gray, wet, fine sand, trace of subrounded gravel	-200
-60	70			S-15	16 30 50/5"			SP	@ 70': Poorly-graded SAND, dense to very dense, bluish gray, wet, fine to medium sand	
-65	75			S-16	15 32 37					
-70	80			S-17	9 23 39					
-75	85								Total Depth of Boring: 81.5 feet bgs Groundwater encountered at 18.5 feet bgs during drilling Boring backfilled with soil cuttings and capped with cold mix asphalt upon completion of drilling	
-80	90									

SAMPLE TYPES:
- B BULK SAMPLE
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TYPE OF TESTS:
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GEOTECHNICAL BORING LOG LB-3

Project No.	11232.002	**Date Drilled**	11-9-16
Project	2nd and PCH Retail Center - Whole Foods Market	**Logged By**	CD
Drilling Co.	2R Drilling, Inc.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	10'
Location	See Figure 2 - *Boring and CPT Location Map*	**Sampled By**	CD

Elevation Feet	Depth Feet	Graphic Log (N / S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION *This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.*	Type of Tests
10	0							CL	@Surface: 1.5 inches of asphalt concrete over 3 inches of aggregate base	
				B-1					**Artificial fill (Af)** @ 0.4': Silty CLAY, brown, moist, low to medium plasticity	MD, EI, CR
				R-1	5 7 12	103	20	ML	**Quaternary-aged young alluvial deposits (Qya)** @ 2.5': Sandy SILT, medium dense, olive brown, moist, FeO staining, very fine-grained, trace of clay, non-plastic, slightly laminated	
5	5			R-2	8 15 24			SM	@ 5': Silty SAND, medium dense, bluish gray, moist, very fine sand	DS
				R-3	4 6 5	93	30	ML CL	@ 7.5': Sandy SILT, loose, bluish gray, moist, FeO staining, very fine-grained @ 8': Silty CLAY, soft, bluish gray, moist, low plasticity, laminated	
0	10			T-4						AL, CN
-5	15			S-5	3 7 6			ML	@ 15' Clayey SILT to Sandy SILT, medium dense, bluish gray, very moist, non-plastic to low plasticity	
-10	20			S-6	3 4 6			SM	@ 20': Silty SAND, medium dense, bluish gray, very moist, very fine sand, trace of clay	-200
-15	25			S-7	4 6 6					
-20	30									

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
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- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
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GEOTECHNICAL BORING LOG LB-3

Project No.	11232.002	**Date Drilled**	11-9-16
Project	2nd and PCH Retail Center - Whole Foods Market	**Logged By**	CD
Drilling Co.	2R Drilling, Inc.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	10'
Location	See Figure 2 - *Boring and CPT Location Map*	**Sampled By**	CD

Elevation Feet	Depth Feet	Graphic Log (N / S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION *This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.*	Type of Tests
-20	30			S-8	4 5 9		23	CL	@ 30': Lean CLAY with Sand, medium stiff, bluish gray, very moist, low plasticity	SA, AL
-25	35			S-9A	3 10				@ 35': medium plasticity	
				S-9B	18			SM	@ 36': Silty SAND, medium dense, bluish gray, very moist, fine sand	
-30	40			S-10A	4 6			CL	@ 40': Lean CLAY, stiff, bluish gray, moist, medium plasticity	
				S-10B	11			SM	@ 41': Silty SAND, medium dense, bluish gray, very moist, fine sand	
-35	45			S-11	12 15 25			SP-SM	@ 45': Poorly-graded SAND with Silt, dense, bluish gray, very moist, medium sand	-200
-40	50			S-12	8 12 23				@ 50': fine to medium sand	
-45	55			S-13	6 12 23				@ 55': Poorly-graded SAND with Silt, dense, bluish gray, very moist, fine sand	-200
-50	60									

SAMPLE TYPES:
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TYPE OF TESTS:
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GEOTECHNICAL BORING LOG LB-3

Project No.	11232.002	**Date Drilled**	11-9-16
Project	2nd and PCH Retail Center - Whole Foods Market	**Logged By**	CD
Drilling Co.	2R Drilling, Inc.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	10'
Location	See Figure 2 - *Boring and CPT Location Map*	**Sampled By**	CD

Elevation Feet	Depth Feet	Graphic Log (N / S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
-50	60			S-14	12 26 38			SP-SM	@ 60': Poorly-graded SAND with Silt, dense, bluish gray, very moist, fine sand	
-55	65								Total Depth of Boring: 61.5 feet below ground surface. Groundwater encountered at 18 feet below ground surface during drilling. Boring backfilled with soil cuttings and capped with cold mix asphalt upon completion of drilling.	
-60	70									
-65	75									
-70	80									
-75	85									
-80	90									

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

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TYPE OF TESTS:
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- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
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GEOTECHNICAL BORING LOG LB-4

Project No.	11232.002	**Date Drilled**	11-9-16
Project	2nd and PCH Retail Center - Whole Foods Market	**Logged By**	CD
Drilling Co.	2R Drilling, Inc.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	10'
Location	See Figure 2 - *Boring and CPT Location Map*	**Sampled By**	CD

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
10	0								@Surface: 3 inches of asphalt concrete over 6 inches of aggregate base	
				B-1				SM	**Artificial fill (Af)** @ 0.8': Silty SAND, brown, moist, trace of gravel and clay	RV
				R-1	8 15 27	109	4	SP-SM	**Quaternary-aged young alluvial deposits (Qya)** @ 3': Poorly-graded SAND with Silt, medium dense, light olive brown, slightly moist, FeO staining, fine sand	
5	5			R-2	8 9 13	92	15	SM	@ 5': Silty SAND, medium dense, olive brown, moist, FeO staining, trace of clay	
				R-3	2 3 3	62	64	CH	@ 7.5': Silty CLAY, soft, bluish gray, wet, trace of organics, high plasticity	
0	10			R-4	2 4 5	88	36			
-5	15								Total Depth of Boring: 11.5 feet below ground surface. Groundwater not encountered during drilling. Boring backfilled with soil cuttings and capped with cold mix asphalt upon completion of drilling.	
-10	20									

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

*** * * This log is a part of a report by Leighton and should not be used as a stand-alone document. * * ***

GEOTECHNICAL BORING LOG LB-5

Project No.	11232.002	**Date Drilled**	11-9-16
Project	2nd and PCH Retail Center - Whole Foods Market	**Logged By**	CD
Drilling Co.	2R Drilling, Inc.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	10'
Location	See Figure 2 - *Boring and CPT Location Map*	**Sampled By**	CD

Elevation Feet	Depth Feet	Graphic Log (N / S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
10	0								@Surface: 4 inches of asphalt concrete over 8 inches of aggregate base	
				B-1				SP-SM	**Artificial fill (Af)** @ 1': Poorly-graded SAND with Silt, light olive brown, slightly moist	RV
				R-1	7 13 23	97	3	SP-SM	**Quaternary-aged young alluvial deposits (Qya)** @ 2.5': Poorly-graded SAND with Silt, dense, light olive brown, slightly moist, FeO staining, fine sand	
5	5			R-2	11 15 15	101	6		@ 5': some shell fragments	
				R-3	7 5 5	83	36		@ 7.5': change color to bluish gray	
								CH	@ 8.5': Silty CLAY, soft to medium stiff, bluish gray, very moist, high plasticity, trace of organics, laminated	
0	10			R-4	4 3 2			CL-ML	@ 10': Sandy CLAY to Clayey SILT, bluish gray, moist, non-plastic to low plasticity	
-5	15								Total Depth of Boring: 11.5 feet below ground surface. Groundwater not encountered during drilling. Boring backfilled with soil cuttings and capped with cold mix asphalt upon completion of drilling.	
-10	20									

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

*** * * This log is a part of a report by Leighton and should not be used as a stand-alone document. * * ***

GEOTECHNICAL BORING LOG P-1

Project No.	11232.001	**Date Drilled**	2-1-16
Project	2nd and PCH Retail Center	**Logged By**	CD
Drilling Co.	2R Drilling, Inc.	**Hole Diameter**	8"
Drilling Method	Hand Auger - 30" Drop	**Ground Elevation**	10'
Location	See Figure 2 - *Boring and CPT Location Map*	**Sampled By**	CD

Elevation Feet	Depth Feet	Graphic Log	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
10	0	N S							*This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.*	
				B-1				SM	@ Surface: 3 inches of asphalt concrete of 2 inches of aggregate base @ 0.4': Silty SAND, olive brown, moist, fine sand	SA
5	5								Total Depth: 5 feet bgs Groundwater not encountered during drilling. Boring converted into a percolation test well, slotted screen from 0-5 feet. Percolation testing performed on 2/2/2016. Test well removed and boring backfilled with soil cuttings and capped with quickset concrete after completion of percolation testing.	
0	10									
-5	15									
-10	20									
-15	25									
-20	30									

SAMPLE TYPES:

- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:

- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

*** * * This log is a part of a report by Leighton and should not be used as a stand-alone document. * * ***

GEOTECHNICAL BORING LOG P-2

Project No.	11232.001	**Date Drilled**	2-1-16
Project	2nd and PCH Retail Center	**Logged By**	CD
Drilling Co.	2R Drilling, Inc.	**Hole Diameter**	8"
Drilling Method	Hand Auger - 30" Drop	**Ground Elevation**	10'
Location	See Figure 2 - *Boring and CPT Location Map*	**Sampled By**	CD

Elevation Feet	Depth Feet	Graphic Log	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
10	0	N S							@ Surface: 2 inches of asphalt concrete of 4 inches of aggregate base	
				B-1				SM	@ 0.4': Silty SAND, olive brown, moist, fine sand	SA
								SM-ML	@ 4': Silty SAND to Sandy SILT, gray, moist, very fine sand	
5	5								Total Depth: 5 feet bgs Groundwater not encountered during drilling. Boring converted into a percolation test well, slotted screen from 0-5 feet. Percolation testing performed on 2/2/2016. Test well removed and boring backfilled with soil cuttings and capped with quickset concrete after completion of percolation testing.	
0	10									
-5	15									
-10	20									
-15	25									
-20	30									

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

*** * * This log is a part of a report by Leighton and should not be used as a stand-alone document. * * ***

GEOTECHNICAL BORING LOG P-3

Project No.	11232.001	**Date Drilled**	2-1-16
Project	2nd and PCH Retail Center	**Logged By**	CD
Drilling Co.	2R Drilling, Inc.	**Hole Diameter**	8"
Drilling Method	Hand Auger - 30" Drop	**Ground Elevation**	10'
Location	See Figure 2 - *Boring and CPT Location Map*	**Sampled By**	CD

Elevation Feet	Depth Feet	Graphic Log (N / S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
10	0			B-1				SM	@ Surface: Grass @ 0.1': Silty SAND, dark brown, moist, fine sand	-200
								SM-ML	@ 1.5': Silty SAND to Sandy SILT, olive brown, moist, very fine sand	
5	5								Total Depth: 5 feet bgs Groundwater not encountered during drilling. Boring converted into a percolation test well,slotted screen from 0-5 feet. Percolation testing performed on 2/2/2016. Test well removed and boring backfilled with soil cuttings after completion of percolation testing.	
0	10									
-5	15									
-10	20									
-15	25									
-20	30									

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

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PREVIOUS GEOTECHNICAL BORING LOGS BY OTHERS (CONVERSE, 2004)

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

BORING LOG SYMBOLS

SAMPLE TYPE

- STANDARD PENETRATION TEST — Split barrel sampler in accordance with ASTM D-1586-84 Standard Test Method
- DRIVE SAMPLE — 2.42" I.D. sampler.
- DRIVE SAMPLE — No recovery
- BULK SAMPLE
- GROUNDWATER WHILE DRILLING
- GROUNDWATER AFTER DRILLING

LABORATORY TESTING ABBREVIATIONS

TEST TYPE
(Results shown in Appendix B)

CLASSIFICATION

Plasticity	pi
Grain Size Analysis	ma
Passing No. 200 Sieve	wa
Sand Equivalent	se
Expansion Index	ei
Compaction Curve	max
Hydrometer	h

STRENGTH

Pocket Penetrometer	p
Direct Shear	ds
Direct Shear (single point)	ds*
Unconfined Compression	uc
Triaxial Compression	tx
Vane Shear	vs
Consolidation	c
Collapse Test	col
Resistance (R) Value	r
Chemical Analysis	ca
Electrical Resistivity	er

UNIFIED SOIL CLASSIFICATION AND KEY TO BORING LOG SYMBOLS

Converse Consultants

Project Name	Project No.	Drawing No.
MIXED-USE COMMUNITY LONG BEACH, CALIFORNIA FOR: LENNAR COMMUNITIES	04-31-118-01	A-1

Log of Boring No. BH-1

Dates Drilled: 3/2/2004 Logged by: CBOO Checked By: KF

Equipment: 8" HOLLOW STEM AUGER Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): 10 Depth to Water (ft): 15

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES DRIVE	SAMPLES BULK	BLOWS	MOISTURE (%)	DRY UNIT WT. (pcf)	OTHER
		4" ASPHALT CONCRETE						ma,se
		FILL (Af): **SANDY SILT (ML):** fine-grained sand, trace clay, brown.						
		ALLUVIUM (Qal): **SILTY SAND (SM):** fine-grained, gray.			3,4,5	24	98	
5					1,5,11	27	97	ds
10		**SANDY SILT (ML):** fine-grained sand, slight odor, gray to dark gray.			3,7,9	21	98	
15					2,3,3	36	82	wa (56%)
20		**SILTY SAND (SM):** fine-grained, trace clay, gray.			2,3,5			wa (45%)
25					3,5,13	32	89	
30		**SAND WITH SILT (SP-SM):** fine-grained, gray.			2,6,11			wa (11%)

Converse Consultants

Project Name
MIXED-USE COMMUNITY
LONG BEACH, CALIFORNIA
FOR: LENNAR COMMUNITIES

Project No.
04-31-118-01

Drawing No.
A-2a

Log of Boring No. BH-1

Dates Drilled: 3/2/2004 Logged by: CBOO Checked By: KF

Equipment: 8" HOLLOW STEM AUGER Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): 10 Depth to Water (ft): 15

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES DRIVE	SAMPLES BULK	BLOWS	MOISTURE (%)	DRY UNIT WT. (pcf)	OTHER
		SAND WITH SILT (SP-SM): fine-grained, gray.	■		5,8,11	21	107	
40		**SILTY SAND (SM):** fine to medium-grained, yellowish gray.	☒		4,4,3			wa (19%)
45		-fine grained	■		11,20,34	24	102	
50		**SAND WITH SILT (SP-SM):** fine-grained, gray.	☒		4,6,6			wa (6%)
55			■		5,14,21	24	99	
60		**SAND (SP):** fine to medium-grained, gray.	☒		6,12,16			wa (4%)
		End of boring at 61.5 feet. Groundwater encountered at 15' bgs. Boring backfilled with soil cuttings and surface patched with asphalt on 3-2-04.						

Converse Consultants

Project Name
MIXED-USE COMMUNITY
LONG BEACH, CALIFORNIA
FOR: LENNAR COMMUNITIES

Project No.
04-31-118-01

Drawing No.
A-2b

Log of Boring No. BH-2

Dates Drilled: 3/2/2004 Logged by: CBOO Checked By: KF

Equipment: 8" HOLLOW STEM AUGER Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): 10 Depth to Water (ft): 15

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES DRIVE	SAMPLES BULK	BLOWS	MOISTURE (%)	DRY UNIT WT. (pcf)	OTHER
		2" ASPHALT CONCRETE						max
		FILL (Af): **SILTY SAND (SM):** fine-grained, greenish brown.						
		ALLUVIUM (Qal): **SILTY SAND (SM):** fine-grained, light gray.	■		4,5,11	16	97	
5			■		5,8,14	26	97	
10		-gray	■		5,6,5	29	92	
15		**CLAYEY SAND (SC):** fine-grained, gray.	■		2,3,2	28	82	
20		**SANDY SILT (ML):** fine-grained sand, gray.	☒		3,2,2			wa (53%)
25			■		5,8,11	29	96	
30		**SILT (ML):** trace of fine-grained sand, gray.	☒		3,3,6			wa (86%)

Converse Consultants

Project Name
MIXED-USE COMMUNITY
LONG BEACH, CALIFORNIA
FOR: LENNAR COMMUNITIES

Project No.
04-31-118-01

Drawing No.
A-3a

Log of Boring No. BH-2

Dates Drilled: 3/2/2004 Logged by: CBOO Checked By: KF

Equipment: 8" HOLLOW STEM AUGER Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): 10 Depth to Water (ft): 15

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES DRIVE	SAMPLES BULK	BLOWS	MOISTURE (%)	DRY UNIT WT. (pcf)	OTHER
		SILT (ML): trace fine-grained sand, gray.	■		4,7,8	31	97	
40		-yellowish brown	☒		2,2,3			wa (92%)
45		**SILTY SAND (SM):** fine-grained, gray.	■		6,12,19	26	95	ds
50		**SAND (SP):** fine to medium-grained, gray.	☒		7,19,15			wa (5%)
55			□					
		-trace fine gravel	■		12,25/6"	20	97	
60		**SAND WITH SILT (SP-SM):** fine-grained, gray.	☒		3,8,16			wa (12%)
		End of boring at 61.5 feet. Groundwater encountered at 15' bgs. Boring backfilled with soil cuttings and surface patched with asphalt on 3-2-04.						

Converse Consultants

Project Name
MIXED-USE COMMUNITY
LONG BEACH, CALIFORNIA
FOR: LENNAR COMMUNITIES

Project No.
04-31-118-01

Drawing No.
A-3b

Log of Boring No. BH-3

Dates Drilled: 3/3/2004 Logged by: CBOO Checked By: KF

Equipment: 8" HOLLOW STEM AUGER Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): 10 Depth to Water (ft): 15

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES DRIVE	SAMPLES BULK	BLOWS	MOISTURE (%)	DRY UNIT WT. (pcf)	OTHER
		3" ASPHALT CONCRETE OVER 2" BASE						
		ALLUVIUM (Qal):						
		SILTY SAND (SM): fine-grained, gray brown.	■	▨	2,4,6	21	103	
5		-increasing silt content	■		4,5,5	25	97	
10		-trace clay	■		1,2,3	39	82	c
15		**SILT (ML):** trace fine-grained sand, gray.	■		2,2,3	49	74	
20		-little clay	☒		1,2,1			wa (90%)
25		**SILTY SAND (SM):** fine-grained, gray.	■		3,6,9	33	90	ds
30		-trace shells	☒		3,6,8			wa (25%)

Converse Consultants

Project Name
MIXED-USE COMMUNITY
LONG BEACH, CALIFORNIA
FOR: LENNAR COMMUNITIES

Project No.
04-31-118-01

Drawing No.
A-4a

Log of Boring No. BH-3

Dates Drilled: 3/3/2004 Logged by: CBOO Checked By: KF

Equipment: 8" HOLLOW STEM AUGER Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): 10 Depth to Water (ft): 15

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES DRIVE	SAMPLES BULK	BLOWS	MOISTURE (%)	DRY UNIT WT. (pcf)	OTHER
		SILTY SAND (SM): fine-grained, gray.	■		8,14,20	24	98	
40		**SILT (ML):** some, fine-grained sand, trace clay, gray.	☒		3,4,5			wa (93%)
45		**SAND (SP):** fine-grained, gray.	■		6,18,22	26	97	
50		-fine-to medium-grained, trace gravel up to 1/4" in maximum dimension.	☒		4,7,10			wa (5%)
55		**SAND WITH SILT (SP-SM):** fine-grained, gray.	■		6,8,13	24		dist.
60		-trace gravel up to 1/3" in maximum dimension.	☒		6,10,15			wa (8%)
65			□		10,23,31			

Converse Consultants

Project Name
MIXED-USE COMMUNITY
LONG BEACH, CALIFORNIA
FOR: LENNAR COMMUNITIES

Project No.
04-31-118-01

Drawing No.
A-4b

Log of Boring No. BH-3

Dates Drilled: 3/3/2004 Logged by: CBOO Checked By: KF

Equipment: 8" HOLLOW STEM AUGER Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): 10 Depth to Water (ft): 15

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES DRIVE	SAMPLES BULK	BLOWS	MOISTURE (%)	DRY UNIT WT. (pcf)	OTHER
		SAND WITH SILT (SP-SM): fine-grained, gray.	X		7,10,16			
75		-trace gravel up to 1/2" in maximum dimension.			10,18,26			
80			X		8,20,28			wa (6%)
		End of boring at 81.5 feet. Groundwater encountered at 15' bgs during drilling. Boring backfilled with soil cuttings and surface patched with asphalt on 3-3-04.						

Converse Consultants

Project Name
MIXED-USE COMMUNITY
LONG BEACH, CALIFORNIA
FOR: LENNAR COMMUNITIES

Project No.
04-31-118-01

Drawing No.
A-4c

Log of Boring No. BH-4

Dates Drilled: 3/2/2004 Logged by: CBOO Checked By: KF

Equipment: 8" HOLLOW STEM AUGER Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): 10 Depth to Water (ft): 10

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES DRIVE	SAMPLES BULK	BLOWS	MOISTURE (%)	DRY UNIT WT. (pcf)	OTHER
		2.5" ASPHALT CONCRETE						ei,r
		FILL (Af):						ca,er
		SILTY SAND (SM): fine-grained, brown.						
		ALLUVIUM (Qal):						
		SILTY SAND (SM): fine-grained, trace clay, gray.	■		6,5,4	23	100	
5		-trace dark gray organic, few shells, slight odor	■		4,6,6	25	94	c
10		CLAY (CL): trace dark gray organic, and fine-grained sand, gray.	■		5,5,6	62	66	pl
15		SILTY SAND (SM): fine-grained, gray to brown.	■		3,4,6	30	91	
20		SILT (ML): some fine-grained sand, trace clay, gray.	☒		5,6,7			wa (89%)
25		SILTY SAND (SM): fine-grained, gray.	■		5,6,14	29	92	
30		SANDY SILT (ML): fine-grained sand, dark gray.	☒		3,5,4			wa (63%)

Converse Consultants

Project Name
MIXED-USE COMMUNITY
LONG BEACH, CALIFORNIA
FOR: LENNAR COMMUNITIES

Project No.
04-31-118-01

Drawing No.
A-5a

Log of Boring No. BH-4

Dates Drilled: 3/2/2004 Logged by: CBOO Checked By: KF

Equipment: 8" HOLLOW STEM AUGER Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): 10 Depth to Water (ft): 10

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES DRIVE	SAMPLES BULK	BLOWS	MOISTURE (%)	DRY UNIT WT. (pcf)	OTHER
		SANDY SILT (ML): fine-grained sand, gray.	■		3,5,7	37	87	ds
40		-trace clay	☒		2,4,12			wa (68%)
45		**SILTY SAND (SM):** fine to medium-grained, gray with light gray.	■		8,22,30	23	103	
50		**SAND WITH SILT (SP-SM):** fine to medium-grained, gray.	☒		3,4,6			wa (9%)
55			□		3,7,9			
60		**SAND (SP):** medium grained, gray.	☒		6,12,18			wa (5%)
		End of boring at 61.5 feet. Groundwater encountered at 10' bgs. Boring backfilled with soil cuttings and surface patched with asphalt on 3-2-04.						

Converse Consultants

Project Name
MIXED-USE COMMUNITY
LONG BEACH, CALIFORNIA
FOR: LENNAR COMMUNITIES

Project No.
04-31-118-01

Drawing No.
A-5b

Log of Boring No. BH-5

Dates Drilled: 3/3/2004 Logged by: CBOO Checked By: KF

Equipment: 8" HOLLOW STEM AUGER Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): 10 Depth to Water (ft): 12

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES DRIVE	SAMPLES BULK	BLOWS	MOISTURE (%)	DRY UNIT WT. (pcf)	OTHER
		3" ASPHALT CONCRETE OVER 3" BASE						
		ALLUVIUM (Qal):						
		SILTY SAND (SM): fine-grained, few clay, gray.						
			■		8,6,9	29	92	
5			■		2,5,14	21	103	
10		**CLAY (CL):** trace fine grained sand, some root, slight odor, gray.			5,5,3			
15		**SILTY SAND (SM):** fine-grained, gray.	■		6,10,8	23		dis.
20		-root	☒		4,4,5			wa (39%)
25			■		5,9,9	29	101	
30		-increasing sand content	☒		3,6,8			wa (30%)

Converse Consultants

Project Name
MIXED-USE COMMUNITY
LONG BEACH, CALIFORNIA
FOR: LENNAR COMMUNITIES

Project No.
04-31-118-01

Drawing No.
A-6a

Log of Boring No. BH-5

Dates Drilled: 3/3/2004 Logged by: CBOO Checked By: KF

Equipment: 8" HOLLOW STEM AUGER Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): 10 Depth to Water (ft): 12

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES DRIVE	SAMPLES BULK	BLOWS	MOISTURE (%)	DRY UNIT WT. (pcf)	OTHER
		SANDY SILT (ML): trace fine-grained sand, gray.	■		5,5,9	27	95	
40		**SILT (ML):** trace fine-grained sand, some clay, gray.	X		4,4,4			wa (98%)
45		**SAND WITH SILT (SP-SM):** fine-grained, gray.	■		7,27,28	24	99	
50		-fine to medium-grained	X		2,2,4			wa (11%)
55		**SILTY SAND (SM):** fine-grained, gray.	■		8,9,13	21	107	
60		**SAND WITH SILT (SP-SM):** fine to medium-grained, gray.	X		7,12,14			wa (12%)

End of boring at 61.5 feet.
Groundwater encountered at 12' bgs during drilling and stabilized at 13' after 15 minutes.
Boring backfilled with soil cuttings and surface patched with asphalt on 3-3-04.

Converse Consultants

Project Name
MIXED-USE COMMUNITY
LONG BEACH, CALIFORNIA
FOR: LENNAR COMMUNITIES

Project No.
04-31-118-01

Drawing No.
A-6b

APPENDIX B

CPT LOGS

Leighton

GREGG DRILLING & TESTING, INC.
GEOTECHNICAL AND ENVIRONMENTAL INVESTIGATION SERVICES

February 3, 2016

Leighton
Attn: Christian Delgadillo

Subject: CPT Site Investigation
SeaPort Marina Hotel
Long Beach, California
GREGG Project Number: 16-509SH

Dear Mr. Delgadillo:

The following report presents the results of GREGG Drilling & Testing's Cone Penetration Test investigation for the above referenced site. The following testing services were performed:

1	Cone Penetration Tests	(CPTU)	☒
2	Pore Pressure Dissipation Tests	(PPD)	☒
3	Seismic Cone Penetration Tests	(SCPTU)	☐
4	UVOST Laser Induced Fluorescence	(UVOST)	☐
5	Groundwater Sampling	(GWS)	☐
6	Soil Sampling	(SS)	☐
7	Vapor Sampling	(VS)	☐
8	Pressuremeter Testing	(PMT)	☐
9	Vane Shear Testing	(VST)	☐
10	Dilatometer Testing	(DMT)	☐

A list of reference papers providing additional background on the specific tests conducted is provided in the bibliography following the text of the report. If you would like a copy of any of these publications or should you have any questions or comments regarding the contents of this report, please do not hesitate to contact our office at (562) 427-6899.

Sincerely,
GREGG Drilling & Testing, Inc.

Peter Robertson
Technical Director, Gregg Drilling & Testing, Inc.

2726 Walnut Ave. • Signal Hill, California 90755 • (562) 427-6899 • FAX (562) 427-3314
www.greggdrilling.com

Cone Penetration Test Sounding Summary

-Table 1-

CPT Sounding Identification	Date	Termination Depth (feet)	Depth of Groundwater Samples (feet)	Depth of Soil Samples (feet)	Depth of Pore Pressure Dissipation Tests (feet)
CPT-1	2/02/16	60	-	-	-
CPT-2	2/02/16	60	-	-	-
CPT-3	2/01/16	80	-	-	-
CPT-4	2/02/16	60	-	-	-
CPT-5	2/02/16	60	-	-	-
CPT-6	2/01/16	80	-	-	80.2
CPT-7	2/02/16	60	-	-	-
CPT-8	2/02/16	60	-	-	-
CPT-9	2/01/16	79	-	-	-
CPT-10	2/02/16	60	-	-	-
CPT-11	2/02/16	60	-	-	-
CPT-12	2/02/16	60	-	-	60.0
CPT-13	2/01/16	80	-	-	-
CPT-14	2/02/16	60	-	-	-
CPT-15	2/01/16	80	-	-	-
CPT-16	2/01/16	80	-	-	29.0

Bibliography

Lunne, T., Robertson, P.K. and Powell, J.J.M., "Cone Penetration Testing in Geotechnical Practice" E & FN Spon. ISBN 0 419 23750, 1997

Roberston, P.K., "Soil Classification using the Cone Penetration Test", Canadian Geotechnical Journal, Vol. 27, 1990 pp. 151-158.

Mayne, P.W., "NHI (2002) Manual on Subsurface Investigations: Geotechnical Site Characterization", available through www.ce.gatech.edu/~geosys/Faculty/Mayne/papers/index.html, Section 5.3, pp. 107-112.

Robertson, P.K., R.G. Campanella, D. Gillespie and A. Rice, "Seismic CPT to Measure In-Situ Shear Wave Velocity", Journal of Geotechnical Engineering ASCE, Vol. 112, No. 8, 1986 pp. 791-803.

Robertson, P.K., Sully, J., Woeller, D.J., Lunne, T., Powell, J.J.M., and Gillespie, D.J., "Guidelines for Estimating Consolidation Parameters in Soils from Piezocone Tests", Canadian Geotechnical Journal, Vol. 29, No. 4, August 1992, pp. 539-550.

Robertson, P.K., T. Lunne and J.J.M. Powell, "Geo-Environmental Application of Penetration Testing", Geotechnical Site Characterization, Robertson & Mayne (editors), 1998 Balkema, Rotterdam, ISBN 90 5410 939 4 pp 35-47.

Campanella, R.G. and I. Weemees, "Development and Use of An Electrical Resistivity Cone for Groundwater Contamination Studies", Canadian Geotechnical Journal, Vol. 27 No. 5, 1990 pp. 557-567.

DeGroot, D.J. and A.J. Lutenegger, "Reliability of Soil Gas Sampling and Characterization Techniques", International Site Characterization Conference - Atlanta, 1998.

Woeller, D.J., P.K. Robertson, T.J. Boyd and Dave Thomas, "Detection of Polyaromatic Hydrocarbon Contaminants Using the UVIF-CPT", 53rd Canadian Geotechnical Conference Montreal, QC October pp. 733-739, 2000.

Zemo, D.A., T.A. Delfino, J.D. Gallinatti, V.A. Baker and L.R. Hilpert, "Field Comparison of Analytical Results from Discrete-Depth Groundwater Samplers" BAT EnviroProbe and QED HydroPunch, Sixth national Outdoor Action Conference, Las Vegas, Nevada Proceedings, 1992, pp 299-312.

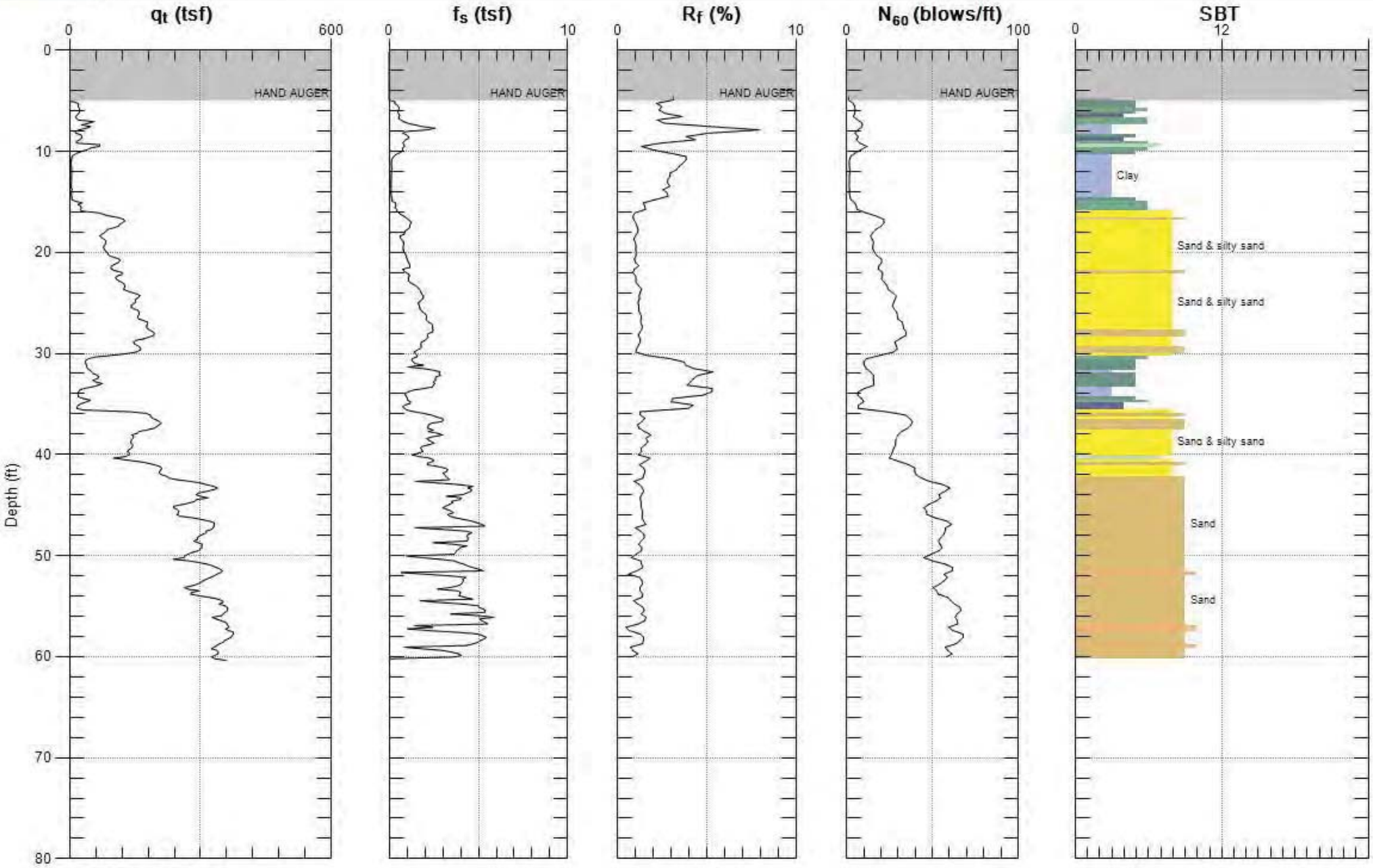
Copies of ASTM Standards are available through www.astm.org

GREGG

LEIGHTON

Site: SEAPORT MARINA HOTEL Engineer: C.DELGADILLO

Sounding: cpt-1 Date: 2/2/2016 02:35



Max. Depth: 60.367 (ft)
Avg. Interval: 0.328 (ft)

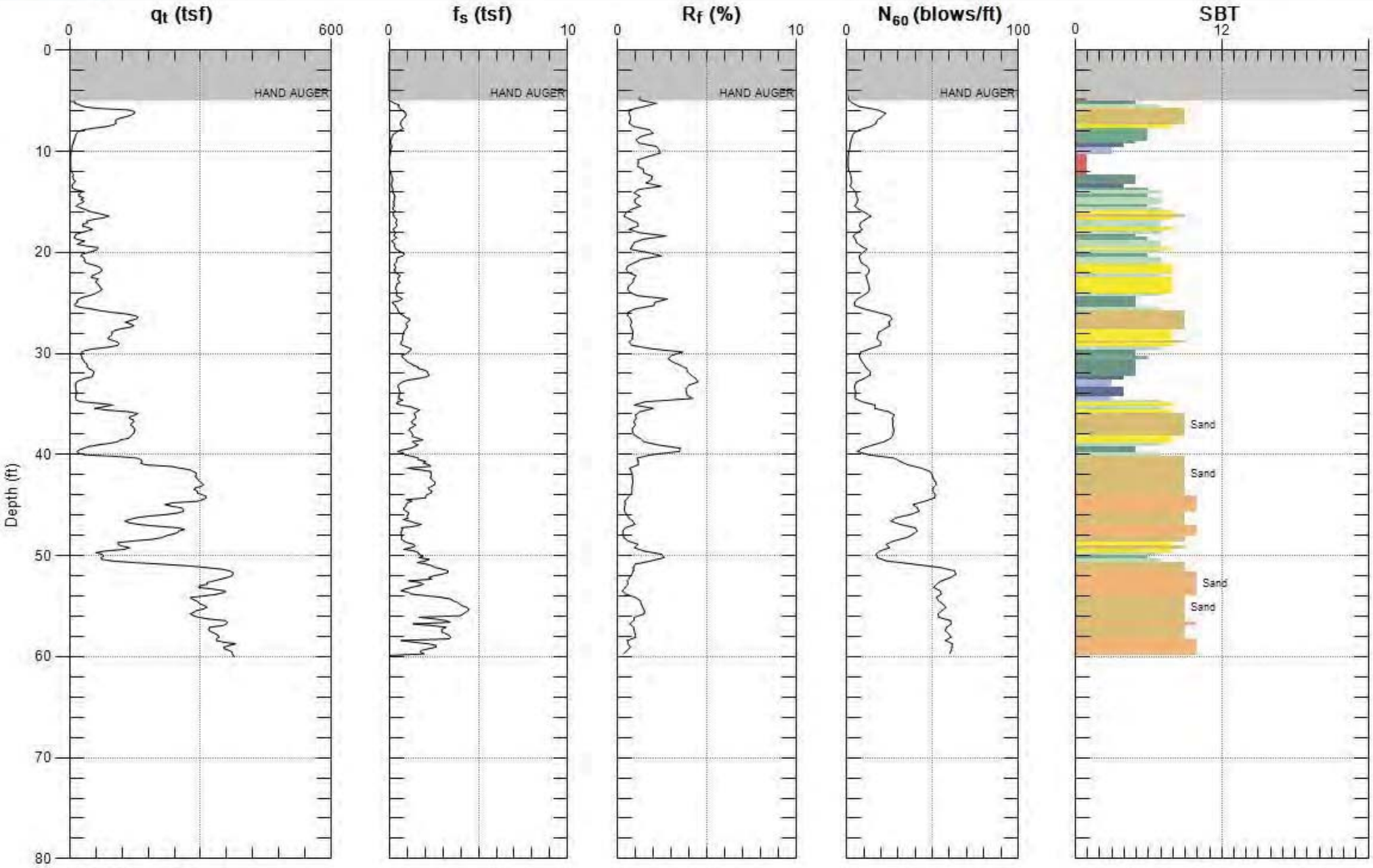
SBT: Soil Behavior Type (Robertson 1990)

GREGG

LEIGHTON

Site: SEAPORT MARINA HOTEL Engineer: C.DELGADILLO

Sounding: cpt-2 Date: 2/2/2016 12:57



Max. Depth: 60.039 (ft)
Avg. Interval: 0.328 (ft)

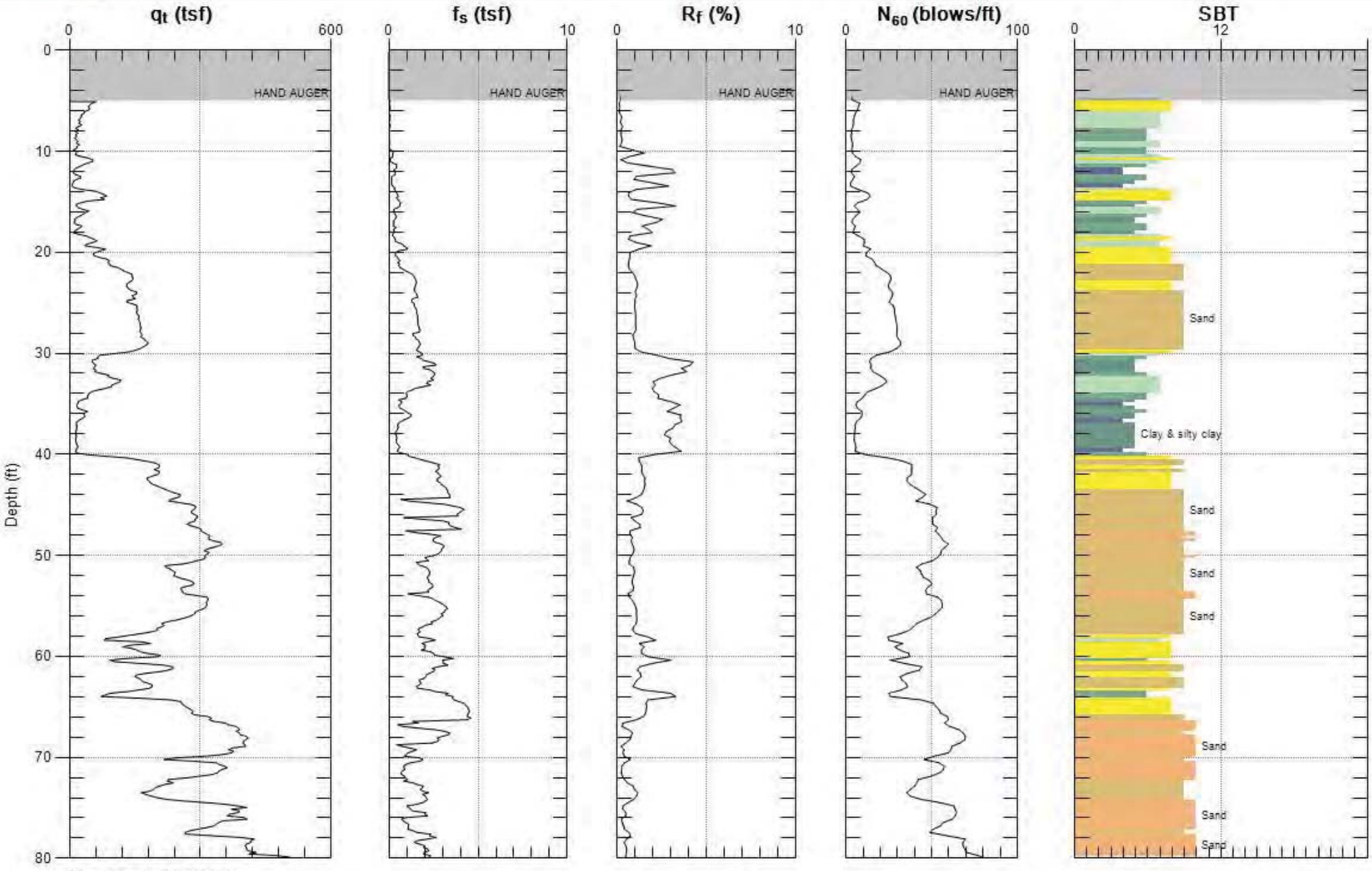
SBT: Soil Behavior Type (Robertson 1990)

GREGG

LEIGHTON

Site: SEAPORT MARINA HOTEL Engineer: C.DELGADILLO

Sounding: cpt-3 Date: 2/1/2016 10:56



Max. Depth: 80.545 (ft)
Avg. Interval: 0.328 (ft)

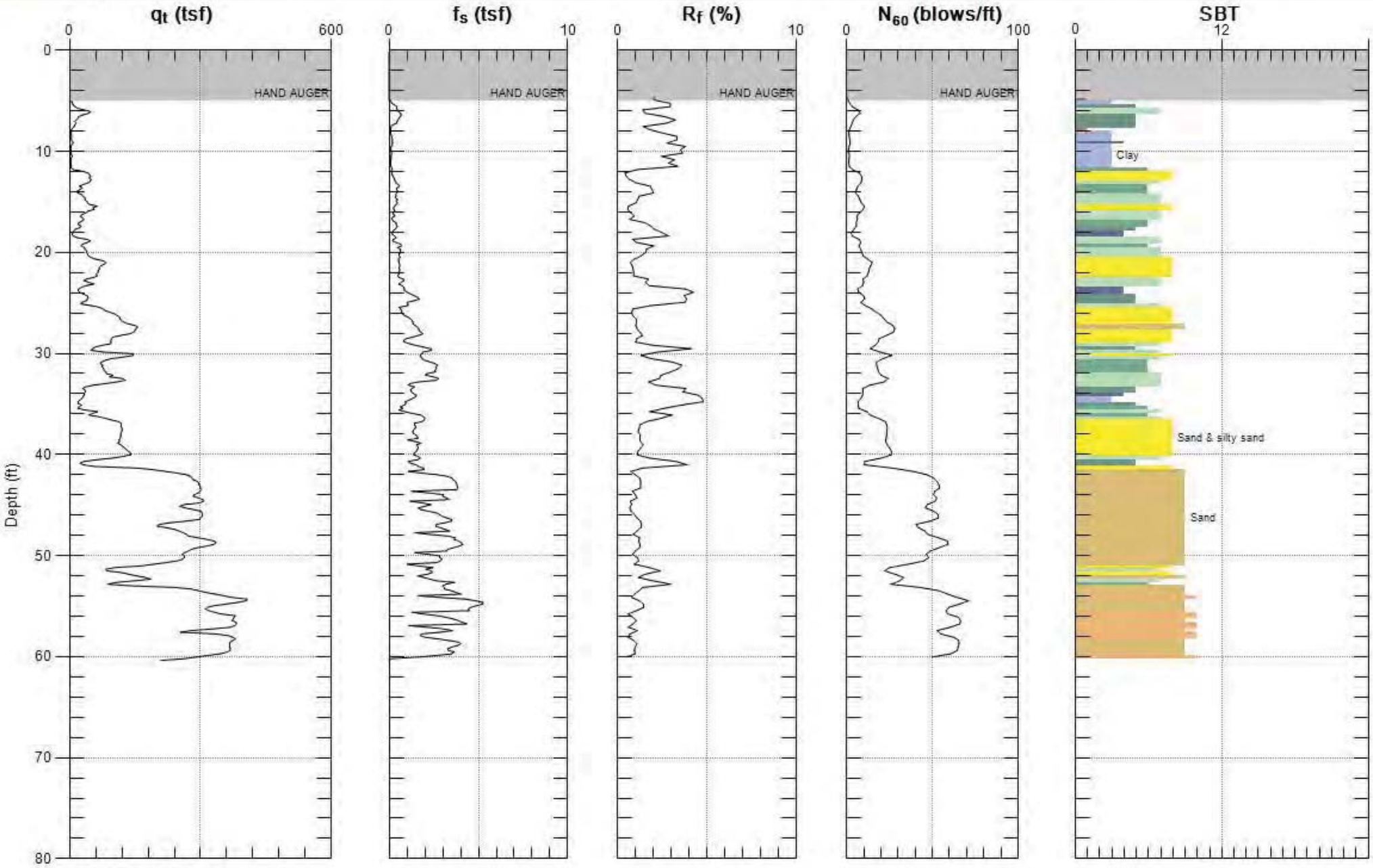
SBT: Soil Behavior Type (Robertson 1990)

GREGG

LEIGHTON

Site: SEAPORT MARINA HOTEL Engineer: C.DELGADILLO

Sounding: cpt-4 Date: 2/2/2016 01:49



Max. Depth: 60.367 (ft)
Avg. Interval: 0.328 (ft)

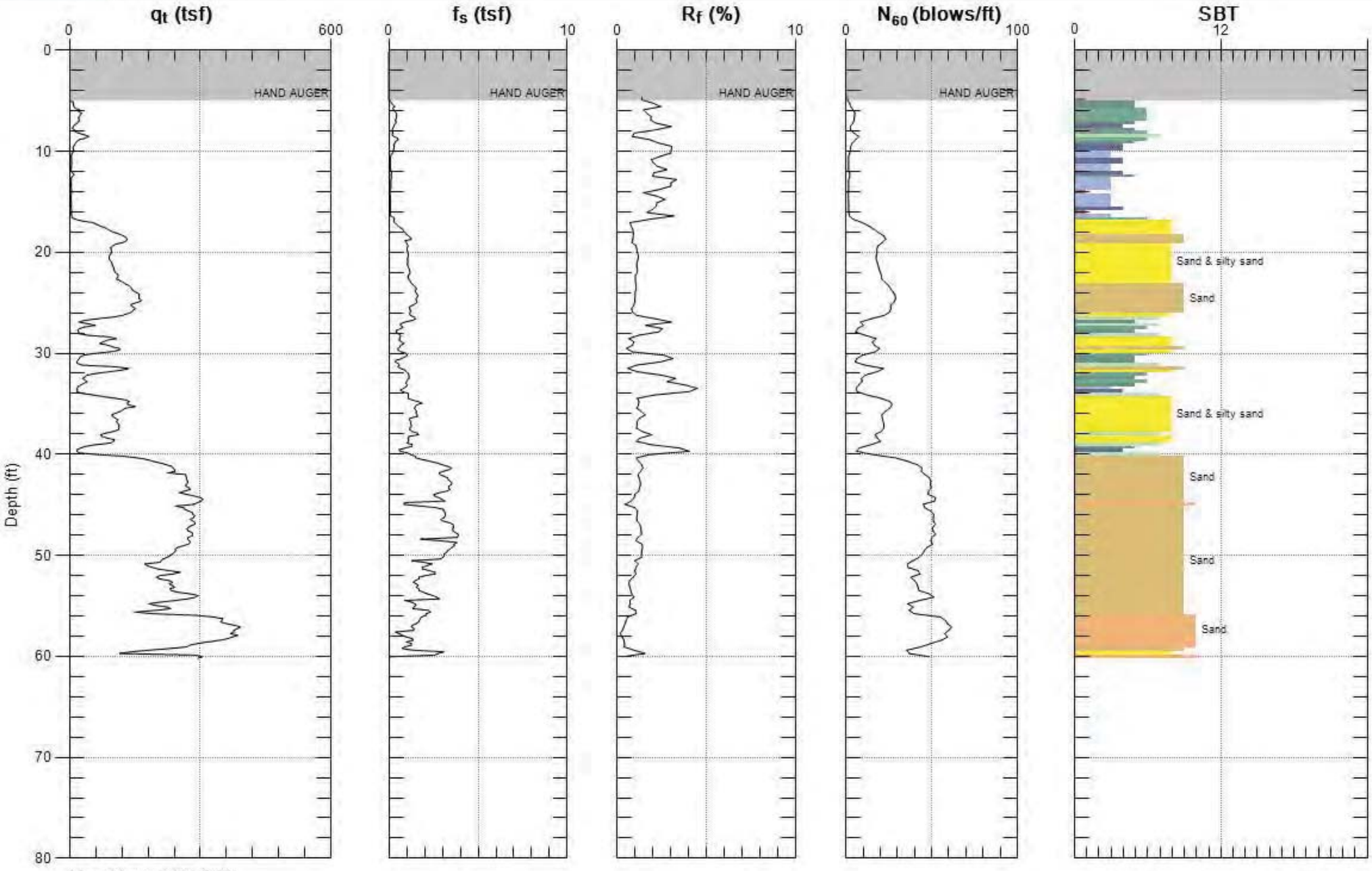
SBT: Soil Behavior Type (Robertson 1990)

GREGG

LEIGHTON

Site: SEAPORT MARINA HOTEL Engineer: C.DELGADILLO

Sounding: cpt-5 Date: 2/2/2016 04:04



Max. Depth: 60.203 (ft)
Avg. Interval: 0.328 (ft)

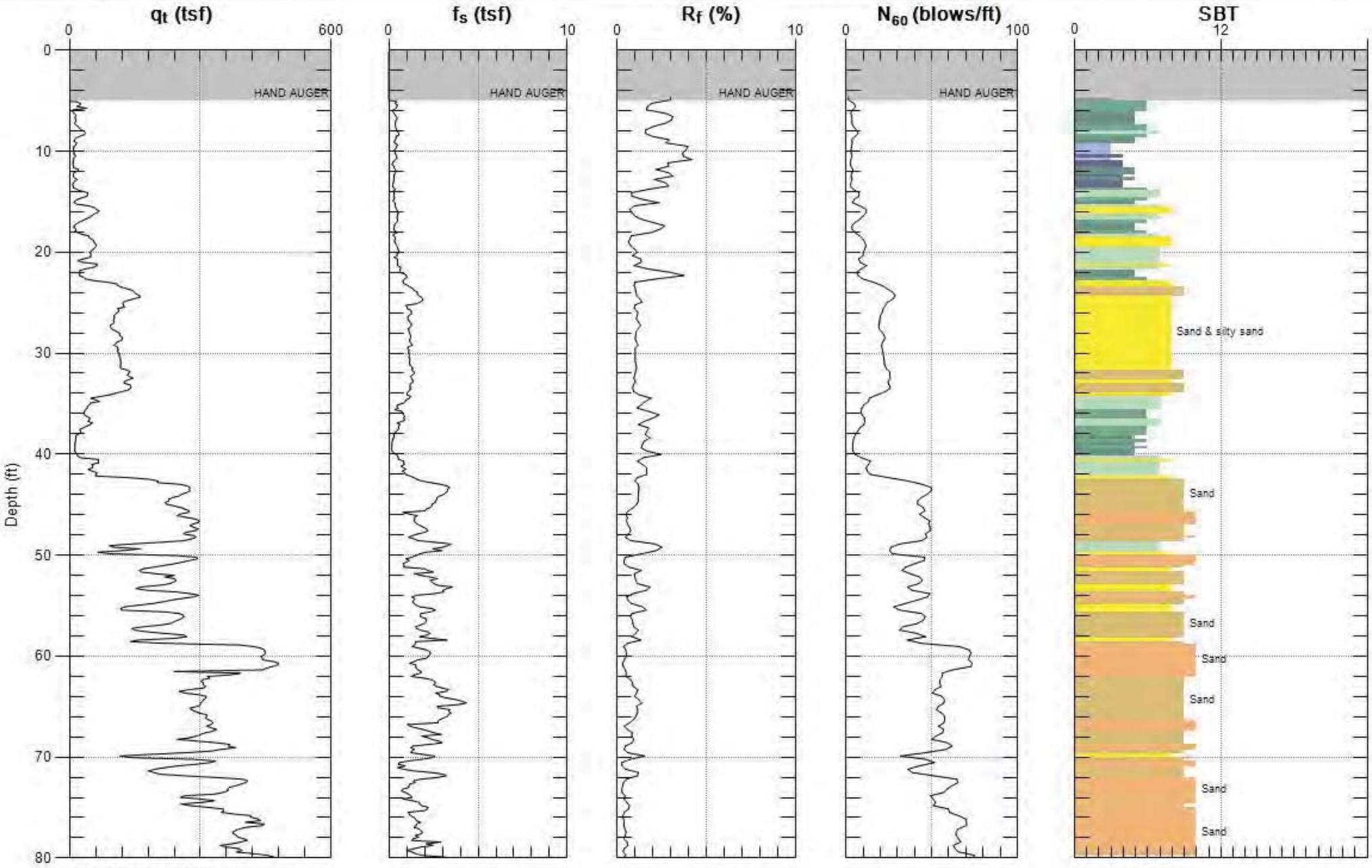
SBT: Soil Behavior Type (Robertson 1990)

GREGG

LEIGHTON

Site: SEAPORT MARINA HOTEL Engineer: C.DELGADILLO

Sounding: cpt-6 Date: 1/30/2016 01:15



Max. Depth: 80.217 (ft)
Avg. Interval: 0.328 (ft)

