APPENDIX E

GEOTECHNICAL ASSESSMENT AND PALEONTOLOGICAL MEMORANDUM

Appendix E-1: Geotechnical Assessment
Appendix E-2: Paleontological Memorandum

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APPENDIX E-1

GEOTECHNICAL ASSESSMENT

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GEOTECHNICAL EVALUATION
FOR
PROPOSED MULTI-FAMILY RESIDENTIAL DEVELOPMENT
SOUTH OF VESSELS CIRCLE AND WEST OF WALKER STREET
CITY OF CYPRESS, ORANGE COUNTY, CALIFORNIA

PREPARED FOR

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PREPARED BY

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PROJECT NO. 2155-CR **AUGUST 12, 2019**

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August 12, 2019
Project No. 2155-CR

Melia Homes
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Attention: Mr. Chad Brown

Subject: Geotechnical Evaluation
Proposed Multi-Family Residential Development
South of Vessels Circle and West of Walker Street
City of Cypress, Orange County, California

Dear Mr. Brown:

We are pleased to provide herein the results of our geotechnical evaluation for the subject site located in the city of Cypress, Orange County, California. This report presents a discussion of our evaluation and provides preliminary geotechnical recommendations for earthwork, foundation design, and construction. In our opinion, site development appears feasible from a geotechnical viewpoint provided that the recommendations included herein are incorporated into the design and construction phases of site development.

The opportunity to be of service is sincerely appreciated. If you should have any questions, please do not hesitate to call our office.

Respectfully submitted,
GeoTek, Inc.

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1. PURPOSE AND SCOPE OF SERVICES

The purpose of this study was to complete a geotechnical evaluation of the existing geotechnical conditions of the project site with respect to currently anticipated site development. Services provided for this study included the following:

- Research and review of available geologic and geotechnical data, and general information pertinent to the site,
- Site reconnaissance,
- Site exploration consisting of the excavation, logging, and sampling of five exploratory hollow-stem auger borings; recording of penetration data of four Cone Penetration Test (CPT) soundings; and installation of one groundwater monitoring well within the property,
- Collection of relatively undisturbed and bulk soil samples of the onsite materials,
- Laboratory testing of the soil samples obtained from the site,
- Review and evaluation of site seismicity,
- Engineering analyses, and
- Compilation of this geotechnical report which presents our findings, conclusions, and recommendations for site development.

The intent of this report is to aid in the assessment of the site for future proposed development from a geotechnical perspective. The professional opinions and geotechnical information contained in this report may need to be updated based upon our review of the final site development plans. These plans should be provided to GeoTek, Inc. (GeoTek) for review when available.

2. SITE DESCRIPTION AND PROPOSED DEVELOPMENT

2.1 SITE DESCRIPTION

The subject site consists of a seven-acre property located south of Vessels Circle and west of Walker Street in the city of Cypress, Orange County, California. The site comprises the southeastern-most portion of the parking lot of Los Alamitos Horse Racetrack facility. The property is part of the Town Center District of the city of Cypress.

The project area mostly includes asphalt concrete-paved drive and parking areas with minimal landscaped zones. The site has a generally flat topography with a gentle fall of about two to four feet to the south-southwest. Surface drainage is to the south-southwest.

The site is surrounded by additional parking areas of the referenced racetrack and parking lots of nearby commercial buildings.

The general location of the site is shown in Figure 1. The current conditions of the site are displayed on a Google Earth aerial image shown as Figure 2, Exploration Location Map.

2.2 PROPOSED DEVELOPMENT

According to the Conceptual Site Plan, prepared by Bassenian Lagoni Architecture, dated April 18, 2019, the site will be developed with townhomes and condominiums, a pool area, parking/drive zones, underground utilities, and hardscape as well as landscape improvements. The structures are anticipated to be two to three stories, of wood-framed construction, and will utilize either concrete slab-on-grade floors and conventional shallow foundations or post-tensioned slabs. Cuts and fills are estimated to be less than five feet.

If site development differs from the assumptions made herein, the recommendations included in this report should be subject to further review and evaluation. Site development plans should be reviewed by GeoTek when they become available. Additional geotechnical field exploration, analyses and recommendations may be necessary upon review of site development plans.

3. FIELD EXPLORATION AND LABORATORY TESTING

3.1 FIELD EXPLORATION

The soils underlying the site were explored on July 12 and 29, 2019 by means of excavating four CPT soundings to maximum depths of 50 feet below the ground surface and five exploratory borings to depths between 21.0 and 51.5 feet. In addition, one temporary monitoring well to a depth of about 30 feet was installed within the northwestern region of the site in order to assess groundwater conditions that may affect the future site development. The CPT soundings were excavated with a 30-ton CPT rig and the borings and monitoring well were drilled with a truck-mounted hollow-stem auger drill rig. An engineer from this firm kept detailed logs of the borings and obtained disturbed as well as undisturbed soil samples for laboratory testing.
The approximate locations of the site explorations are shown on the Exploration Location Map, Figure 2. Logs of the borings and CPT soundings are provided in Appendices A and B, respectively.

3.2 LABORATORY TESTING

Laboratory testing was performed on selected relatively undisturbed and bulk soil samples collected during the field exploration. The purpose of the laboratory testing was to confirm the field classification of the soil materials encountered and to evaluate the soils physical properties for use in the engineering design and analysis. Results of the laboratory testing program along with a brief description and relevant information regarding testing procedures are included in Appendix C.

4. GEOLOGIC AND SOILS CONDITIONS

4.1 REGIONAL SETTING

The subject property is situated in the Peninsular Ranges geomorphic province. The Peninsular Ranges province is one of the largest geomorphic units in western North America. Basically, it extends roughly 975 miles from the north and extends from the Transverse Ranges geomorphic province to the tip of Baja California, from north to south. This province varies in width from about 30 to 100 miles. It is bounded on the west by the Pacific Ocean, on the south by the Gulf of California and on the east by the Colorado Desert Province.

The Peninsular Ranges are essentially a series of northwest-southeast oriented fault blocks. Several major fault zones are found in this province. The Elsinore Fault zone and the San Jacinto

Fault zone trend northwest-southeast and are found in the near the middle of the province. The San Andreas Fault zone borders the northeasterly margin of the province.

More specific to the subject property, Roffers, P.D. and Bedrossian, T.L., (2010) map the site to be underlain by Holocene to Late Pleistocene age younger alluvial fan deposits. Additionally, the nearest known active fault to the site is the Los Alamitos fault located approximately 2.3 miles to the southwest.

4.2 GENERAL SOIL/GEOLOGIC CONDITIONS

A brief description of the earth materials encountered in our explorations is presented in the following sections.

4.2.1 Undocumented Fill

Undocumented fill was encountered in all exploratory borings below the existing asphalt concrete pavement to depths of about three to four feet. The fill consisted of interbedded layers of silty sand, clayey sand, sandy silt, and sandy clay which were brown in color, moist to very moist, and soft/loose to medium stiff/dense.

4.2.2 Alluvium

Alluvial deposits were encountered in our borings below the fill and extended to the maximum depth explored of about 51.5 feet. The alluvium encountered generally consisted of alternating layers of silty sand, poorly graded sand, sandy silt, and clay. The alluvium was brown to gray in color, moist to saturated, and loose/soft to medium dense/stiff to the total depth explored, based on our field observations, blow counts, and in-place density determinations. Similar soil conditions were noted in the CPT soundings.

The near surface site soils tested were found to have "very low" to "low" expansion potential when tested and classified in accordance with ASTM D 4829.

Detailed descriptions of the subsurface soil conditions are provided in the boring logs presented in Appendix A.

4.3 SURFACE AND GROUNDWATER

4.3.1 Surface Water

If encountered during the earthwork construction, surface water on this site is the result of precipitation or surface run-off from surrounding sites. Overall drainage in the area is variable,

and most commonly directed toward the south-southwest. Provisions for surface drainage will need to be accounted for by the project civil engineer.

4.3.2 Groundwater

Pore pressure dissipation tests conducted at selected levels in three of the CPT soundings indicate that the depth to groundwater at the property is about six to seven feet. This agrees with the measurements conducted in the monitoring well installed within the northwestern edge of the site which indicate that groundwater is about five to six feet deep.

It should be noted that open hole groundwater measurements were done immediately at the completion of the exploratory borings and CPT soundings, with groundwater levels on the order of 12 to 18 feet. These levels were somewhat deeper than the levels observed in the monitoring well and pressure dissipation test probably because of the lack of additional time for the groundwater to reach the hydrostatic level in the holes.

Our review of the *Historically Highest Groundwater Map* published within the *Seismic Hazard Zone Report for the Los Alamitos 7.5-Minute Quadrangle* (California Department of Conservation, 1998*)* reveal past high groundwater levels on the order of 10 to 20 feet in the general area of the site.

The GeoTracker database shows records for a property located about one-third of a mile southwest of the site, with depth to groundwater ranging from five to eight feet. This information concurs with the groundwater levels recorded during our field investigation.

Perched groundwater or localized seepage can occur due to variations in rainfall, irrigation practices, and other factors not evident at the time of this investigation.

4.4 FAULTING AND SEISMICITY

The geologic structure of the entire southern California area is dominated mainly by northwest-trending faults associated with the San Andreas system. The site is in a seismically active region. No active or potentially active fault is known to exist at this site nor is the site situated within an *"Alquist-Priolo"* Earthquake Fault Zone (Bryant and Hart, 2007; CGS, 1986). The subject property is located within a State of California Seismic Hazard Zone for earthquake induced liquefaction (CGS, 1998). The subject property is not located within a State of California Seismic Hazard Zone for earthquake induced landsliding. The nearest known active fault to the site is the Los Alamitos fault located approximately 2.3 miles to the southwest.

4.4.1 Seismic Design Parameters

The site is located at approximately 33.8059 Latitude and -118.0404 Longitude. Site spectral accelerations (S_a and S_1), for 0.2 and 1.0 second periods for a Class "D" site, was determined from the SEAOC/OSHPD web interface that utilizes the USGS web services and retrieves the seismic design data and presents that information in a report format. The results are presented in the following table.

SITE SEISMIC PARAMETERS	
Mapped 0.2 sec Period Spectral Acceleration, S_s	1.502g
Mapped 1.0 sec Period Spectral Acceleration, S_1	0.547g
Site Coefficient for Site Class "D", F_a	1.0
Site Coefficient for Site Class "D", F_v	1.5
Maximum Considered Earthquake Spectral Response Acceleration for 0.2 Second, S_{MS}	1.502g
Maximum Considered Earthquake Spectral Response Acceleration for 1.0 Second, S_{M1}	0.821g
5% Damped Design Spectral Response Acceleration Parameter at 0.2 Second, S_{DS}	1.001g
5% Damped Design Spectral Response Acceleration Parameter at 1 second, S_{D1}	0.547g
Peak Ground Acceleration Adjusted for Site Class Effects, PGA_M	0.550g

4.5 LIQUEFACTION AND SEISMICALLY INDUCED SETTLEMENT

Liquefaction describes a phenomenon in which cyclic stresses, produced by earthquake-induced ground motion, create excess pore pressures in relatively cohesionless and low plastic soils. These soils may thereby acquire a high degree of mobility, which can lead to lateral movement, sliding, consolidation and settlement of loose sediments, sand boils and other damaging deformations. This phenomenon occurs only below the water table, but, after liquefaction has developed, the effects can propagate upward into overlying non-saturated soil as excess pore water dissipates.

The factors known to influence liquefaction potential include soil type and grain size, relative density, groundwater level, confining pressures, and both intensity and duration of ground shaking. In general, materials that are susceptible to liquefaction are loose, saturated granular soils having low fines content under low confining pressures and some low plastic silts and clays.

Based on the review of available groundwater data, a highest groundwater depth of about five feet was used in our liquefaction analysis. The analysis was performed with the aid of the computer program Cliq version 2.2.0.32 (Geologismiki, 2006) in conjunction with the soil profiles identified within all CPT soundings performed at the property. A mean magnitude weighted (Mw)

seismic event of 6.71 obtained with the USGS deaggregation web application (based on a 2 percent exceedance in 50 years) and a PGA_M value of 0.55g were used in the assessment.

The results of the analyses indicated the presence of some layers of loose sands and silty sands that would be prone to liquefaction and settlement during the design-level earthquake. The following table summarizes the amount of settlement estimated at each CPT location:

ESTIMATED SEISMICALLY INDUCED TOTAL SETTLEMENT (PGAM = 0.55g, MW=6.71)	
CPT Sounding	Total Settlement (in)
1	2.0
2	1.5
3	2.0
4	1.4

As noted above, the seismically induced total settlements of the sandy soils at the property could be up to two inches total and one-inch differential over a 40-foot span.

Due to the flat topography of the site, the potential for lateral spread is considered nil.

Based on relationships developed by Ishihara (1985) with respect to the thickness of potentially liquefiable soils relative to the thickness of the non-liquefiable soils, it is our opinion that there is potential for surface manifestations (sand boils and/or loss of bearing support) to occur during the design level earthquake. Recommendations presented in subsequent sections of this report have been prepared to reduce the potential impacts due to surface manifestations and seismically induced settlement.

The results of the liquefaction analysis are presented within Appendix D.

4.6 OTHER SEISMIC HAZARDS

Evidence of ancient landslides or slope instabilities at this site was not observed during our investigation. Thus, the potential for landslides is considered negligible.

The potential for secondary seismic hazards such as a seiche or tsunami is considered negligible due to site elevation and distance to an open body of water.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 GENERAL

Development of the site appears feasible from a geotechnical viewpoint. The following recommendations should be incorporated into the design and construction phases of development.

5.2 EARTHWORK CONSIDERATIONS

Earthwork and grading should be performed in accordance with the applicable grading ordinances of the City of Cypress, the *2016 California Building Code* (CBC), and recommendations contained in this report. Site grading plans should be reviewed by this office when they become available. Additional recommendations will likely be offered subsequent to review of these plans.

5.2.1 Site Clearing and Preparation

Site preparation should start with demolition/razing of existing site improvements and removal of deleterious materials and vegetation. Demolition should include removal of all pavements, slabs, underground utilities, and any other below-grade construction. These materials should be properly disposed of off-site. Voids resulting from site clearing (such as removals of underground utilities, etc.) should be backfilled with engineered fill materials.

5.2.2 Removals

As a minimum, the upper four feet of soil should be completely removed within the structural grading limits. The depth of removals should be extended, where needed, to eliminate any undocumented fill. Additional removals may be recommended if unsuitable materials are exposed. As a minimum, removals should extend down and away from foundation elements at a 1:1 (h:v) projection to the recommended removal depth, or a minimum of five feet laterally.

A minimum 24 inches of engineered fill should be provided below the bottom of the proposed foundations. A representative of this firm should observe the bottom of all excavations.

A minimum of 12 inches of engineered fill should be provided below asphaltic concrete pavement and Portland cement concrete hardscape areas. The horizontal extent of removals should extend at least two feet beyond the edge.

Development plans should be reviewed by this firm when available. Depending on actual field conditions encountered during grading, locally deeper areas of removal may be recommended.

The bottom of all removals should be scarified to a minimum depth of six inches, brought to slightly above the optimum moisture content, and then recompacted to at least 90 percent of the soil's maximum dry density (ASTM D 1557). The bottoms of removals should be observed by a GeoTek representative prior to scarification.

The bottom of removals may encounter very moist/soft soils that may require stabilization. If necessary, removal bottoms may be stabilized with a layer of gravel or geogrid supplemented with gravel, prior to placing engineered compacted fill. A 12-inch thick layer of gravel has been successfully used on similar project sites that GeoTek has provided services in the past. Specific stabilization recommendations should be provided by GeoTek based on the soil conditions encountered at the time of site grading.

5.2.3 Engineered Fill

The onsite soils are considered suitable for reuse as engineered fill provided they are free from vegetation, roots, and rock or hard lumps greater than six inches in maximum dimension.

At the time of our field investigation, most of the on-site soils were very moist (six to ten percent above optimum water content). To be suitable for placement as engineered fill, these materials should be dried to approximately optimum moisture content.

The undercut areas should be brought to final pad elevations with fill materials that are placed and compacted in general accordance with minimum project standards. Fill materials should be placed at or above optimum moisture content and should be compacted to a minimum relative compaction of 90 percent as determined by ASTM Test Method D 1557. Additional recommendations pertaining to fill placement are presented in Appendix E.

5.2.4 Excavation Characteristics

Excavation in the onsite soil materials is expected to be easy using heavy-duty grading equipment in good operating conditions.

All temporary excavations for grading purposes and installation of underground utilities should be constructed in accordance with local and Cal-OSHA guidelines. Temporary excavations within the onsite materials should be stable at 1:1 (h:v) inclinations for cuts less than five feet in height.

5.2.5 Shrinkage and Subsidence

Several factors will impact earthwork balancing on the site, including shrinkage, bulking, subsidence, trench spoil from utilities and footing excavations, as well as the accuracy of topography.

Shrinkage, bulking, and subsidence are primarily dependent upon the degree of compactive effort achieved during construction. For planning purposes, a shrinkage factor of 10 to 15 percent for both the existing fills and upper alluvium may be considered. Site balance areas should be available in order to adjust project grades, depending on actual field conditions at the conclusion of site earthwork construction. Bulking is not considered to be a significant factor with the underlying materials within the vicinity of the anticipated construction. Subsidence on the order of 0.1-foot could occur.

5.2.6 Trench Excavations and Backfill

Temporary excavations within the onsite materials should be stable at 1:1 (h:v) inclinations for short durations during construction, and where cuts do not exceed five feet in height. Temporary cuts to a maximum height of four feet can be excavated vertically, but local sloughing and/or failure could occur due to the granular nature of some of the site soils. Increased caution should be applied when working near or within any excavations at this site.

Trench excavations should conform to Cal-OSHA regulations. The contractor should have a competent person, per OSHA requirements, on site during construction to observe conditions and to make the appropriate recommendations.

Utility trench backfill should be compacted to at least 90 percent relative compaction (as determined per ASTM D 1557). Under-slab trenches should also be compacted to project specifications. Where applicable, based on jurisdictional requirements, the top 12 inches of backfill below subgrade for road pavements should be compacted to at least 95 percent relative compaction. Much of the surficial onsite materials may not be suitable for use as bedding material but should be suitable as backfill provided particles larger than 6± inches are removed.

Compaction should be achieved with a mechanical compaction device. Ponding or jetting of trench backfill is not recommended. If backfill soils have dried out, they should be thoroughly moisture conditioned prior to placement in trenches.

5.2.7 Slopes

Slopes at the site constructed at gradients of 2:1 (h:v) or flatter, in accordance with industry standards, are anticipated to be grossly stable. Fill placed on sloping ground should be properly benched into competent soils.

5.3 DESIGN RECOMMENDATIONS

5.3.1 Foundation Design Criteria

Post-tensioned slabs are recommended for the site to help mitigate the potential effects of surface manifestations of liquefaction and seismically induced settlements. We recommend that the post-tensioned slabs be designed to span a potential five-foot horizontal distance where loss of support could occur, resulting from surface manifestations caused by soil liquefaction. In addition, foundations should be designed for the estimated seismically induced settlement of about two-inches total and one-inch differential in a 40-foot span.

Based on the results of our recent testing, the on-site soils near subgrade may be classified as having a "very low" ($0 \leq EI \leq 20$) to "low" ($21 \leq EI \leq 50$) potential for expansion in accordance with ASTM D 4829. However, additional expansion index testing should be performed upon completion of the site rough grading in order to verify the expansiveness of the materials near the finish pad elevations.

Presented below are post-tensioned foundation design parameters for the proposed residential structures at the site. These parameters are in general conformance with *Design of Post-Tensioned Slabs-on-Ground*, Third Edition *with 2008 Supplement* (PTI, 2008). These are minimal recommendations and are not intended to supersede the design by the project structural engineer. The parameters presented below were developed for foundation areas with "low" expansive soils. Areas with "very low" expansive soils could be safely designed using the "low" expansive criteria.

DESIGN PARAMETERS FOR POST-TENSIONED SLABS	
Foundation Design Parameter	Design Value
	"Low" Expansion Potential (LL≤29; PI≤11; Passing #200 Sieve ≈ 58%; Clay fines ≈ 20%)
Edge Moisture Variation Distance, e_m - Edge Lift (swelling) - Center Lift (shrinkage)	 4.9 ft 9.0 ft
Soil Differential Movement, y_m - Edge Lift (swelling) - Center Lift (shrinkage)	 ≈0.40 in ≈0.17 in
Ext. Perimeter Beam Embedment	One- and Two-Story – 12 inches* Three-Story – 18 inches*
Presaturation of Subgrade Soil (Percent of Optimum)	Minimum 110% to a depth of 12 inches

*Required depth of perimeter beam/stiffening rib per structural calculations may govern.
The following assumptions were used to generate e_m and y_m values: Thornthwaite Moisture Index = -20; constant suction value = 3.9pF; post-equilibrium case assumed with wet (swelling) cycle going from 3.9pF to 3.0pF and drying (shrinking) cycle going from 3.9pF to 4.5pF.

Post-tensioned slabs should be designed in accordance with the *2016 CBC* and PTI design methodology.

The bottom of the perimeter edge beam/deepened footing should be designed to resist tension forces using either cable or conventional reinforcement, per the structural engineer.

In general, an allowable bearing capacity of 2,000 pounds per square foot (psf) may be used for design of post-tensioned slab foundations.

The passive earth pressure may be computed as an equivalent fluid having a density of 220 psf per foot of depth, to a maximum earth pressure of 2,500 psf for footings founded on engineered fill. A coefficient of friction between soil and concrete of 0.35 may be used with dead load forces. The upper one foot of soil below the adjacent grade should not be used in calculating passive pressure.

The above values may be increased as allowed by Code to resist short-term transient loads (e.g. seismic and wind loads).

For foundations designed in accordance with the recommendations presented in this report, we would anticipate a maximum static settlement of less than one-inch and a maximum differential static settlement of less than ½-inch in a 40-foot span. Seismically induced settlement is expected to be about two-inches total and one-inch differential in a 40-foot span.

It should be noted that the above recommendations are based on soil support characteristics only. The structural engineer should design the slab and beam reinforcement based on actual loading conditions.

A moisture and vapor retarding system should be placed below slabs-on-grade where moisture migration through the slab is undesirable. Guidelines for these systems are provided in the 2016 *California Green Building Standards Code (CALGreen)* Section 4.505.2 and the 2016 *CBC* Section 1910.1.

It should be realized that the effectiveness of the vapor retarding membrane can be adversely impacted as the result of construction related punctures (e.g. stake penetrations, tears, punctures from walking on the aggregate layer, etc.). These occurrences should be limited as much as possible during construction. Thicker membranes are generally more resistant to accidental puncture than thinner ones. Products specifically designed for use as moisture/vapor retarders may also be more puncture resistant. It is GeoTek's opinion that a minimum ten mil thick membrane with joints properly overlapped and sealed should be considered, unless otherwise specified by the slab design professional. Moisture and vapor retarding systems are intended to provide a certain level of resistance to vapor and moisture transmission through the concrete, but do not eliminate it. The acceptable level of moisture transmission through the slab is to a large extent based on the type of flooring used and atmospheric conditions.

Ultimately, the vapor retarding system should be comprised of suitable elements to limit migration of water and reduce transmission of water vapor through the slab to acceptable levels. The selected elements should have suitable properties (i.e. thickness, composition, strength, and permeance) to achieve the desired performance level. Consideration should be given to consulting with an individual possessing specific expertise in this area for additional evaluation.

5.3.2 Miscellaneous Foundation Recommendations

- To minimize moisture penetration beneath the slab on grade areas, utility trenches should be backfilled with engineered fill, lean concrete or concrete slurry where they intercept the perimeter footing or thickened slab edge.
- Soils from the footing excavations should not be placed in the slab-on-grade areas unless properly compacted and tested. The excavations should be free of loose/sloughed materials and be neatly trimmed at the time of concrete placement.
- Under-slab utility trenches should be compacted to project specifications. Compaction should be achieved with a mechanical compaction device. If backfill soils have dried out, they should be thoroughly moisture conditioned prior to placement in trenches.

5.3.3 Foundation Setbacks

Foundations should comply with the following setbacks. Improvements not conforming to these setbacks are subject to the increased likelihood of excessive lateral movements and/or differential settlements. If large enough, these movements can compromise the integrity of the improvements. The following recommendations are presented:

- The outside bottom edge of all footings should be set back a minimum of H/2 (where H is the slope height) from the face of any ascending slope. The setback should be at least five feet and need not to exceed 15 feet. Where a retaining wall is constructed at the toe of the slope, the height of the slope should be measured from top of the wall to the top of the slope.
- The outside bottom edge of all footings should be set back a minimum of H/3 from the face of any descending slope. The setback should be at least seven feet and need not exceed 40 feet.
- The bottom of all footings for structures near retaining walls should be deepened so as to extend below a 1:1 (h:v) projection upward from the bottom inside edge of the wall foundation.
- The bottom of any existing foundations for structures should be deepened so as to extend below a 1:1 (h:v) projection upward from the bottom of the nearest excavation.

5.3.4 Retaining Wall Design and Construction

5.3.4.1 General Design Criteria

Recommendations presented in this report apply to typical masonry or concrete retaining walls to a maximum height of up to six feet. Additional review and recommendations should be requested for higher walls. These are typical design criteria and are not intended to supersede the design by the structural engineer.

Retaining wall foundations should be embedded a minimum of 12 inches into engineered fill. Retaining wall foundations should be designed in accordance with Section 5.3.1 of this report. Structural needs may govern and should be evaluated by the project structural engineer.

