Appendix H
Updated Geotechnical Exploration Report
December 2, 2016

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
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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Distribution: (1) Addressee
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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 cm² 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>
<thead>
<tr>
<th>Boring No.</th>
<th>Drilled Depth (feet)</th>
<th>Screen Interval Depth (feet)</th>
<th>Measured Infiltration Rate (inches/hour)</th>
</tr>
</thead>
<tbody>
<tr>
<td>P-1</td>
<td>5</td>
<td>0 to 5</td>
<td>2.2</td>
</tr>
<tr>
<td>P-2</td>
<td>5</td>
<td>0 to 5</td>
<td>0.8</td>
</tr>
<tr>
<td>P-3</td>
<td>5</td>
<td>0 to 5</td>
<td>0.3</td>
</tr>
</tbody>
</table>

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 (MW) 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 $1\frac{1}{2}$ 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

<table>
<thead>
<tr>
<th>CPT ID</th>
<th>Vertical Settlement (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPT-1</td>
<td>1.8</td>
</tr>
<tr>
<td>CPT-2</td>
<td>3.1</td>
</tr>
<tr>
<td>CPT-3</td>
<td>3.8</td>
</tr>
<tr>
<td>CPT-4</td>
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<td>CPT-6</td>
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<td>CPT-15</td>
<td>2.7</td>
</tr>
<tr>
<td>CPT-16</td>
<td>2.4</td>
</tr>
</tbody>
</table>

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 [(N₁)₆₀,сₘ] or corrected CPT tip resistance [(qₜ₁N)ₖₘ] and regression equations.

The pseudo-static analysis was performed considering the presence of liquefiable soil layers and inertial forces (kᵢ = 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\textsuperscript{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

<table>
<thead>
<tr>
<th>Pile Head Deflection (inches)</th>
<th>Shear Force at Pile Top (kips)</th>
<th>Maximum Bending Moment (kips-ft)</th>
<th>Depth to Maximum Moment (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>¼</td>
<td>5</td>
<td>17</td>
<td>6</td>
</tr>
<tr>
<td>½</td>
<td>10</td>
<td>31</td>
<td>6</td>
</tr>
<tr>
<td>1</td>
<td>17</td>
<td>51</td>
<td>7</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pile Head Deflection (inches)</th>
<th>Shear Force at Pile Top (kips)</th>
<th>Maximum Bending Moment (kips-ft) at Top of Pile</th>
<th>Depth to Zero Moment (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>¼</td>
<td>13</td>
<td>48</td>
<td>5</td>
</tr>
<tr>
<td>½</td>
<td>22</td>
<td>84</td>
<td>5</td>
</tr>
<tr>
<td>1</td>
<td>30</td>
<td>137</td>
<td>6</td>
</tr>
</tbody>
</table>

Table 4 – Lateral Capacities of 14-inch Square Pile

<table>
<thead>
<tr>
<th>Pile Head Deflection (inches)</th>
<th>Shear Force at Pile Top (kips)</th>
<th>Maximum Bending Moment (kips-ft)</th>
<th>Depth to Maximum Moment (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>¼</td>
<td>7</td>
<td>25</td>
<td>7</td>
</tr>
<tr>
<td>½</td>
<td>12</td>
<td>44</td>
<td>7</td>
</tr>
<tr>
<td>1</td>
<td>19</td>
<td>72</td>
<td>7</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pile Head Deflection (inches)</th>
<th>Shear Force at Pile Top (kips)</th>
<th>Maximum Bending Moment (kips-ft) at Top of Pile</th>
<th>Depth to Zero Moment (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>¼</td>
<td>16</td>
<td>68</td>
<td>6</td>
</tr>
<tr>
<td>½</td>
<td>27</td>
<td>121</td>
<td>6</td>
</tr>
<tr>
<td>1</td>
<td>40</td>
<td>206</td>
<td>7</td>
</tr>
</tbody>
</table>
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

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

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**

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

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

<table>
<thead>
<tr>
<th>Condition</th>
<th>Equivalent Fluid Unit Weight for Level Backfill (psf/ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active</td>
<td>40</td>
</tr>
<tr>
<td>At-Rest</td>
<td>60</td>
</tr>
<tr>
<td>Passive</td>
<td>360</td>
</tr>
<tr>
<td>Coefficient of Friction</td>
<td>0.30</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Traffic Index</th>
<th>Flexible Pavement (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AC</td>
</tr>
<tr>
<td>5 or less</td>
<td>3.0</td>
</tr>
<tr>
<td>6</td>
<td>3.5</td>
</tr>
<tr>
<td>7</td>
<td>4.5</td>
</tr>
<tr>
<td>8</td>
<td>5.0</td>
</tr>
</tbody>
</table>

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.
5.0 REFERENCES

American Concrete Institute, 2011, Building Code Requirements for Structural Concrete (ACI 318-11) and Commentary, 2011.


Converse Consultants, 2005, Geotechnical Investigation Report, Mixed-Use Community-Seaport Marina, Southeast Corner of 2nd Street and East Pacific Coast Highway (PCH), Long Beach, California, Project No. 04-31-118-01, dated September 1, 2005.


United States Geological Survey (USGS), 1956, Groundwater Geology of the Coastal Zone, Long Beach-Santa Ana Area, California.


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.

SITE LOCATION MAP
6400 East Pacific Coast Highway
Long Beach, California

Figure 1

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

Base Map: ESRI ArcGIS Online 2016
Thematic Information: Leighton
Author: Leighton Geomatics (btran)
Nominal Axial Capacities (kips)

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

Engineer: DJC
Date: 12/2016

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

Figure No. 4
APPENDIX A

GEOTECHNICAL BORING LOGS
**GEOTECHNICAL BORING LOG LB-1**

**Project No.** 11232.001  
**Project** 2nd and PCH Retail Center  
**Drilling Co.** 2R Drilling, Inc.  
**Drilling Method** Hollow Stem Auger - 140lb - Autohammer - 30" Drop  
**Location** See Figure 2 - Boring and CPT Location Map

<table>
<thead>
<tr>
<th>Elevation Feet</th>
<th>Depth Feet</th>
<th>Graphic Log</th>
<th>Attitudes</th>
<th>Sample No.</th>
<th>Blows Per Feet</th>
<th>Dry Density, pcf</th>
<th>Moisture Content, %</th>
<th>Soil Class, (U.S.C.S.)</th>
<th>Type of Tests</th>
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<tbody>
<tr>
<td>10</td>
<td>0</td>
<td></td>
<td>B-1</td>
<td></td>
<td></td>
<td>SM</td>
<td>@ Surface: 3 inches of asphalt concrete over 2 inches of aggregate base</td>
<td>Artificial fill (Af)</td>
<td>CR</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>@ 0.4&quot;: Silty SAND, olive brown, slightly moist, fine sand</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>0</td>
<td></td>
<td>R-1</td>
<td>15</td>
<td>111</td>
<td>14</td>
<td>@ 5&quot;: Silty SAND, dense, dark brown, slightly moist</td>
<td></td>
<td></td>
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<td>Quaternary-aged young alluvial fan deposits (Qvf)</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>@ 6&quot;: Sandy CLAY, medium stiff, dark brown, moist, low plasticity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td></td>
<td>R-2</td>
<td>1</td>
<td>64</td>
<td>59</td>
<td>@ 10&quot;: Silty CLAY, very soft, dark gray, moist, high plasticity, trace of organics</td>
<td></td>
<td>AL, CN</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>R-3</td>
<td>1</td>
<td>92</td>
<td>30</td>
<td>@ 15&quot;: Silty SAND, medium dense, bluish gray, wet, trace of organics, trace of clay</td>
<td></td>
<td>AL, PP</td>
</tr>
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<td></td>
<td>4</td>
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<td></td>
<td></td>
<td>R-4</td>
<td>3</td>
<td>98</td>
<td>26</td>
<td>@ 20&quot;: Silty SAND, medium dense, bluish gray, wet, fine sand</td>
<td></td>
<td>DS, PP</td>
</tr>
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<td></td>
<td></td>
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<td>10</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>S-5</td>
<td>2</td>
<td></td>
<td></td>
<td>@ 25&quot;: shell fragments</td>
<td></td>
<td>-200</td>
</tr>
</tbody>
</table>

**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:**
- BULK SAMPLE
- CORE SAMPLE
- GRAB SAMPLE
- RING SAMPLE
- SPLIT SPOON SAMPLE
- TUBE SAMPLE

**TYPE OF TESTS:**
- -200 % FINES PASSING
- ATTERBERG LIMITS
- CONSOLIDATION
- COLLAPSE
- CORROSION
- UNDRAINED TRIAXIAL
- DS
- EI
- H
- MD
- PP
- CU
- DIRECT SHEAR
- EXPANSION INDEX
- HYDROMETER
- MAXIMUM DENSITY
- POCKET PENETROMETER
- R VOLUME
- SA
- SE
- SG
- UC

*** 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**

<table>
<thead>
<tr>
<th>Elevation Feet</th>
<th>Depth Feet</th>
<th>Graphic Log</th>
<th>Attitudes</th>
<th>Sample No.</th>
<th>Blows Per 6 Inches</th>
<th>Dry Density pcf</th>
<th>Moisture Content %</th>
<th>Soil Class (U.C.S.)</th>
<th>Type of Tests</th>
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<tr>
<td>-20</td>
<td>30</td>
<td></td>
<td></td>
<td>S-6</td>
<td>2</td>
<td>5</td>
<td>SM</td>
<td>@ 30': Silty SAND, medium dense, bluish gray, wet, fine sand</td>
<td>-200</td>
</tr>
<tr>
<td>-25</td>
<td>35</td>
<td></td>
<td></td>
<td>S-7</td>
<td>3</td>
<td>11</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-30</td>
<td>40</td>
<td></td>
<td></td>
<td>S-8</td>
<td>6</td>
<td>11</td>
<td></td>
<td>@ 40': Silty SAND, medium dense, bluish gray, interlayered, fine sand</td>
<td>-200</td>
</tr>
<tr>
<td>-35</td>
<td>45</td>
<td></td>
<td></td>
<td>R-9</td>
<td>17</td>
<td>36</td>
<td>100</td>
<td>@ 45': Poorly-graded SAND, dense, gray, wet, fine sand</td>
<td>-200, DS</td>
</tr>
<tr>
<td>-40</td>
<td>50</td>
<td></td>
<td></td>
<td>S-10</td>
<td></td>
<td>50/4&quot;</td>
<td>24</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-45</td>
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<td></td>
<td></td>
<td>R-11</td>
<td>20</td>
<td>50/5&quot;</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>-50</td>
<td>60</td>
<td></td>
<td></td>
<td>S-12</td>
<td>2</td>
<td>4</td>
<td></td>
<td>@ 55': Poorly-graded SAND, dense, gray, wet to medium sand, trace of rounded gravel</td>
<td>CR</td>
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</tbody>
</table>

**SOIL DESCRIPTION**

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**SAMPLE TYPES:**
- BULK SAMPLE
- CORE SAMPLE
- GRAB SAMPLE
- RING SAMPLE
- SPLIT SPOON SAMPLE
- TUBE SAMPLE

**TYPE OF TESTS:**
- 200 % FINES PASSING
- ATTERBERG LIMITS
- CONSOLIDATION
- COLLAPSE
- CORROSION
- UNDRAINED TRIAXIAL
- DIRECT SHEAR
- EXPANSION INDEX
- HYDROMETER
- MAXIMUM DENSITY
- POCKET PENETROMETER
- SIEVE ANALYSIS
- SAND EQUIVALENT
- SPECIFIC GRAVITY
- UNCONFINED COMPRESSIVE STRENGTH
- R VALUE

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

Page 2 of 3
**GEOTECHNICAL BORING LOG LB-1**

<table>
<thead>
<tr>
<th>Depth Feet</th>
<th>Graphic Log</th>
<th>Attitudes</th>
<th>Sample No.</th>
<th>Blows Per Inches</th>
<th>Dry Densitypcf</th>
<th>Moisture Content%</th>
<th>Soil Class (U.C.S.)</th>
<th>Type of Tests</th>
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<td>-50-60</td>
<td></td>
<td>S-13</td>
<td>7</td>
<td>21</td>
<td>35</td>
<td>SP</td>
<td>@ 60°: Poorly-graded SAND, dense, gray, wet, fine sand</td>
<td></td>
</tr>
<tr>
<td>-55-65</td>
<td></td>
<td>S-14</td>
<td>4</td>
<td>25</td>
<td>34</td>
<td>@ 65°: trace of subrounded gravel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-60-70</td>
<td></td>
<td>S-15</td>
<td>2</td>
<td>4</td>
<td>19</td>
<td>@ 70°: medium dense</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-65-75</td>
<td></td>
<td>S-16</td>
<td>3</td>
<td>10</td>
<td>30</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-70-80</td>
<td></td>
<td>S-17</td>
<td>8</td>
<td>39</td>
<td>50/55</td>
<td>@ 80°: Poorly-graded SAND, very dense, gray, wet, fine sand</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

**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:**
- BULK SAMPLE
- CORE SAMPLE
- GRAB SAMPLE
- RING SAMPLE
- SPLIT SPON SAMPLE
- TUBE SAMPLE

**Type of Tests:**
- DIRECT SHEAR
- EXPANSION INDEX
- HYDROMETER
- MAXIMUM DENSITY
- POCKET PENETROMETER
- 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-2

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<th>Project No.</th>
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<td>Project</td>
<td>2nd and PCH Retail Center</td>
</tr>
<tr>
<td>Drilling Co.</td>
<td>2R Drilling, Inc.</td>
</tr>
<tr>
<td>Drilling Method</td>
<td>Hollow Stem Auger - 140lb - Autohammer - 30&quot; Drop</td>
</tr>
<tr>
<td>Location</td>
<td>See Figure 2 - Boring and CPT Location Map</td>
</tr>
<tr>
<td>Date Drilled</td>
<td>2-1-16</td>
</tr>
<tr>
<td>Logged By</td>
<td>CD</td>
</tr>
<tr>
<td>Hole Diameter</td>
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<tr>
<td>Ground Elevation</td>
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<td>Sampled By</td>
<td>CD</td>
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</table>

#### 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.

<table>
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<th>Elevation Feet</th>
<th>Depth Feet</th>
<th>Graphic Log</th>
<th>Attitudes</th>
<th>Sample No.</th>
<th>Blows Per Foot</th>
<th>Dry Density pcf</th>
<th>Moisture Content, %</th>
<th>Soil Class (U.C.S.)</th>
<th>Type of Tests</th>
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<td>@ Surface: 3 inches of asphalt concrete over 2 inches of aggregate base</td>
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<td>@ 0.7: Silty SAND to Clayey SAND, olive gray, moist, fine-grained</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>@ 2: Silty SAND, bluish gray, moist, fine sand, trace of clay</td>
<td></td>
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</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>@ 5': Sandy CLAY, soft, bluish gray, moist, fine sand</td>
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</tr>
<tr>
<td>-5-5</td>
<td>5-5</td>
<td>R-1</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
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<td></td>
<td>@ 10': Silty CLAY, soft, bluish gray, very moist, low plasticity, trace organics</td>
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<td>10-10</td>
<td>R-2</td>
<td></td>
<td></td>
<td>1</td>
<td>81</td>
<td>40</td>
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<td>-200, PP</td>
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<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>@ 15': Sandy SILT, loose, bluish gray, moist, very fine sand, non-plastic</td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
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<td>AL, PP</td>
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<tr>
<td>-15-15</td>
<td>15-15</td>
<td>R-3</td>
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<td>1</td>
<td>90</td>
<td>32</td>
<td>ML</td>
<td>-200</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>@ 20': Sandy SILT, loose, bluish gray, very moist, non-plastic, trace of clay</td>
<td></td>
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<td>AL, PP</td>
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<td>-20-20</td>
<td>20-20</td>
<td>S-5</td>
<td></td>
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<td>2</td>
<td>87</td>
<td>35</td>
<td>SP</td>
<td>-200</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>@ 25': Poorly-graded SAND, medium dense, bluish gray, wet, medium sand</td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>@ 26': Silty SAND, medium dense, bluish gray, moist, medium sand</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-25-25</td>
<td>25-25</td>
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</tr>
</tbody>
</table>