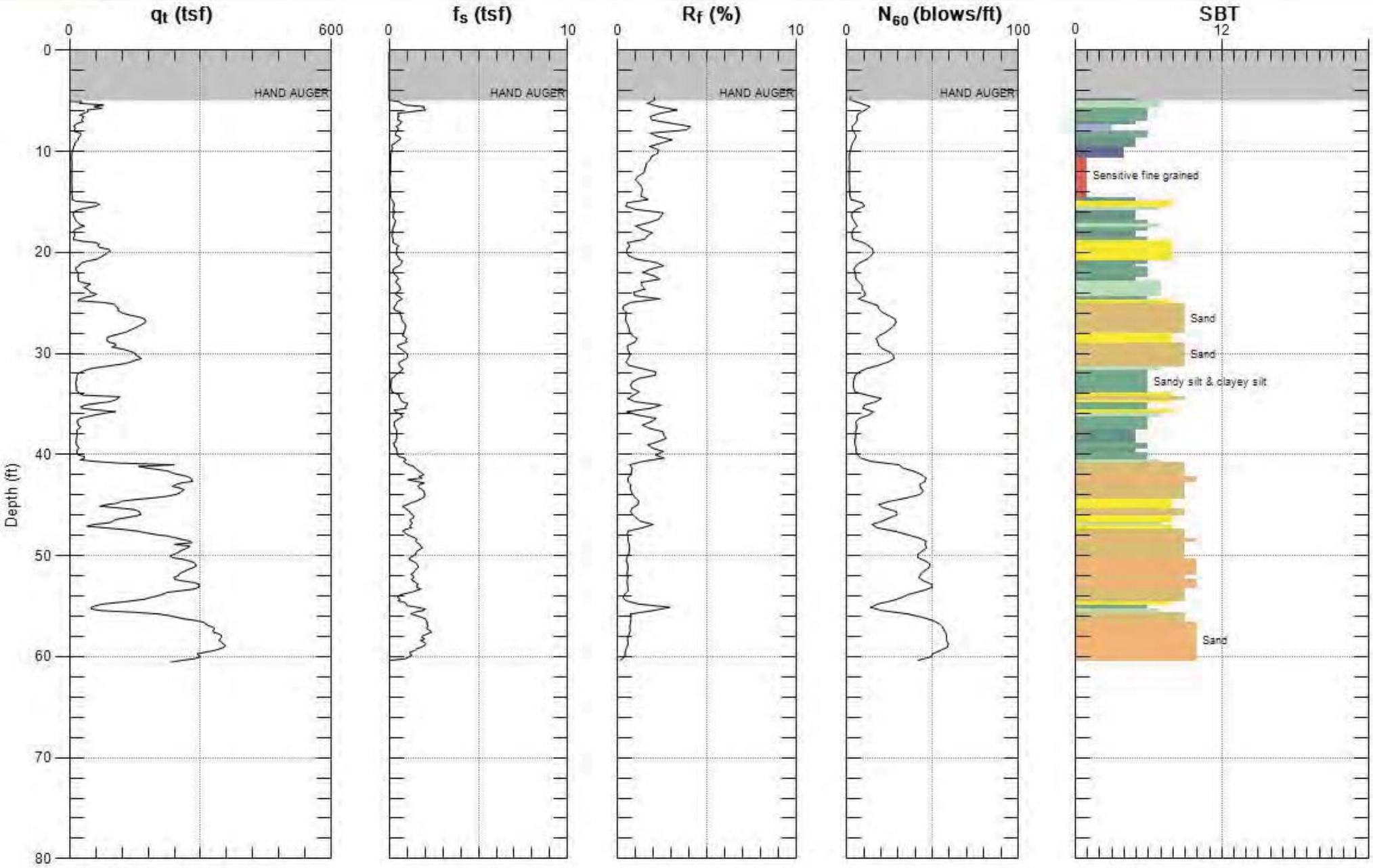
SBT: Soil Behavior Type (Robertson 1990)

GREGG

LEIGHTON

Site: SEAPORT MARINA HOTEL Engineer: C.DELGADILLO

Sounding: cpt-7 Date: 2/2/2016 07:33



Max. Depth: 60.531 (ft)
Avg. Interval: 0.328 (ft)

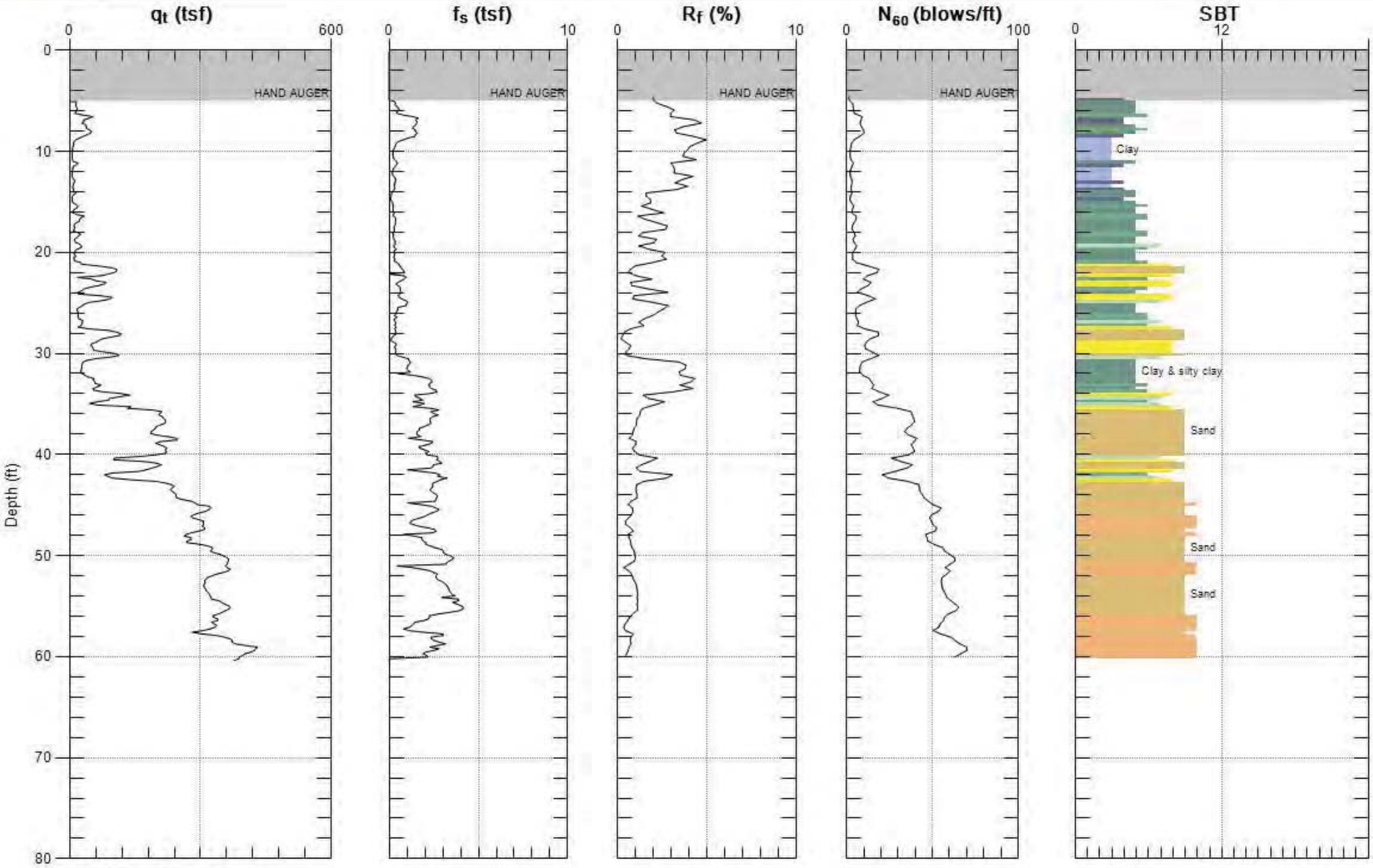
SBT: Soil Behavior Type (Robertson 1990)

GREGG

LEIGHTON

Site: SEAPORT MARINA HOTEL Engineer: C.DELGADILLO

Sounding: cpt-8 Date: 2/2/2016 08:32



Max. Depth: 60.367 (ft)
Avg. Interval: 0.328 (ft)

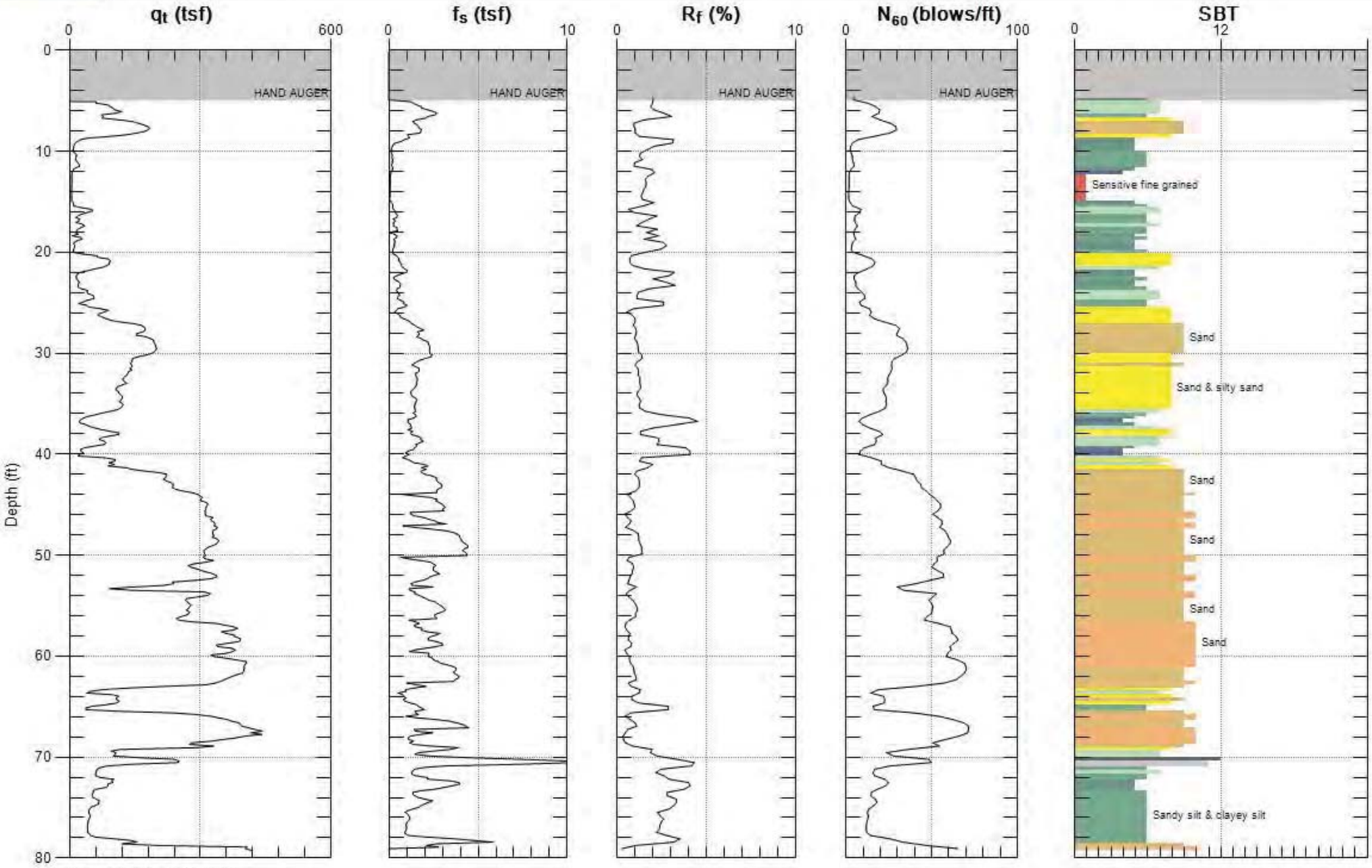
SBT: Soil Behavior Type (Robertson 1990)

GREGG

LEIGHTON

Site: SEAPORT MARINA HOTEL Engineer: C.DELGADILLO

Sounding: cpt-9 Date: 2/1/2016 09:04



Max. Depth: 79.232 (ft)
Avg. Interval: 0.328 (ft)

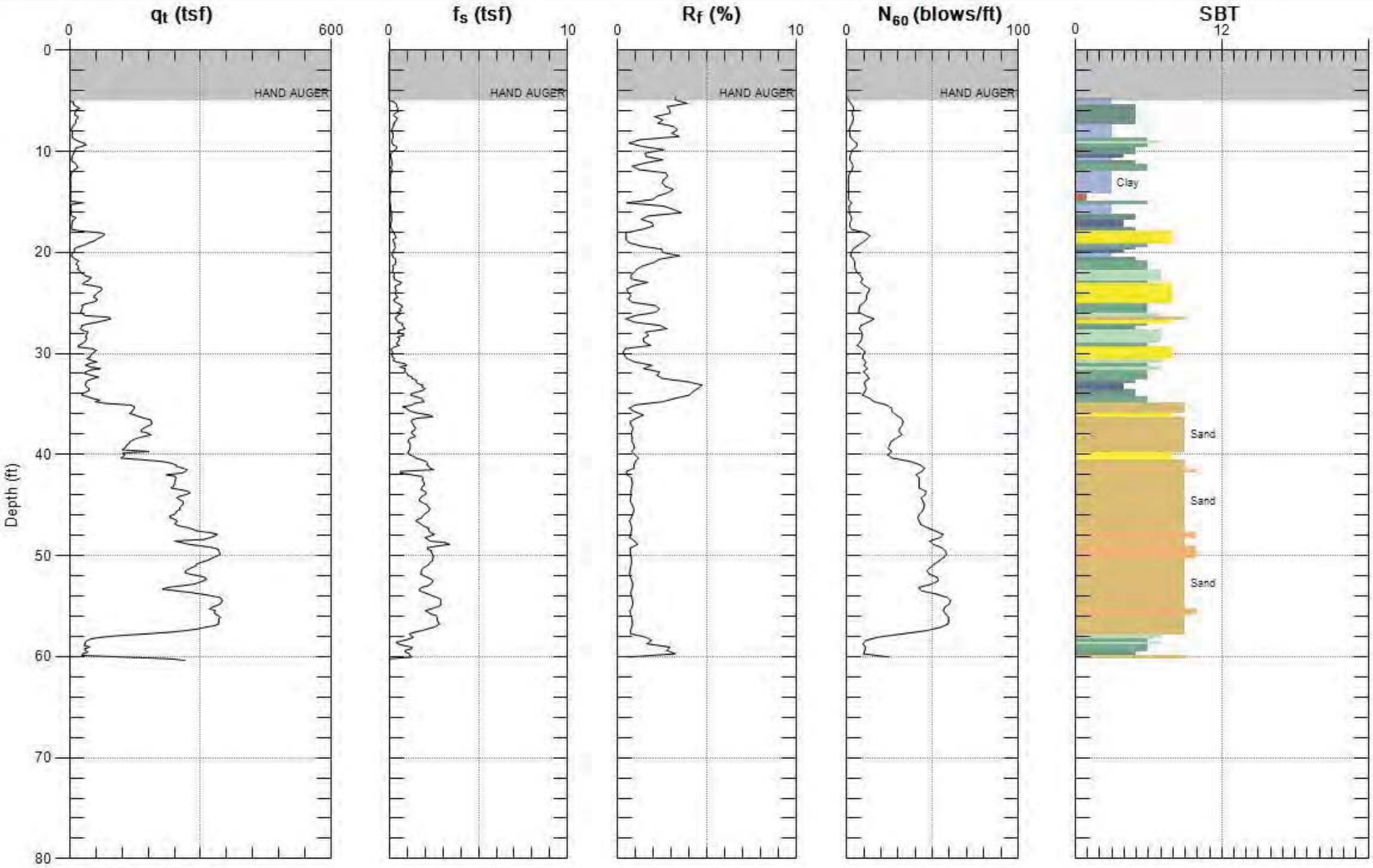
SBT: Soil Behavior Type (Robertson 1990)

GREGG

LEIGHTON

Site: SEAPORT MARINA HOTEL Engineer: C.DELGADILLO

Sounding: cpt-10 Date: 2/2/2016 09:19



Max. Depth: 60.367 (ft)
Avg. Interval: 0.328 (ft)

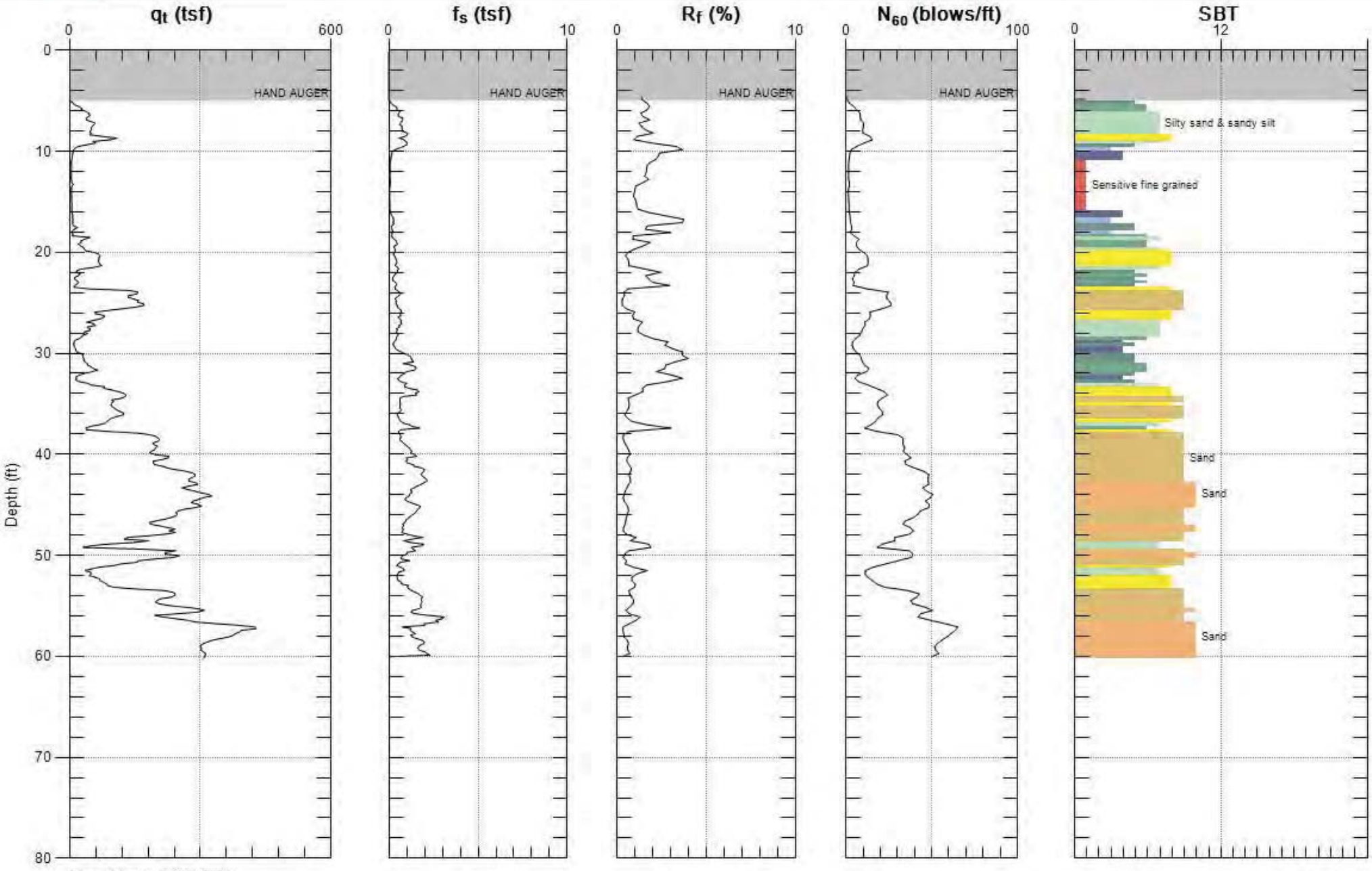
SBT: Soil Behavior Type (Robertson 1990)

GREGG

LEIGHTON

Site: SEAPORT MARINA HOTEL Engineer: C.DELGADILLO

Sounding: cpt-11 Date: 2/2/2016 03:20



Max. Depth: 60.203 (ft)
Avg. Interval: 0.328 (ft)

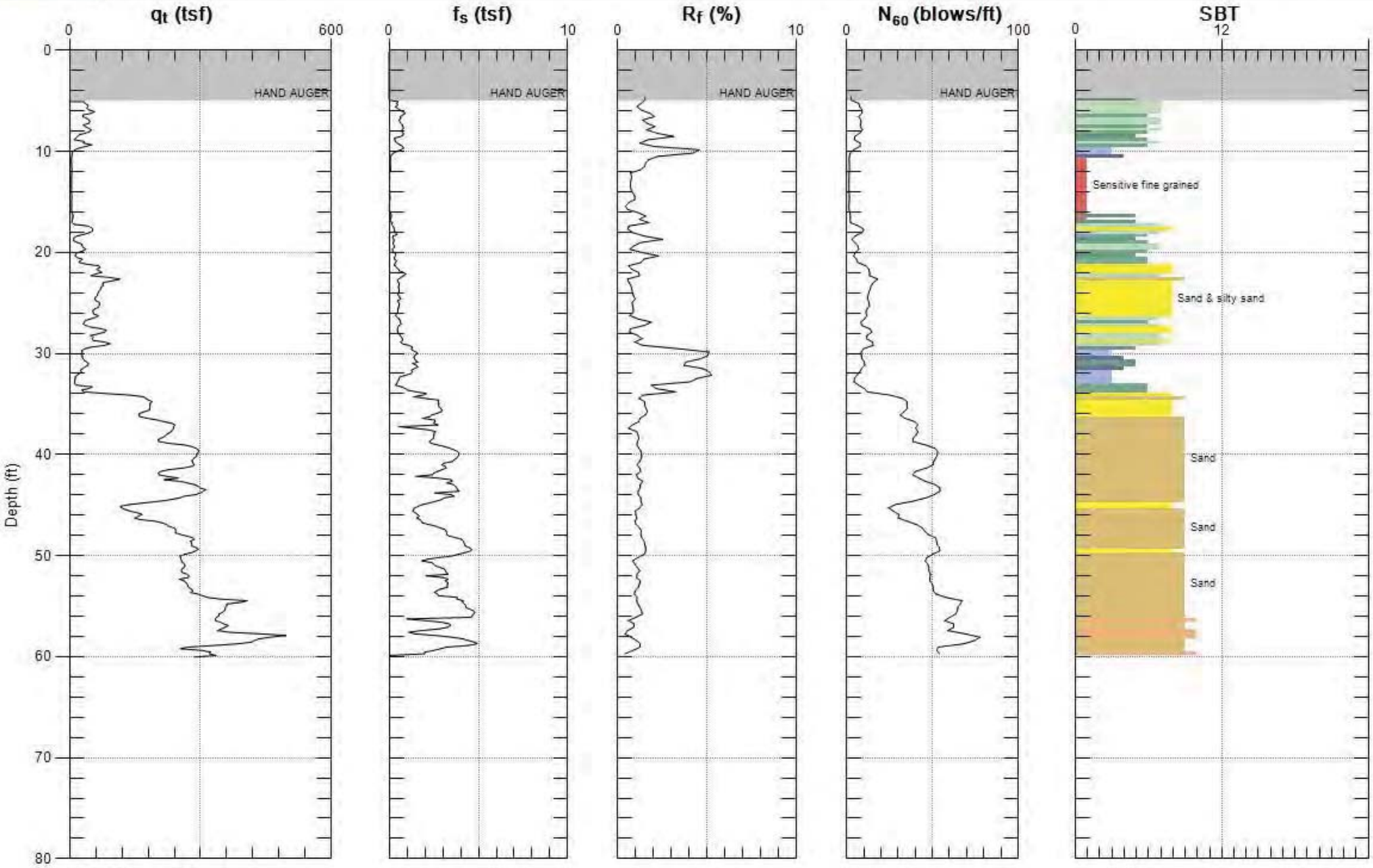
SBT: Soil Behavior Type (Robertson 1990)

GREGG

LEIGHTON

Site: SEAPORT MARINA HOTEL Engineer: C.DELGADILLO

Sounding: cpt-12 Date: 2/2/2016 11:43



Max. Depth: 60.039 (ft)
Avg. Interval: 0.328 (ft)

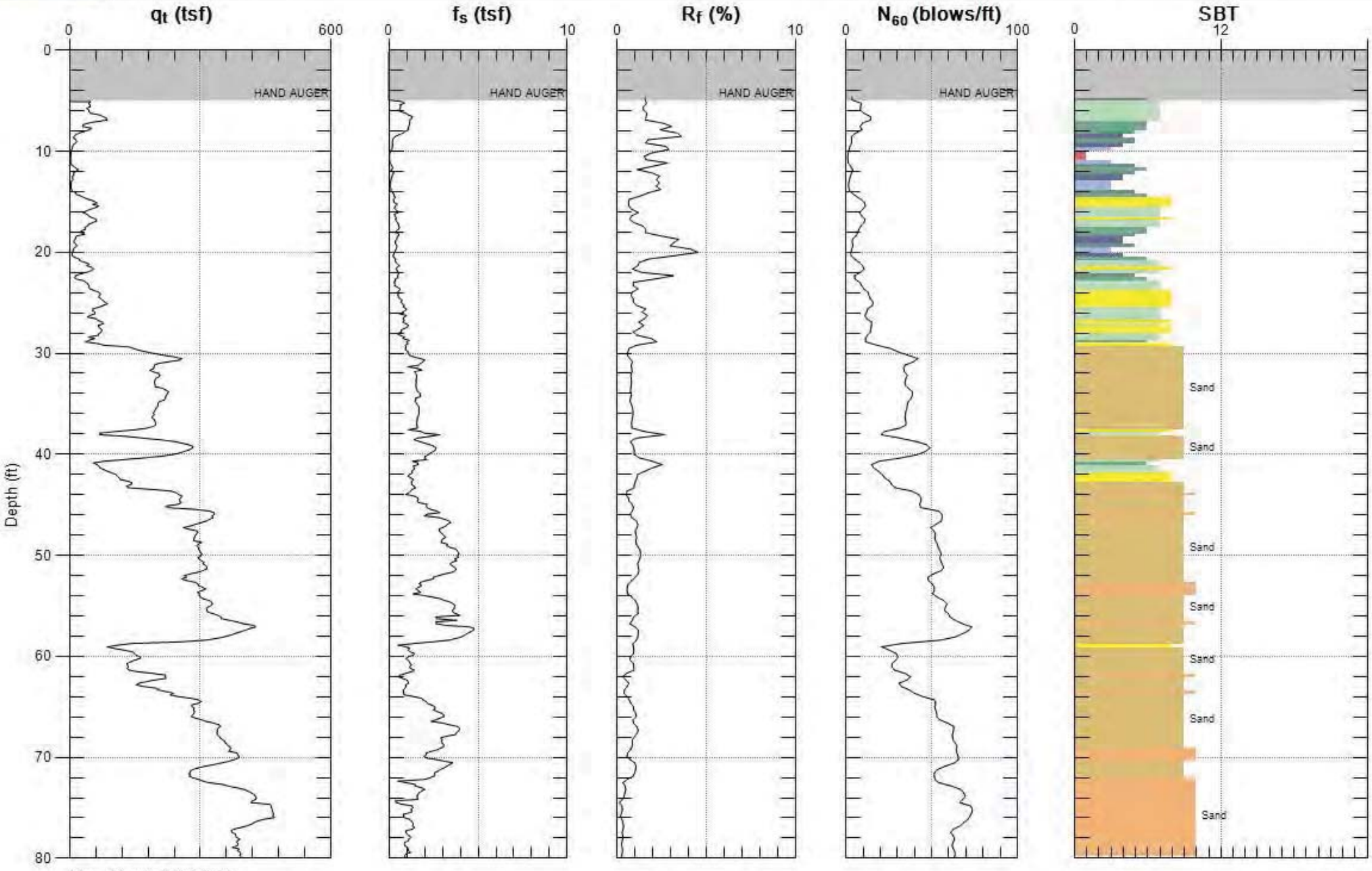
SBT: Soil Behavior Type (Robertson 1990)

GREGG

LEIGHTON

Site: SEAPORT MARINA HOTEL Engineer: C.DELGADILLO

Sounding: cpt-13 Date: 2/1/2016 02:21



Max. Depth: 80.381 (ft)
Avg. Interval: 0.328 (ft)

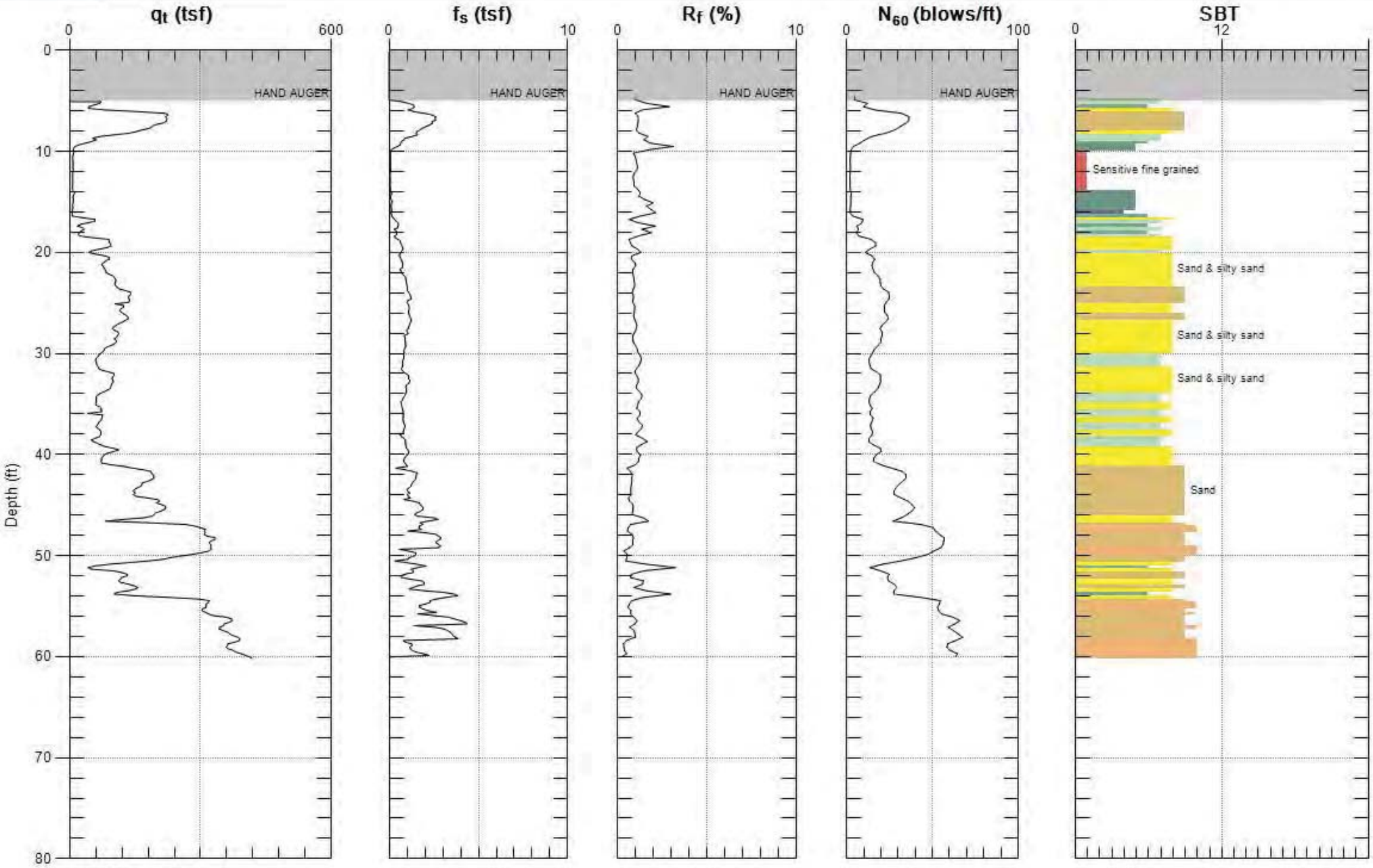
SBT: Soil Behavior Type (Robertson 1990)

GREGG

LEIGHTON

Site: SEAPORT MARINA HOTEL Engineer: C.DELGADILLO

Sounding: cpt-14 Date: 2/2/2016 10:42



Max. Depth: 60.203 (ft)
Avg. Interval: 0.328 (ft)

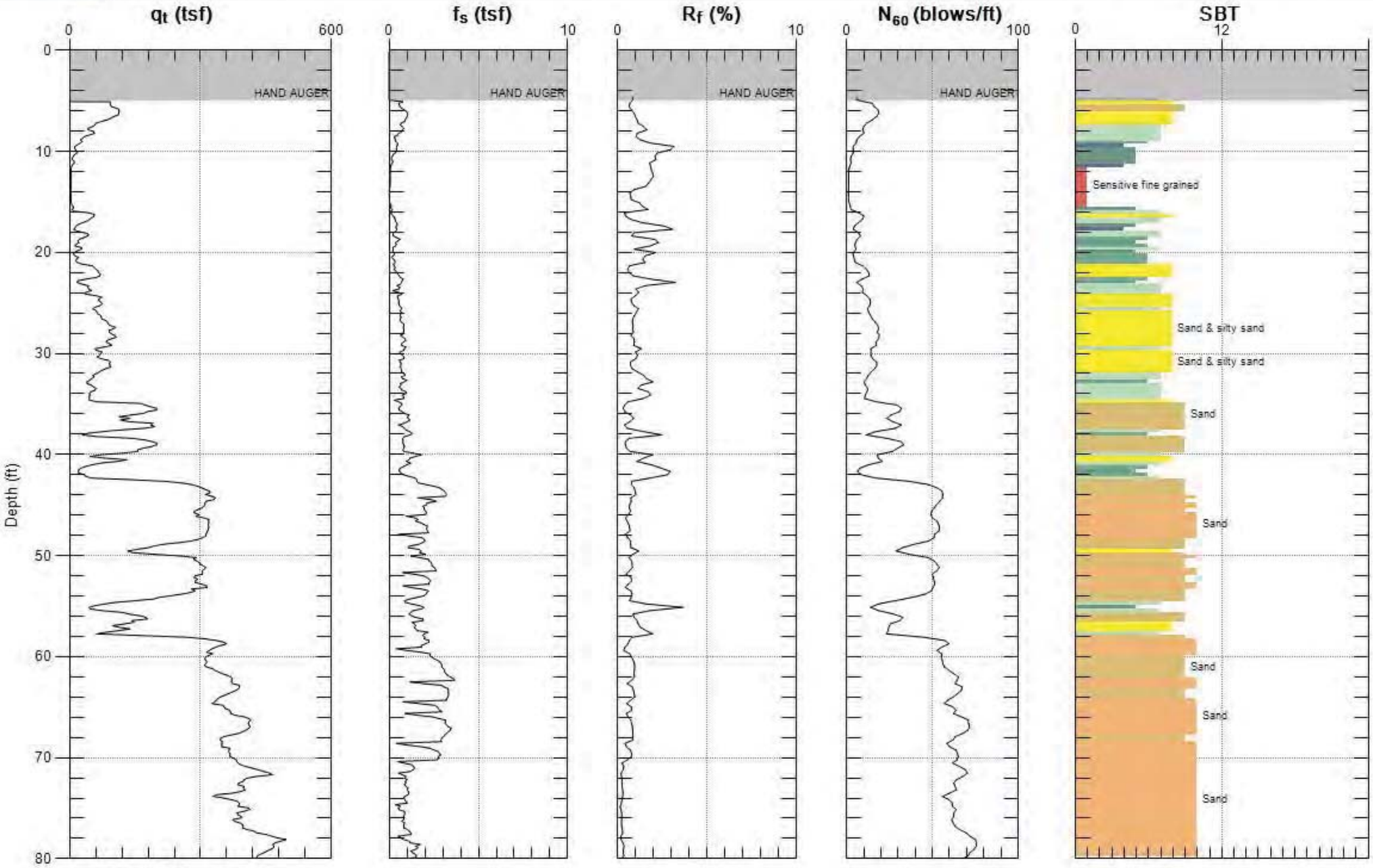
SBT: Soil Behavior Type (Robertson 1990)

GREGG

LEIGHTON

Site: SEAPORT MARINA HOTEL Engineer: C.DELGADILLO

Sounding: cpt-15 Date: 2/1/2016 01:23



Max. Depth: 80.217 (ft)
Avg. Interval: 0.328 (ft)

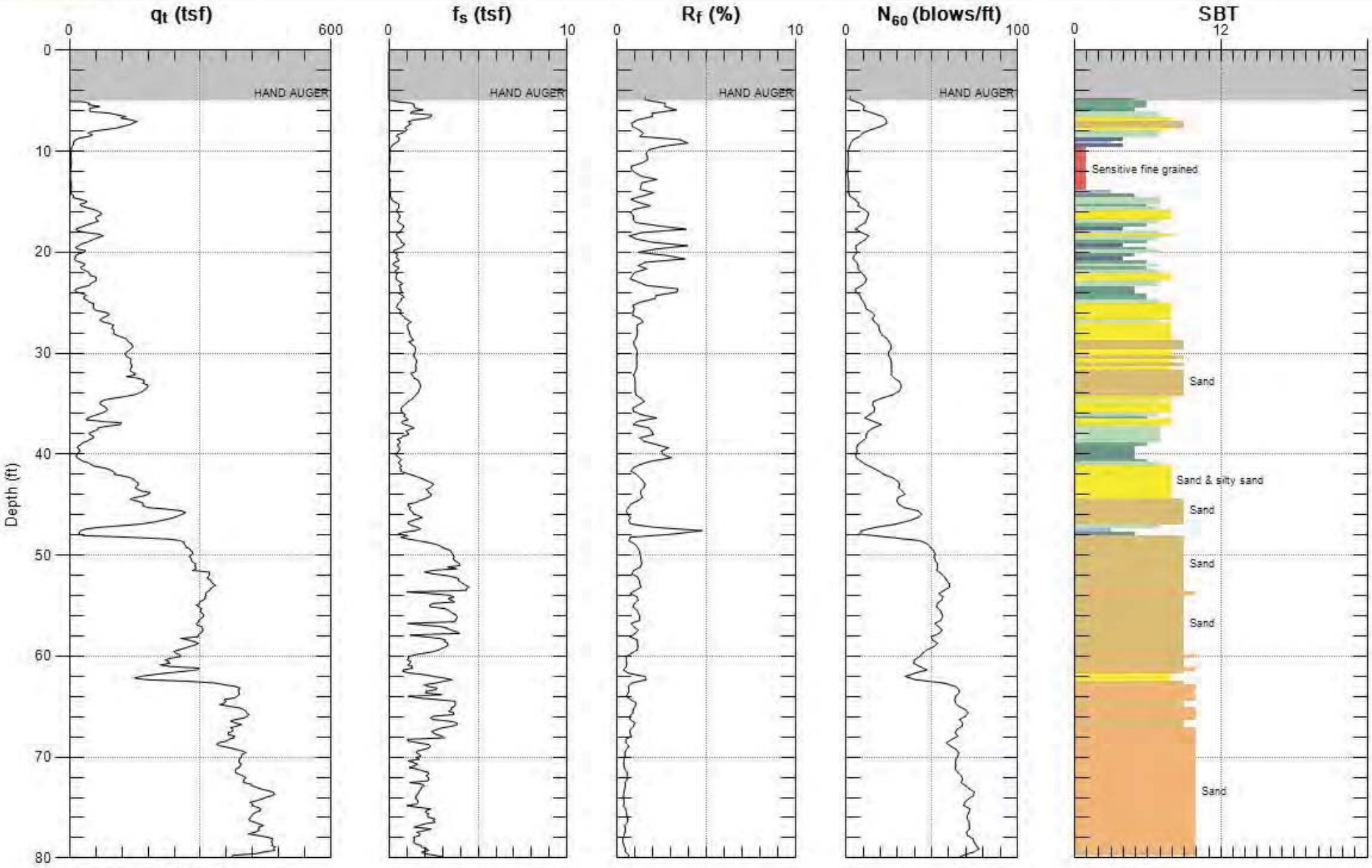
SBT: Soil Behavior Type (Robertson 1990)

GREGG

LEIGHTON

Site: SEAPORT MARINA HOTEL Engineer: C.DELGADILLO

Sounding: cpt-16 Date: 2/1/2016 12:10



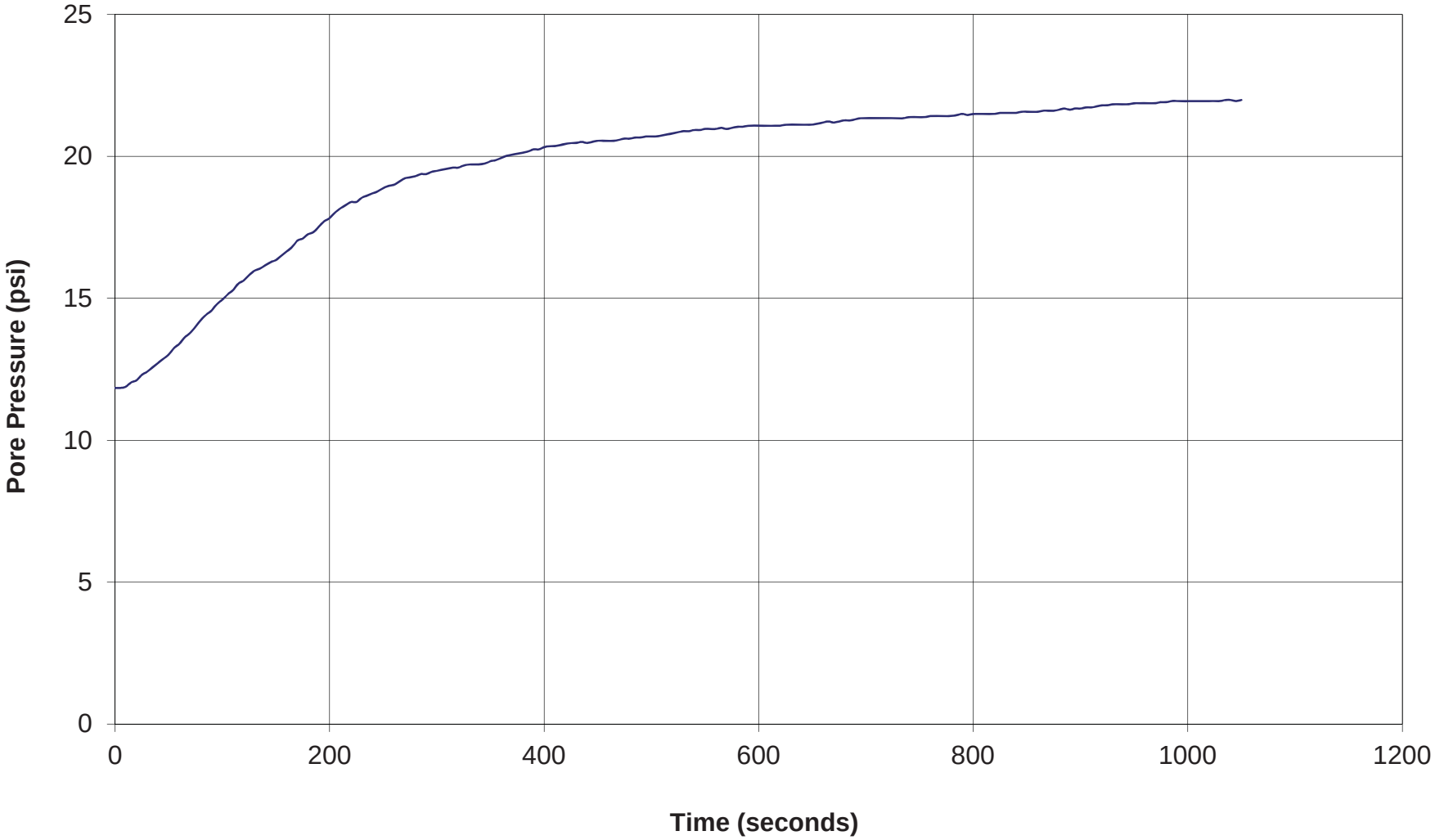
Max. Depth: 80.381 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG DRILLING & TESTING

Pore Pressure Dissipation Test

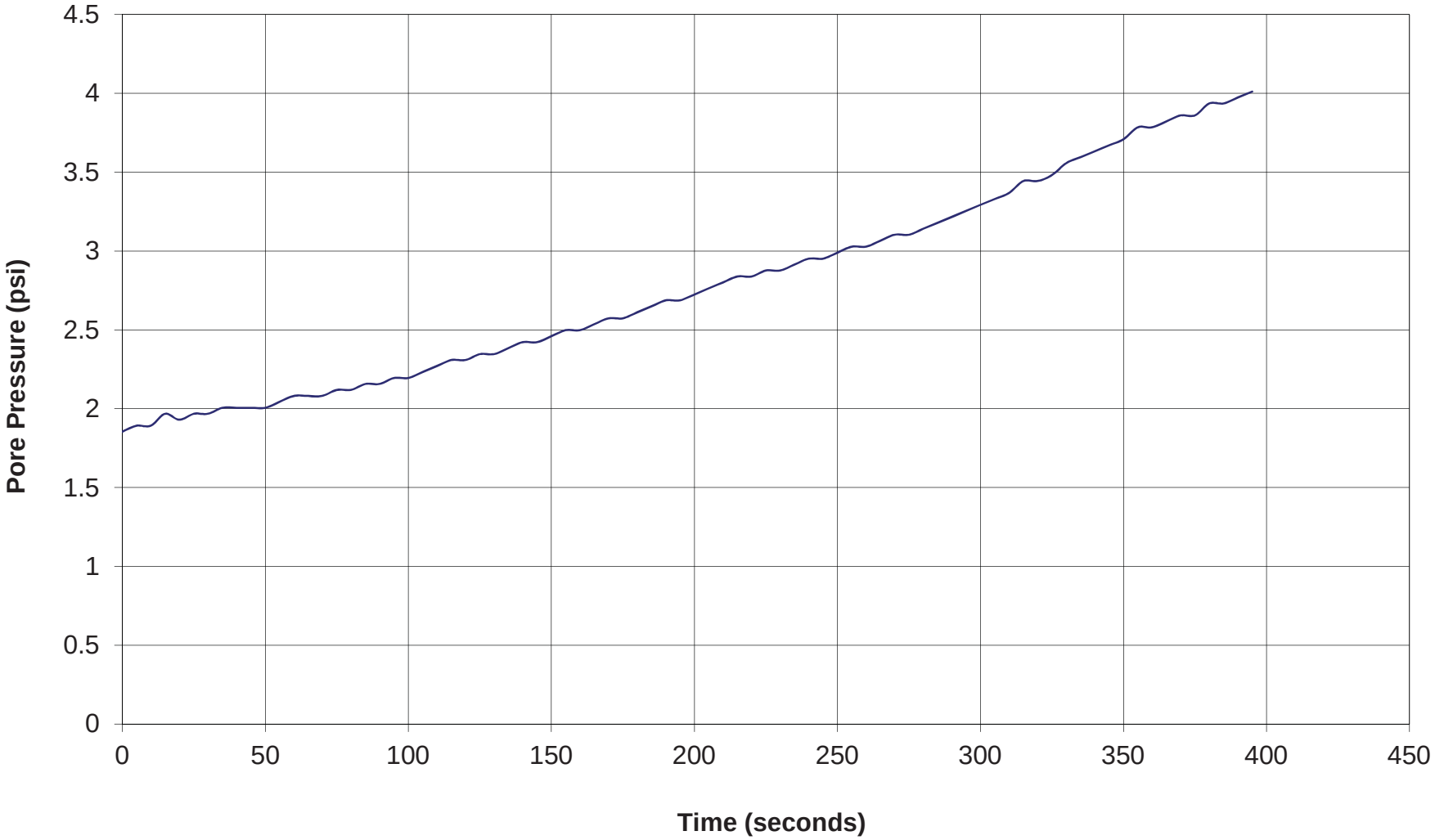
Sounding: CPT-12
Depth: 60.039189
Site: SEAPORT MARINA
Engineer: C.DELGADILLO



GREGG DRILLING & TESTING

Pore Pressure Dissipation Test

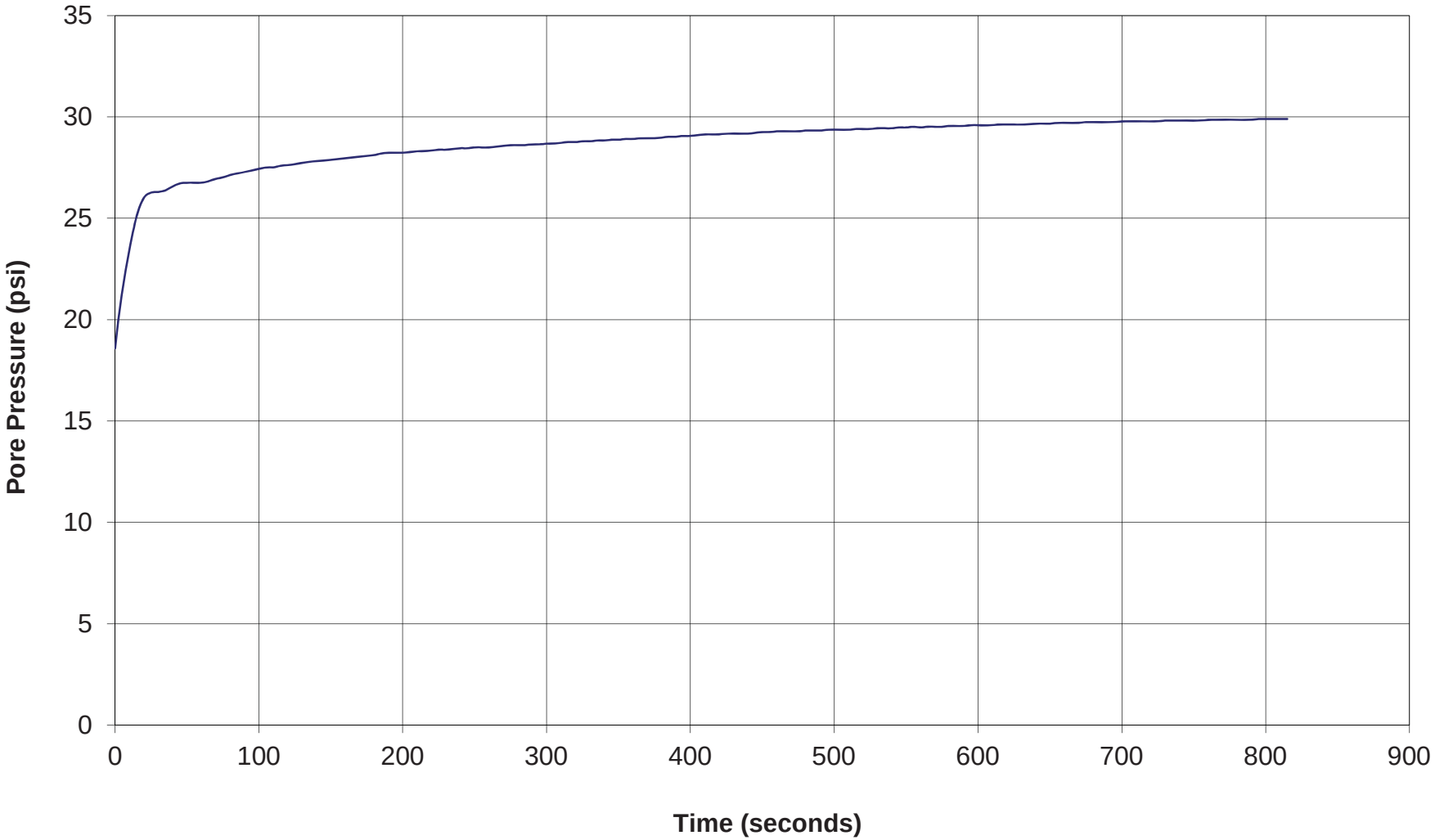
Sounding: CPT-16
Depth: 29.0353455
Site: SEAPORT MARINA
Engineer: C.DELGADILLO



GREGG DRILLING & TESTING

Pore Pressure Dissipation Test

Sounding: CPT-6
Depth: 80.2162935
Site: SEAPORT MARINA
Engineer: C.DELGADILLO



November 7, 2016

Leighton
Attn: Christian Delgadillo

Subject: CPT Site Investigation
SeaPort Marina Hotel
Long Beach, California
GREGG Project Number: 16-509SH – part 2

Dear Mr. Delgadillo:

The following report presents the results of GREGG Drilling & Testing's Cone Penetration Test investigation for the above referenced site. The following testing services were performed:

1	Cone Penetration Tests	(CPTU)	☒
2	Pore Pressure Dissipation Tests	(PPD)	☒
3	Seismic Cone Penetration Tests	(SCPTU)	☐
4	UVOST Laser Induced Fluorescence	(UVOST)	☐
5	Groundwater Sampling	(GWS)	☐
6	Soil Sampling	(SS)	☐
7	Vapor Sampling	(VS)	☐
8	Pressuremeter Testing	(PMT)	☐
9	Vane Shear Testing	(VST)	☐
10	Dilatometer Testing	(DMT)	☐

A list of reference papers providing additional background on the specific tests conducted is provided in the bibliography following the text of the report. If you would like a copy of any of these publications or should you have any questions or comments regarding the contents of this report, please do not hesitate to contact our office at (562) 427-6899.

Sincerely,
GREGG Drilling & Testing, Inc.

Peter Robertson
Technical Director, Gregg Drilling & Testing, Inc.