All earth retention structure plans, as applicable, should be reviewed by this office prior to finalization. The seismic design parameters as discussed in this report remain applicable to all proposed earth retention structures at this site and should be properly incorporated into the design and construction of the structures.

Earthwork considerations, site clearing and remedial earthwork for all earth retention structures should meet the requirements of this report, unless specifically provided otherwise, or more stringent requirements or recommendations are made by the designer. The backfill material placement for all earth retention structures should meet the requirement of *Section 5.3.4.4* in this report.

In general, cantilever earth retention structures, which are designed to yield at least 0.001H, where H is equal to the height of the earth retention structure to the base of its footing, may be designed using the active condition. Rigid earth retention structures (including but not limited to rigid walls, and walls braced at top, such as typical basement walls) should be designed using the at-rest condition.

In addition to the design lateral forces due to retained earth, surcharges due to improvements, such as an adjacent building or traffic loading, should be considered in the design of the earth retention structures. Loads applied within a 1:1 (h:v) projection from the surcharge on the stem and footing of the earth retention structure should be considered in the design.

Final selection of the appropriate design parameters should be made by the designer of the earth retention structures.

5.3.4.2 Cantilevered Walls

The recommendations presented below are for cantilevered retaining walls up to six feet high. Active earth pressure may be used for retaining wall design, provided the top of the wall is not restrained from minor deflections. An equivalent fluid pressure approach may be used to compute the horizontal pressure against the wall. Appropriate fluid unit weights are given below for specific slope gradients of the retained material. These do not include other superimposed loading conditions such as traffic, structures, or adverse geologic conditions.

ACTIVE EARTH PRESSURES	
Surface Slope of Retained Materials (h:v)	Equivalent Fluid Pressure (pcf) Native Backfill*
Level	44
2:1	78

*The design pressures assume the native backfill material has an expansion index less than or equal to 50. Backfill zone includes area between the back of the wall and footing to a plane (1:1 h:v) up from the bottom of the wall foundation to the ground surface.

5.3.4.3 Restrained Retaining Walls

Retaining walls that will be restrained prior to placing and compacting backfill material or that have reentrant or male corners should be designed for an at-rest equivalent fluid pressure of 64 pcf, plus any applicable surcharge loading, for drained native backfill and level back slope condition. For areas of male or reentrant corners, the restrained wall design should extend a minimum distance of twice the height of the wall laterally from the corner, or a distance otherwise determined by the project structural engineer.

5.3.4.4 Retaining Wall Backfill and Drainage

Retaining wall backfill should be free of deleterious and/or oversized materials and should have expansion index less than 50. Retaining walls should be provided with an adequate pipe and gravel back drain system to help prevent buildup of hydrostatic pressures. Backdrains should consist of a four-inch diameter perforated collector pipe (Schedule 40, SDR 35, or approved equivalent) embedded in a minimum of one-cubic foot per linear foot of ¾- to 1-inch clean crushed rock or an approved equivalent, wrapped in filter fabric (Mirafi 140N or an approved equivalent). The drain system should be connected to a suitable outlet. Waterproofing of site walls should be performed where moisture migration through the wall is undesirable.

Retaining wall backfill should be placed in lifts no greater than eight inches in thickness and compacted to a minimum of 90 percent relative compaction in accordance with ASTM Test Method D 1557. The wall backfill should also include a minimum one-foot wide section of ¾- to 1-inch clean crushed rock (or an approved equivalent). The rock should be placed immediately adjacent to the back of the wall and extend up from a back drain to within approximately 24 inches of the finish grade. The rock should be separated from the earth with filter fabric. The upper 24 inches should consist of compacted on-site soil.

As an alternative to the drain rock and fabric, Miradrain 2000, or approved equivalent, may be used behind the retaining wall. The Miradrain 2000 should extend from the base of the wall to within two feet of the ground surface. The subdrain should be placed at the base of the wall in direct contact with the Miradrain 2000.

The presence of other materials might necessitate revision to the parameters provided and modification of the wall designs. Proper surface drainage needs to be provided and maintained.

5.3.4.5 Other Design Considerations

- Wall design should consider the additional surcharge loads from superjacent slopes and/or footings, where appropriate.

- No backfill should be placed against concrete until minimum design strengths are evident by compression tests of cylinders.
- The retaining wall footing excavations, backcuts, and backfill materials should be approved the project geotechnical engineer or their authorized representative.

5.3.5 Pool Construction

Because of the presence of shallow groundwater, dewatering systems will likely be required to facilitate the excavation of the pool area. We recommend that the water table be lowered to a least two feet below the deepest excavation and maintained at that depth until the pool is constructed and filled.

The proposed swimming pool should derive support entirely from engineered fill. A minimum 12 inches of engineered fill should be provided below the pool shell.

The pool walls should be designed for at-rest soil conditions using an equivalent fluid density of 64 pcf for at-rest conditions. Pool walls surcharged by adjacent structures should be designed for additional pressures. Alternatively, the pool walls may be designed as freestanding walls using the active soil state conditions provided that some lateral movement of the pool walls would be acceptable. If the active state is to be used, an equivalent fluid density of 44 pcf is considered suitable. These pressures are recommended for sections of the pool walls above the groundwater table and are based on drained conditions. Below the groundwater level (about five to six feet), the pool walls should then be designed for an equivalent fluid density of 86 pcf for the active condition and 98 pcf for the at-rest condition. These values include the hydrostatic pressure.

Due to the high groundwater table under the site, positive drainage below the pool will likely not be feasible. We recommend that the pool walls be designed to include the hydrostatic pressure as indicated above. Also, buoyancy of the pool should be evaluated by the pool designer using a groundwater level of about five feet below the existing ground surface. The pool designer should consider hydrostatic relief valves or equivalent in order to prevent the effects of hydrostatic pressure on an empty pool shell.

Pool decking supported on grade should be separated from the pool bond beam by a full-depth, mastic construction joint. If it is desired to extend the pool deck over the bond beam, consideration should be given to designing the deck as a structural slab supported by the pool shell. This will reduce the possibility of deck cracking occurring along the outer edge of the bond beam. We also recommend that the area of the pool decking be pre-saturated prior to concrete placement. The subgrade soils should be moisture conditioned to at least 110 percent of the soil's optimum moisture content to a depth of 12 inches, prior to concrete placement. Testing

by the geotechnical engineer is recommended to confirm that the soils have been adequately moisture treated.

Pool decking may consist of five-inch thick concrete and the use of reinforcement is suggested. Control joints should be placed in two directions and located a distance apart approximately equal to 24 to 36 times the slab thickness. The project structural engineer should provide final design recommendations.

5.3.6 Pavement Design Considerations

Pavement design for proposed street improvements was conducted per Caltrans *Highway Design Manual* guidelines for flexible pavements. Based on an assumed design R-value of 20 and for Traffic Indices (TIs) of 5.0 and 6.0 generally linked to roads with light vehicular traffic with occasional heavy truck traffic, the following preliminary sections were calculated:

PRELIMINARY MINIMUM PAVEMENT SECTION		
Traffic Index	Thickness of Asphalt Concrete (inches)	Thickness of Aggregate Base (inches)
5.0	3	8
6.0	4	9

Traffic Indices (TIs) used in our pavement design are considered reasonable values for the proposed residential street areas and should provide a pavement life of approximately 20 years with a normal amount of flexible pavement maintenance. Irrigation adjacent to pavements, without a deep curb or other cutoff to separate landscaping from the paving may result in premature pavement failure. Traffic parameters used for design were selected based upon engineering judgment and not upon information furnished to us such as an equivalent wheel load analysis or a traffic study.

The recommended pavement sections provided are intended as a minimum guideline and final selection of pavement cross section parameters should be made by the project civil engineer, based upon the local laws and ordinates, expected subgrade and pavement response, and desired level of conservatism. If thinner or highly variable pavement sections are constructed, increased maintenance and repair could be expected. Final pavement design should be checked by testing of soils exposed at subgrade (the upper five feet) after final grading has been completed.

Asphalt concrete and aggregate base should conform to current Caltrans Standard Specifications Section 39 and 26-1.02, respectively. As an alternative, asphalt concrete can conform to Section 203-6 of the current Standard Specifications for Public Work (Green Book). Crushed aggregate base or crushed miscellaneous base can conform to Section 200-2.2 and 200-2.4 of the Green

Book, respectively. Pavement base should be compacted to at least 95 percent of the ASTM D1557 laboratory maximum dry density (modified proctor).

All pavement installation, including preparation and compaction of subgrade, compaction of base material, placement and rolling of asphaltic concrete should be done in accordance with the City of Cypress specifications, and under the observation and testing of GeoTek and a City Inspector where required. Jurisdictional minimum compaction requirements in excess of the aforementioned minimums may govern.

Deleterious material, excessive wet or dry pockets, oversized rock fragments, and other unsuitable yielding materials encountered during grading should be removed. Once existing compacted fill are brought to the proposed pavement subgrade elevations, the subgrade should be proof-rolled in order to check for a uniform and unyielding surface. The upper 12 inches of pavement subgrade soils should be scarified, moisture conditioned at or near optimum moisture content, and recompacted to at least 95 percent of the laboratory maximum dry density (ASTM D1557). If loose or yielding materials are encountered during construction, additional evaluation of these areas should be carried out by GeoTek. All pavement section changes should be properly transitioned.

5.3.7 Soil Corrosivity

The soil resistivity was tested in the laboratory on two samples collected during our field exploration. The results of the testing (2,010 ohm-cm) indicate that the soil samples are "highly corrosive" to buried ferrous metals, based on the guidelines provided in *Corrosion Basics: An Introduction* (Roberge, 2005). Chloride content of the samples (0.0027 and 0.0035 percent) was found to be negligible. Consideration should be given to consulting with a corrosion engineer.

5.3.8 Soil Sulfate Content

The sulfate content was determined in the laboratory for two soil samples obtained during our field investigation. The results (0.0071 and 0.0192 percent) indicate that the water-soluble sulfate range is less than 0.1 percent by weight which is considered "not applicable" (i.e. negligible) as per Table 4.2.1 of ACI 318. Based upon the test results, no special concrete mix design is required by Code for sulfate attack resistance. Additional testing of soils collected near finish grade should be performed subsequent to site grading.

5.3.9 Import Soils

Import soils should have an expansion index similar to the on-site soils. GeoTek also recommends that, as a minimum, proposed import soils be tested for soluble sulfate content.

GeoTek should be notified a minimum of 72 hours of potential import sources so that appropriate sampling and laboratory testing can be performed.

5.3.10 Concrete Flatwork

5.3.10.1 Exterior Concrete Slabs, Sidewalks, and Driveways

Exterior concrete slabs, sidewalks, and driveways should be designed using a four-inch minimum thickness. No specific reinforcement is required due to the non-structural nature. However, the use of some reinforcement should be considered. Some shrinkage and cracking of the concrete should be anticipated as a result of typical mix designs and curing practices commonly utilized in residential construction.

Sidewalks and driveways may be under the jurisdiction of the governing agency. If so, jurisdictional design and construction criteria would apply, if more restrictive than the recommendations presented herein.

Subgrade soils below exterior concrete flatwork should be pre-moistened prior to placing concrete. The subgrade soils with "very low" expansion potential should be pre-saturated to a minimum of 100 percent of optimum moisture content to a depth of 12 inches. Subgrade soils with "low" expansion potential should be presaturated to a minimum of 110 percent of optimum moisture content to a depth of approximately 12 inches.

All concrete installation, including preparation and compaction of subgrade, should be done in accordance with the City of Cypress specifications, and under the observation and testing of GeoTek and a City Inspector, if necessary.

5.3.10.2 Concrete Performance

Concrete cracks should be expected. These cracks can vary from sizes that are essentially unnoticeable to more than 1/8 inch in width. Most cracks in concrete, while unsightly, do not significantly impact long-term performance. While it is possible to take measures (proper concrete mix, placement, curing, control joints, etc.) to reduce the extent and size of cracks that occur, some cracking will occur despite the best efforts to minimize it. Concrete can also undergo chemical processes that are dependent on a wide range of variables, which are difficult, at best, to control. Concrete, while seemingly a stable material, is also subject to internal expansion and contraction due to external changes over time.

One of the simplest means to control cracking is to provide weakened control joints for cracking to occur along. These do not prevent cracks from developing; they simply provide a relief point

for the stresses that develop. These joints are a widely accepted means to control cracks but are not always effective. Control joints are more effective the more closely spaced they are. GeoTek suggests that control joints be placed in two directions and located a distance apart roughly equal to 24 to 36 times the slab thickness.

Exterior concrete flatwork (patios, walkways, driveways, etc.) is often some of the most visible aspects of site development. They are typically given the least level of quality control, being considered "non-structural" components. We suggest that the same standards of care be applied to these features as to the structure itself.

5.4 POST CONSTRUCTION CONSIDERATIONS

5.4.1 Landscape Maintenance and Planting

Water has been shown to weaken the inherent strength of soil, and slope stability is significantly reduced by overly wet conditions. Positive surface drainage away from graded slopes should be maintained and only the amount of irrigation necessary to sustain plant life should be provided for planted slopes. Controlling surface drainage and runoff, and maintaining a suitable vegetation cover can minimize erosion. Plants selected for landscaping should be lightweight, deep-rooted types that require little water and are capable of surviving the prevailing climate.

Overwatering should be avoided. The soils should be maintained in a solid to semi-solid state as defined by the materials Atterberg Limits. Care should be taken when adding soil amendments to avoid excessive watering. Leaching as a method of soil preparation prior to planting is not recommended. An abatement program to control ground-burrowing rodents should be implemented and maintained. This is critical as burrowing rodents can decreased the long-term performance of slopes.

It is common for planting to be placed adjacent to structures in planter or lawn areas. This will result in the introduction of water into the ground adjacent to the foundation. This type of landscaping should be avoided. If used, then extreme care should be exercised with regard to the irrigation and drainage in these areas.

5.4.2 Drainage

The need to maintain proper surface drainage and subsurface systems cannot be overly emphasized. Positive site drainage should be maintained at all times. Drainage should not flow uncontrolled down any descending slope. Water should be directed away from foundations and not allowed to pond or seep into the ground. Pad drainage should be directed toward approved area(s) and not be blocked by other improvements.

It is the owner's responsibility to maintain and clean drainage devices on or contiguous to their lot. In order to be effective, maintenance should be conducted on a regular and routine schedule and necessary corrections made prior to each rainy season.

5.5 PLAN REVIEW AND CONSTRUCTION OBSERVATIONS

We recommend that site grading plans, pool plans, retaining wall plans, foundation plans, and relevant project specifications be reviewed by this office prior to construction to check for conformance with the recommendations of this report. We also recommend that GeoTek representatives be present during site grading and foundation construction to check for proper implementation of the geotechnical recommendations. The owner/developer should verify that GeoTek representatives perform at least the following duties:

- Observe site clearing and grubbing operations for proper removal of unsuitable materials.
- Observe and test bottom of removals prior to fill placement.
- Evaluate the suitability of onsite and import materials for fill placement and collect soil samples for laboratory testing where necessary.
- Observe the fill for uniformity during placement, including utility trenches.
- Perform field density testing of the fill materials.
- Observe and probe foundation excavations to confirm suitability of bearing materials.

If requested, a construction observation and compaction report can be provided by GeoTek, which can comply with the requirements of the governmental agencies having jurisdiction over the project. We recommend that these agencies be notified prior to commencement of construction so that necessary grading permits can be obtained.

6. INTENT

It is the intent of this report to aid in the design and construction of the proposed development. Implementation of the advice presented in this report is intended to reduce risk associated with construction projects. The professional opinions and geotechnical advice contained in this report are not intended to imply total performance of the project or guarantee that unusual or variable conditions will not be discovered during or after construction.

The scope of our evaluation is limited to the boundaries of the subject site. This review does not and should in no way be construed to encompass any areas beyond the specific area of the proposed construction as indicated to us by the client. Further, no evaluation of any existing site improvements is included. The scope is based on our understanding of the project and the client's needs, our fee estimate (P-0503019r) dated May 22, 2019 and geotechnical engineering standards normally used on similar projects in this region.

7. LIMITATIONS

The materials observed on the project site appear to be representative of the area; however, soil materials vary in character between excavations or conditions exposed during site construction. Site conditions may vary due to seasonal changes or other factors. GeoTek, Inc. assumes no responsibility or liability for work, testing or recommendations performed or provided by others.

Since our recommendations are based on the site conditions observed and encountered, and laboratory testing, our conclusion and recommendations are professional opinions that are limited to the extent of the available data. Observations during construction are important to allow for any change in recommendations found to be warranted. These opinions have been derived in accordance with current standards of practice and no warranty is expressed or implied. Standards of practice are subject to change with time.

8. SELECTED REFERENCES

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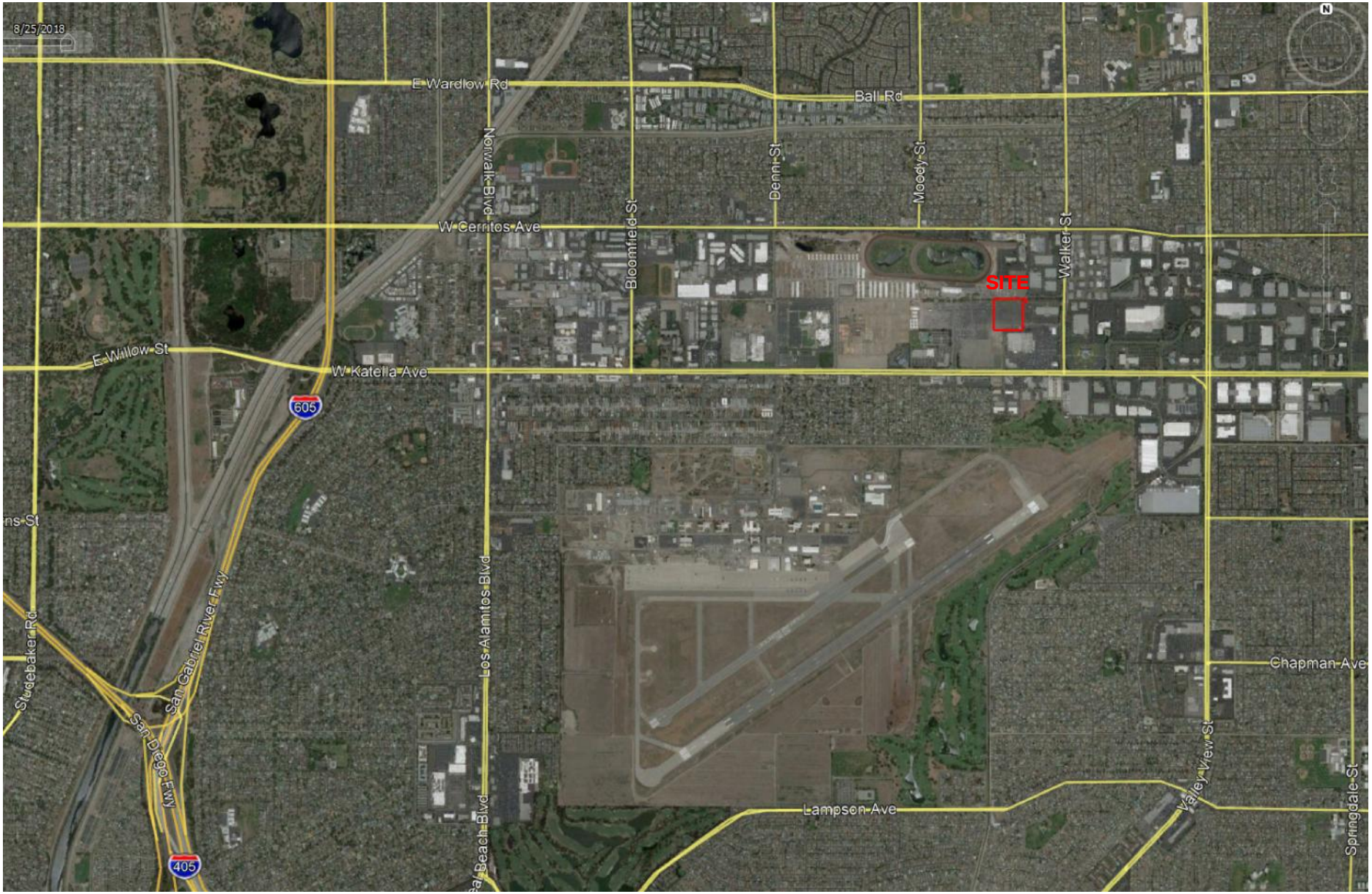


Melia Homes
Multi-Family Residential Project
South of Vessels Circle and West of Walker Street
Cypress, Orange County, California

Project No. 2155-CR

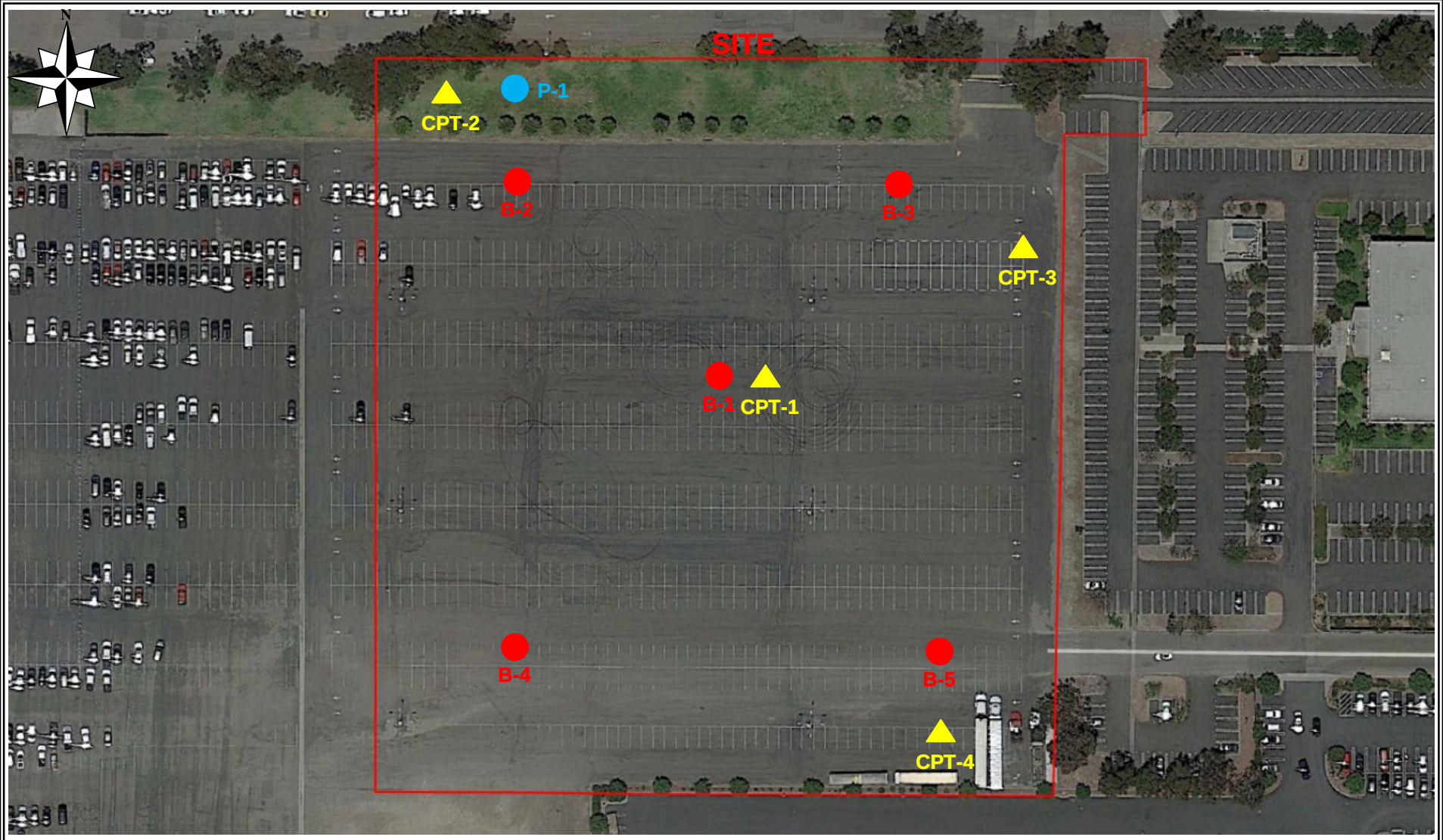
Scale: As Shown

0 0.5 mi

Figure 1

Site Location Map

GEOTEK



Legend:
(Locations are approximate)

CPT-4 - CPT Sounding

B-5 - Exploratory Boring

P-1 - Groundwater Monitoring Well

Melia Homes
Multi-Family Residential Project
South of Vessels Circle and West of Walker Street
Cypress, Orange County, California

Project No. 2155-CR

Scale: As Shown

0 100 ft

Figure 2

Exploration Location Map

GEOTEK

APPENDIX A

EXPLORATORY BORING LOGS

Geotechnical Evaluation
Proposed Multi-Family Residential Development, Cypress, California
Project No. 2155-CR

GEOTEK

A - FIELD TESTING AND SAMPLING PROCEDURES

The Modified Split-Barrel Sampler (Ring)

The ring sampler is driven into the ground in accordance with ASTM Test Method D 3550. The sampler, with an external diameter of 3.0 inches, is lined with 1-inch long, thin brass rings with inside diameters of approximately 2.4 inches. The sampler is typically driven into the ground 12 or 18 inches with a 140-pound hammer free falling from a height of 30 inches. Blow counts are recorded for every 6 inches of penetration as indicated on the logs of borings. The samples are removed from the sample barrel in the brass rings, sealed, and transported to the laboratory for testing.