**Sample Types:**
- BULK SAMPLE
- CORE SAMPLE
- GRAB SAMPLE
- RING SAMPLE
- SPLIT SPOON SAMPLE
- TUBE SAMPLE

**Type of Tests:**
- DS: DIRECT SHEAR
- EI: EXPANSION INDEX
- H: HYDROMETER
- MD: MAXIMUM DENSITY
- PP: POCKET PENETROMETER
- CU: UNDRAINED TRIAXIAL
- RV: R VALUE

***This log is a part of a report by Leighton and should not be used as a stand-alone document.***
# GEOTECHNICAL BORING LOG LB-2

<table>
<thead>
<tr>
<th>Elevation Feet</th>
<th>Depth Feet</th>
<th>Graphic Log</th>
<th>Attitudes</th>
<th>Sample No.</th>
<th>Blows Per Foot</th>
<th>Dry Density pcf</th>
<th>Moisture Content %</th>
<th>Soil Class, (U.S.C.S.)</th>
<th>Soil Description</th>
<th>Type of Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>N</td>
<td>S-6</td>
<td></td>
<td></td>
<td>SP-SM</td>
<td>@ 30’: Poorly-graded SAND with Silt, dense, gray, wet, dense, fine sand</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-20</td>
<td>30</td>
<td></td>
<td>S</td>
<td>S-7</td>
<td>7</td>
<td></td>
<td>SP</td>
<td>@ 35’: Poorly-graded SAND, medium dense, gray, wet, fine sand, local silty clay</td>
<td>-200</td>
<td></td>
</tr>
<tr>
<td>-25</td>
<td>35</td>
<td></td>
<td>N</td>
<td>S-8</td>
<td>6</td>
<td></td>
<td>SM</td>
<td>@ 40’: Silty SAND, dense, bluish gray, wet, fine sand</td>
<td></td>
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</tr>
<tr>
<td>-30</td>
<td>40</td>
<td></td>
<td>S</td>
<td>R-9</td>
<td>10</td>
<td>102</td>
<td>23</td>
<td>@ 45’: local silty clay, pockets of sand</td>
<td>-200, DS</td>
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</tr>
<tr>
<td>-35</td>
<td>45</td>
<td></td>
<td></td>
<td>S-10</td>
<td>3</td>
<td>50</td>
<td>16</td>
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<td></td>
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</tr>
<tr>
<td>-40</td>
<td>50</td>
<td></td>
<td>R</td>
<td>R-11</td>
<td>19</td>
<td>50/5°</td>
<td>SP-SM</td>
<td>@ 50’: Poorly-graded SAND with Silt, dense, bluish gray, wet, fine sand</td>
<td>-200</td>
<td></td>
</tr>
<tr>
<td>-45</td>
<td>55</td>
<td></td>
<td>S</td>
<td>S-12</td>
<td>4</td>
<td>12</td>
<td>32</td>
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<td></td>
</tr>
<tr>
<td>-50</td>
<td>60</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
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</tr>
</tbody>
</table>

**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.
# GEOTECHNICAL BORING LOG LB-2

<table>
<thead>
<tr>
<th>Project No.</th>
<th>11232.001</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project</td>
<td>2nd and PCH Retail Center</td>
</tr>
<tr>
<td>Drilling Co.</td>
<td>2R Drilling, Inc.</td>
</tr>
<tr>
<td>Drilling Method</td>
<td>Hollow Stem Auger - 140lb - Autohammer - 30&quot; Drop</td>
</tr>
<tr>
<td>Location</td>
<td>See Figure 2 - Boring and CPT Location Map</td>
</tr>
</tbody>
</table>

## 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.

<table>
<thead>
<tr>
<th>Elevation, Feet</th>
<th>Depth, Feet</th>
<th>Graphic Log</th>
<th>Attitudes</th>
<th>Sample No.</th>
<th>Blows Per 6 Inches</th>
<th>Density, pcf</th>
<th>Moisture Content, %</th>
<th>Soil Class, (U.S.C.S.)</th>
<th>Type of Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>-50</td>
<td>60</td>
<td>S-13</td>
<td>14</td>
<td>36</td>
<td>SP @ 60°: Poorly-graded SAND, dense to very dense, bluish gray, wet, fine to medium sand</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-55</td>
<td>65</td>
<td>S-14</td>
<td>14</td>
<td>36</td>
<td>SP @ 65°: Poorly-graded SAND with Silt, dense, bluish gray, wet, fine sand, trace of subrounded gravel</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-60</td>
<td>70</td>
<td>S-15</td>
<td>16</td>
<td>30</td>
<td>SP @ 70°: Poorly-graded SAND, dense to very dense, bluish gray, wet, fine to medium sand</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-65</td>
<td>75</td>
<td>S-16</td>
<td>15</td>
<td>32</td>
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<td></td>
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<td></td>
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<tr>
<td>-70</td>
<td>80</td>
<td>S-17</td>
<td>9</td>
<td>23</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**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.

---

**Type of Tests:**

- BULK SAMPLE
- CORE SAMPLE
- GRAB SAMPLE
- RING SAMPLE
- SPLIT SPOON SAMPLE
- 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

---

*** This log is a part of a report by Leighton and should not be used as a stand-alone document. ***
## GEOTECHNICAL BORING LOG LB-3

**Project No.:** 11232.002  
**Date Drilled:** 11-9-16  
**Logged By:** CD  
**Hole Diameter:** 8"  
**Ground Elevation:** 10'  
**Sampled By:** CD

### Sampled By Drilling Co.

<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
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</thead>
<tbody>
<tr>
<td>0 - 10</td>
<td>103</td>
<td>5</td>
<td>CL</td>
<td>B-1</td>
<td></td>
<td>2R Drilling, Inc.</td>
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<tr>
<td>5 - 5</td>
<td>7</td>
<td>12</td>
<td>ML</td>
<td>R-1</td>
<td></td>
<td>2R Drilling, Inc.</td>
</tr>
<tr>
<td>10 - 0</td>
<td>8</td>
<td>24</td>
<td>SM</td>
<td>R-2</td>
<td></td>
<td>2R Drilling, Inc.</td>
</tr>
<tr>
<td>5 - 5</td>
<td>4</td>
<td>6</td>
<td>ML</td>
<td>R-3</td>
<td></td>
<td>2R Drilling, Inc.</td>
</tr>
<tr>
<td>10 - 0</td>
<td>3</td>
<td>7</td>
<td>ML</td>
<td>T-4</td>
<td></td>
<td>2R Drilling, Inc.</td>
</tr>
<tr>
<td>5 - 5</td>
<td>3</td>
<td>7</td>
<td>ML</td>
<td>S-5</td>
<td></td>
<td>2R Drilling, Inc.</td>
</tr>
<tr>
<td>10 - 0</td>
<td>3</td>
<td>4</td>
<td>SM</td>
<td>S-6</td>
<td></td>
<td>2R Drilling, Inc.</td>
</tr>
<tr>
<td>5 - 5</td>
<td>4</td>
<td>6</td>
<td>ML</td>
<td>S-7</td>
<td></td>
<td>2R Drilling, Inc.</td>
</tr>
</tbody>
</table>

### Sample Types:

- BULK SAMPLE
- GRAB SAMPLE
- SPLIT SPOON SAMPLE
- TUBE SAMPLE
- CORE SAMPLE
- RING SAMPLE
- PIPE SAMPLE

### Type of Tests:

- DIRECT SHEAR
- EXPANSION INDEX
- HYDROMETER
- MAXIMUM DENSITY
- POCKET PENETROMETER
- UNCONFINED COMRESSIVE STRENGTH

---

**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.

- **Surface:** 1.5 inches of asphalt concrete over 3 inches of aggregate base
- **Artificial fill (Af):** @ 0.4': Silty CLAY, brown, moist, low to medium plasticity
- **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': Silty SAND, medium dense, bluish gray, moist, very fine sand
  - @ 7.5': Sandy SILT, loose, bluish gray, moist, FeO staining, very fine-grained
  - @ 8': Silty CLAY, soft, bluish gray, moist, low plasticity, laminated
  - @ 15': Clayey SILT to Sandy SILT, medium dense, bluish gray, very moist, non-plastic to low plasticity
  - @ 20': Silty SAND, medium dense, bluish gray, very moist, very fine sand, trace of clay

---

**Sampled Location:** See Figure 2 - Boring and CPT Location Map

---

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### SOIL DESCRIPTION

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<table>
<thead>
<tr>
<th>Elevation Feet</th>
<th>Depth Feet</th>
<th>Attitudes</th>
<th>Sample No.</th>
<th>Blows Per 6 Inches</th>
<th>Moisture Content, %</th>
<th>Soil Class, (U.S.C.S.)</th>
<th>Type of Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>-20</td>
<td>30</td>
<td>N</td>
<td>S-8</td>
<td>4</td>
<td>23</td>
<td>CL</td>
<td>SA, AL</td>
</tr>
<tr>
<td></td>
<td></td>
<td>S-9A</td>
<td></td>
<td>3</td>
<td>10</td>
<td>CL</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>S-9B</td>
<td></td>
<td>18</td>
<td>SM</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>S-10A</td>
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<td>4</td>
<td>6</td>
<td>CL</td>
<td></td>
</tr>
<tr>
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<td></td>
<td>S-10B</td>
<td></td>
<td>11</td>
<td>SM</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>S-11</td>
<td></td>
<td>12</td>
<td>15</td>
<td>SP-SM</td>
<td>-200</td>
</tr>
<tr>
<td></td>
<td></td>
<td>S-12</td>
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<td></td>
<td>S-13</td>
<td></td>
<td>6</td>
<td>12</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- @ 30': Lean CLAY with Sand, medium stiff, bluish gray, very moist, low plasticity
- @ 35': medium plasticity
- @ 36': Silty SAND, medium dense, bluish gray, very moist, fine sand
- @ 40': Lean CLAY, stiff, bluish gray, moist, medium plasticity
- @ 41': Silty SAND, medium dense, bluish gray, very moist, fine sand
- @ 45': Poorly-graded SAND with Silt, dense, bluish gray, very moist, medium sand
- @ 50': fine to medium sand
- @ 55': Poorly-graded SAND with Silt, dense, bluish gray, very moist, fine sand
- @ 60':

---

**Sample Types:**
- BULK SAMPLE
- CORE SAMPLE
- GRAB SAMPLE
- RING SAMPLE
- SPLIT SPOON SAMPLE
- 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. ***
**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.

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.
## GEOTECHNICAL BORING LOG LB-4

<table>
<thead>
<tr>
<th>Elevation Feet</th>
<th>Depth Feet</th>
<th>Graphic Long</th>
<th>Attitudes</th>
<th>Sample No.</th>
<th>Blows Per 6 Inches</th>
<th>Dry Density pcf</th>
<th>Moisture Content, %</th>
<th>Soil Class, (U.S.C.S.)</th>
<th>Type of Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>0</td>
<td>N</td>
<td>B-1</td>
<td></td>
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<td>R-1</td>
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<td>15</td>
<td>109</td>
<td>4</td>
<td>SP-SM</td>
<td>RV</td>
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<td>R-2</td>
<td>8</td>
<td>9</td>
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<td>4</td>
<td>88</td>
<td>36</td>
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</tr>
</tbody>
</table>

**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.

- **Temporary fill:** Artificial fill (Af)
  - 0.8': Silty SAND, brown, moist, trace of gravel and clay

- **Quaternary-aged young alluvial deposits (Qya)**
  - 3': Poorly-graded SAND with Silt, medium dense, light olive brown, slightly moist, FeO staining, fine sand
  - 5': Silty SAND, medium dense, olive brown, moist, FeO staining, trace of clay
  - 7.5': Silty CLAY, soft, bluish gray, wet, trace of organics, high plasticity

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.
**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.

<table>
<thead>
<tr>
<th>Depth Feet</th>
<th>Blows</th>
<th>Moisture Content, %</th>
<th>Soil Class, (U.S.C.S.)</th>
<th>Type of Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>10'</td>
<td>0</td>
<td>@Surface: 4 inches of asphalt concrete over 8 inches of aggregate base</td>
<td>SP-SM</td>
<td>RV</td>
</tr>
<tr>
<td>5'</td>
<td>1</td>
<td>Artificial fill (AF)</td>
<td>1: Poorly-graded SAND with Silt, light olive brown, slightly moist</td>
<td>SP-SM</td>
</tr>
<tr>
<td>2.5'</td>
<td>2</td>
<td>Quaternary-aged young alluvial deposits (Qya)</td>
<td>2.5: Poorly-graded SAND with Silt, dense, light olive brown, slightly moist, FeO staining, fine sand</td>
<td>SP-SM</td>
</tr>
<tr>
<td>@ 5': some shell fragments</td>
<td>SP-SM</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.5'</td>
<td>4</td>
<td>change color to bluish gray</td>
<td>SP-SM</td>
<td></td>
</tr>
<tr>
<td>8.5'</td>
<td>5</td>
<td>Silty CLAY, soft to medium stiff, bluish gray, very moist, high plasticity, trace of organics, laminated</td>
<td>SP-SM</td>
<td></td>
</tr>
<tr>
<td>10': Sandy CLAY to Clayey SILT, bluish gray, moist, non-plastic to low plasticity</td>
<td>CL-ML</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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.
GEOTECHNICAL BORING LOG P-1

<table>
<thead>
<tr>
<th>Project No.</th>
<th>11232.001</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project</td>
<td>2nd and PCH Retail Center</td>
</tr>
<tr>
<td>Drilling Co.</td>
<td>2R Drilling, Inc.</td>
</tr>
<tr>
<td>Drilling Method</td>
<td>Hand Auger - 30&quot; Drop</td>
</tr>
<tr>
<td>Location</td>
<td>See Figure 2 - Boring and CPT Location Map</td>
</tr>
<tr>
<td>Date Drilled</td>
<td>2-1-16</td>
</tr>
<tr>
<td>Logged By</td>
<td>CD</td>
</tr>
<tr>
<td>Hole Diameter</td>
<td>8&quot;</td>
</tr>
<tr>
<td>Ground Elevation</td>
<td>10'</td>
</tr>
<tr>
<td>Sampled By</td>
<td>CD</td>
</tr>
</tbody>
</table>

**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.

<table>
<thead>
<tr>
<th>Elevation Feet</th>
<th>Depth Feet</th>
<th>Graphic Log</th>
<th>Attitudes</th>
<th>Sample No.</th>
<th>Blows Per 6 Inches</th>
<th>Dry Density pcf</th>
<th>Moisture Content, %</th>
<th>Soil Class, (U.S.C.S.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>0</td>
<td>N</td>
<td></td>
<td>B-1</td>
<td>SM</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Surface: 3 inches of asphalt concrete of 2 inches of aggregate base
- 0.4": Silty SAND, olive brown, moist, fine sand

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.