Cone Penetration Test Sounding Summary

-Table 1-

CPT Sounding Identification	Date	Termination Depth (feet)	Depth of Groundwater Samples (feet)	Depth of Soil Samples (feet)	Depth of Pore Pressure Dissipation Tests (feet)
CPT-17	11/04/16	60	-	-	-
CPT-18	11/04/16	60	-	-	-
CPT-19	11/04/16	60	-	-	-
CPT-20	11/04/16	60	-	-	-

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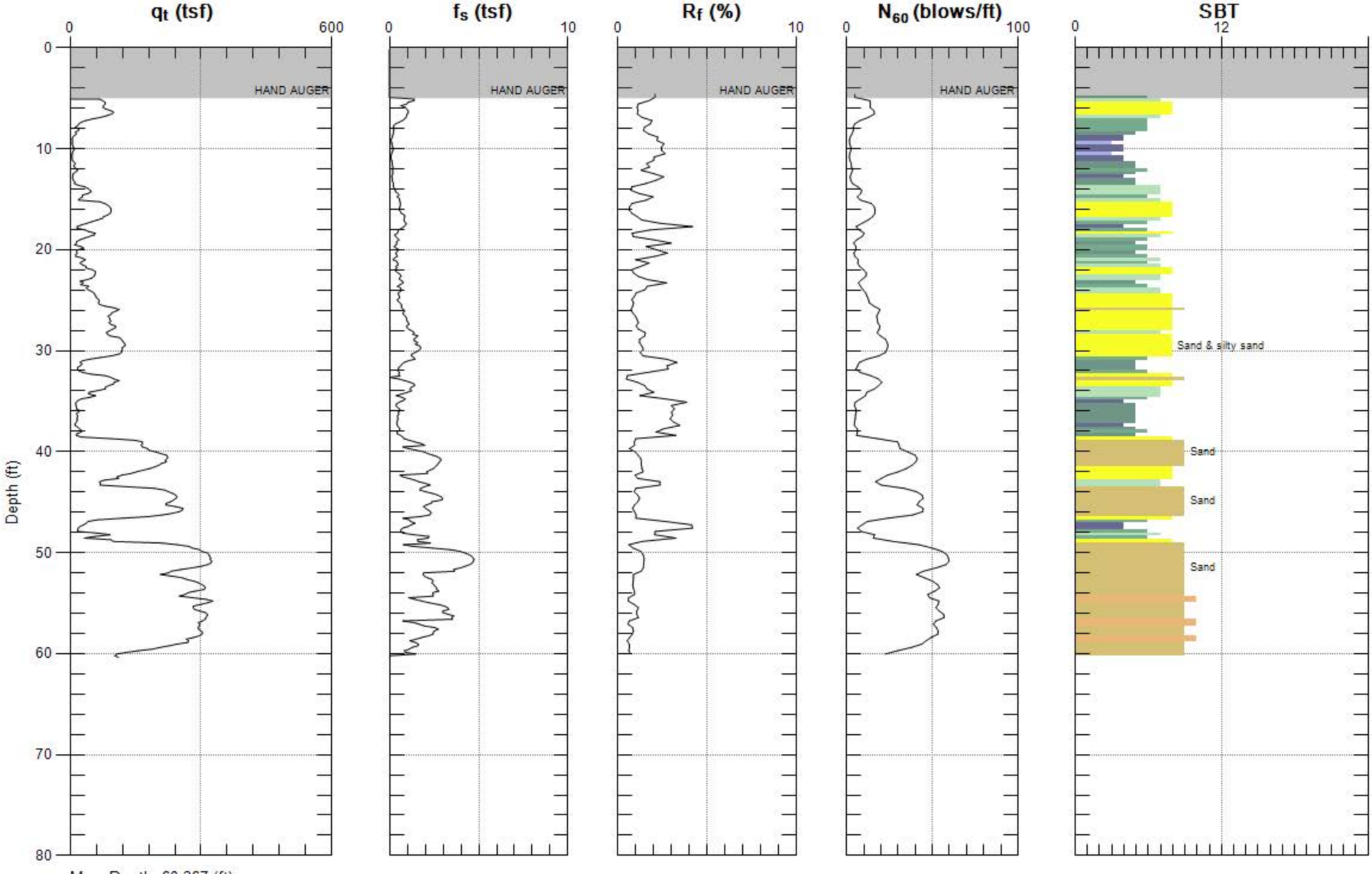
Copies of ASTM Standards are available through www.astm.org

LEIGHTON

Site: SEAPORT MARINA
Sounding: CPT-17

Engineer: C.DELGADILLO
Date: 11/4/16 11:17



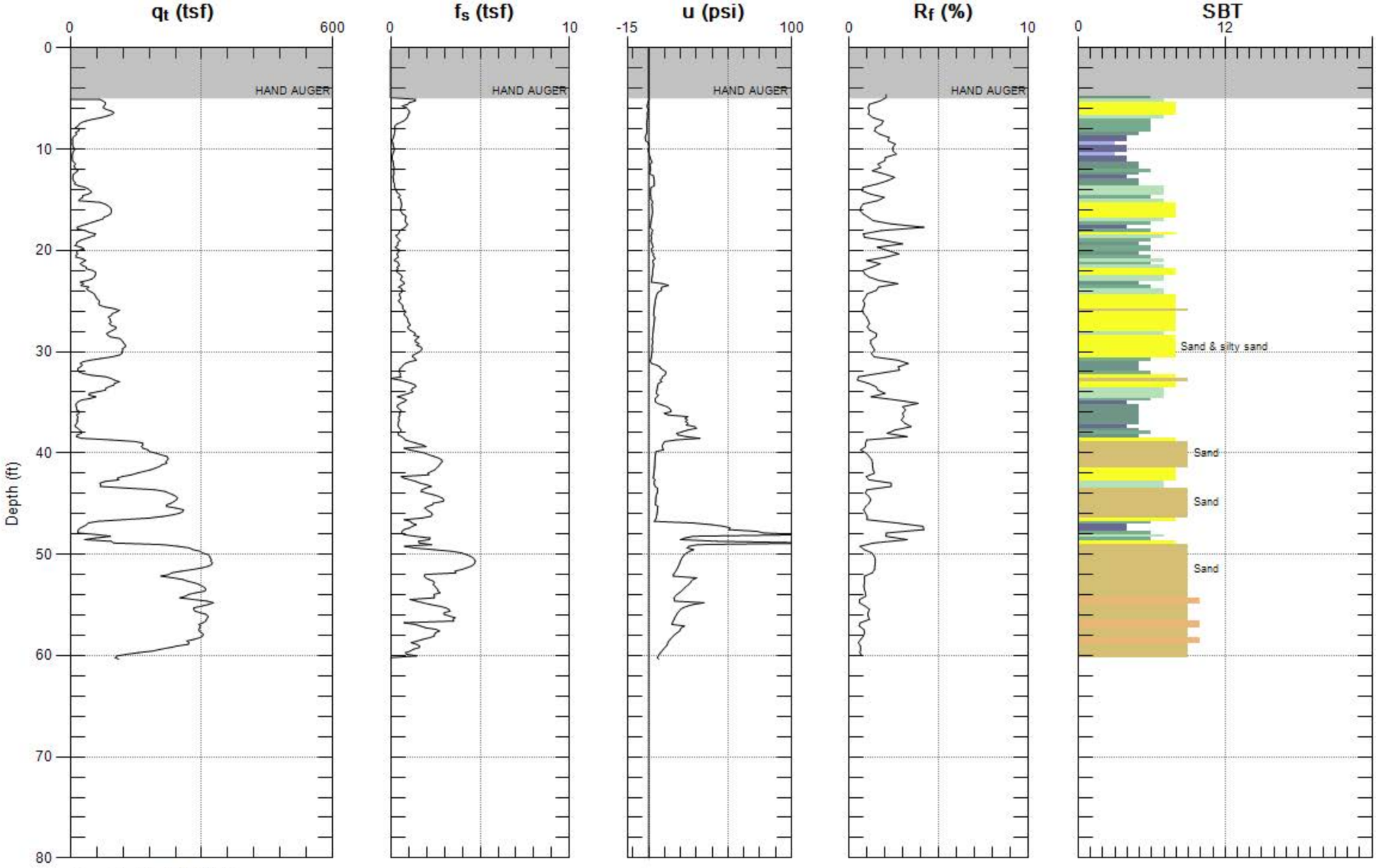
Max. Depth: 60.367 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

LEIGHTON

Site: SEAPORT MARINA
Sounding: CPT-17

Engineer: C.DELGADILLO
Date: 11/4/16 11:17



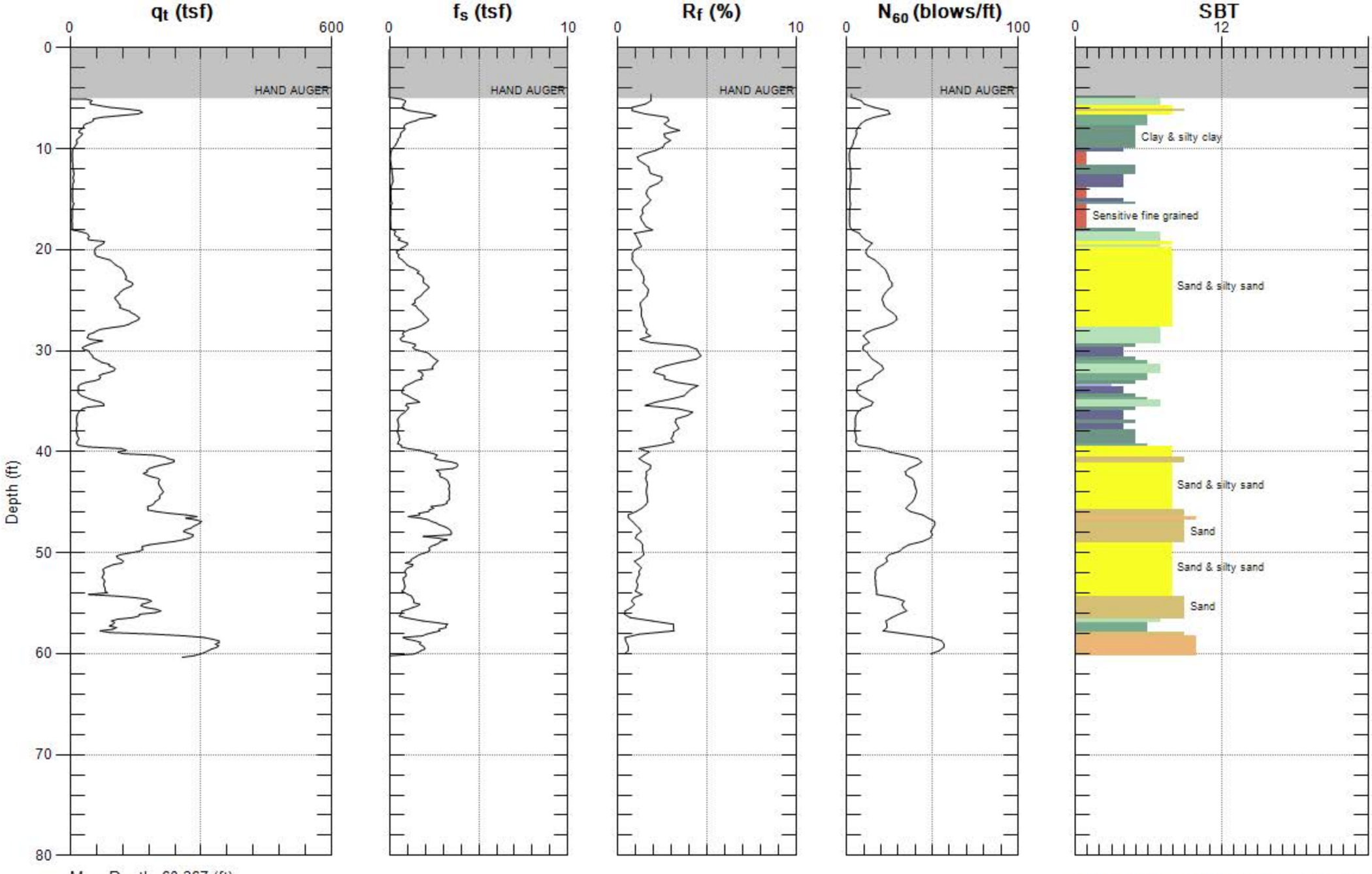
Max. Depth: 60.367 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

LEIGHTON

Site: SEAPORT MARINA
Sounding: CPT-18

Engineer: C.DELGADILLO
Date: 11/4/16 10:10



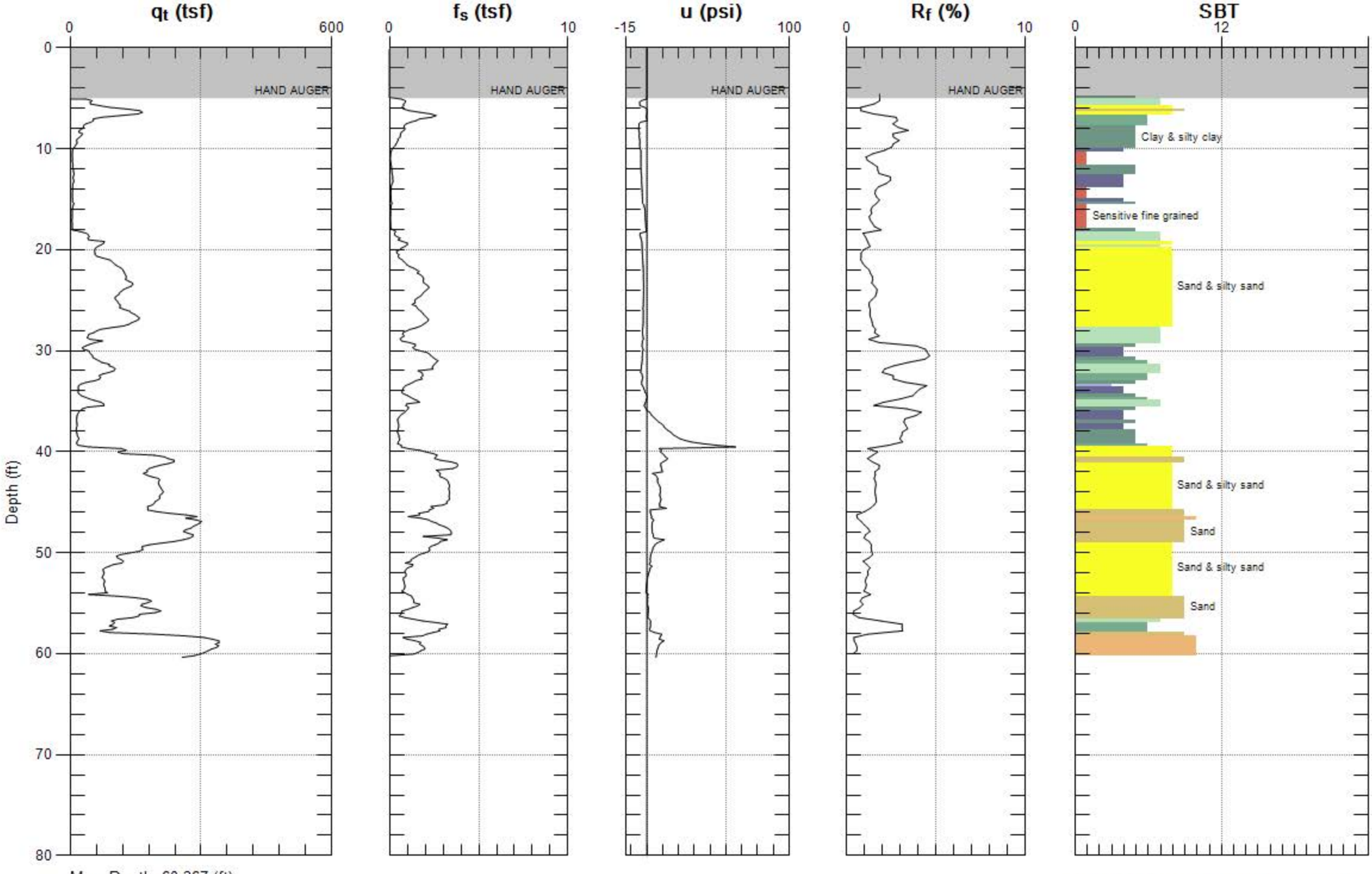
Max. Depth: 60.367 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

LEIGHTON

Site: SEAPORT MARINA
Sounding: CPT-18

Engineer: C.DELGADILLO
Date: 11/4/16 10:10



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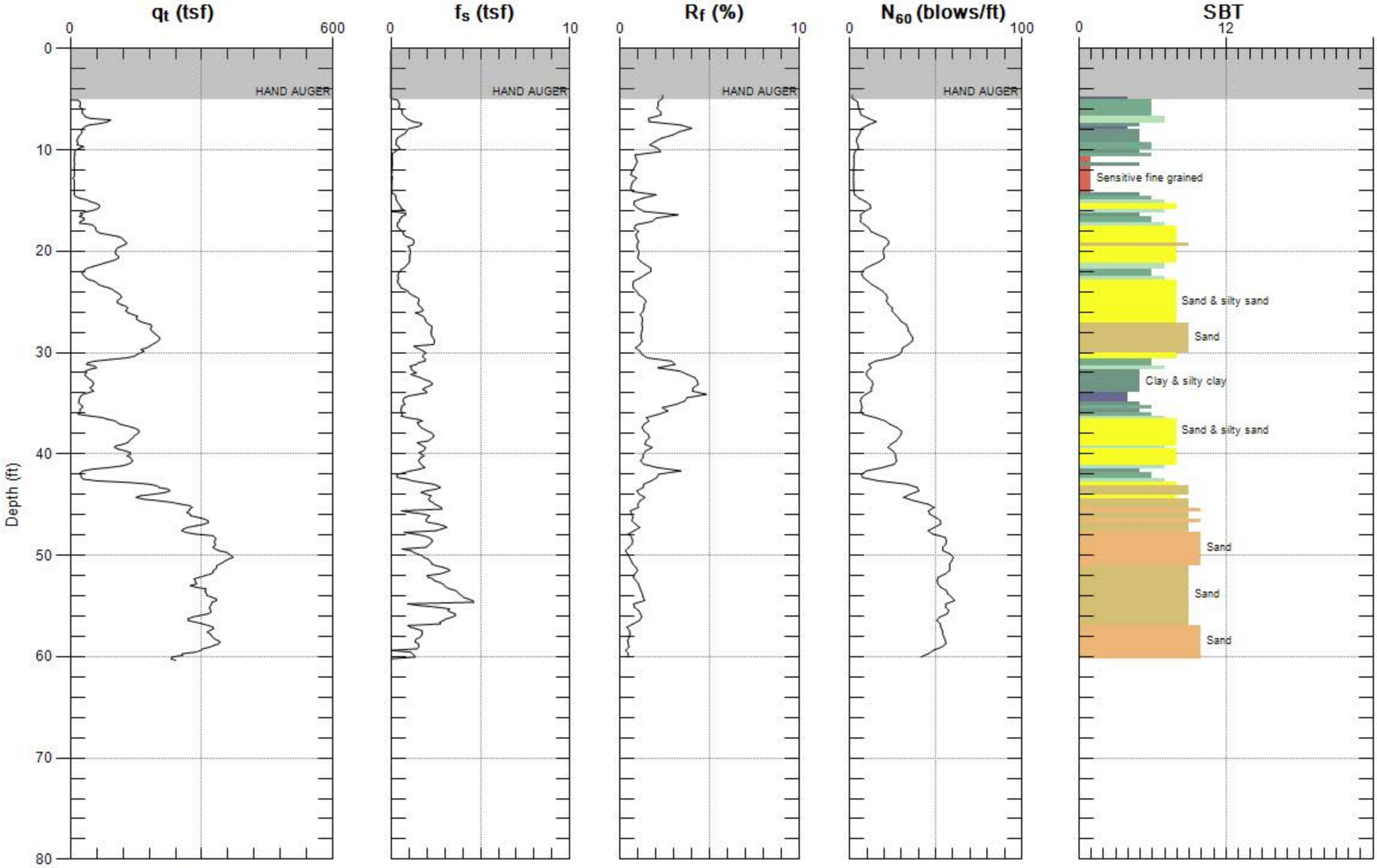
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

LEIGHTON

Site: SEAPORT MARINA
Sounding: CPT-19

Engineer: C.DELGADILLO
Date: 11/4/16 08:37



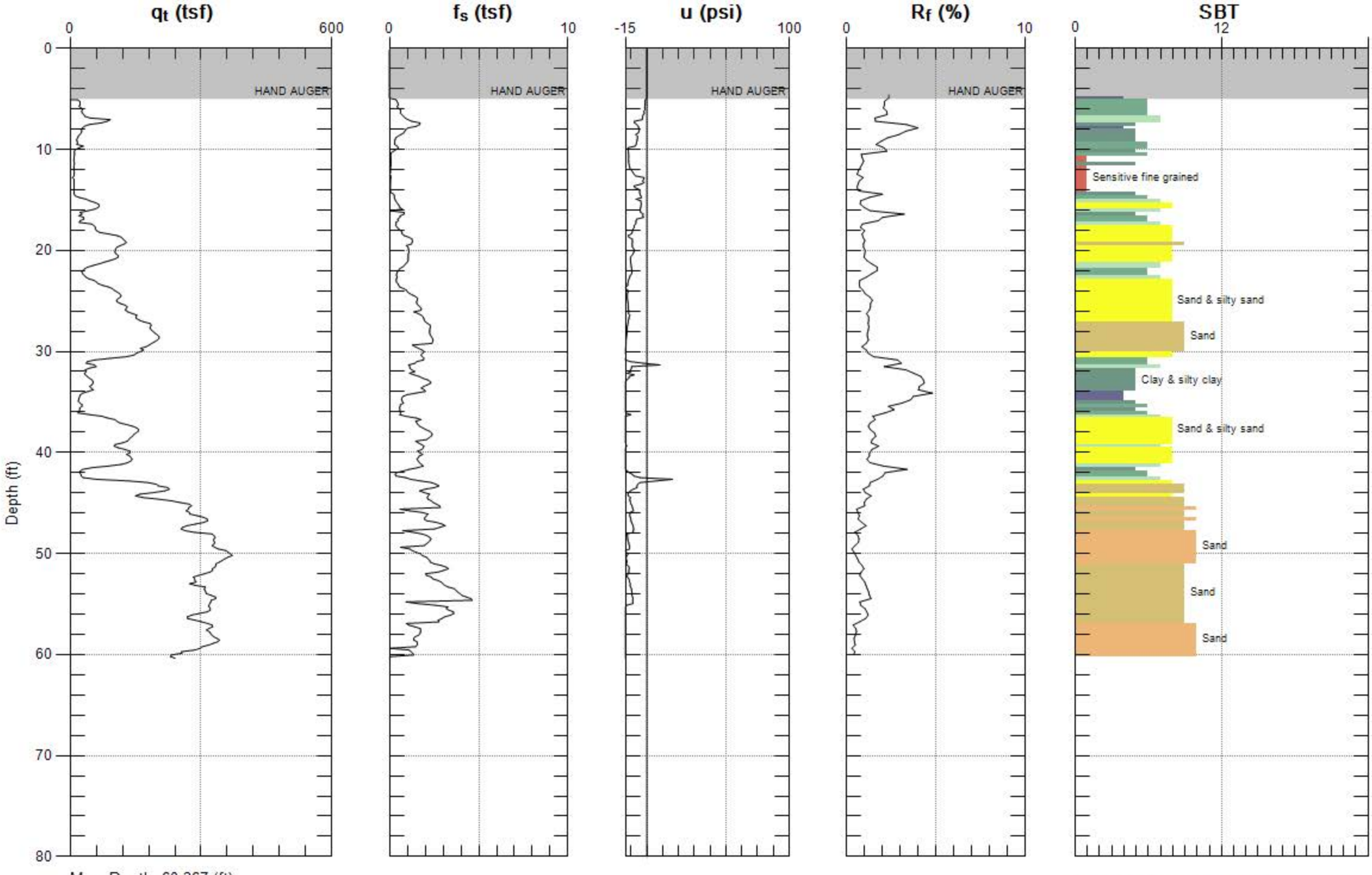
Max. Depth: 60.367 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

LEIGHTON

Site: SEAPORT MARINA
Sounding: CPT-19

Engineer: C.DELGADILLO
Date: 11/4/16 08:37



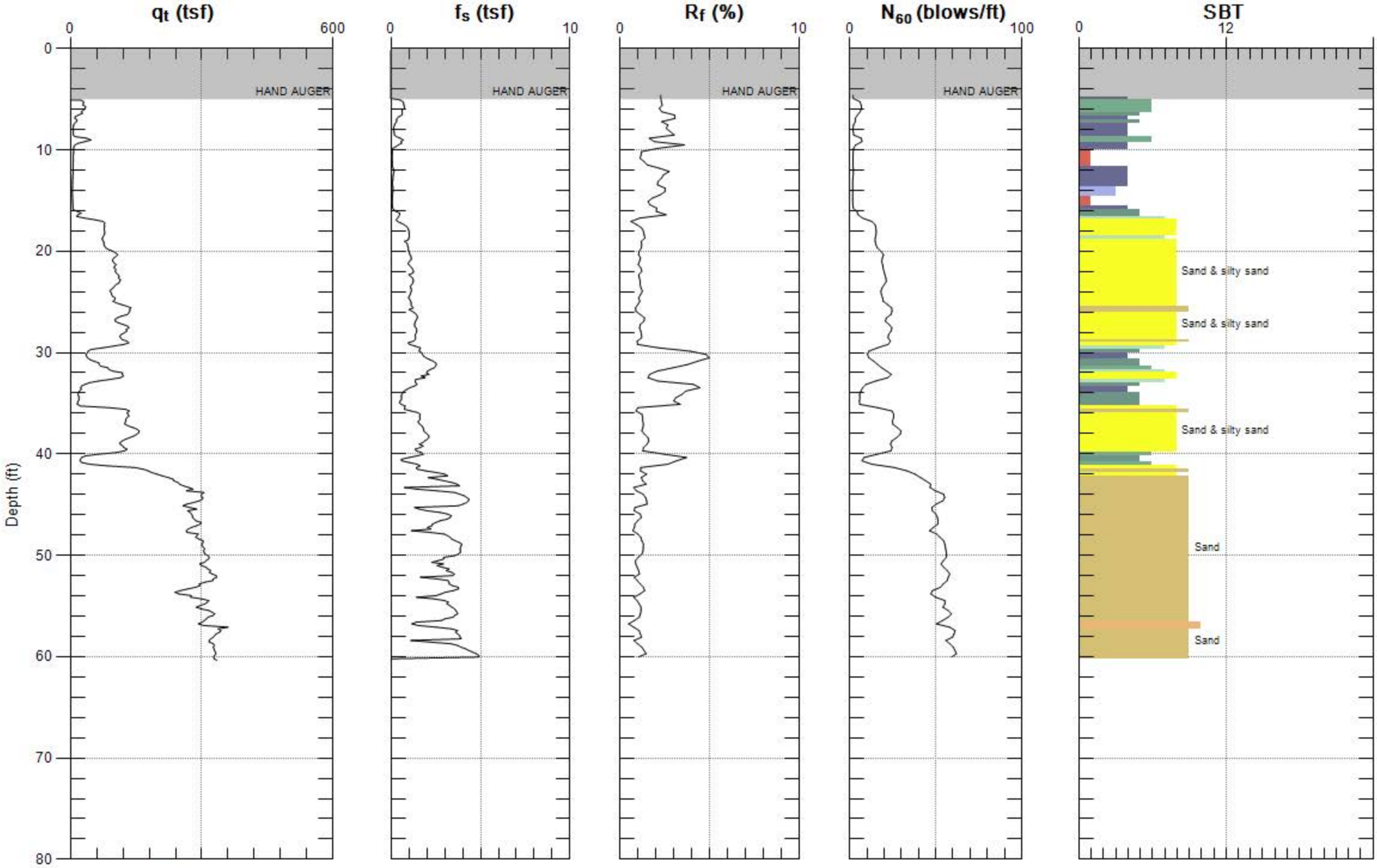
Max. Depth: 60.367 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

LEIGHTON

Site: SEAPORT MARINA
Sounding: CPT-20

Engineer: C.DELGADILLO
Date: 11/4/16 09:23



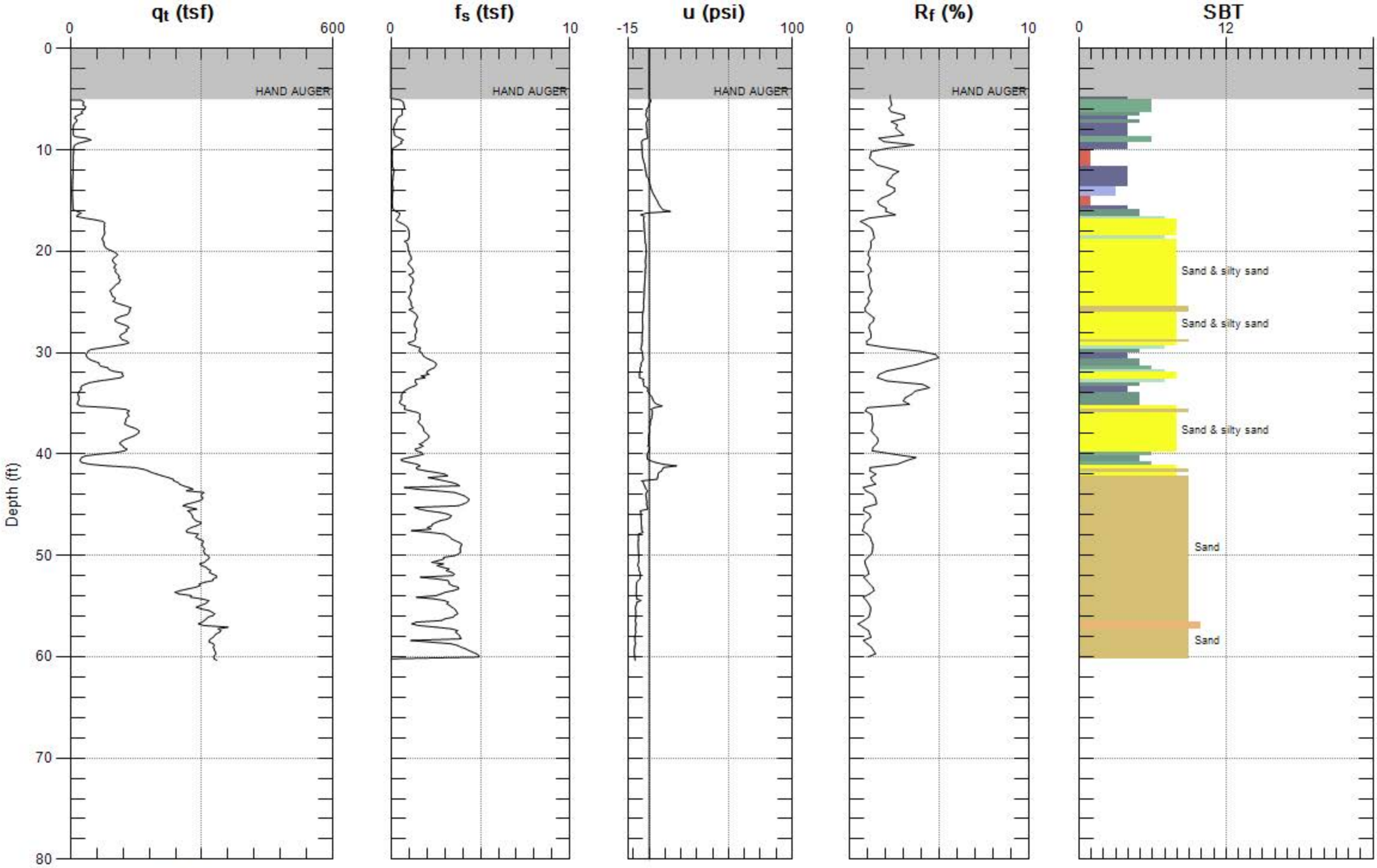
Max. Depth: 60.367 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

LEIGHTON

Site: SEAPORT MARINA
Sounding: CPT-20

Engineer: C.DELGADILLO
Date: 11/4/16 09:23



Max. Depth: 60.367 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

APPENDIX C

LABORATORY TEST RESULTS

Leighton

Boring No.	LB-1	LB-1	LB-1	LB-1	LB-2	LB-2	LB-2	LB-2
Sample No.	S-5	S-6	S-8	S-10	R-3	S-5B	S-7	R-9
Depth (ft.)	25.0	30.0	40.0	46.5	15.0	26-26.5	35.0	45.0
Sample Type	SPT	SPT	SPT	SPT	Ring	SPT	SPT	Ring
Soil Identification	Dark gray silty sand (SM)	Gray silty sand (SM)	Dark gray silty sand (SM)	Dark gray poorly-graded sand with silt (SP-SM)	Dark gray silt (ML)	Very dark gray silty sand (SM), trace shells noted	Very dark gray silty sand (SM)	Olive gray silty sand (SM)
Moisture Correction								
Wet Weight of Soil + Container (g)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dry Weight of Soil + Container (g)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Weight of Container (g)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Moisture Content (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sample Dry Weight Determination								
Weight of Sample + Container (g)	894.3	643.3	614.3	971.6	444.5	606.4	852.6	553.7
Weight of Container (g)	109.0	109.1	108.7	107.8	233.1	161.0	108.8	249.1
Weight of Dry Sample (g)	785.3	534.2	505.6	863.8	211.4	445.4	743.8	304.6
Container No.:								
After Wash								
Method (A or B)	B	B	B	B	B	B	B	B
Dry Weight of Sample + Cont. (g)	757.0	458.3	527.9	906.7	263.2	421.7	696.5	465.9
Weight of Container (g)	109.0	109.1	108.7	107.8	233.1	161.0	108.8	249.1
Dry Weight of Sample (g)	648.0	349.2	419.2	798.9	30.1	260.7	587.7	216.8
% Passing No. 200 Sieve	**17.5**	**34.6**	**17.1**	**7.5**	**85.8**	**41.5**	**21.0**	**28.8**
% Retained No. 200 Sieve	82.5	65.4	82.9	92.5	14.2	58.5	79.0	71.2

Leighton

PERCENT PASSING
No. 200 SIEVE
ASTM D 1140

Project Name: CenterCal/2nd & PCH
Project No.: 11232.001
Client Name: CenterCal Properties, LLC
Tested By: SF/GB Date: 02/09/16

Boring No.	LB-2	LB-2						
Sample No.	R-11	S-14						
Depth (ft.)	50.0	65.0						
Sample Type	SPT	SPT						
Soil Identification	Gray silty sand (SM)	Gray poorly-graded sand with silt (SP-SM)						
Moisture Correction								
Wet Weight of Soil + Container (g)	0.0	0.0						
Dry Weight of Soil + Container (g)	0.0	0.0						
Weight of Container (g)	1.0	1.0						
Moisture Content (%)	0.0	0.0						
Sample Dry Weight Determination								
Weight of Sample + Container (g)	622.0	976.1						
Weight of Container (g)	108.9	107.1						
Weight of Dry Sample (g)	513.1	869.0						
Container No.:								
After Wash								
Method (A or B)	B	B						
Dry Weight of Sample + Cont. (g)	539.5	874.7						
Weight of Container (g)	108.9	107.1						
Dry Weight of Sample (g)	430.6	767.6						
% Passing No. 200 Sieve	**16.1**	**11.7**						
% Retained No. 200 Sieve	83.9	88.3						

Leighton

PERCENT PASSING
No. 200 SIEVE
ASTM D 1140

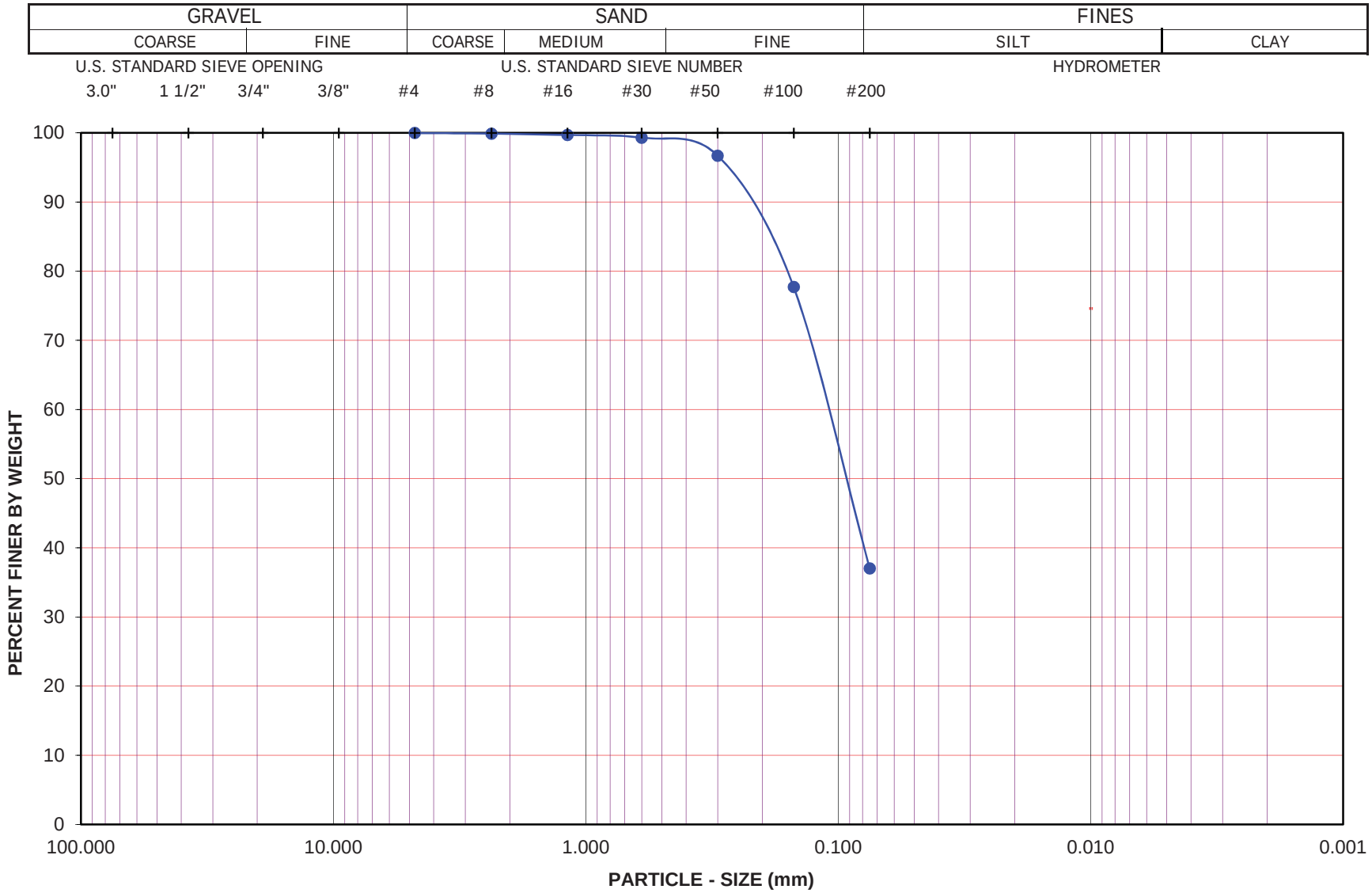
Project Name: CenterCal/2nd & PCH
Project No.: 11232.001
Client Name: CenterCal Properties, LLC
Tested By: S. Felter Date: 02/09/16

Boring No.	LB-3	LB-3	LB-3					
Sample No.	S-6	S-11	S-13					
Depth (ft.)	20.0	45.0	55.0					
Sample Type	SPT	SPT	SPT					
Soil Identification	Olive sandy silt s(ML)	Olive poorly-graded sand with silt (SP-SM)	Olive poorly-graded sand with silt (SP-SM)					
Moisture Correction								
Wet Weight of Soil + Container (g)	0.0	0.0	0.0					
Dry Weight of Soil + Container (g)	0.0	0.0	0.0					
Weight of Container (g)	1.0	1.0	1.0					
Moisture Content (%)	0.0	0.0	0.0					
Sample Dry Weight Determination								
Weight of Sample + Container (g)	677.4	803.1	681.3					
Weight of Container (g)	238.3	248.8	221.4					
Weight of Dry Sample (g)	439.1	554.3	459.9					
Container No.:								
After Wash								
Method (A or B)	B	B	B					
Dry Weight of Sample + Cont. (g)	440.9	772.5	640.3					
Weight of Container (g)	238.3	248.8	221.4					
Dry Weight of Sample (g)	202.6	523.7	418.9					
% Passing No. 200 Sieve	**53.9**	**5.5**	**8.9**					
% Retained No. 200 Sieve	46.1	94.5	91.1					

Leighton

PERCENT PASSING
No. 200 SIEVE
ASTM D 1140

Project Name: CenterCal/LB Whole Foods Market
Project No.: 11232.002
Client Name: CenterCal Properties, LLC
Tested By: A. Santos Date: 11/11/16



Project Name: CenterCal/2nd & PCH

Project No.: 11232.001

Boring No.: P-1 Sample No.: B-1

Depth (feet): 1-5 Soil Type : SM

Soil Identification: Olive brown silty sand (SM)

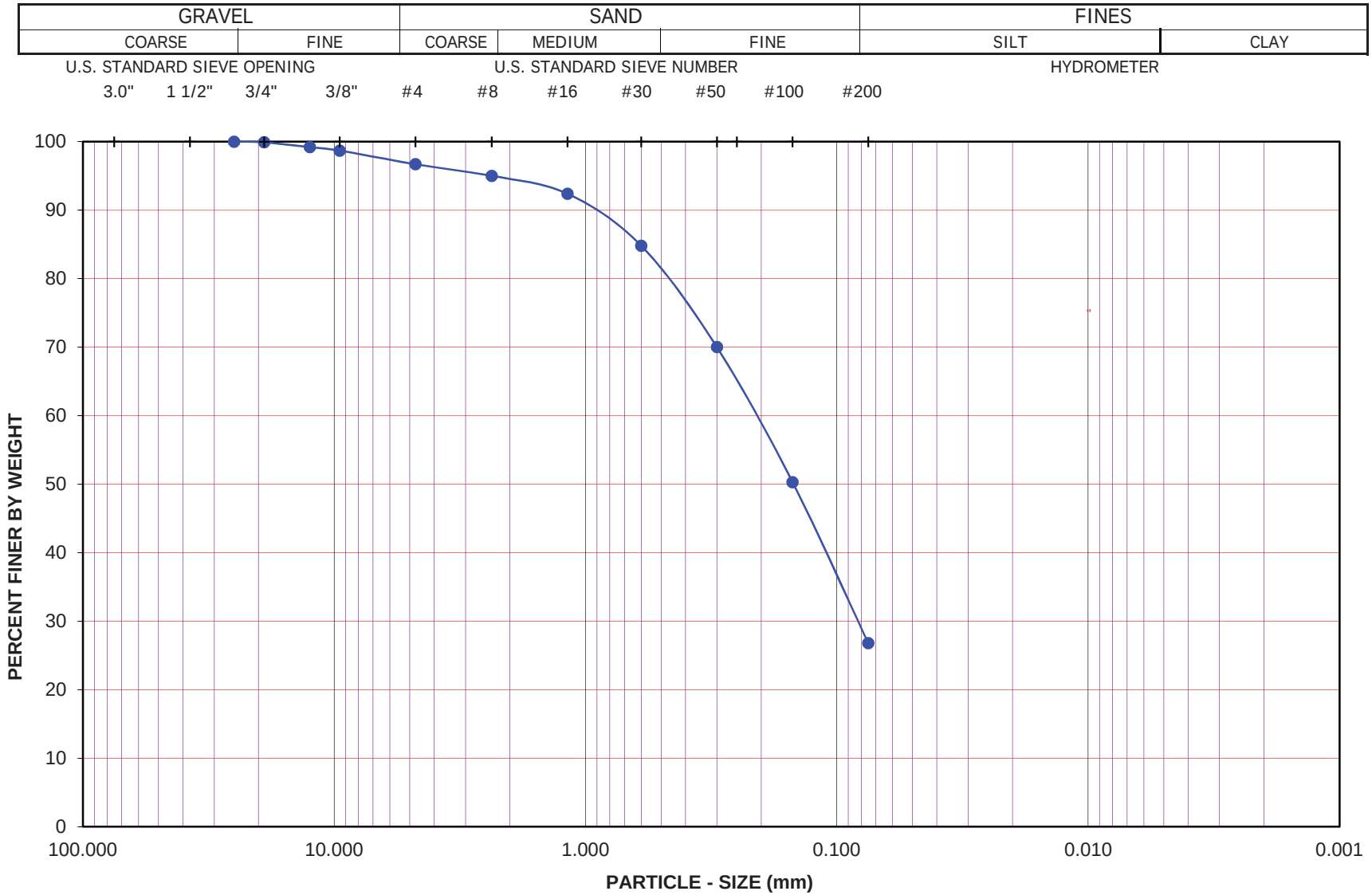
GR:SA:FI : (%) 0 : 63 : 37

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 6913

02/23/16

SA P-1, B-1 @ 1-5



Project Name: CenterCal/2nd & PCH

Project No.: 11232.001

Boring No.: P-2 Sample No.: B-1

Depth (feet): 1-5 Soil Type : SM

Soil Identification: Olive brown silty sand (SM), shells noted

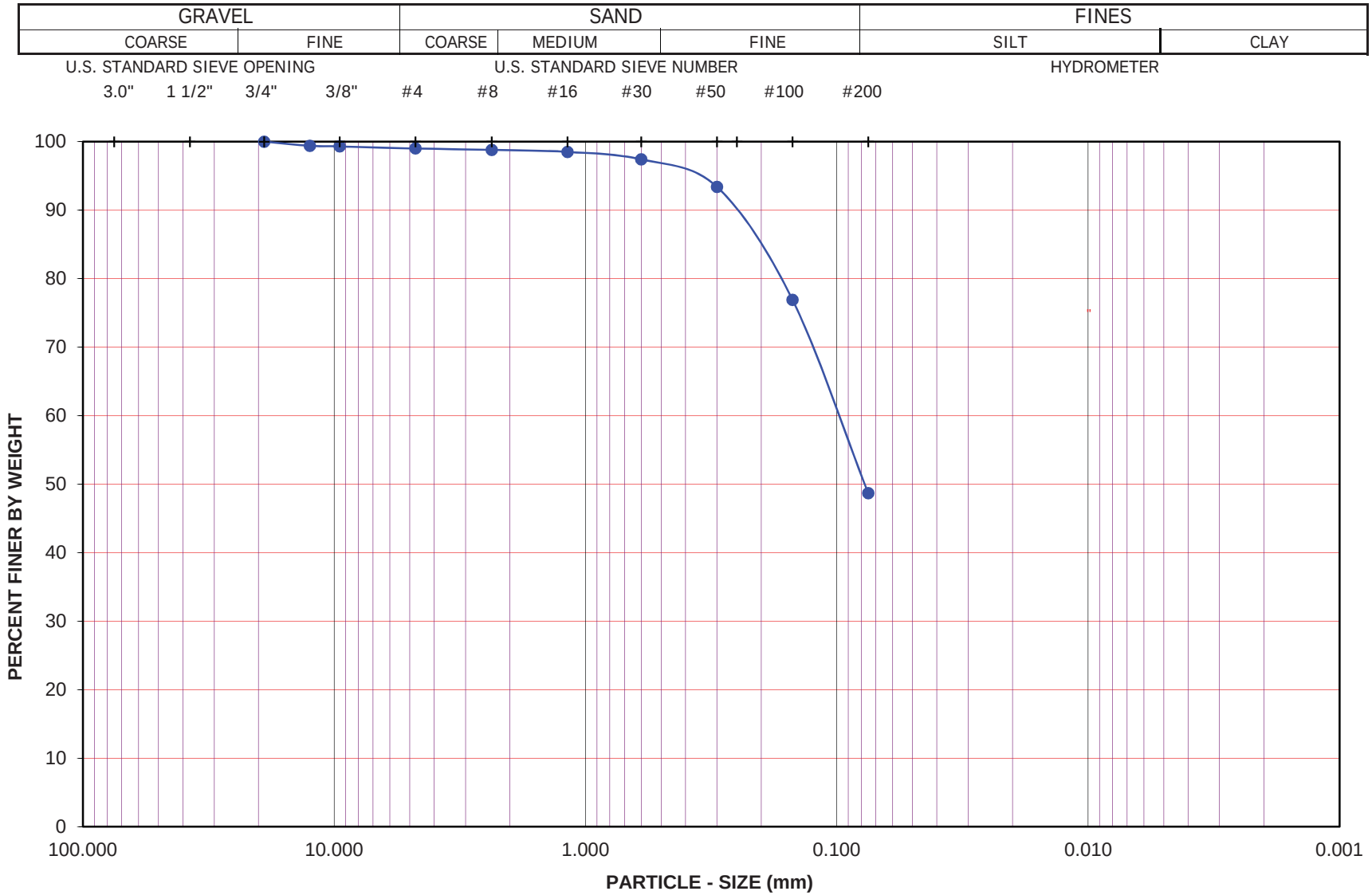
GR:SA:FI : (%) 3 : 70 : 27

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 6913

02/23/16

SA P-2, B-1 @ 1-5



Project Name: CenterCal/2nd & PCH

Project No.: 11232.001

Boring No.: P-3

Sample No.: B-1

Depth (feet): 0-5

Soil Type : SM

Soil Identification: Dark olive brown silty sand (SM)

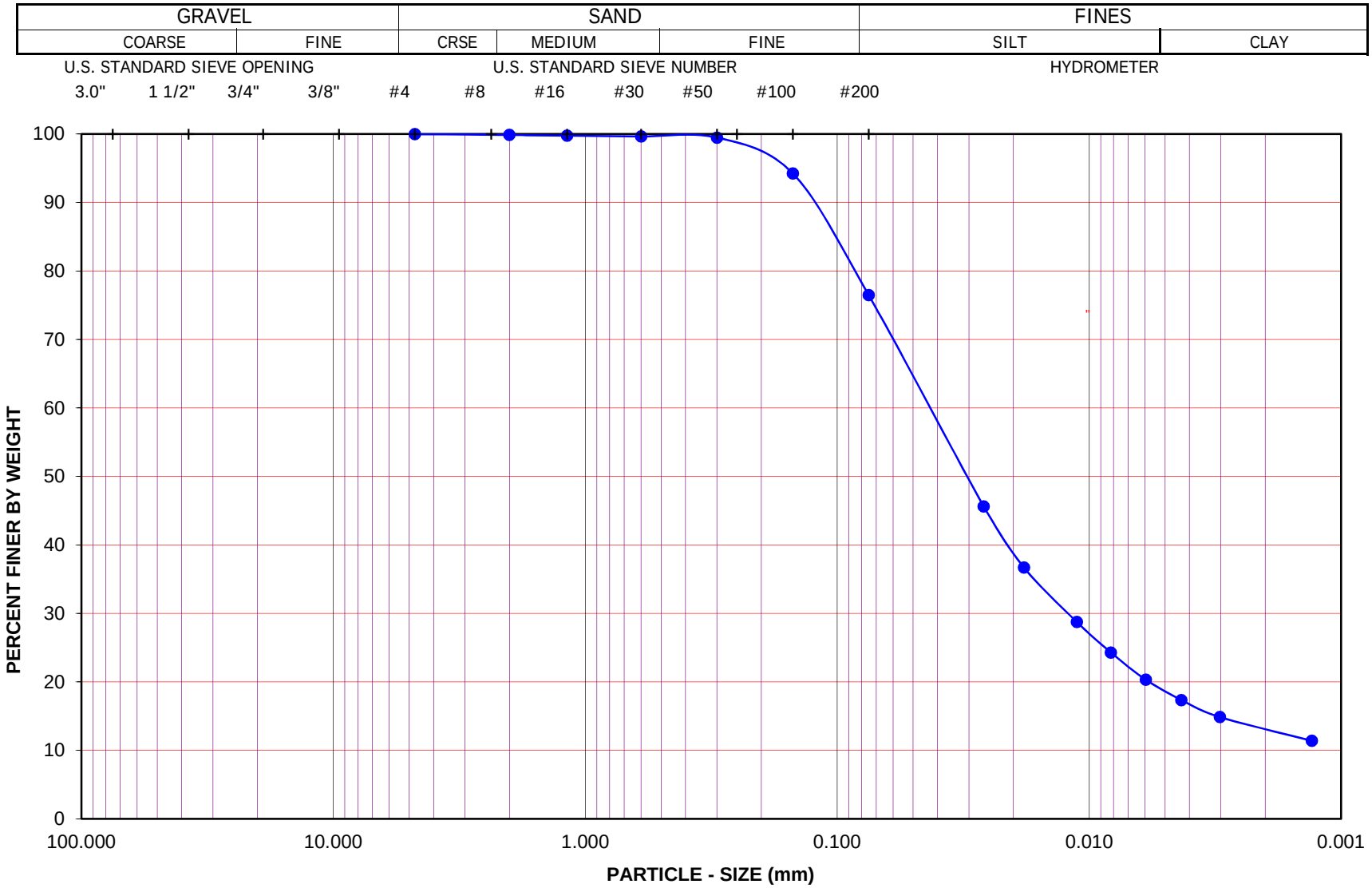
GR:SA:FI : (%) 1 : 50 : 49

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 6913

02/23/16

SA P-3, B-1 @ 0-5



Project Name: CenterCal/LB Whole Foods Market

Project No.: 11232.002

Boring No.: LB-3 Sample No.: S-8

Depth (feet): 30.0 Soil Type : (CL)s

Soil Identification: Dark olive gray lean clay with sand (CL)s

GR:SA:FI : (%) 0 : 24 : 76

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Nov-16

SA & Hyd LB-3, S-8 @ 30

Leighton

ATTERBERG LIMITS

ASTM D 4318

Project Name:	CenterCal/2nd & PCH	Tested By:	A. Santos	Date:	02/21/16
Project No. :	11232.001	Input By:	J. Ward	Date:	02/23/16
Boring No.:	LB-1	Checked By:	J. Ward		
Sample No.:	R-2	Depth (ft.)	10.0		
Soil Identification:	Gray fat clay (CH)				

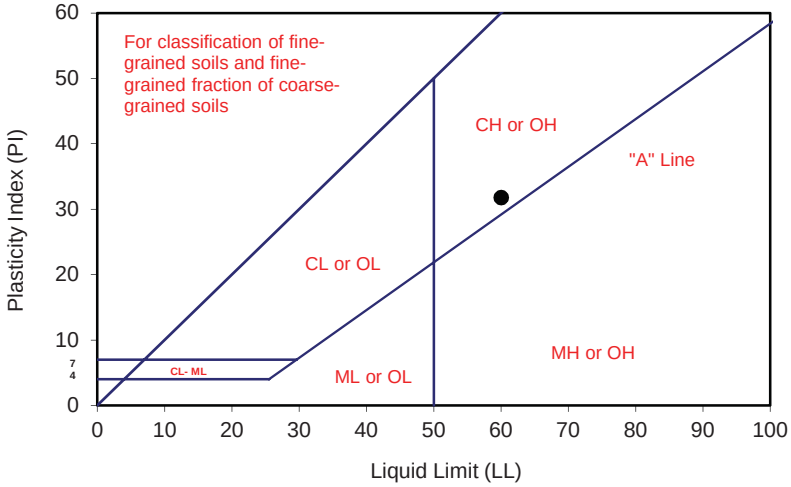
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			33	25	19	
Wet Wt. of Soil + Cont. (g)	9.53	8.66	20.46	22.93	23.53	
Dry Wt. of Soil + Cont. (g)	7.66	7.00	13.39	14.75	14.94	
Wt. of Container (g)	1.08	1.07	1.08	1.03	1.08	
Moisture Content (%) [Wn]	28.42	27.99	57.43	59.62	61.98	

Liquid Limit	**60**
Plastic Limit	**28**
Plasticity Index	**32**
Classification	**CH**

PI at "A" - Line = 0.73(LL-20) 29.2

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.121}$



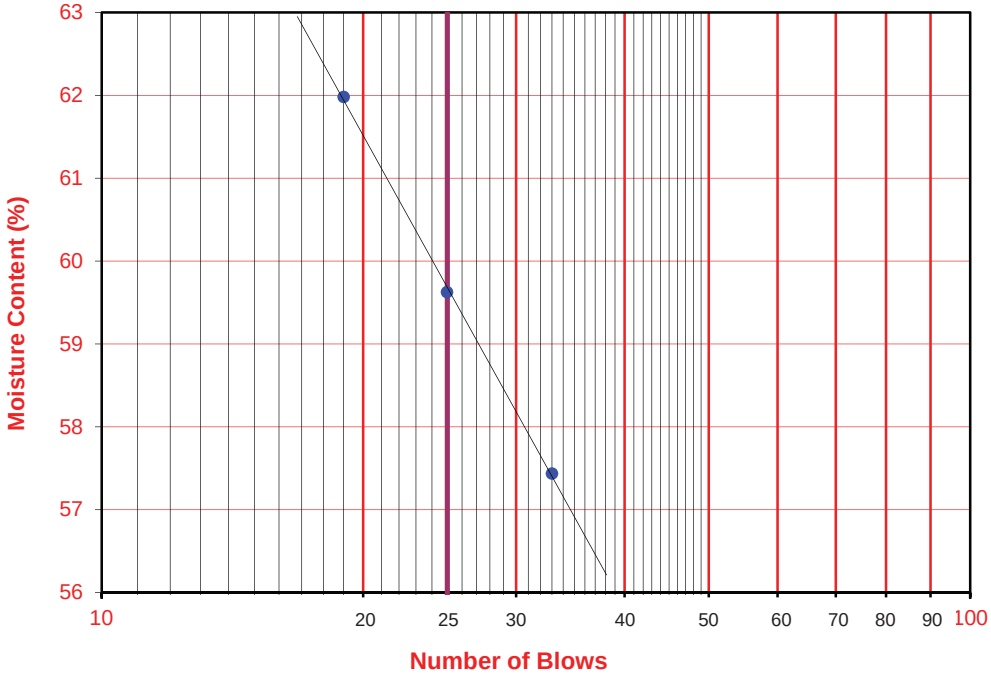
PROCEDURES USED

[ ] Wet Preparation
Multipoint - Wet

[X] Dry Preparation
Multipoint - Dry

[X] Procedure A
Multipoint Test

[ ] Procedure B
One-point Test



Leighton

ATTERBERG LIMITS

ASTM D 4318

Project Name:	CenterCal/2nd & PCH	Tested By:	S. Felter	Date:	02/15/16
Project No. :	11232.001	Input By:	J. Ward	Date:	02/23/16
Boring No.:	LB-1	Checked By:	J. Ward		
Sample No.:	R-3	Depth (ft.)	15.0		
Soil Identification:	Dark gray silty sand (SM)				

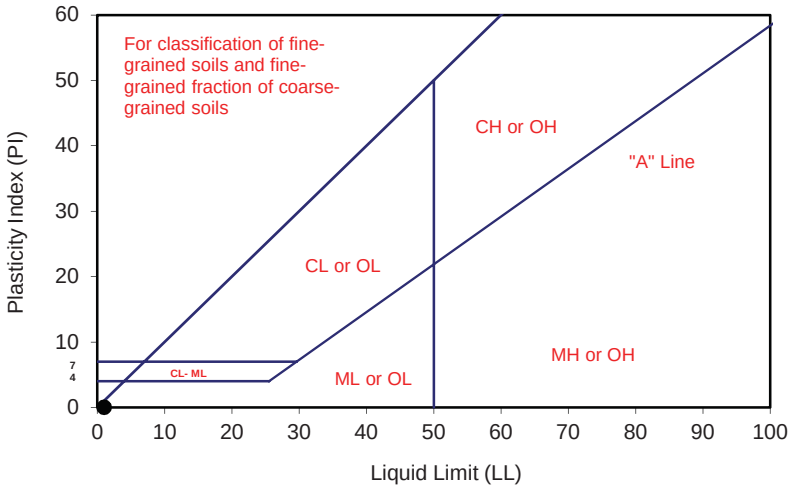
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			4			
Wet Wt. of Soil + Cont. (g)	**Cannot be rolled:**		41.37	**Cannot get more than 4 blows:**		
Dry Wt. of Soil + Cont. (g)	**NonPlastic**		34.75	**NonPlastic**		
Wt. of Container (g)			13.60			
Moisture Content (%) [Wn]			31.30			