Bulk Samples (Large)

These samples are normally large bags of earth materials over 20 pounds in weight collected from the field by means of hand digging or exploratory cuttings.

Bulk Samples (Small)

These are plastic bag samples which are normally airtight and contain less than five pounds in weight of earth materials collected from the field by means of hand digging or exploratory cuttings. These samples are primarily used for determining natural moisture content and classification indices.

B – BORING LOG LEGEND

The following abbreviations and symbols often appear in the classification and description of soil and rock on the logs of borings:

SOILS

USCS	Unified Soil Classification System
f-c	Fine to coarse
f-m	Fine to medium

GEOLOGIC

B: Attitudes	Bedding: strike/dip
J: Attitudes	Joint: strike/dip
C: Contact line	
……..	Dashed line denotes USCS material change
———	Solid Line denotes unit / formational change
———	Thick solid line denotes end of boring

(Additional denotations and symbols are provided on the logs of borings)

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	Melia Homes	**DRILLER:**	2R Drilling	**LOGGED BY:**	D.Alvarez
PROJECT NAME:	7-Acre Site Cypress Town Center	**DRILL METHOD:**	Hollow-Stem	**OPERATOR:**	Ish/Kyle
PROJECT NO.:	2155-CR	**HAMMER:**	140#/30"	**RIG TYPE:**	CME 75
LOCATION:	See Exploration Location Map			**DATE:**	7/29/2019

Boring No.: B-1

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 in	SAMPLES: Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
0					3" Asphaltic Concrete			
					Fill:			MD, SH, EI, AL, SR
				CL	Sandy CLAY, moderate brown, moist to very moist, soft			
				SM	Silty f SAND, light brown, moist, loose			
				SC	Silty f SAND with clay, moderate brown, moist to very moist, loose			
5		2 3 3		SM	**Alluvium:** Silty f-m SAND, light brown, very moist, loose	23.0		SA
10		1 2 4		SM-ML	Silty f SAND to sandy SILT, moderate brown, very moist, loose	30.0		
15		1 1 2	▽	SM	Silty f SAND, olive-brown, wet, very loose	27.4		SA
20		2 3 5		SP	F SAND, brown, wet, loose	25.3		
25		1 1 1		CL	Clay, moderate dark brown, wet, very soft	32.6		SA
30		1 2 4			Clay, moderate dark brown, wet, medium stiff	30.9		

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing: AL = Atterberg Limits; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test; SR = Sulfate/Resisitivity Test; SH = Shear Test; HC= Consolidation; MD = Maximum Density

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	Melia Homes	**DRILLER:**	2R Drilling	**LOGGED BY:**	D.Alvarez
PROJECT NAME:	7-Acre Site Cypress Town Center	**DRILL METHOD:**	Hollow-Stem	**OPERATOR:**	Ish/Kyle
PROJECT NO.:	2155-CR	**HAMMER:**	140#/30"	**RIG TYPE:**	CME 75
LOCATION:	See Exploration Location Map			**DATE:**	7/29/2019

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 in	SAMPLES: Sample Number	USCS Symbol	**Boring No.: B-1 (Continued)** MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
30								
35		1 7 4		SP-SM	M SAND with silt, brown, wet, medium dense	24.8		SA
40		4 6 6		SP	M-c SAND, brown, wet, medium dense	24.5		
45		8 8 18		SP	F SAND with some silt, gray, wet, medium dense	18.3		
50		4 18 35			M SAND, brown, wet, very dense	21.9		
					BORING TERMINATED AT 51.5 FEET Boring backfilled with bentonite. Groundwater encountered at 15.0 feet.			
55								
60								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing:

AL = Atterberg Limits	EI = Expansion Index	SA = Sieve Analysis	RV = R-Value Test
SR = Sulfate/Resisitivity Test	SH = Shear Test	HC= Consolidation	MD = Maximum Density

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	Melia Homes	**DRILLER:**	2R Drilling	**LOGGED BY:**	D.Alvarez
PROJECT NAME:	7-Acre Site Cypress Town Center	**DRILL METHOD:**	Hollow-Stem	**OPERATOR:**	Ish/Kyle
PROJECT NO.:	2155-CR	**HAMMER:**	140#/30"	**RIG TYPE:**	CME 75
LOCATION:	See Exploration Location Map			**DATE:**	7/29/2019

Boring No.: B-2

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 in	SAMPLES: Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
0					2.5" Asphaltic Concrete			
				SM-ML	**Fill:** Sandy SILT to silty SAND, brown, moist, medium dense			
				SC	Silty SAND with some clay, moderate brown, moist to very moist, medium dense			
5		7 10 12		SP	**Alluvium:** F-m SAND, brown, very moist, medium dense	22.8	104.4	
		5 9 6			F-m SAND, brown, very moist, loose	23.9	102.0	
10		1 2 3	▽	ML	SILT with few sand, moderate brown-olive, very moist, soft	31.7	91.5	HC
15		2 4 5			SILT with few sand, moderate brown-olive, wet, medium stiff	24.6	102.6	
20		4 9 14		SP	F-m SAND, brown, wet, medium dense	22.7	102.8	
25					**BORING TERMINATED AT 21.5 FEET** Boring backfilled with bentonite. Groundwater encountered at 12.0 feet.			
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing: AL = Atterberg Limits; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test; SR = Sulfate/Resisitivity Test; SH = Shear Test; HC= Consolidation; MD = Maximum Density

GeoTek, Inc.
LOG OF EXPLORATORY BORING

CLIENT:	Melia Homes	**DRILLER:**	2R Drilling	**LOGGED BY:**	D.Alvarez
PROJECT NAME:	7-Acre Site Cypress Town Center	**DRILL METHOD:**	Hollow-Stem	**OPERATOR:**	Ish/Kyle
PROJECT NO.:	2155-CR	**HAMMER:**	140#/30"	**RIG TYPE:**	CME 75
LOCATION:	See Exploration Location Map			**DATE:**	7/29/2019

Boring No.: B-3

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 in	SAMPLES: Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
0					3" Asphaltic Concrete			
				SM-ML	**Fill:** Silty f SAND to silty SAND, light brown, moist, medium dense			
				SP	**Alluvium:** F-m SAND, brown, moist, medium dense			
5	Ring	6 9 13			F-m SAND brown, moist, medium dense	11.6	109.0	
	Ring	7 10 11			M SAND, brown, moist, medium dense	22.8	100.3	
10	Ring	2 2 3		ML-CL	Clayey SILT to Silty CLAY, moderate dark brown, very moist to wet, soft	36.6	87.2	
15	Ring	2 3 4	▽	SM-ML	Silty f SAND to sandy SILT, moderate dark brown, wet, very loose	25.2	101.2	
20	Ring	8 12 16		SP	F SAND, olive brown, wet, medium dense	25.3	100.6	
					BORING TERMINATED AT 21.0 FEET Boring backfilled with bentonite. Groundwater encountered at 15.0 feet.			
25								
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing: AL = Atterberg Limits; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test; SR = Sulfate/Resisitivity Test; SH = Shear Test; HC= Consolidation; MD = Maximum Density

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	Melia Homes	**DRILLER:**	2R Drilling	**LOGGED BY:**	D.Alvarez
PROJECT NAME:	7-Acre Site Cypress Town Center	**DRILL METHOD:**	Hollow-Stem	**OPERATOR:**	Ish/Kyle
PROJECT NO.:	2155-CR	**HAMMER:**	140#/30"	**RIG TYPE:**	CME 75
LOCATION:	See Exploration Location Map			**DATE:**	7/29/2019

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 in	SAMPLES: Sample Number	USCS Symbol	**Boring No.: B-4** MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
0					4" Asphaltic Concrete			
				SC-SM	**Fill:** Clayey sandy SILT to silty f SAND, brown, moist to very moist, medium dense			MD, EI, SH, SR
5		4 6		SP	**Alluvium:** F-m SAND, light brown, moist, medium dense M-c SAND, brown, moist, loose	21.5	101.2	
		10 3 4 6		SM-ML	Silty f SAND to sandy SILT, brown, very moist, loose	29.2	96.4	HC
10		5 6 9		SP	F SAND, brown, very moist, loose	25.3	100.4	
15		3 4 9		SM-ML	Silty f SAND to sandy SILT, brown, very moist, loose to medium stiff	23.4	104.3	
20		4 7 8						
25					**BORING TERMINATED AT 21.5 FEET** Boring backfilled with bentonite. Groundwater encountered at 18.0 feet.			
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing: AL = Atterberg Limits; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test; SR = Sulfate/Resisitivity Test; SH = Shear Test; HC= Consolidation; MD = Maximum Density

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	Melia Homes	**DRILLER:**	2R Drilling	**LOGGED BY:**	D.Alvarez
PROJECT NAME:	7-Acre Site Cypress Town Center	**DRILL METHOD:**	Hollow-Stem	**OPERATOR:**	Ish/Kyle
PROJECT NO.:	2155-CR	**HAMMER:**	140#/30"	**RIG TYPE:**	CME 75
LOCATION:	See Exploration Location Map			**DATE:**	7/29/2019

Boring No.: B-5

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 in	SAMPLES: Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
0					3.0" Asphaltic Concrete			
					Fill:			
				SM-ML	Sandy SILT to silty SAND, light brown, moist, medium dense			
				ML-SC	Sandy SILT to silty SAND with some clay, light brown, moist, medium dense			
					Alluvium:			
5	Ring	11 12 15		SP	F-m SAND, light brown, moist, medium dense	16.6	104.1	
	Ring	3 4 9			F-m SAND, light brown, very moist, medium dense	23.0	101.2	
10	Ring	9 14 14		SM	F SAND with some silt, brown, very moist, dense	18.6	107.0	
15	Ring	3 5 6	▽		Silty f SAND, moderate brown, very moist, loose	23.2	105	
20	Ring	3 5 8		SM-ML	Silty f SAND to sandy SILT, brown, wet, loose	26.0	98.7	
					BORING TERMINATED AT 21.5 FEET			
					Boring backfilled with bentonite. Groundwater encountered at 18.0 feet.			
25								
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing: AL = Atterberg Limits; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test; SR = Sulfate/Resisitivity Test; SH = Shear Test; HC= Consolidation; MD = Maximum Density

APPENDIX B

LOGS OF CPT SOUNDINGS

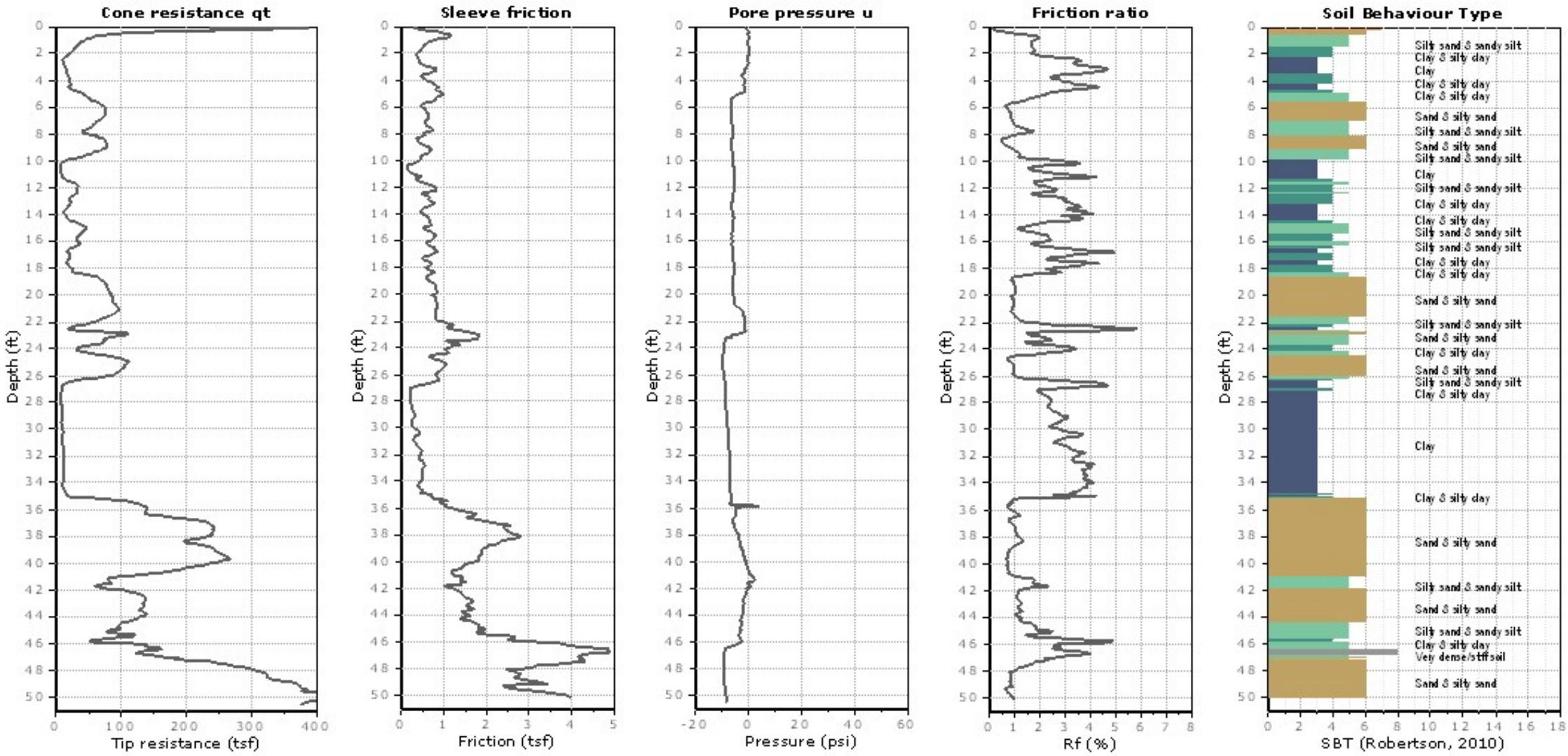
Geotechnical Evaluation
Proposed Multi-Family Residential Development, Cypress, California
Project No. 2155-CR

GEOTEK

Kehoe Testing and Engineering
714-901-7270
steve@kehoetesting.com
www.kehoetesting.com

Project: GeoTek
Location: 5401 Katella Ave, Cypress, CA

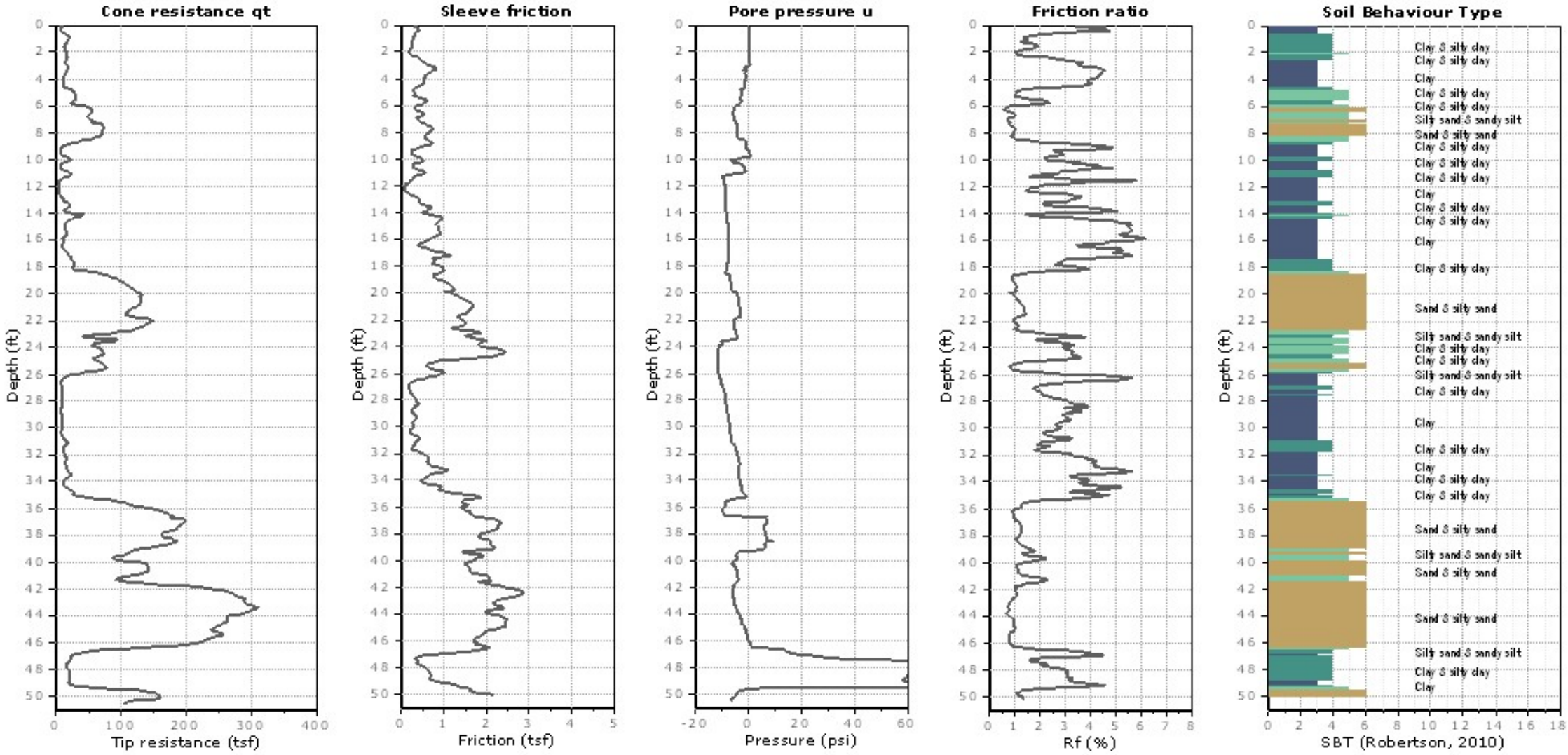
CPT-1
Total depth: 50.47 ft, Date: 7/12/2019



Kehoe Testing and Engineering
714-901-7270
steve@kehoetesting.com
www.kehoetesting.com

Project: GeoTek
Location: 5401 Katella Ave, Cypress, CA

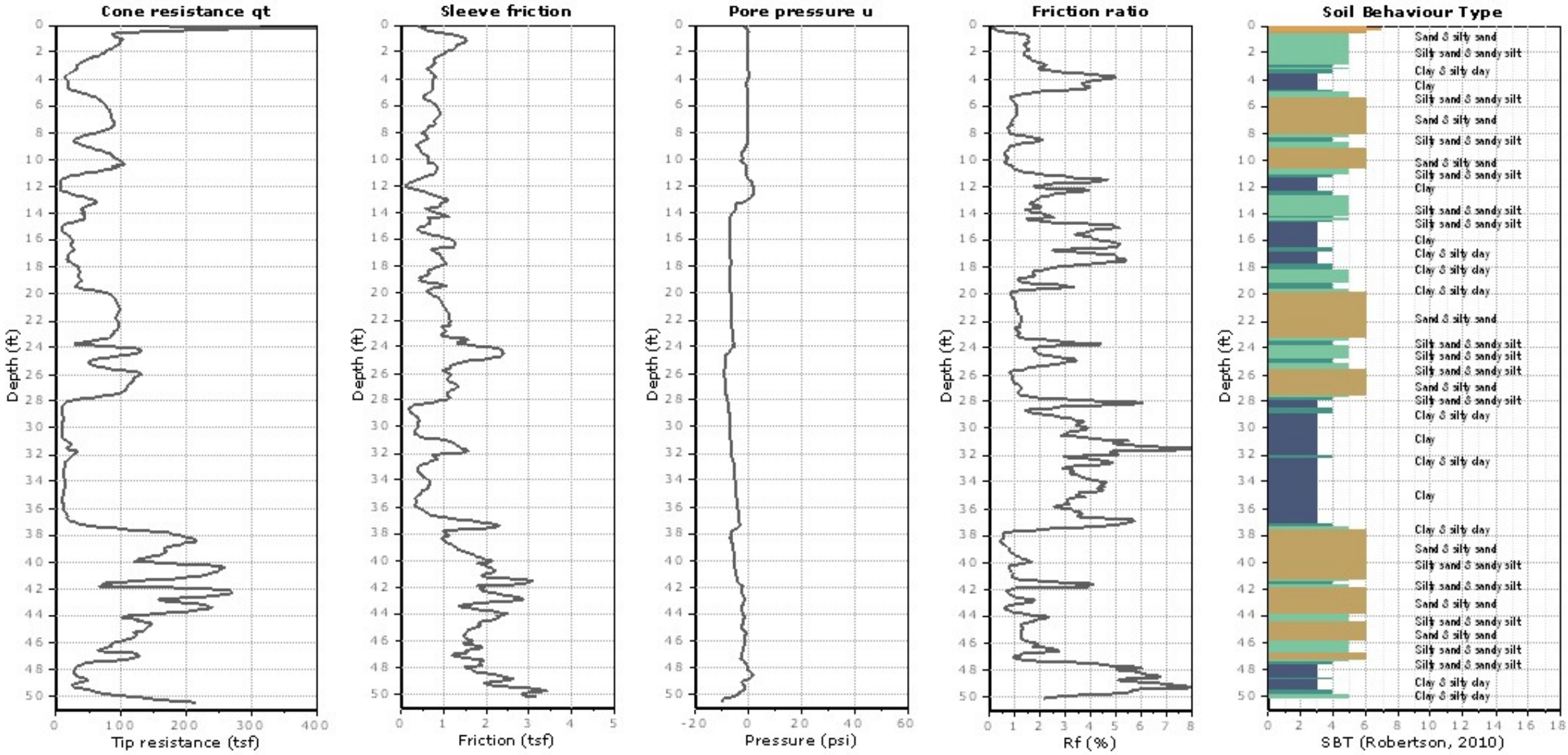
CPT-2
Total depth: 50.48 ft, Date: 7/12/2019



Kehoe Testing and Engineering
714-901-7270
steve@kehoetesting.com
www.kehoetesting.com

Project: GeoTek
Location: 5401 Katella Ave, Cypress, CA

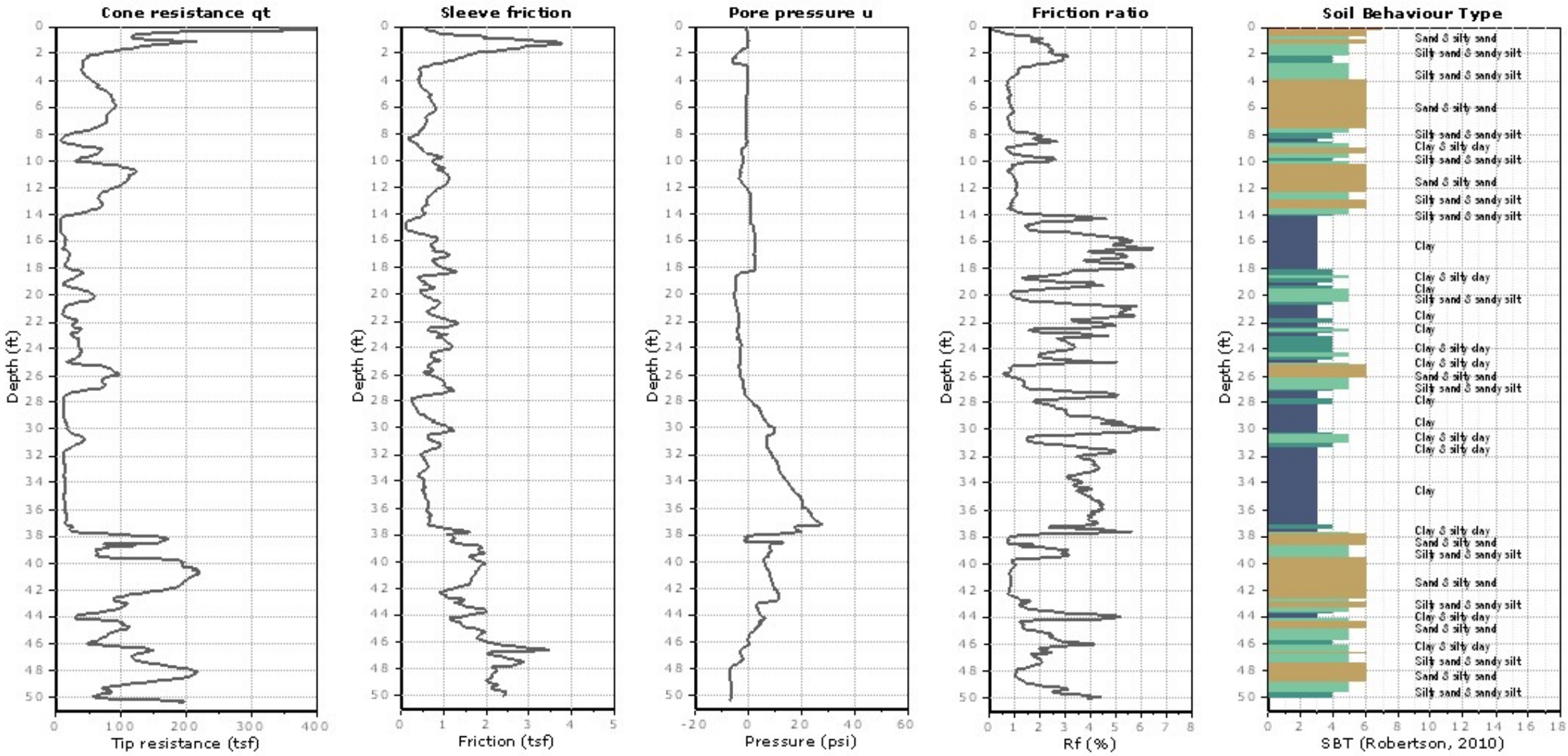
CPT-3
Total depth: 50.53 ft, Date: 7/12/2019



Kehoe Testing and Engineering
714-901-7270
steve@kehoetesting.com
www.kehoetesting.com

Project: GeoTek
Location: 5401 Katella Ave, Cypress, CA

CPT-4
Total depth: 50.40 ft, Date: 7/12/2019



APPENDIX C

LABORATORY TEST RESULTS

Geotechnical Evaluation
Proposed Multi-Family Residential Development, Cypress, California
Project No. 2155-CR

GEOTEK

SUMMARY OF LABORATORY TESTING

Classification
Soils were classified visually in general accordance to the Unified Soil Classification System (ASTM Test Method D 2487). The soil classifications are shown on the logs of exploratory borings in Appendix A.