**SAMPLE TYPES:**
- BULK SAMPLE
- CORE SAMPLE
- GRAB SAMPLE
- RING SAMPLE
- SPLIT SPOON SAMPLE
- TUBE SAMPLE

**TYPE OF TESTS:**
- 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

<table>
<thead>
<tr>
<th>Project No.</th>
<th>11232.001</th>
<th>Date Drilled</th>
<th>2-1-16</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project</td>
<td>2nd and PCH Retail Center</td>
<td>Logged By</td>
<td>CD</td>
</tr>
<tr>
<td>Drilling Co.</td>
<td>2R Drilling, Inc.</td>
<td>Hole Diameter</td>
<td>8&quot;</td>
</tr>
<tr>
<td>Drilling Method</td>
<td>Hand Auger - 30&quot; Drop</td>
<td>Ground Elevation</td>
<td>10'</td>
</tr>
<tr>
<td>Location</td>
<td>See Figure 2 - Boring and CPT Location Map</td>
<td>Sampled By</td>
<td>CD</td>
</tr>
</tbody>
</table>

### 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.

<table>
<thead>
<tr>
<th>Elevation Feet</th>
<th>Depth Feet</th>
<th>Graphic Long</th>
<th>Attitudes</th>
<th>Sample No.</th>
<th>Blows Per 6 Inches</th>
<th>Dry Density pcf</th>
<th>Moisture Content %</th>
<th>Soil Class (U.S.C.S.)</th>
<th>Type of Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>0</td>
<td>NS</td>
<td>N</td>
<td>B-1</td>
<td>SM</td>
<td></td>
<td></td>
<td>SM</td>
<td>SA</td>
</tr>
<tr>
<td>@ Surface: 2 inches of asphalt concrete of 4 inches of aggregate base</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>@ 0.4&quot;: Silty SAND, olive brown, moist, fine sand</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>NS</td>
<td></td>
<td></td>
<td>SM-ML</td>
<td></td>
<td></td>
<td>@ 4&quot;: Silty SAND to Sandy SILT, gray, moist, very fine sand</td>
<td></td>
</tr>
</tbody>
</table>

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.

---

**SAMPLE TYPES:**
- BULK SAMPLE
- CORE SAMPLE
- GRAB SAMPLE
- RING SAMPLE
- SPLIT SPOON SAMPLE
- 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**

<table>
<thead>
<tr>
<th>Elevation Feet</th>
<th>Depth Feet</th>
<th>Graphic Long</th>
<th>Attitudes</th>
<th>Sample No.</th>
<th>Blows Per 6 Inches</th>
<th>Dry Densitypcf</th>
<th>Moisture Content, %</th>
<th>Soil Class, (U.S.C.S.)</th>
<th>Type of Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>0</td>
<td>N</td>
<td></td>
<td>B-1</td>
<td>SM</td>
<td></td>
<td></td>
<td>@ Surface: Grass @ 0.1'; Silty SAND, dark brown, moist, fine sand</td>
<td>-200</td>
</tr>
<tr>
<td></td>
<td></td>
<td>S</td>
<td></td>
<td></td>
<td>SM-ML</td>
<td></td>
<td></td>
<td>@ 1.5'; Silty SAND to Sandy SILT, olive brown, moist, very fine sand</td>
<td></td>
</tr>
</tbody>
</table>

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.

**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:**
- BULK SAMPLE
- CORE SAMPLE
- GRAB SAMPLE
- RING SAMPLE
- SPLIT SPOON SAMPLE
- 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

*** This log is a part of a report by Leighton and should not be used as a stand-alone document. ***
PREVIOUS GEOTECHNICAL BORING LOGS BY
OTHERS (CONVERSE, 2004)
## Soil Classification Chart

<table>
<thead>
<tr>
<th>Major Divisions</th>
<th>Symbols</th>
<th>Typical Descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gravel and Gravelly Soils</strong></td>
<td>GW</td>
<td>Well-graded Gravels, Gravel - Sand Mixtures, Little or No Fines</td>
</tr>
<tr>
<td>Clean Gravels (Little or No Fines)</td>
<td>GP</td>
<td>Poorly-graded Gravels, Gravel - Sand Mixtures, Little or No Fines</td>
</tr>
<tr>
<td>Gravels With Fines</td>
<td>GM</td>
<td>Silty Gravels, Gravel - Sand - Silt Mixtures</td>
</tr>
<tr>
<td><strong>Sand and Sandy Soils</strong></td>
<td>GC</td>
<td>Clayey Gravels, Gravel - Sand - Clay Mixtures</td>
</tr>
<tr>
<td>Clean Sands (Little or No Fines)</td>
<td>SW</td>
<td>Well-graded Sands, Gravelly Sands, Little or No Fines</td>
</tr>
<tr>
<td>Sands With Fines</td>
<td>SP</td>
<td>Poorly-graded Sands, Gravelly Sands, Little or No Fines</td>
</tr>
<tr>
<td><strong>Silty Sands and Silts</strong></td>
<td>SM</td>
<td>Silt-Gravels, Sand - Silt Mixtures</td>
</tr>
<tr>
<td>Sands With Fines</td>
<td>SC</td>
<td>Clayey Sands, Sand - Clay Mixtures</td>
</tr>
<tr>
<td><strong>Silt and Clay Soils</strong></td>
<td>ML</td>
<td>Organic Silts and Organic Silt-Clays of Low Plasticity</td>
</tr>
<tr>
<td>Liquid Limit Less Than 50</td>
<td>CL</td>
<td>Organic Silt-Clays of Moderately Low Plasticity, Gravelly Clays, Sandy Clays, Silt Clays, Lean Clays</td>
</tr>
<tr>
<td><strong>Silt and Clay Soils</strong></td>
<td>OL</td>
<td>Organic Silt-Clays of Low Plasticity</td>
</tr>
<tr>
<td>Liquid Limit Greater Than 50</td>
<td>MH</td>
<td>Organic Silt-Clays of Moderately High Plasticity</td>
</tr>
<tr>
<td><strong>Highly Organic Soils</strong></td>
<td>CH</td>
<td>Organic Clays of High Plasticity</td>
</tr>
<tr>
<td>PT</td>
<td>Organic Clays of Medium to High Plasticity, Organic Sands</td>
<td></td>
</tr>
</tbody>
</table>

Note: Dual symbols are used to indicate borderline soil classifications.

### Boring Log Symbols

- **Sample Type**
  - Standard Penetration Test
  - Drive Sample - 2 1/2" I.D. Sample
  - Bulk Sample
  - Groundwater While Drilling
  - Groundwater After Drilling

### Laboratory Testing Abbreviations

<table>
<thead>
<tr>
<th>Test Type</th>
<th>Strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct Shear</td>
<td></td>
</tr>
<tr>
<td>Unconfined Compression</td>
<td></td>
</tr>
<tr>
<td>Vane Shear</td>
<td></td>
</tr>
<tr>
<td>Consolidation</td>
<td></td>
</tr>
<tr>
<td>Cyclic Test</td>
<td></td>
</tr>
<tr>
<td>Retardation (R) Value</td>
<td></td>
</tr>
<tr>
<td>Chemical Analysis</td>
<td></td>
</tr>
<tr>
<td>Electrical Resistivity</td>
<td></td>
</tr>
</tbody>
</table>

---

**Converse Consultants**

**Project Name**

Mixed-Use Community
Long Beach, California
For: Lennar Communities

**Project No.** 04-31-118-01

**Drawing No.** 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

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.

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Graphic Log</th>
<th>Drive Blows</th>
<th>Bulk Blows</th>
<th>Moisture (%)</th>
<th>Dry Unit Wt. (pcf)</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>4&quot; ASPHALT CONCRETE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FILL (AF):</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SANDY SILT (ML): fine-grained sand, trace clay, brown.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ALLUVIUM (Qa):</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SILTY SAND (SM): fine-grained, gray.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3,4,5</td>
<td>24</td>
<td>98</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1,5,11</td>
<td>27</td>
<td>97</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| SANDY SILT (ML): fine-grained sand, slight odor, gray to dark gray. |
| 3,7,9 | 21 | 98 | |

| SILTY SAND (SM): fine-grained, trace clay, gray. |
| 2,3,5 | | | wa (45%) |

| SAND WITH SILT (SP-SM): fine-grained, gray. |
| 2,6,11 | | | wa (11%) |

Converse Consultants
Mixed-Use Community
Long Beach, California
For: Lennar Communities

Project Name
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

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Graphic Log</th>
<th>SAND WITH SILT (SP-SM): fine-grained, gray.</th>
<th>SILTY SAND (SM): fine to medium-grained, yellowish gray.</th>
<th>SAND WITH SILT (SP-SM): fine-grained, gray.</th>
<th>SAND (SP): fine to medium-grained, gray.</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td></td>
<td>SAMPLES</td>
<td>BLOWS</td>
<td>SAMPLES</td>
<td>BLOWS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DRIVE BULK</td>
<td>MOISTURE (%)</td>
<td>DRIVE BULK</td>
<td>MOISTURE (%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5,8,11</td>
<td>21</td>
<td>4,4,3</td>
<td>wa (19%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>45</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50</td>
<td></td>
<td></td>
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<tr>
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<td></td>
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<td></td>
</tr>
<tr>
<td>55</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>60</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>wa (4%)</td>
</tr>
</tbody>
</table>

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.
Log of Boring No. BH-2

Dates Drilled: 3/2/2004  Logged by: CBOO  Checked By: KF
Equipment: 9" HOLLOW STEM AUGER  Driving Weight and Drop: 140 lbs / 30 in
Ground Surface Elevation (ft): 10  Depth to Water (ft): 15

### SUMMARY OF SUBSURFACE CONDITIONS

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<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Graphic Log</th>
<th>SAMPLES</th>
<th>DRIVE</th>
<th>BULK</th>
<th>BLOWS</th>
<th>MOISTURE (%)</th>
<th>DRY UNIT WT. (pcf)</th>
<th>OTHER</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>max</td>
</tr>
<tr>
<td>2&quot; ASPHALT CONCRETE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>FILL (AF):</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SILTY SAND (SM): fine-grained, greenish brown.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ALLUVIUM (Cal):</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SILTY SAND (SM): fine-grained, light gray.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-gray</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
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<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CLAYEY SAND (SC): fine-grained, gray.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>wa</td>
</tr>
<tr>
<td>20</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(53%)</td>
</tr>
<tr>
<td>SANDY SILT (ML): fine-grained sand, gray.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>wa</td>
</tr>
<tr>
<td>25</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(56%)</td>
</tr>
<tr>
<td>SILT (ML): trace of fine-grained sand, gray.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# 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

---

## SUMMARY OF SUBSURFACE CONDITIONS

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<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Graphic Log</th>
<th>SAMPLES</th>
<th>MOISTURE (%)</th>
<th>DRY UNIT WT. (pcf)</th>
<th>OTHER</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td></td>
<td>DRIVE</td>
<td>BULK</td>
<td>4,7,8</td>
<td>31</td>
</tr>
<tr>
<td>45</td>
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<td></td>
<td></td>
<td>2,2,3</td>
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</tr>
<tr>
<td>50</td>
<td></td>
<td></td>
<td></td>
<td>6,12,19</td>
<td>26</td>
</tr>
<tr>
<td>55</td>
<td></td>
<td></td>
<td></td>
<td>7,19,15</td>
<td></td>
</tr>
<tr>
<td>60</td>
<td></td>
<td></td>
<td></td>
<td>12,25/6&quot;</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3,8,16</td>
<td></td>
</tr>
</tbody>
</table>

**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.
## 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 ln  
**Ground Surface Elevation (ft):** 10  
**Depth to Water (ft):** 15

### 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.

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Graphic Log</th>
<th>SAMPLES</th>
<th>BLOWS</th>
<th>MOISTURE (%)</th>
<th>DRY UNIT WT.</th>
<th>OTHER</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td>DRIVE</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>3&quot; ASPHALT CONCRETE OVER 2&quot; BASE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>ALLUVIUM (Qai):</td>
<td>2,4,6</td>
<td>21</td>
<td>103</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>SILTY SAND (SM): fine-grained, gray brown.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-increasing silt content</td>
<td>4,5,5</td>
<td>25</td>
<td>97</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>-trace clay</td>
<td>1,2,3</td>
<td>39</td>
<td>82</td>
<td>c</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>SILT (ML): trace fine-grained sand, gray.</td>
<td>2,2,3</td>
<td>49</td>
<td>74</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>-little clay</td>
<td>1,2,1</td>
<td>wa</td>
<td>(90%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>SILTY SAND (SM): fine-grained, gray.</td>
<td>3,6,9</td>
<td>33</td>
<td>90</td>
<td>ds</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>-trace shells</td>
<td>3,6,8</td>
<td>wa</td>
<td>(25%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

Converse Consultants  
Project Name: MIXED-USE COMMUNITY  
Project No.: 04-31-118-01  
LONG BEACH, CALIFORNIA  
FOR: LENNAR COMMUNITIES  
Drawing No.: A-4a
Log of Boring No. BH-3

Dates Drilled: 3/3/2004
Equipment: 8" HOLLOW STEM AUGER
Ground Surface Elevation (ft): 10
Depth to Water (ft): 15
Logged by: CBOO
Checked By: KF
Driving Weight and Drop: 140 lbs / 30 in

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Graphic Log</th>
<th>SUMMARY OF SUBSURFACE CONDITIONS</th>
<th>SAMPLES</th>
<th>DRIVE</th>
<th>BULK</th>
<th>MOISTURE (%)</th>
<th>DRY UNIT WT. (pcf)</th>
<th>OTHER</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td></td>
<td>SILTY SAND (SM): fine-grained, gray.</td>
<td></td>
<td></td>
<td>8,14,20</td>
<td>24</td>
<td>98</td>
<td></td>
</tr>
<tr>
<td>45</td>
<td></td>
<td>SILT (ML): some, fine-grained sand, trace clay, gray.</td>
<td></td>
<td></td>
<td>3,4,5</td>
<td></td>
<td></td>
<td>wa (93%)</td>
</tr>
<tr>
<td>50</td>
<td></td>
<td>SAND (SP): fine-grained, gray.</td>
<td></td>
<td></td>
<td>6,16,22</td>
<td>26</td>
<td>97</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>-fine-to medium-grained, trace gravel up to 1/4&quot; in maximum dimension.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>wa (5%)</td>
</tr>
<tr>
<td>55</td>
<td></td>
<td>SAND WITH SILT (SP-SM): fine-grained, gray.</td>
<td></td>
<td></td>
<td>6,8,13</td>
<td>24</td>
<td></td>
<td>dist.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-trace gravel up to 1/3&quot; in maximum dimension.</td>
<td></td>
<td></td>
<td>6,10,15</td>
<td></td>
<td></td>
<td>wa (8%)</td>
</tr>
<tr>
<td>60</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>10,23,31</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Converse Consultants
MIXED-USE COMMUNITY
LONG BEACH, CALIFORNIA
FOR: LENNAR COMMUNITIES

Project Name
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

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#### 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.