Liquid Limit	**NP**
Plastic Limit	**NP**
Plasticity Index	**NP**
Classification	**NP**

PI at "A" - Line = 0.73(LL-20) =

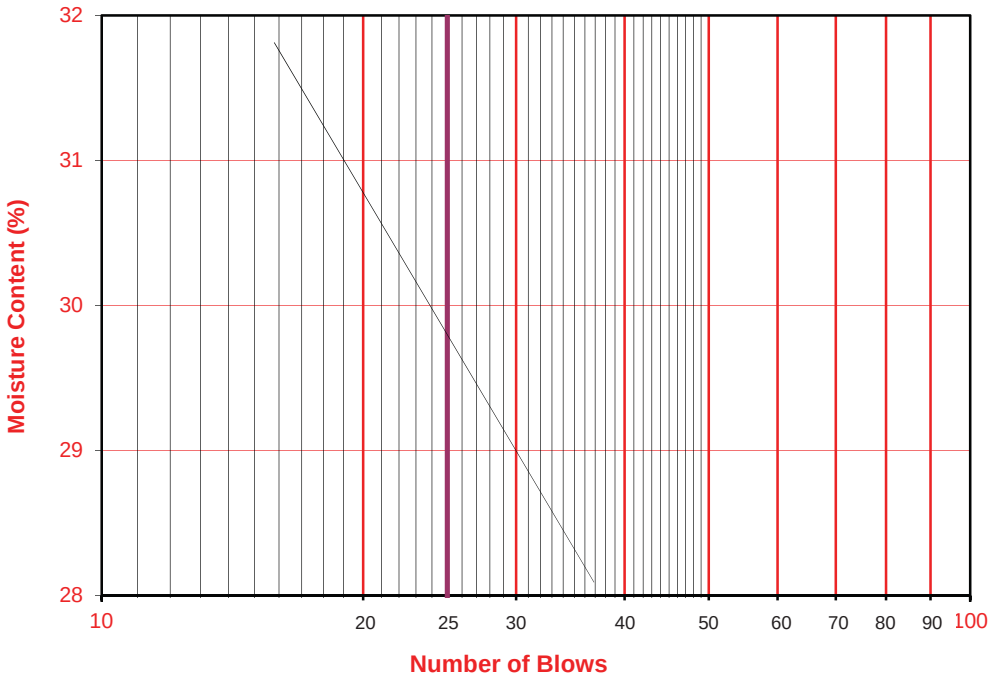
One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.121}$



PROCEDURES USED

- [ ] Wet Preparation
  Multipoint - Wet
- [x] Dry Preparation
  Multipoint - Dry
- [x] Procedure A
  Multipoint Test
- [ ] Procedure B
  One-point Test



Leighton

ATTERBERG LIMITS

ASTM D 4318

Project Name:	CenterCal/2nd & PCH	Tested By:	A. Santos	Date:	02/21/16
Project No. :	11232.001	Input By:	J. Ward	Date:	02/23/16
Boring No.:	LB-2	Checked By:	J. Ward		
Sample No.:	R-2	Depth (ft.)	10.0		
Soil Identification:	Gray silt (ML)				

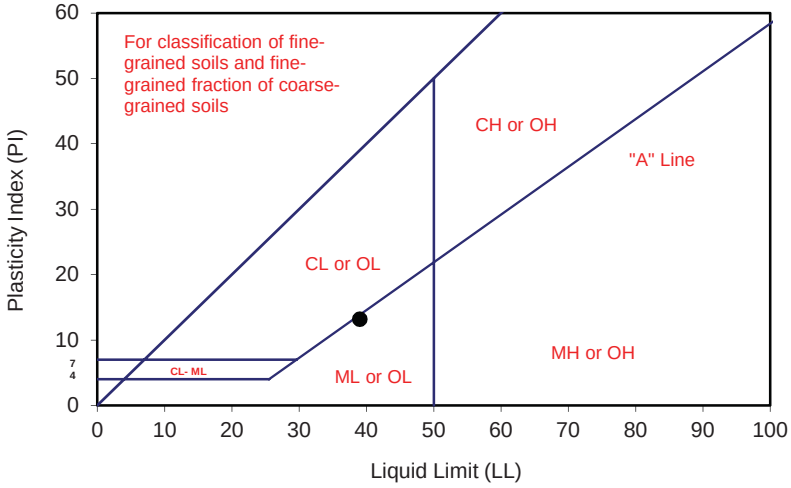
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			28	23	18	
Wet Wt. of Soil + Cont. (g)	11.31	10.48	23.90	22.70	20.59	
Dry Wt. of Soil + Cont. (g)	9.22	8.54	17.48	16.55	14.95	
Wt. of Container (g)	1.09	1.05	1.06	1.02	1.06	
Moisture Content (%) [Wn]	25.71	25.90	39.10	39.60	40.60	

Liquid Limit	**39**
Plastic Limit	**26**
Plasticity Index	**13**
Classification	**ML**

PI at "A" - Line = 0.73(LL-20) 13.87

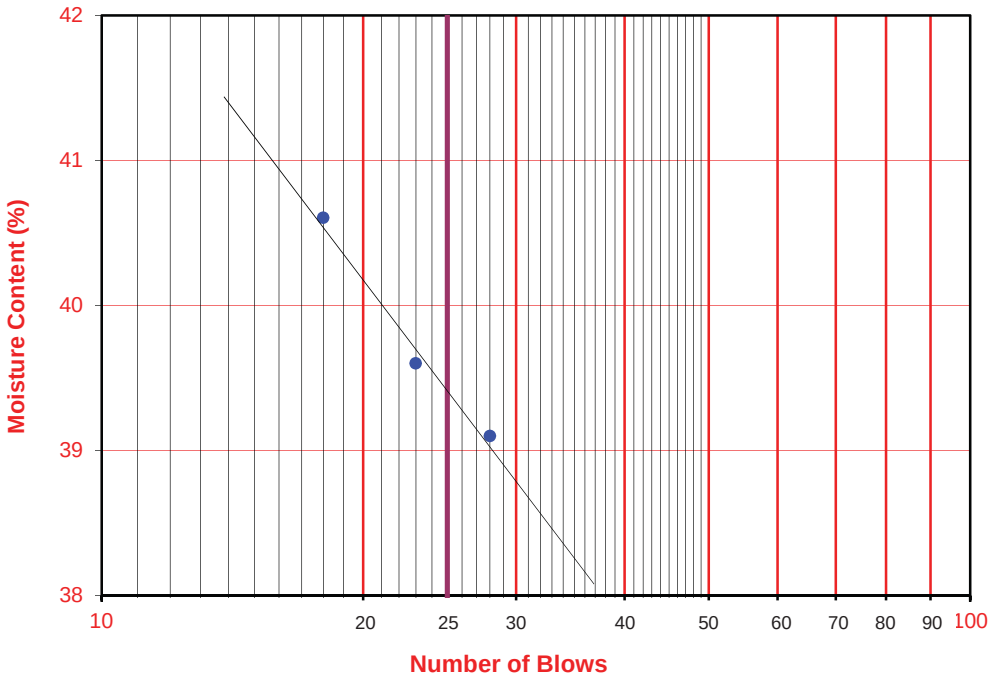
One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.121}$



PROCEDURES USED

- [ ] Wet Preparation
  Multipoint - Wet
- [x] Dry Preparation
  Multipoint - Dry
- [x] Procedure A
  Multipoint Test
- [ ] Procedure B
  One-point Test



Leighton

ATTERBERG LIMITS

ASTM D 4318

Project Name:	CenterCal/2nd & PCH	Tested By:	S. Felter	Date:	02/15/16
Project No. :	11232.001	Input By:	J. Ward	Date:	02/23/16
Boring No.:	LB-2	Checked By:	J. Ward		
Sample No.:	R-4	Depth (ft.)	20.0		
Soil Identification:	Dark gray silty sand (SM)				

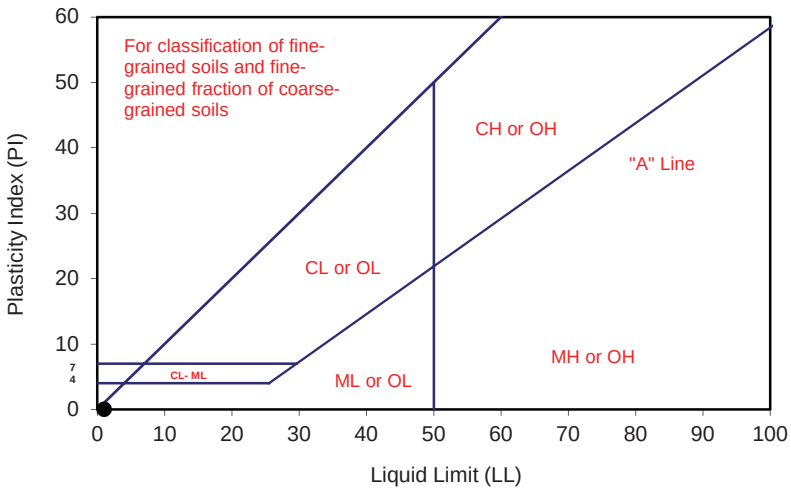
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			5			
Wet Wt. of Soil + Cont. (g)	**Cannot be rolled:**		37.60	**Cannot get more than 5 blows:**		
Dry Wt. of Soil + Cont. (g)	**NonPlastic**		30.86	**NonPlastic**		
Wt. of Container (g)			13.58			
Moisture Content (%) [Wn]			39.00			

Liquid Limit	**NP**
Plastic Limit	**NP**
Plasticity Index	**NP**
Classification	**NP**

PI at "A" - Line = 0.73(LL-20) =

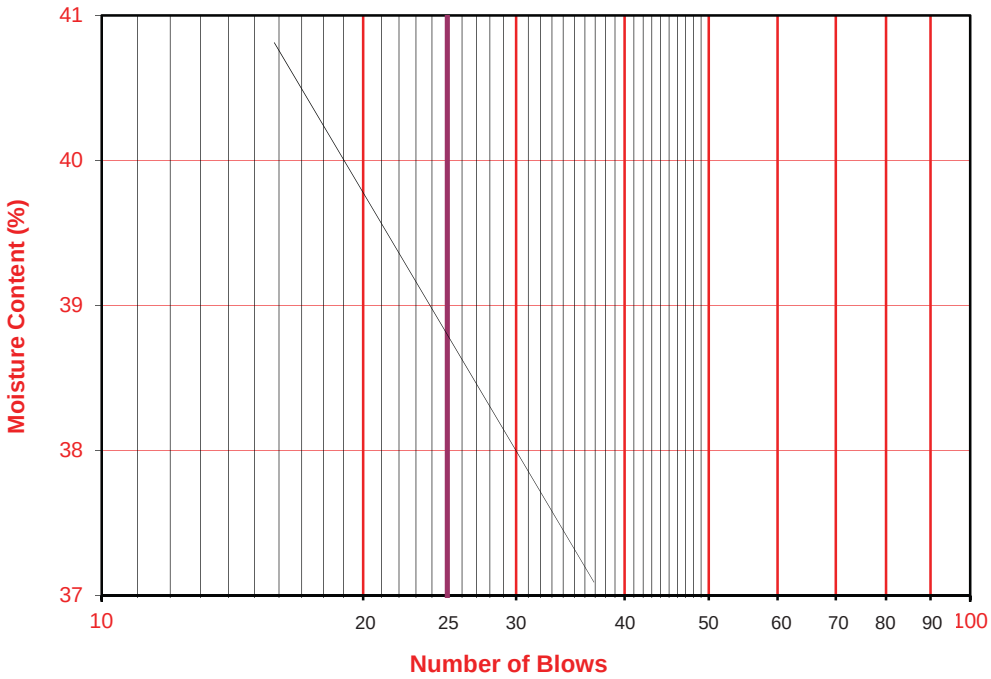
One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.121}$



PROCEDURES USED

- [ ] Wet Preparation
  Multipoint - Wet
- [x] Dry Preparation
  Multipoint - Dry
- [x] Procedure A
  Multipoint Test
- [ ] Procedure B
  One-point Test



ATTERBERG LIMITS

ASTM D 4318

Project Name:	CenterCal/LB Whole Foods Market	Tested By:	G. Bathala	Date:	11/21/16
Project No. :	11232.002	Input By:	J. Ward	Date:	11/28/16
Boring No.:	LB-3	Checked By:	J. Ward		
Sample No.:	T-4	Depth (ft.)	10.0		
Soil Identification:	Olive gray lean clay (CL)				

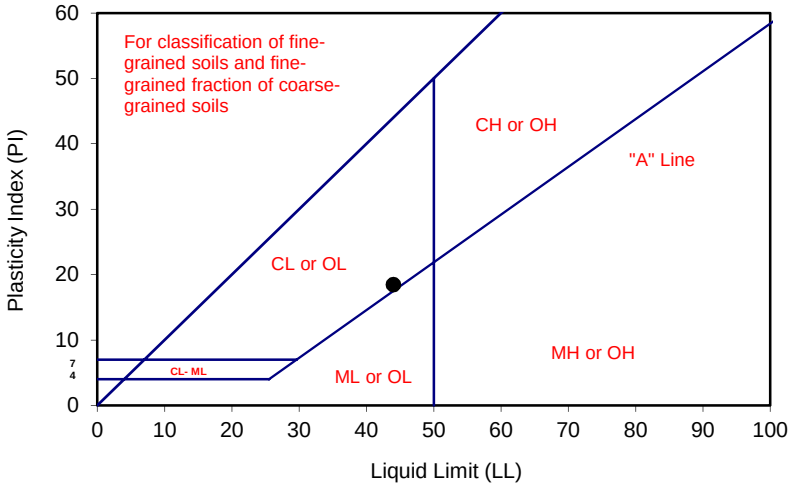
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			35	29	23	17
Wet Wt. of Soil + Cont. (g)	21.09	21.32	25.76	26.54	27.57	28.15
Dry Wt. of Soil + Cont. (g)	19.14	19.36	22.08	22.59	23.27	23.59
Wt. of Container (g)	11.52	11.67	13.53	13.56	13.52	13.44
Moisture Content (%) [Wn]	25.59	25.49	43.04	43.74	44.10	44.93

Liquid Limit	**44**
Plastic Limit	**26**
Plasticity Index	**18**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 17.52

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.121}$



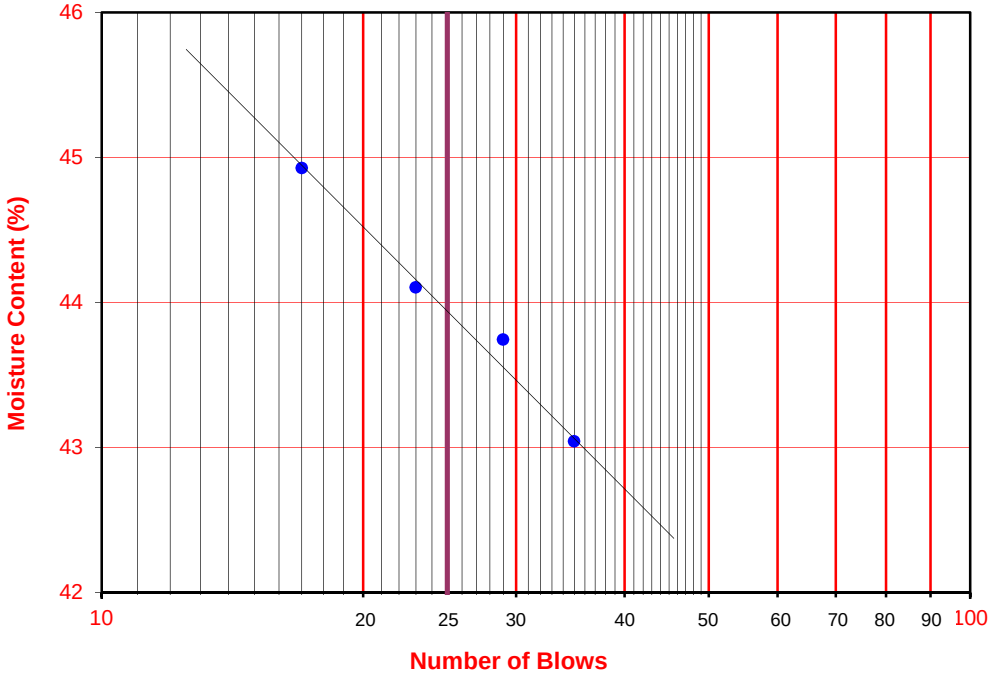
PROCEDURES USED

[ ] Wet Preparation
Multipoint - Wet

[X] Dry Preparation
Multipoint - Dry

[X] Procedure A
Multipoint Test

[ ] Procedure B
One-point Test



Leighton

ATTERBERG LIMITS

ASTM D 4318

Project Name:	CenterCal/LB Whole Foods Market	Tested By:	G. Bathala	Date:	11/22/16
Project No. :	11232.002	Input By:	J. Ward	Date:	11/28/16
Boring No.:	LB-3	Checked By:	J. Ward		
Sample No.:	S-8	Depth (ft.)	30.0		
Soil Identification:	Dark olive gray lean clay with sand (CL)s				

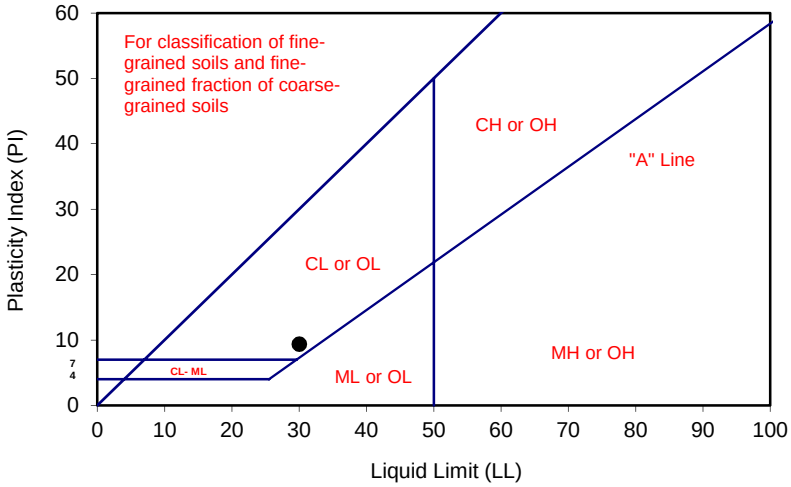
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			31	26	24	15
Wet Wt. of Soil + Cont. (g)	24.85	24.51	28.42	25.86	26.91	25.39
Dry Wt. of Soil + Cont. (g)	22.93	22.62	24.99	23.00	23.77	22.53
Wt. of Container (g)	13.59	13.48	13.48	13.54	13.54	13.48
Moisture Content (%) [Wn]	20.56	20.68	29.80	30.23	30.69	31.60

Liquid Limit	**30**
Plastic Limit	**21**
Plasticity Index	**9**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 7.3

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.121}$



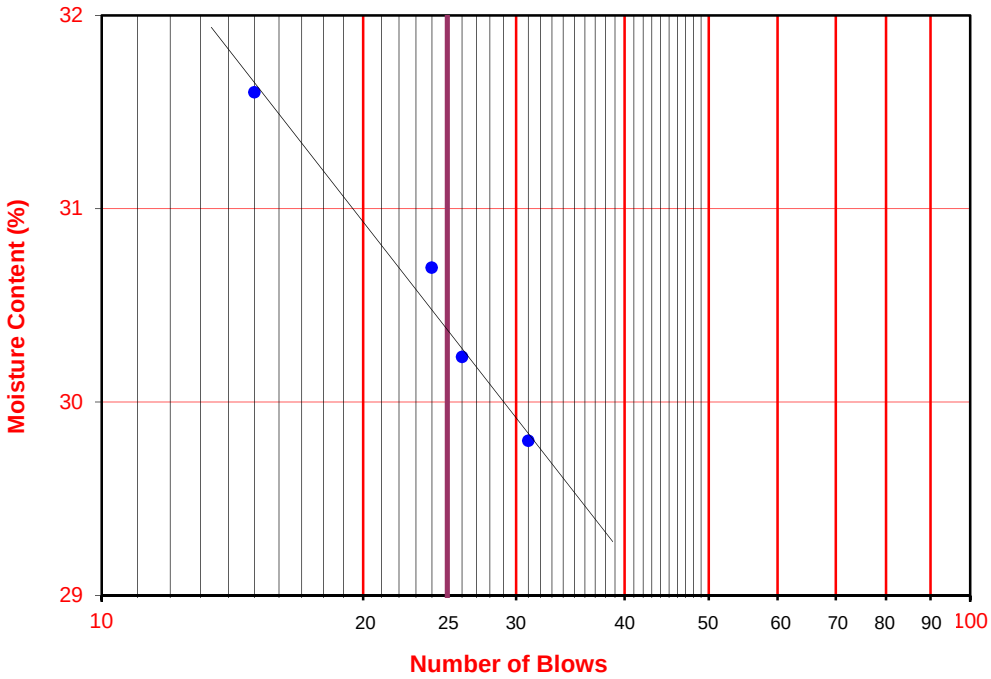
PROCEDURES USED

[ ] Wet Preparation
Multipoint - Wet

[X] Dry Preparation
Multipoint - Dry

[X] Procedure A
Multipoint Test

[ ] Procedure B
One-point Test

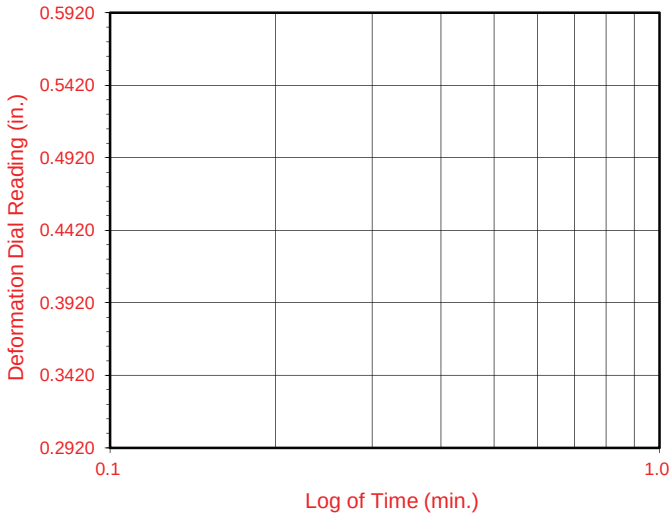


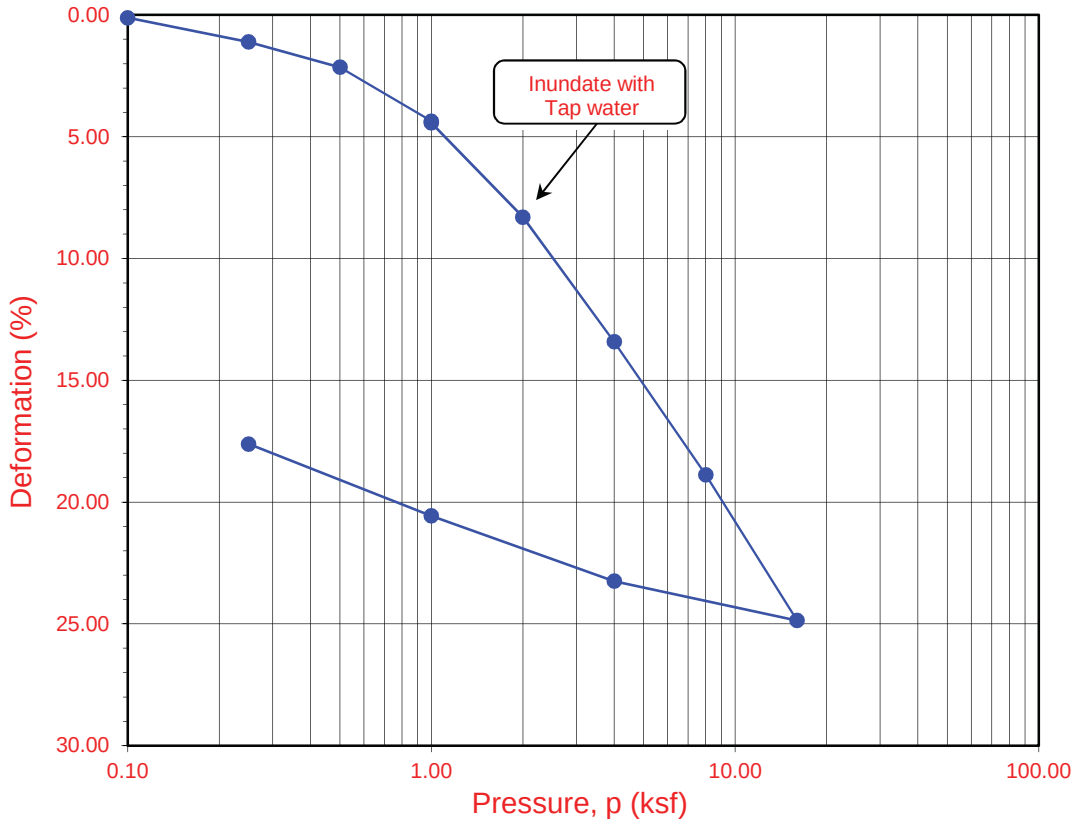
CenterCal/2nd & PCH
11232.001

Summary of Pocket Penetrometer Test Results
Prepared by JHW, 02-23-16

LB-1	R-1	>4.50
	R-3	1.25
LB-2	R-3	1.00
	R-4	1.25

No Time Readings





Boring No.	Sample No.	Depth (ft.)	Moisture Content (%)		Dry Density (pcf)		Void Ratio		Degree of Saturation (%)	
			Initial	Final	Initial	Final	Initial	Final	Initial	Final
LB-1	**R-2**	**10.0**	**58.6**	**44.6**	**64.2**	**77.9**	**1.723**	**1.243**	**95**	**100**

Soil Identification: Gray fat clay (CH)

Leighton

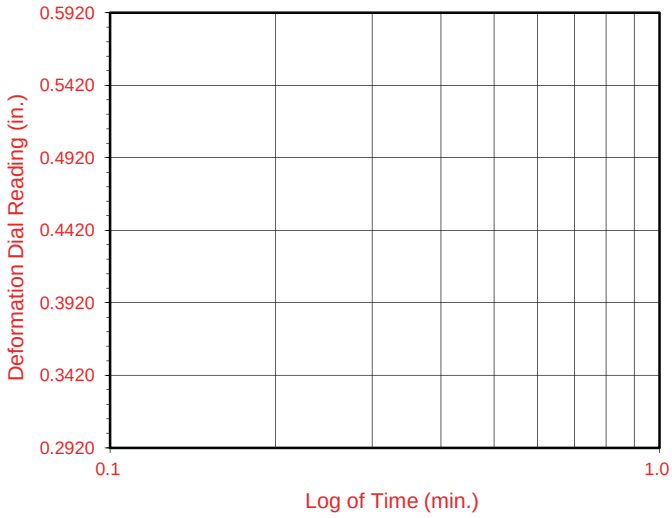
ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS
ASTM D 2435

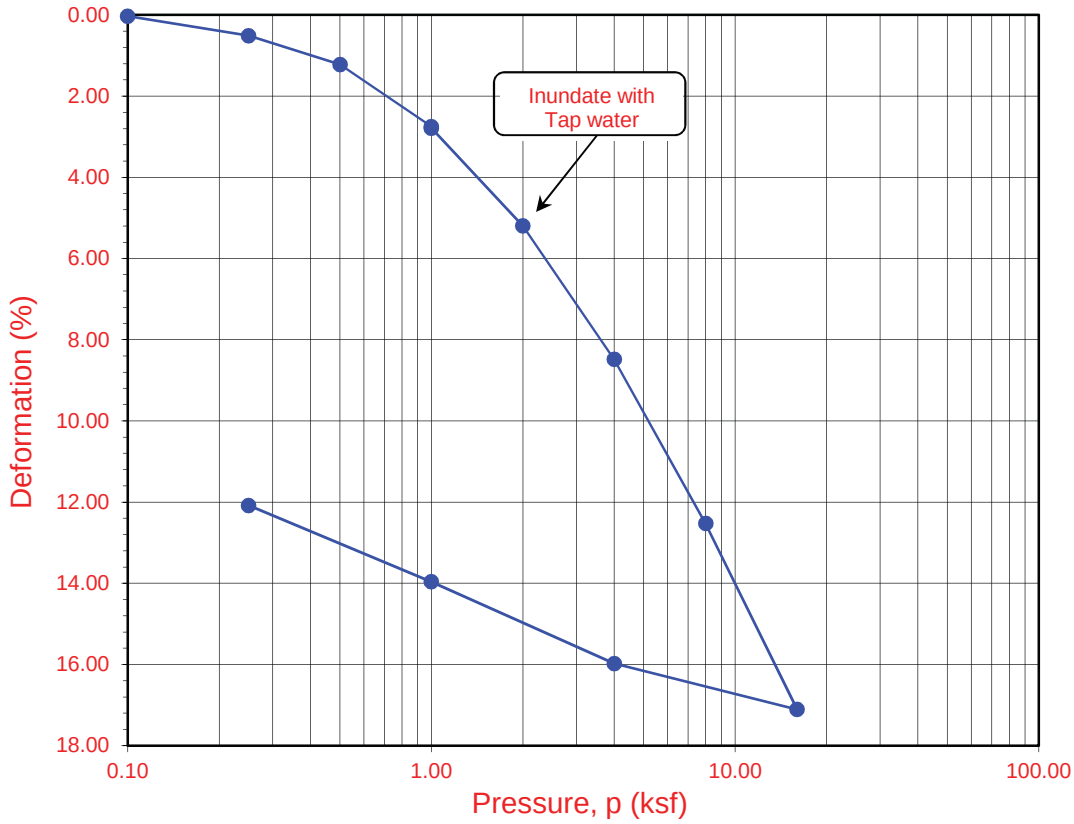
Project No.: 11232.001

CenterCal/2nd & PCH

02-16

No Time Readings





Boring No.	Sample No.	Depth (ft.)	Moisture Content (%)		Dry Density (pcf)		Void Ratio		Degree of Saturation (%)	
			Initial	Final	Initial	Final	Initial	Final	Initial	Final
LB-2	**R-2**	**10.0**	**39.6**	**34.8**	**80.9**	**88.6**	**1.154**	**0.893**	**96**	**100**

Soil Identification: Gray silt (ML)

Leighton

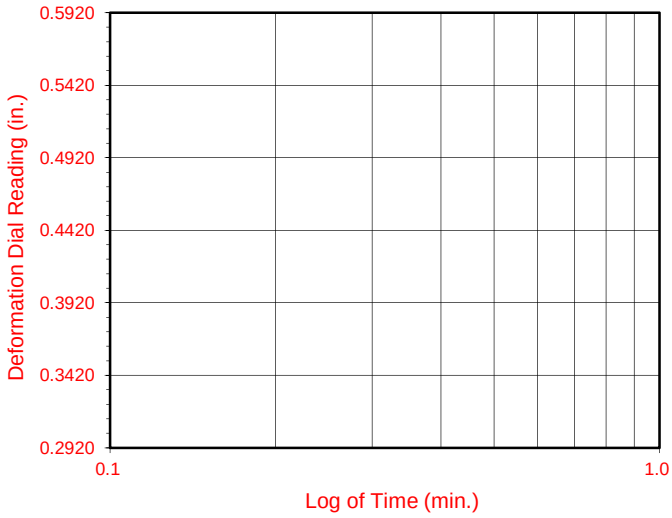
ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS
ASTM D 2435

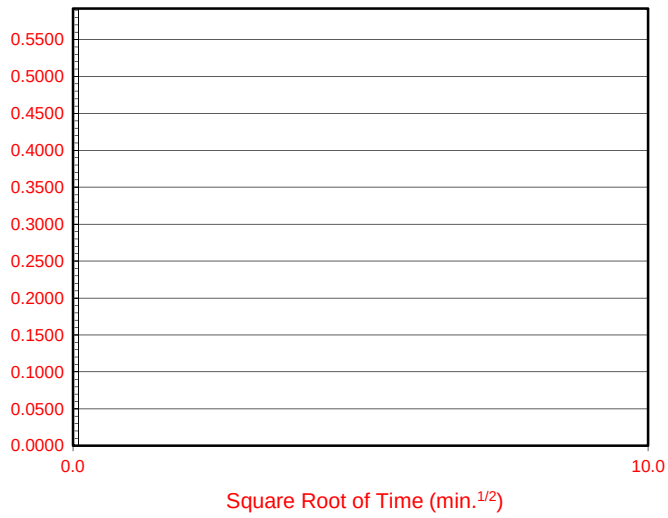
Project No.: 11232.001

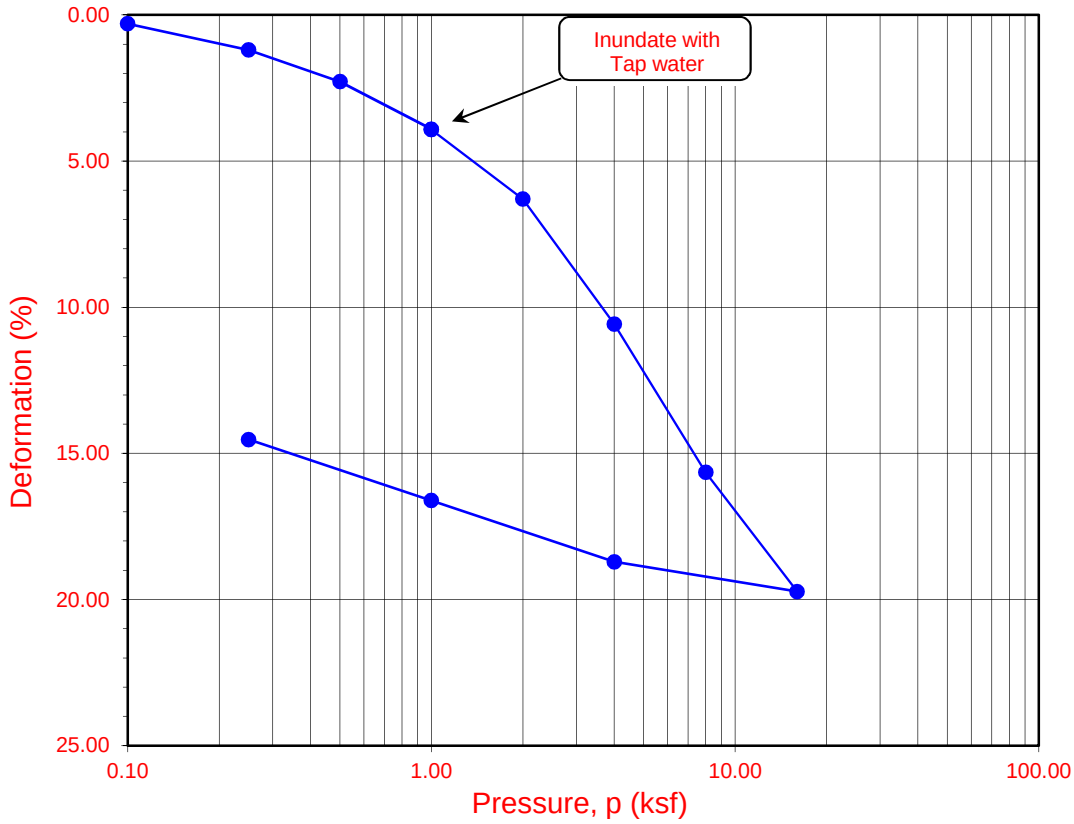
CenterCal/2nd & PCH

02-16

Time Readings







Boring No.	Sample No.	Depth (ft.)	Moisture Content (%)		Dry Density (pcf)		Void Ratio		Degree of Saturation (%)	
			Initial	Final	Initial	Final	Initial	Final	Initial	Final
LB-3	**T-4**	**10.0**	**44.4**	**38.4**	**76.2**	**85.2**	**1.334**	**0.995**	**95**	**100**

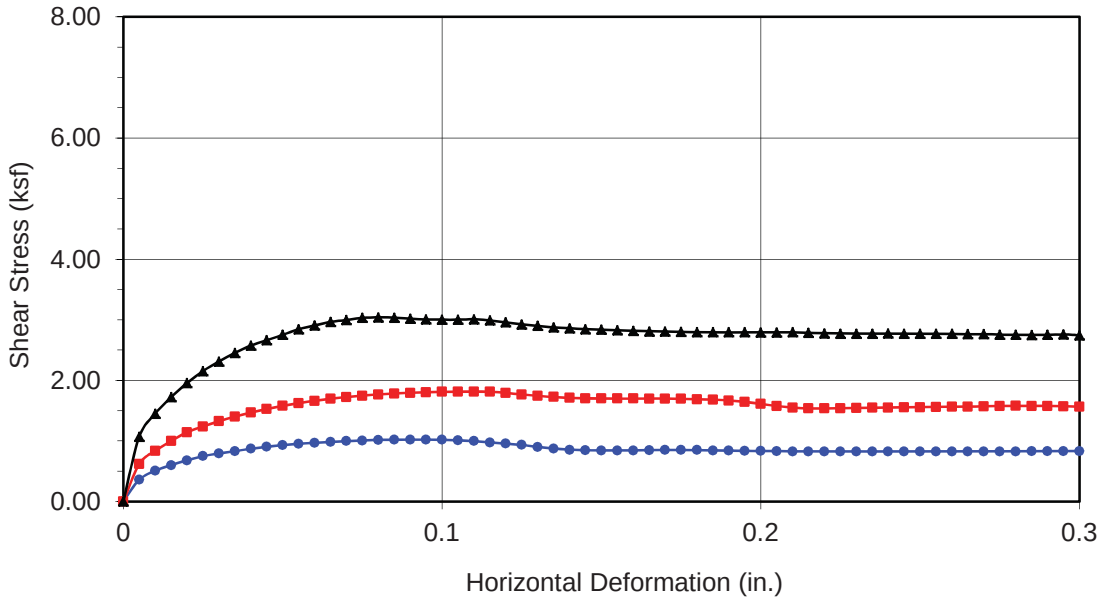
Soil Identification: Olive gray lean clay (CL)

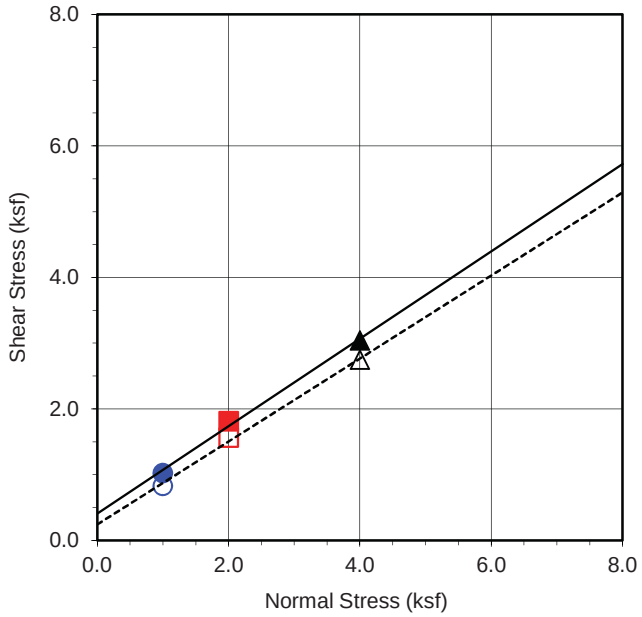
Leighton

ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS
ASTM D 2435

Project No.: 11232.002

CenterCal/LB Whole Foods Market





Boring No.	**LB-1**
Sample No.	**R-4**
Depth (ft)	**20**
Sample Type:	Ring

Soil Identification:
Olive gray sandy silt s(ML)

Strength Parameters

	C (psf)	ϕ (°)
Peak	409.0	33.6
Ultimate	240.5	32.3

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 1.022	■ 1.814	▲ 3.040
Shear Stress @ End of Test (ksf)	○ 0.830	□ 1.566	△ 2.745
Deformation Rate (in./min.)	0.0500	0.0500	0.0500
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	25.99	25.99	25.99
Dry Density (pcf)	96.8	96.9	101.4
Saturation (%)	94.7	95.0	106.1
Soil Height Before Shearing (in.)	0.9868	0.9843	0.9692
Final Moisture Content (%)	25.2	25.2	22.4

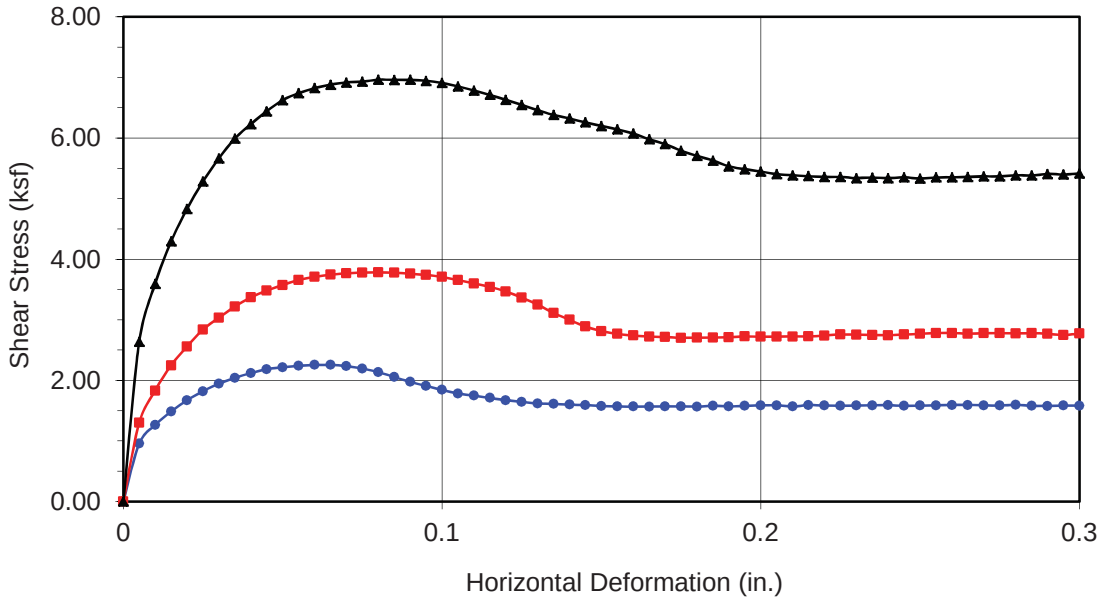
Leighton

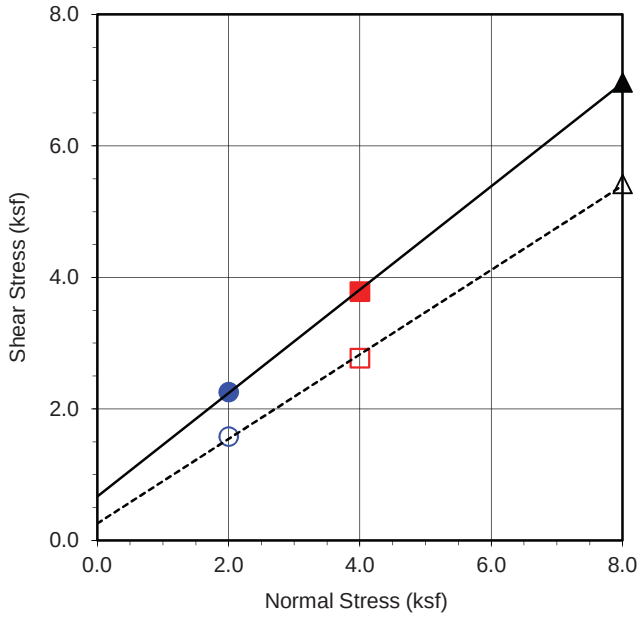
DIRECT SHEAR TEST RESULTS
Consolidated Undrained

Project No.: 11232.001

CenterCal/2nd & PCH

02-16





Boring No.	**LB-1**
Sample No.	**R-9**
Depth (ft)	**45**
Sample Type:	Ring
Soil Identification: Olive gray silty sand (SM)	

Strength Parameters

	C (psf)	ϕ (^{o})
Peak	663.5	38.2
Ultimate	256.0	32.7

Normal Stress (kip/ft²)	2.000	4.000	8.000
Peak Shear Stress (kip/ft²)	● 2.254	■ 3.782	▲ 6.963
Shear Stress @ End of Test (ksf)	○ 1.578	□ 2.773	△ 5.417
Deformation Rate (in./min.)	0.0500	0.0500	0.0500
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	24.16	24.16	24.16
Dry Density (pcf)	99.4	100.7	100.9
Saturation (%)	93.8	96.9	97.4
Soil Height Before Shearing (in.)	0.9875	0.9878	0.9776
Final Moisture Content (%)	25.4	24.8	25.2

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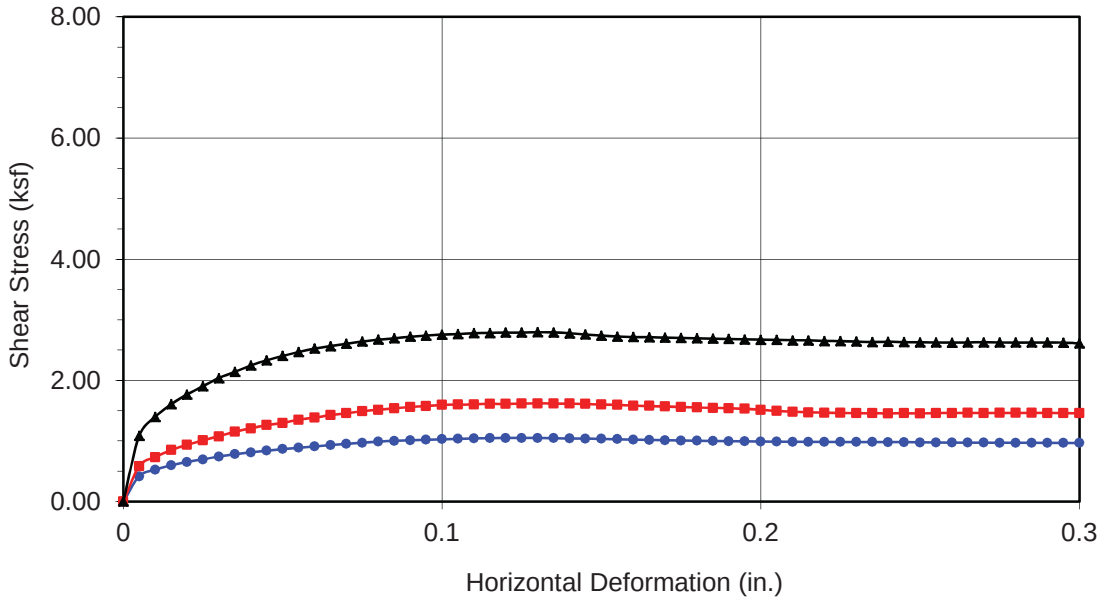
DIRECT SHEAR TEST RESULTS

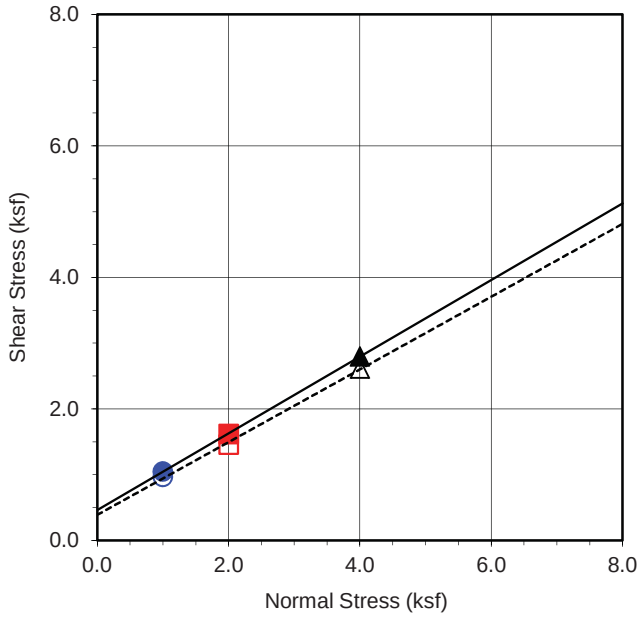
Consolidated Undrained

Project No.: 11232.001

CenterCal/2nd & PCH

02-16





Boring No.	**LB-2**
Sample No.	**R-1**
Depth (ft)	**5**
Sample Type:	Ring

Soil Identification:
Olive gray silty clay (CL-ML)

Strength Parameters

	C (psf)	ϕ (°)
Peak	459.0	30.3
Ultimate	387.0	28.9

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 1.047	■ 1.619	▲ 2.795
Shear Stress @ End of Test (ksf)	○ 0.965	□ 1.456	△ 2.612
Deformation Rate (in./min.)	0.0500	0.0500	0.0500
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	30.06	30.06	30.06
Dry Density (pcf)	90.8	91.2	91.5
Saturation (%)	94.7	95.7	96.5
Soil Height Before Shearing (in.)	0.9675	0.9567	0.9460
Final Moisture Content (%)	28.4	24.3	22.9

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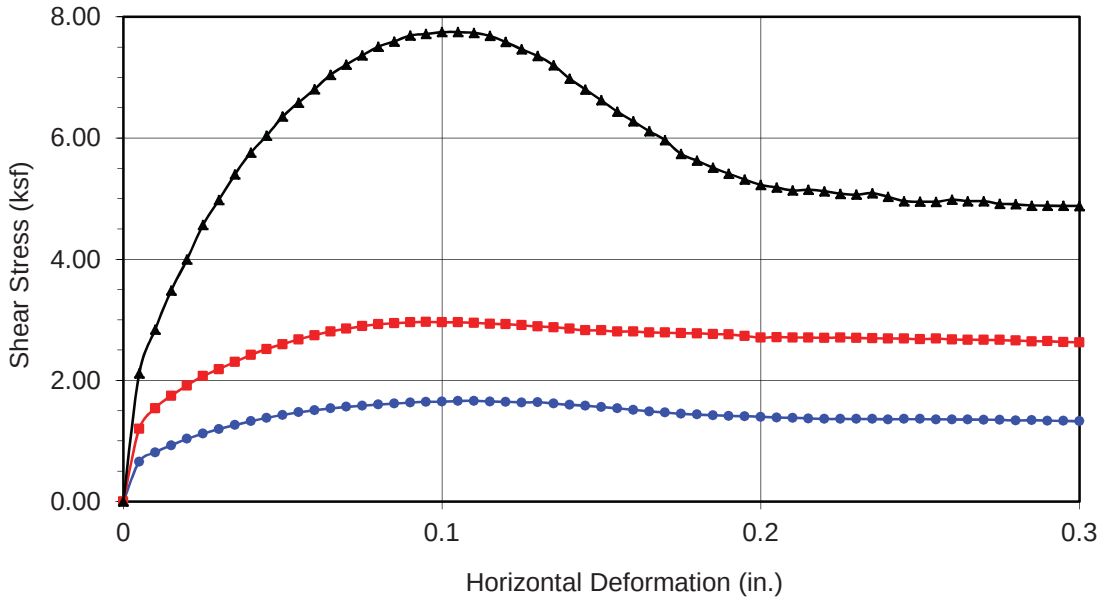
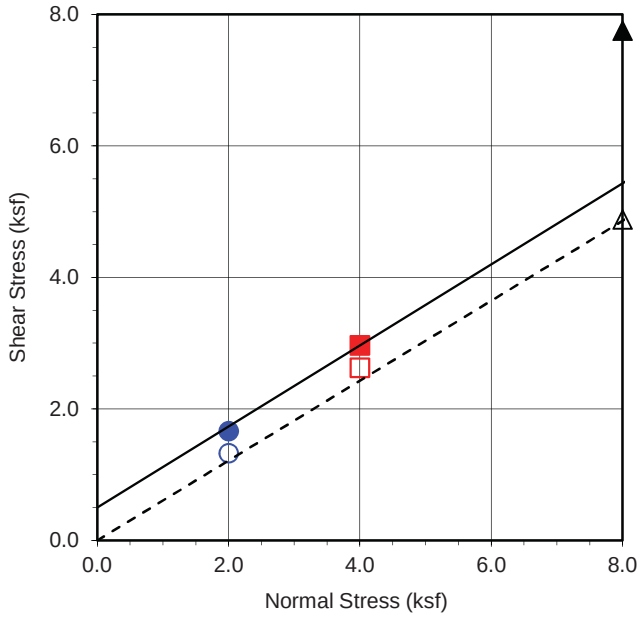
DIRECT SHEAR TEST RESULTS
Consolidated Undrained

Project No.: 11232.001

CenterCal/2nd & PCH

02-16





Boring No.	**LB-2**
Sample No.	**R-9**
Depth (ft)	**45**
Sample Type:	Ring
Soil Identification: Olive gray silty sand (SM)	

Strength Parameters

	C (psf)	ϕ (^{o})
Peak	500.0	31.3
Ultimate	0.0	31.3

Normal Stress (kip/ft²)	2.000	4.000	8.000
Peak Shear Stress (kip/ft²)	● 1.660	■ 2.965	▲ 7.749
Shear Stress @ End of Test (ksf)	○ 1.324	□ 2.625	△ 4.879
Deformation Rate (in./min.)	0.0500	0.0500	0.0500
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	22.97	22.97	22.97
Dry Density (pcf)	99.9	102.3	102.6
Saturation (%)	90.2	95.8	96.4
Soil Height Before Shearing (in.)	0.9611	0.9517	0.9602
Final Moisture Content (%)	27.3	24.1	22.3

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DIRECT SHEAR TEST RESULTS

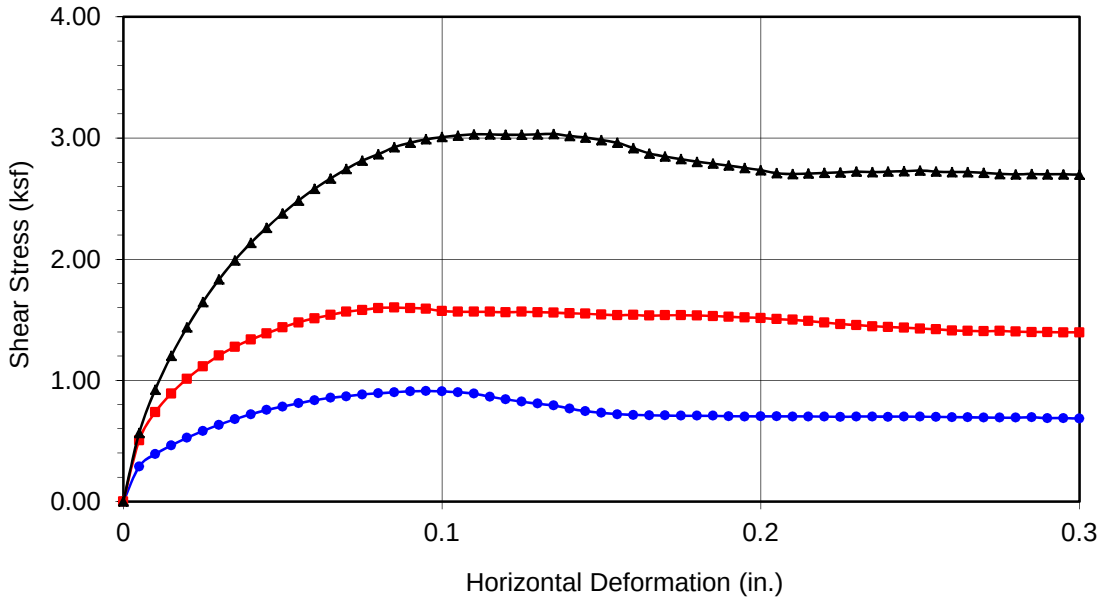
Consolidated Undrained

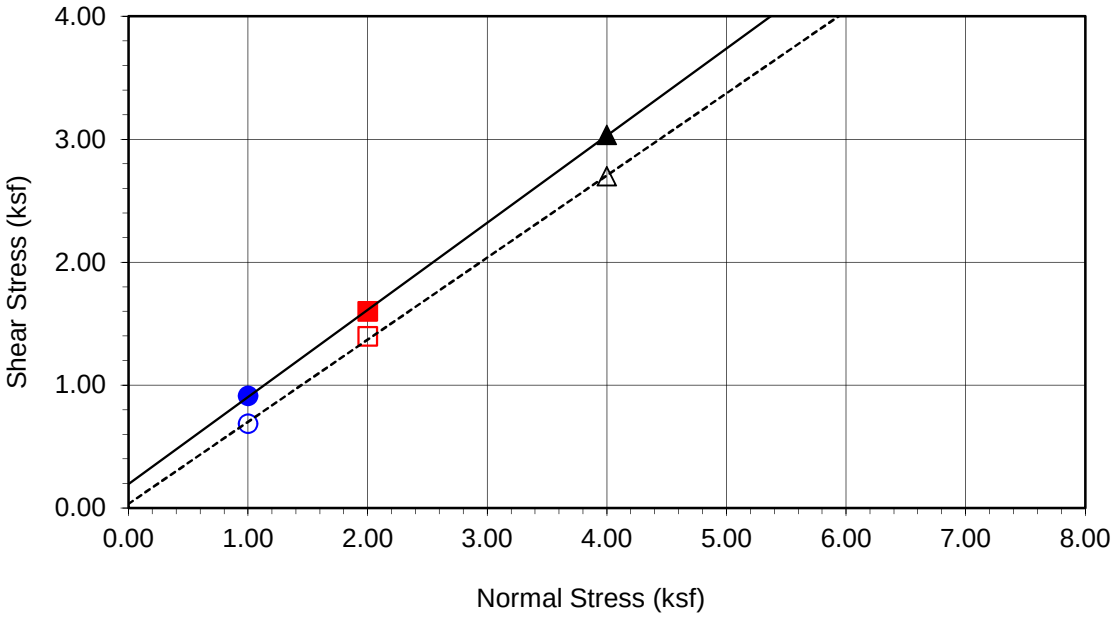
Project No.: 11232.001

CenterCal/2nd & PCH

02-16

DS LB-2, R-9 @ 45, lines replotted on page 3





Boring No.	**LB-3**
Sample No.	**R-2**
Depth (ft)	**5**
Sample Type:	Ring

Soil Identification:
Olive gray sandy silt s(ML)

Strength Parameters

	C (psf)	ϕ (^{o})
Peak	195	35
Ultimate	35	34

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 0.912	■ 1.600	▲ 3.034
Shear Stress @ End of Test (ksf)	○ 0.685	□ 1.396	△ 2.697
Deformation Rate (in./min.)	0.0025	0.0025	0.0025
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	18.04	18.04	18.04
Dry Density (pcf)	91.5	92.7	93.8
Saturation (%)	57.8	59.6	61.2
Soil Height Before Shearing (in.)	0.9943	0.9859	0.9773
Final Moisture Content (%)	28.1	29.0	26.9

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DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 11232.002

CenterCal/LB Whole Foods Market

11-16

Leighton

EXPANSION INDEX of SOILS

ASTM D 4829

Project Name:	CenterCal/LB Whole Foods Market	Tested By:	S. Felter	Date:	11/17/16
Project No.:	11232.002	Checked By:	J. Ward	Date:	11/28/16
Boring No.:	LB-3	Depth (ft.):	1-5		
Sample No.:	B-1				
Soil Identification:	Olive sandy silt s(ML)				

Dry Wt. of Soil + Cont.	(g)	1000.00
Wt. of Container No.	(g)	0.00
Dry Wt. of Soil	(g)	1000.00
Weight Soil Retained on #4 Sieve		0.00
Percent Passing # 4		100.00

MOLDED SPECIMEN		Before Test	After Test
Specimen Diameter	(in.)	4.01	4.01
Specimen Height	(in.)	1.0000	1.0265
Wt. Comp. Soil + Mold	(g)	549.10	421.22
Wt. of Mold	(g)	162.60	0.00
Specific Gravity (Assumed)		2.70	2.70
Container No.		O	O
Wet Wt. of Soil + Cont.	(g)	768.60	583.82
Dry Wt. of Soil + Cont.	(g)	689.30	509.24
Wt. of Container	(g)	0.00	162.60
Moisture Content	(%)	11.50	21.52
Wet Density	(pcf)	116.6	123.8
Dry Density	(pcf)	104.6	101.9
Void Ratio		0.612	0.655
Total Porosity		0.380	0.396
Pore Volume	(cc)	78.6	84.1
Degree of Saturation (%) [S_{meas}]		**50.7**	88.7

SPECIMEN INUNDATION in distilled water for the period of 24 h or expansion rate < 0.0002 in./h

Date	Time	Pressure (psi)	Elapsed Time (min.)	Dial Readings (in.)
11/17/16	13:55	1.0	0	0.2085
11/17/16	14:05	1.0	10	0.2080
Add Distilled Water to the Specimen				
11/17/16	14:15	1.0	10	0.2110
11/18/16	6:35	1.0	990	0.2350
11/18/16	8:57	1.0	1132	0.2350

Expansion Index (EI_{meas}) = ((Final Rdg - Initial Rdg) / Initial Thick.) x 1000	**27**

Leighton

SOIL RESISTIVITY TEST

DOT CA TEST 643

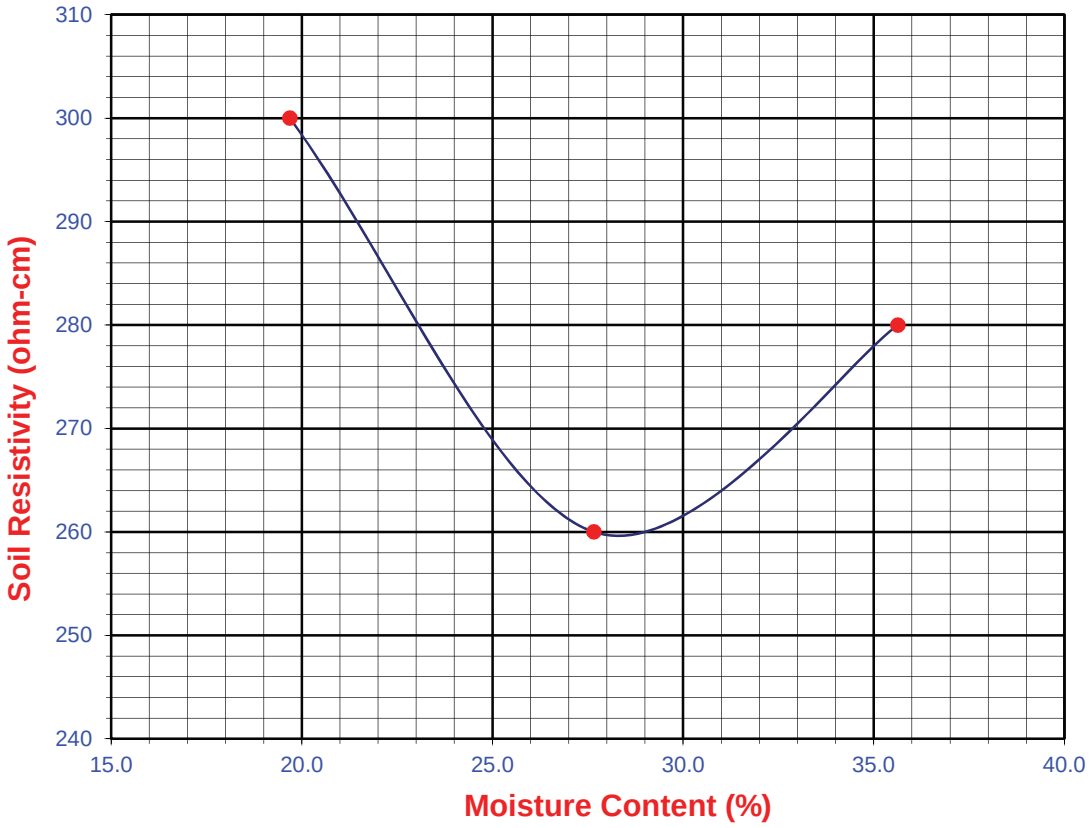
Project Name:	CenterCal/2nd & PCH	Tested By :	O. Figueroa	Date:	02/23/16
Project No. :	11232.001	Data Input By:	J. Ward	Date:	02/23/16
Boring No.:	LB-1	Depth (ft.) :	55-65		
Sample No. :	S-12, S-13, S-14 combined				
Soil Identification:*	Olive (ML)s				

*California Test 643 requires soil specimens to consist only of portions of samples passing through the No. 8 US Standard Sieve before resistivity testing. Therefore, this test method may not be representative for coarser materials.