In Situ Moisture Content and Unit Weight
The field moisture content was measured in the laboratory on selected samples collected during the field investigation. The field moisture content is determined as a percentage of the dry unit weight. The dry density was measured in the laboratory on selected ring samples. The results are shown on the logs of exploratory borings in Appendix A.

Moisture-Density Relationship
Laboratory testing was performed on two samples collected during the subsurface exploration. The laboratory maximum dry density and optimum moisture content for the soil type was determined in general accordance with test method ASTM Test Procedure D 1557. The results are presented herein.

Direct Shear
Direct shear testing was performed on remolded samples of the surficial soils according to ASTM Test Method D 3080. The results of these tests are presented herein.

Expansion Index
The expansion potential of the soils was determined by performing expansion index tests on two representative soil samples from the site in general accordance with ASTM D 4829. The results of these tests are presented herein.

Consolidation/Collapse
Consolidation/collapse tests were conducted in accordance with ASTM D2435. The results of these tests are presented herein.

Atterberg Limits
Atterberg limits testing were performed on two fine-grained samples collected from the site. The tests were performed in general accordance with ASTM D 4318. The test results are presented herein.

Percent of Soil Finer than No. 200 Sieve
Tests to determine the percent of soil finer than No. 200 sieve were performed on selected samples obtained from the property. The tests were conducted in general accordance with ASTM D1140. The results of these tests are presented herein.

Sulfate Content, Resistivity and Chloride Content
Testing to determine the water-soluble sulfate content was performed by others in general accordance with California Test No. 417. Resistivity testing was completed by others in general accordance with California Test No. 643. Testing to determine the chloride content was performed by others in general accordance with California Test No. 422. The results are included herein.

GEOTEK

MOISTURE/DENSITY RELATIONSHIP

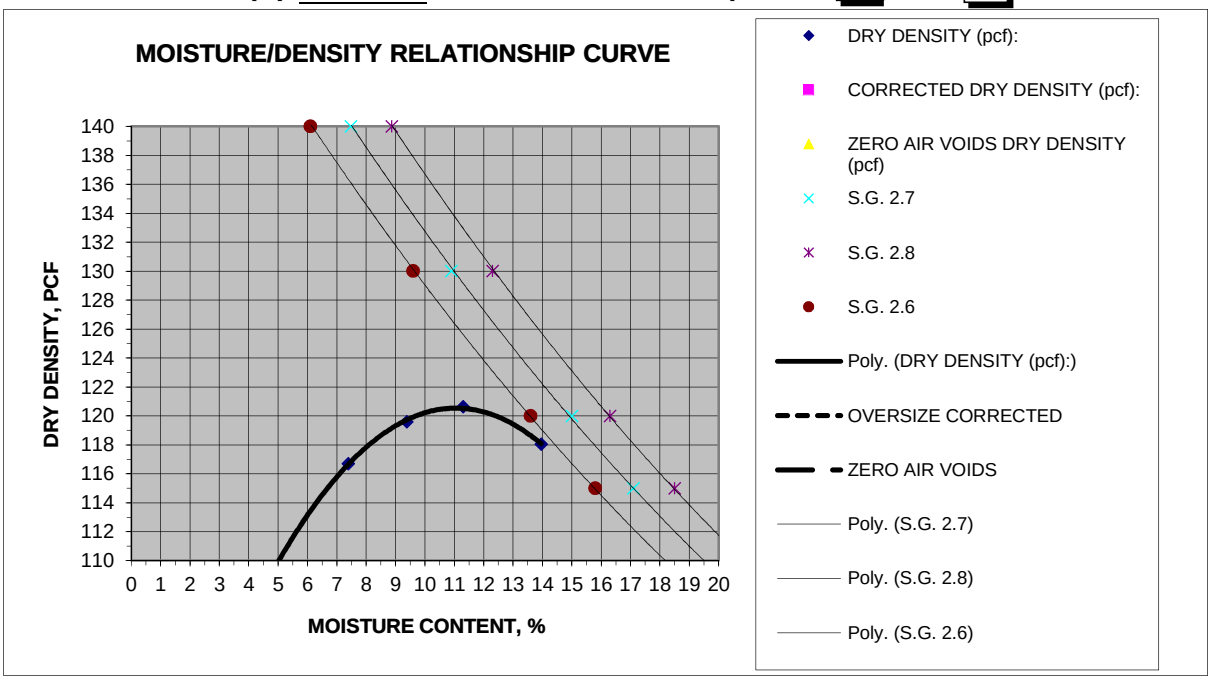
Client: Melia Homes
Project: 7 Acre Site
Location: Cypress
Material Type: Light Gray Brown Silty Sand w/Clay
Material Supplier: -
Material Source: -
Sample Location: B-1 @ 1 - 5 ft
-

Job No.: 2155-CR
Lab No.: Corona

Sampled By: DA
Received By: DLI
Tested By: MC
Reviewed By: -

Date Sampled: 7/29/2019
Date Received: 7/30/2019
Date Tested: 7/30/2019
Date Reviewed: -

Test Procedure: ASTM D1557 **Method:** A
Oversized Material (%): 0.0 **Correction Required:** [ ] yes [x] no



MOISTURE DENSITY RELATIONSHIP VALUES

Maximum Dry Density, pcf	121.0	**@ Optimum Moisture, %**	11.5
Corrected Maximum Dry Density, pcf		**@ Optimum Moisture, %**	

MATERIAL DESCRIPTION

Grain Size Distribution:

	% Gravel (retained on No. 4)
	% Sand (Passing No. 4, Retained on No. 200)
	% Silt and Clay (Passing No. 200)

Atterberg Limits:

	Liquid Limit, %
	Plastic Limit, %
	Plasticity Index, %

Classification:

Unified Soils Classification:

AASHTO Soils Classification:

GEOTEK

MOISTURE/DENSITY RELATIONSHIP

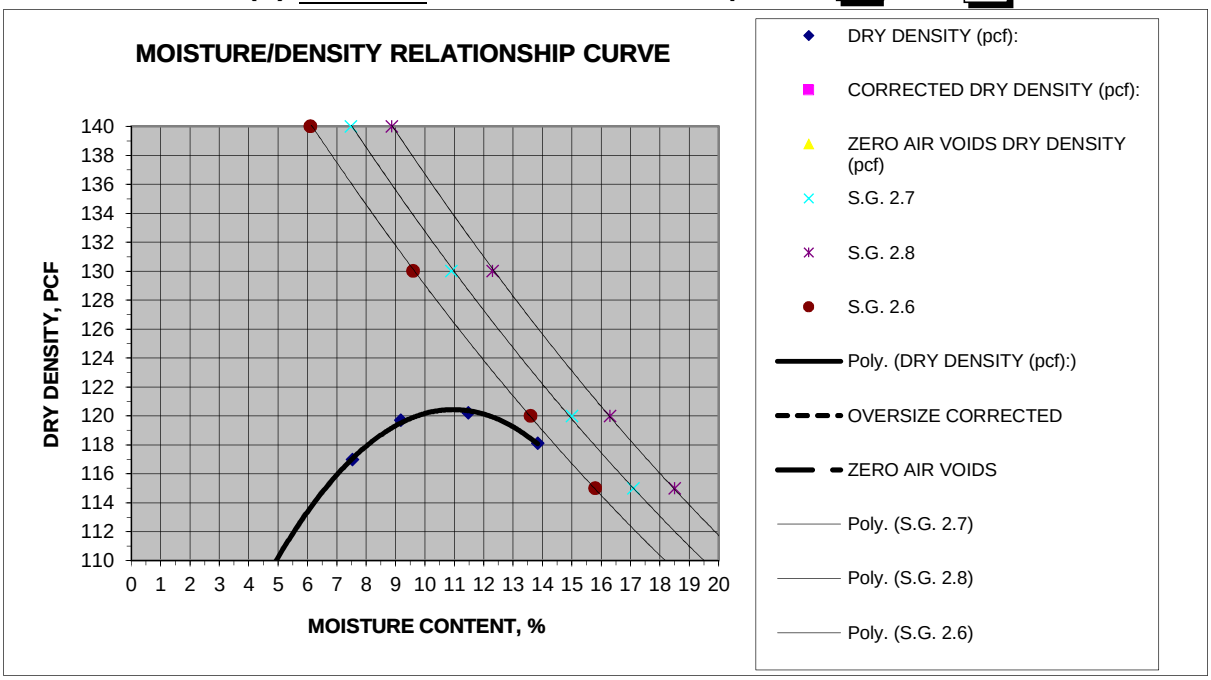
Client: Melia Homes
Project: 7 Acre Site
Location: Cypress
Material Type: Light Brown F - M Sand w/Silt
Material Supplier: -
Material Source: -
Sample Location: B-4 @ 1 - 2 ft
-

Job No.: 2155-CR
Lab No.: Corona

Sampled By: DA
Received By: DLI
Tested By: MC
Reviewed By: -

Date Sampled: 7/29/2019
Date Received: 7/30/2019
Date Tested: 7/30/2019
Date Reviewed: -

Test Procedure: ASTM D1557 **Method:** A
Oversized Material (%): 1.1 **Correction Required:** [ ] yes [x] no



MOISTURE DENSITY RELATIONSHIP VALUES

Maximum Dry Density, pcf	120.5	**@ Optimum Moisture, %**	11.0
Corrected Maximum Dry Density, pcf		**@ Optimum Moisture, %**	

MATERIAL DESCRIPTION

Grain Size Distribution:

	% Gravel (retained on No. 4)
	% Sand (Passing No. 4, Retained on No. 200)
	% Silt and Clay (Passing No. 200)

Atterberg Limits:

	Liquid Limit, %
	Plastic Limit, %
	Plasticity Index, %

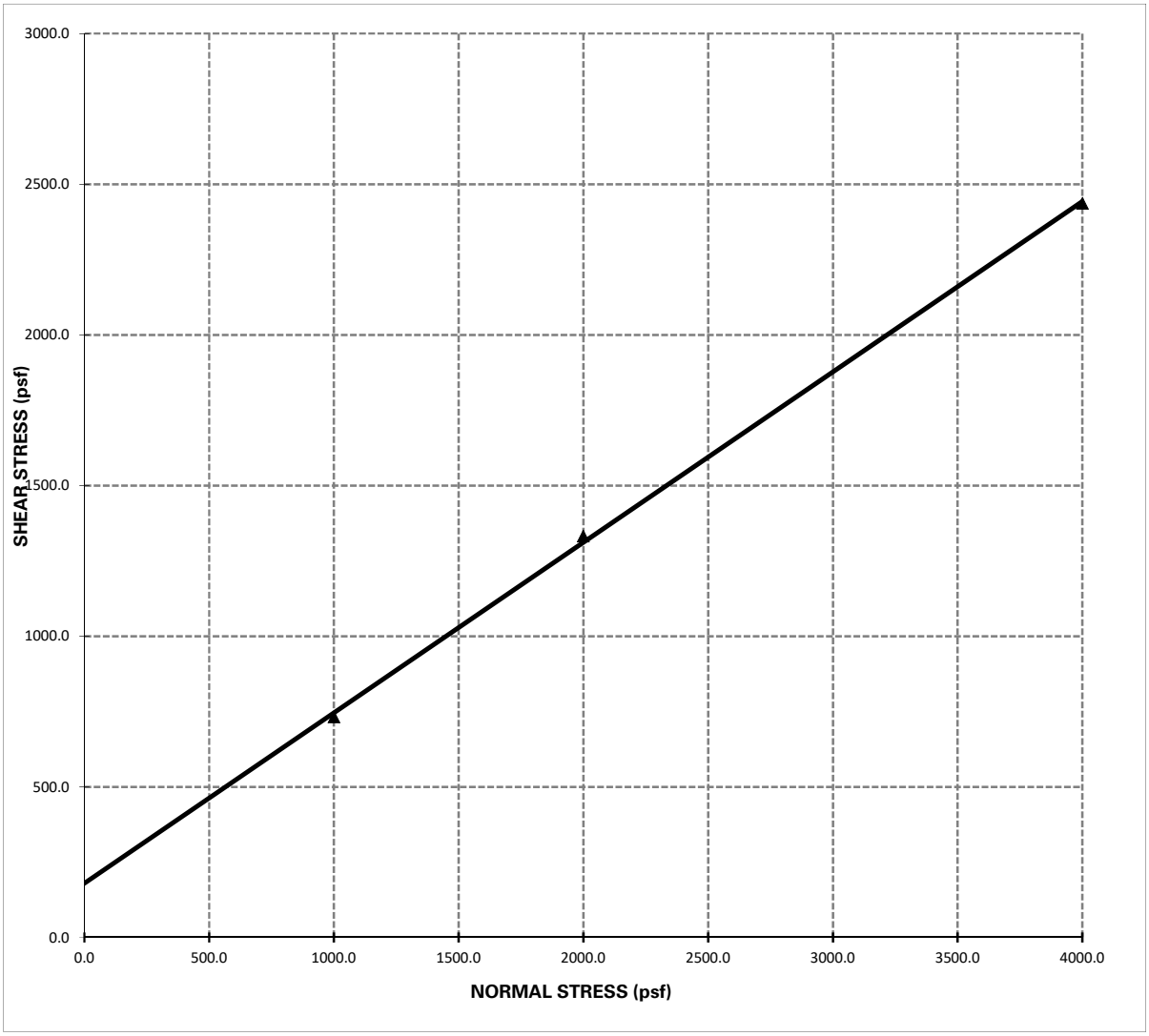
Classification:

Unified Soils Classification: _____

AASHTO Soils Classification: _____

DIRECT SHEAR TEST

Project Name:	7 Acre Site Cypress	***Sample Location:***	B-1 @ 1 - 5 ft
Project Number:	2155-CR	***Date Tested:***	8/2/2019



Shear Strength: Φ = **29.5 °** , **C = 180.00 psf**

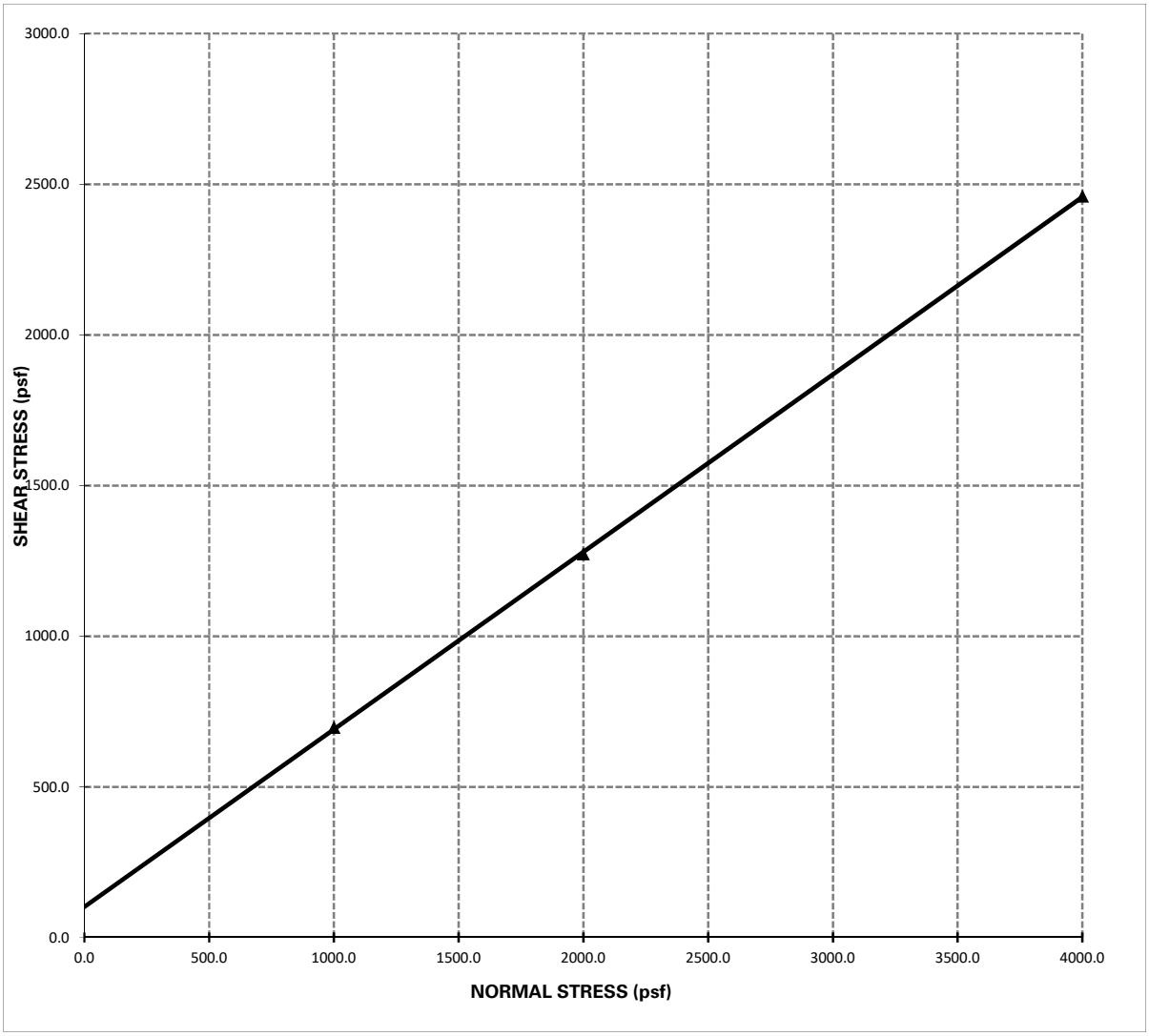
Notes: 1 - The soil specimen used in the shear box was a ring sample remolded to approximately 90% relative compaction from a bulk sample collected during the field investigation.

2 - The above reflect direct shear strength at saturated conditions.

3 - The tests were run at a shear rate of 0.035 in/min.

DIRECT SHEAR TEST

Project Name:	7 Acre Site Cypress	***Sample Location:***	B-4 @ 1 - 2 ft
Project Number:	2155-CR	***Date Tested:***	8/2/2019



Shear Strength: Φ = **30.5 °** , **C = 102.00 psf**

Notes: 1 - The soil specimen used in the shear box was a ring sample remolded to approximately 90% relative compaction from a bulk sample collected during the field investigation.

2 - The above reflect direct shear strength at saturated conditions.

3 - The tests were run at a shear rate of 0.035 in/min.

GEOTEK

EXPANSION INDEX TEST

(ASTM D4829)

Client:	Melia Homes	***Tested/ Checked By:***	MC Lab No Corona
Project Number:	2155-CR	***Date Tested:***	8/1/2019
Project Location:	7 Acre Site Cypress	***Sample Source:***	B-1 @ 1 - 5 ft
		Sample Description:	

Ring #:_____ Ring Dia. : 4.01" Ring Ht.1"

DENSITY DETERMINATION

A	Weight of compacted sample & ring (gm)	759.4
B	Weight of ring (gm)	366.8
C	Net weight of sample (gm)	**392.6**
D	Wet Density, lb / ft3 (C*0.3016)	**118.4**
E	Dry Density, lb / ft3 (D/1.F)	**107.4**

SATURATION DETERMINATION

F	Moisture Content, %	10.3
G	Specific Gravity, assumed	**2.70**
H	Unit Wt. of Water @ 20 °C, (pcf)	**62.4**
I	% Saturation	**48.8**

READINGS

DATE	TIME	READING	
8/1/2019	13:00	0.2350	Initial
	13:10	0.2340	10 min/Dry
8/4/2019	7:55	0.2560	Final

FINAL MOISTURE

Final Weight of wet sample & tare	% Moisture
802.7	**21.3**

EXPANSION INDEX = 22

GEOTEK

EXPANSION INDEX TEST

(ASTM D4829)

Client:	Melia Homes	***Tested/ Checked By:***	DI Lab No Corona
Project Number:	2155-CR	***Date Tested:***	8/1/2019
Project Location:	7 Acre Site Cypress	***Sample Source:***	B-4 @ 1 - 2 ft
		Sample Description:	

Ring #:_____ Ring Dia. : 4.01" Ring Ht.1"

DENSITY DETERMINATION

A	Weight of compacted sample & ring (gm)	757.9
B	Weight of ring (gm)	362.4
C	Net weight of sample (gm)	**395.5**
D	Wet Density, lb / ft3 (C*0.3016)	**119.3**
E	Dry Density, lb / ft3 (D/1.F)	**107.7**

SATURATION DETERMINATION

F	Moisture Content, %	10.8
G	Specific Gravity, assumed	**2.70**
H	Unit Wt. of Water @ 20 °C, (pcf)	**62.4**
I	% Saturation	**51.6**

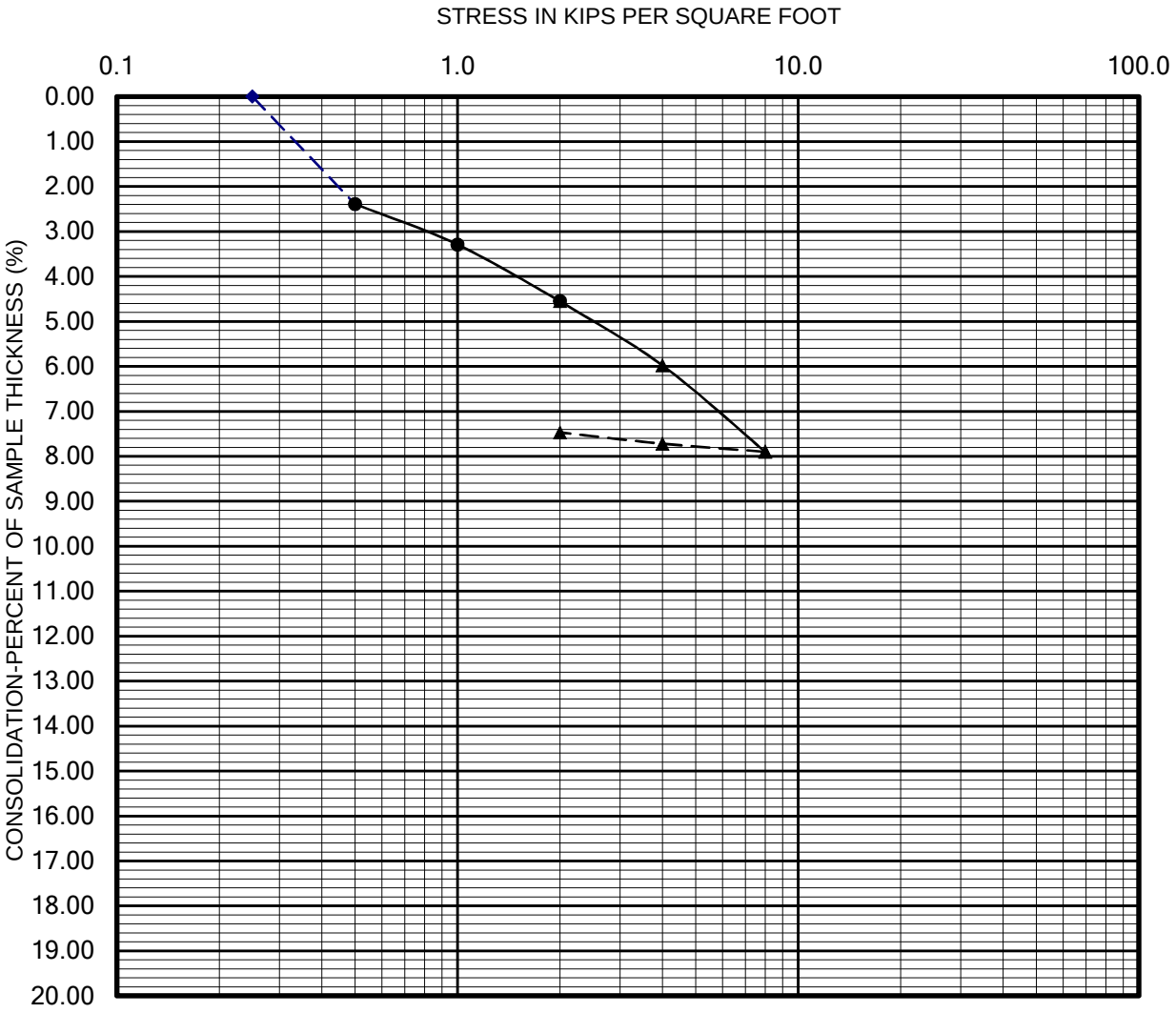
READINGS

DATE	TIME	READING	
8/1/2019	7:44	0.1780	Initial
	7:54	0.1780	10 min/Dry
8/4/2019	7:55	0.1780	Final