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Graphic Log</th>
<th>Samples</th>
<th>BULK</th>
<th>BLOWS</th>
<th>MOISTURE (%)</th>
<th>DRY UNIT WT. (pcf)</th>
<th>OTHER</th>
</tr>
</thead>
<tbody>
<tr>
<td>75</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>wa (5%)</td>
</tr>
<tr>
<td>80</td>
<td></td>
<td>7,10,16</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>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.</td>
<td>10,18,26</td>
<td>8,20,26</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>
### LOG OF BORING NO. BH-4

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Graphic Log</th>
<th>SUMMARY OF SUBSURFACE CONDITIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.5</td>
<td>Asphalt Concrete</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Fill (Ag): 6,5,4</td>
<td>23 100</td>
</tr>
<tr>
<td></td>
<td>Silty Sand (SM): fine-grained, brown.</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Clay (CL): 5,6,6</td>
<td>62 66</td>
</tr>
<tr>
<td></td>
<td>Trace dark gray organic, and fine-grained sand, gray.</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Silty Sand (SM): 3,4,6</td>
<td>30 91</td>
</tr>
<tr>
<td></td>
<td>Fine-grained, gray to brown.</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Silty Sand (SM): 5,6,7</td>
<td>58 (99%)</td>
</tr>
<tr>
<td></td>
<td>Some fine-grained sand, trace clay, gray.</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>Silty Sand (SM): 5,6,14</td>
<td>29 92</td>
</tr>
<tr>
<td></td>
<td>Fine-grained, gray.</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>Sandy Silty (ML): 3,5,4</td>
<td>30 (83%)</td>
</tr>
<tr>
<td></td>
<td>Fine-grained sand, dark gray.</td>
<td></td>
</tr>
</tbody>
</table>

**Equipment:** 8" Hollow Stem Auger

**Driving Weight and Drop:** 140 lbs / 30 in

**Ground Surface Elevation (ft):** 10

**Depth to Water (ft):** 10

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**Converse Consultants**

**Project Name:** Mixed-Use Community

**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

## SUMMARY OF SUBSURFACE CONDITIONS

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<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Graphic Log</th>
<th>SAMPLES</th>
<th>DRIVE</th>
<th>BULK</th>
<th>BLOWS</th>
<th>MOISTURE (%)</th>
<th>DRY UNT WT. (pcf)</th>
<th>OTHER</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td></td>
<td>SANDY SILT (ML): fine-grained sand, gray.</td>
<td></td>
<td>3,5,7</td>
<td>37</td>
<td>87</td>
<td>da</td>
<td></td>
</tr>
<tr>
<td>45</td>
<td></td>
<td>-trace clay</td>
<td></td>
<td></td>
<td>2,4,12</td>
<td></td>
<td>wa (68%)</td>
<td></td>
</tr>
<tr>
<td>50</td>
<td></td>
<td>SILTY SAND (SM): fine to medium-grained, gray with light gray.</td>
<td></td>
<td>8,22,30</td>
<td>23</td>
<td>103</td>
<td>wa (9%)</td>
<td></td>
</tr>
<tr>
<td>55</td>
<td></td>
<td>SAND WITH SILT (SP-SM): fine to medium-grained, gray.</td>
<td></td>
<td>3,4,5</td>
<td></td>
<td></td>
<td>wa (5%)</td>
<td></td>
</tr>
<tr>
<td>60</td>
<td></td>
<td>SAND (SP): medium grained, gray.</td>
<td></td>
<td>3,7,9</td>
<td>6,12,18</td>
<td></td>
<td>wa (5%)</td>
<td></td>
</tr>
</tbody>
</table>

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.
# Log of Boring No. BH-5

**Dates Drilled:** 3/3/2004  
**Logged by:** CBOO  
**Checked By:** KF  
**Equipment:** 8\(^{\text{th}}\) HOLLOW STEM AUGER  
**Driving Weight and Drop:** 140 lbs / 30 in  
**Ground Surface Elevation (ft):** 10  
**Depth to Water (ft):** 12

## SUMMARY OF SUBSURFACE CONDITIONS

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<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Graphic Log</th>
<th>SAMPLES</th>
<th>BULK</th>
<th>MOISTURE (%)</th>
<th>DRY UNIT WT. (pcf)</th>
<th>OTHER</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 - 5</td>
<td>3(^{\text{rd}}) ASPHALT CONCRETE OVER 3(^{\text{rd}}) BASE</td>
<td>[Diagram]</td>
<td>8,6,9</td>
<td>29</td>
<td>92</td>
<td></td>
</tr>
</tbody>
</table>
| 5 - 10    | ALLUVIUM (Cal):  
SILTY SAND (SM): fine-grained, few clay, gray. | [Diagram] | 2,5,14 | 21 | 103 | |
| 10 - 15   | CLAY (CL): trace fine grained sand, some root, slight odor, gray. | [Diagram] | 5,5,3 | | | |
| 15 - 20   | SILTY SAND (SM): fine-grained, gray.  
-root | [Diagram] | 6,10,8 | 23 | | wa (39%) |
| 20 - 25   | -increasing sand content | [Diagram] | 4,4,5 | | wa (30%) |
| 25 - 30   | | [Diagram] | 5,9,9 | 29 | 101 | |
| 30 -      | | [Diagram] | 3,8,8 | | | |

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**Project Name:** MIXED-USE COMMUNITY  
**Location:** 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

## 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.

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Graphic Log</th>
<th>SAMPLES</th>
<th></th>
<th>MOISTURE (%)</th>
<th>DRY UNIT WT. (pcf)</th>
<th>OTHER</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>DRIVE</td>
<td>BULK</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40</td>
<td></td>
<td>5,5,9</td>
<td>27</td>
<td></td>
<td>95</td>
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</tr>
<tr>
<td>45</td>
<td></td>
<td>4,4,4</td>
<td></td>
<td></td>
<td></td>
<td>WA (98%)</td>
</tr>
<tr>
<td>50</td>
<td></td>
<td>7,27,28</td>
<td>24</td>
<td></td>
<td>99</td>
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</tr>
<tr>
<td>55</td>
<td></td>
<td>2,2,4</td>
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<td></td>
<td></td>
<td>WA (11%)</td>
</tr>
<tr>
<td>60</td>
<td></td>
<td>8,9,13</td>
<td>21</td>
<td></td>
<td>107</td>
<td></td>
</tr>
<tr>
<td>65</td>
<td></td>
<td>7,12,14</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

**SANDY SILT (ML):** trace fine-grained sand, gray.  
**SILT (ML):** trace fine-grained sand, some clay, gray.  
**SAND WITH SILT (SP-SM):** fine-grained, gray. -fine to medium-grained  
**SILTY SAND (SM):** fine-grained, gray.  
**SAND WITH SILT (SP-SM):** fine to medium-grained, gray.  

End of boring at 51.5 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.
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:

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Cone Penetration Tests</td>
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<tr>
<td>2</td>
<td>Pore Pressure Dissipation Tests</td>
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<tr>
<td>3</td>
<td>Seismic Cone Penetration Tests</td>
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<tr>
<td>4</td>
<td>UVOST Laser Induced Fluorescence</td>
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<tr>
<td>5</td>
<td>Groundwater Sampling</td>
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<tr>
<td>6</td>
<td>Soil Sampling</td>
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<tr>
<td>7</td>
<td>Vapor Sampling</td>
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<tr>
<td>8</td>
<td>Pressuremeter Testing</td>
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<td>9</td>
<td>Vane Shear Testing</td>
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<tr>
<td>10</td>
<td>Dilatometer Testing</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

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-

<table>
<thead>
<tr>
<th>CPT Sounding Identification</th>
<th>Date</th>
<th>Termination Depth (feet)</th>
<th>Depth of Groundwater Samples (feet)</th>
<th>Depth of Soil Samples (feet)</th>
<th>Depth of Pore Pressure Dissipation Tests (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPT-1</td>
<td>2/02/16</td>
<td>60</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CPT-2</td>
<td>2/02/16</td>
<td>60</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CPT-3</td>
<td>2/01/16</td>
<td>80</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CPT-4</td>
<td>2/02/16</td>
<td>60</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CPT-5</td>
<td>2/02/16</td>
<td>60</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CPT-6</td>
<td>2/01/16</td>
<td>80</td>
<td>-</td>
<td>-</td>
<td>80.2</td>
</tr>
<tr>
<td>CPT-7</td>
<td>2/02/16</td>
<td>60</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CPT-8</td>
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Bibliography


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

Site: SEAPORT MARINA HOTEL
Engineer: C. DELGADILLO
Sounding: cpt-4
Date: 2/2/2016 01:49

Graphs showing:
- $q_t$ (tsf)
- $f_s$ (tsf)
- $R_f$ (%)
- $N_{60}$ (blows/ft)

SBT: Soil Behavior Type (Robertson 1990)

Max. Depth: 60.367 ft
Avg. Interval: 0.326 ft
LEIGHTON

Site: SEAPORT MARINA HOTELEngineer: C. DELGADILLO
Sounding: cpt-13 Date: 2/1/2016 02:21

Max. Depth: 80.381 (ft)
Avg. Interval: 0.326 (ft)

SBT: Soil Behavior Type (Robertson 1990)
GREGG DRILLING & TESTING
Pore Pressure Dissipation Test

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

![Graph showing pore pressure dissipation over time](image-url)
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:

<table>
<thead>
<tr>
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<th>Testing Services</th>
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<tr>
<td>1</td>
<td>Cone Penetration Tests (CPTU)</td>
</tr>
<tr>
<td>2</td>
<td>Pore Pressure Dissipation Tests (PPD)</td>
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<tr>
<td>3</td>
<td>Seismic Cone Penetration Tests (SCPTU)</td>
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<td>4</td>
<td>UVOST Laser Induced Fluorescence (UVOST)</td>
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<td>5</td>
<td>Groundwater Sampling (GWS)</td>
</tr>
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<td>6</td>
<td>Soil Sampling (SS)</td>
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<td>Vapor Sampling (VS)</td>
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<td>8</td>
<td>Pressuremeter Testing (PMT)</td>
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<td>9</td>
<td>Vane Shear Testing (VST)</td>
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<td>10</td>
<td>Dilatometer Testing (DMT)</td>
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</table>

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-

<table>
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<tr>
<th>CPT Sounding Identification</th>
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<th>Termination Depth (feet)</th>
<th>Depth of Groundwater Samples (feet)</th>
<th>Depth of Soil Samples (feet)</th>
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Bibliography


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

Site: SEAPORT MARINA
Sounding: CPT-18
Engineer: C. DELGADILLO
Date: 11/4/16 10:10

Max. Depth: 60.357 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)
APPENDIX C

LABORATORY TEST RESULTS
### Moisture Correction

<table>
<thead>
<tr>
<th>Soil Identification</th>
<th>Dark gray silty sand (SM)</th>
<th>Gray silty sand (SM)</th>
<th>Dark gray silty sand (SM)</th>
<th>Dark gray poorly-graded sand with silt (SP-SM)</th>
<th>Dark gray silt (ML)</th>
<th>Very dark gray silty sand (SM), trace shells noted</th>
<th>Very dark gray silty sand (SM)</th>
<th>Olive gray silty sand (SM)</th>
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### Sample Dry Weight Determination

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<td>S-6</td>
<td>S-8</td>
<td>S-10</td>
<td>R-3</td>
<td>S-5B</td>
<td>S-7</td>
<td>R-9</td>
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<tr>
<td>Depth (ft.)</td>
<td>25.0</td>
<td>30.0</td>
<td>40.0</td>
<td>46.5</td>
<td>15.0</td>
<td>26-26.5</td>
<td>35.0</td>
<td>45.0</td>
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<td>Sample Type</td>
<td>SPT</td>
<td>SPT</td>
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<td>SPT</td>
<td>Ring</td>
<td>SPT</td>
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### Moisture Content (%)

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<td>Depth (ft.)</td>
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### Sample Dry Weight Determination

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<td>R-9</td>
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<td>Depth (ft.)</td>
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<td>30.0</td>
<td>40.0</td>
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<td>26-26.5</td>
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<td>SPT</td>
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<td>Ring</td>
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<td>SPT</td>
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### Percent Passing

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<td>S-5B</td>
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<td>R-9</td>
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<td>30.0</td>
<td>40.0</td>
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<td>26-26.5</td>
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## Project Details

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

---

**Leighton**

PERCENT PASSING

No. 200 SIEVE

ASTM D 1140
| Boring No. | LB-2 | LB-2 |
| Sample No. | R-11 | S-14 |
| Depth (ft.) | 50.0 | 65.0 |
| Sample Type | SPT | SPT |

**Soil Identification**

<table>
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<th>Soil Identification</th>
<th>LB-2</th>
<th>LB-2</th>
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<td>Gray silty sand (SM)</td>
<td></td>
<td>Gray poorly-graded sand with silt (SP-SM)</td>
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</table>

**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 |

**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 |

---

**PERCENT PASSING**

**No. 200 SIEVE**

**ASTM D 1140**

---

**Leighton**

**Project Name:** CenterCal/2nd & PCH  
**Project No.:** 11232.001  
**Client Name:** CenterCal Properties, LLC  
**Tested By:** S. Felter  
**Date:** 02/09/16
<table>
<thead>
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<td>Soil Identification</td>
<td>Olive sandy silt s(ML)</td>
<td>Olive poorly-graded sand with silt (SP-SM)</td>
<td>Olive poorly-graded sand with silt (SP-SM)</td>
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### 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 |

### 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 |

---

**Project Name:** CenterCal/LB Whole Foods Market  
**Project No.:** 11232.002  
**Client Name:** CenterCal Properties, LLC  
**Tested By:** A. Santos  
**Date:** 11/11/16  
**Leighton**  
**PERCENT PASSING**  
No. 200 SIEVE  
ASTM D 1140
<table>
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<tr>
<th>GRAVEL</th>
<th>SAND</th>
<th>FINES</th>
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<td>COARSE</td>
<td>FINE</td>
<td>COARSE</td>
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<tr>
<td>3.0&quot;</td>
<td>1 1/2&quot;</td>
<td>3/4&quot;</td>
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**Soil Identification:** Olive brown silty sand (SM)

**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)
<table>
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<th>U.S. STANDARD SIEVE NUMBER</th>
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<tr>
<td>#4</td>
<td>#8</td>
<td>#16</td>
</tr>
<tr>
<td>#30</td>
<td>#50</td>
<td>#100</td>
</tr>
<tr>
<td>#200</td>
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</table>

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

**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

---

**Project Name:** CenterCal/2nd & PCH

**Project No.:** 11232.001

---

**Leighton**

**PARTICLE - SIZE DISTRIBUTION**

**ASTM D 6913**
Soil Identification: Dark olive brown silty sand (SM)

GR:SA:FI (%): 1 : 50 : 49
GRAVEL    SAND    FINES
<table>
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<tr>
<th>COARSE</th>
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<th>CLAY</th>
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<td>#4</td>
<td>#8</td>
<td>#16</td>
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</table>

Project Name: CenterCal/LB Whole Foods Market
Project No.: 11232.002

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
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)

<table>
<thead>
<tr>
<th>TEST</th>
<th>PLASTIC LIMIT</th>
<th>LIQUID LIMIT</th>
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<tbody>
<tr>
<td>NO.</td>
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<td>2</td>
</tr>
<tr>
<td>Number of Blows [N]</td>
<td>33</td>
<td>25</td>
</tr>
<tr>
<td>Wet Wt. of Soil + Cont. (g)</td>
<td>9.53</td>
<td>8.66</td>
</tr>
<tr>
<td>Dry Wt. of Soil + Cont. (g)</td>
<td>7.66</td>
<td>7.00</td>
</tr>
<tr>
<td>Wt. of Container (g)</td>
<td>1.08</td>
<td>1.07</td>
</tr>
<tr>
<td>Moisture Content (%) [Wn]</td>
<td>28.42</td>
<td>27.99</td>
</tr>
</tbody>
</table>