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	20	19.69	300	300
2	30	27.66	260	260
3	40	35.64	280	280
4				
5				

Moisture Content (%) (MCi)	3.74
Wet Wt. of Soil + Cont. (g)	202.14
Dry Wt. of Soil + Cont. (g)	196.94
Wt. of Container (g)	57.90
Container No.	
Initial Soil Wt. (g) (Wt)	130.10
Box Constant	1.000
MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100	

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 643	
260	**28.3**	**158**	**810**	**8.56**	**20.3**



Leighton

SOIL RESISTIVITY TEST

DOT CA TEST 643

Project Name: CenterCal/2nd & PCH

Project No. : 11232.001

Boring No.: LB-1

Sample No. : B-1

Soil Identification:* Olive brown SM

Tested By : O. Figueroa Date: 02/23/16

Data Input By: J. Ward Date: 02/23/16

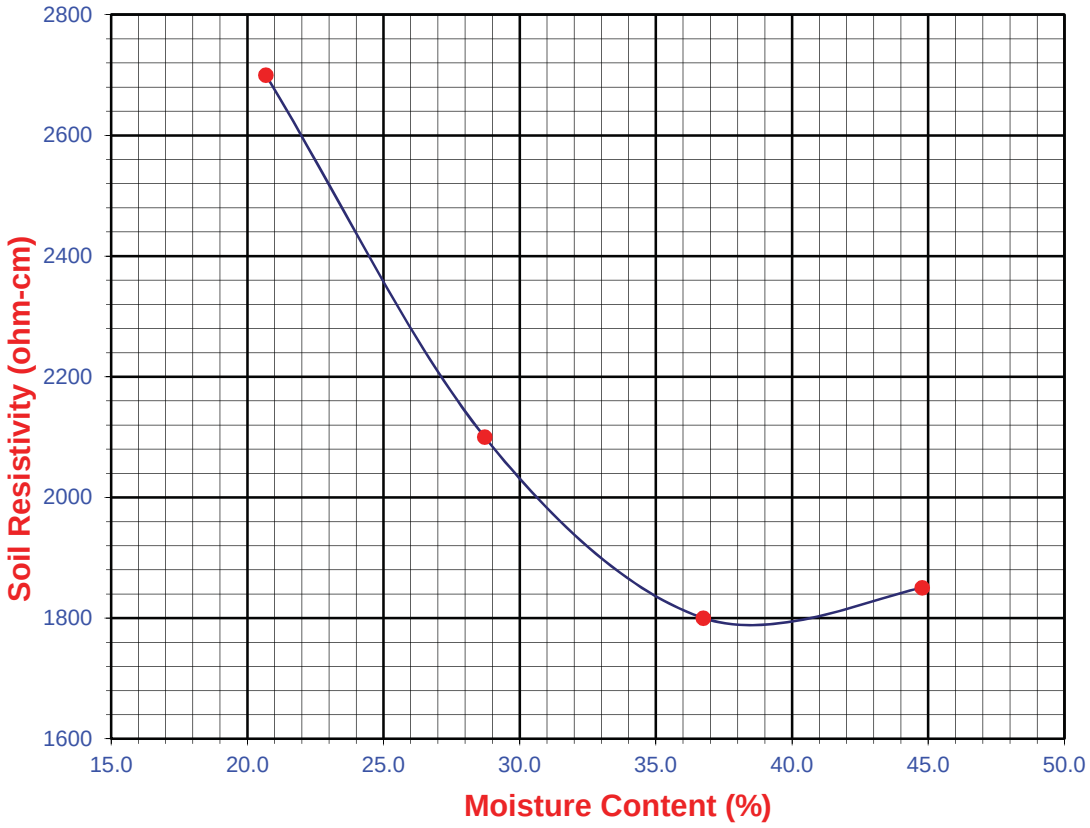
Depth (ft.) : 1-5

*California Test 643 requires soil specimens to consist only of portions of samples passing through the No. 8 US Standard Sieve before resistivity testing. Therefore, this test method may not be representative for coarser materials.

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	20	20.69	2700	2700
2	30	28.72	2100	2100
3	40	36.74	1800	1800
4	50	44.77	1850	1850
5				

Moisture Content (%) (MCi)	4.63
Wet Wt. of Soil + Cont. (g)	199.75
Dry Wt. of Soil + Cont. (g)	194.10
Wt. of Container (g)	71.97
Container No.	
Initial Soil Wt. (g) (Wt)	130.30
Box Constant	1.000
MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100	

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 643	
1785	**38.5**	**177**	**42**	**7.79**	**20.5**



Leighton

SOIL RESISTIVITY TEST

DOT CA TEST 643

Project Name: CenterCal/2nd & PCH

Project No. : 11232.001

Boring No.: LB-2

Sample No. : B-1

Soil Identification:* Olive gray SC-SM

Tested By : O. Figueroa Date: 02/23/16

Data Input By: J. Ward Date: 02/23/16

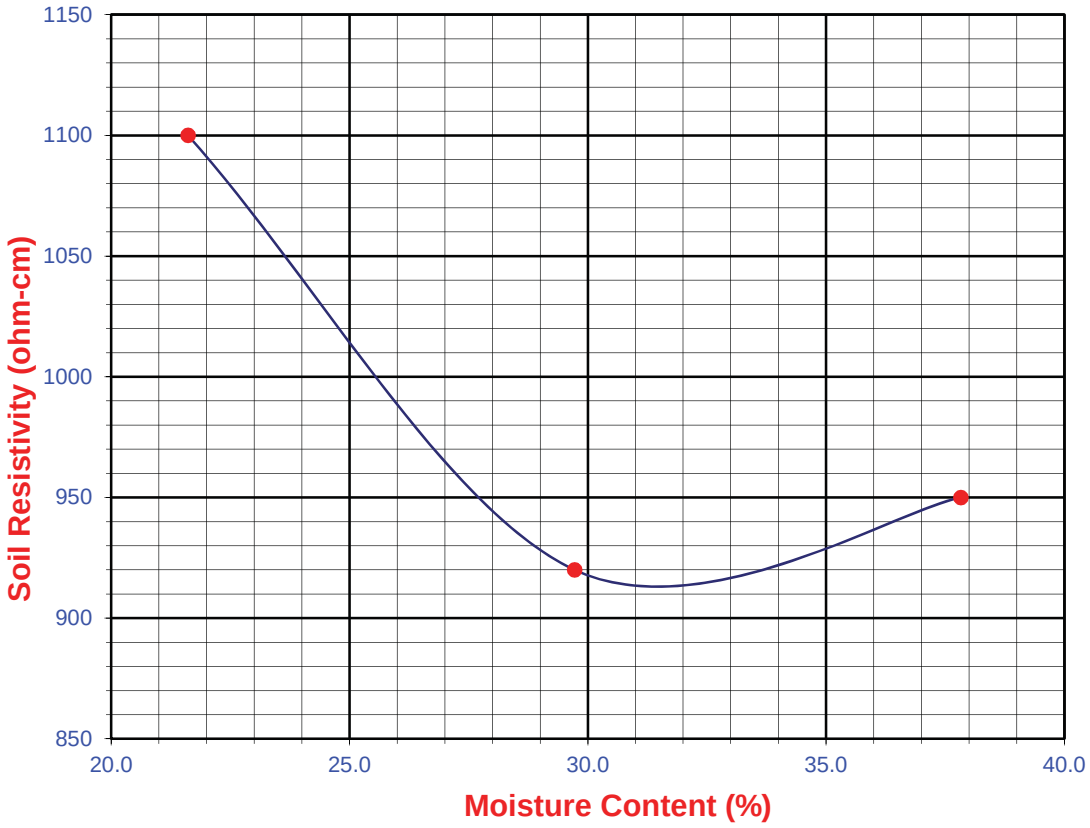
Depth (ft.) : 1-5

*California Test 643 requires soil specimens to consist only of portions of samples passing through the No. 8 US Standard Sieve before resistivity testing. Therefore, this test method may not be representative for coarser materials.

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	20	21.61	1100	1100
2	30	29.72	920	920
3	40	37.83	950	950
4				
5				

Moisture Content (%) (MCi)	5.40
Wet Wt. of Soil + Cont. (g)	208.93
Dry Wt. of Soil + Cont. (g)	201.31
Wt. of Container (g)	60.19
Container No.	
Initial Soil Wt. (g) (Wt)	130.00
Box Constant	1.000
MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100	

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 643	
912	**31.4**	**252**	**42**	**8.05**	**20.4**



Leighton

SOIL RESISTIVITY TEST

DOT CA TEST 643

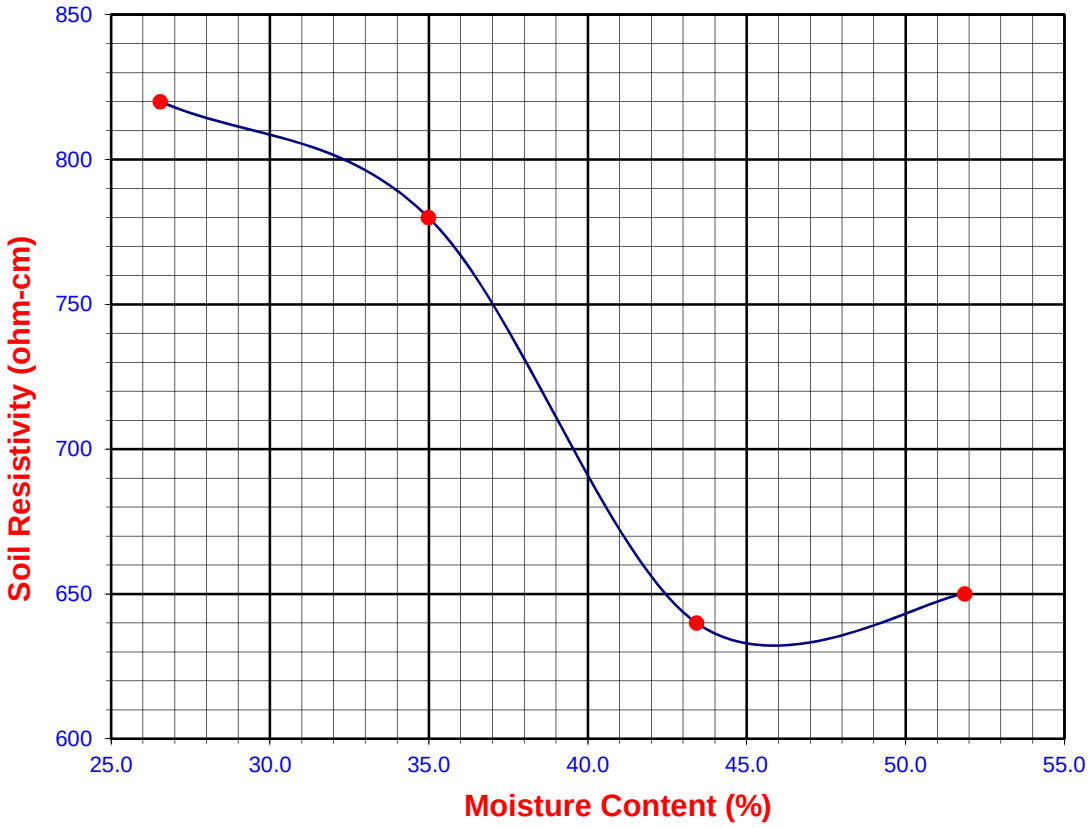
Project Name:	CenterCal/LB Whole Foods Market	Tested By :	A. Santos	Date:	11/22/16
Project No. :	11232.002	Data Input By:	J. Ward	Date:	11/28/16
Boring No.:	LB-3	Depth (ft.) :	1-5		
Sample No. :	B-1				
Soil Identification:*	Olive s(ML)				

*California Test 643 requires soil specimens to consist only of portions of samples passing through the No. 8 US Standard Sieve before resistivity testing. Therefore, this test method may not be representative for coarser materials.

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	20	26.55	820	820
2	30	34.99	780	780
3	40	43.42	640	640
4	50	51.86	650	650
5				

Moisture Content (%) (MCi)	9.68
Wet Wt. of Soil + Cont. (g)	180.04
Dry Wt. of Soil + Cont. (g)	169.47
Wt. of Container (g)	60.25
Container No.	
Initial Soil Wt. (g) (Wt)	130.00
Box Constant	1.000
MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100	

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 643	
632	**45.8**	**2050**	**122**	**6.97**	**20.7**



Leighton

MODIFIED PROCTOR COMPACTION TEST

ASTM D 1557

Project Name:	CenterCal/LB Whole Foods Market	Tested By:	O. Figueroa	Date:	11/16/16
Project No.:	11232.002	Input By:	J. Ward	Date:	11/28/16
Boring No.:	LB-3	Depth (ft.):	1-5		
Sample No.:	B-1				
Soil Identification:	Olive sandy silt s(ML)				

Preparation Method: [X] Moist [ ] Dry

[X] Mechanical Ram [ ] Manual Ram

Mold Volume (ft³) 0.03330

Ram Weight = 10 lb.; Drop = 18 in.

TEST NO.	1	2	3	4	5	6
Wt. Compacted Soil + Mold (g)	3738	3817	3882	3847		
Weight of Mold (g)	1829	1829	1829	1829		
Net Weight of Soil (g)	1909	1988	2053	2018		
Wet Weight of Soil + Cont. (g)	358.4	425.5	453.5	466.4		
Dry Weight of Soil + Cont. (g)	335.9	390.2	408.8	410.1		
Weight of Container (g)	39.0	39.1	53.9	39.4		
Moisture Content (%)	7.58	10.05	12.60	15.19		
Wet Density (pcf)	126.4	131.6	135.9	133.6		
Dry Density (pcf)	117.5	119.6	120.7	116.0		

Maximum Dry Density (pcf) 121.0 **Optimum Moisture Content (%)** 12.0

PROCEDURE USED

[X] **Procedure A**
Soil Passing No. 4 (4.75 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
May be used if +#4 is 20% or less

[ ] **Procedure B**
Soil Passing 3/8 in. (9.5 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
Use if +#4 is >20% and +3/8 in. is 20% or less

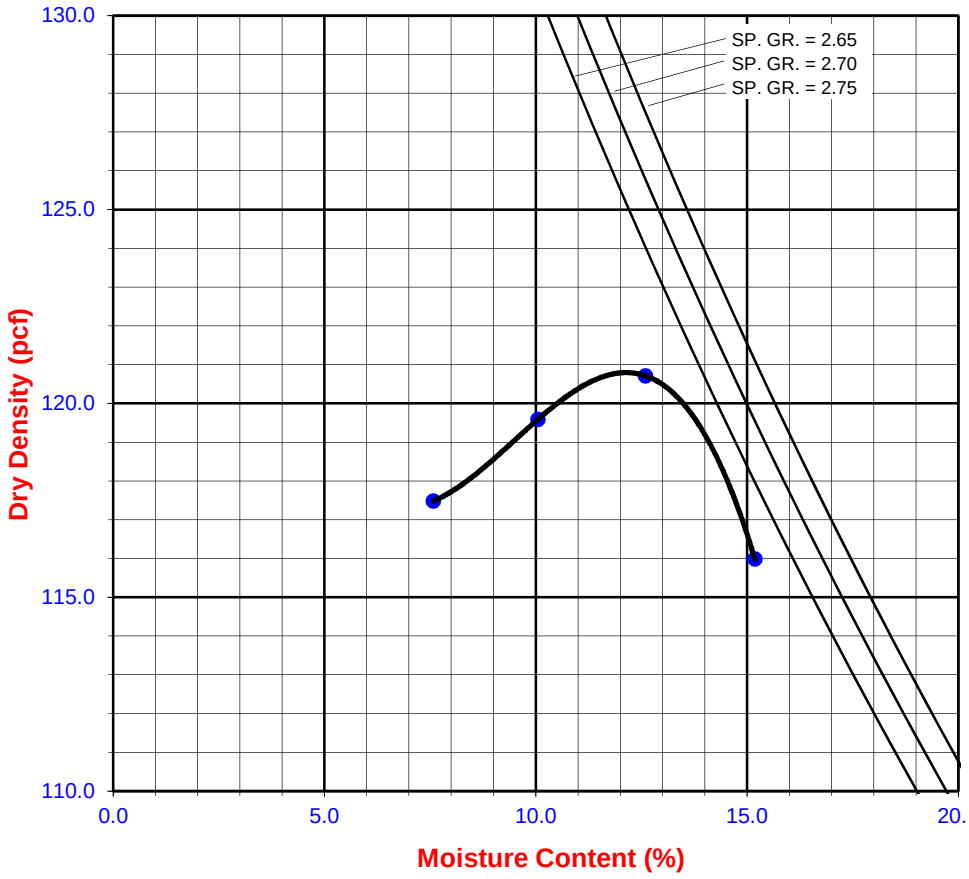
[ ] **Procedure C**
Soil Passing 3/4 in. (19.0 mm) Sieve
Mold : 6 in. (152.4 mm) diameter
Layers : 5 (Five)
Blows per layer : 56 (fifty-six)
Use if +3/8 in. is >20% and +¾ in. is <30%

Particle-Size Distribution:

GR:SA:FI

Atterberg Limits:

LL,PL,PI



MX LB-3, B-1 @ 1-5

Leighton

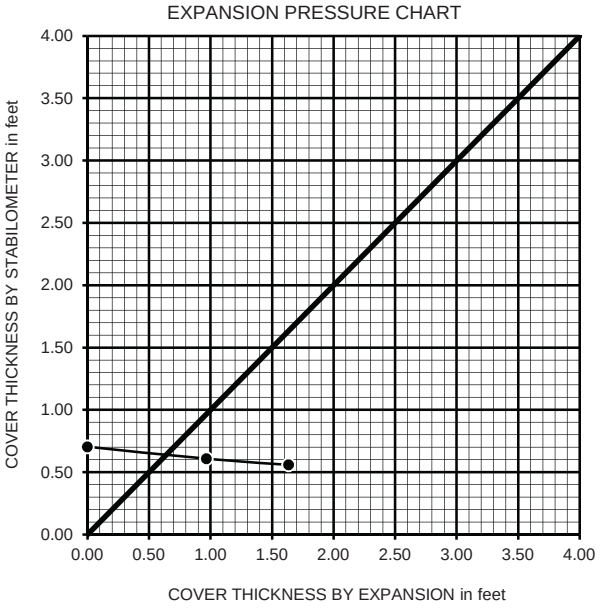
R-VALUE TEST RESULTS

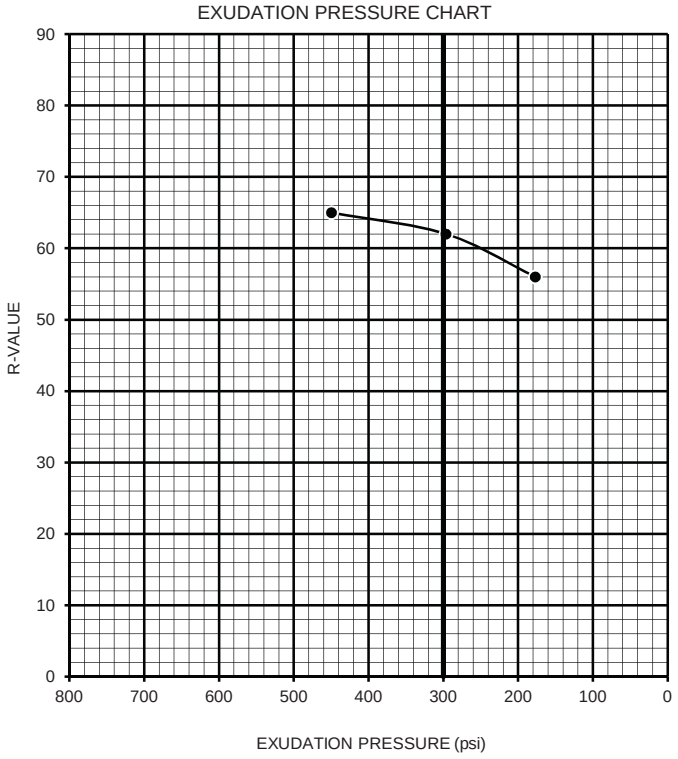
DOT CA Test 301

PROJECT NAME:	CenterCal/2nd & PCH	PROJECT NUMBER:	11232.001
BORING NUMBER:	LB-2	DEPTH (FT.):	1-5
SAMPLE NUMBER:	B-1	TECHNICIAN:	S. Felter
SAMPLE DESCRIPTION:	Olive gray silty, clayey sand (SC-SM)	DATE COMPLETED:	2/23/2016

TEST SPECIMEN	a	b	c
MOISTURE AT COMPACTION %	12.6	13.1	14.0
HEIGHT OF SAMPLE, Inches	2.43	2.50	2.54
DRY DENSITY, pcf	119.8	116.1	120.0
COMPACTOR PRESSURE, psi	300	250	150
EXUDATION PRESSURE, psi	450	296	177
EXPANSION, Inches x 10exp-4	49	29	0
STABILITY Ph 2,000 lbs (160 psi)	34	37	46
TURNS DISPLACEMENT	4.72	5.00	4.94
R-VALUE UNCORRECTED	66	62	56
R-VALUE CORRECTED	65	62	56

DESIGN CALCULATION DATA	a	b	c
GRAVEL EQUIVALENT FACTOR	1.0	1.0	1.0
TRAFFIC INDEX	5.0	5.0	5.0
STABILOMETER THICKNESS, ft.	0.56	0.61	0.70
EXPANSION PRESSURE THICKNESS, ft.	1.63	0.97	0.00





R-VALUE BY EXPANSION:	61
R-VALUE BY EXUDATION:	62
EQUILIBRIUM R-VALUE:	61

Leighton

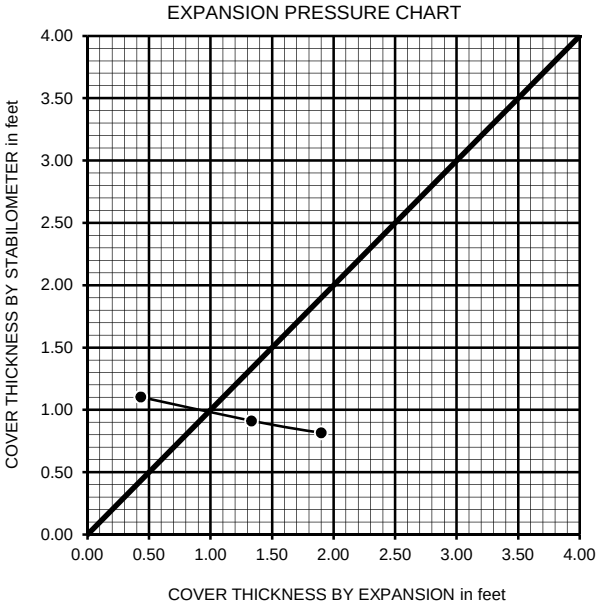
R-VALUE TEST RESULTS

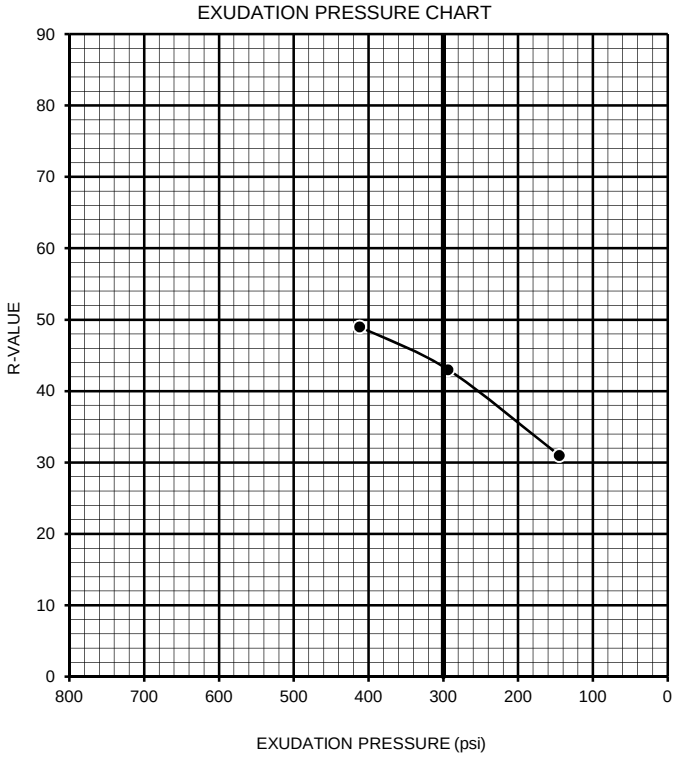
DOT CA Test 301

PROJECT NAME:	CenterCal/LB Whole Foods Market	PROJECT NUMBER:	11232.002
BORING NUMBER:	LB-4	DEPTH (FT.):	1-5
SAMPLE NUMBER:	B-1	TECHNICIAN:	S. Felter
SAMPLE DESCRIPTION:	Brown SC-SM	DATE COMPLETED:	11/16/2016

TEST SPECIMEN	a	b	c
MOISTURE AT COMPACTION %	14.6	15.0	16.0
HEIGHT OF SAMPLE, Inches	2.51	2.49	2.61
DRY DENSITY, pcf	146.0	117.8	116.4
COMPACTOR PRESSURE, psi	250	200	100
EXUDATION PRESSURE, psi	412	294	145
EXPANSION, Inches x 10exp-4	57	40	13
STABILITY Ph 2,000 lbs (160 psi)	58	66	89
TURNS DISPLACEMENT	4.62	4.75	4.93
R-VALUE UNCORRECTED	49	43	29
R-VALUE CORRECTED	49	43	31

DESIGN CALCULATION DATA	a	b	c
GRAVEL EQUIVALENT FACTOR	1.0	1.0	1.0
TRAFFIC INDEX	5.0	5.0	5.0
STABILOMETER THICKNESS, ft.	0.82	0.91	1.10
EXPANSION PRESSURE THICKNESS, ft.	1.90	1.33	0.43





R-VALUE BY EXPANSION:	38
R-VALUE BY EXUDATION:	43
EQUILIBRIUM R-VALUE:	38

Leighton

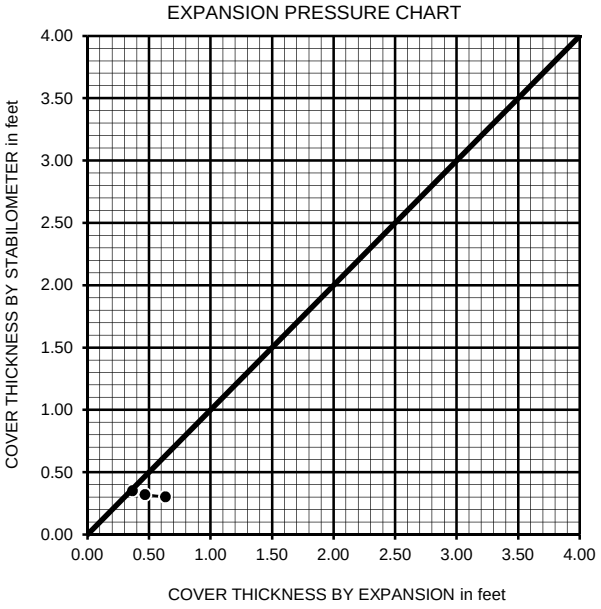
R-VALUE TEST RESULTS

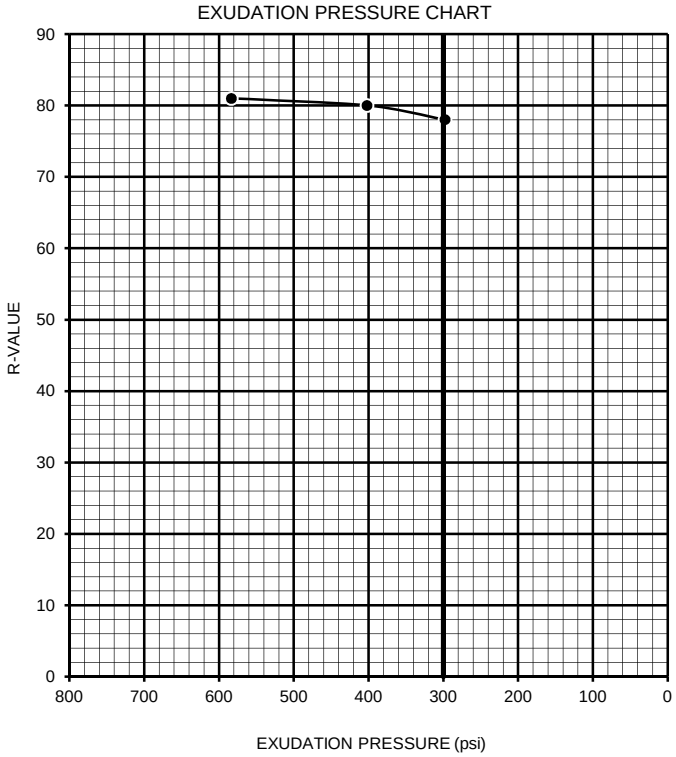
DOT CA Test 301

PROJECT NAME:	CenterCal/LB Whole Foods Market	PROJECT NUMBER:	11232.002
BORING NUMBER:	LB-5	DEPTH (FT.):	1-5
SAMPLE NUMBER:	B-1	TECHNICIAN:	S. Felter
SAMPLE DESCRIPTION:	Brown SP-SM	DATE COMPLETED:	11/16/2016

TEST SPECIMEN	a	b	c
MOISTURE AT COMPACTION %	12.0	12.9	13.7
HEIGHT OF SAMPLE, Inches	2.50	2.57	2.58
DRY DENSITY, pcf	111.1	110.8	111.7
COMPACTOR PRESSURE, psi	350	325	275
EXUDATION PRESSURE, psi	583	402	298
EXPANSION, Inches x 10exp-4	19	14	11
STABILITY Ph 2,000 lbs (160 psi)	19	21	23
TURNS DISPLACEMENT	4.49	4.29	4.56
R-VALUE UNCORRECTED	81	79	77
R-VALUE CORRECTED	81	80	78

DESIGN CALCULATION DATA	a	b	c
GRAVEL EQUIVALENT FACTOR	1.0	1.0	1.0
TRAFFIC INDEX	5.0	5.0	5.0
STABILOMETER THICKNESS, ft.	0.30	0.32	0.35
EXPANSION PRESSURE THICKNESS, ft.	0.63	0.47	0.37





R-VALUE BY EXPANSION:	77
R-VALUE BY EXUDATION:	78
EQUILIBRIUM R-VALUE:	77

APPENDIX D

PERCOLATION TEST RESULTS

Leighton

Boring/Excavation Percolation Testing Field Log

Date: 2/1/2016

Project Name:	CenterCal Long Beach	**Boring/Test Number:**		**P-1**	
Earth Description:	Silty Sand	**Diameter of Boring, in.**	8	**Diameter of Casing, in.**	2
Tested by:	CD	**Depth of Boring**	5	feet	
Liquid Description:	Water	**Depth to Invert of BMP**	See report text		
Measurement Method:	Sounder	**Depth to Water Table**	See report text		
		Depth to Initial Water Depth (d_1)	48	inches	

Time Interval Standard

Start Time for Pre-Soak	8:30 AM	2/1/2016	**Water Remaining in Boring (Y/N):**	Y	
Start Time for Standard	9:00 AM	2/2/2016	**Standard Time Interval Between Readings**	30	minutes

Reading Number	Time Start/End (hh:mm)	Elapsed Time Δtime (min)	Water Drop During Standard Time Interval (inches) Δd	Percolation Rate for Reading (in/hr)	Soil Description/Notes/Comments
1	9:00 AM 9:30 AM	30	--	--	Water filled to 1 feet bgs. Water remained in hole. Standard time interval is 30 minutes
2	9:31 AM 10:01 AM	30	12.60	25.20	Start of percolation testing using County of Los Angeles boring percolation testing method. Water refilled every 30 minutes to maintain initial water depth.
3	10:02 AM 10:32 AM	30	12.30	24.60	
4	10:33 AM 11:03 AM	30	12.20	24.40	Stabilized rates (within 10%) achieved with Δd Readings 2, 3, and 4.
5					
6					
7					
8					

Note:

Reduction Factor (R_f) = $R_f = \left(\frac{2d_1 - \Delta d}{DIA}\right) + 1$ = 11.45

Infiltration rate = $\frac{\text{Preadjusted percolation rate}}{\text{Reduction factor}}$ = **2.16 in/hr**

Boring/Excavation Percolation Testing Field Log

Date: 2/1/2016

Project Name:	CenterCal Long Beach	**Boring/Test Number:**		**P-2**	
Earth Description:	Silty Sand and Sandy Silt	**Diameter of Boring, in.**	8	**Diameter of Casing, in.**	2
Tested by:	CD	**Depth of Boring**	5	feet	
Liquid Description:	Water	**Depth to Invert of BMP**	See report text		
Measurement Method:	Sounder	**Depth to Water Table**	See report text		
		Depth to Initial Water Depth (d_1)	48	inches	

Time Interval Standard

Start Time for Pre-Soak	9:00 AM	2/1/2016	**Water Remaining in Boring (Y/N):**	Y	
Start Time for Standard	9:10 AM	2/2/2016	**Standard Time Interval Between Readings**	30	minutes

Reading Number	Time Start/End (hh:mm)	Elapsed Time Δtime (min)	Water Drop During Standard Time Interval (inches) Δd	Percolation Rate for Reading (in/hr)	Soil Description/Notes/Comments
1	9:10 AM 9:40 AM	30	--	--	Water filled to 1 feet bgs. Water remained in hole. Standard time interval is 30 minutes
2	9:41 AM 10:11 AM	30	5.80	11.60	Start of percolation testing using County of Los Angeles boring percolation testing method. Water refilled every 30 minutes to maintain initial water depth.
3	10:12 AM 10:42 AM	30	5.60	11.20	
4	10:43 AM 11:13 AM	30	5.60	11.20	Stabilized rates (within 10%) achieved with Δd Readings 2, 3, and 4.
5					
6					
7					
8					

Note:

Reduction Factor (R_f) = $R_f = (\frac{2d_1 - \Delta d}{DIA}) + 1$ = 12.29

Infiltration rate = $\frac{\text{Preadjusted percolation rate}}{\text{Reduction factor}}$ = **0.92 in/hr**

Boring/Excavation Percolation Testing Field Log

Date: 2/1/2016

Project Name:	CenterCal Long Beach	**Boring/Test Number:**		**P-3**	
Earth Description:	Silty Sand and Sandy Silt	**Diameter of Boring, in.**	8	**Diameter of Casing, in.**	2
Tested by:	CD	**Depth of Boring**	5	feet	
Liquid Description:	Water	**Depth to Invert of BMP**	See report text		
Measurement Method:	Sounder	**Depth to Water Table**	See report text		
		Depth to Initial Water Depth (d_1)	48	inches	

Time Interval Standard

Start Time for Pre-Soak	5:30 PM	2/1/2016	**Water Remaining in Boring (Y/N):**	Y	
Start Time for Standard	9:20 AM	2/2/2016	**Standard Time Interval Between Readings**	30	minutes

Reading Number	Time Start/End (hh:mm)	Elapsed Time Δtime (min)	Water Drop During Standard Time Interval (inches) Δd	Percolation Rate for Reading (in/hr)	Soil Description/Notes/Comments
1	9:20 AM 9:50 AM	30	--	--	Water filled to 1 feet bgs. Water remained in hole. Standard time interval is 30 minutes
2	9:51 AM 10:21 AM	30	2.40	4.80	Start of percolation testing using County of Los Angeles boring percolation testing method. Water refilled every 30 minutes to maintain initial water depth.
3	10:22 AM 10:52 AM	30	1.90	3.80	
4	10:53 AM 11:23 AM	30	2.00	4.00	Stabilized rates (within 10%) achieved with Δd Readings 2, 3, and 4.
5					
6					
7					
8					

Note:

Reduction Factor (R_f) = $R_f = (\frac{2d_1 - \Delta d}{DIA}) + 1$ = 12.74

Infiltration rate = $\frac{\text{Preadjusted percolation rate}}{\text{Reduction factor}}$ = **0.33 in/hr**

APPENDIX E

LIQUEFACTION ANALYSIS

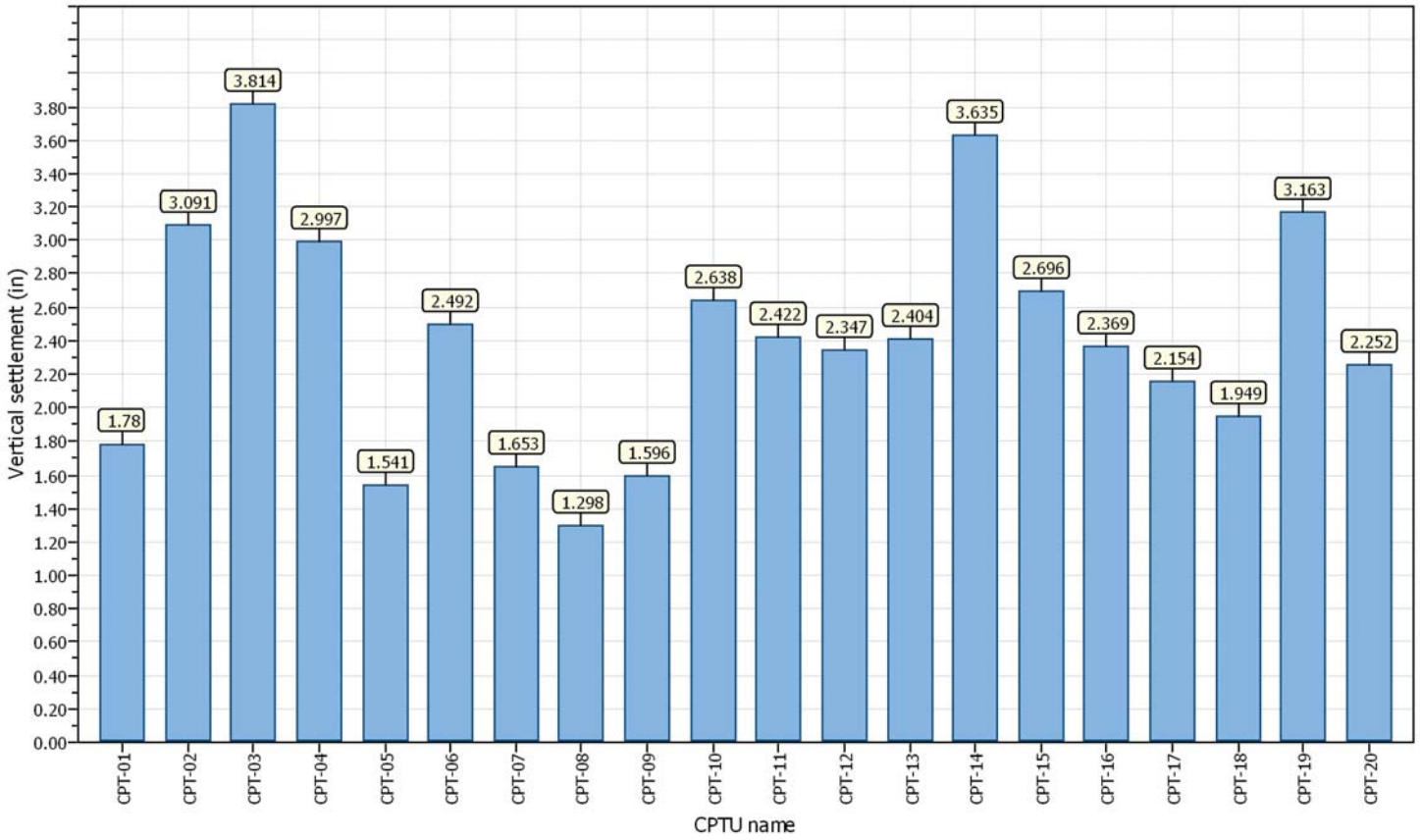
Leighton

Leighton Consulting, Inc.
17781 Cowan
Irvine, CA
http://www.leightongeo.com/

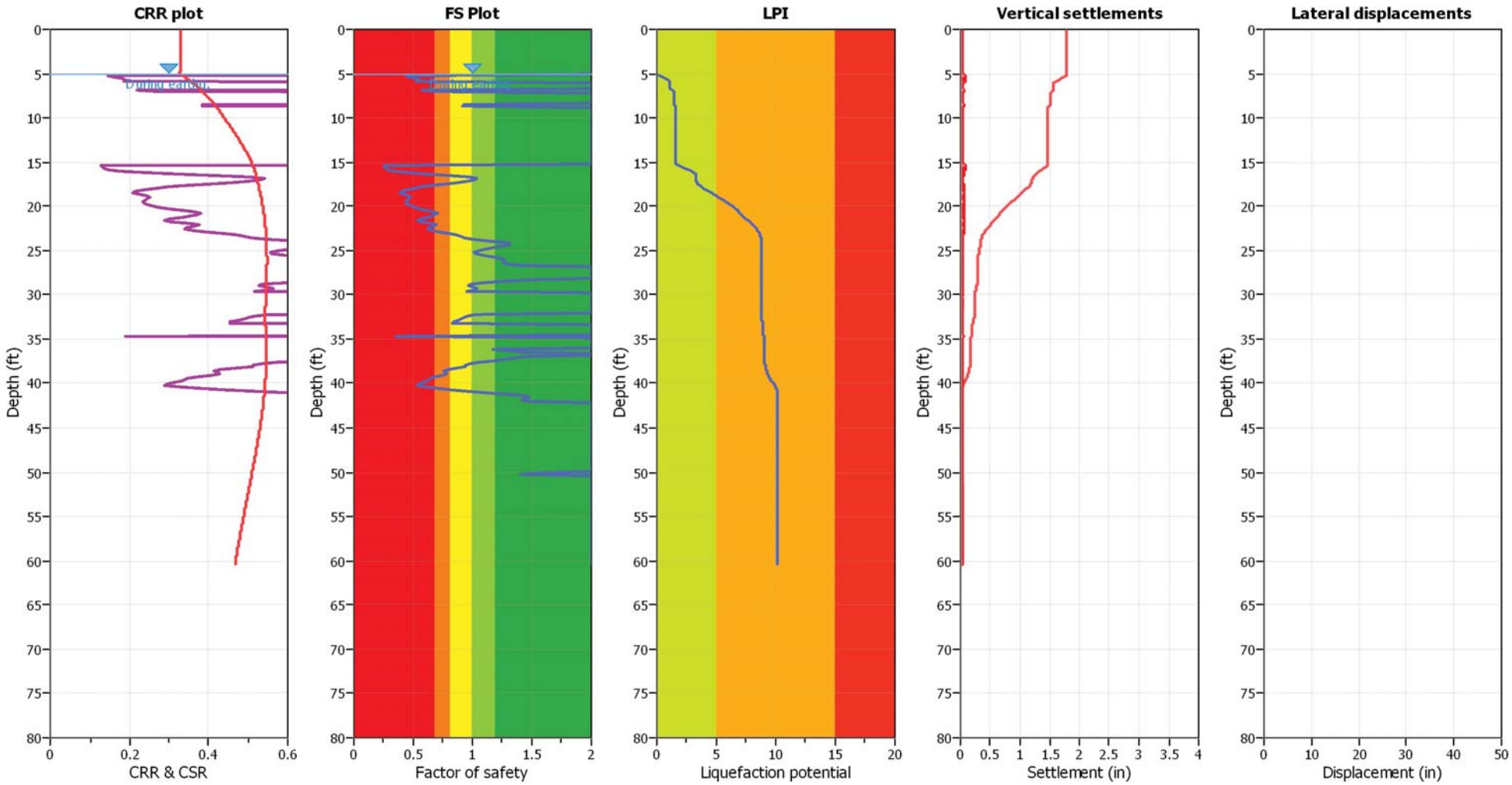
Project title : 2nd and PCH Retail Center

Location : Long Beach, CA

Overall vertical settlements report



Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.03	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.60	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	5.00 ft	Fill height:	N/A	Limit depth:	N/A

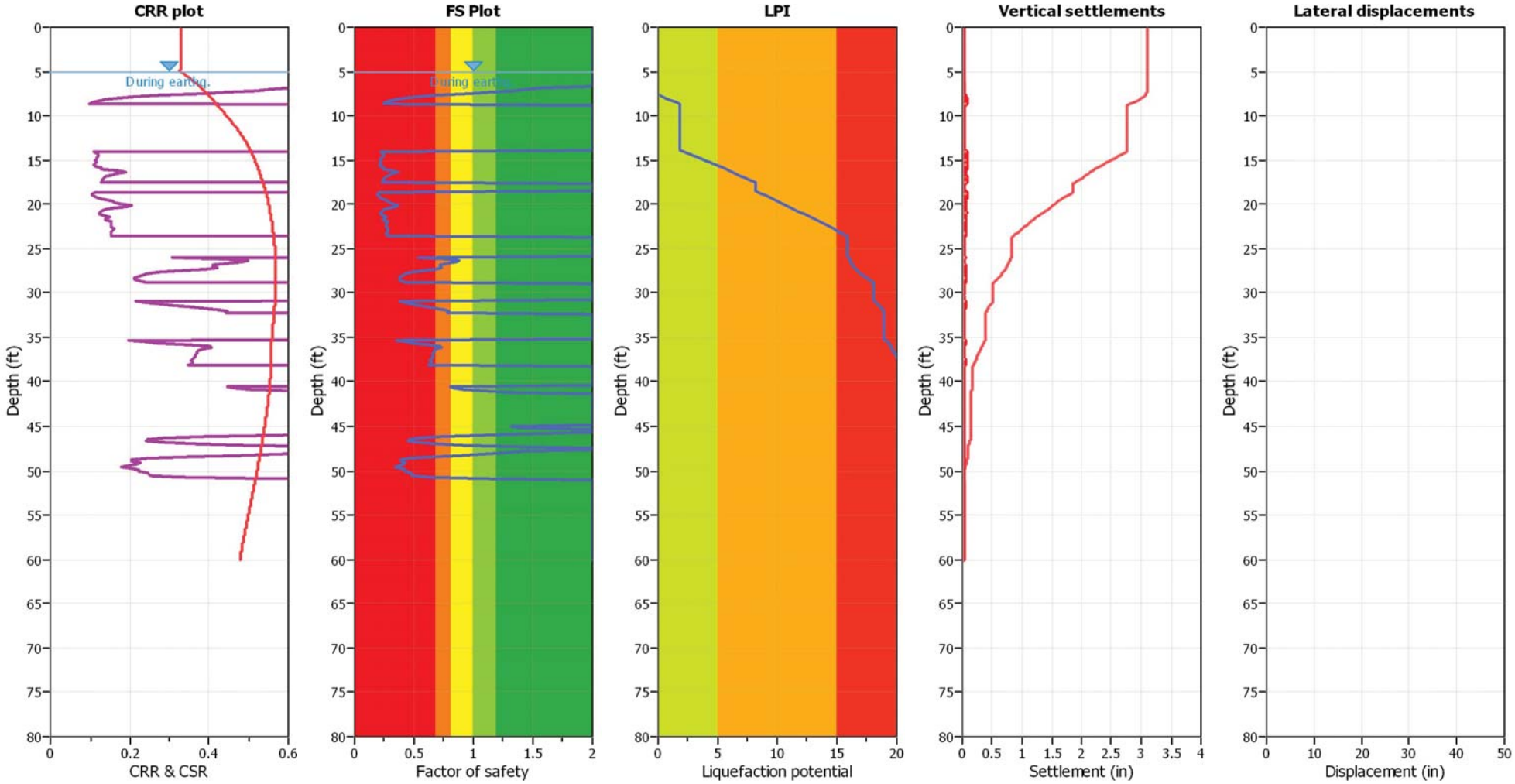
F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.03	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.60	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	5.00 ft	Fill height:	N/A	Limit depth:	N/A