FINAL MOISTURE

Final Weight of wet sample & tare	% Moisture
778.8	**16.1**

EXPANSION INDEX = 0



Seating Cycle
Loading Prior to Inundation
Loading After Inundation
Rebound Cycle

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 2435

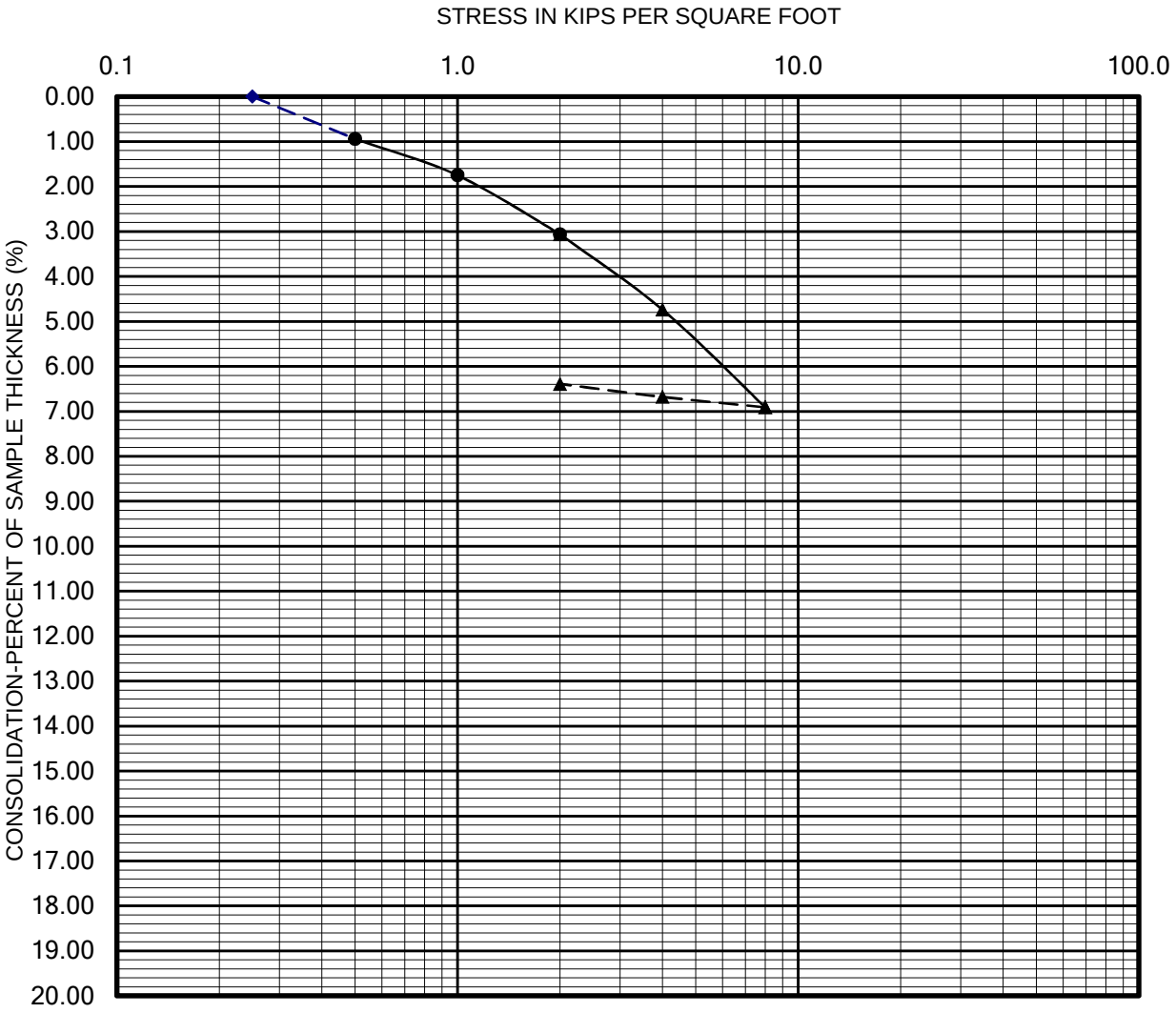
GEOTEK

CHECKED BY:	Lab:
PROJECT NO.: 2155-CR	Date: 7/31/2019

CONSOLIDATION REPORT

Sample:

B-2 @ 10 ft



Seating Cycle
Loading Prior to Inundation
Loading After Inundation
Rebound Cycle

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 2435

GEOTEK

CHECKED BY:	Lab:
PROJECT NO.: 2155-CR	Date: 7/31/2019

CONSOLIDATION REPORT

Sample:

B-4 @ 6.5

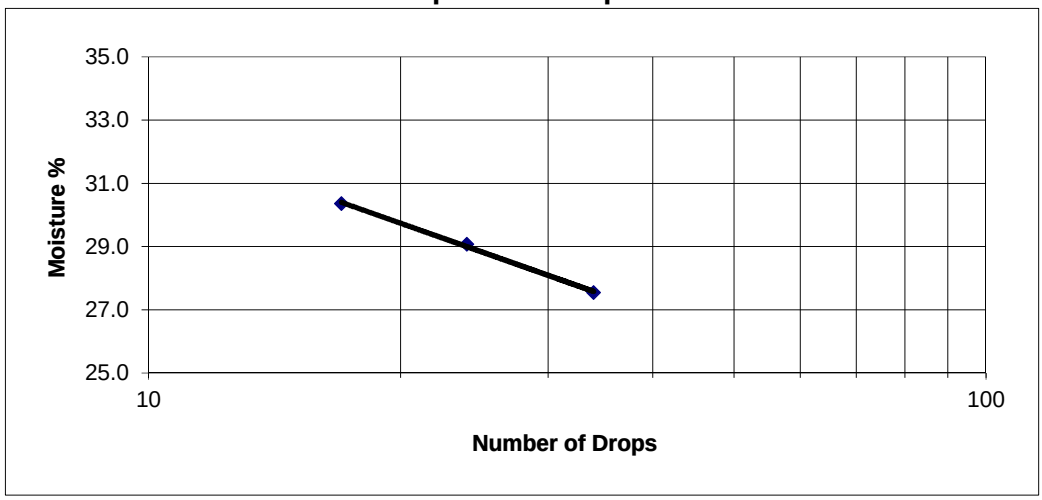
GEOTEK

ATTERBERG LIMITS DATA

Field Classification		Job No.	2155-CR
Sample Number		Client	Melia Homes
Sample Type	Bulk	Project	7 Acre Site Cypress
Location	B-1 @ 1 - 5 ft		
Tested by:	DI		

	Plastic Limit			Liquid Limit		
Number of Blows				34	24	17
Wt. of Dish + Wet Soil	13.49	13.62		20.41	20.36	20.38
Wt. of Dish + Dry Soil	12.37	12.49		17.32	17.15	17.05
Wt. of Moisture	1.12	1.13		3.09	3.21	3.33
Wt. of Dish	6.08	6.11		6.10	6.11	6.08
Wt. of Dry Soil	6.29	6.38		11.22	11.04	10.97
Moisture Content %	17.8	17.7		27.5	29.1	30.4

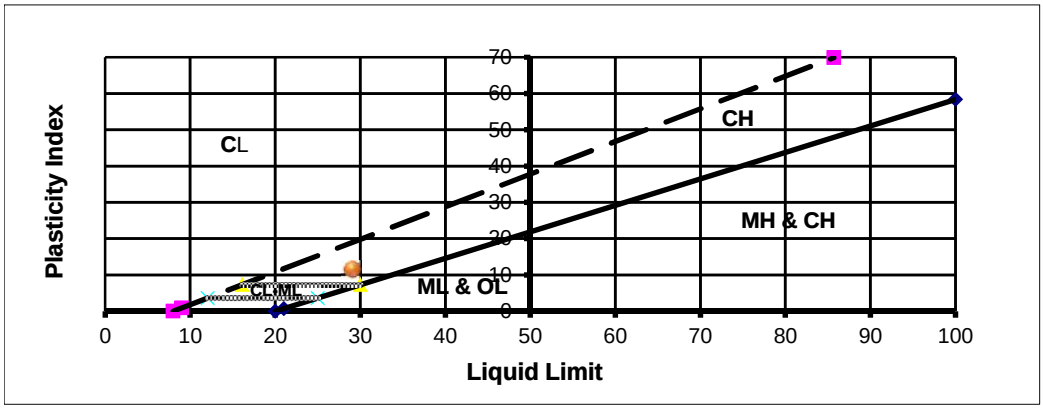
Liquid Limit Graph



Liquid Limit
29

Plastic Limit
18

Plasticity Index
11



GEOTEK

-200 WASH

Date:	8/5/2019		
W.O.:	2155-CR	sample ID	B-1
Client:	Melia Homes	depth	1-5 ft
Project:	7 Acre Site Cypress		

Sieve Size	Particle Diameter		Wt. Retained	Wt. Passing	% Passing	Specs
	in.	mm.				
#200	0.0029	0.074	85	115	57.5%	

Dry Weight		200
Soak Time	1440	Minutes

GEOTEK

-200 WASH

Date:	8/2/2019		
W.O.:	2155-CR	sample ID	B-1
Client:	Melia Homes	depth	5 ft
Project:	7 Acre Sitew Cypress		

Sieve Size	Particle Diameter		Wt. Retained	Wt. Passing	% Passing	Specs
	in.	mm.				
#200	0.0029	0.074	151	49	24.5%	

Dry Weight		200
Soak Time	1440	Minutes

GEOTEK

-200 WASH

Date:	8/2/2019		
W.O.:	2155-CR	sample ID	B-1
Client:	Melia Homes	depth	15 ft
Project:	7 Acre Sitew Cypress		

Sieve Size	Particle Diameter		Wt. Retained	Wt. Passing	% Passing	Specs
	in.	mm.				
#200	0.0029	0.074	106.5	93.5	46.8%	

Dry Weight	200	
Soak Time	1440	Minutes

GEOTEK

-200 WASH

Date:	8/2/2019		
W.O.:	2155-CR	sample ID	B-1 ft
Client:	Melia Homes	depth	25
Project:	7 Acre Sitew Cypress		

Sieve Size	Particle Diameter		Wt. Retained	Wt. Passing	% Passing	Specs
	in.	mm.				
#200	0.0029	0.074	13.4	186.6	93.3%	

Dry Weight	200	
Soak Time	1440	Minutes

GEOTEK

-200 WASH

Date:	8/2/2019		
W.O.:	2155-CR	sample ID	B-1
Client:	Melia Homes	depth	35 ft
Project:	7 Acre Sitew Cypress		

Sieve Size	Particle Diameter		Wt. Retained	Wt. Passing	% Passing	Specs
	in.	mm.				
#200	0.0029	0.074	178.9	21.1	10.6%	

Dry Weight	200	
Soak Time	1440	Minutes

Soil Analysis Lab Results

Client: GeoTek, Inc.
Job Name: 7 Acre Site, Cypress
Client Job Number: 2155-CR
Project X Job Number: S190802C
August 6, 2019

	Method	ASTM D4327		ASTM D4327		ASTM G187		ASTM G51	ASTM G200	SM 4500-S2-D	ASTM D4327	ASTM D4327	ASTM D4327	ASTM D4327	ASTM D4327	ASTM D4327	ASTM D4327	ASTM D4327	ASTM D4327	SM-2320B
Bore# / Description	**Depth**	**Sulfates** SO_4^{2-}		**Chlorides** Cl^-		**Resistivity** As Rec'd	Minimum	**pH**	**Redox**	**Sulfide** S^{2-}	**Nitrate** NO_3^-	**Ammonium** NH_4^+	**Lithium** Li^+	**Sodium** Na^+	**Potassium** K^+	**Magnesium** Mg^{2+}	**Calcium** Ca^{2+}	**Flouride** F_2^{--}	**Phosphate** PO_4^{3-}	**Bicarbonate** HCO_3^-
	(ft)	(mg/kg)	(wt%)	(mg/kg)	(wt%)	(Ohm-cm)	(Ohm-cm)		(mV)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
B-1	1.0-5.0	192.3	0.0192	35.4	0.0035	4,958	2,010	9.8	108.0	0.6	118.9	2.6	0.6	432.5	11.4	59.8	205.2	12.2	0.7	214
B-4	1.0-2.0	71.4	0.0071	26.5	0.0027	5,762	2,010	10.0	98.0	0.6	54.7	3.4	0.3	317.4	7.0	28.0	171.6	8.6	0.9	55

Cations and Anions, except Sulfide and Bicarbonate, tested with Ion Chromatography
mg/kg = milligrams per kilogram (parts per million) of dry soil weight
ND = 0 = Not Detected | NT = Not Tested | Unk = Unknown
Chemical Analysis performed on 1:3 Soil-To-Water extract

APPENDIX D

RESULTS OF LIQUEFACTION ANALYSES

Geotechnical Evaluation
Proposed Multi-Family Residential Development, Cypress, California
Project No. 2155-CR

GEOTEK

GeoTek, Inc.
1548 N. Maple Street
Corona, CA 92880
http://www.geotekusa.com

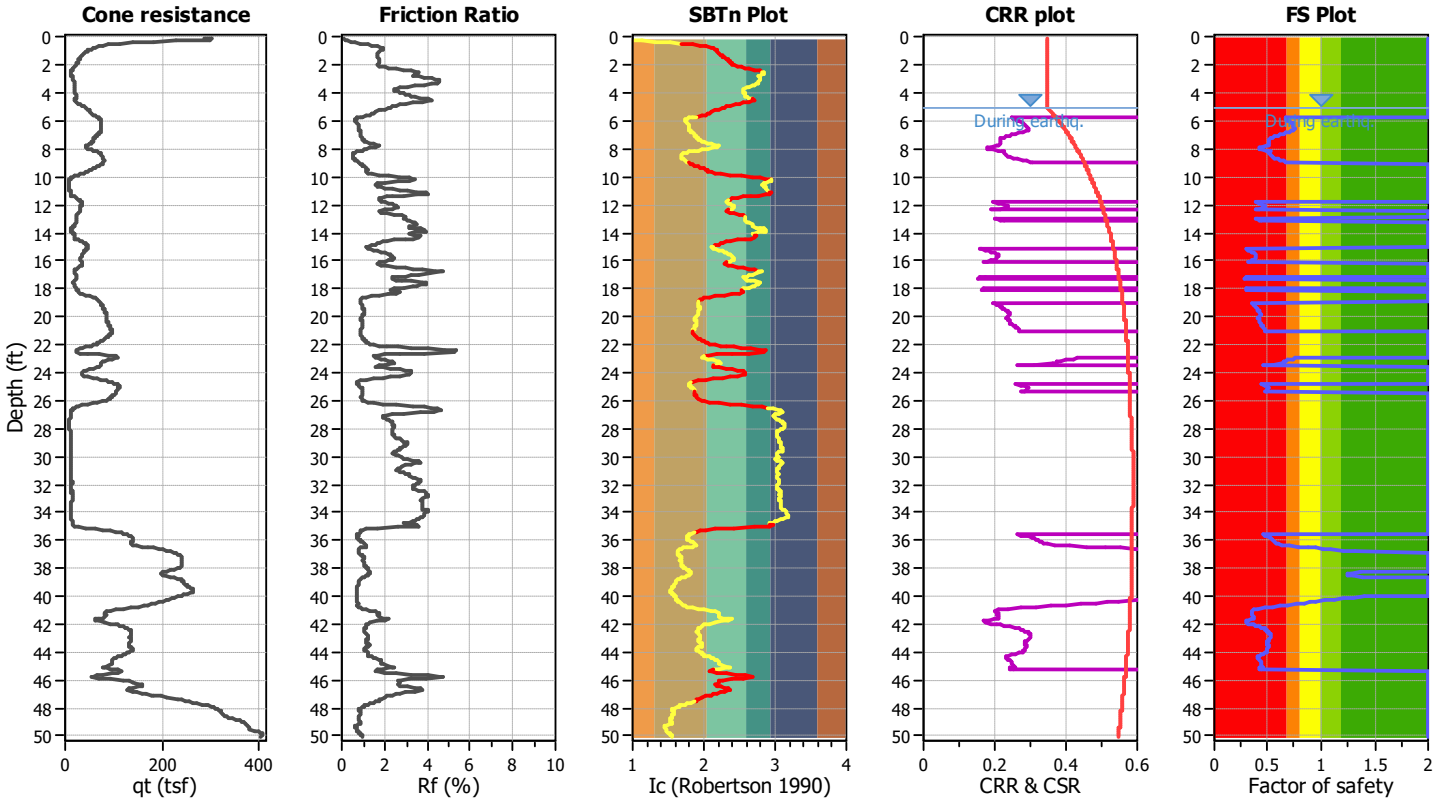
LIQUEFACTION ANALYSIS REPORT

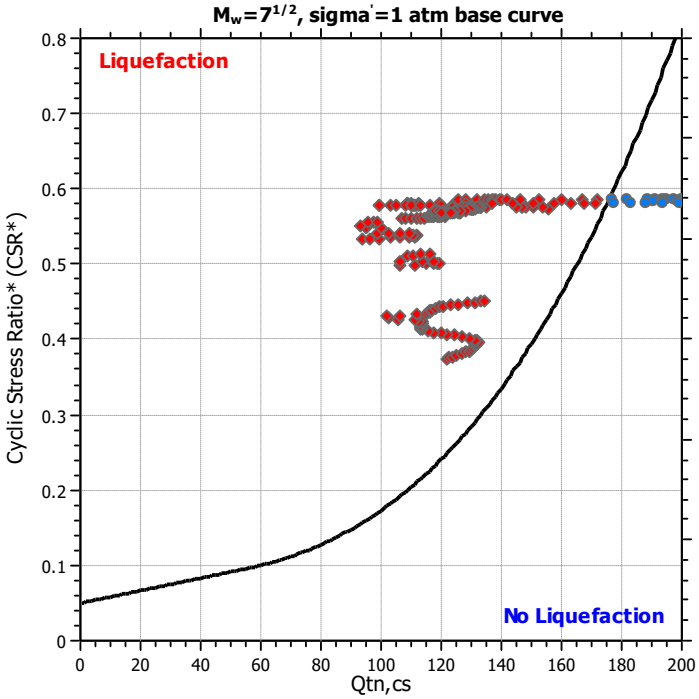
Project title : 7-Acre Site, Cypress Town Center **Location : Cypress, CA**

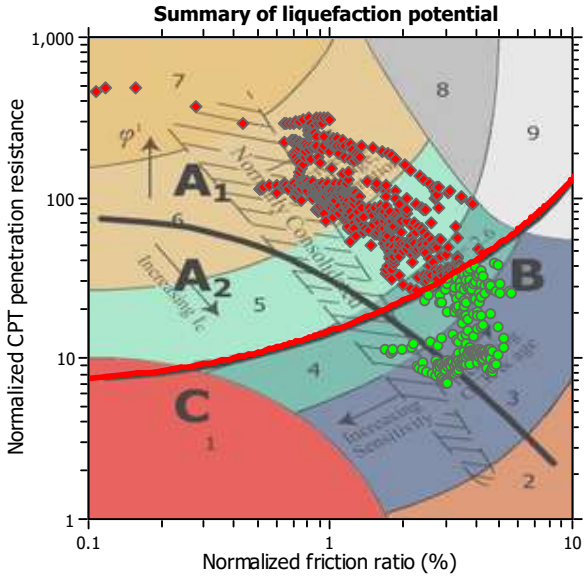
CPT file : CPT-1

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	6.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	5.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	50.00 ft
Earthquake magnitude M_w:	6.71	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.55	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

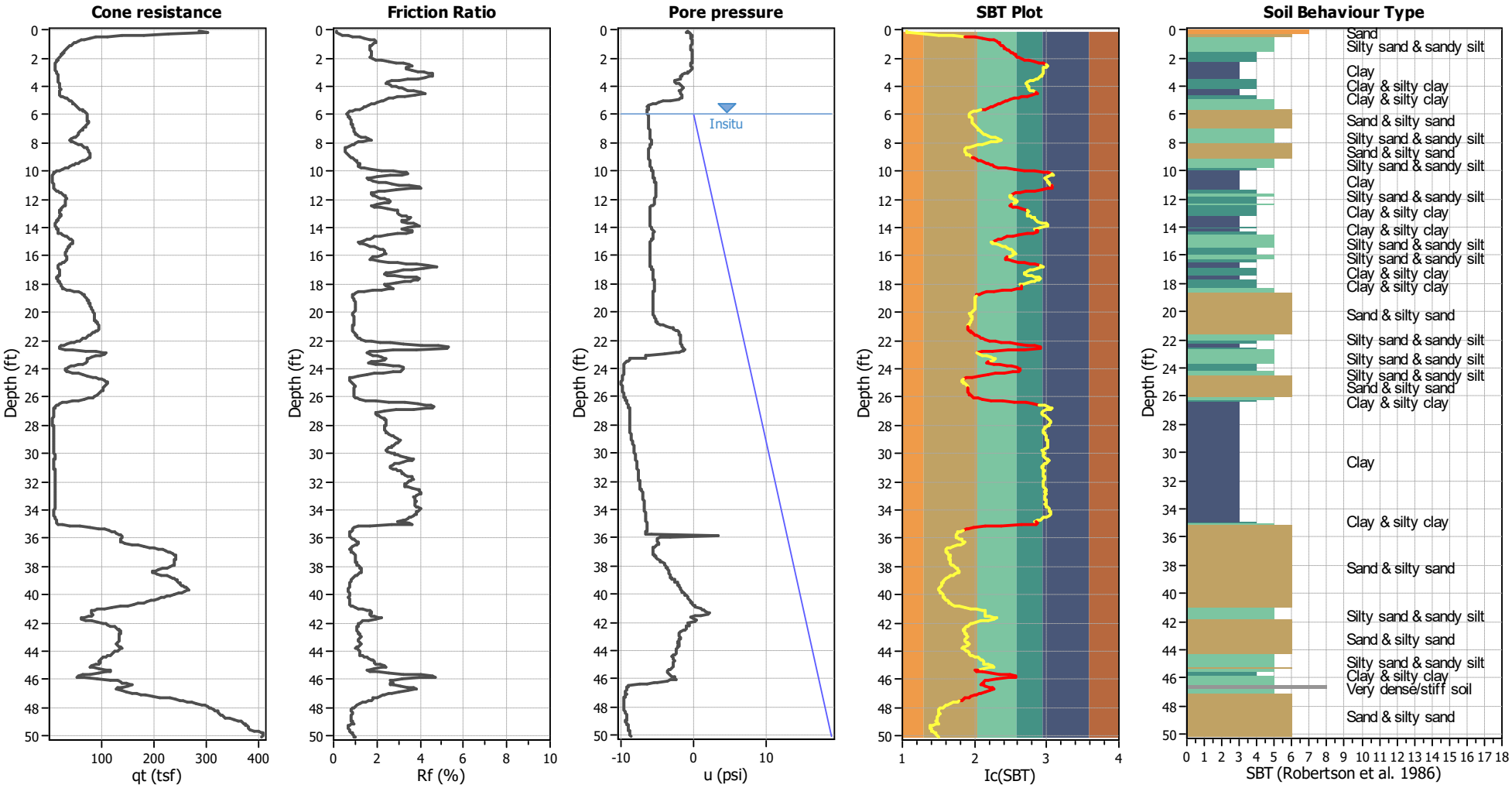






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



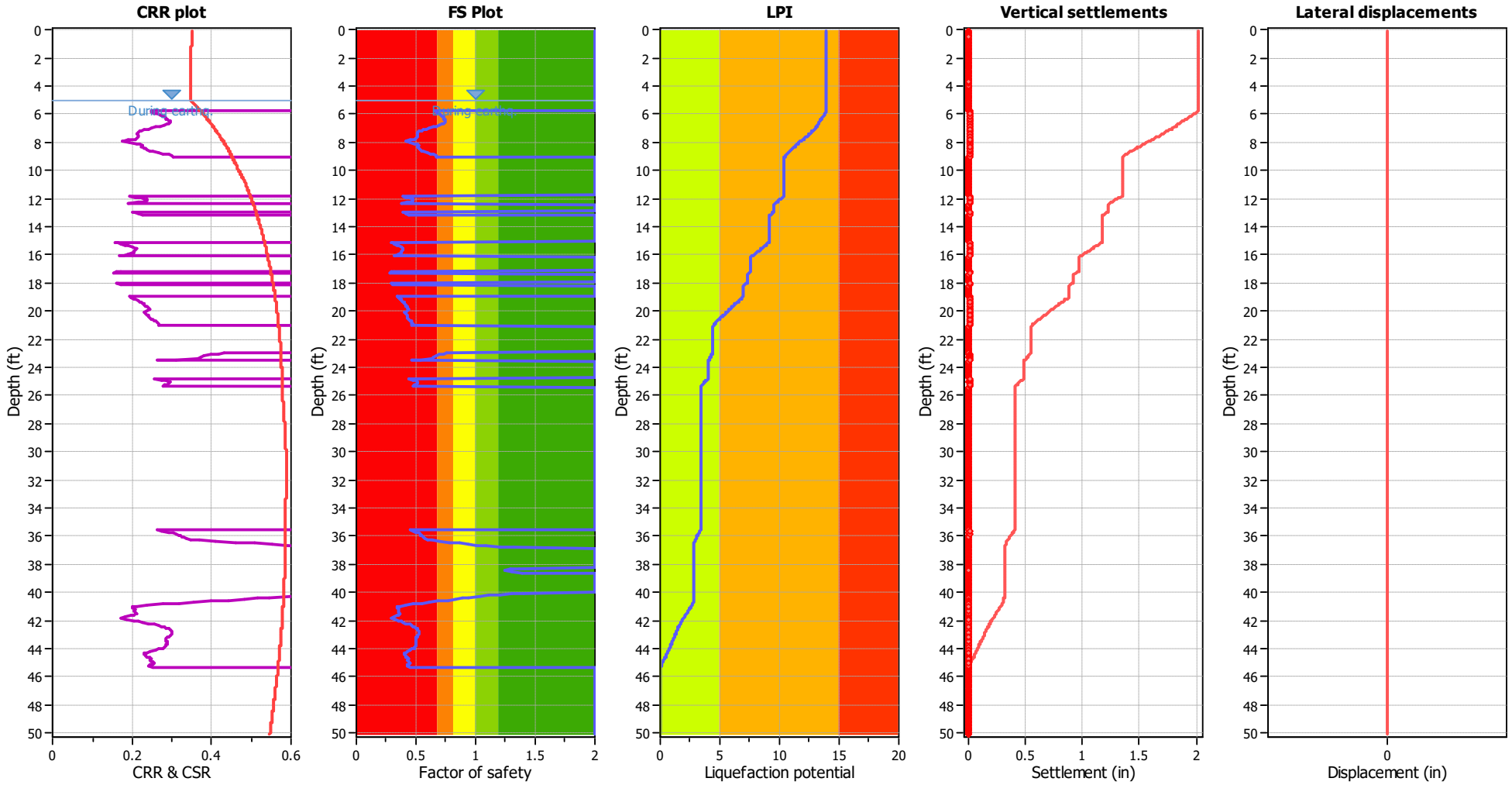
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.71	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	6.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