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

- Dry Preparation
  - Multipoint - Dry

- Procedure A
  - Multipoint Test

- Procedure B
  - One-point Test
**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)

---

### Atterberg Limits

**ASTM D 4318**

- **Liquid Limit (LL):** NP
- **Plastic Limit (PL):** NP
- **Plasticity Index (PI):** NP
- **Classification:** NP

**One-Point Liquid Limit Calculation**

\[ \text{PI at } "A" - \text{ Line} = 0.73(\text{LL-20}) = \]

\[ \text{LL} = \text{Wn}(N/25)^{0.121} \]

---

### PROCEDURES USED

- **Wet Preparation**
  - Multipoint - Wet
- **Dry Preparation**
  - Multipoint - Dry
- **Procedure A**
  - Multipoint Test
- **Procedure B**
  - One-point Test

---

### Table: Atterberg Limits

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<th>LIQUID LIMIT</th>
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<td>2</td>
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<tr>
<td>N</td>
<td>NP</td>
<td>NP</td>
</tr>
</tbody>
</table>

- **Cannot be rolled:** 41.37
- **Cannot get more than 4 blows:** NonPlastic

---

### Graphs: Atterberg Limits

- **Graph 1:** Moisture Content vs. Number of Blows
- **Graph 2:** Liquid Limit vs. Plastic Limit
- **Graph 3:** Plasticity Index vs. Number of Blows

---

**For classification of fine-grained soils and fine-grained fraction of coarse-grained soils**

- **CH or OH**
- **CL or OL**
- **ML or OL**
- **MH or OH**
- **"A" Line**
### ATTERBERG LIMITS

**ASTM D 4318**

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<thead>
<tr>
<th>TEST</th>
<th>PLASTIC LIMIT</th>
<th>LIQUID LIMIT</th>
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<tbody>
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<td>NO.</td>
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<td>2</td>
</tr>
<tr>
<td>Number of Blows [N]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wet Wt. of Soil + Cont. (g)</td>
<td>11.31</td>
<td>10.48</td>
</tr>
<tr>
<td>Dry Wt. of Soil + Cont. (g)</td>
<td>9.22</td>
<td>8.54</td>
</tr>
<tr>
<td>Wt. of Container (g)</td>
<td>1.09</td>
<td>1.05</td>
</tr>
<tr>
<td>Moisture Content (%) [Wn]</td>
<td>25.71</td>
<td>25.90</td>
</tr>
</tbody>
</table>

**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)

### PROCEDURES USED

- Wet Preparation  
  - Multipoint - Wet
- **X** Dry Preparation  
  - Multipoint - Dry
- **X** Procedure A  
  - Multipoint Test
- Procedure B  
  - One-point Test

---

![Diagram showing Atterberg limits with classification lines for CL, ML, OL, CH, OH, and CH or OH]
Project Name: CenterCal/2nd & PCH  
Project No.: 11232.001  
Boring No.: LB-2  
Sample No.: R-4  
Soil Identification: Dark gray silty sand (SM)

**ATTERBERG LIMITS**  
**ASTM D 4318**

<table>
<thead>
<tr>
<th>TEST</th>
<th>PLASTIC LIMIT</th>
<th>LIQUID LIMIT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Number of Blows [N]</td>
<td>[No value]</td>
<td>[No value]</td>
</tr>
<tr>
<td>Wet Wt. of Soil + Cont. (g)</td>
<td>Cannot be rolled:</td>
<td>37.60</td>
</tr>
<tr>
<td>Dry Wt. of Soil + Cont. (g)</td>
<td>NonPlastic</td>
<td>13.58</td>
</tr>
<tr>
<td>Wt. of Container (g)</td>
<td>[No value]</td>
<td>[No value]</td>
</tr>
<tr>
<td>Moisture Content (%) [Wn]</td>
<td>[No value]</td>
<td>[No value]</td>
</tr>
</tbody>
</table>

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

PI at "A" - Line = 0.73(LL-20) = [No value]

One - Point Liquid Limit Calculation  
LL =Wn(N/25)\(^{0.121}\)

**PROCEDURES USED**

- Wet Preparation  
  - Multipoint - Wet
- Dry Preparation  
  - Multipoint - Dry
- Procedure A  
  - Multipoint Test
- Procedure B  
  - One-point Test
**Tested By:** G. Bathala  
**Date:** 11/21/16

**Input By:** J. Ward  
**Date:** 11/28/16

**Checked By:** J. Ward

**Depth (ft.):** 10.0

**Soil Identification:** Olive gray lean clay (CL)

### Atterberg Limits

**Test:** ASTM D 4318

<table>
<thead>
<tr>
<th>TEST</th>
<th>PLASTIC LIMIT</th>
<th>LIQUID LIMIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO.</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Number of Blows</td>
<td>[N]</td>
<td></td>
</tr>
<tr>
<td>Wet Wt. of Soil + Cont. (g)</td>
<td>21.09</td>
<td>21.32</td>
</tr>
<tr>
<td>Dry Wt. of Soil + Cont. (g)</td>
<td>19.14</td>
<td>19.36</td>
</tr>
<tr>
<td>Wt. of Container (g)</td>
<td>11.52</td>
<td>11.67</td>
</tr>
<tr>
<td>Moisture Content (%) [Wn]</td>
<td>25.59</td>
<td>25.49</td>
</tr>
</tbody>
</table>

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

Plasticity Index (PI)

For classification of fine-grained soils and fine-grained fraction of coarse-grained soils

- CH or OH
- CL or ML
- ML or OL
- MH or OH
- "A" Line

**PROCEDURES USED**

- **Wet Preparation**  
  - Multipoint - Wet

- **Dry Preparation**  
  - Multipoint - Dry

- **Procedure A**  
  - Multipoint Test

- **Procedure B**  
  - One-point Test

Liquid Limit (LL) vs. Moisture Content (%) for Olive gray lean clay (CL)
**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)

### TEST

<table>
<thead>
<tr>
<th>TEST NO.</th>
<th>PLASTIC LIMIT</th>
<th>LIQUID LIMIT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Number of Blows [N]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wet Wt. of Soil + Cont. (g)</td>
<td>24.85</td>
<td>24.51</td>
</tr>
<tr>
<td>Dry Wt. of Soil + Cont. (g)</td>
<td>22.93</td>
<td>22.62</td>
</tr>
<tr>
<td>Wt. of Container (g)</td>
<td>13.59</td>
<td>13.48</td>
</tr>
<tr>
<td>Moisture Content (%) [Wn]</td>
<td>20.56</td>
<td>20.68</td>
</tr>
</tbody>
</table>

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

Plasticity Index (PI) = 0.73(LL-20) = 7.3

One-Point Liquid Limit Calculation

LL = \( W_n \times (N/25)\)

**PROCEDURES USED**

- **Wet Preparation**  
  Multipoint - Wet
- **Dry Preparation**  
  Multipoint - Dry
- **Procedure A**  
  Multipoint Test
- **Procedure B**  
  One-point Test

**GRAPH:**

- For classification of fine-grained soils and fine-grained fraction of coarse-grained soils
- "A" Line
- CH or OH
- CL or OL
- ML or OL
- MH or OH

**NUMERICAL DATA:**

- 0 1 0 2 0 3 0 4 0 5 0 6 0 7 0 8 0 9 0 1 0 0

**NUMBER OF BLOWS:**

- 0 10 20 30 40 50 60 70 80 90 100

**MOISTURE CONTENT (%):**

- 29 30 31 32

**LIQUID LIMIT:**

- 0 1 2 3 4 5 6 7 8 9 10

**PLASTIC LIMIT:**

- 0 1 2 3 4 5 6 7 8 9 10
<table>
<thead>
<tr>
<th>Site</th>
<th>Level</th>
<th>Ranks</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>LB-1</td>
<td></td>
<td>R-1</td>
<td>&gt;4.50</td>
</tr>
<tr>
<td></td>
<td></td>
<td>R-3</td>
<td>1.25</td>
</tr>
<tr>
<td>LB-2</td>
<td></td>
<td>R-3</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>R-4</td>
<td>1.25</td>
</tr>
</tbody>
</table>
Soil Identification: Gray fat clay (CH)

<table>
<thead>
<tr>
<th>Boring No.</th>
<th>Sample No.</th>
<th>Depth (ft.)</th>
<th>Moisture Content (%)</th>
<th>Dry Density (pcf)</th>
<th>Void Ratio</th>
<th>Degree of Saturation (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LB-1</td>
<td>R-2</td>
<td>10.0</td>
<td>58.6 44.6</td>
<td>64.2 77.9</td>
<td>1.723</td>
<td>1.243</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>95 100</td>
</tr>
</tbody>
</table>

Inundate with Tap water

ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS
ASTM D 2435

Project No.: 11232.001

CenterCal/2nd & PCH

02-16
Soil Identification: Gray silt (ML)

<table>
<thead>
<tr>
<th>Boring No.</th>
<th>Sample No.</th>
<th>Depth (ft.)</th>
<th>Moisture Content (%)</th>
<th>Dry Density (pcf)</th>
<th>Void Ratio</th>
<th>Degree of Saturation (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LB-2</td>
<td>R-2</td>
<td>10.0</td>
<td>39.6</td>
<td>80.9</td>
<td>1.154</td>
<td>96</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>34.8</td>
<td>88.6</td>
<td>0.893</td>
<td>100</td>
</tr>
</tbody>
</table>

Inundate with Tap water
### Materials

**Soil Identification:** Olive gray lean clay (CL)

### Table

<table>
<thead>
<tr>
<th>Boring No.</th>
<th>Sample No.</th>
<th>Depth (ft.)</th>
<th>Moisture Content (%)</th>
<th>Dry Density (pcf)</th>
<th>Void Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>LB-3</td>
<td>T-4</td>
<td>10.0</td>
<td>44.4 38.4</td>
<td>76.2 85.2</td>
<td>1.334 0.995</td>
</tr>
</tbody>
</table>

### Observations

- **Deformation Dial Reading (in.):**
  - Initial: 0.2920
  - Final: 0.3420
- **Log of Time (min.):**
  - 0.00
- **Deformation (%)**
- **Pressure, p (ksf):**
  - 0.0000
  - 0.0500
  - 0.1000
  - 0.1500
  - 0.2000
  - 0.2500
  - 0.3000
  - 0.3500
  - 0.4000
  - 0.4500
  - 0.5000

### Diagram

- **Time Readings**
- **Degree of Saturation (%):**
- **Density (pcf):**
- **Void Ratio:**
- **Inundate with Tap water**

---

**Project No.: 11232.002**

**CenterCal/LB Whole Foods Market**

---

**One-Dimensional Consolidation Properties of Soils**

**ASTM D 2435**
**DIRECT SHEAR TEST RESULTS**

**Consolidated Undrained**

<table>
<thead>
<tr>
<th>Boring No.</th>
<th>LB-1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sample No.</strong></td>
<td>R-4</td>
</tr>
<tr>
<td><strong>Depth (ft)</strong></td>
<td>20</td>
</tr>
<tr>
<td><strong>Sample Type:</strong></td>
<td>Ring</td>
</tr>
<tr>
<td><strong>Soil Identification:</strong></td>
<td>Olive gray sandy silt s(ML)</td>
</tr>
</tbody>
</table>

### Strength Parameters

<table>
<thead>
<tr>
<th></th>
<th>C (psf)</th>
<th>$\phi$ (°)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak</td>
<td>409.0</td>
<td>33.6</td>
</tr>
<tr>
<td>Ultimate</td>
<td>240.5</td>
<td>32.3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Normal Stress (kip/ft²)</th>
<th>1.000</th>
<th>2.000</th>
<th>4.000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak Shear Stress (kip/ft²)</td>
<td>1.022</td>
<td>1.814</td>
<td>3.040</td>
</tr>
<tr>
<td>Shear Stress @ End of Test (ksf)</td>
<td>0.830</td>
<td>1.566</td>
<td>2.745</td>
</tr>
<tr>
<td>Deformation Rate (in./min.)</td>
<td>0.0500</td>
<td>0.0500</td>
<td>0.0500</td>
</tr>
</tbody>
</table>

| 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 |

**Project No.: 11232.001**

**CenterCal/2nd & PCH**

02-16
<table>
<thead>
<tr>
<th>Boring No.</th>
<th>LB-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample No.</td>
<td>R-9</td>
</tr>
<tr>
<td>Depth (ft)</td>
<td>45</td>
</tr>
<tr>
<td>Sample Type:</td>
<td>Ring</td>
</tr>
<tr>
<td>Soil Identification:</td>
<td>Olive gray silty sand (SM)</td>
</tr>
</tbody>
</table>

### Strength Parameters

<table>
<thead>
<tr>
<th></th>
<th>C (psf)</th>
<th>$\phi$ (°)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak</td>
<td>663.5</td>
<td>38.2</td>
</tr>
<tr>
<td>Ultimate</td>
<td>256.0</td>
<td>32.7</td>
</tr>
</tbody>
</table>

### Direct Shear Test Results

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

**Project No.:** 11232.001  
**CenterCal/2nd & PCH**
**DIRECT SHEAR TEST RESULTS**

**Consolidated Undrained**

**Sample**
- **Sample Type:** Ring
- **Soil Identification:** Olive gray silty clay (CL-ML)

**Strength Parameters**

<table>
<thead>
<tr>
<th>Strength Parameter</th>
<th>Peak</th>
<th>Ultimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>C (psf)</td>
<td>459.0</td>
<td>387.0</td>
</tr>
<tr>
<td>(\phi^\text{\degree})</td>
<td>30.3</td>
<td>28.9</td>
</tr>
</tbody>
</table>

**Project No.:** 11232.001

**CenterCal/2nd & PCH**

**Graphs**
- **Horizontal Deformation (in.) vs. Shear Stress (ksf)**
- **Normal Stress (kip/ft²)** vs. **Shear Stress (ksf)**

**Table:**

<table>
<thead>
<tr>
<th>Normal Stress (kip/ft²)</th>
<th>1.000</th>
<th>2.000</th>
<th>4.000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak Shear Stress (kip/ft²)</td>
<td>1.047</td>
<td>1.619</td>
<td>2.795</td>
</tr>
<tr>
<td>Shear Stress @ End of Test (ksf)</td>
<td>0.965</td>
<td>1.456</td>
<td>2.612</td>
</tr>
<tr>
<td>Deformation Rate (in./min.)</td>
<td>0.0500</td>
<td>0.0500</td>
<td>0.0500</td>
</tr>
</tbody>
</table>

| 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 |
**Sample Information**

- **Boring No.** LB-2
- **Sample No.** R-9
- **Depth (ft)** 45
- **Sample Type:** Ring

**Soil Identification:** Olive gray silty sand (SM)

**Strength Parameters**

<table>
<thead>
<tr>
<th></th>
<th>C (psf)</th>
<th>$\phi$ (°)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak</td>
<td>500.0</td>
<td>31.3</td>
</tr>
<tr>
<td>Ultimate</td>
<td>0.0</td>
<td>31.3</td>
</tr>
</tbody>
</table>