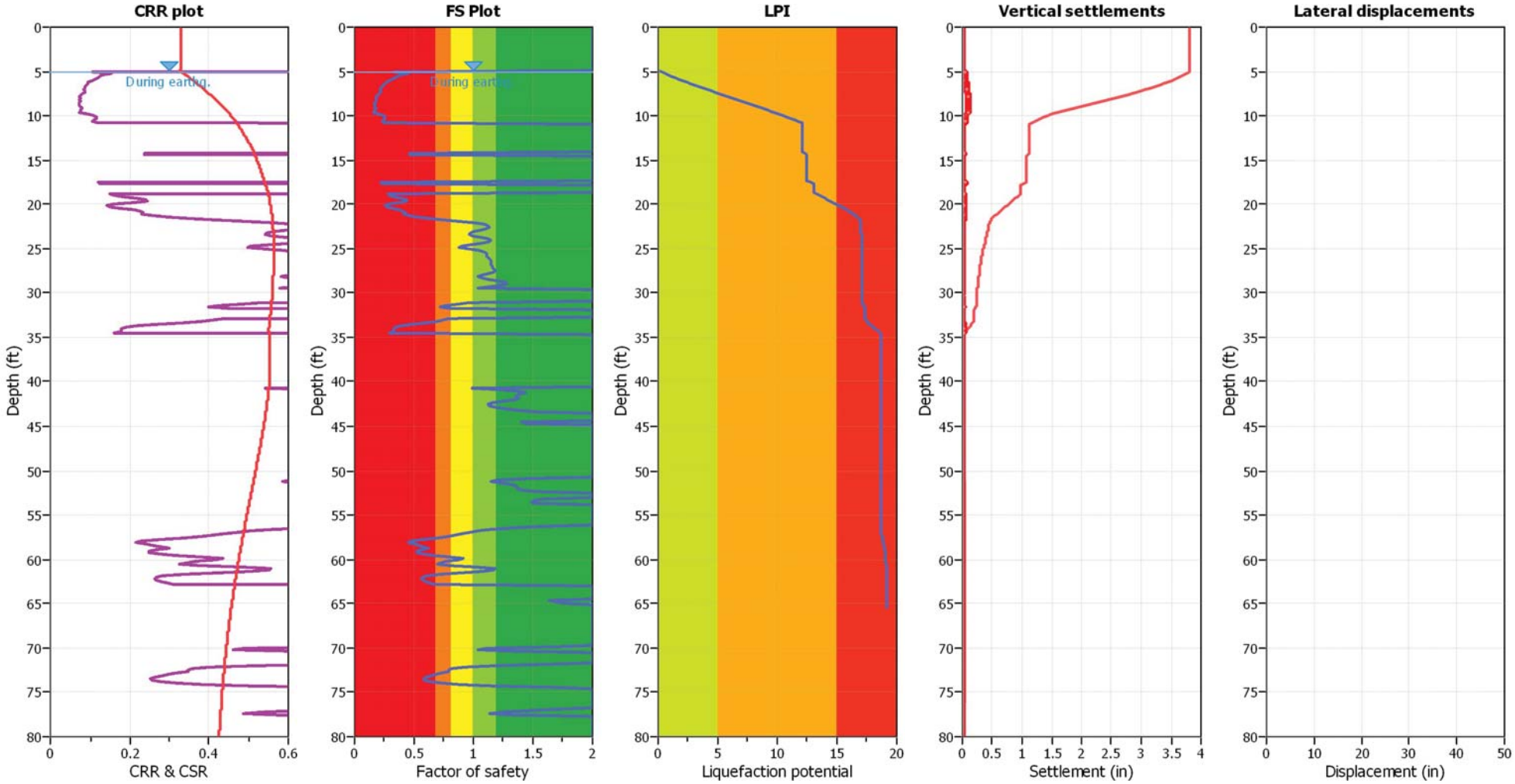
F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.03	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.60	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	5.00 ft	Fill height:	N/A	Limit depth:	N/A

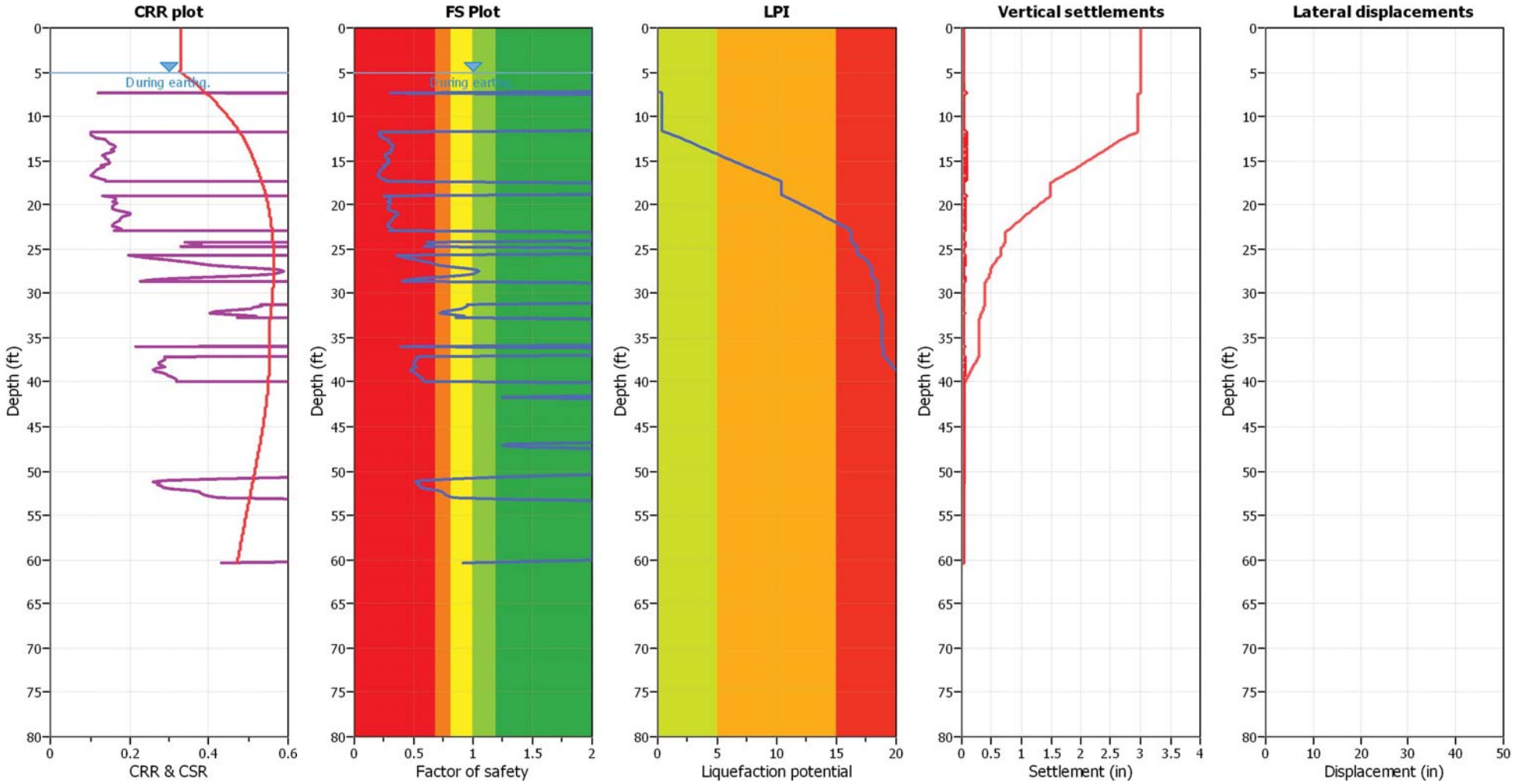
F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.03	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.60	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	5.00 ft	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
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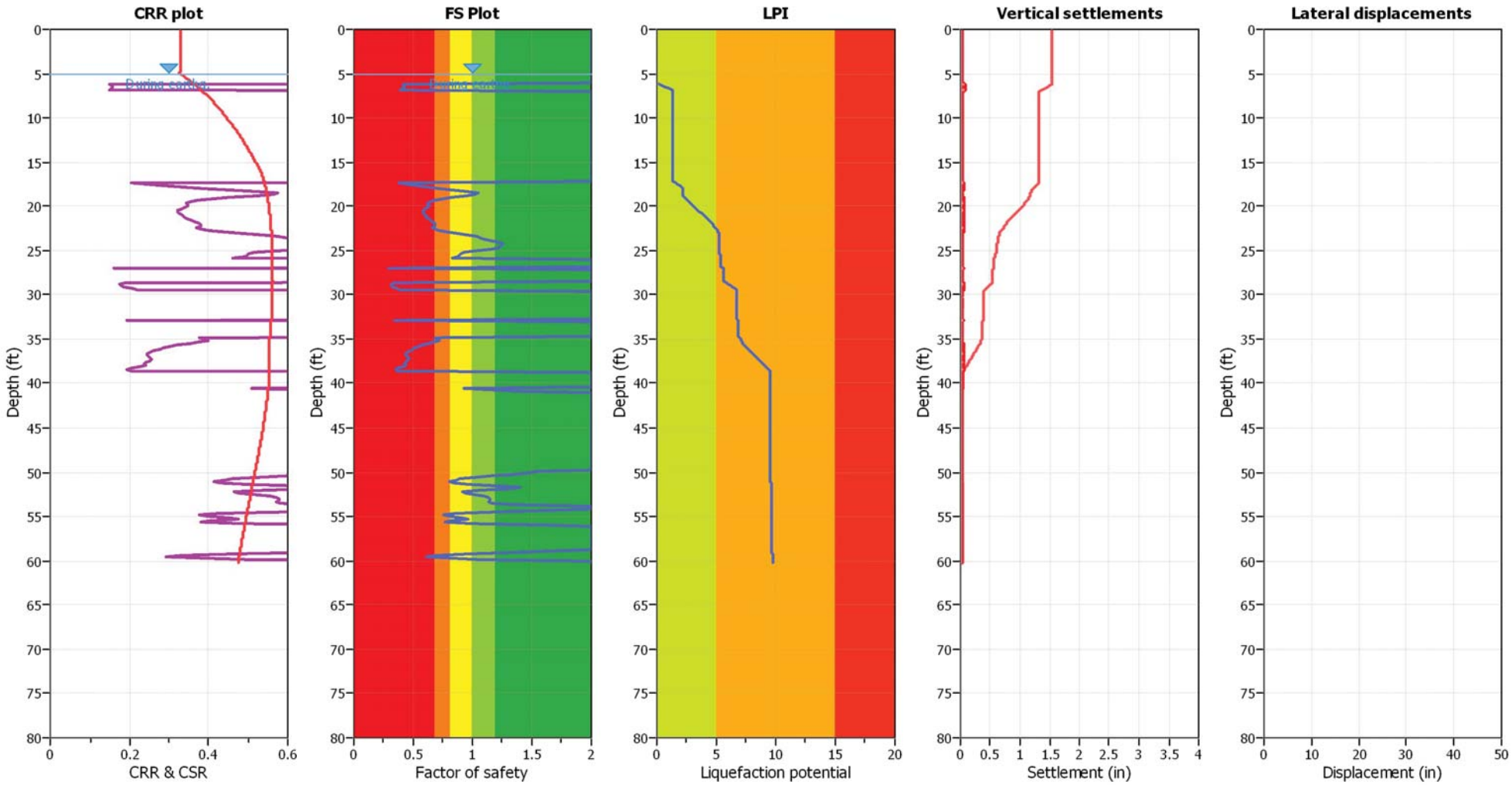
- Low risk

Liquefaction analysis overall plots



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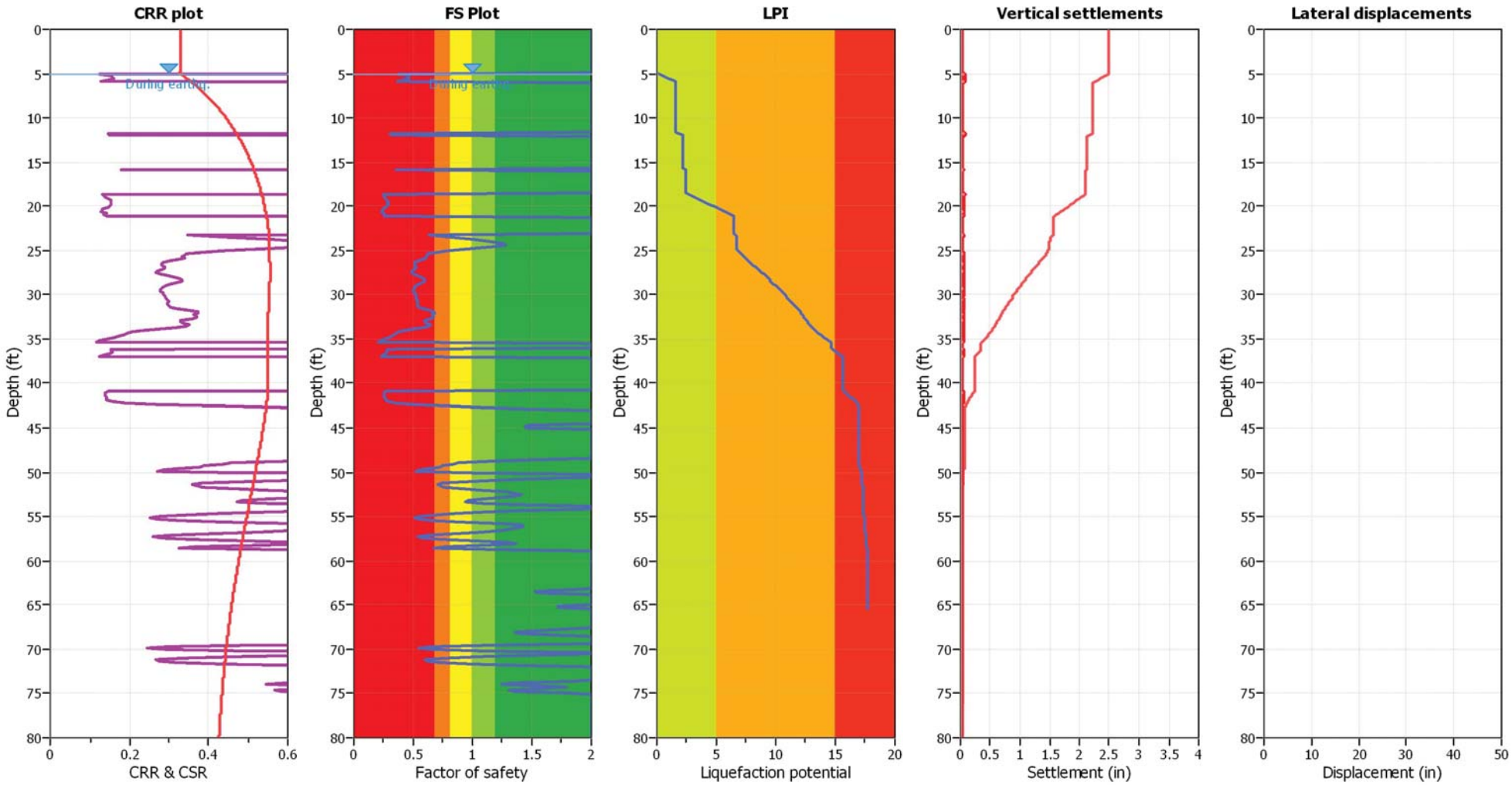

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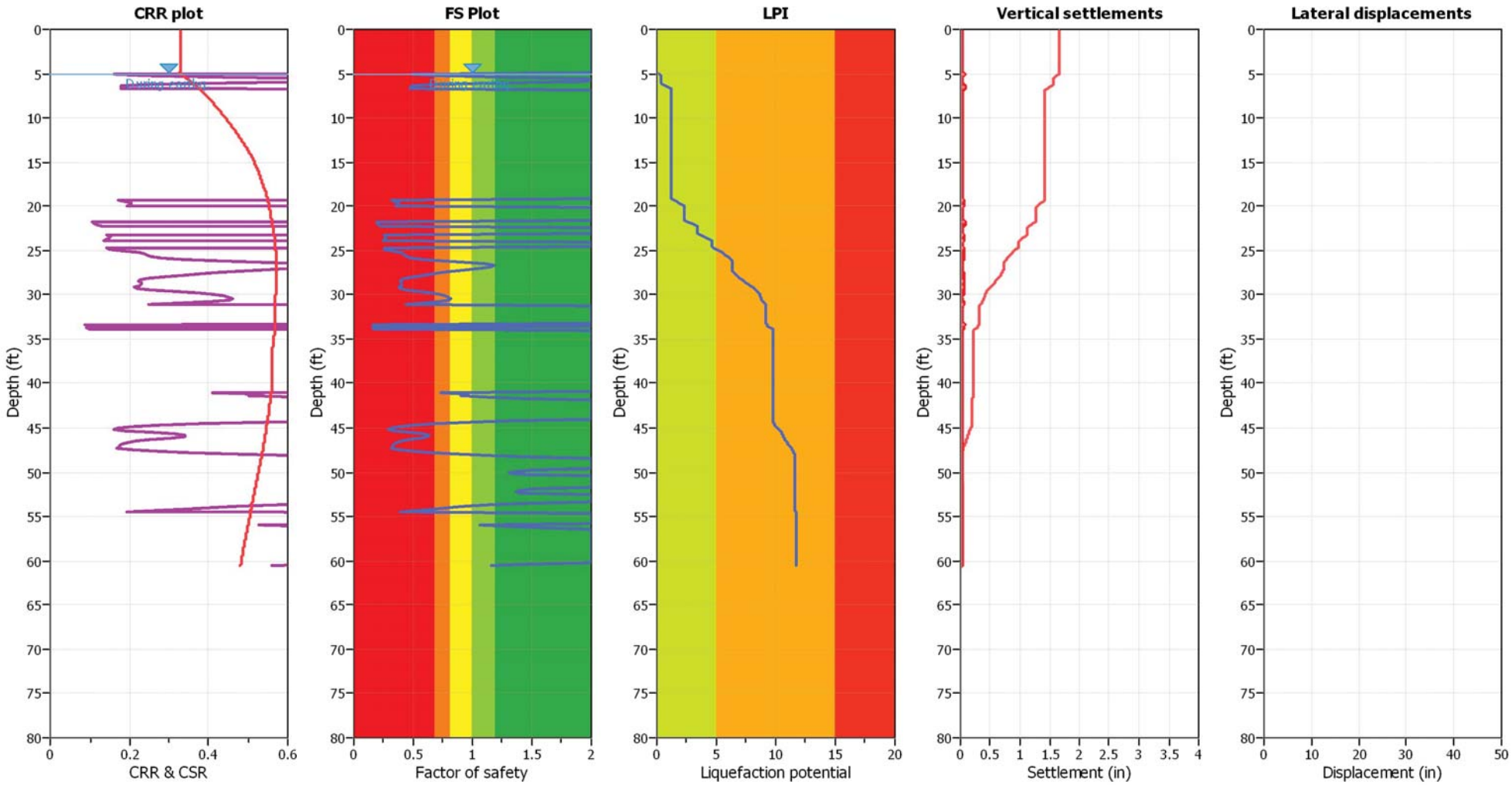

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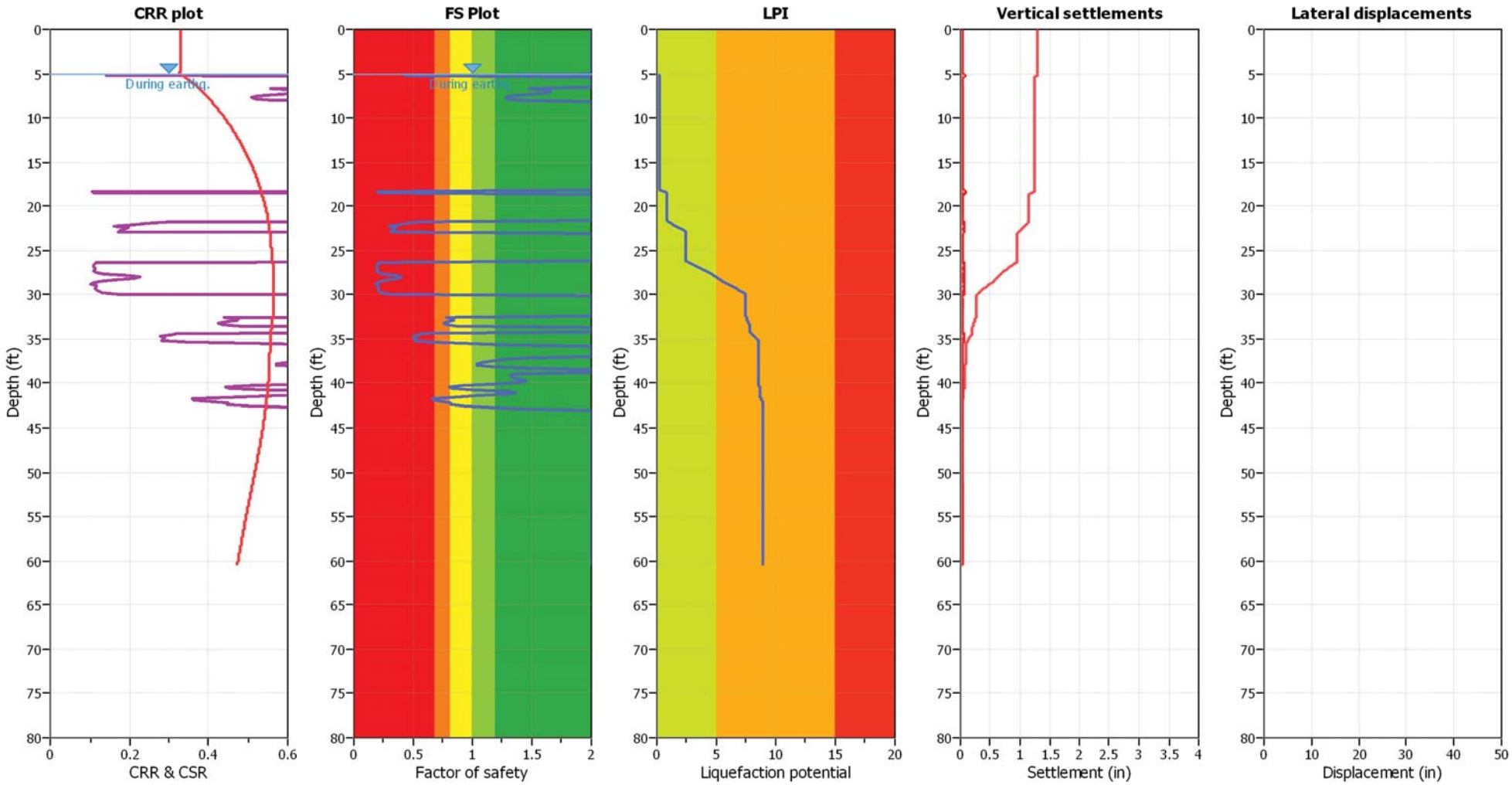

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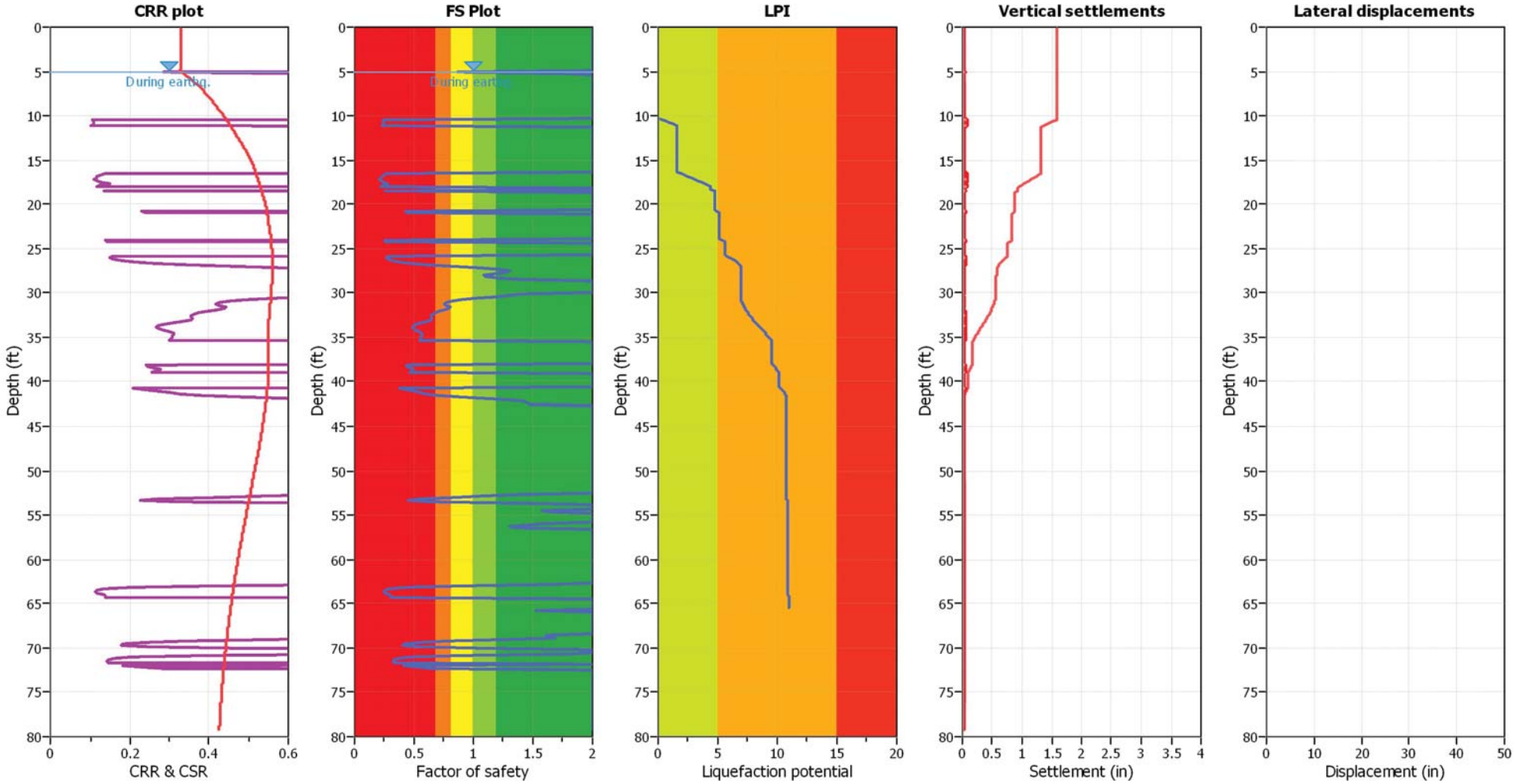

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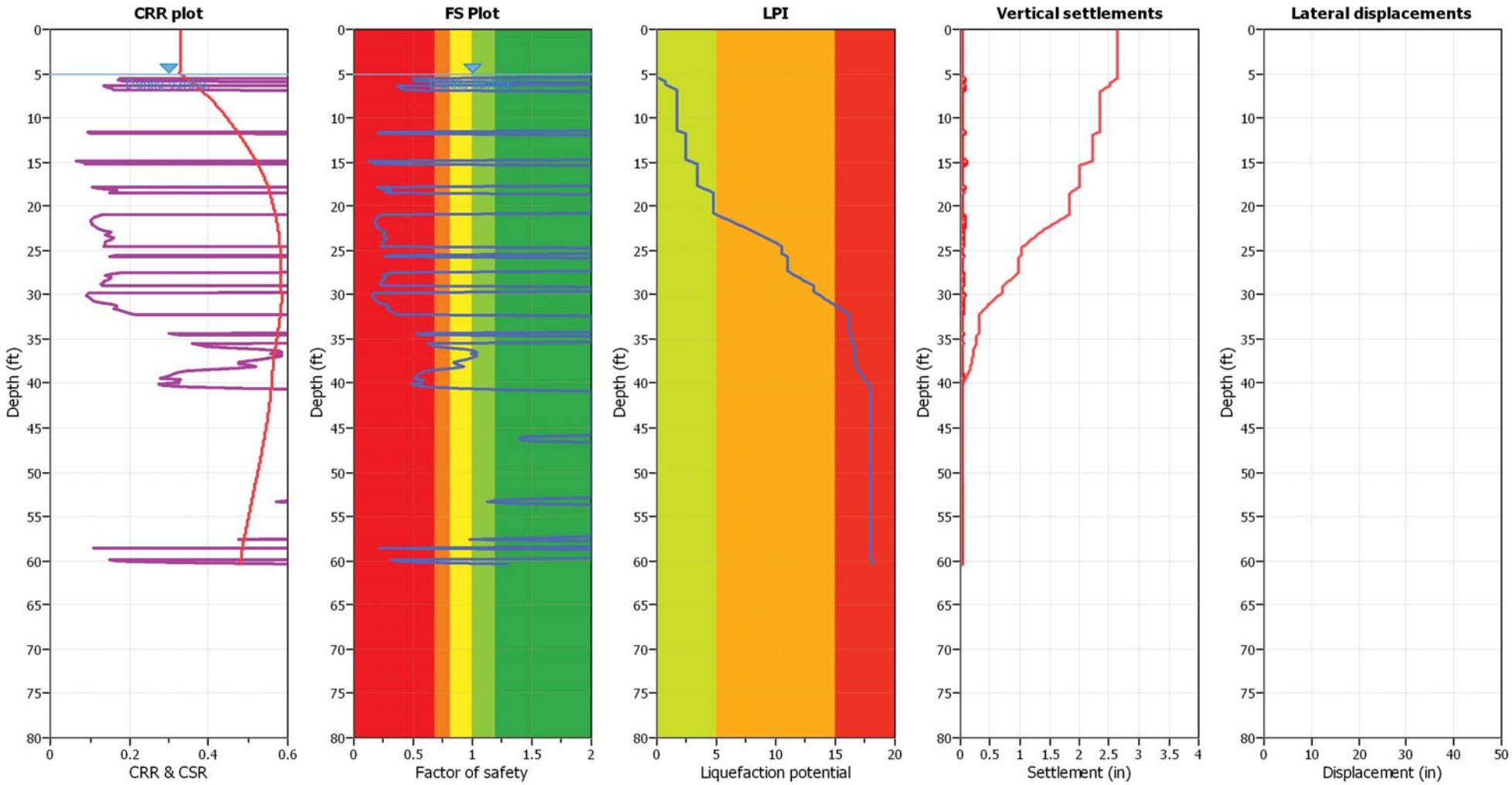

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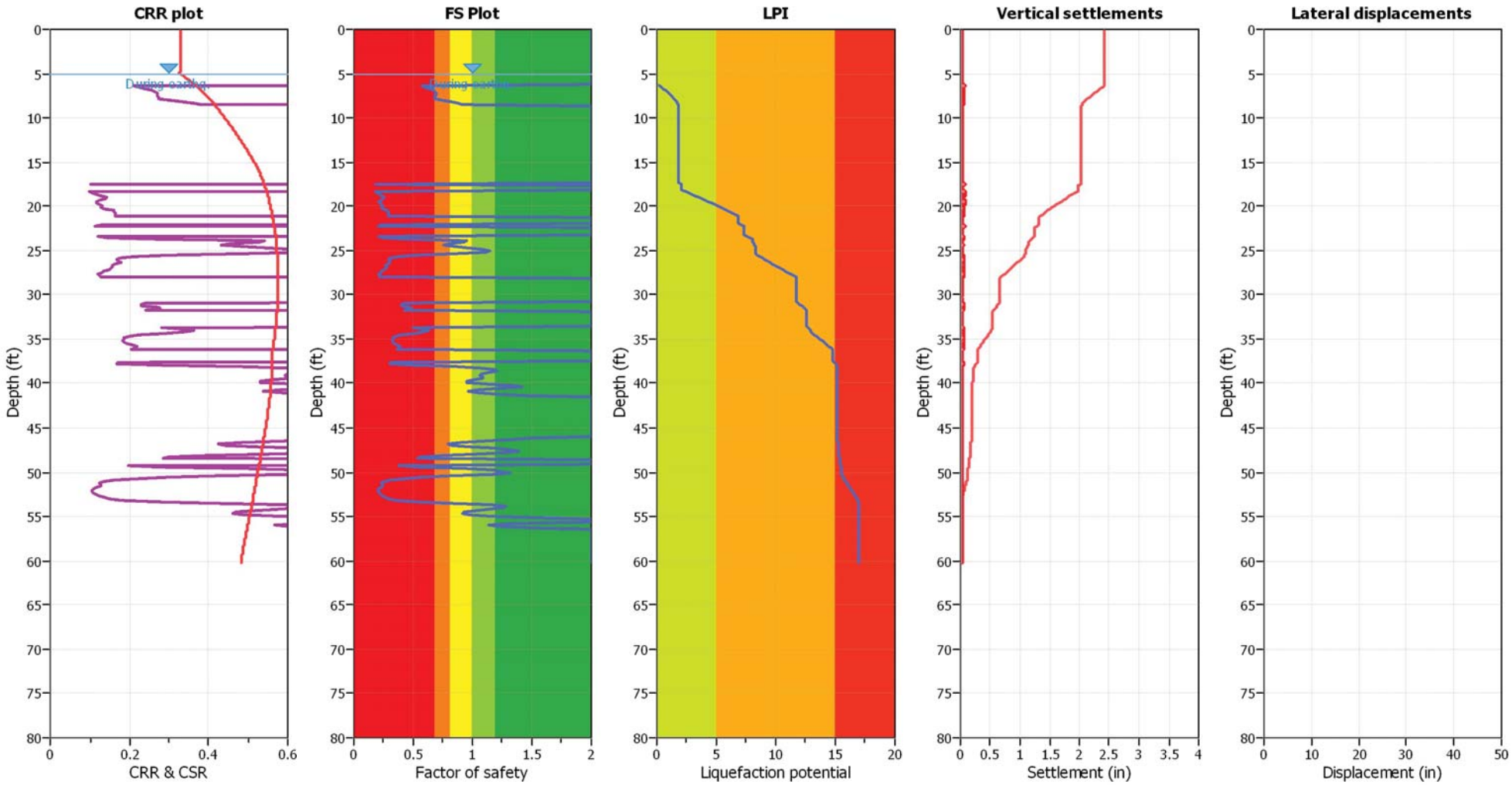

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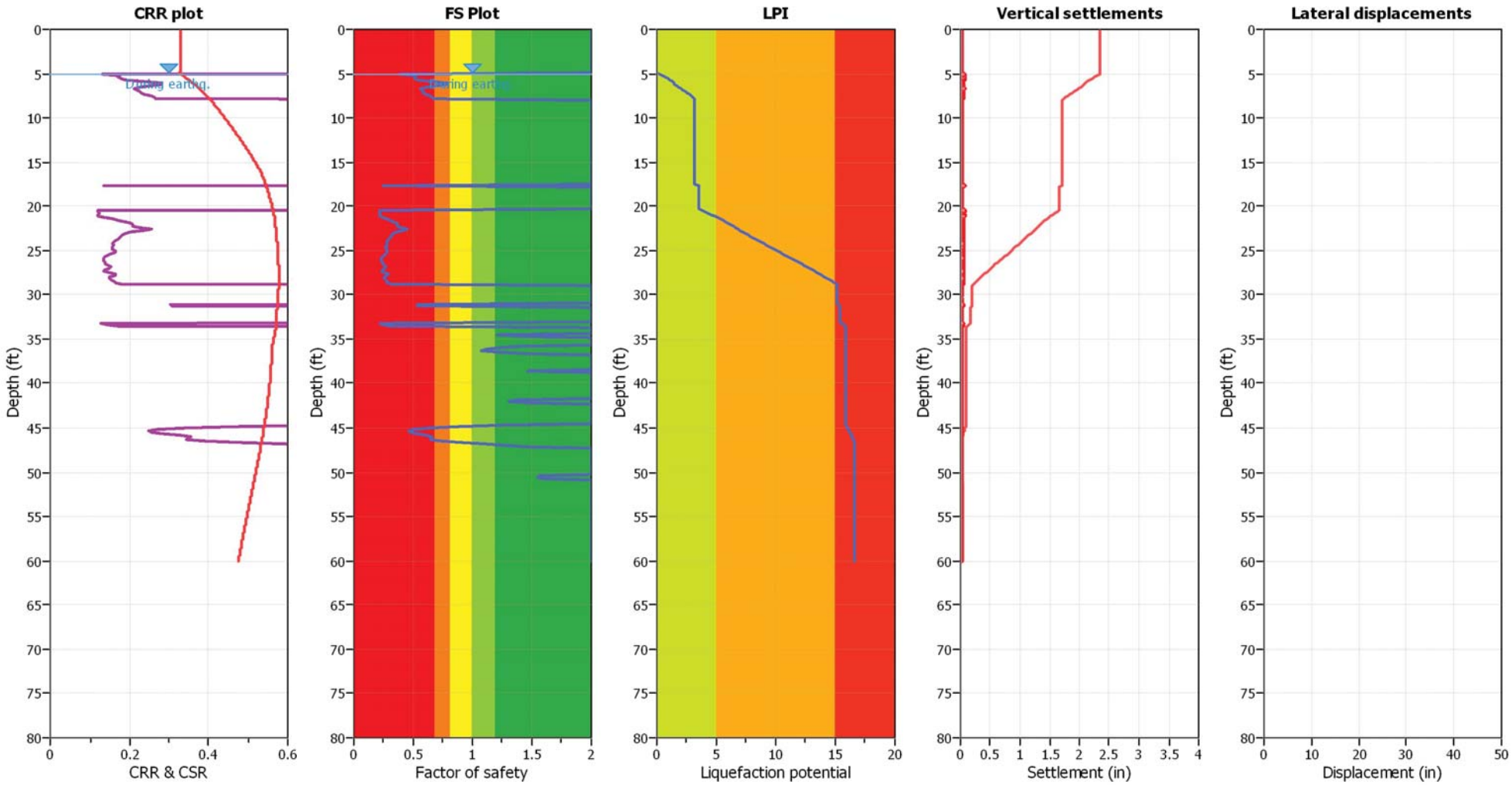

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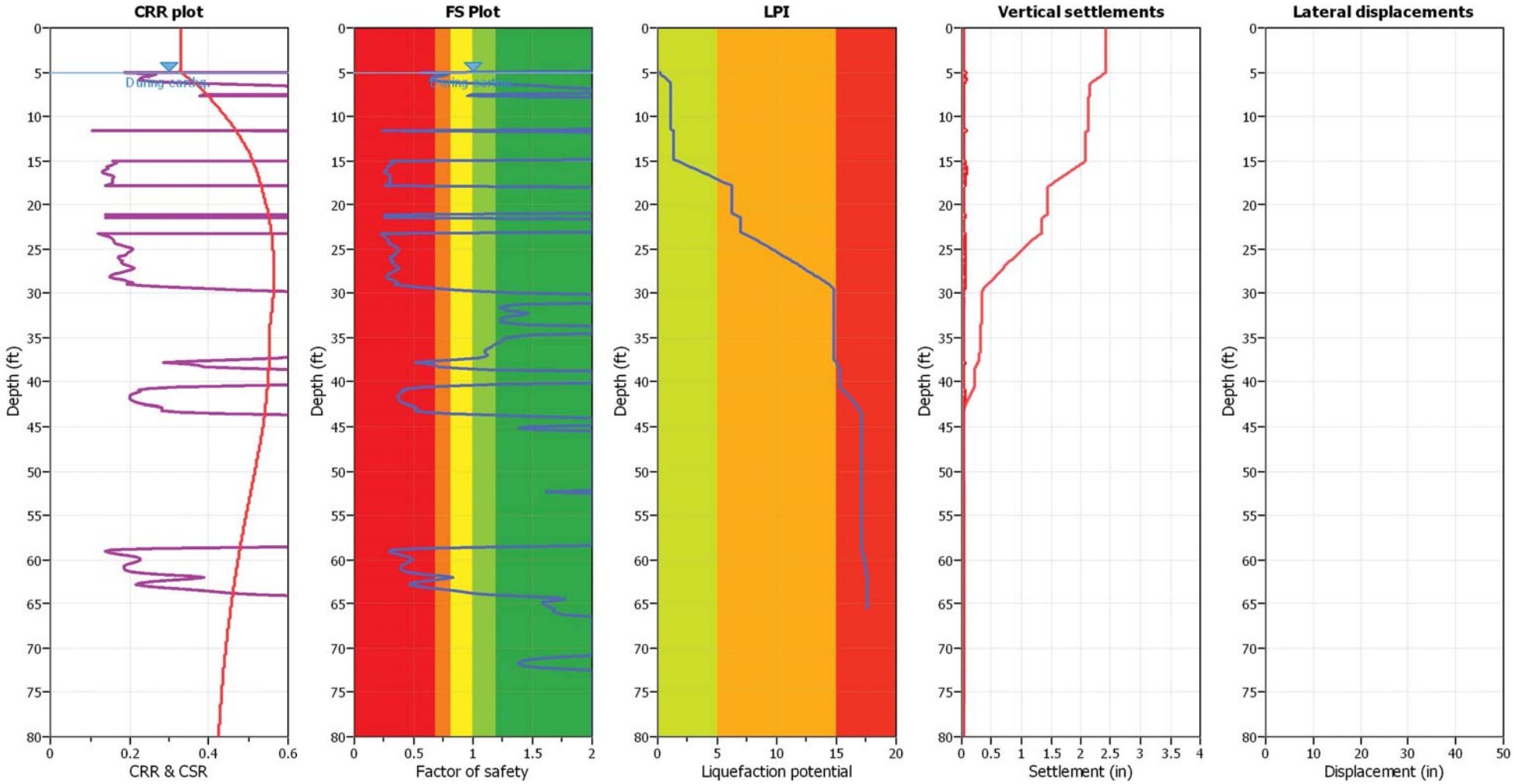

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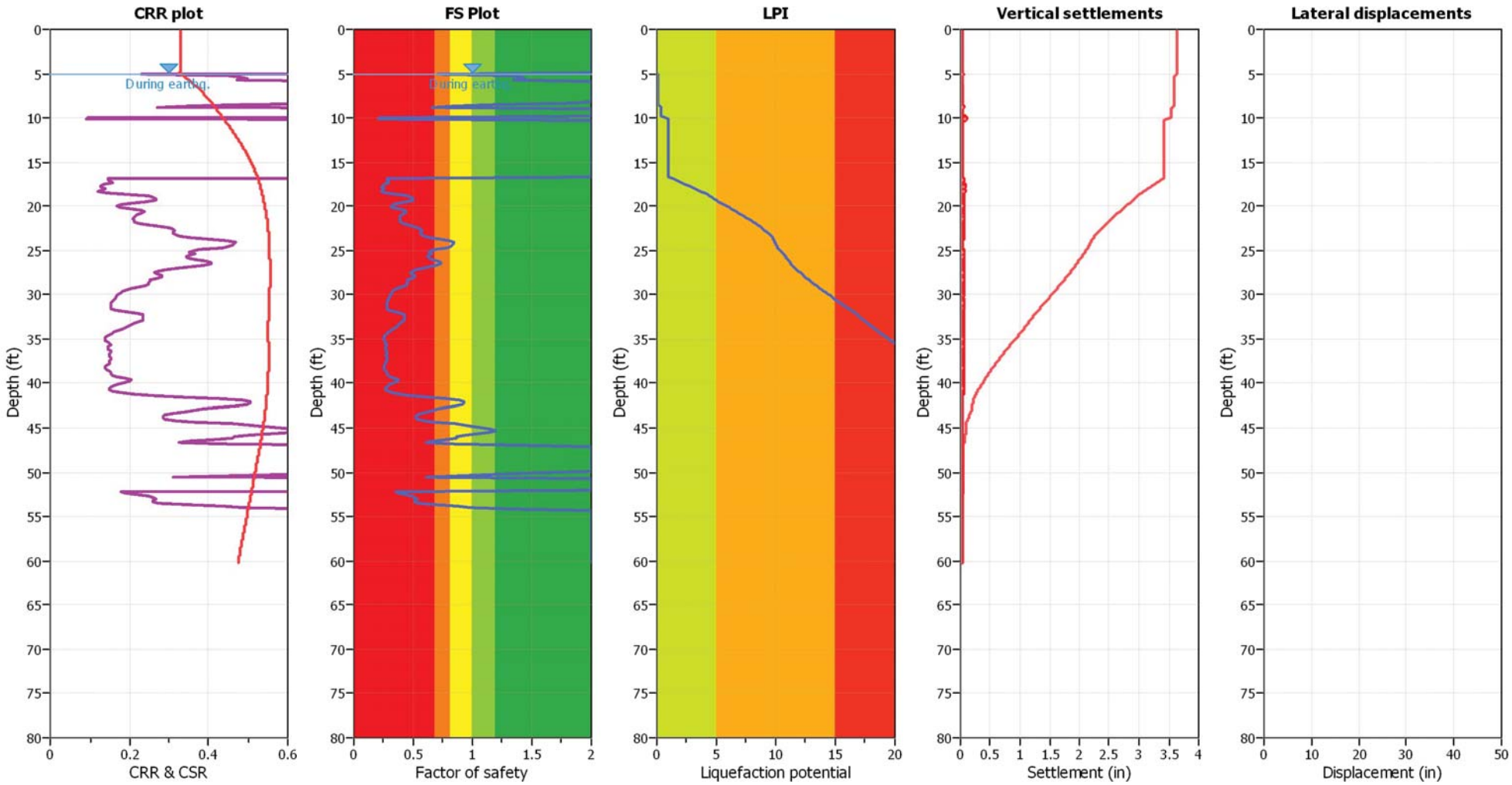

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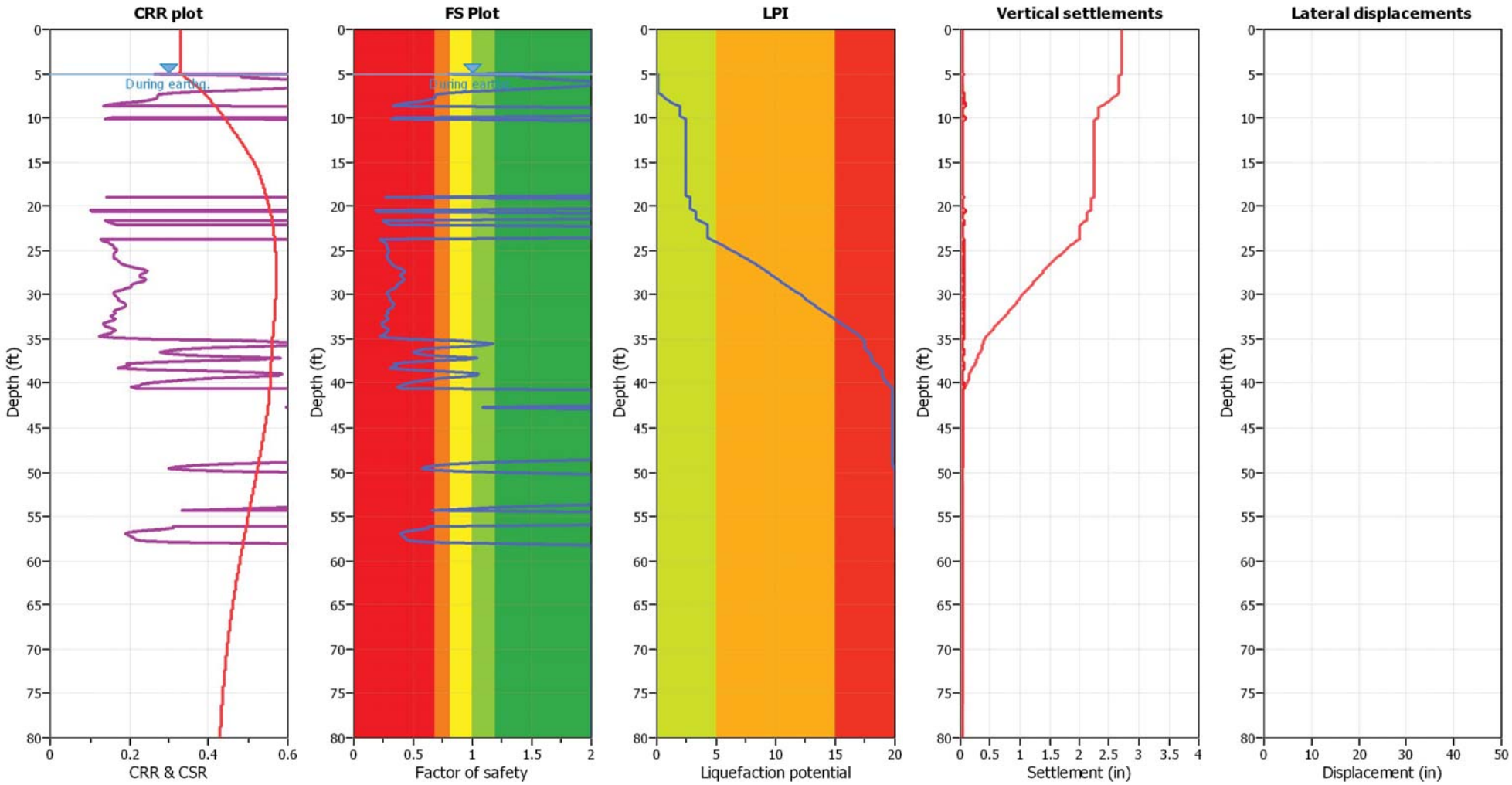

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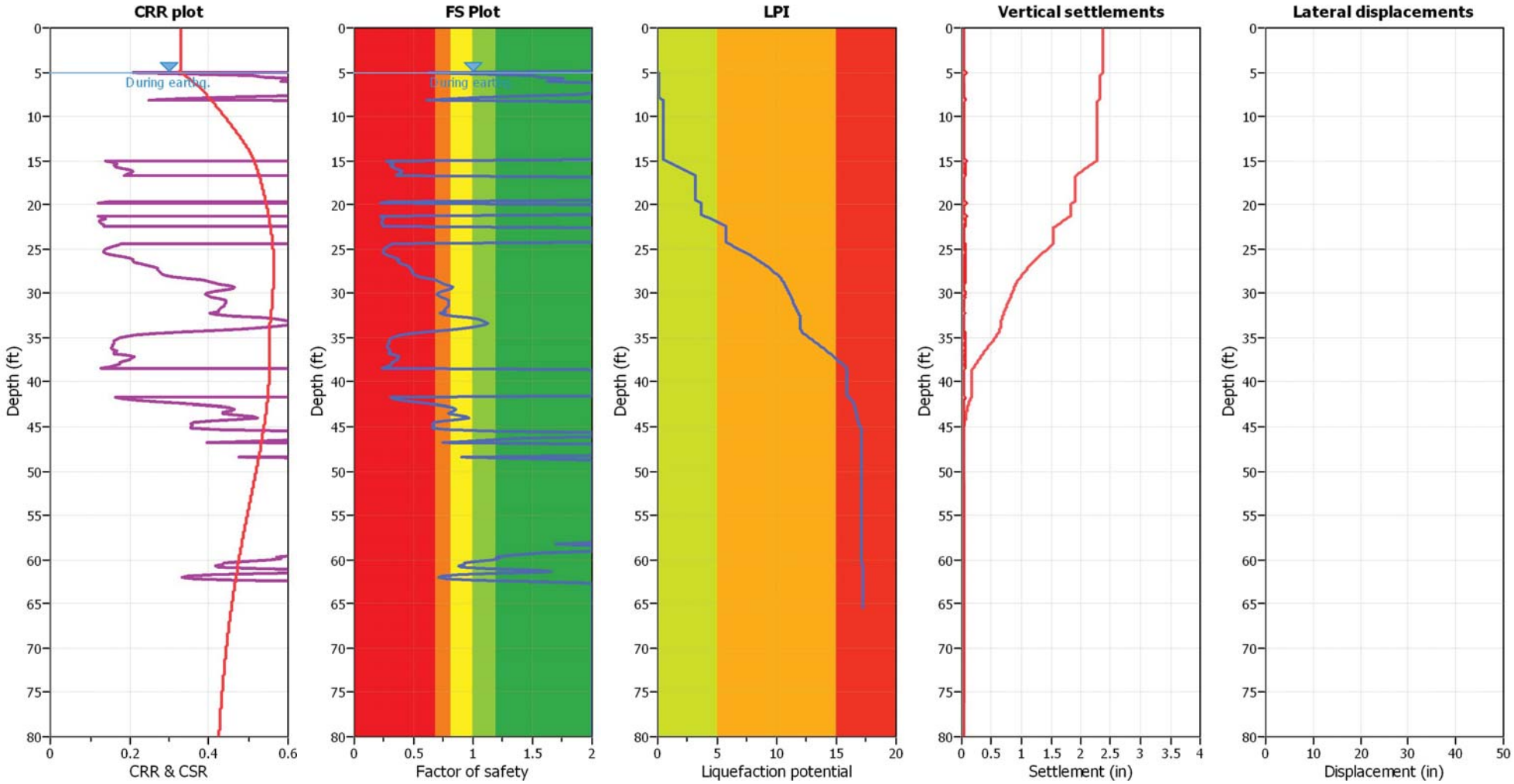

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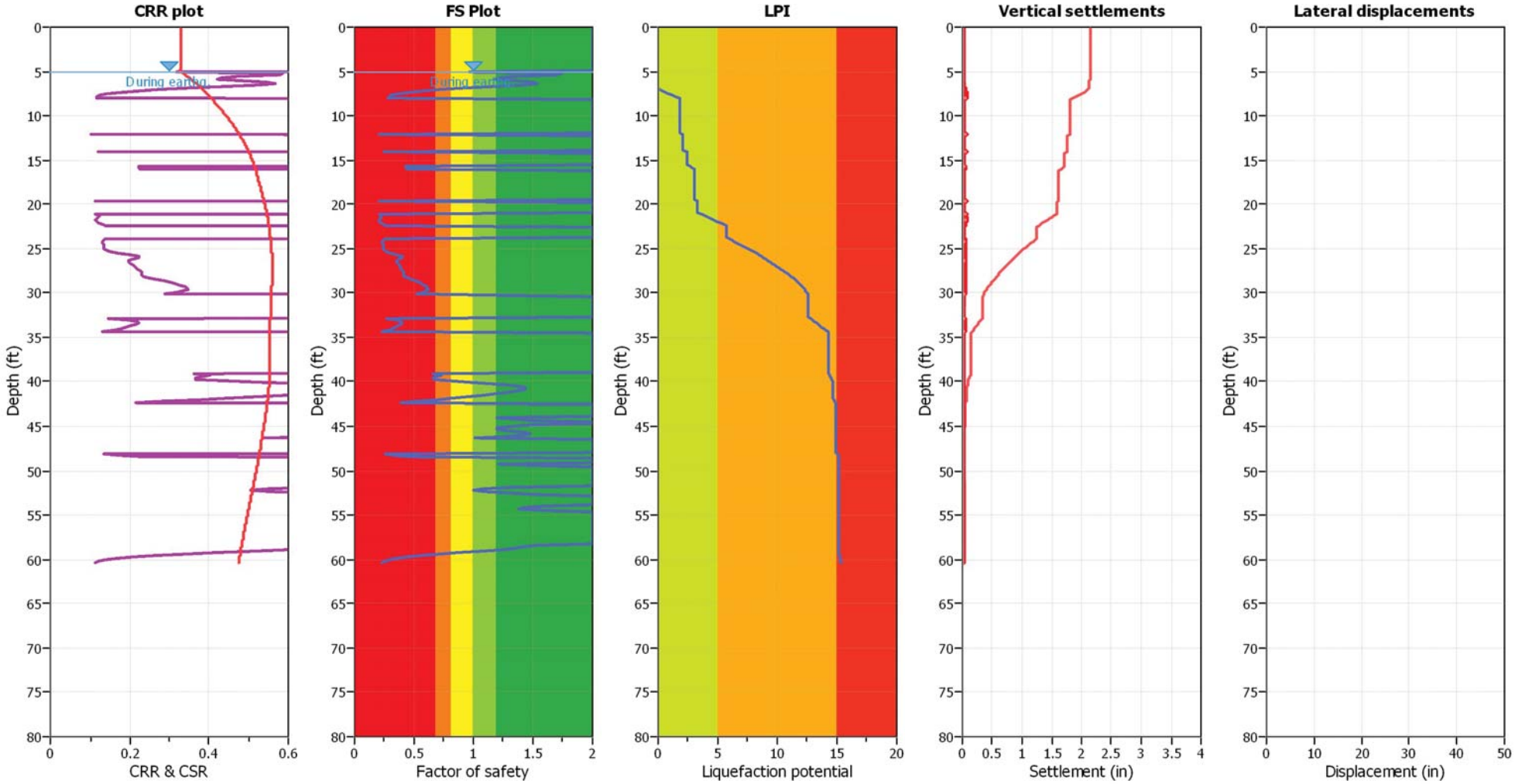