SBT legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.71	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	6.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

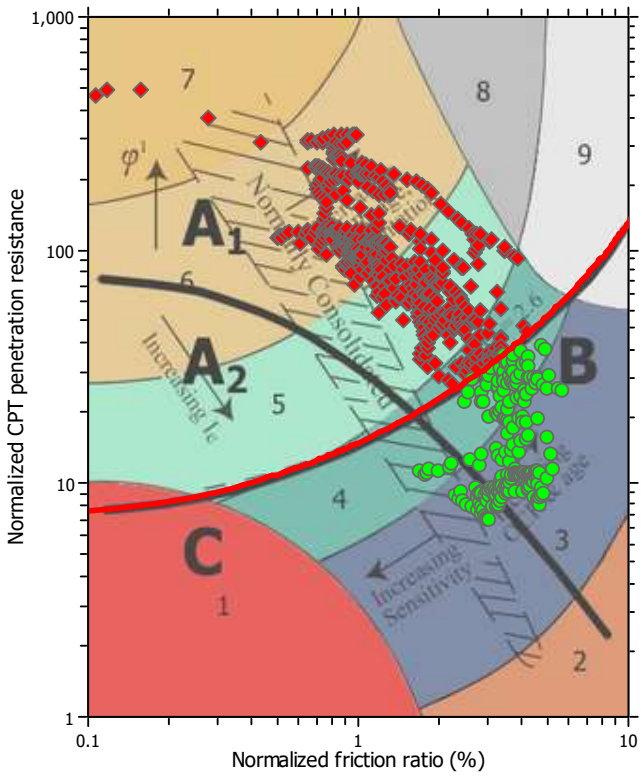
F.S. color scheme

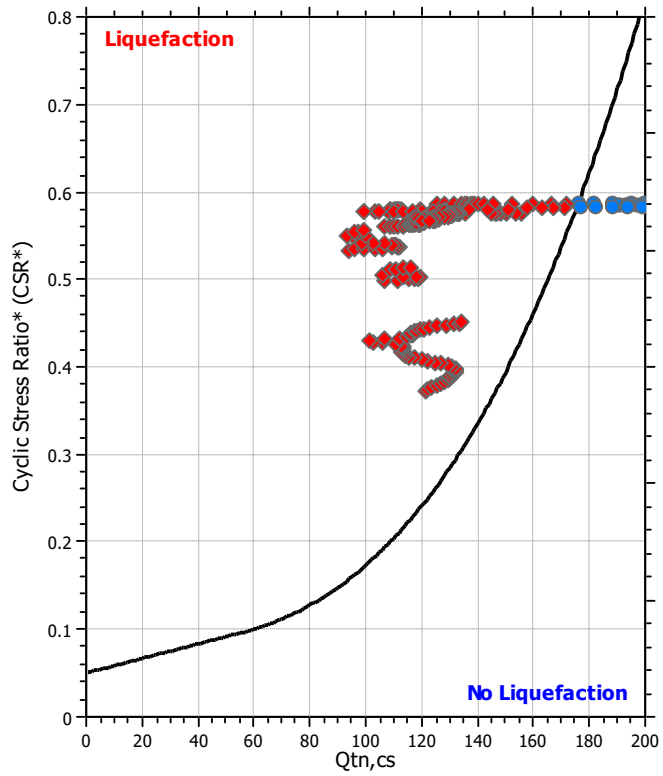
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

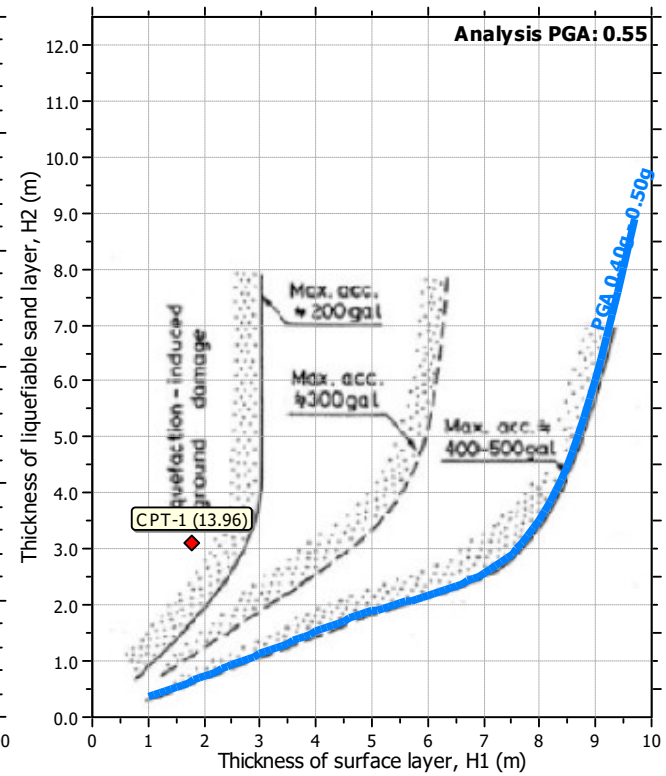
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots







Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.71	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	6.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

:: Post-earthquake settlement of dry sands ::

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
0.08	0.85	458.76	1.00	458.76	66	750	0.35	0.000	0.00	8.70	0.00	0.000
0.14	0.83	488.99	1.00	488.99	70	786	0.35	0.000	0.00	8.70	0.00	0.000
0.21	0.89	482.55	1.00	482.55	70	835	0.35	0.001	0.00	8.70	0.00	0.000
0.27	1.12	368.91	1.00	368.91	57	853	0.35	0.001	0.00	8.70	0.00	0.000
0.34	1.32	289.92	1.00	289.92	48	867	0.35	0.001	0.00	8.70	0.00	0.000
0.40	1.52	223.48	1.00	223.48	39	861	0.35	0.001	0.00	8.70	0.00	0.000
0.47	1.68	179.49	1.03	184.39	34	849	0.35	0.001	0.00	8.70	0.00	0.000
0.53	1.84	144.42	1.14	164.56	0	0	0.35	0.000	0.00	8.70	0.00	0.000
0.60	1.94	126.91	1.23	155.72	0	0	0.35	0.000	0.00	8.70	0.00	0.000
0.66	2.03	109.87	1.35	147.96	0	0	0.35	0.000	0.00	8.70	0.00	0.000
0.73	2.10	98.39	1.45	143.01	0	0	0.35	0.000	0.00	8.70	0.00	0.000
0.79	2.13	90.75	1.52	138.08	0	0	0.35	0.000	0.00	8.70	0.00	0.000
0.86	2.16	83.79	1.57	131.41	0	0	0.35	0.000	0.00	8.70	0.00	0.000
0.93	2.17	77.23	1.61	124.13	0	0	0.35	0.000	0.00	8.70	0.00	0.000
1.00	2.18	72.03	1.63	117.30	0	0	0.35	0.000	0.00	8.70	0.00	0.000
1.06	2.19	67.92	1.65	111.85	0	0	0.35	0.000	0.00	8.70	0.00	0.000
1.12	2.20	63.87	1.68	107.20	0	0	0.35	0.000	0.00	8.70	0.00	0.000
1.20	2.22	60.22	1.72	103.58	0	0	0.35	0.000	0.00	8.70	0.00	0.000
1.26	2.24	57.15	1.77	100.89	0	0	0.35	0.000	0.00	8.70	0.00	0.000
1.31	2.25	54.45	1.81	98.60	0	0	0.35	0.000	0.00	8.70	0.00	0.000
1.39	2.27	52.06	1.86	96.95	0	0	0.35	0.000	0.00	8.70	0.00	0.000
1.45	2.29	49.51	1.93	95.35	0	0	0.35	0.000	0.00	8.70	0.00	0.000
1.52	2.31	47.37	1.99	94.06	0	0	0.35	0.000	0.00	8.70	0.00	0.000
1.59	2.33	45.24	2.05	92.69	0	0	0.35	0.000	0.00	8.70	0.00	0.000
1.65	2.35	43.26	2.11	91.36	0	0	0.35	0.000	0.00	8.70	0.00	0.000
1.72	2.36	41.49	2.17	90.02	0	0	0.35	0.000	0.00	8.70	0.00	0.000
1.78	2.38	39.71	2.23	88.53	0	0	0.35	0.000	0.00	8.70	0.00	0.000
1.84	2.39	37.94	2.26	85.80	0	0	0.35	0.000	0.00	8.70	0.00	0.000
1.91	2.40	35.86	2.32	83.23	0	0	0.35	0.000	0.00	8.70	0.00	0.000
1.98	2.42	33.77	2.41	81.33	0	0	0.35	0.000	0.00	8.70	0.00	0.000
2.04	2.46	31.48	2.59	81.55	0	0	0.35	0.000	0.00	8.70	0.00	0.000
2.11	2.52	29.09	2.85	83.01	0	0	0.35	0.000	0.00	8.70	0.00	0.000
2.17	2.58	26.79	3.18	85.30	0	0	0.35	0.000	0.00	8.70	0.00	0.000
2.25	2.64	24.45	3.60	88.01	0	0	0.35	0.000	0.00	0.00	0.00	0.000
2.32	2.71	22.16	4.07	90.29	0	0	0.35	0.000	0.00	0.00	0.00	0.000
2.38	2.78	20.08	4.59	92.10	0	0	0.35	0.000	0.00	0.00	0.00	0.000
2.44	2.82	18.77	4.95	92.98	0	0	0.35	0.000	0.00	0.00	0.00	0.000
2.52	2.84	18.25	5.12	93.42	0	0	0.35	0.000	0.00	0.00	0.00	0.000
2.56	2.83	18.40	5.05	92.87	0	0	0.35	0.000	0.00	0.00	0.00	0.000
2.64	2.81	18.97	4.89	92.71	0	0	0.35	0.000	0.00	0.00	0.00	0.000
2.70	2.78	20.16	4.64	93.47	0	0	0.35	0.000	0.00	0.00	0.00	0.000
2.78	2.77	21.08	4.55	95.85	0	0	0.35	0.000	0.00	0.00	0.00	0.000
2.83	2.77	22.12	4.56	100.81	0	0	0.35	0.000	0.00	0.00	0.00	0.000
2.91	2.78	22.93	4.63	106.22	0	0	0.35	0.000	0.00	0.00	0.00	0.000
2.96	2.79	24.12	4.68	112.91	0	0	0.35	0.000	0.00	0.00	0.00	0.000
3.04	2.78	25.46	4.64	118.04	0	0	0.35	0.000	0.00	0.00	0.00	0.000
3.09	2.78	26.74	4.60	122.91	0	0	0.35	0.000	0.00	0.00	0.00	0.000
3.17	2.77	27.77	4.52	125.65	0	0	0.35	0.000	0.00	0.00	0.00	0.000

:: Post-earthquake settlement of dry sands :: (continued)

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
3.23	2.76	28.33	4.47	126.58	0	0	0.35	0.000	0.00	0.00	0.00	0.000
3.30	2.75	28.53	4.39	125.14	0	0	0.35	0.000	0.00	0.00	0.00	0.000
3.36	2.73	28.53	4.25	121.34	0	0	0.35	0.000	0.00	0.00	0.00	0.000
3.44	2.71	28.41	4.08	115.95	0	0	0.35	0.000	0.00	0.00	0.00	0.000
3.49	2.68	28.50	3.83	109.03	0	0	0.35	0.000	0.00	0.00	0.00	0.000
3.57	2.64	28.80	3.56	102.64	0	0	0.35	0.000	0.00	0.00	0.00	0.000
3.62	2.59	29.62	3.29	97.57	26	443	0.35	0.047	0.03	8.70	0.02	0.000
3.70	2.56	30.60	3.11	95.25	25	441	0.35	0.050	0.04	8.70	0.03	0.001
3.76	2.54	31.75	3.00	95.35	25	446	0.35	0.050	0.04	8.70	0.03	0.000
3.83	2.54	32.43	2.99	97.02	26	454	0.35	0.049	0.04	8.70	0.03	0.000
3.88	2.55	32.63	3.05	99.48	26	463	0.35	0.047	0.03	8.70	0.02	0.000
3.96	2.57	32.60	3.12	101.70	27	470	0.35	0.047	0.03	8.70	0.02	0.000
4.01	2.58	32.55	3.23	105.02	28	480	0.35	0.045	0.03	8.70	0.02	0.000
4.09	2.59	33.48	3.25	108.72	29	496	0.35	0.042	0.03	8.70	0.02	0.000
4.14	2.59	34.85	3.26	113.48	31	518	0.35	0.039	0.02	8.70	0.02	0.000
4.22	2.59	35.88	3.25	116.71	31	533	0.35	0.037	0.02	8.70	0.02	0.000
4.27	2.61	35.30	3.37	119.11	0	0	0.35	0.000	0.00	0.00	0.00	0.000
4.35	2.64	33.58	3.61	121.25	0	0	0.35	0.000	0.00	0.00	0.00	0.000
4.42	2.68	32.11	3.88	124.47	0	0	0.35	0.000	0.00	0.00	0.00	0.000
4.47	2.70	31.74	4.01	127.43	0	0	0.35	0.000	0.00	0.00	0.00	0.000
4.55	2.69	32.62	3.91	127.40	0	0	0.35	0.000	0.00	0.00	0.00	0.000
4.60	2.63	35.32	3.53	124.63	0	0	0.35	0.000	0.00	0.00	0.00	0.000
4.68	2.56	38.95	3.12	121.42	0	0	0.35	0.000	0.00	8.70	0.00	0.000
4.72	2.49	44.09	2.73	120.29	0	0	0.35	0.000	0.00	8.70	0.00	0.000
4.81	2.44	49.11	2.46	120.95	0	0	0.35	0.000	0.00	8.70	0.00	0.000
4.86	2.38	55.03	2.23	122.58	0	0	0.35	0.000	0.00	8.70	0.00	0.000
4.92	2.33	60.93	2.04	124.07	0	0	0.35	0.000	0.00	8.70	0.00	0.000
5.00	2.29	66.00	1.90	125.59	0	0	0.35	0.000	0.00	8.70	0.00	0.000

Total estimated settlement: 0.00

Abbreviations

Q_{tn}: Equivalent clean sand normalized cone resistance
K_c: Fines correction factor
$Q_{tn,cs}$: Post-liquefaction volumentric strain
G_{max}: Small strain shear modulus
CSR: Soil cyclic stress ratio
γ: Cyclic shear strain
$e_{vol(15)}$: Volumetric strain after 15 cycles
N_c: Equivalent number of cycles
e_v: Volumetric strain
Settle.: Calculated settlement

:: Post-earthquake settlement due to soil liquefaction ::

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
5.06	126.69	2.00	0.00	0.91	0.00	5.13	125.05	2.00	0.00	0.91	0.00
5.21	122.83	2.00	0.00	0.91	0.00	5.25	120.40	2.00	0.00	0.91	0.00
5.33	120.55	2.00	0.00	0.91	0.00	5.41	121.40	2.00	0.00	0.91	0.00
5.46	121.34	2.00	0.00	0.91	0.00	5.52	121.58	2.00	0.00	0.91	0.00
5.59	121.15	2.00	0.00	0.91	0.00	5.66	122.02	2.00	0.00	0.90	0.00
5.72	121.51	2.00	0.00	0.90	0.00	5.78	121.75	0.66	1.68	0.90	0.01
5.86	122.38	0.67	1.66	0.90	0.01	5.91	123.69	0.68	1.64	0.90	0.01

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
5.99	125.20	0.69	1.61	0.90	0.02	6.04	126.96	0.71	1.57	0.90	0.01
6.11	128.35	0.72	1.55	0.90	0.01	6.17	129.29	0.73	1.53	0.90	0.01
6.24	129.99	0.73	1.51	0.89	0.01	6.32	130.41	0.74	1.51	0.89	0.01
6.38	131.08	0.74	1.49	0.89	0.01	6.45	131.53	0.74	1.48	0.89	0.01
6.51	132.17	0.75	1.47	0.89	0.01	6.58	132.34	0.75	1.47	0.89	0.01
6.64	131.90	0.74	1.47	0.89	0.01	6.71	130.97	0.72	1.49	0.89	0.01
6.76	129.32	0.70	1.51	0.89	0.01	6.83	126.99	0.67	1.55	0.88	0.01
6.91	124.51	0.64	1.72	0.88	0.02	6.96	121.93	0.61	1.75	0.88	0.01
7.04	119.84	0.59	1.77	0.88	0.02	7.09	117.63	0.56	1.80	0.88	0.01
7.16	115.71	0.54	1.82	0.88	0.02	7.23	114.06	0.53	1.84	0.88	0.02
7.29	113.09	0.52	1.85	0.88	0.01	7.36	112.89	0.51	1.85	0.88	0.02
7.42	112.92	0.51	1.85	0.87	0.01	7.48	113.11	0.51	1.84	0.87	0.02
7.56	113.47	0.51	1.84	0.87	0.02	7.62	113.50	0.51	1.83	0.87	0.01
7.69	112.58	0.50	1.84	0.87	0.02	7.77	110.95	0.49	1.86	0.87	0.02
7.81	105.87	0.45	1.93	0.87	0.01	7.88	102.41	0.42	1.99	0.87	0.02
7.96	101.57	0.41	2.00	0.87	0.02	8.01	106.52	0.45	1.92	0.86	0.01
8.08	111.99	0.49	1.84	0.86	0.02	8.16	114.70	0.51	1.80	0.86	0.02
8.21	116.47	0.52	1.78	0.86	0.01	8.29	115.78	0.51	1.78	0.86	0.02
8.34	116.44	0.52	1.77	0.86	0.01	8.40	117.18	0.52	1.76	0.86	0.01
8.47	118.26	0.53	1.74	0.86	0.01	8.55	119.28	0.54	1.73	0.86	0.02
8.60	120.80	0.55	1.71	0.85	0.01	8.68	122.83	0.57	1.68	0.85	0.02
8.73	125.84	0.59	1.65	0.85	0.01	8.80	128.74	0.62	1.62	0.85	0.01
8.86	131.45	0.65	1.59	0.85	0.01	8.93	133.30	0.67	1.39	0.85	0.01
9.01	134.24	0.68	1.37	0.85	0.01	9.06	133.93	2.00	0.00	0.85	0.00
9.14	131.93	2.00	0.00	0.85	0.00	9.21	129.03	2.00	0.00	0.84	0.00
9.25	124.75	2.00	0.00	0.84	0.00	9.33	120.30	2.00	0.00	0.84	0.00
9.41	115.98	2.00	0.00	0.84	0.00	9.45	110.97	2.00	0.00	0.84	0.00
9.53	105.98	2.00	0.00	0.84	0.00	9.58	100.12	2.00	0.00	0.84	0.00
9.65	95.52	2.00	0.00	0.84	0.00	9.73	91.57	2.00	0.00	0.84	0.00
9.81	89.81	2.00	0.00	0.83	0.00	9.85	90.23	2.00	0.00	0.83	0.00
9.92	91.64	2.00	0.00	0.83	0.00	10.00	92.82	2.00	0.00	0.83	0.00
10.05	91.29	2.00	0.00	0.83	0.00	10.12	88.06	2.00	0.00	0.83	0.00
10.19	83.54	2.00	0.00	0.83	0.00	10.24	77.58	2.00	0.00	0.83	0.00
10.31	70.14	2.00	0.00	0.83	0.00	10.39	62.52	2.00	0.00	0.82	0.00
10.46	57.57	2.00	0.00	0.82	0.00	10.51	55.79	2.00	0.00	0.82	0.00
10.57	55.88	2.00	0.00	0.82	0.00	10.63	56.73	2.00	0.00	0.82	0.00
10.70	59.40	2.00	0.00	0.82	0.00	10.77	63.68	2.00	0.00	0.82	0.00
10.85	69.11	2.00	0.00	0.82	0.00	10.92	73.90	2.00	0.00	0.81	0.00
10.96	79.62	2.00	0.00	0.81	0.00	11.04	86.21	2.00	0.00	0.81	0.00
11.12	92.90	2.00	0.00	0.81	0.00	11.18	95.89	2.00	0.00	0.81	0.00
11.23	92.18	2.00	0.00	0.81	0.00	11.31	87.68	2.00	0.00	0.81	0.00
11.37	83.97	2.00	0.00	0.81	0.00	11.42	84.44	2.00	0.00	0.81	0.00
11.48	85.36	2.00	0.00	0.81	0.00	11.55	88.05	2.00	0.00	0.80	0.00
11.62	92.19	2.00	0.00	0.80	0.00	11.69	96.94	2.00	0.00	0.80	0.00
11.75	101.46	2.00	0.00	0.80	0.00	11.81	106.50	0.39	1.77	0.80	0.01
11.89	111.25	0.42	1.71	0.80	0.01	11.96	115.27	0.45	1.66	0.80	0.02
12.01	117.70	0.46	1.63	0.80	0.01	12.08	118.91	0.47	1.61	0.80	0.01
12.14	119.20	0.47	1.61	0.79	0.01	12.21	117.80	0.46	1.62	0.79	0.01

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
12.28	113.46	0.43	1.67	0.79	0.01	12.34	105.96	0.38	1.76	0.79	0.01
12.41	98.72	2.00	0.00	0.79	0.00	12.47	94.26	2.00	0.00	0.79	0.00
12.54	94.93	2.00	0.00	0.79	0.00	12.60	98.54	2.00	0.00	0.79	0.00
12.67	103.58	2.00	0.00	0.79	0.00	12.74	107.67	2.00	0.00	0.78	0.00
12.80	109.43	2.00	0.00	0.78	0.00	12.87	109.16	2.00	0.00	0.78	0.00
12.95	108.86	0.39	1.70	0.78	0.02	13.00	110.52	0.40	1.68	0.78	0.01
13.07	113.38	0.42	1.64	0.78	0.01	13.15	116.03	0.44	1.61	0.78	0.02
13.19	117.23	2.00	0.00	0.78	0.00	13.27	117.00	2.00	0.00	0.78	0.00
13.32	115.61	2.00	0.00	0.77	0.00	13.40	112.20	2.00	0.00	0.77	0.00
13.47	107.56	2.00	0.00	0.77	0.00	13.52	102.35	2.00	0.00	0.77	0.00
13.60	99.16	2.00	0.00	0.77	0.00	13.67	97.90	2.00	0.00	0.77	0.00
13.72	98.12	2.00	0.00	0.77	0.00	13.79	98.72	2.00	0.00	0.77	0.00
13.87	100.14	2.00	0.00	0.76	0.00	13.94	100.99	2.00	0.00	0.76	0.00
13.98	101.08	2.00	0.00	0.76	0.00	14.06	101.59	2.00	0.00	0.76	0.00
14.12	104.54	2.00	0.00	0.76	0.00	14.20	108.54	2.00	0.00	0.76	0.00
14.24	110.96	2.00	0.00	0.76	0.00	14.33	111.71	2.00	0.00	0.76	0.00
14.39	111.65	2.00	0.00	0.76	0.00	14.45	110.86	2.00	0.00	0.76	0.00
14.51	108.11	2.00	0.00	0.75	0.00	14.60	105.82	2.00	0.00	0.75	0.00
14.66	104.23	2.00	0.00	0.75	0.00	14.72	103.86	2.00	0.00	0.75	0.00
14.78	103.45	2.00	0.00	0.75	0.00	14.84	102.78	2.00	0.00	0.75	0.00
14.90	99.74	2.00	0.00	0.75	0.00	14.99	96.22	2.00	0.00	0.75	0.00
15.05	93.67	2.00	0.00	0.75	0.00	15.11	94.01	0.29	1.83	0.74	0.01
15.17	96.29	0.31	1.79	0.74	0.01	15.24	99.44	0.32	1.74	0.74	0.01
15.31	103.07	0.34	1.69	0.74	0.01	15.38	106.25	0.36	1.64	0.74	0.01
15.44	109.08	0.37	1.61	0.74	0.01	15.50	111.09	0.39	1.58	0.74	0.01
15.56	112.02	0.39	1.57	0.74	0.01	15.63	111.57	0.39	1.57	0.74	0.01
15.71	110.67	0.38	1.58	0.73	0.02	15.77	110.29	0.38	1.58	0.73	0.01
15.83	110.44	0.38	1.58	0.73	0.01	15.88	109.34	0.37	1.59	0.73	0.01
15.95	106.38	0.36	1.62	0.73	0.01	16.04	102.50	0.33	1.67	0.73	0.02
16.09	98.88	0.31	1.72	0.73	0.01	16.15	97.87	2.00	0.00	0.73	0.00
16.22	96.32	2.00	0.00	0.73	0.00	16.29	97.88	2.00	0.00	0.72	0.00
16.36	101.32	2.00	0.00	0.72	0.00	16.42	108.32	2.00	0.00	0.72	0.00
16.48	112.83	2.00	0.00	0.72	0.00	16.55	116.28	2.00	0.00	0.72	0.00
16.61	118.97	2.00	0.00	0.72	0.00	16.69	123.38	2.00	0.00	0.72	0.00
16.75	126.22	2.00	0.00	0.72	0.00	16.81	126.06	2.00	0.00	0.72	0.00
16.88	122.16	2.00	0.00	0.71	0.00	16.96	116.45	2.00	0.00	0.71	0.00
17.03	110.82	2.00	0.00	0.71	0.00	17.08	105.81	2.00	0.00	0.71	0.00
17.14	99.89	0.31	1.66	0.71	0.01	17.20	95.14	0.29	1.72	0.71	0.01
17.29	93.06	0.28	1.75	0.71	0.02	17.35	93.92	2.00	0.00	0.71	0.00
17.41	98.03	2.00	0.00	0.70	0.00	17.48	102.79	2.00	0.00	0.70	0.00
17.53	108.98	2.00	0.00	0.70	0.00	17.59	112.29	2.00	0.00	0.70	0.00
17.65	113.55	2.00	0.00	0.70	0.00	17.74	112.73	2.00	0.00	0.70	0.00
17.79	111.50	2.00	0.00	0.70	0.00	17.86	108.69	2.00	0.00	0.70	0.00
17.92	102.79	2.00	0.00	0.70	0.00	18.00	97.56	0.30	1.66	0.69	0.02
18.06	95.76	0.29	1.68	0.69	0.01	18.12	99.05	0.31	1.63	0.69	0.01
18.19	103.99	2.00	0.00	0.69	0.00	18.27	107.62	2.00	0.00	0.69	0.00
18.33	108.43	2.00	0.00	0.69	0.00	18.38	105.84	2.00	0.00	0.69	0.00
18.45	102.11	2.00	0.00	0.69	0.00	18.51	99.60	2.00	0.00	0.69	0.00