**Strength Parameters**

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

**Direct Shear Test Results**

- Consolidated Undrained

**Project No.:** 11232.001

**CenterCal/2nd & PCH**

02-16
Boring No. | LB-3  
---|---  
Sample No. | R-2  
Depth (ft) | 5  
Sample Type: | Ring  
Soil Identification: | Olive gray sandy silt s(ML)  

### Strength Parameters

<table>
<thead>
<tr>
<th></th>
<th>C (psf)</th>
<th>$\phi$ (°)</th>
</tr>
</thead>
</table>
Peak | 195 | 35 |  
Ultimate | 35 | 34 |  

### Direct Shear Test Results

**Consolidated Drained - ASTM D 3080**

<table>
<thead>
<tr>
<th>Normal Stress (kip/ft²)</th>
<th>1.000</th>
<th>2.000</th>
<th>4.000</th>
</tr>
</thead>
</table>
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 |  

Project No.: 11232.002  
CenterCal/LB Whole Foods Market
## EXPANSION INDEX of SOILS

**ASTM D 4829**

---

**Project Name:** CenterCal/LB Whole Foods Market  
**Project No.:** 11232.002  
**Boring No.:** LB-3  
**Sample No.:** B-1  
**Soil Identification:** Olive sandy silt (ML)

**Tested By:** S. Felter  
**Date:** 11/17/16  
**Checked By:** J. Ward  
**Date:** 11/28/16  
**Depth (ft.):** 1-5

---

### Dry Wt. of Soil + Cont. (g)

<table>
<thead>
<tr>
<th></th>
<th>1000.00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wt. of Container</td>
<td>0.00</td>
</tr>
<tr>
<td>Dry Wt. of Soil</td>
<td>1000.00</td>
</tr>
<tr>
<td>Weight Soil Retained on #4 Sieve</td>
<td>0.00</td>
</tr>
<tr>
<td>Percent Passing # 4</td>
<td>100.00</td>
</tr>
</tbody>
</table>

---

### MOLDED SPECIMEN

<table>
<thead>
<tr>
<th></th>
<th>Before Test</th>
<th>After Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specimen Diameter (in.)</td>
<td>4.01</td>
<td>4.01</td>
</tr>
<tr>
<td>Specimen Height (in.)</td>
<td>1.0000</td>
<td>1.0265</td>
</tr>
<tr>
<td>Wt. Comp. Soil + Mold (g)</td>
<td>549.10</td>
<td>421.22</td>
</tr>
<tr>
<td>Wt. of Mold (g)</td>
<td>162.60</td>
<td>0.00</td>
</tr>
<tr>
<td>Specific Gravity (Assumed)</td>
<td>2.70</td>
<td>2.70</td>
</tr>
<tr>
<td>Container No.</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Wet Wt. of Soil + Cont. (g)</td>
<td>768.60</td>
<td>583.82</td>
</tr>
<tr>
<td>Dry Wt. of Soil + Cont. (g)</td>
<td>689.30</td>
<td>509.24</td>
</tr>
<tr>
<td>Wt. of Container (g)</td>
<td>0.00</td>
<td>162.60</td>
</tr>
<tr>
<td>Moisture Content (%)</td>
<td>11.50</td>
<td>21.52</td>
</tr>
<tr>
<td>Wet Density (pcf)</td>
<td>116.6</td>
<td>123.8</td>
</tr>
<tr>
<td>Dry Density (pcf)</td>
<td>104.6</td>
<td>101.9</td>
</tr>
<tr>
<td>Void Ratio</td>
<td>0.612</td>
<td>0.655</td>
</tr>
<tr>
<td>Total Porosity (cc)</td>
<td>0.380</td>
<td>0.396</td>
</tr>
<tr>
<td>Pore Volume</td>
<td>78.6</td>
<td>84.1</td>
</tr>
<tr>
<td>Degree of Saturation (%) [ S meas]</td>
<td><strong>50.7</strong></td>
<td>88.7</td>
</tr>
</tbody>
</table>

---

### SPECIMEN INUNDATION

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

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

---

**Expansion Index (El meas) = \((\text{Final Rdg} - \text{Initial Rdg}) / \text{Initial Thick.}) \times 1000**

**27**
SOIL RESISTIVITY TEST
DOT CA TEST 643

Project Name: CenterCal/2nd & PCH
Project No.: 11232.001
Boring No.: LB-1
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.

<table>
<thead>
<tr>
<th>Specimen No.</th>
<th>Water Added (ml) (Wa)</th>
<th>Adjusted Moisture Content (MC)</th>
<th>Resistance Reading (ohm)</th>
<th>Soil Resistivity (ohm-cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>20</td>
<td>19.69</td>
<td>300</td>
<td>300</td>
</tr>
<tr>
<td>2</td>
<td>30</td>
<td>27.66</td>
<td>260</td>
<td>260</td>
</tr>
<tr>
<td>3</td>
<td>40</td>
<td>35.64</td>
<td>280</td>
<td>280</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| 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

<table>
<thead>
<tr>
<th>Min. Resistivity (ohm-cm)</th>
<th>Moisture Content (%)</th>
<th>Sulfate Content (ppm)</th>
<th>Chloride Content (ppm)</th>
<th>Soil pH</th>
</tr>
</thead>
<tbody>
<tr>
<td>DOT CA Test 643</td>
<td>DOT CA Test 417 Part II</td>
<td>DOT CA Test 422</td>
<td>DOT CA Test 643</td>
<td></td>
</tr>
<tr>
<td>260</td>
<td>28.3</td>
<td>158</td>
<td>810</td>
<td>8.56</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>20.3</td>
</tr>
</tbody>
</table>

Graph showing the relationship between soil resistivity (ohm-cm) and moisture content (%).
**SOIL RESISTIVITY TEST**  
**DOT CA TEST 643**

Project Name: CenterCal/2nd & PCH  
Project No.: 11232.001  
Boring No.: LB-1  
Sample No.:  

***Olive brown SM***  
*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.*

<table>
<thead>
<tr>
<th>Specimen No.</th>
<th>Water Added (ml) (Wa)</th>
<th>Adjusted Moisture Content (MC)</th>
<th>Resistance Reading (ohm)</th>
<th>Soil Resistivity (ohm-cm)</th>
<th>Moisture Content (%) (MCi)</th>
<th>Wet Wt. of Soil + Cont. (g)</th>
<th>Dry Wt. of Soil + Cont. (g)</th>
<th>Wt. of Container (g)</th>
<th>Container No.</th>
<th>Initial Soil Wt. (g) (Wt)</th>
<th>Box Constant</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>20</td>
<td>20.69</td>
<td>2700</td>
<td>2700</td>
<td>4.63</td>
<td>199.75</td>
<td>194.10</td>
<td>71.97</td>
<td></td>
<td>130.30</td>
<td>1.000</td>
</tr>
<tr>
<td>2</td>
<td>30</td>
<td>28.72</td>
<td>2100</td>
<td>2100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>40</td>
<td>36.74</td>
<td>1800</td>
<td>1800</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>50</td>
<td>44.77</td>
<td>1850</td>
<td>1850</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\[ MC = \left(1 + \frac{MCi}{100}\right) \times \frac{(Wa/Wt+1)}{-1} \times 100 \]

<table>
<thead>
<tr>
<th>Min. Resistivity (ohm-cm)</th>
<th>Moisture Content (%)</th>
<th>Sulfate Content (ppm)</th>
<th>Chloride Content (ppm)</th>
<th>Soil pH</th>
</tr>
</thead>
<tbody>
<tr>
<td>DOT CA Test 643</td>
<td>DOT CA Test 417 Part II</td>
<td>DOT CA Test 422</td>
<td>DOT CA Test 643</td>
<td></td>
</tr>
<tr>
<td><strong>1785</strong></td>
<td><strong>38.5</strong></td>
<td><strong>177</strong></td>
<td><strong>42</strong></td>
<td><strong>7.79</strong></td>
</tr>
</tbody>
</table>

![Graph showing the relationship between soil resistivity and moisture content]
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-2
Depth (ft.): 1-5
Sample No.: B-1

Soil Identification: Olive gray SC-SM

*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.

<table>
<thead>
<tr>
<th>Specimen No.</th>
<th>Water Added (ml) (Wa)</th>
<th>Adjusted Moisture Content (MC)</th>
<th>Resistance Reading (ohm)</th>
<th>Soil Resistivity (ohm-cm)</th>
<th>Moisture Content (%) (MCi)</th>
<th>Wet Wt. of Soil + Cont. (g)</th>
<th>Dry Wt. of Soil + Cont. (g)</th>
<th>Wt. of Container (g)</th>
<th>Container No.</th>
<th>Initial Soil Wt. (g) (Wt)</th>
<th>Box Constant</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>20</td>
<td>21.61</td>
<td>1100</td>
<td>1100</td>
<td>5.40</td>
<td>208.93</td>
<td>201.31</td>
<td></td>
<td></td>
<td>130.00</td>
<td>1.00</td>
</tr>
<tr>
<td>2</td>
<td>30</td>
<td>29.72</td>
<td>920</td>
<td>920</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>40</td>
<td>37.83</td>
<td>950</td>
<td>950</td>
<td></td>
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</tr>
<tr>
<td>4</td>
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<td></td>
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<td></td>
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</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

MC = ((1+MCi/100)x(Wa/Wt+1)-1)x100

Min. Resistivity (ohm-cm) | Moisture Content (%) | Sulfate Content (ppm) | Chloride Content (ppm) | Soil pH
-------------------------|----------------------|------------------------|------------------------|-------------------
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

Graph: Soil Resistivity (ohm-cm) vs. Moisture Content (%)
SOIL RESISTIVITY TEST  
DOT CA TEST 643

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

MC = (((1 + MCI/100) x (Wa/Wt + 1)) - 1) x 100

<table>
<thead>
<tr>
<th>Min. Resistivity (ohm-cm)</th>
<th>Moisture Content (%)</th>
<th>Sulfate Content (ppm)</th>
<th>Chloride Content (ppm)</th>
<th>Soil pH</th>
</tr>
</thead>
<tbody>
<tr>
<td>DOT CA Test 643</td>
<td>DOT CA Test 417 Part II</td>
<td>DOT CA Test 422</td>
<td>DOT CA Test 643</td>
<td></td>
</tr>
<tr>
<td>632</td>
<td>45.8</td>
<td>2050</td>
<td>122</td>
<td>6.97</td>
</tr>
</tbody>
</table>

*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.
MODIFIED PROCTOR COMPACTATION 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.

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

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 +1/4 in. is <30%

Particle-Size Distribution:
GR:SA:FI

Atterberg Limits:
LL, PL, PI
R-VALUE TEST RESULTS

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

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

DESIGN CALCULATION DATA

<table>
<thead>
<tr>
<th>a</th>
<th>b</th>
<th>c</th>
</tr>
</thead>
<tbody>
<tr>
<td>GRAVEL EQUIVALENT FACTOR</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>TRAFFIC INDEX</td>
<td>5.0</td>
<td>5.0</td>
</tr>
<tr>
<td>STABILOMETER THICKNESS, ft.</td>
<td>0.56</td>
<td>0.61</td>
</tr>
<tr>
<td>EXPANSION PRESSURE THICKNESS, ft.</td>
<td>1.63</td>
<td>0.97</td>
</tr>
</tbody>
</table>

EXPANSION PRESSURE CHART

R-VALUE BY EXPANSION: 61
R-VALUE BY EXUDATION: 62
EQUILIBRIUM R-VALUE: 61
**R-VALUE TEST RESULTS**

**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

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

<table>
<thead>
<tr>
<th>a</th>
<th>b</th>
<th>c</th>
</tr>
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<tbody>
<tr>
<td>GRAVEL EQUIVALENT FACTOR</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>TRAFFIC INDEX</td>
<td>5.0</td>
<td>5.0</td>
</tr>
<tr>
<td>STABILOMETER THICKNESS, ft.</td>
<td>0.82</td>
<td>0.91</td>
</tr>
<tr>
<td>EXPANSION PRESSURE THICKNESS, ft.</td>
<td>1.90</td>
<td>1.33</td>
</tr>
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</table>

**R-VALUE BY EXPANSION:** 38  
**R-VALUE BY EXUDATION:** 43  
**EQUILIBRIUM R-VALUE:** 38
### R-VALUE TEST RESULTS

**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  
**DATE COMPLETED:** 11/16/2016

#### TEST SPECIMEN

<table>
<thead>
<tr>
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<td>MOISTURE AT COMPACTION %</td>
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<td>13.7</td>
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<td>HEIGHT OF SAMPLE, Inches</td>
<td>2.50</td>
<td>2.57</td>
<td>2.58</td>
</tr>
<tr>
<td>DRY DENSITY, pcf</td>
<td>111.1</td>
<td>110.8</td>
<td>111.7</td>
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<tr>
<td>COMPACTOR PRESSURE, psi</td>
<td>350</td>
<td>325</td>
<td>275</td>
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<tr>
<td>EXUDATION PRESSURE, psi</td>
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<td>402</td>
<td>298</td>
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<td>EXPANSION, Inches x 10exp-4</td>
<td>19</td>
<td>14</td>
<td>11</td>
</tr>
<tr>
<td>STABILITY Ph 2,000 lbs (160 psi)</td>
<td>19</td>
<td>21</td>
<td>23</td>
</tr>
<tr>
<td>TURNS DISPLACEMENT</td>
<td>4.49</td>
<td>4.29</td>
<td>4.56</td>
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#### DESIGN CALCULATION DATA

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<td>GRAVEL EQUIVALENT FACTOR</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>TRAFFIC INDEX</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
</tr>
<tr>
<td>STABILOMETER THICKNESS, ft.</td>
<td>0.30</td>
<td>0.32</td>
<td>0.35</td>
</tr>
<tr>
<td>EXPANSION PRESSURE THICKNESS, ft.</td>
<td>0.63</td>
<td>0.47</td>
<td>0.37</td>
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</table>

![Expansion Pressure Chart](image1)

**R-VALUE BY EXPANSION:** 77  
**R-VALUE BY EXUDATION:** 78  
**EQUILIBRIUM R-VALUE:** 77
APPENDIX D

PERCOLATION TEST RESULTS
### 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  
**Depth of Boring:** 5 feet  
**Depth to Invert of BMP:** See report text  
**Depth to Water Table:** See report text  
**Depth to Initial Water Depth (d1):** 48 inches

**Tested by:** CD  
**Liquid Description:** Water  
**Measurement Method:** Sounder

### 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 |

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

**Note:**

Reduction Factor \( (R_f) = R_f = \left(\ \frac{2d_1 - \Delta d}{d_{IA}} \right) + 1 \)

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

Reduction factor \( (R_f) = 11.45 \)

Water filled to 1 feet bgs. Water remained in hole. Standard time interval is 30 minutes
## Boring/Excavation Percolation Testing Field Log

**Date:** 2/1/2016

<table>
<thead>
<tr>
<th>Project Name:</th>
<th>CenterCal Long Beach</th>
<th>Boring/Test Number:</th>
<th>P-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earth Description:</td>
<td>Silty Sand and Sandy Silt</td>
<td>Diameter of Boring, in.</td>
<td>8</td>
</tr>
<tr>
<td>Tested by:</td>
<td>CD</td>
<td>Depth of Casing, in.</td>
<td>2</td>
</tr>
<tr>
<td>Liquid Description:</td>
<td>Water</td>
<td>Diameter of Boring</td>
<td>See report text</td>
</tr>
<tr>
<td>Measurement Method:</td>
<td>Sounder</td>
<td>Depth to Invert of BMP</td>
<td>See report text</td>
</tr>
<tr>
<td>Depth of Boring</td>
<td>5 feet</td>
<td>Depth to Water Table</td>
<td>48 inches</td>
</tr>
</tbody>
</table>