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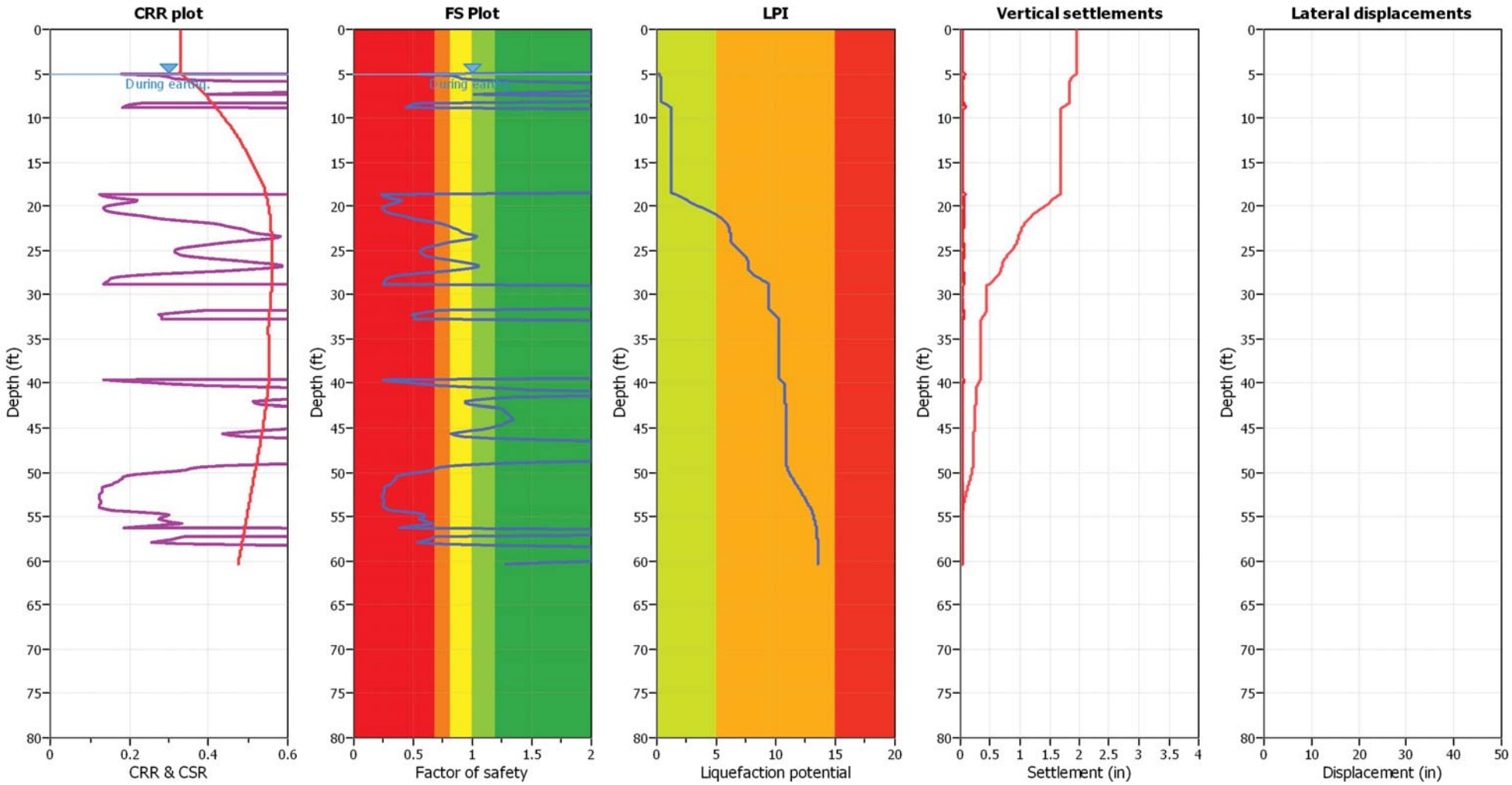

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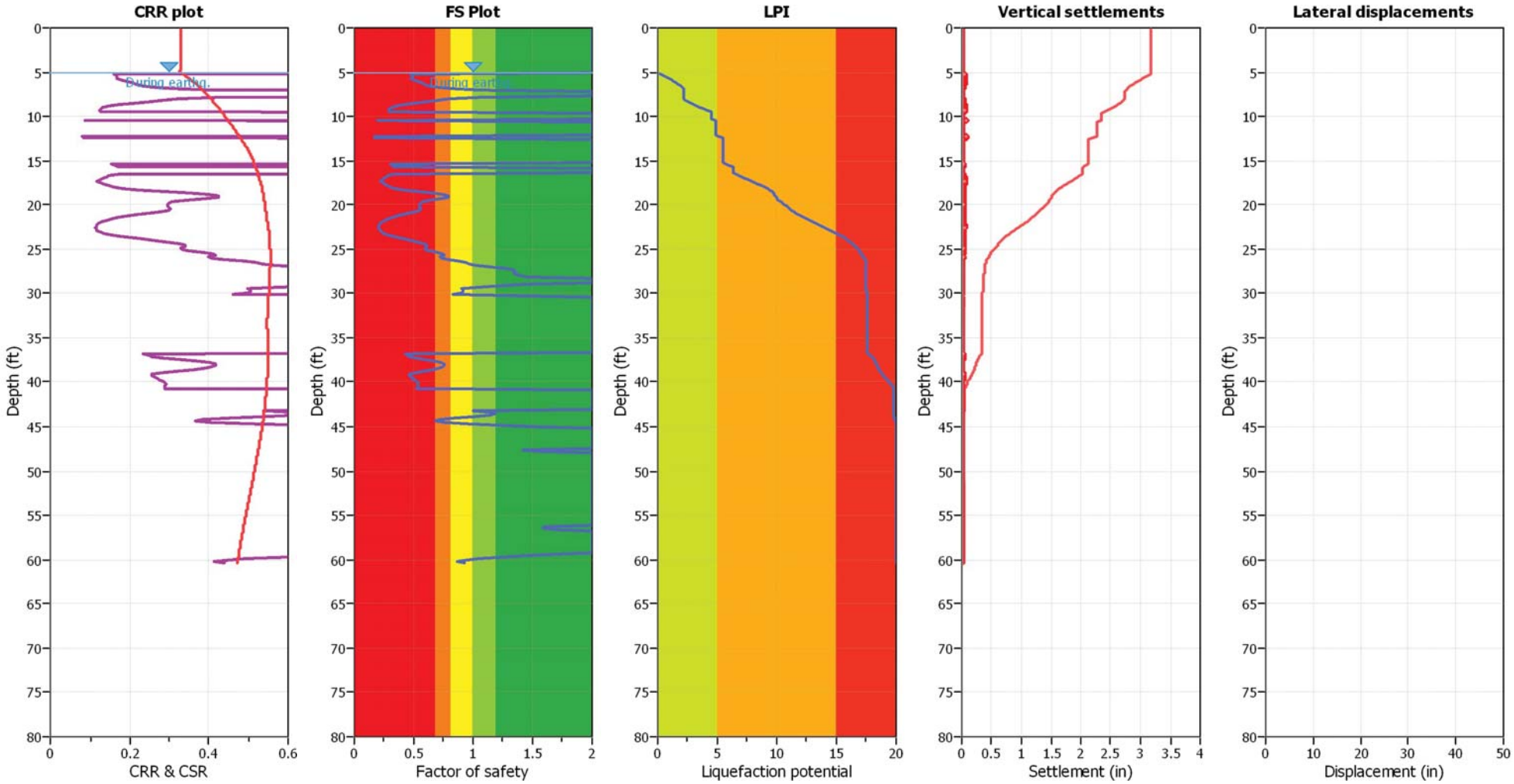

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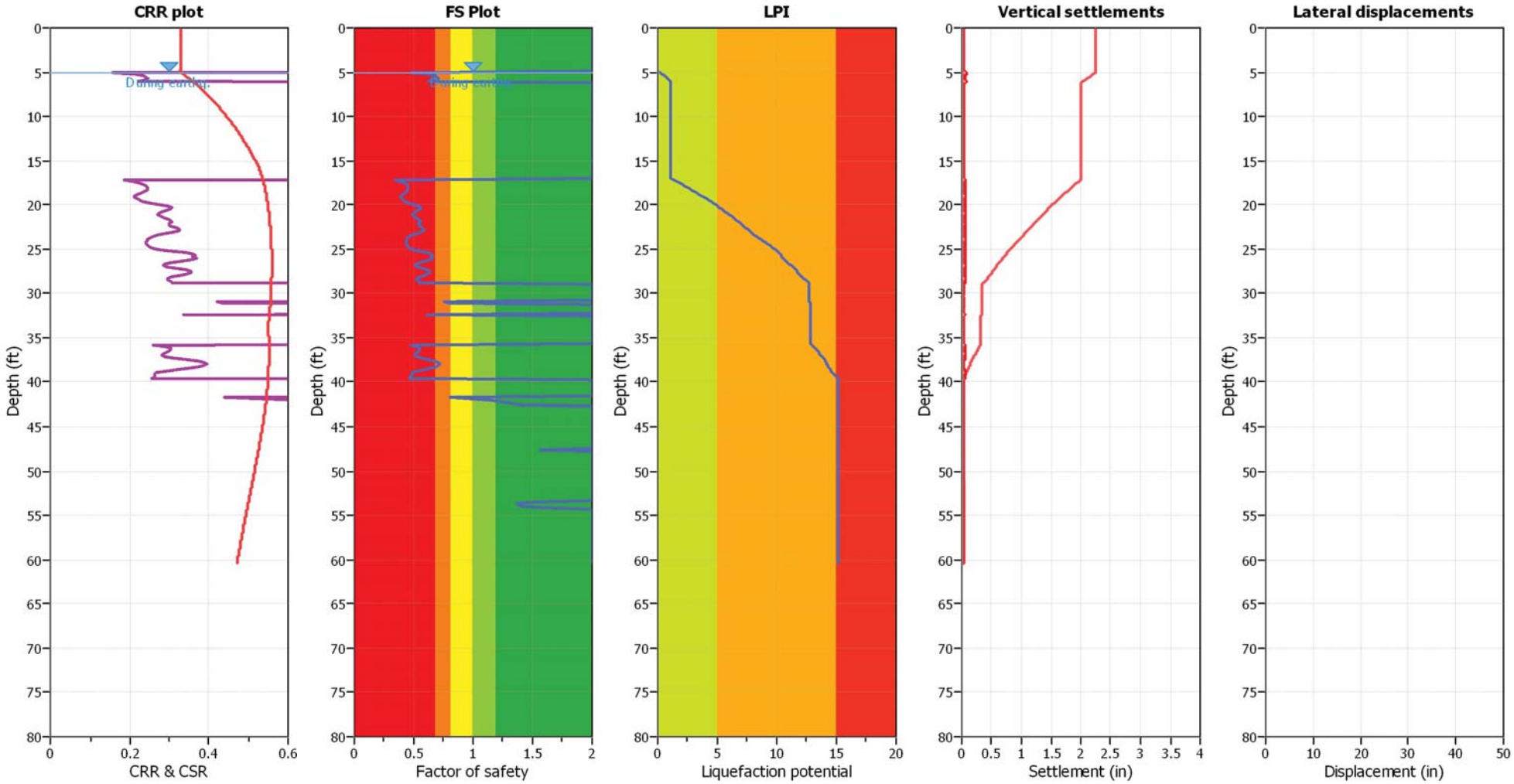

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LIQUEFACTION ANALYSIS WITH

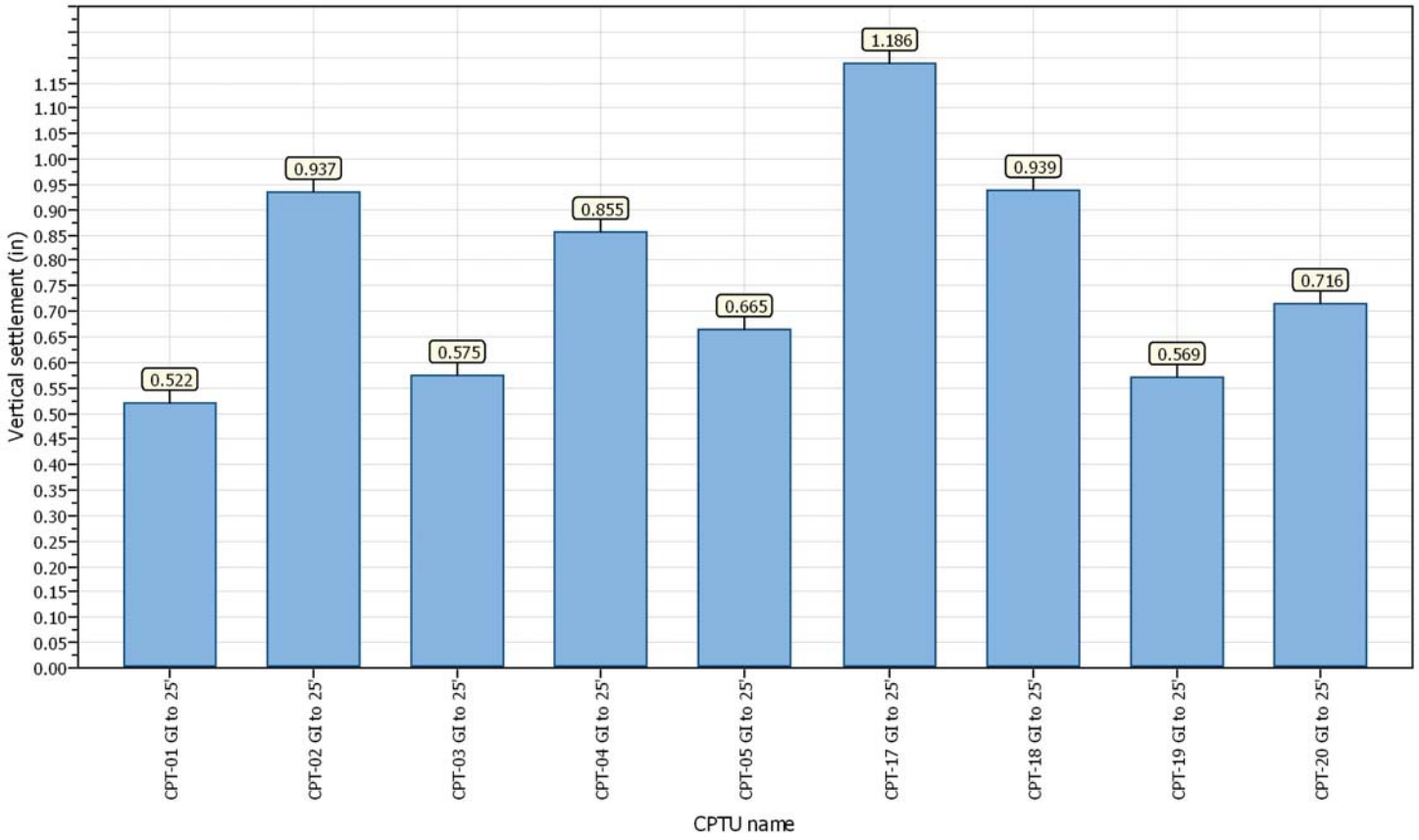
GROUND IMPROVEMENT DEPTH OF 25 FEET

Leighton Consulting, Inc.
17781 Cowan
Irvine, CA
http://www.leightongeo.com/

Project title : 2nd and PCH Retail Center - Liquefaction with Ground Improvement to 25 feet

Location : Long Beach, CA

Overall vertical settlements report



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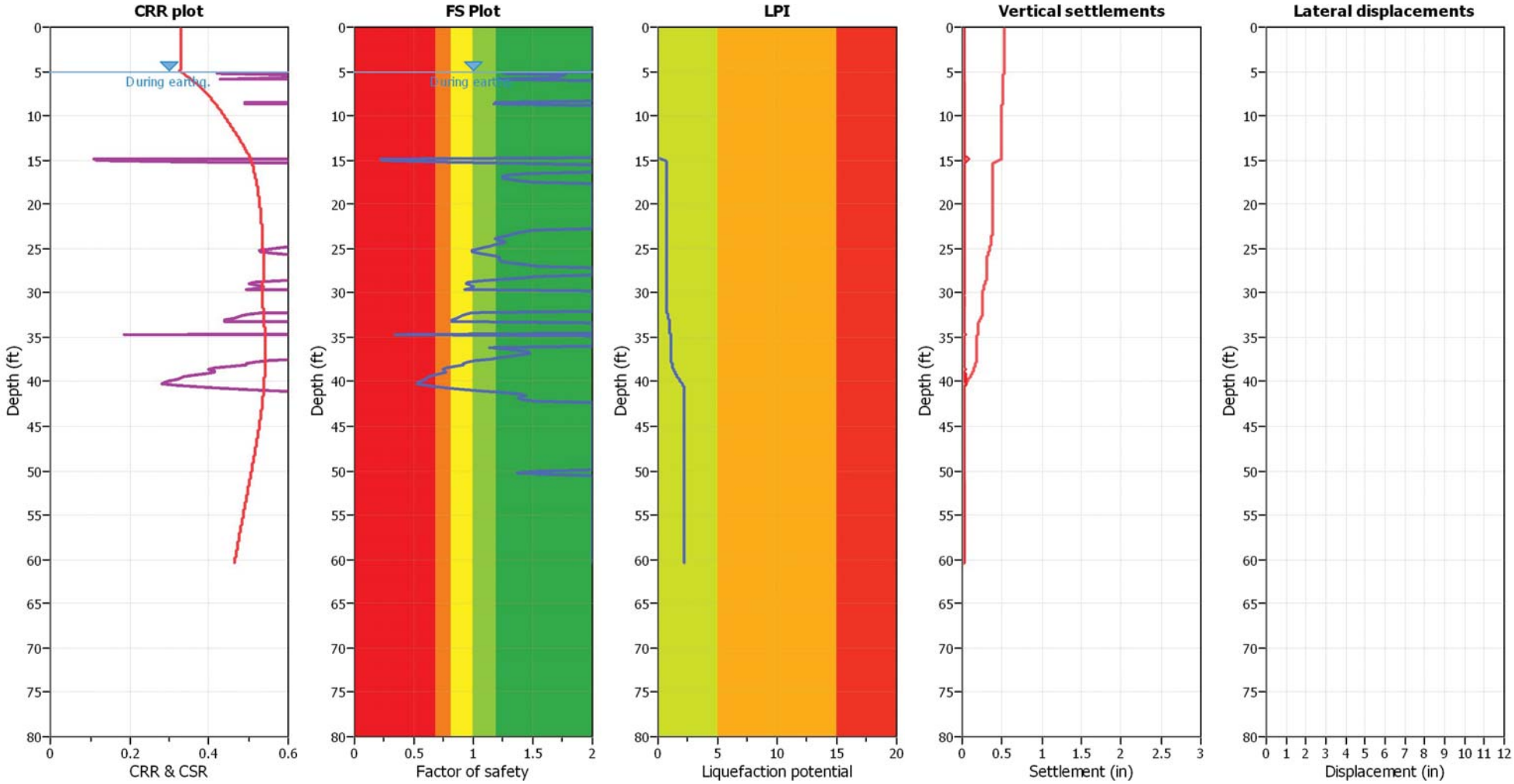

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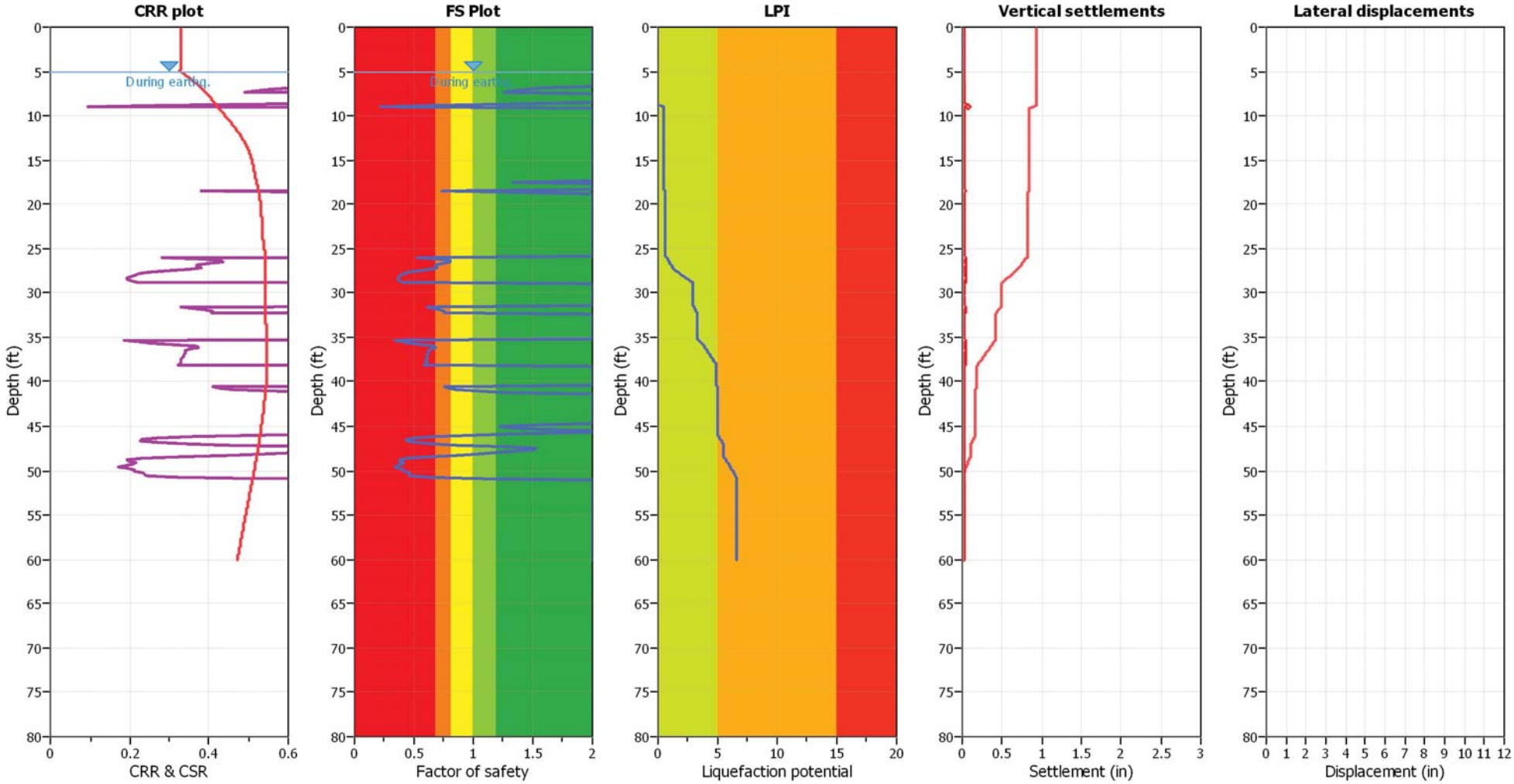

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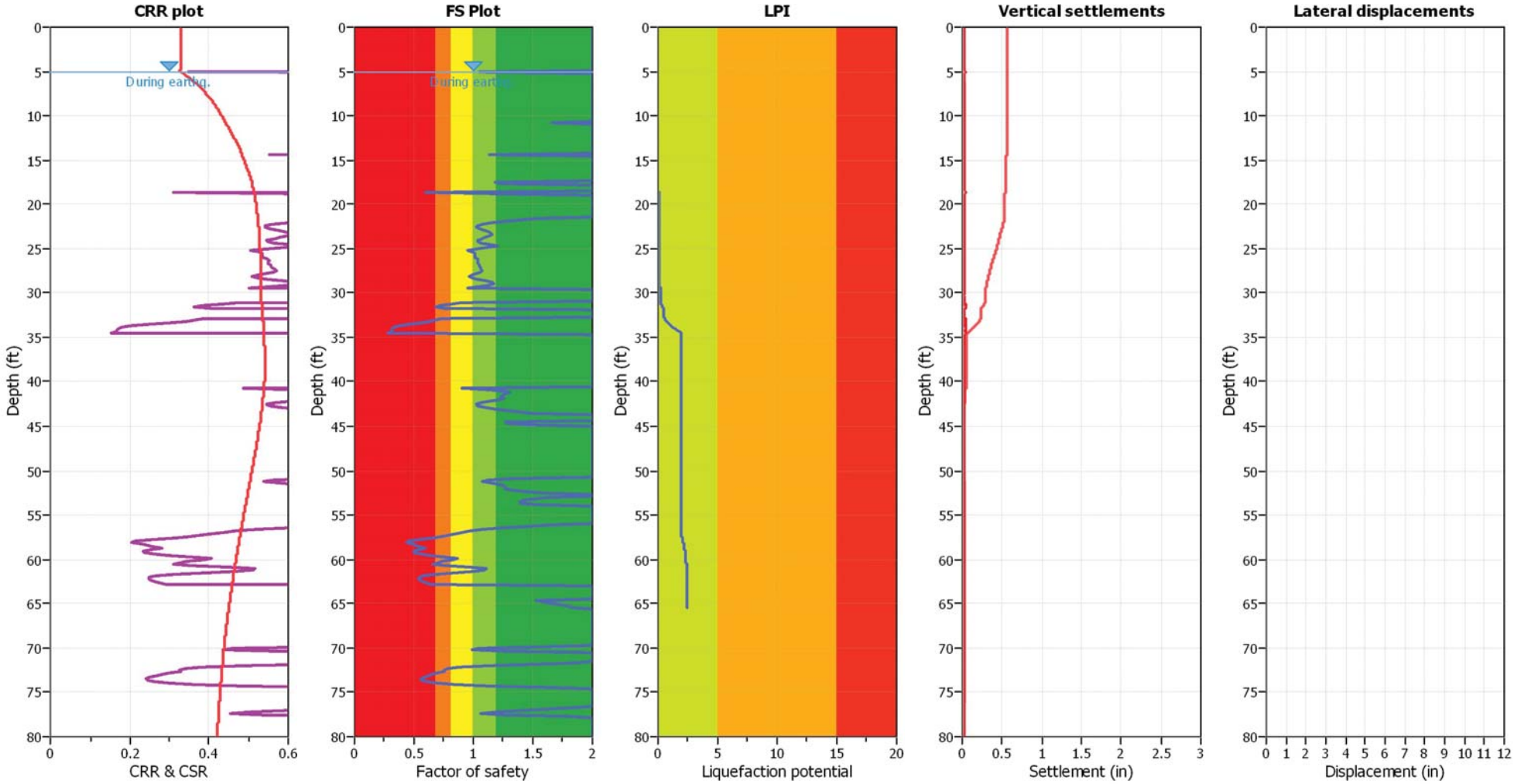

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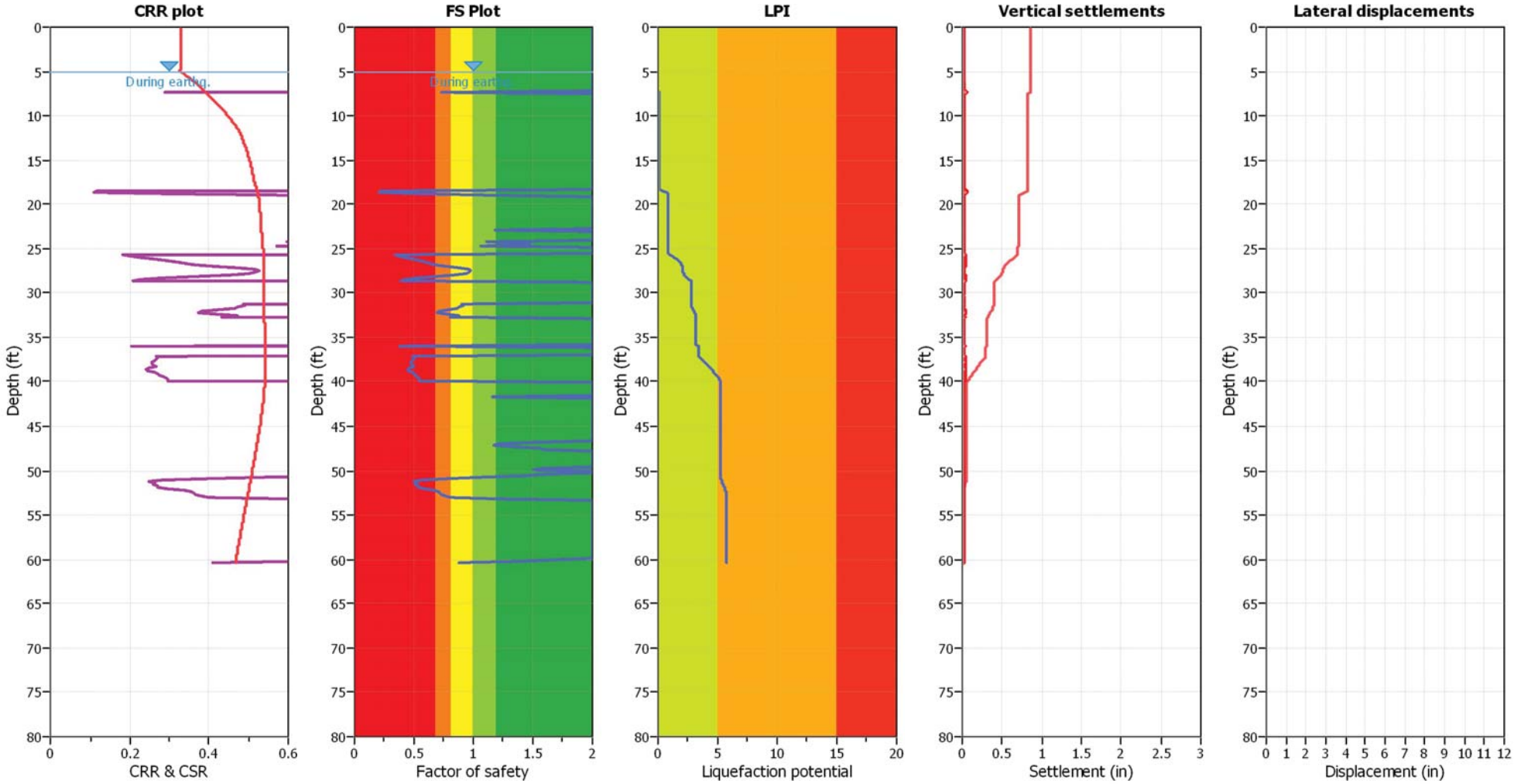
Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.03	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.60	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	5.00 ft	Fill height:	N/A	Limit depth:	N/A

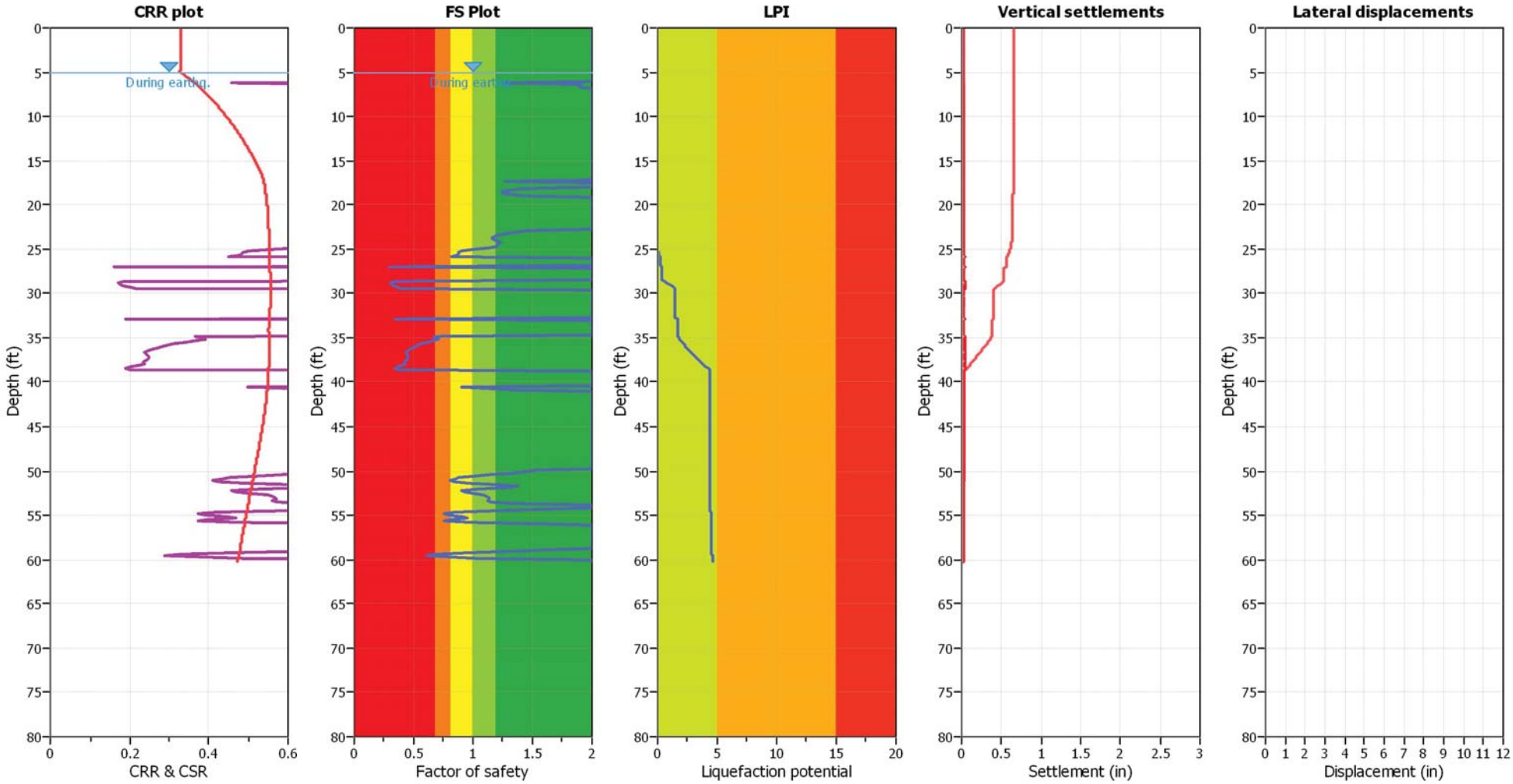
F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.03	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.60	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	5.00 ft	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

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- Liquefaction and no liq. are equally likely
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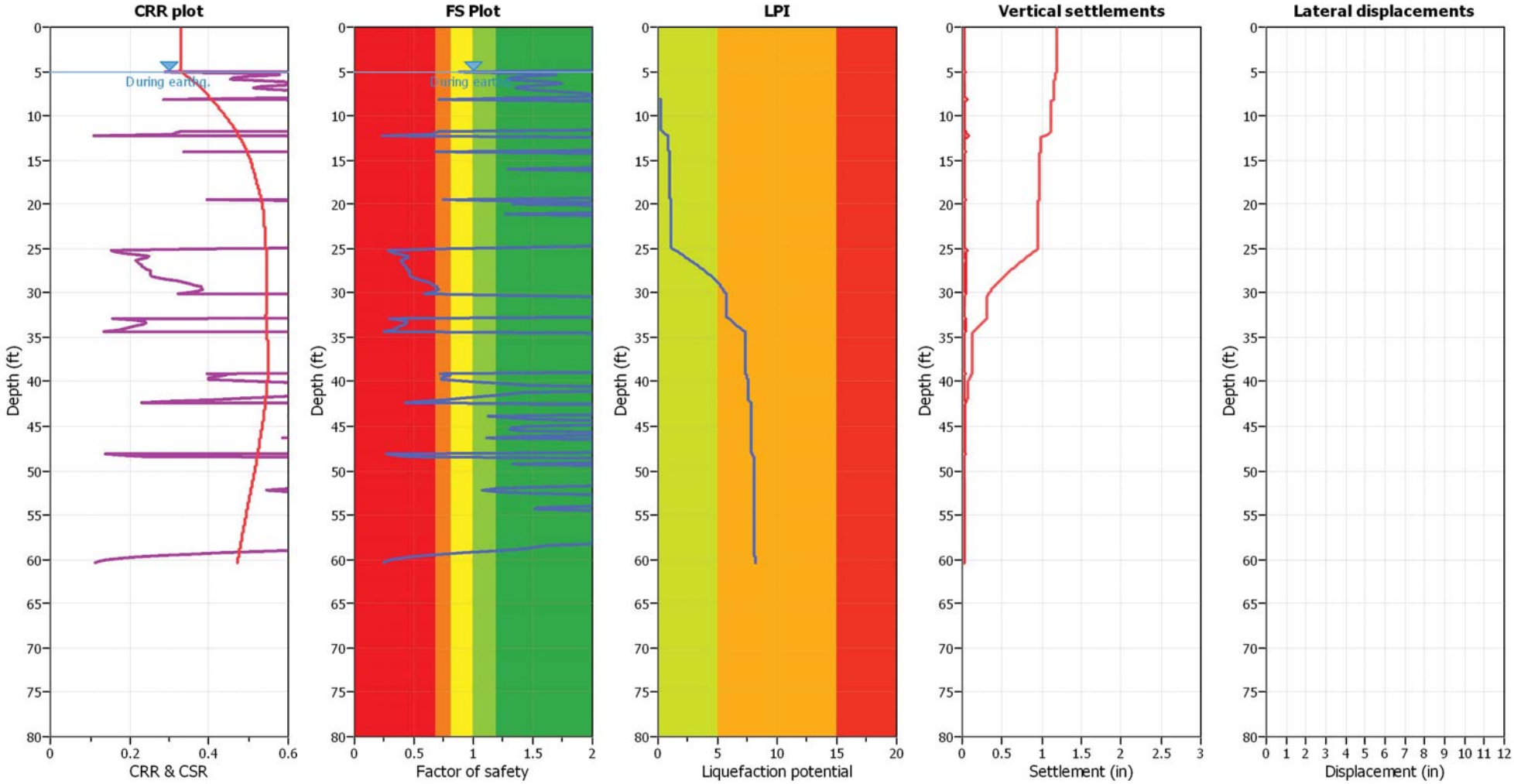
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.03	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.60	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	5.00 ft	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

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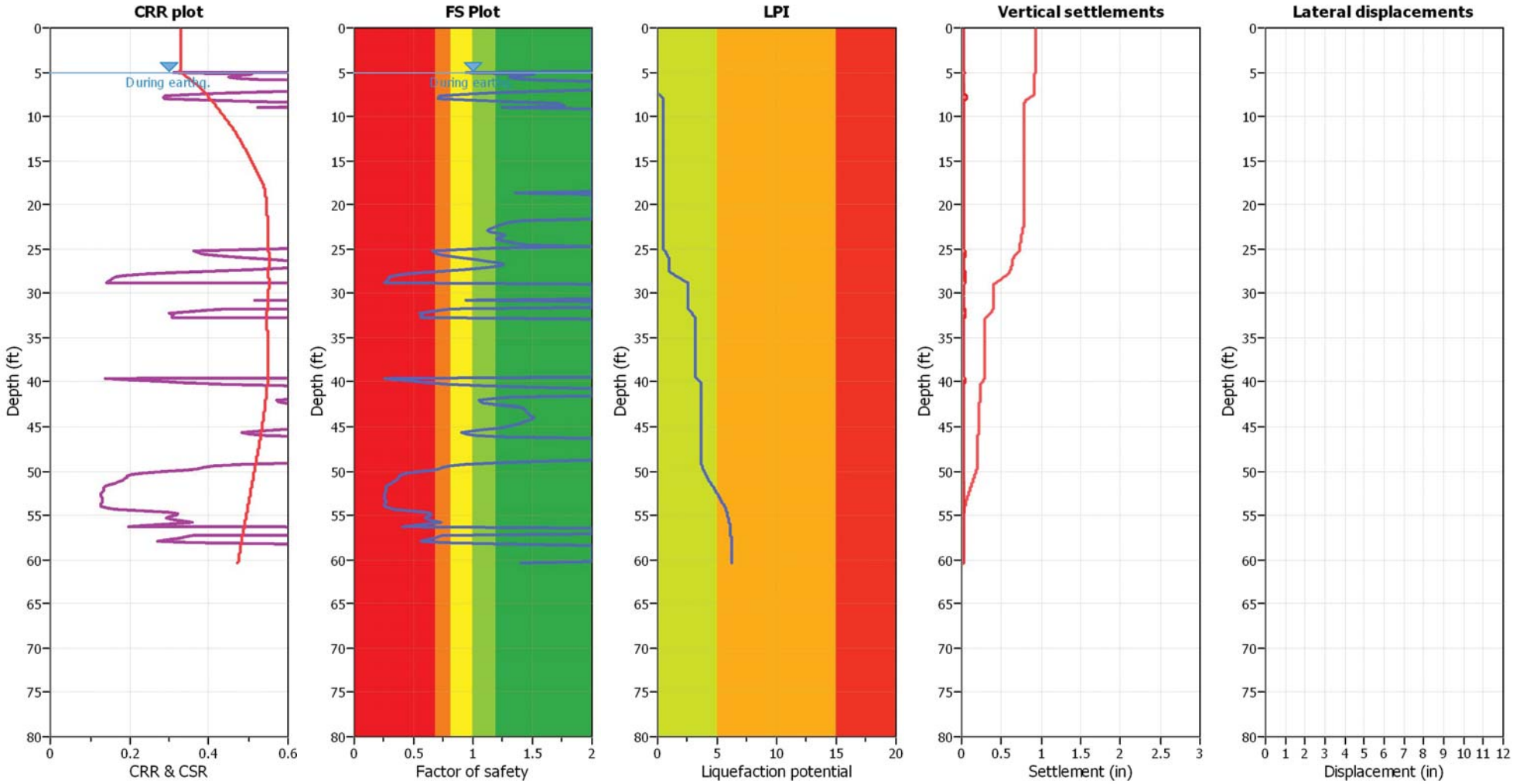
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.03	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.60	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	5.00 ft	Fill height:	N/A	Limit depth:	N/A

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LPI color scheme

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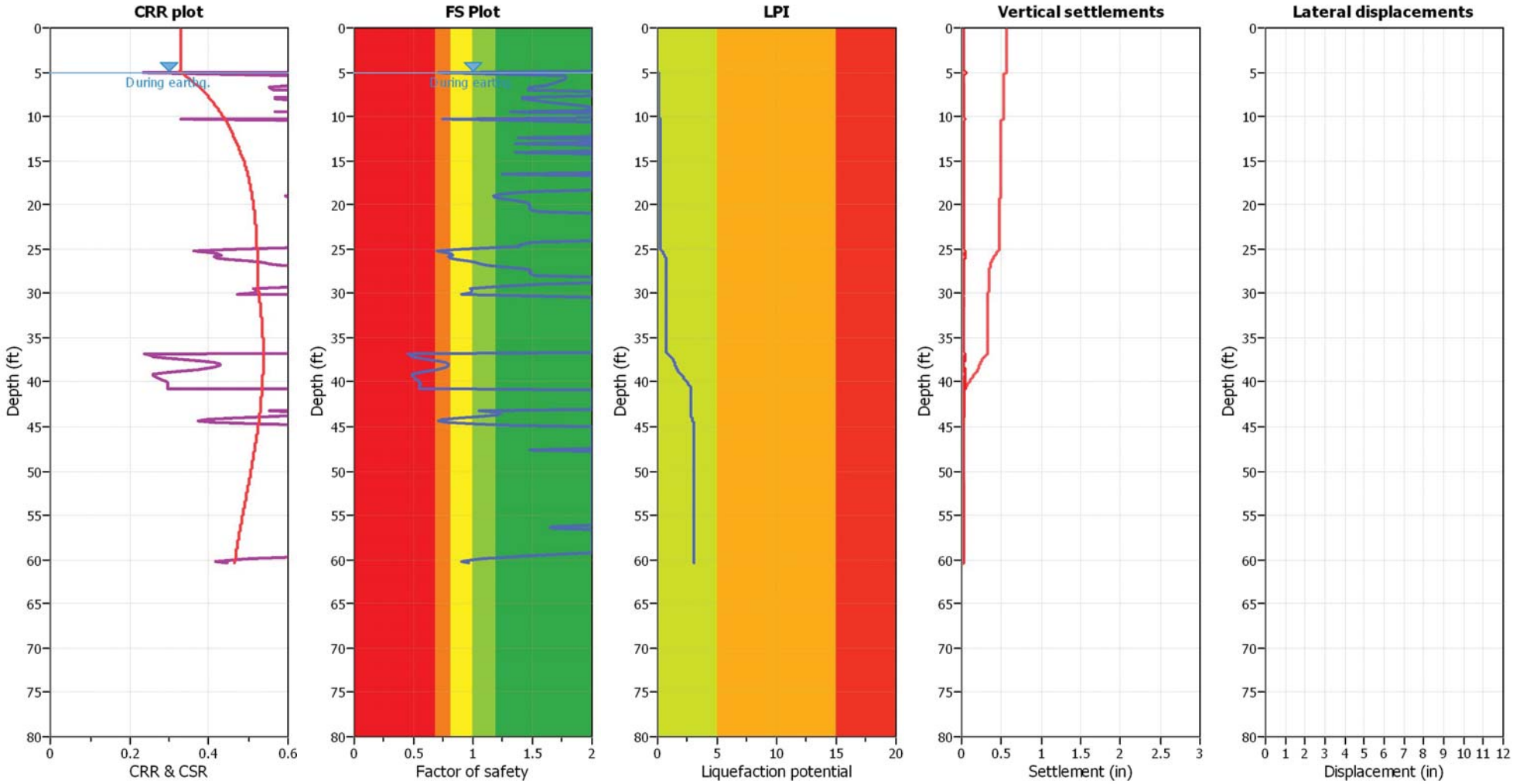
Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.03	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.60	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	5.00 ft	Fill height:	N/A	Limit depth:	N/A

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LPI color scheme

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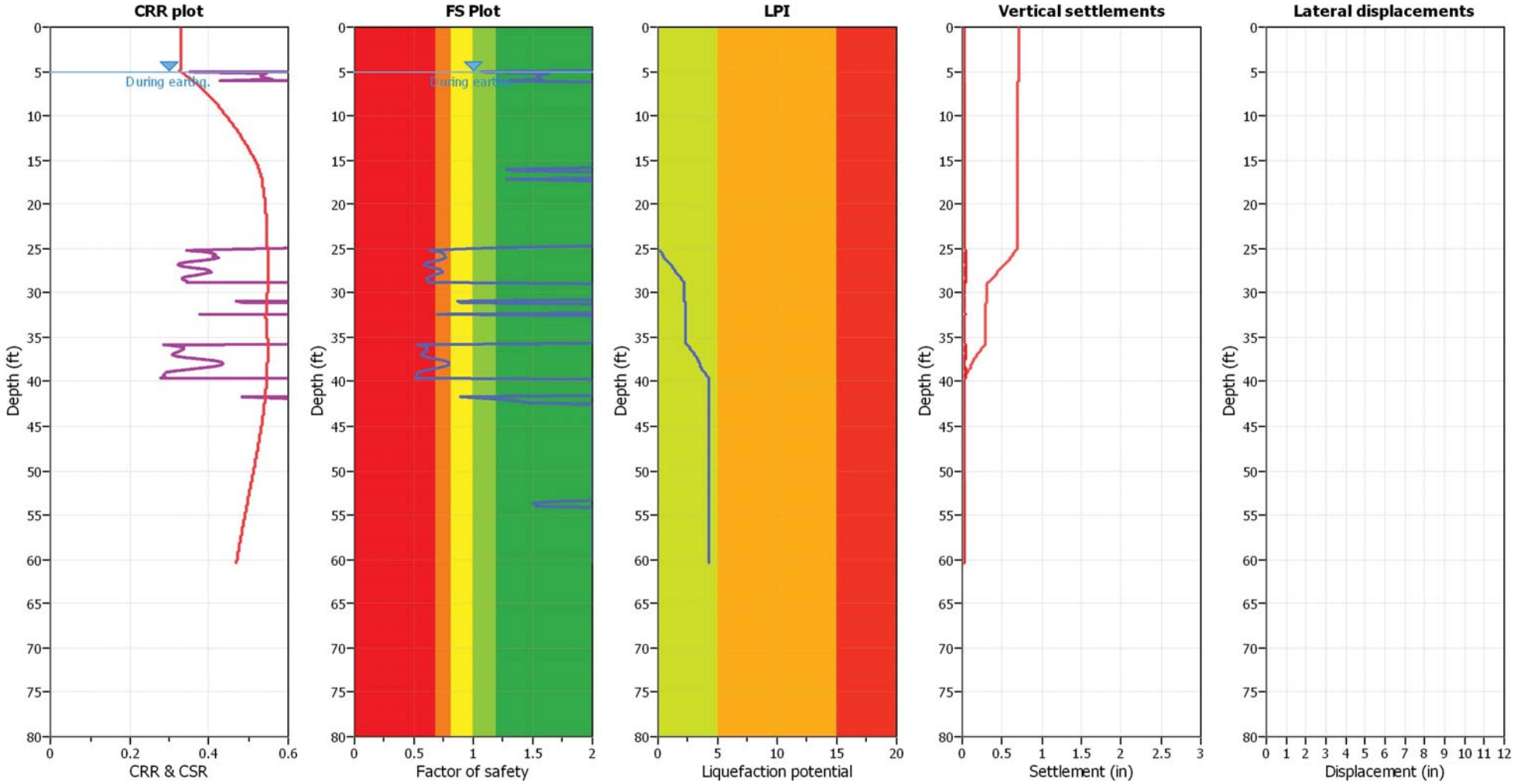
Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.03	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.60	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	5.00 ft	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

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- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

LIQUEFACTION ANALYSIS WITH

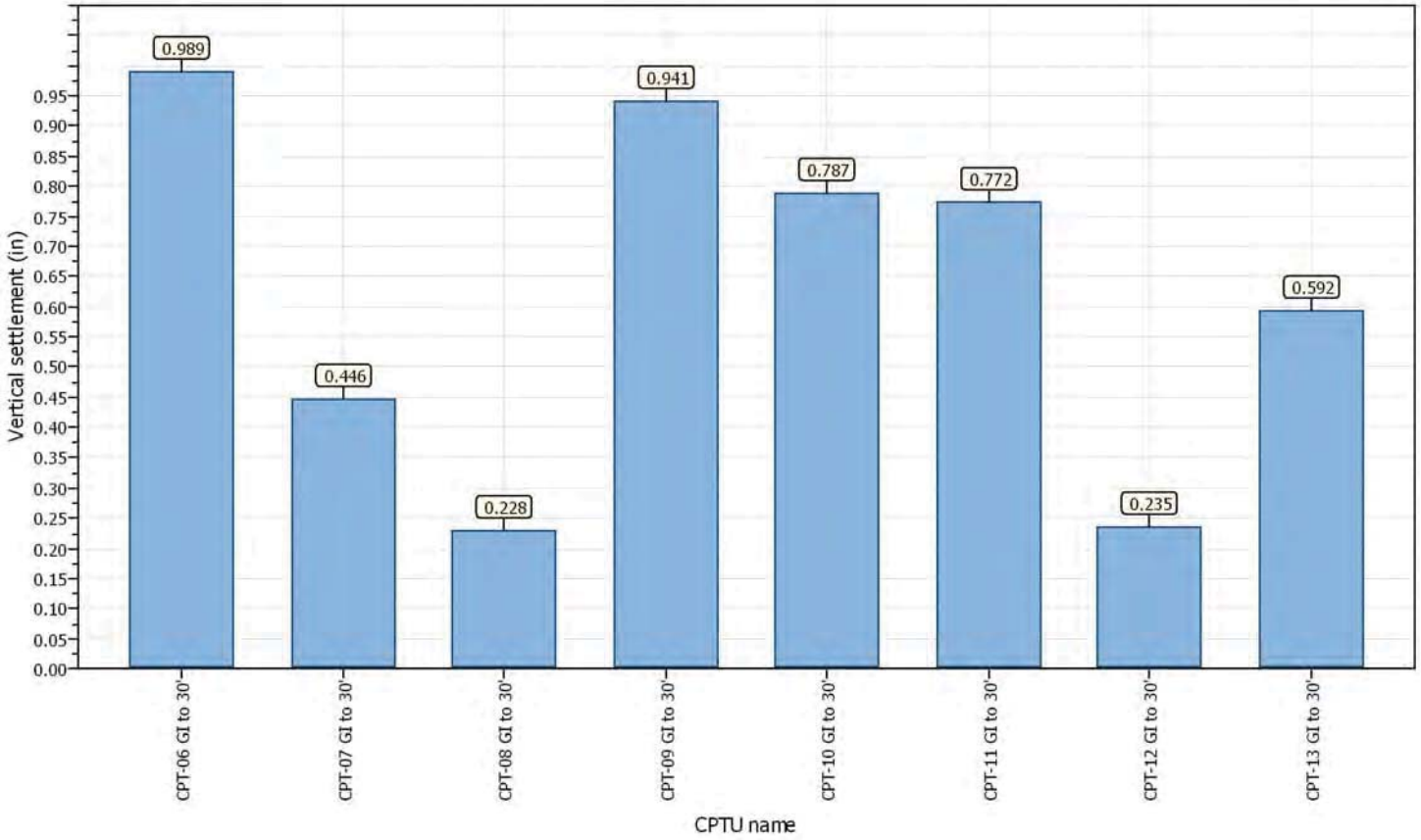
GROUND IMPROVEMENT DEPTH OF 30 FEET

Leighton Consulting, Inc.
17781 Cowan
Irvine, CA
http://www.leightongeo.com/

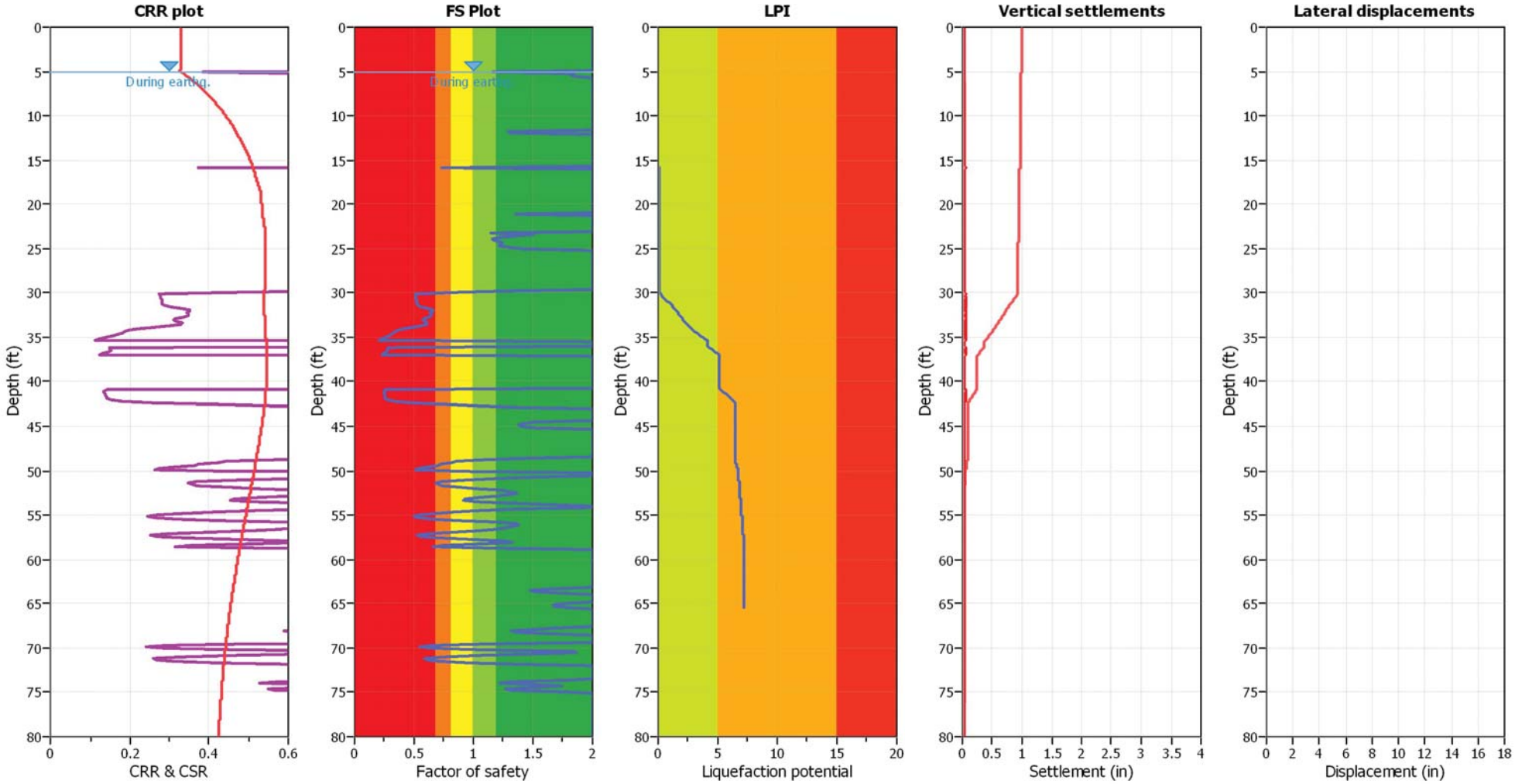
Project title : 2nd and PCH Retail Center - Liquefaction with Ground Improvement to 30 feet