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
18.58	99.07	2.00	0.00	0.69	0.00	18.64	99.80	2.00	0.00	0.68	0.00
18.71	100.67	2.00	0.00	0.68	0.00	18.77	101.87	2.00	0.00	0.68	0.00
18.85	103.35	2.00	0.00	0.68	0.00	18.91	104.98	2.00	0.00	0.68	0.00
18.97	106.61	0.34	1.50	0.68	0.01	19.03	108.43	0.35	1.48	0.68	0.01
19.11	110.10	0.36	1.46	0.68	0.01	19.17	111.68	0.37	1.44	0.68	0.01
19.23	113.15	0.38	1.42	0.67	0.01	19.32	114.39	0.39	1.41	0.67	0.02
19.37	115.50	0.40	1.39	0.67	0.01	19.43	116.19	0.40	1.39	0.67	0.01
19.49	116.99	0.41	1.38	0.67	0.01	19.57	117.74	0.41	1.37	0.67	0.01
19.63	118.54	0.42	1.36	0.67	0.01	19.69	119.26	0.42	1.35	0.67	0.01
19.75	120.15	0.43	1.34	0.67	0.01	19.83	120.99	0.43	1.33	0.66	0.01
19.89	120.98	0.43	1.32	0.66	0.01	19.98	119.36	0.42	1.34	0.66	0.01
20.04	117.86	0.41	1.35	0.66	0.01	20.09	117.31	0.41	1.35	0.66	0.01
20.14	118.40	0.41	1.34	0.66	0.01	20.24	119.40	0.42	1.33	0.66	0.01
20.29	120.20	0.43	1.32	0.66	0.01	20.35	120.50	0.43	1.31	0.66	0.01
20.43	120.59	0.43	1.31	0.65	0.01	20.49	120.89	0.43	1.31	0.65	0.01
20.55	121.78	0.44	1.30	0.65	0.01	20.63	122.84	0.44	1.28	0.65	0.01
20.68	123.92	0.45	1.27	0.65	0.01	20.74	124.66	0.46	1.26	0.65	0.01
20.81	125.41	0.46	1.26	0.65	0.01	20.89	125.96	0.47	1.25	0.65	0.01
20.94	126.24	0.47	1.25	0.65	0.01	21.01	126.04	0.47	1.24	0.64	0.01
21.07	125.52	2.00	0.00	0.64	0.00	21.16	124.71	2.00	0.00	0.64	0.00
21.21	123.60	2.00	0.00	0.64	0.00	21.27	122.00	2.00	0.00	0.64	0.00
21.34	120.23	2.00	0.00	0.64	0.00	21.40	118.49	2.00	0.00	0.64	0.00
21.47	116.94	2.00	0.00	0.64	0.00	21.53	115.13	2.00	0.00	0.64	0.00
21.60	113.07	2.00	0.00	0.63	0.00	21.67	110.90	2.00	0.00	0.63	0.00
21.75	108.77	2.00	0.00	0.63	0.00	21.82	107.09	2.00	0.00	0.63	0.00
21.85	105.73	2.00	0.00	0.63	0.00	21.92	105.51	2.00	0.00	0.63	0.00
22.00	106.46	2.00	0.00	0.63	0.00	22.06	109.86	2.00	0.00	0.63	0.00
22.14	114.64	2.00	0.00	0.62	0.00	22.18	120.51	2.00	0.00	0.62	0.00
22.24	126.70	2.00	0.00	0.62	0.00	22.31	132.21	2.00	0.00	0.62	0.00
22.38	134.03	2.00	0.00	0.62	0.00	22.45	133.45	2.00	0.00	0.62	0.00
22.52	133.28	2.00	0.00	0.62	0.00	22.60	130.96	2.00	0.00	0.62	0.00
22.67	128.52	2.00	0.00	0.62	0.00	22.70	132.26	2.00	0.00	0.62	0.00
22.77	140.67	2.00	0.00	0.61	0.00	22.84	150.25	2.00	0.00	0.61	0.00
22.90	154.73	2.00	0.00	0.61	0.00	22.98	155.68	0.75	0.65	0.61	0.01
23.04	153.86	0.73	0.81	0.61	0.01	23.10	150.63	0.69	0.84	0.61	0.01
23.18	148.08	0.66	0.85	0.61	0.01	23.26	146.88	0.65	0.86	0.61	0.01
23.30	146.63	0.65	1.03	0.61	0.00	23.36	145.18	0.63	1.04	0.60	0.01
23.43	135.28	0.54	1.10	0.60	0.01	23.50	125.70	0.46	1.17	0.60	0.01
23.57	118.33	2.00	0.00	0.60	0.00	23.64	121.32	2.00	0.00	0.60	0.00
23.72	125.47	2.00	0.00	0.60	0.00	23.76	128.10	2.00	0.00	0.60	0.00
23.82	127.55	2.00	0.00	0.60	0.00	23.89	125.59	2.00	0.00	0.60	0.00
23.96	121.82	2.00	0.00	0.59	0.00	24.03	119.04	2.00	0.00	0.59	0.00
24.11	117.30	2.00	0.00	0.59	0.00	24.18	117.15	2.00	0.00	0.59	0.00
24.22	116.05	2.00	0.00	0.59	0.00	24.28	114.40	2.00	0.00	0.59	0.00
24.35	112.76	2.00	0.00	0.59	0.00	24.43	110.68	2.00	0.00	0.59	0.00
24.49	107.98	2.00	0.00	0.58	0.00	24.57	107.85	2.00	0.00	0.58	0.00
24.64	109.61	2.00	0.00	0.58	0.00	24.68	113.91	2.00	0.00	0.58	0.00
24.74	118.60	2.00	0.00	0.58	0.00	24.82	123.79	0.44	1.14	0.58	0.01

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
24.89	127.78	0.47	1.10	0.58	0.01	24.96	130.47	0.50	1.08	0.58	0.01
25.03	131.73	0.51	1.07	0.58	0.01	25.07	132.25	0.51	1.07	0.58	0.00
25.14	131.82	0.51	1.07	0.57	0.01	25.21	130.90	0.50	1.07	0.57	0.01
25.28	129.64	0.49	1.08	0.57	0.01	25.35	128.27	0.48	1.09	0.57	0.01
25.42	126.88	2.00	0.00	0.57	0.00	25.49	125.28	2.00	0.00	0.57	0.00
25.56	123.79	2.00	0.00	0.57	0.00	25.59	122.07	2.00	0.00	0.57	0.00
25.67	120.18	2.00	0.00	0.56	0.00	25.73	118.05	2.00	0.00	0.56	0.00
25.80	116.12	2.00	0.00	0.56	0.00	25.87	114.23	2.00	0.00	0.56	0.00
25.94	111.68	2.00	0.00	0.56	0.00	26.01	108.23	2.00	0.00	0.56	0.00
26.08	104.24	2.00	0.00	0.56	0.00	26.14	100.66	2.00	0.00	0.56	0.00
26.21	98.77	2.00	0.00	0.56	0.00	26.28	99.90	2.00	0.00	0.55	0.00
26.34	103.89	2.00	0.00	0.55	0.00	26.41	107.71	2.00	0.00	0.55	0.00
26.45	108.34	2.00	0.00	0.55	0.00	26.52	105.92	2.00	0.00	0.55	0.00
26.59	101.37	2.00	0.00	0.55	0.00	26.66	95.95	2.00	0.00	0.55	0.00
26.73	90.41	2.00	0.00	0.55	0.00	26.79	84.32	2.00	0.00	0.55	0.00
26.86	77.27	2.00	0.00	0.54	0.00	26.93	69.75	2.00	0.00	0.54	0.00
26.98	63.48	2.00	0.00	0.54	0.00	27.05	59.59	2.00	0.00	0.54	0.00
27.12	57.79	2.00	0.00	0.54	0.00	27.18	57.37	2.00	0.00	0.54	0.00
27.25	57.52	2.00	0.00	0.54	0.00	27.32	57.74	2.00	0.00	0.54	0.00
27.39	57.97	2.00	0.00	0.54	0.00	27.46	58.17	2.00	0.00	0.53	0.00
27.53	58.28	2.00	0.00	0.53	0.00	27.57	58.12	2.00	0.00	0.53	0.00
27.64	57.92	2.00	0.00	0.53	0.00	27.70	57.68	2.00	0.00	0.53	0.00
27.77	57.71	2.00	0.00	0.53	0.00	27.84	57.84	2.00	0.00	0.53	0.00
27.91	58.15	2.00	0.00	0.53	0.00	27.98	58.57	2.00	0.00	0.53	0.00
28.05	59.04	2.00	0.00	0.52	0.00	28.09	59.80	2.00	0.00	0.52	0.00
28.15	60.58	2.00	0.00	0.52	0.00	28.23	61.47	2.00	0.00	0.52	0.00
28.29	62.16	2.00	0.00	0.52	0.00	28.36	62.63	2.00	0.00	0.52	0.00
28.43	62.93	2.00	0.00	0.52	0.00	28.50	63.14	2.00	0.00	0.52	0.00
28.57	63.65	2.00	0.00	0.52	0.00	28.65	64.23	2.00	0.00	0.51	0.00
28.69	65.44	2.00	0.00	0.51	0.00	28.74	66.37	2.00	0.00	0.51	0.00
28.81	67.37	2.00	0.00	0.51	0.00	28.88	68.20	2.00	0.00	0.51	0.00
28.95	69.26	2.00	0.00	0.51	0.00	29.02	70.09	2.00	0.00	0.51	0.00
29.08	70.16	2.00	0.00	0.51	0.00	29.16	69.66	2.00	0.00	0.51	0.00
29.22	68.50	2.00	0.00	0.50	0.00	29.29	66.94	2.00	0.00	0.50	0.00
29.36	65.30	2.00	0.00	0.50	0.00	29.43	64.03	2.00	0.00	0.50	0.00
29.49	63.11	2.00	0.00	0.50	0.00	29.53	62.65	2.00	0.00	0.50	0.00
29.59	62.12	2.00	0.00	0.50	0.00	29.66	62.36	2.00	0.00	0.50	0.00
29.73	62.51	2.00	0.00	0.50	0.00	29.80	63.47	2.00	0.00	0.49	0.00
29.87	64.74	2.00	0.00	0.49	0.00	29.93	66.62	2.00	0.00	0.49	0.00
29.99	68.54	2.00	0.00	0.49	0.00	30.06	70.23	2.00	0.00	0.49	0.00
30.12	72.31	2.00	0.00	0.49	0.00	30.20	75.12	2.00	0.00	0.49	0.00
30.27	77.40	2.00	0.00	0.49	0.00	30.35	78.08	2.00	0.00	0.49	0.00
30.42	77.20	2.00	0.00	0.48	0.00	30.45	75.68	2.00	0.00	0.48	0.00
30.51	73.74	2.00	0.00	0.48	0.00	30.58	71.41	2.00	0.00	0.48	0.00
30.65	69.33	2.00	0.00	0.48	0.00	30.72	68.03	2.00	0.00	0.48	0.00
30.79	67.23	2.00	0.00	0.48	0.00	30.86	66.42	2.00	0.00	0.48	0.00
30.94	65.99	2.00	0.00	0.48	0.00	31.00	66.43	2.00	0.00	0.47	0.00
31.07	67.92	2.00	0.00	0.47	0.00	31.14	69.60	2.00	0.00	0.47	0.00

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
31.20	70.90	2.00	0.00	0.47	0.00	31.24	72.07	2.00	0.00	0.47	0.00
31.31	73.26	2.00	0.00	0.47	0.00	31.38	74.37	2.00	0.00	0.47	0.00
31.45	75.62	2.00	0.00	0.47	0.00	31.52	77.04	2.00	0.00	0.47	0.00
31.59	78.52	2.00	0.00	0.46	0.00	31.65	79.77	2.00	0.00	0.46	0.00
31.72	80.38	2.00	0.00	0.46	0.00	31.80	80.63	2.00	0.00	0.46	0.00
31.83	80.49	2.00	0.00	0.46	0.00	31.90	80.17	2.00	0.00	0.46	0.00
31.97	79.38	2.00	0.00	0.46	0.00	32.04	78.29	2.00	0.00	0.46	0.00
32.11	77.49	2.00	0.00	0.46	0.00	32.18	77.12	2.00	0.00	0.45	0.00
32.25	77.02	2.00	0.00	0.45	0.00	32.31	77.11	2.00	0.00	0.45	0.00
32.37	78.33	2.00	0.00	0.45	0.00	32.44	80.20	2.00	0.00	0.45	0.00
32.51	81.93	2.00	0.00	0.45	0.00	32.56	82.86	2.00	0.00	0.45	0.00
32.62	83.45	2.00	0.00	0.45	0.00	32.68	84.18	2.00	0.00	0.45	0.00
32.76	84.71	2.00	0.00	0.44	0.00	32.82	84.47	2.00	0.00	0.44	0.00
32.89	83.52	2.00	0.00	0.44	0.00	32.95	82.34	2.00	0.00	0.44	0.00
33.02	81.63	2.00	0.00	0.44	0.00	33.09	81.24	2.00	0.00	0.44	0.00
33.16	80.87	2.00	0.00	0.44	0.00	33.24	80.47	2.00	0.00	0.44	0.00
33.27	80.17	2.00	0.00	0.44	0.00	33.34	80.06	2.00	0.00	0.43	0.00
33.40	80.05	2.00	0.00	0.43	0.00	33.47	80.00	2.00	0.00	0.43	0.00
33.55	79.83	2.00	0.00	0.43	0.00	33.61	79.61	2.00	0.00	0.43	0.00
33.68	79.56	2.00	0.00	0.43	0.00	33.75	79.66	2.00	0.00	0.43	0.00
33.80	79.57	2.00	0.00	0.43	0.00	33.86	79.12	2.00	0.00	0.43	0.00
33.93	78.05	2.00	0.00	0.42	0.00	33.99	76.77	2.00	0.00	0.42	0.00
34.06	75.52	2.00	0.00	0.42	0.00	34.13	74.52	2.00	0.00	0.42	0.00
34.19	73.80	2.00	0.00	0.42	0.00	34.25	73.24	2.00	0.00	0.42	0.00
34.33	73.22	2.00	0.00	0.42	0.00	34.39	73.95	2.00	0.00	0.42	0.00
34.47	75.38	2.00	0.00	0.42	0.00	34.53	77.06	2.00	0.00	0.41	0.00
34.60	78.21	2.00	0.00	0.41	0.00	34.67	78.87	2.00	0.00	0.41	0.00
34.71	79.59	2.00	0.00	0.41	0.00	34.81	78.12	2.00	0.00	0.41	0.00
34.84	81.26	2.00	0.00	0.41	0.00	34.91	85.55	2.00	0.00	0.41	0.00
34.98	90.68	2.00	0.00	0.41	0.00	35.04	89.83	2.00	0.00	0.41	0.00
35.12	84.71	2.00	0.00	0.40	0.00	35.18	86.14	2.00	0.00	0.40	0.00
35.25	93.82	2.00	0.00	0.40	0.00	35.30	104.49	2.00	0.00	0.40	0.00
35.38	113.67	2.00	0.00	0.40	0.00	35.45	120.07	2.00	0.00	0.40	0.00
35.52	123.49	2.00	0.00	0.40	0.00	35.57	125.47	0.45	0.77	0.40	0.00
35.65	128.22	0.47	0.75	0.40	0.01	35.70	131.72	0.50	0.74	0.39	0.00
35.77	134.12	0.52	0.72	0.39	0.01	35.85	135.77	0.53	0.71	0.39	0.01
35.92	136.58	0.54	0.71	0.39	0.01	35.97	137.55	0.55	0.70	0.39	0.00
36.03	138.24	0.56	0.70	0.39	0.01	36.11	139.23	0.56	0.69	0.39	0.01
36.18	140.22	0.57	0.69	0.39	0.01	36.24	142.13	0.59	0.68	0.39	0.00
36.31	145.94	0.63	0.66	0.38	0.01	36.37	152.26	0.70	0.52	0.38	0.00
36.44	159.89	0.78	0.39	0.38	0.00	36.50	166.63	0.87	0.28	0.38	0.00
36.57	172.08	0.94	0.27	0.38	0.00	36.63	176.60	1.01	0.20	0.38	0.00
36.69	181.58	1.09	0.14	0.38	0.00	36.76	188.76	1.20	0.10	0.38	0.00
36.82	195.10	1.31	0.07	0.38	0.00	36.88	200.18	2.00	0.00	0.37	0.00
36.94	204.27	2.00	0.00	0.37	0.00	37.03	207.84	2.00	0.00	0.37	0.00
37.09	212.15	2.00	0.00	0.37	0.00	37.16	216.79	2.00	0.00	0.37	0.00
37.22	220.04	2.00	0.00	0.37	0.00	37.28	220.95	2.00	0.00	0.37	0.00
37.34	220.20	2.00	0.00	0.37	0.00	37.42	218.75	2.00	0.00	0.37	0.00

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
37.48	218.17	2.00	0.00	0.36	0.00	37.54	218.31	2.00	0.00	0.36	0.00
37.61	218.21	2.00	0.00	0.36	0.00	37.68	217.82	2.00	0.00	0.36	0.00
37.75	217.88	2.00	0.00	0.36	0.00	37.82	218.50	2.00	0.00	0.36	0.00
37.86	219.54	2.00	0.00	0.36	0.00	37.95	219.19	2.00	0.00	0.36	0.00
38.00	217.28	2.00	0.00	0.36	0.00	38.07	213.59	2.00	0.00	0.35	0.00
38.14	208.33	2.00	0.00	0.35	0.00	38.21	202.64	2.00	0.00	0.35	0.00
38.27	197.57	1.36	0.00	0.35	0.00	38.32	193.45	1.29	0.06	0.35	0.00
38.39	191.17	1.25	0.09	0.35	0.00	38.48	190.84	1.24	0.09	0.35	0.00
38.52	194.03	1.30	0.06	0.35	0.00	38.60	198.81	1.39	0.00	0.35	0.00
38.67	202.13	2.00	0.00	0.34	0.00	38.72	204.12	2.00	0.00	0.34	0.00
38.79	205.54	2.00	0.00	0.34	0.00	38.85	209.28	2.00	0.00	0.34	0.00
38.92	211.36	2.00	0.00	0.34	0.00	38.98	212.64	2.00	0.00	0.34	0.00
39.06	213.66	2.00	0.00	0.34	0.00	39.13	215.01	2.00	0.00	0.34	0.00
39.18	216.88	2.00	0.00	0.34	0.00	39.26	218.25	2.00	0.00	0.33	0.00
39.32	220.25	2.00	0.00	0.33	0.00	39.39	222.24	2.00	0.00	0.33	0.00
39.44	224.72	2.00	0.00	0.33	0.00	39.51	226.73	2.00	0.00	0.33	0.00
39.58	228.88	2.00	0.00	0.33	0.00	39.64	229.52	2.00	0.00	0.33	0.00
39.71	227.81	2.00	0.00	0.33	0.00	39.78	224.06	2.00	0.00	0.33	0.00
39.84	218.19	2.00	0.00	0.32	0.00	39.90	211.79	2.00	0.00	0.32	0.00
39.98	205.01	2.00	0.00	0.32	0.00	40.03	199.26	1.40	0.00	0.32	0.00
40.10	193.68	1.30	0.06	0.32	0.00	40.17	188.38	1.21	0.08	0.32	0.00
40.23	182.83	1.12	0.12	0.32	0.00	40.29	177.46	1.03	0.16	0.32	0.00
40.37	171.11	0.94	0.22	0.32	0.00	40.43	167.31	0.89	0.23	0.31	0.00
40.49	163.21	0.83	0.31	0.31	0.00	40.56	157.61	0.76	0.33	0.31	0.00
40.63	150.73	0.69	0.43	0.31	0.00	40.70	143.72	0.61	0.54	0.31	0.00
40.75	136.69	0.55	0.56	0.31	0.00	40.82	128.28	0.48	0.59	0.31	0.00
40.89	119.27	0.41	0.62	0.31	0.00	40.96	112.42	0.37	0.65	0.31	0.01
41.02	108.97	0.35	0.66	0.30	0.00	41.09	108.97	0.35	0.66	0.30	0.01
41.14	110.31	0.35	0.65	0.30	0.00	41.21	111.28	0.36	0.65	0.30	0.01
41.28	110.85	0.36	0.64	0.30	0.01	41.35	110.46	0.35	0.64	0.30	0.01
41.41	111.30	0.36	0.64	0.30	0.00	41.48	112.35	0.37	0.63	0.30	0.01
41.55	111.68	0.36	0.63	0.30	0.01	41.61	110.28	0.35	0.64	0.29	0.00
41.67	108.29	0.34	0.64	0.29	0.00	41.74	103.26	0.32	0.67	0.29	0.01
41.81	99.20	0.30	0.69	0.29	0.01	41.87	99.32	0.30	0.68	0.29	0.01
41.95	104.86	0.32	0.65	0.29	0.01	42.01	110.15	0.35	0.62	0.29	0.00
42.06	113.39	0.37	0.61	0.29	0.00	42.14	116.47	0.39	0.59	0.29	0.01
42.20	119.98	0.42	0.57	0.28	0.00	42.27	124.00	0.45	0.56	0.28	0.01
42.33	126.59	0.47	0.54	0.28	0.00	42.42	128.06	0.48	0.54	0.28	0.01
42.47	129.31	0.49	0.53	0.28	0.00	42.53	130.47	0.50	0.52	0.28	0.00
42.60	131.66	0.51	0.52	0.28	0.00	42.68	132.58	0.52	0.51	0.28	0.00
42.73	133.12	0.52	0.51	0.28	0.00	42.79	133.23	0.52	0.51	0.27	0.00
42.88	133.19	0.52	0.50	0.27	0.00	42.93	133.26	0.52	0.50	0.27	0.00
42.99	133.13	0.52	0.50	0.27	0.00	43.05	132.70	0.52	0.50	0.27	0.00
43.13	131.93	0.51	0.50	0.27	0.01	43.18	131.11	0.50	0.50	0.27	0.00
43.25	130.39	0.50	0.50	0.27	0.00	43.33	129.91	0.49	0.50	0.27	0.00
43.39	129.87	0.49	0.50	0.26	0.00	43.44	130.30	0.50	0.50	0.26	0.00
43.52	130.78	0.50	0.49	0.26	0.00	43.58	130.83	0.50	0.49	0.26	0.00
43.64	130.70	0.50	0.49	0.26	0.00	43.72	130.42	0.50	0.49	0.26	0.00