**Time Interval Standard**

- **Start Time for Pre-Soak:** 9:00 AM 2/1/2016
- **Start Time for Standard:** 9:10 AM 2/2/2016

**Water Remaining in Boring (Y/N):** Y

**Standard Time Interval Between Readings:** 30 minutes

### Soil Description/Notes/Comments

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

**Note:**

\[
R_f = \left( \frac{2d_1 - \Delta d}{d_{IA}} \right) + 1
\]

**Infiltration rate** = $\frac{\text{Preadjusted percolation rate}}{\text{Reduction factor}}$

\[
= \frac{0.92 \text{ in/hr}}{12.29} = 0.073 \text{ in/hr}
\]
### Boring/Excavation Percolation Testing Field Log

**Project Name:** CenterCal Long Beach  
**Boring/Test Number:** P-3  
**Earth Description:** Silty Sand and Sandy Silt  
**Diameter of Boring, in.:** 8  
**Depth of Casing, in.:** 2  
**Diameter of Boring, in.:** 8  
**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 (d1):** 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

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

**Note:**

\[
R_f = R_f = \left( \frac{2d_1 - \Delta d}{\text{DIA}} \right) + 1 = 12.74
\]

\[
\text{Infiltration rate} = \frac{\text{Preadjusted percolation rate}}{\text{Reduction factor}} = 0.33 \text{ in/hr}
\]
Project title: 2nd and PCH Retail Center
Location: Long Beach, CA

Overall vertical settlements report
**Input parameters and analysis data**

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

**LPI 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**

**F.S. color scheme**

- **Very high risk**
- **High risk**
- **Low risk**
Input parameters and analysis data

- Points to test: Based on IC value
- Earthquake magnitude $M_w$: 7.03
- Peak ground acceleration: 0.60
- Depth to water table (erthq.): 5.00 ft
- Use fill: No
- Fill height: N/A
- Ic cut-off value: 2.60
- Unit weight calculation: Based on SBT
- Average results interval: 3

Depth to water table (erthq): 5.00 ft
Average results interval: 3
Ic cut-off value: 2.60
Unit weight calculation: Based on SBT
Use fill: No
Fill height: 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
- Almost certain it will not liquefy
**Liquefaction analysis overall plots**

### Input parameters and analysis data

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

---

**CLiq v.1.7.6.49 - CPT Liquefaction Assessment Software - Report created on: 12/2/2016, 6:10:10 PM**

Project file: P:\INFOCUS PROJ\ECTS\11001-11500\11232 CenterCal 2nd & PCH\002\Analyses\CLiq\11232.002_GW at S NCEER.clq
**Liquefaction analysis overall plots**

**Input parameters and analysis data**

- **Analysis method:** NCEER (1998)
- **Fines correction method:** NCEER (1998)
- **Points to test:** Based on Ic value
- **Earthquake magnitude \( M_e \):** 7.03
- **Peak ground acceleration:** 0.60
- **Depth to water table (erthq.):** 5.00 ft
- **Fill weight:** N/A
- **Transition detect. applied:** Yes
- **K_s applied:** Yes
- **Clay like behavior applied:** Sands only
- **Liquefaction and no liq. are equally likely:** Unlike to liquefy
- **Almost certain it will not liquefy:** Low risk
- **Very high risk:** High risk
- **Very likely to liquefy:** Medium risk
- **Almost certain it will liquefy:** Almost certain

**Project file:** P:\INFOCUS PROJECTS\11001-11500\11232 CenterCal 2nd & PCH\002\Analyses\Cliq\11232.002_GW at S NCEER.clq
### Input parameters and analysis data

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<tr>
<th>Parameter</th>
<th>Value</th>
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<td>NCEER (1998)</td>
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<tr>
<td>Earthquake magnitude $M_w$</td>
<td>7.03</td>
</tr>
<tr>
<td>Peak ground acceleration</td>
<td>0.60</td>
</tr>
<tr>
<td>Depth to water table ($\text{msl}$)</td>
<td>5.00 ft</td>
</tr>
<tr>
<td>Depth to water table (erthq.)</td>
<td>5.00 ft</td>
</tr>
<tr>
<td>Average results interval</td>
<td>3</td>
</tr>
<tr>
<td>Ic cut-off value</td>
<td>2.60</td>
</tr>
<tr>
<td>Unit weight calculation</td>
<td>Based on SBT</td>
</tr>
<tr>
<td>Use fill</td>
<td>No</td>
</tr>
<tr>
<td>Fill height</td>
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<td>$K_s$ applied</td>
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<td>Limit depth</td>
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</tr>
<tr>
<td>F.S. color scheme</td>
<td>Almost certain it will liquefy</td>
</tr>
<tr>
<td>LPI color scheme</td>
<td>Very high risk</td>
</tr>
</tbody>
</table>

### 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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depth to water table (erthq.)</td>
<td>5.00 ft</td>
</tr>
<tr>
<td>Average results interval</td>
<td>3</td>
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<tr>
<td>Ic cut-off value</td>
<td>2.60</td>
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<tr>
<td>Unit weight calculation</td>
<td>Based on SBT</td>
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<td>Use fill</td>
<td>No</td>
</tr>
<tr>
<td>Fill height</td>
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<td>Peak ground acceleration</td>
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<td>Depth to water table (ft)</td>
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<td>Almost certain it will liquefy</td>
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<td>Low risk</td>
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<td>LPI color scheme</td>
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</tr>
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<tr>
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<tr>
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**CLiq v.1.7.6.49 - CPT Liquefaction Assessment Software - Report created on: 12/2/2016, 6:10:13 PM**

Project file: P:\INFOCUS PROJECTS\11001-11500\11232 CenterCal 2nd & PCH\002\Analyses\CLiq\11232.002_GW at 5 NCEER.clq
Input parameters and analysis data

**Analysis method:** NCEER (1998)
**Fines correction method:** NCEER (1998)
**Points to test:** Based on Fc value

**Earthquake magnitude \( M_e \):** 7.03
**Peak ground acceleration:** 0.60
**Depth to water table (erthq.):** 5.00 ft

**Average results interval:** 3
**Ic cut-off value:** 2.60

**Unit weight calculation:** Based on SBT
**Use fill:** No
**Fill height:** N/A

**Fill weight:** N/A
**Transition detect. applied:** Yes
**K_s applied:** Yes
**Clay like behavior applied:** Sands only
**Limit depth applied:** No
**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

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

Vertical settlements

Lateral displacements
Input parameters and analysis data

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

---

This software is licensed to: Leighton Group, Inc

CPT name: CPT-09
**Liquefaction analysis overall plots**

**Input parameters and analysis data**

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

**F.S. color scheme**

- **Very high risk**
- **High risk**
- **Low risk**

**LPI 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**
Input parameters and analysis data

- **Analysis method:** NCEER (1998)
- **Fines correction method:** NCEER (1998)
- **Points to test:** Based on fc value
- **Earthquake magnitude Mw:** 7.03
- **Peak ground acceleration:** 0.60
- **Depth to water table (erthq.):** 5.00 ft
- **Fill weight:** N/A
- **Transition detect. applied:** N/A
- **K_s applied:** Yes
- **Clay like behavior applied:** Yes
- **Limit depth applied:** No
- **Limit depth:** N/A
- **Almost certain it will liquefy:** Almost certain it will not liquefy
- **Very likely to liquefy:** Very high risk
- **Liquefaction and no liq. are equally likely:** High risk
- **Unlike to liquefy:** Low risk

**F.S. color scheme**
- Red: Almost certain it will liquefy
- Orange: Very likely to liquefy
- Yellow: Liquefaction and no liq. are equally likely
- Green: Unlike to liquefy
- Green: Almost certain it will not liquefy

**LPI color scheme**
- Red: Very high risk
- Orange: High risk
- Yellow: Low risk
Liquefaction analysis overall plots

**Input parameters and analysis data**

- **Analysis method:** NCEER (1998)
- **Fines correction method:** NCEER (1998)
- **Points to test:** Based on Ic value
- **Earthquake magnitude \( M_e \):** 7.03
- **Peak ground acceleration:** 0.60
- **Depth to water table (erthq.):** 5.00 ft

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

**LPI color scheme**

- **Very high risk**
- **High risk**
- **Low risk**

**F.S. color scheme**

- **Almost certain it will liquefy**
- **Very likely to liquefy**
- **Liquefaction and no liq. are equally likely**
- **Unlikely to liquefy**
- **Almost certain it will not liquefy**
Liquefaction analysis overall plots

Input parameters and analysis data

- Points to test: Based on IC value
- Earthquake magnitude Mw: 7.03
- Peak ground acceleration: 0.60 g
- Depth to water table (masc): 5.00 ft
- Average results interval: 3 ft
- ICS cut-off value: 2.60
- Unit weight calculation: Based on SBT
- Use fill: No
- Fill height: N/A ft
- IC cut-off value: 5.00 ft
- ICS cut-off value: 2.60
- Unit weight calculation: Based on SBT
- Use fill: No
- Fill height: N/A ft
- F.S. color scheme:
  - Almost certain it will liquefy
  - Very likely to liquefy
  - Low risk
- LPI color scheme:
  - Almost certain it will liquefy
  - Very likely to liquefy
  - Low risk

Vertical settlements

Lateral displacements
Liquefaction analysis overall plots

Input parameters and analysis data

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

Vertical settlements
Lateral displacements
Liquefaction analysis overall plots

Input parameters and analysis data

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</table>

F.S. color scheme

LPI color scheme

Project file: P:\INFOCUS PROJECTS\11001-11500\11232 CenterCal 2nd & PCH\002\Analyses\Cliq\11232.002_GW at S NCEER.clq
### Liquefaction analysis overall plots

**CRR plot**

**FS Plot**

**LPI**

**Vertical settlements**

**Lateral displacements**

### Input parameters and analysis data

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</table>

### 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**

---

CLiq v.1.7.6.49 - CPT Liquefaction Assessment Software - Report created on: 12/2/2016, 6:10:37 PM

Project file: P:\INFOCUS PROJ\ECTS\11001-11500\11232 CenterCal 2nd & PCH\002\Analyses\CLiq\11232.002_GW at S NCEER.clq
**Liquefaction analysis overall plots**

**Input parameters and analysis data**

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

**F.S. color scheme**
- Almost certain it will liquefy
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- 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
Input parameters and analysis data

- Fines correction method: NCEER (1998)
- Points to test: Based on ic value
- Earthquake magnitude $M_w$: 7.03
- Peak ground acceleration: 0.60
- Depth to water table (erthq.): 10.00 ft

Depth to water table (erthq.): 5.00 ft
Average results interval: 3
Ic cut-off value: 2.60
Unit weight calculation: Based on SBT
Use fill: No
Fill height: N/A

- CRR & CSR
- Factor of safety
- Liquefaction potential
- Vertical settlements
- Lateral displacements

F.S. color scheme
- Almost certain it will liquefy
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- Almost certain it will not liquefy

LPI color scheme
- Very high risk
- High risk
- Low risk

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

Input parameters and analysis data

Fineness correction method: NCEER (1998)
Points to test: Based on Ic value
Earthquake magnitude M_w: 7.03
Peak ground acceleration: 0.60
Depth to water table (erthq.): 5.00 ft
Average results interval: 3
Average results depth: 2.60
Unit weight calculation: Based on SBT
Use fill: No
Fill height: N/A

Limit depth applied: No
Limit depth: N/A
Fill weight: N/A
Transition detect. applied: Yes
K_a applied: Yes
Clay like behavior applied: Sands only
Liquefaction and no liq. are equally likely
Unlike to liquefy
Almost certain it will not liquefy
Low risk
High risk
Very likely to liquefy
Almost certain it will liquefy
Very high risk

F.S. color scheme
LPI color scheme
LIQUEFACTION ANALYSIS WITH
GROUND IMPROVEMENT DEPTH OF 25 FEET
Project title: 2nd and PCH Retail Center - Liquefaction with Ground Improvement to 25 feet
Location: Long Beach, CA

Overall vertical settlements report

![Graph of vertical settlements](image-url)
Liquefaction analysis overall plots

**Input parameters and analysis data**

<table>
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<tr>
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</table>

**Project file**: P:\INFOCUS\PROJECTS\11001-11500\11232 CenterCal 2nd & PCH\002\Analyses\Cliq\01MMP,25 feet,11232.002 GIMP to 25 feet DGW 5 feet.clq
Liquefaction analysis overall plots

Input parameters and analysis data

- Points to test: Based on Ic value
- Earthquake magnitude $M_e$: 7.03
- Peak ground acceleration: 0.60
- Depth to water table (etfgh): 5.00 ft

- Average results interval: 3 ft
- Ic cut-off value: 2.60
- Unit weight calculation: Based on SBT
- Use fill: No
- Fill height: N/A

- Fill weight: N/A
- Transition detect. applied: Yes
- $K_s$ applied: Yes
- Clay like behavior applied: Sands only
- Limit depth applied: No
- Limit depth: N/A

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

FS. color scheme

- Very high risk
- High risk
- Low risk

LPI 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
Input parameters and analysis data

- Fines correction method: NCEER (1998)
- Points to test: Based on Ic value
- Earthquake magnitude Mw: 7.03
- Peak ground acceleration: 0.60
- Depth to water table (in ft): 5.00

Depth to water table (in ft): 5.00
Average results interval: 3
Ic cut-off value: 2.60
Unit weight calculation: Based on SBT
Use fill: No
Fill height: N/A

Fill weight: N/A
Transition detector applied: Yes
Ks applied: Yes
Clay like behavior applied: Sands only
Limit depth applied: No
Limit depth: N/A

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

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

Very high risk
High risk
Low risk
Liquefaction analysis overall plots

Input parameters and analysis data

- Fine correction method: NCEER (1998)
- Points to test: Based on Ic value
- Earthquake magnitude Mw: 7.03
- Peak ground acceleration: 0.60
- Depth to water table (feet): 5.00

- Depth to water table (earthq.): 5.00 ft
- Average results interval: 3
- Ic cut-off value: 2.60
- Unit weight calculation: Based on SBT
- Use fill: No
- Fill height: N/A

- Fill weight: N/A
- Transition detect. applied: Yes
- Ks applied: Yes
- Clay like behavior applied: Sands only
- Limit depth applied: No
- 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

---

CLiq v.1.7.6.49 - CPT Liquefaction Assessment Software - Report created on: 12/2/2016, 6:23:12 PM
Project file: P:\INFOCUS\PROJ\ECT\5\11001-11500\11232 CenterCal 2nd & PCH.XXX\Analyses\CLiq\GIMP\25 feet\11232.002 GIMP to 25 feet DGW 5 feet.clq
Input parameters and analysis data

- **Analysis method:** NCEER (1998)
- **Points to test:** Based on lc value
- **Depth to water table (erthq.):** 5.00 ft
- **Average results interval:** 3
- **Ic cut-off value:** 2.60
- **Unit weight calculation:** Based on SBT
- **Use fill:** No
- **Fill height:** N/A
- **K_s applied:** Yes
- **Clay like behavior applied:** Sands only
- **Limit depth applied:** No
- **Limit depth:** N/A
- **Fill weight:** N/A