Location : Long Beach, CA

Overall vertical settlements report



Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.03	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.60	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	5.00 ft	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

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- Very likely to liquefy
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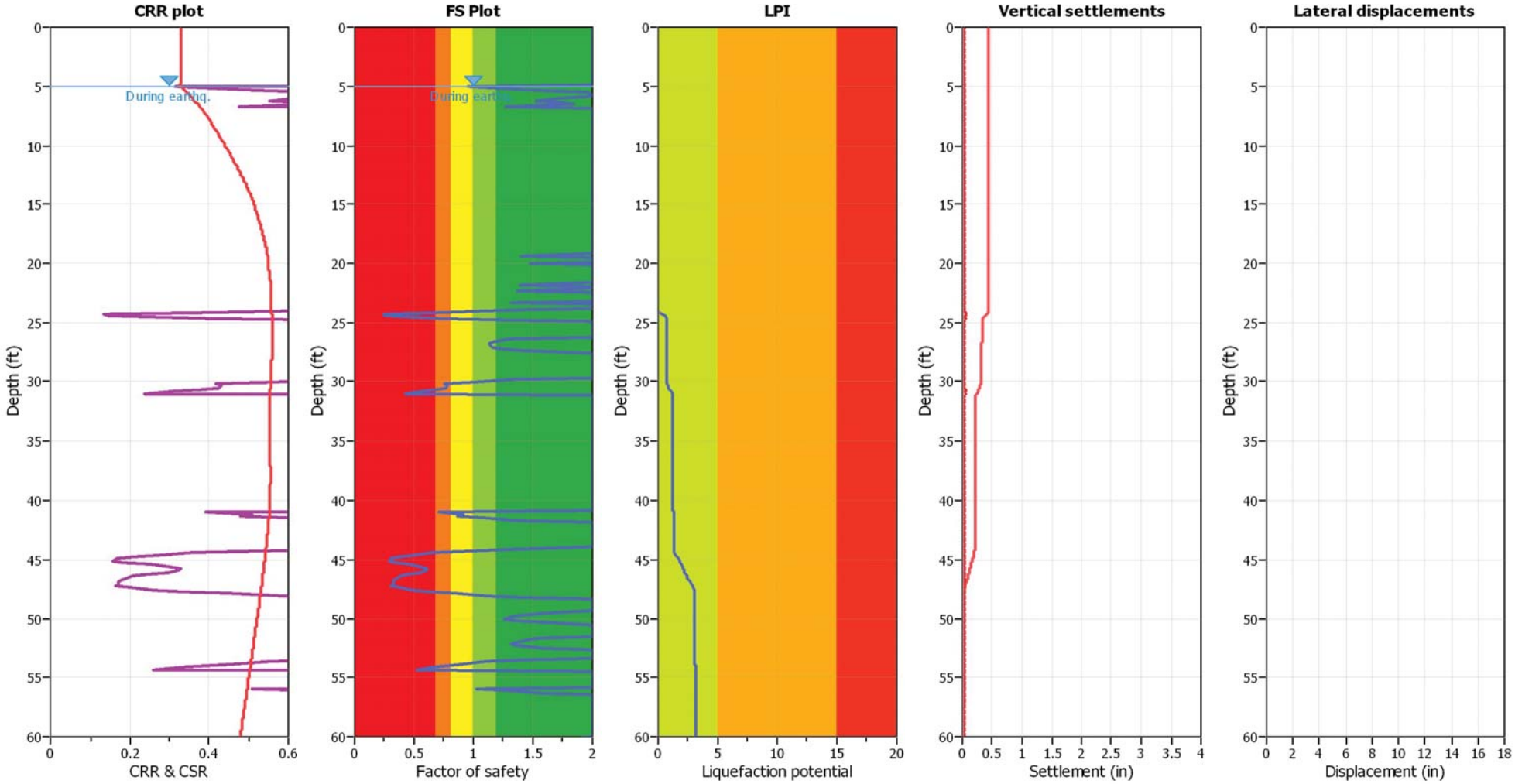
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.03	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.60	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	5.00 ft	Fill height:	N/A	Limit depth:	N/A

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LPI color scheme

- Very high risk
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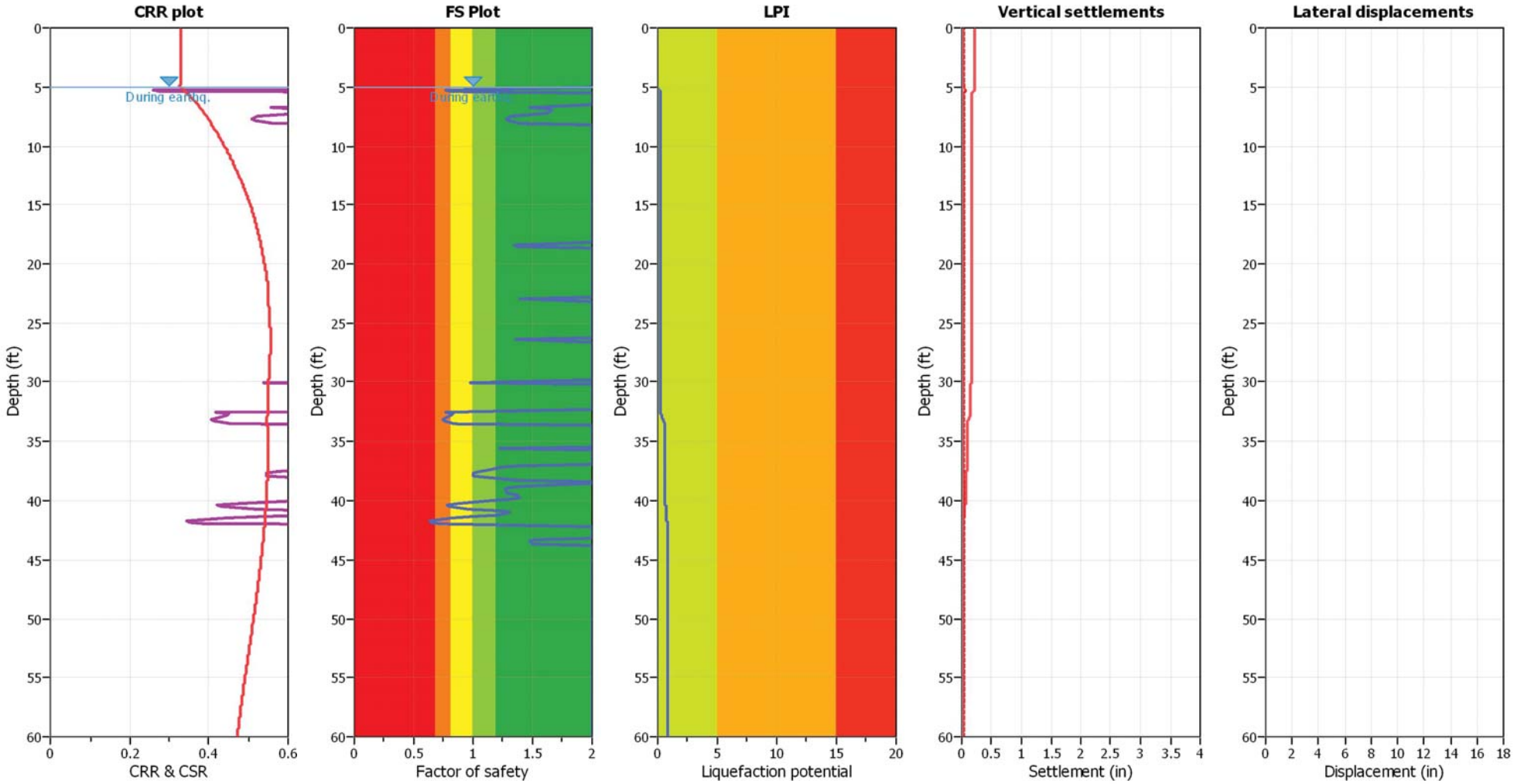
Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
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Earthquake magnitude M_w:	7.03	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
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Depth to water table (insitu):	5.00 ft	Fill height:	N/A	Limit depth:	N/A

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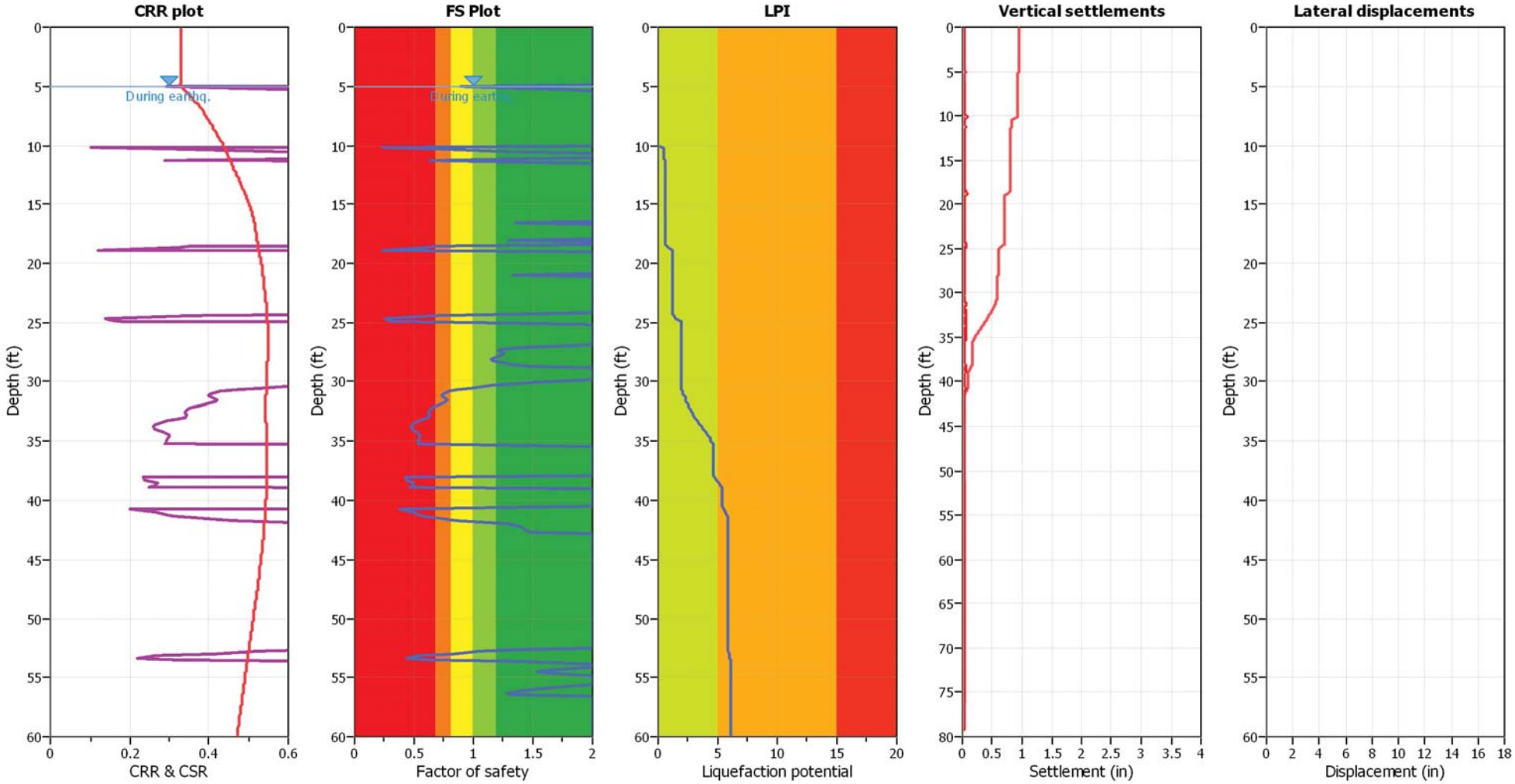
Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.03	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.60	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	5.00 ft	Fill height:	N/A	Limit depth:	N/A

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LPI color scheme

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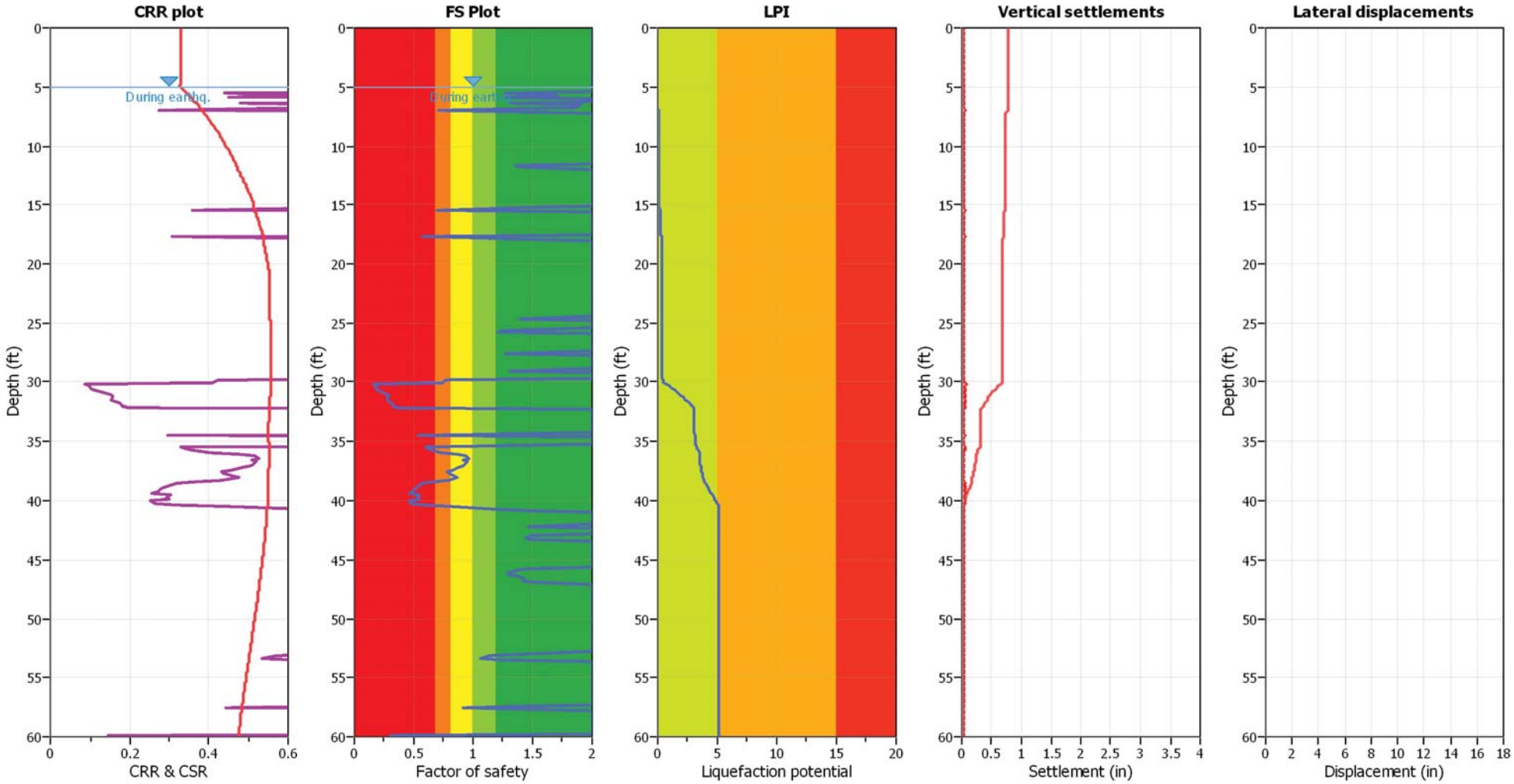
Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.03	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.60	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	5.00 ft	Fill height:	N/A	Limit depth:	N/A

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LPI color scheme

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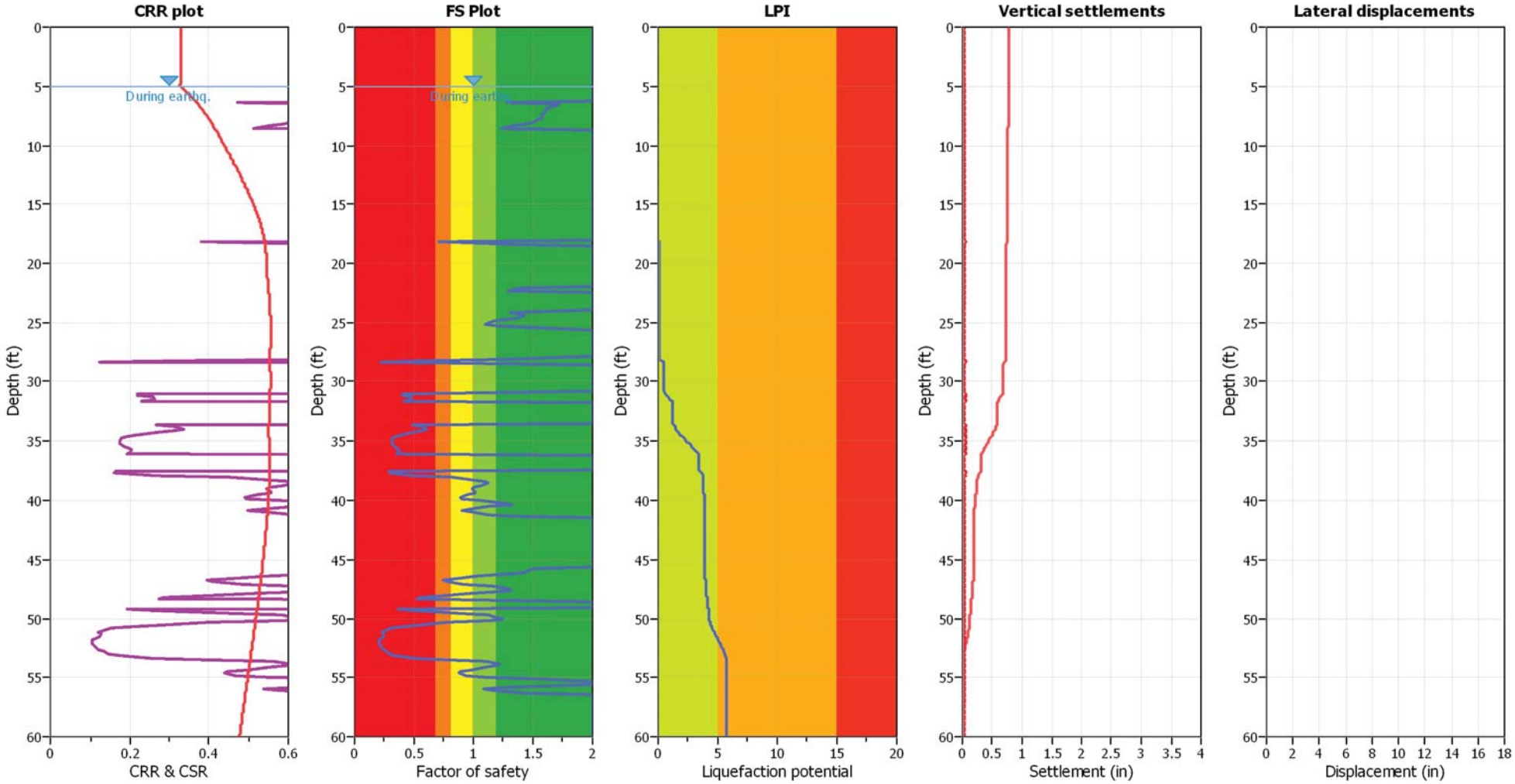
Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.03	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.60	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	5.00 ft	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

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LPI color scheme

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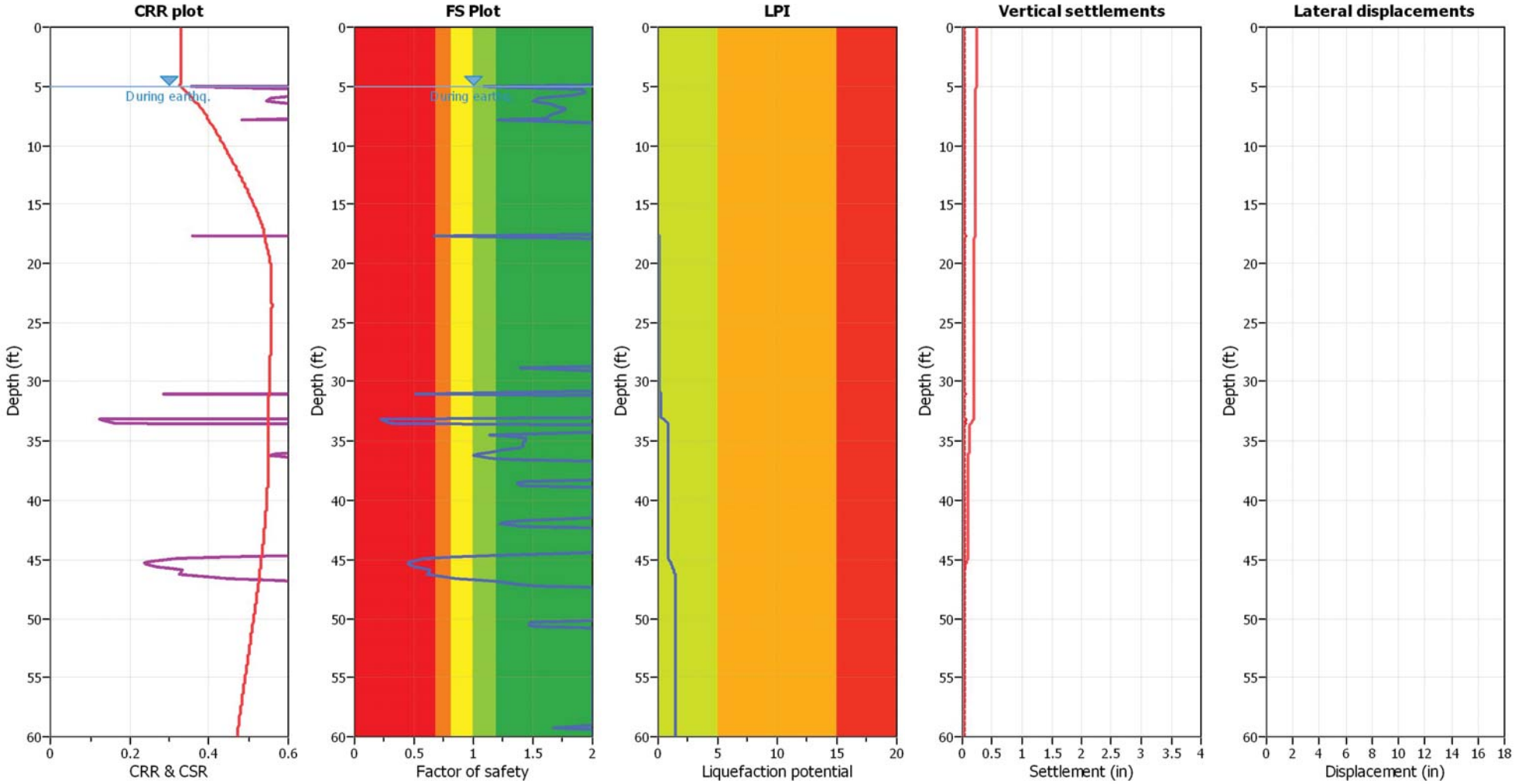
Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.03	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.60	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	5.00 ft	Fill height:	N/A	Limit depth:	N/A

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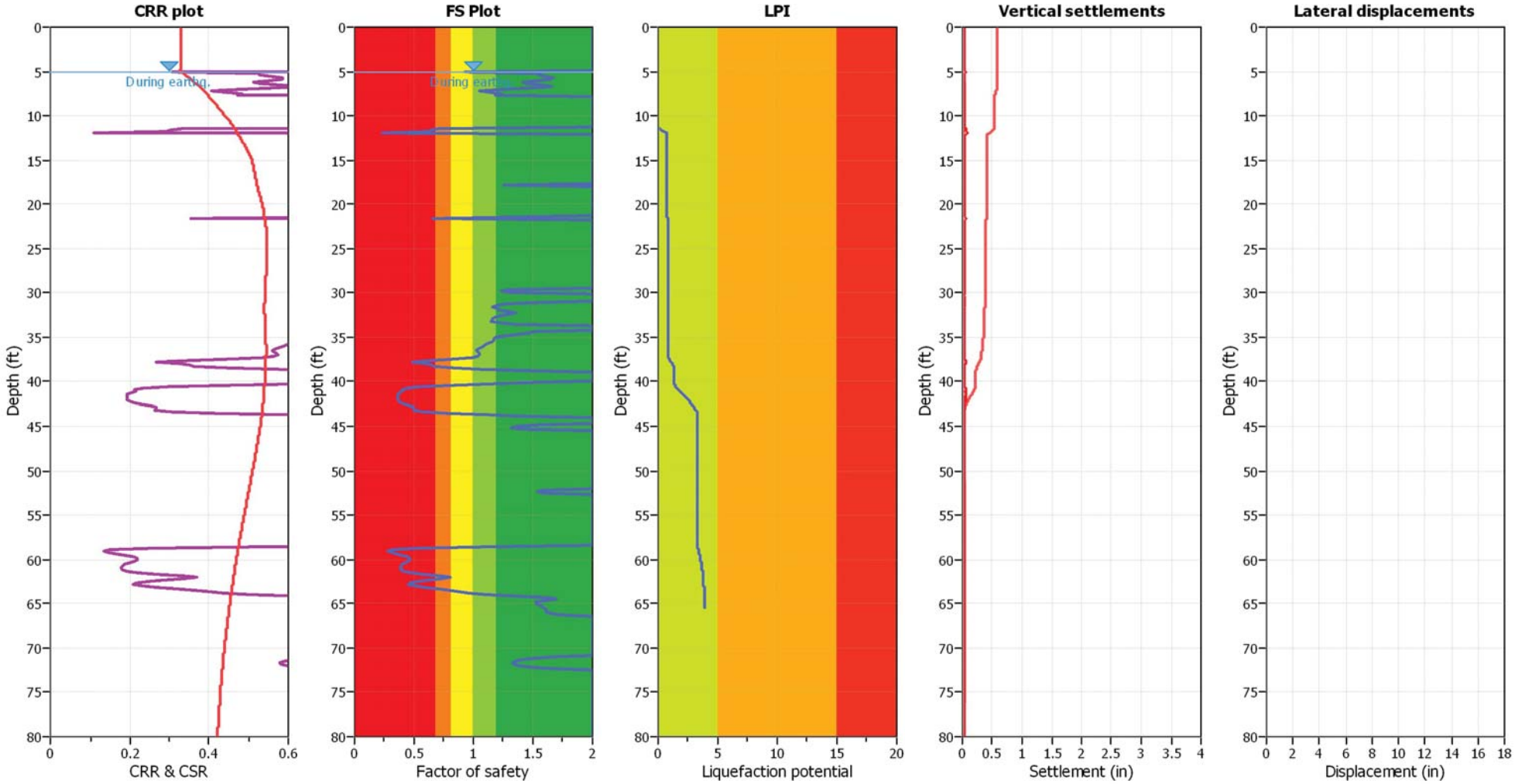
Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
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Earthquake magnitude M_w:	7.03	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.60	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	5.00 ft	Fill height:	N/A	Limit depth:	N/A

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LPI color scheme

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- Low risk

LIQUEFACTION ANALYSIS WITH

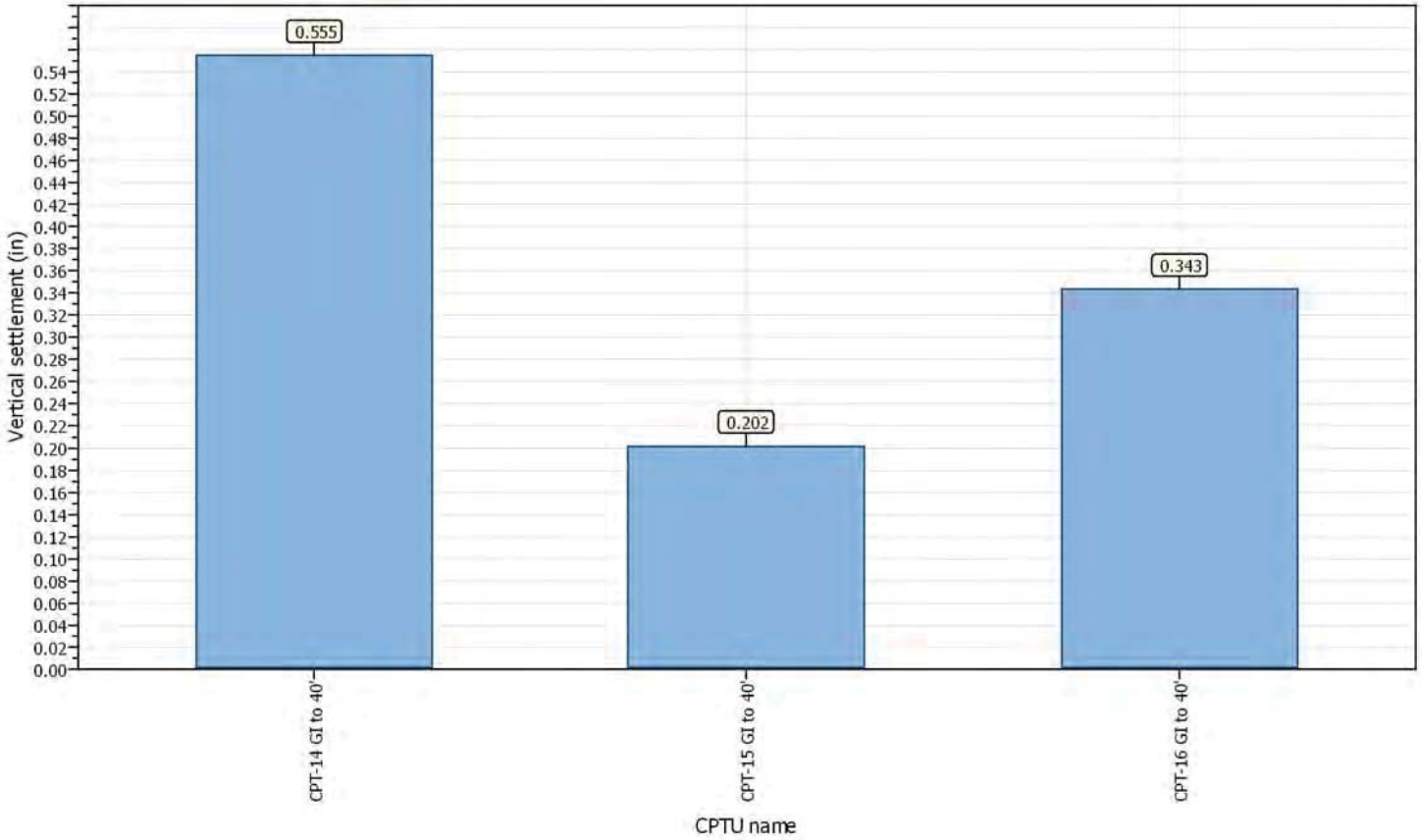
GROUND IMPROVEMENT DEPTH OF 40 FEET

Leighton Consulting, Inc.
17781 Cowan
Irvine, CA
http://www.leightongeo.com/

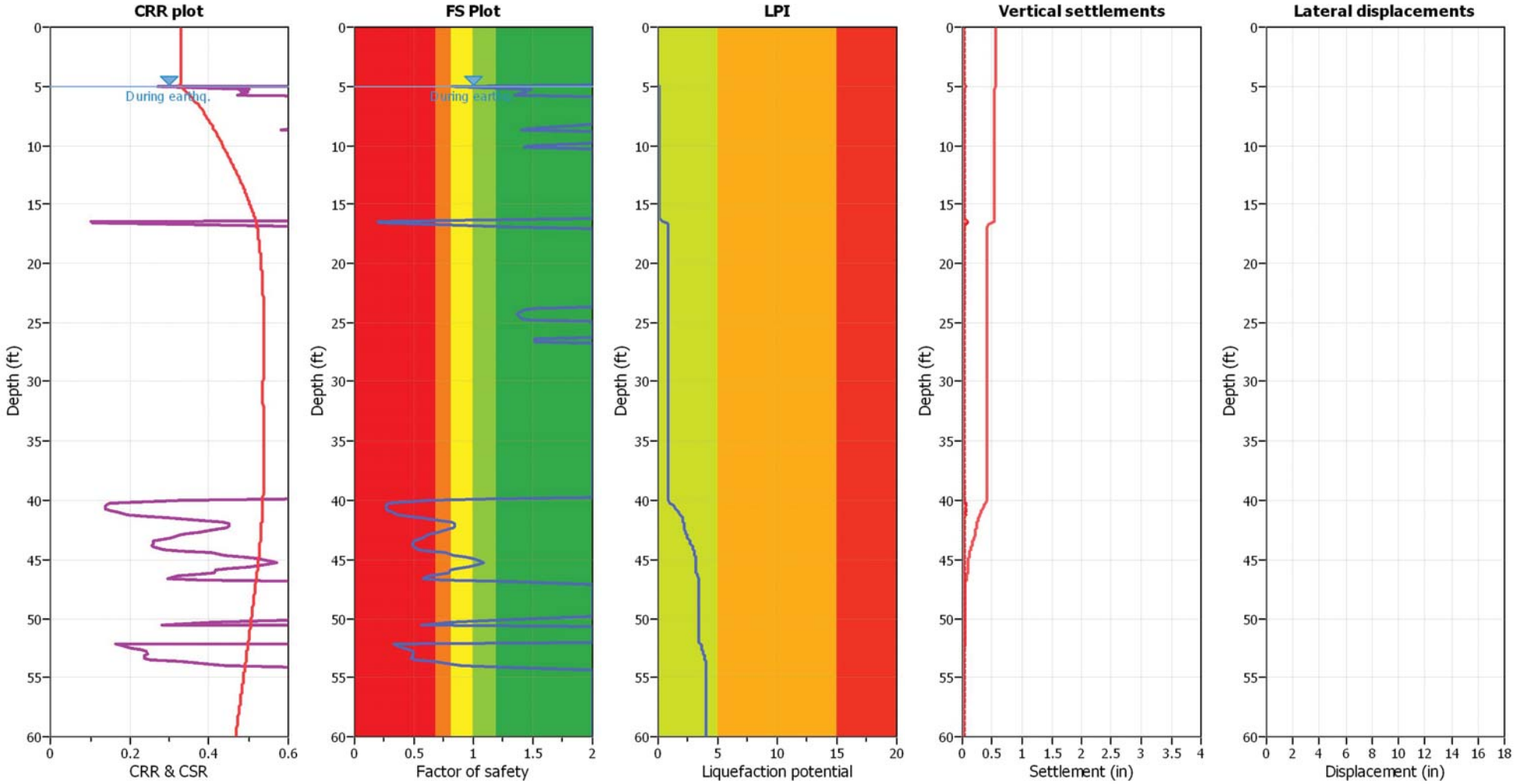
Project title : 2nd and PCH Retail Center - Liquefaction with Ground Improvement to 40 feet

Location : Long Beach, CA

Overall vertical settlements report



Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.03	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.60	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	5.00 ft	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

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LPI color scheme

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- High risk
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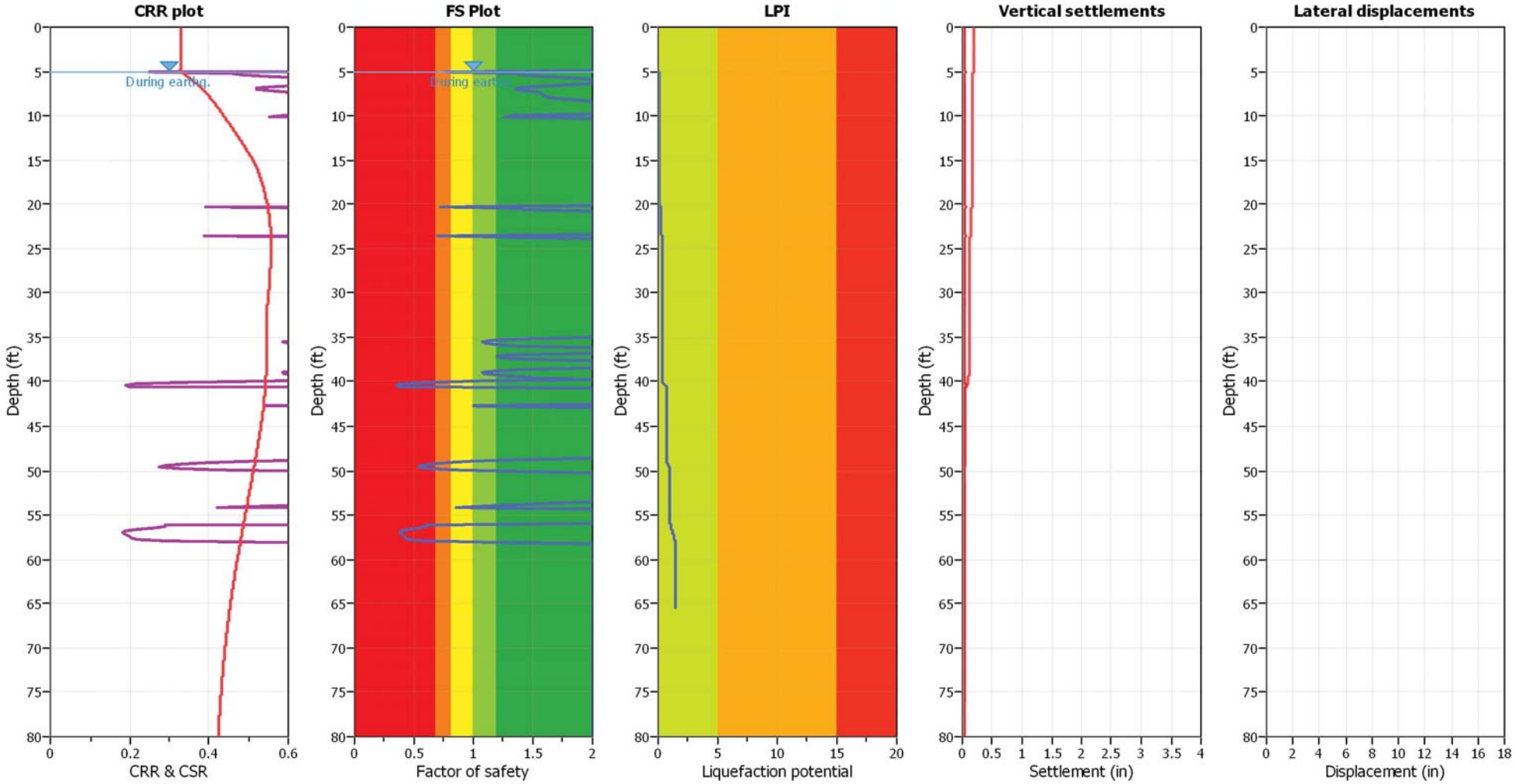
Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.03	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.60	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	5.00 ft	Fill height:	N/A	Limit depth:	N/A

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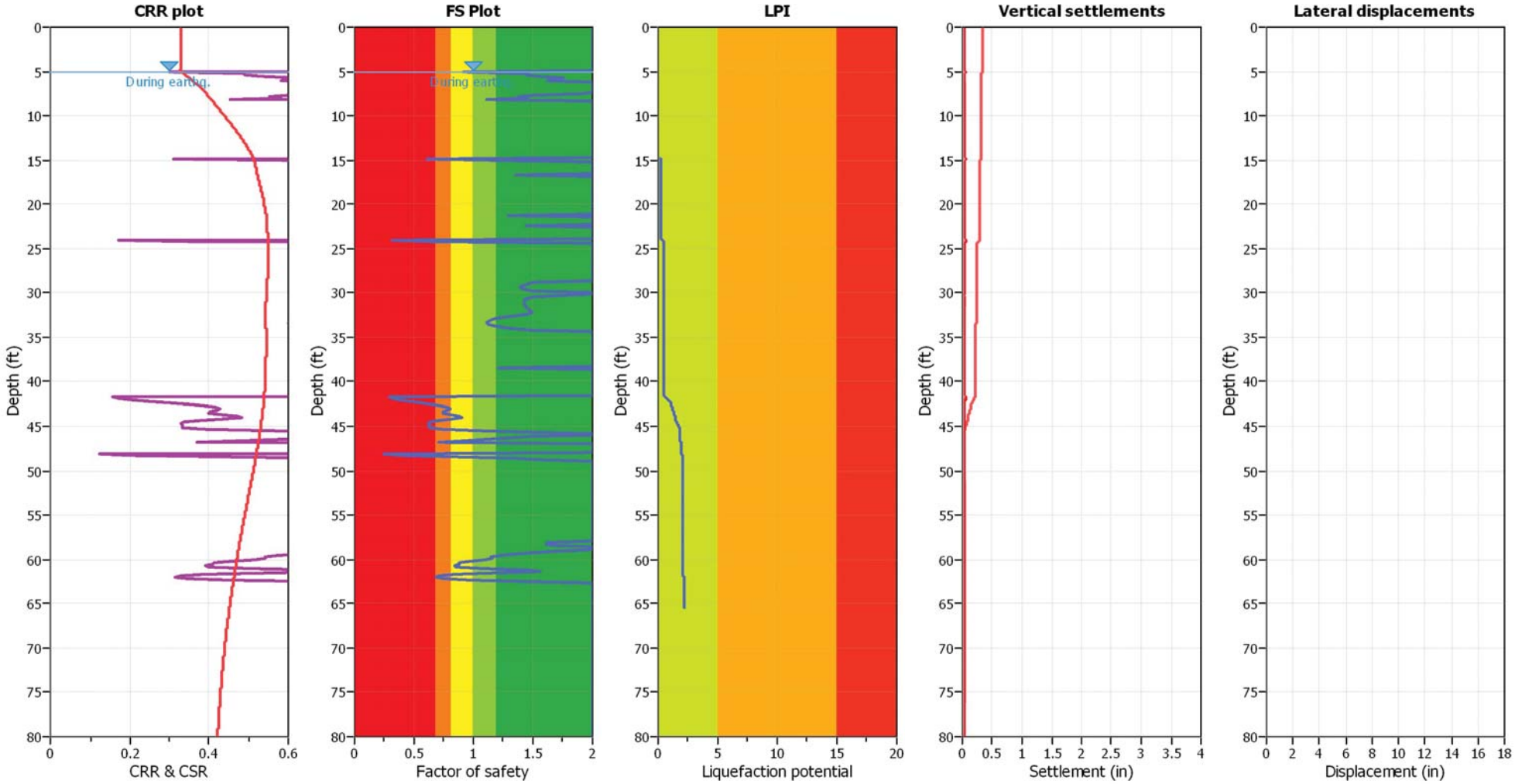
Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.03	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.60	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	5.00 ft	Fill height:	N/A	Limit depth:	N/A

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LPI color scheme

- Very high risk
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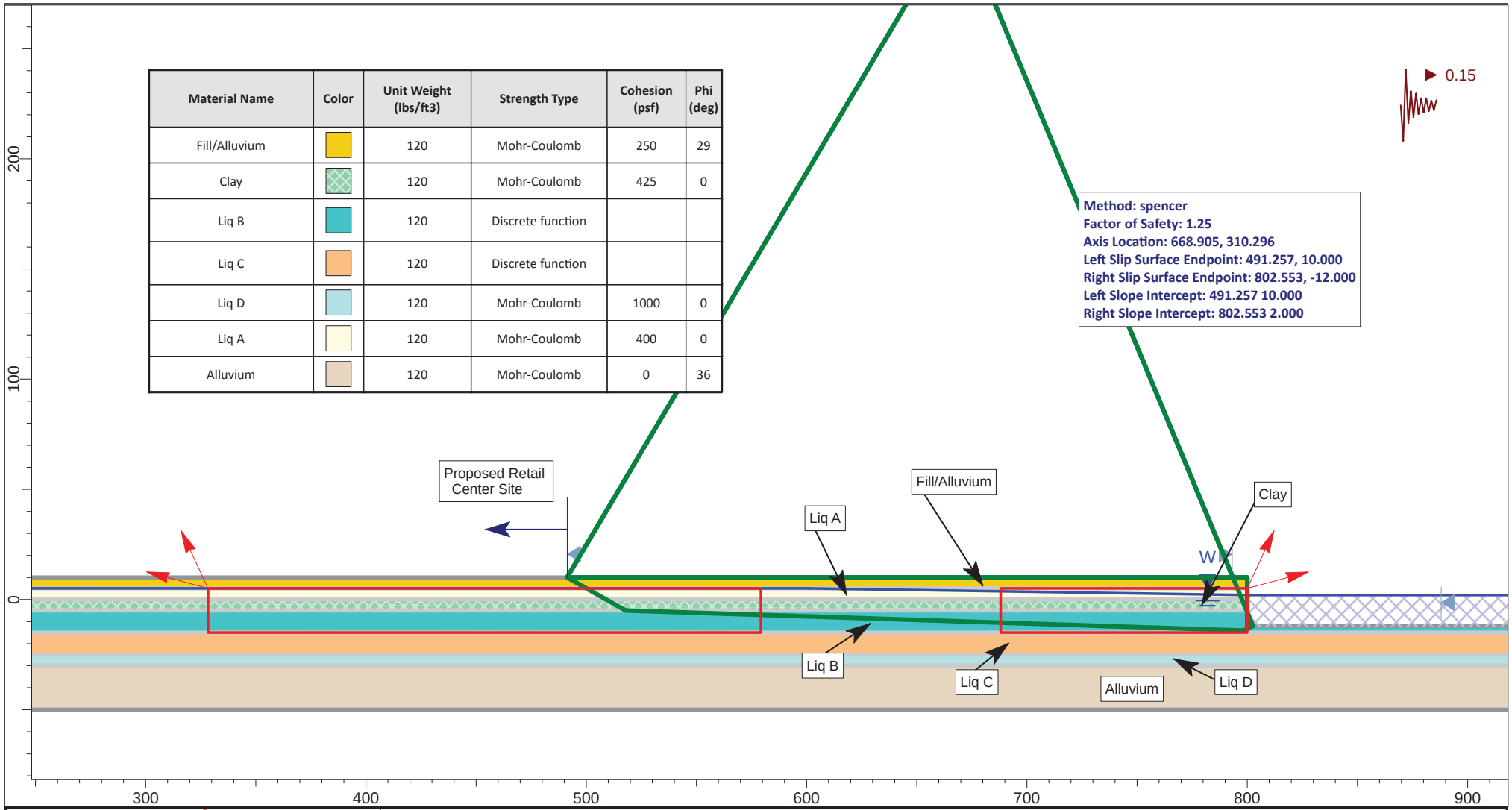
SLOPE STABILITY ANALYSIS

Section A - A'

Post-Liquefaction Stability

P:\INFOCUS PROJECTS\11001-11500\11232 CenterCal 2nd & PCH\002\Analyses\Slope Stability\Sec A - Liq_a1 kh.slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Fill/Alluvium		120	Mohr-Coulomb	250	29
Clay		120	Mohr-Coulomb	425	0
Liq B		120	Discrete function		
Liq C		120	Discrete function		
Liq D		120	Mohr-Coulomb	1000	0
Liq A		120	Mohr-Coulomb	400	0
Alluvium		120	Mohr-Coulomb	0	36

SLIDEINTERPRET 7.009

Leighton Consulting, Inc.
A LEIGHTON GROUP COMPANY

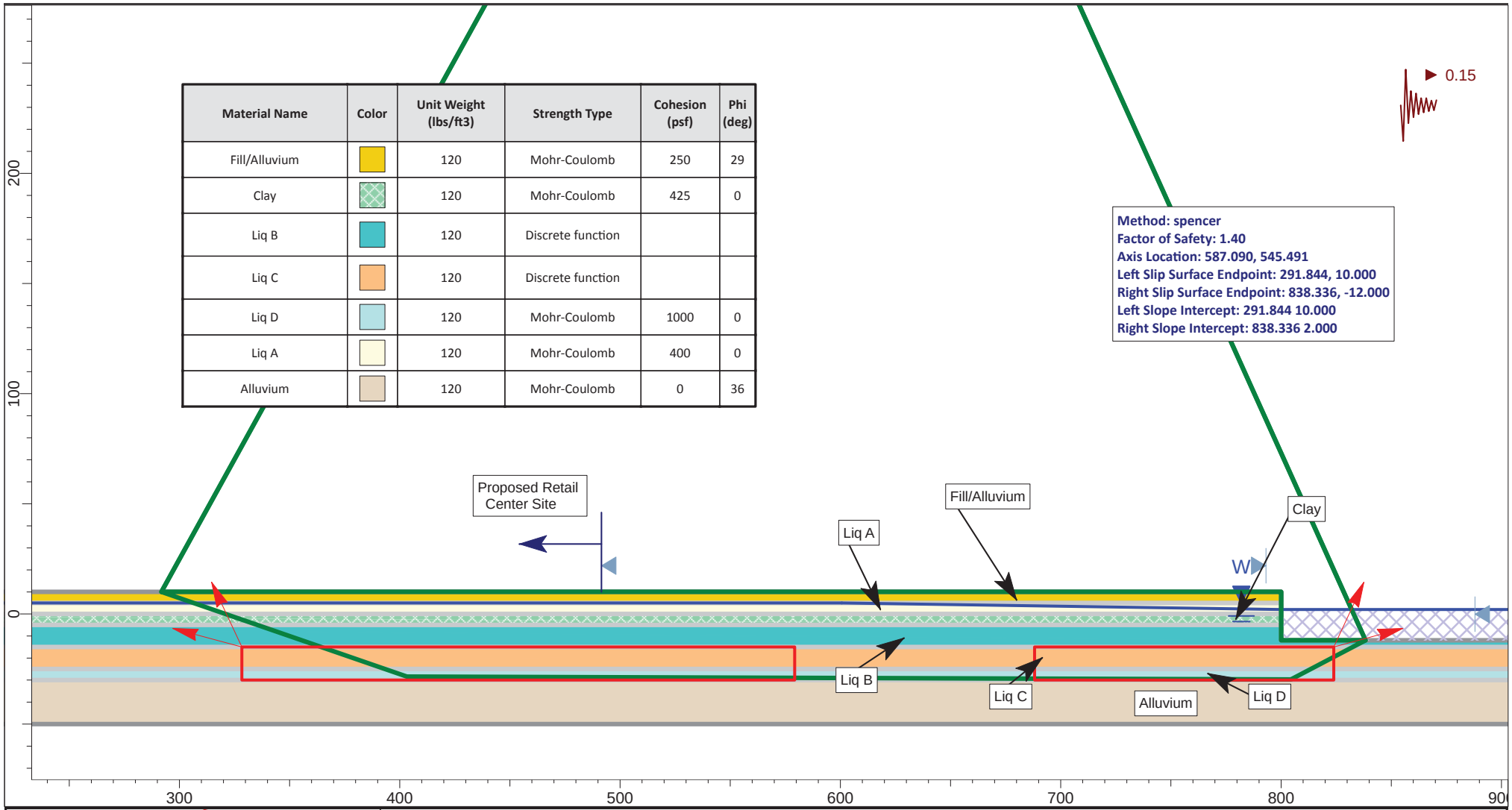
Project	2nd and PCH Retail Center, Long Beach, California		
Analyzed By CD	*Units* feet	*Scale* 1:780	*Project No.:* 11232.002
Date December 2016	*Condition* **Seismic**		

Section A - A'

Post-Liquefaction Stability

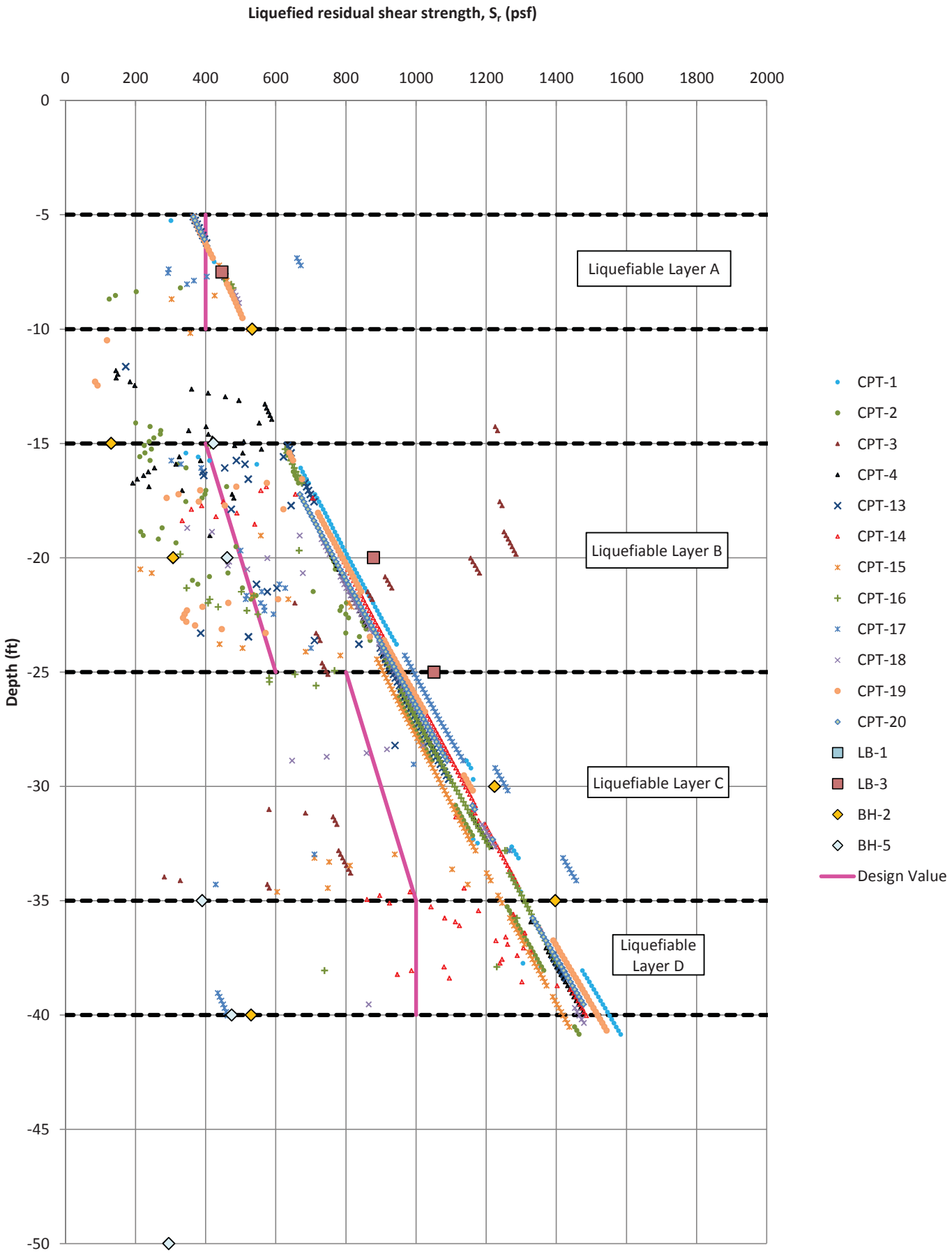
P:\INFOCUS PROJECTS\11001-11500\11232 CenterCal 2nd & PCH\002\Analyses\Slope Stability\Sec A - Liq_b1 kh.slim

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Fill/Alluvium		120	Mohr-Coulomb	250	29
Clay		120	Mohr-Coulomb	425	0
Liq B		120	Discrete function		
Liq C		120	Discrete function		
Liq D		120	Mohr-Coulomb	1000	0
Liq A		120	Mohr-Coulomb	400	0
Alluvium		120	Mohr-Coulomb	0	36



SLIDEINTERPRET 7.009

Leighton Consulting, Inc.
A LEIGHTON GROUP COMPANY

Project: 2nd and PCH Retail Center, Long Beach, California			
Analyzed By: CD	Units: feet	Scale: 1:780	Project No.: 11232.002
Date: December 2016	Condition: Seismic		

S_r Profile for 11232.002