F.S. color scheme

- Almost certain it will liquefy
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- Unlike to liquefy
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LPI color scheme

- Very high risk
- High risk
- Low risk
- Almost certain it will not liquefy
**Input parameters and analysis data**

- **Analysis method:** NCEER (1998)
- **Fines correction method:** NCEER (1998)
- **Points to test:** Based on Ic value
- **Earthquake magnitude Mw:** 7.03
- **Peak ground acceleration:** 0.60
- **Depth to water table (erthq.):** 5.00 ft

- **Fill weight:** N/A
- **Transition detect. applied:** Yes
- **Ks applied:** Yes
- **Clay like behavior applied:** Sands only
- **Limit depth applied:** No
- **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

---

The software is licensed to: Leighton Group, Inc

CPT name: CPT-17 GI to 25'

---

**Liquefaction analysis overall plots**

- **CRR plot**
- **FS Plot**
- **LPI**
- **Vertical settlements**
- **Lateral displacements**
This software is licensed to: Leighton Group, Inc

### Liquefaction analysis overall plots

![CRR plot](image1)
![FS Plot](image2)
![LPI](image3)

#### Input parameters and analysis data

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fines correction method:</td>
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<td>Earthquake magnitude Mₛₑ</td>
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<tr>
<td>Peak ground acceleration</td>
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<td>Based on SBT</td>
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<tr>
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<td>Fill height:</td>
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</tbody>
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#### 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

### Additional Information

- Project file: P:\INFOCUS PROJECTS\11001-11500\11232 CenterCal 2nd & PCH\002\Analyses\Clique\GIMP\25 feet\11232.002 GIMP to 25 feet.clq
Liquefaction analysis overall plots

Input parameters and analysis data

- Fines correction method: NCEER (1998)
- Points to test: Based on Ic value
- Earthquake magnitude $M_w$: 7.03
- Peak ground acceleration: 0.60
- Depth to water table (n/a): 5.00 ft

Depth to water table (erthq.): 5.00 ft
Average results interval: 3
Ic cut-off value: 2.60
Unit weight calculation: Based on SBT
Use fill: No
Fill height: N/A

Fill weight: N/A
Transition detect. applied: Yes
K_s applied: Yes
Clay like behavior applied: Sands only
Limit depth applied: No
Limit depth: N/A

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

Very high risk
High risk
Low risk

LPI color scheme

F.S. color scheme
**Liquefaction analysis overall plots**

### Input parameters and analysis data

- **Analysis method**: NCEER (1998)
- **Fines correction method**: NCEER (1998)
- **Points to test**: Based on Ic value
- **Earthquake magnitude Mw**: 7.03
- **Peak ground acceleration**: 0.60
- **Depth to water table (in situ)**: 5.00 ft

#### Depth to water table (erthq.)
- Average results interval: 5.00 ft

#### Fill weight
- N/A

#### Factor of safety
- **Transition detect. applied**: Yes
- **Ks applied**: Yes
- **Clay like behavior applied**: Sands only
- **Limit depth applied**: No
- **Limit depth**: N/A

#### Fill height
- N/A

#### CRR & CSR

#### Factor of safety

#### Liquefaction potential

#### Vertical settlements

#### Lateral displacements

---

**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**

---

CLiq v.1.7.6.49 - CPT Liquefaction Assessment Software - Report created on: 12/2/2016, 6:23:20 PM

Project file: P:\INFOCUS PROJ\ECTS\11001-11500\11232 CenterCal 2nd & PCH\002\Analyses\CLiq\GIMP\25 feet\11232.002 GIMP to 25 feet DGW 5 feet.clq
LIQUEFACTION ANALYSIS WITH
GROUND IMPROVEMENT DEPTH OF 30 FEET
Project title: 2nd and PCH Retail Center - Liquefaction with Ground Improvement to 30 feet
Location: Long Beach, CA

Overall vertical settlements report

![Graph showing overall vertical settlements report](image-url)
Liquefaction analysis overall plots

**Input parameters and analysis data**

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

---

CLiq v.1.7.6.49 - CPT Liquefaction Assessment Software - Report created on: 12/2/2016, 6:20:46 PM
Project file: P:\INFOCUS PROJECT\11001-11500\11232 CenterCal 2nd & PCH\002\Analyses\CLiq\GIMP\30 feet\GIMP to 30 feet DGW 5 feet.ciq
Liquefaction analysis overall plots

Input parameters and analysis data

- Fines correction method: NCEER (1998)
- Points to test: Based on Ic value
- Earthquake magnitude $M_w$: 7.03
- Peak ground acceleration: 0.60
- Depth to water table (etlwhq.): 5.00 ft
- Average results interval: 3
- Ic cut-off value: 2.60
- Unit weight calculation: Based on SBT
- Use fill: No
- Fill height: 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

NCEER (1998)
- Based on Ic value
- No
- N/A
- Yes
- Yes
- Sands only
- N/A
- N/A

Input parameters and analysis data

- NCEER (1998)
- N/A
- Yes
- Yes
- Sands only
- N/A

N/AYesSands onlyNo

Fill weight:
Transition detect. applied:
$K_a$ applied:
Clay like behavior applied:
Limit depth applied:
Limit depth:

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

Vertical settlements
Lateral displacements

Depth (ft)
Settlement (in)
Displacement (in)

Depth (ft)

Input parameters and analysis data

- NCEER (1998)
- N/A
- Yes
- Yes
- Sands only
- N/A

N/AYesSands onlyNo

Fill weight:
Transition detect. applied:
$K_a$ applied:
Clay like behavior applied:
Limit depth applied:
Limit depth:

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

Vertical settlements
Lateral displacements

Depth (ft)
Settlement (in)
Displacement (in)

Depth (ft)
Input parameters and analysis data

- **Analysis method:** NCEER (1998)
- **Fines correction method:** NCEER (1998)
- **Points to test:** Based on Ic value
- **Earthquake magnitude Mw:** 7.03
- **Peak ground acceleration:** 0.60
- **Depth to water table (in situ):** 5.00 ft

**Depth to water table (erthq.):** 5.00 ft
**Average results interval:** 3
**Ic cut-off value:** 2.60
**Unit weight calculation:** Based on SBT
**Use fill:** No
**Fill height:** N/A

**Fill weight:** N/A
**Transition detect. applied:** Yes
**K_s applied:** Yes
**Clay like behavior applied:** Sands only
**Limit depth applied:** No
**Limit depth:** N/A

**F.S. color scheme**
- **Almost certain it will liquefy**
- **Very likely to liquefy**
- **Liquefaction and no liquefied 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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
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<td>Fill height</td>
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<tr>
<td>Depth to water table (in situ)</td>
<td>5.00 ft</td>
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</tbody>
</table>

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

CLiq v.1.7.6.49 - CPT Liquefaction Assessment Software - Report created on: 12/2/2016, 6:20:48 PM
Project file: P:\INFOCUS PROJECTS\11001-11500\11232 CenterCal 2nd & PCH (001)\Analyses\CLiq\GIMP\30 feet\GIMP to 30 feet DGW 5 feet.clq
Input parameters and analysis data

Fines correction method: NCEER (1998)
Points to test: Based on Ic value
Earthquake magnitude $M_w$: 7.03
Peak ground acceleration: 0.60
Depth to water table (ft): 5.00 ft

Depth to water table (est.): 5.00 ft
Average results interval: 3
Ic cut-off value: 2.60
Unit weight calculation: Based on SBT
Use fill: No
Fill height: N/A

Fill weight: N/A
Transition detect. applied: Yes
$K_s$ applied: Yes
Clay like behavior applied: Sands only
Limit depth applied: No
Limit depth: N/A

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

Almost certain it will liquefy
Very likely to liquefy
High risk
Low risk

Liquefaction analysis overall plots
**Liquefaction analysis overall plots**

### Input parameters and analysis data

- **Analysis method:** NCEER (1998)
- **Fines correction method:** NCEER (1998)
- **Points to test:** Based on Ic value
- **Earthquake magnitude \( M_e \):** 7.03
- **Peak ground acceleration:** 0.60
- **Depth to water table (entlq.):** 5.00 ft

#### F.S. color scheme

- **Fill weight:** N/A
- **Transition detect. applied:** Yes
- **K_s applied:** Yes
- **Clay like behavior applied:** Sands only
- **Limit depth applied:** No
- **Limit depth:** N/A

#### LPI color scheme

- **Almost certain it will liquefy**
- **Almost certain it will not liquefy**
- **Very high risk**
- **High risk**
- **Low risk**
- **Unlikely to liquefy**
- **Very likely to liquefy**
- **Liquefaction and no liq. are equally likely**
- **Almost certain it will not liquefy**

---

CLiq v.1.7.6.49 - CPT Liquefaction Assessment Software - Report created on: 12/2/2016, 6:20:51 PM

Project file: P:\INFOCUS PROJ\ECTS\511001-11500\11232 CenterCal 2nd & PCH\002\Analyses\CLiq\GIMP\30 feet\GIMP to 30 feet DGW 5 feet.clq
Liquefaction analysis overall plots

Input parameters and analysis data

- Fines correction method: NCEER (1998)
- Points to test: Based on Ic value
- Earthquake magnitude $M_w$: 7.03
- Peak ground acceleration: 0.60
- Depth to water table (erthq.): 5.00 ft
- Average results interval: 3 ft
- Ic cut-off value: 2.60
- Unit weight calculation: Based on SBT
- Use fill: No
- Fill height: N/A
- Fill weight: N/A
- Transition detect. applied: Yes
- $K_s$ applied: Yes
- Clay like behavior applied: Sands only
- Limit depth applied: No
- Limit depth: N/A
- CRR & CSR
- Factor of safety
- Liquefaction potential
- Vertical settlements
- Lateral displacements

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

CLiq v.1.7.6.49 - CPT Liquefaction Assessment Software - Report created on: 12/2/2016, 6:20:52 PM
Project file: P:\INFOCUS PROJ\ECTS\11001-11500\11232 CenterCal 2nd & PCH\004\Analyses\CLiq\GIMP, 30 feet\GIMP to 30 feet DGW 5 feet.ciq
Input parameters and analysis data

- Fines correction method: NCEER (1998)
- Points to test: Based on Ic value
- Earthquake magnitude Mw: 7.03
- Peak ground acceleration: 0.60
- Depth to water table (erthq.): 5.00 ft
- Average results interval: 3
- Ic cut-off value: 2.60
- Unit weight calculation: Based on SBT
- Use fill: No
- Fill height: 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

- Limit depth applied: No
- Limit depth: N/A

- LPI color scheme
  - Very high risk
  - High risk
  - Low risk

Ceq v.1.7.6.49 - CPT Liquefaction Assessment Software - Report created on: 12/2/2016, 6:20:53 PM
Project file: P:\INFOCUS PROJ\ECTS\11001-11500\11232 CenterCal 2nd & PCH\002\Analyses\Cliq\GIMP\30 feet\GIMP to 30 feet DGW 5 feet.clq
LIQUEFACTION ANALYSIS WITH
GROUND IMPROVEMENT DEPTH OF 40 FEET
Project title: 2nd and PCH Retail Center - Liquefaction with Ground Improvement to 40 feet
Location: Long Beach, CA

Overall vertical settlements report

![Graph showing overall vertical settlements](image-url)
Input parameters and analysis data

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

F.S. color scheme
- Almost certain it will liquefy
- Very likely to liquefy
- Likefaction 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

- CRR plot
- FS Plot
- LPI
- Vertical settlements
- Lateral displacements

CLiq v.1.7.6.49 - CPT Liquefaction Assessment Software - Report created on: 12/2/2016, 6:22:31 PM
Project file: P:\INFOCUS PROJ\ECTS\11001-11500\11232 CenterCal 2nd & PCH\002\Analyses\CLiq\GIMP\40 feet\GIMP to 40 feet DGW 5 feet.clic
**Liquefaction analysis overall plots**

---

### Input parameters and analysis data

- **Analysis method:** NCEER (1998)
- **Fines correction method:** NCEER (1998)
- **Points to test:** Based on Ic value
- **Earthquake magnitude \( M_e \):** 7.03
- **Peak ground acceleration:** 0.60
- **Depth to water table (ertlq.):** 5.00 ft
- **Depth to water table (strat.):** N/A
- **Unit weight calculation:** Based on SBT
- **Use fill:** No
- **Fill height:** N/A
- **Fill weight:** N/A
- **Transition detect. applied:** Yes
- **K_s applied:** Yes
- **Clay like behavior applied:** Sands only
- **Limit depth applied:** No
- **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**

---

**Project file:** P:\INFUS PROJECTS\11000-11500\11232 CenterCal 2nd & PCH (X:\X\Analyses\Clq\GIMP,40 feet\GIMP to 40 feet DGW 5 feet.clq)
Input parameters and analysis data

Points to test: Based on Ic value
Earthquake magnitude Mw: 7.03
Peak ground acceleration: 0.60
Depth to water table (in situ): 5.00 ft

Depth to water table (erthq.): 5.00 ft
Average results interval: 3
Ic cut-off value: 2.60
Unit weight calculation: Based on SBT
Use fill: No
Fill height: N/A

Fill weight: N/A
Transition detect. applied: Yes
Ks applied: Yes
Clay like behavior applied: Sands only
Limit depth applied: No
Limit depth: N/A

NCEER (1998) Based on Ic value
5.00 ft
2.60
N/A
Yes
Yes
Sands only
No
N/A

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

Very high risk
Very likely to liquefy
High risk
Liquefaction and no liq. are equally likely
Low risk
Unlike to liquefy
Almost certain it will not liquefy

F.S. color scheme
LPI color scheme
SLOPE STABILITY ANALYSIS
Section A - A'

Post-Liquefaction Stability

Project No.: 11232.002

2nd and PCH Retail Center, Long Beach, California

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 | 0
Liq C | 120 | Discrete function | 0
Liq D | 120 | Mohr-Coulomb | 1000 | 0
Liq A | 120 | Mohr-Coulomb | 400 | 0
Alluvium | 120 | Mohr-Coulomb | 0 | 36

Method: spencer
Factor of Safety: 1.25
Axis Location: 668.905, 310.296
Left Slip Surface Endpoint: 491.257, 10.000
Right Slip Surface Endpoint: 802.553, -12.000
Left Slope Intercept: 491.257 10.000
Right Slope Intercept: 802.553 2.000

Leighton Consulting, Inc.
A LEIGHTON GROUP COMPANY
### Material Properties

<table>
<thead>
<tr>
<th>Material Name</th>
<th>Color</th>
<th>Unit Weight (lbs/cu yd)</th>
<th>Strength Type</th>
<th>Cohesion (psf)</th>
<th>Phi (deg)</th>
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<td>Mohr-Coulomb</td>
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<td>120</td>
<td>Mohr-Coulomb</td>
<td>0</td>
<td>36</td>
</tr>
</tbody>
</table>

### Site Details

**Project No.:** 11232.002

**2nd and PCH Retail Center, Long Beach, California**

- **Analyzed By:** CD
- **Units:** Feet
- **Scale:** 1:780
- **Date:** December 2016
- **Condition:** Seismic

**Method:** spencer

- **Factor of Safety:** 1.40
- **Axis Location:** 587.090, 545.491
- **Left Slip Surface Endpoint:** 291.844, 10.000
- **Right Slip Surface Endpoint:** 838.336, -12.000
- **Left Slope Intercept:** 291.844 10.000
- **Right Slope Intercept:** 838.336 2.000