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
43.77	130.42	0.50	0.49	0.26	0.00	43.84	129.99	0.50	0.48	0.26	0.00
43.91	129.37	0.49	0.48	0.26	0.00	43.97	128.28	0.48	0.49	0.25	0.00
44.03	126.44	0.47	0.49	0.25	0.00	44.12	124.30	0.45	0.49	0.25	0.00
44.16	121.24	0.43	0.50	0.25	0.00	44.25	118.87	0.41	0.51	0.25	0.01
44.30	117.61	0.41	0.51	0.25	0.00	44.36	117.72	0.41	0.51	0.25	0.00
44.42	117.94	0.41	0.50	0.25	0.00	44.49	118.11	0.41	0.50	0.25	0.00
44.56	119.08	0.42	0.50	0.24	0.00	44.63	120.75	0.43	0.49	0.24	0.00
44.70	121.50	0.43	0.48	0.24	0.00	44.76	121.85	0.44	0.48	0.24	0.00
44.82	121.35	0.43	0.48	0.24	0.00	44.90	122.04	0.44	0.47	0.24	0.00
44.96	122.80	0.44	0.47	0.24	0.00	45.04	123.98	0.45	0.46	0.24	0.00
45.10	122.75	0.44	0.47	0.24	0.00	45.15	120.73	0.43	0.47	0.23	0.00
45.23	120.08	0.42	0.47	0.23	0.00	45.28	123.00	0.45	0.46	0.23	0.00
45.34	126.82	2.00	0.00	0.23	0.00	45.43	129.29	2.00	0.00	0.23	0.00
45.48	132.70	2.00	0.00	0.23	0.00	45.54	137.25	2.00	0.00	0.23	0.00
45.62	142.56	2.00	0.00	0.23	0.00	45.68	147.24	2.00	0.00	0.23	0.00
45.74	147.50	2.00	0.00	0.22	0.00	45.81	148.27	2.00	0.00	0.22	0.00
45.87	148.08	2.00	0.00	0.22	0.00	45.95	151.42	2.00	0.00	0.22	0.00
46.00	159.75	2.00	0.00	0.22	0.00	46.08	167.44	2.00	0.00	0.22	0.00
46.13	173.16	2.00	0.00	0.22	0.00	46.21	175.75	2.00	0.00	0.22	0.00
46.27	179.15	2.00	0.00	0.22	0.00	46.35	183.61	2.00	0.00	0.21	0.00
46.40	189.25	2.00	0.00	0.21	0.00	46.49	193.63	2.00	0.00	0.21	0.00
46.53	196.05	2.00	0.00	0.21	0.00	46.62	196.15	2.00	0.00	0.21	0.00
46.68	196.25	2.00	0.00	0.21	0.00	46.72	196.16	2.00	0.00	0.21	0.00
46.81	192.87	2.00	0.00	0.21	0.00	46.86	189.24	2.00	0.00	0.21	0.00
46.94	187.09	2.00	0.00	0.20	0.00	46.99	188.19	2.00	0.00	0.20	0.00
47.07	190.08	2.00	0.00	0.20	0.00	47.12	191.87	2.00	0.00	0.20	0.00
47.18	197.04	2.00	0.00	0.20	0.00	47.27	203.44	2.00	0.00	0.20	0.00
47.33	213.40	2.00	0.00	0.20	0.00	47.41	218.53	2.00	0.00	0.20	0.00
47.46	222.73	2.00	0.00	0.20	0.00	47.51	225.17	2.00	0.00	0.19	0.00
47.59	226.75	2.00	0.00	0.19	0.00	47.65	228.71	2.00	0.00	0.19	0.00
47.73	230.67	2.00	0.00	0.19	0.00	47.78	233.29	2.00	0.00	0.19	0.00
47.86	235.12	2.00	0.00	0.19	0.00	47.92	236.58	2.00	0.00	0.19	0.00
47.97	238.77	2.00	0.00	0.19	0.00	48.05	241.47	2.00	0.00	0.19	0.00
48.10	245.01	2.00	0.00	0.18	0.00	48.18	248.01	2.00	0.00	0.18	0.00
48.25	250.81	2.00	0.00	0.18	0.00	48.31	252.06	2.00	0.00	0.18	0.00
48.38	252.33	2.00	0.00	0.18	0.00	48.44	253.16	2.00	0.00	0.18	0.00
48.52	254.41	2.00	0.00	0.18	0.00	48.57	256.33	2.00	0.00	0.18	0.00
48.63	258.47	2.00	0.00	0.18	0.00	48.71	261.57	2.00	0.00	0.17	0.00
48.76	266.95	2.00	0.00	0.17	0.00	48.84	272.85	2.00	0.00	0.17	0.00
48.89	279.27	2.00	0.00	0.17	0.00	48.97	283.58	2.00	0.00	0.17	0.00
49.03	286.79	2.00	0.00	0.17	0.00	49.10	288.01	2.00	0.00	0.17	0.00
49.15	288.95	2.00	0.00	0.17	0.00	49.23	289.56	2.00	0.00	0.17	0.00
49.29	291.74	2.00	0.00	0.16	0.00	49.36	293.86	2.00	0.00	0.16	0.00
49.42	294.03	2.00	0.00	0.16	0.00	49.49	292.03	2.00	0.00	0.16	0.00
49.54	294.54	2.00	0.00	0.16	0.00	49.63	300.38	2.00	0.00	0.16	0.00
49.68	308.14	2.00	0.00	0.16	0.00	49.75	311.55	2.00	0.00	0.16	0.00
49.81	312.96	2.00	0.00	0.16	0.00	49.89	312.92	2.00	0.00	0.15	0.00
49.94	311.89	2.00	0.00	0.15	0.00	50.03	310.62	2.00	0.00	0.15	0.00

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
50.08	309.61	2.00	0.00	0.15	0.00						

Total estimated settlement: 2.01

Abbreviations

$Q_{tn,cs}$:	Equivalent clean sand normalized cone resistance
FS:	Factor of safety against liquefaction
e_v (%):	Post-liquefaction volumentric strain
DF:	e_v depth weighting factor
Settlement:	Calculated settlement

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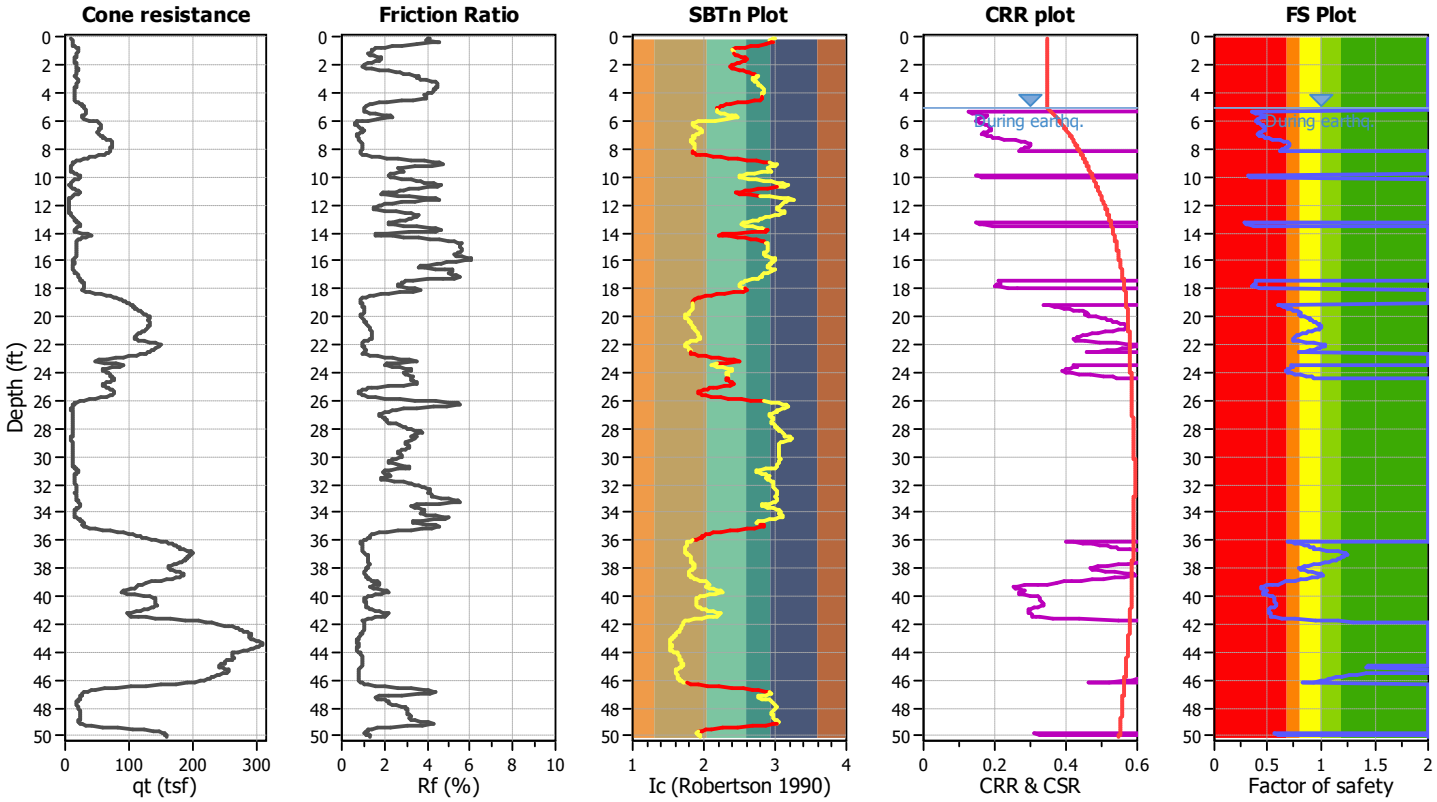
LIQUEFACTION ANALYSIS REPORT

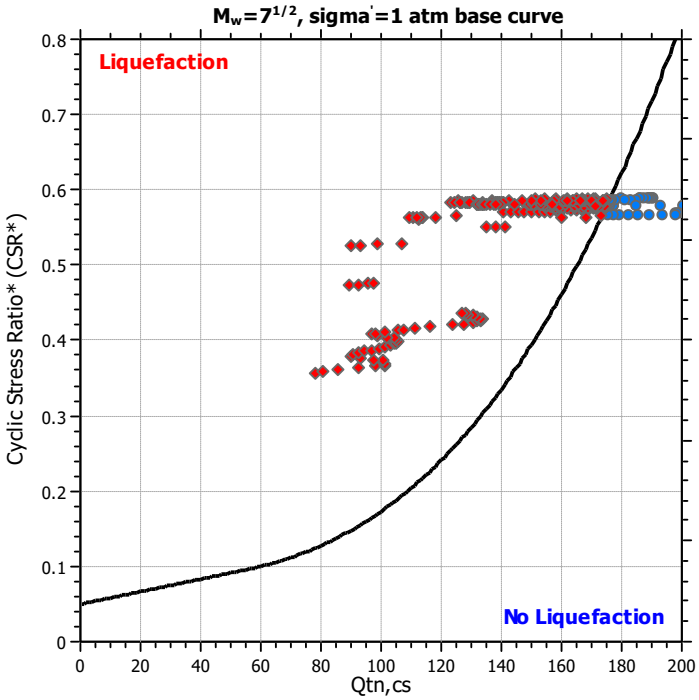
Project title : 7-Acre Site, Cypress Town Center **Location : Cypress, CA**

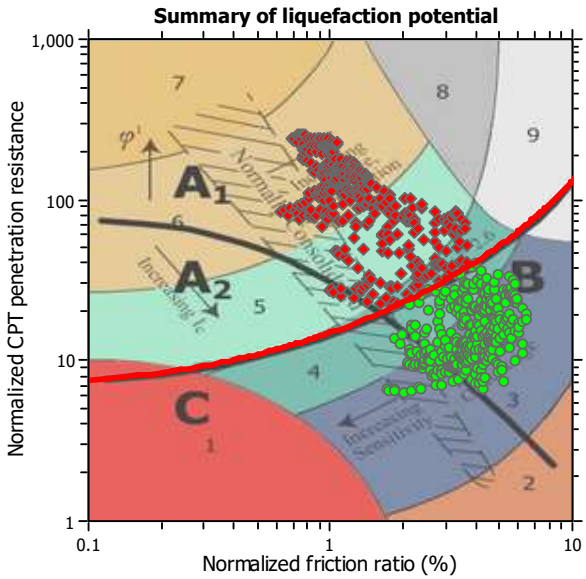
CPT file : CPT-2

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	6.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	5.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	50.00 ft
Earthquake magnitude M_w:	6.71	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.55	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

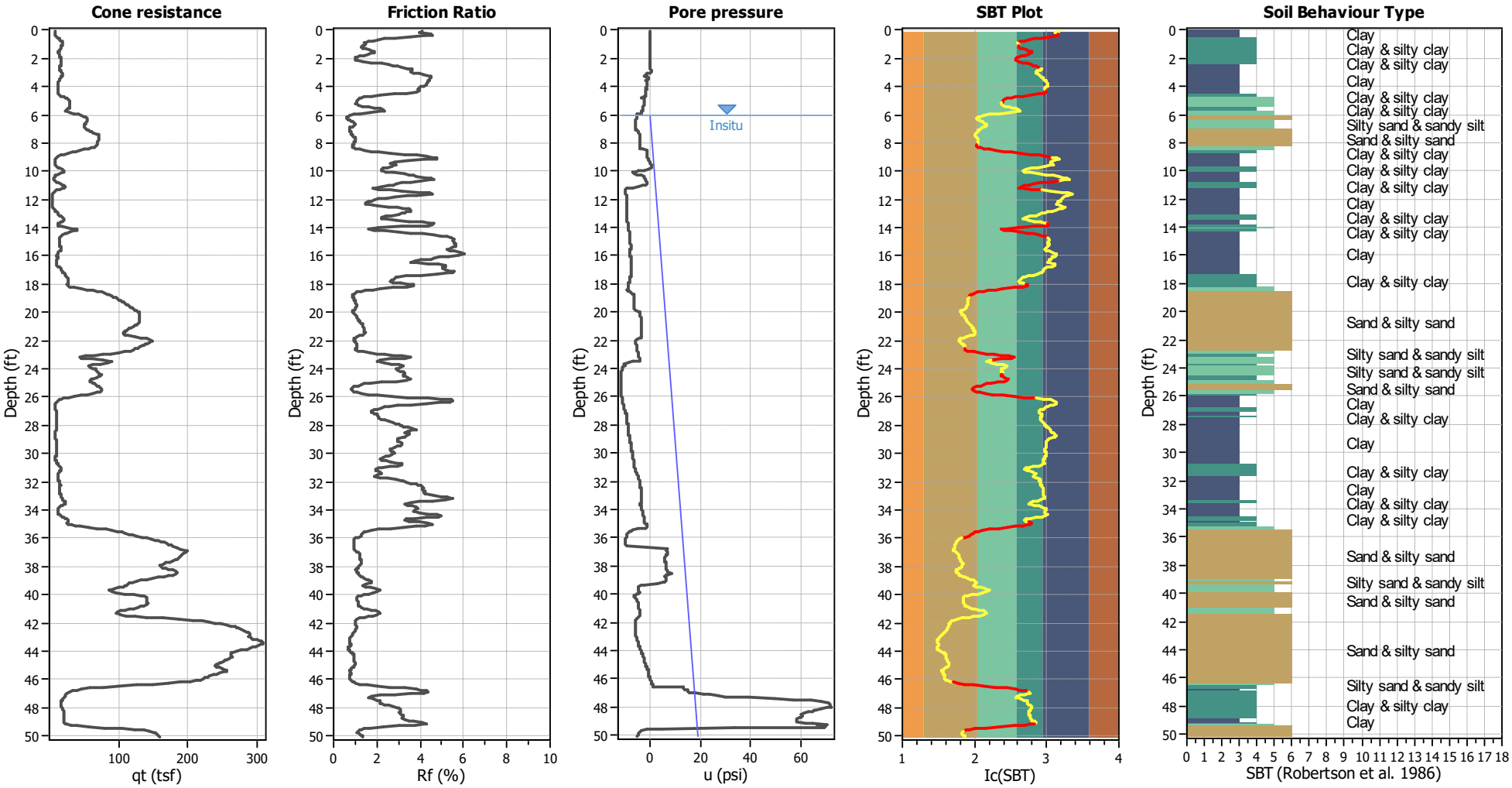






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



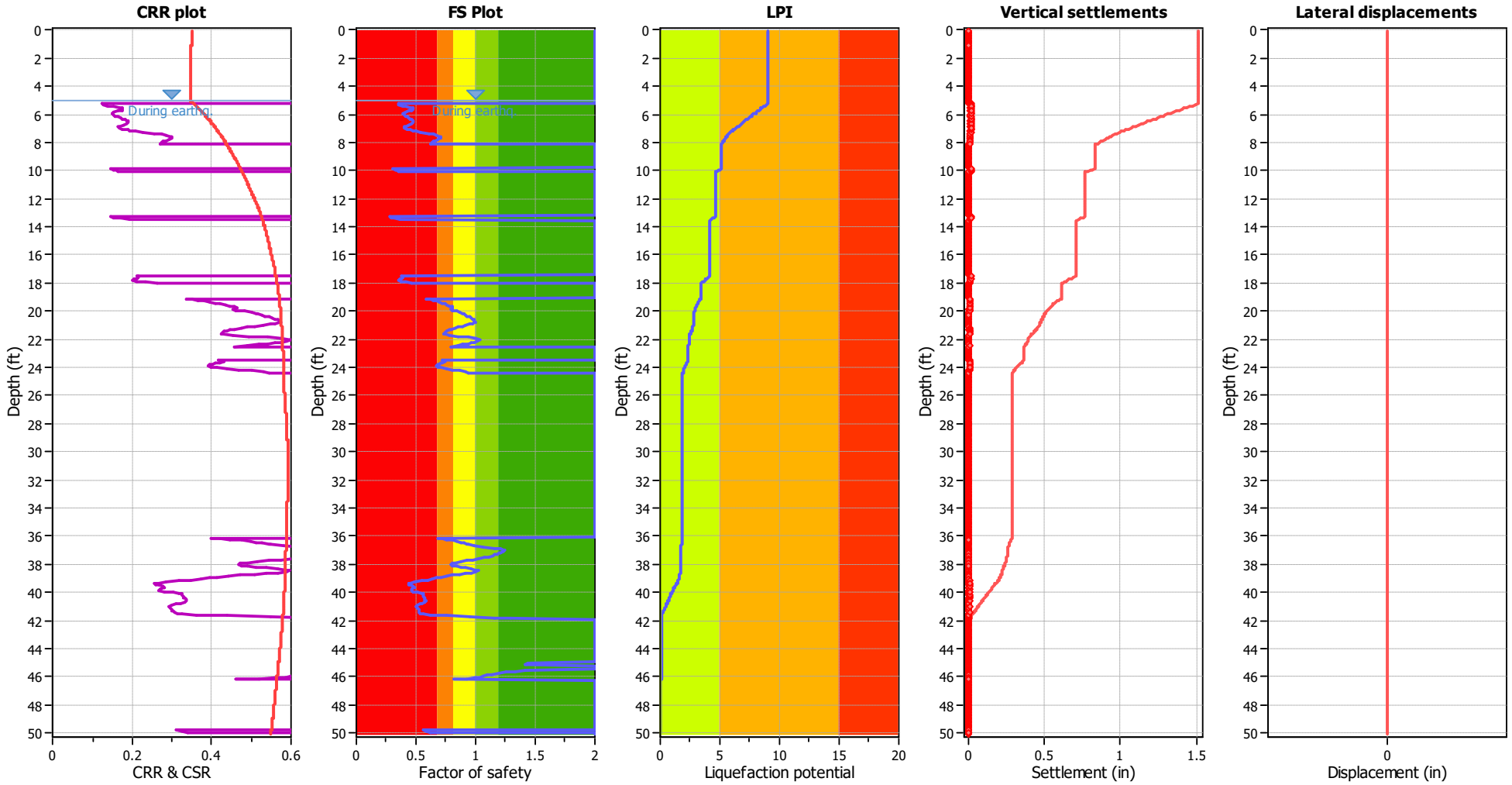
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.71	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	6.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

SBT legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.71	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	6.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

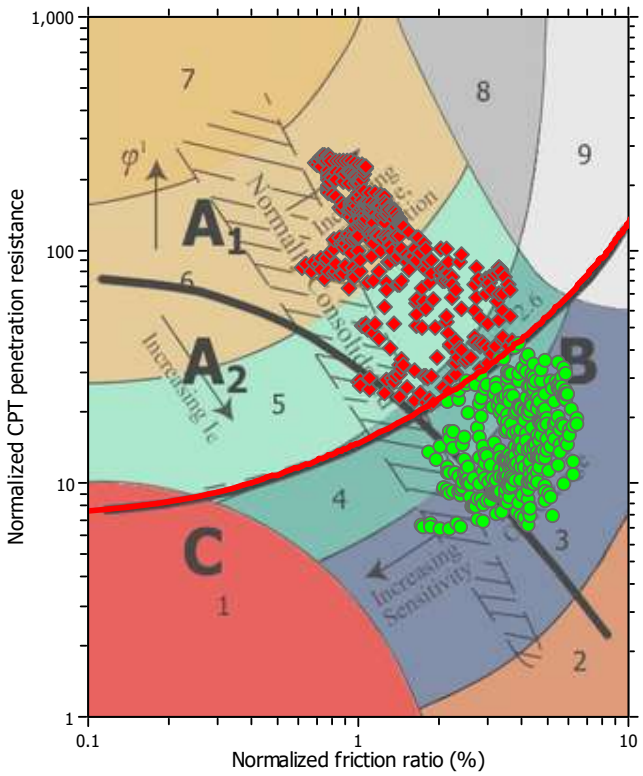
F.S. color scheme

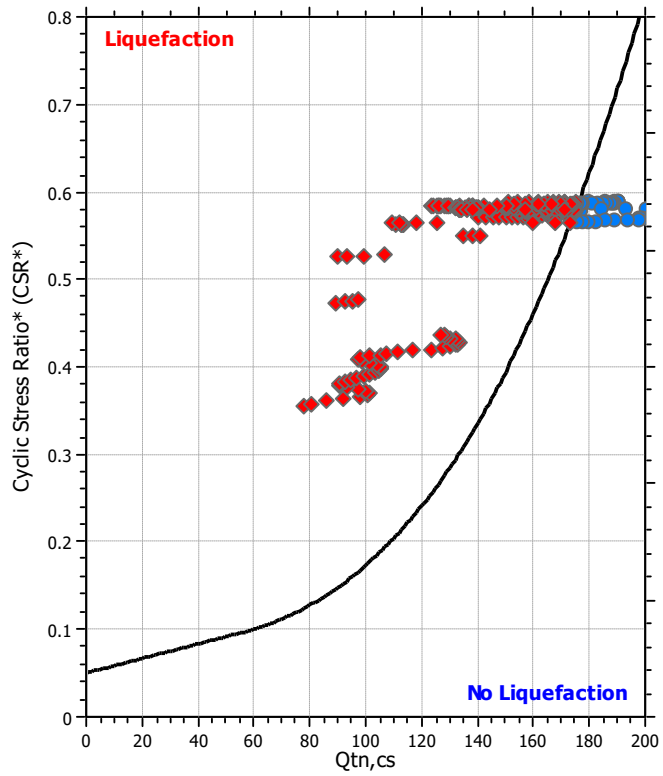
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

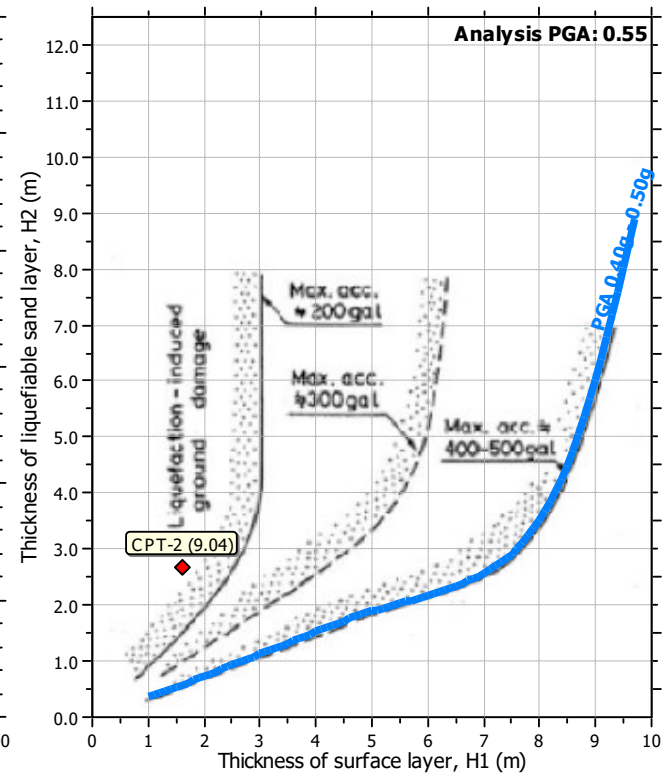
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots







Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.71	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	6.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

:: Post-earthquake settlement of dry sands ::

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
0.07	3.00	12.46	6.73	83.86	0	0	0.35	0.000	0.00	0.00	0.00	0.000
0.14	2.96	13.70	6.34	86.82	0	0	0.35	0.000	0.00	0.00	0.00	0.000
0.21	2.92	15.30	5.91	90.48	0	0	0.35	0.000	0.00	0.00	0.00	0.000
0.27	2.97	14.51	6.43	93.26	0	0	0.35	0.000	0.00	0.00	0.00	0.000
0.35	2.98	14.50	6.51	94.47	0	0	0.35	0.000	0.00	0.00	0.00	0.000
0.40	2.94	15.02	6.15	92.36	0	0	0.35	0.000	0.00	0.00	0.00	0.000
0.49	2.86	16.57	5.35	88.58	0	0	0.35	0.000	0.00	0.00	0.00	0.000
0.55	2.76	19.16	4.42	84.60	0	0	0.35	0.000	0.00	0.00	0.00	0.000
0.59	2.65	22.74	3.62	82.31	0	0	0.35	0.000	0.00	0.00	0.00	0.000
0.69	2.57	25.64	3.14	80.51	0	0	0.35	0.000	0.00	8.70	0.00	0.000
0.74	2.50	28.18	2.78	78.34	0	0	0.35	0.000	0.00	8.70	0.00	0.000
0.79	2.45	30.26	2.52	76.36	0	0	0.35	0.000	0.00	8.70	0.00	0.000
0.88	2.40	32.22	2.32	74.80	0	0	0.35	0.000	0.00	8.70	0.00	0.000
0.93	2.39	32.42	2.28	73.86	0	0	0.35	0.000	0.00	8.70	0.00	0.000
1.01	2.41	30.91	2.37	73.23	18	368	0.35	0.009	0.01	8.70	0.01	0.000
1.06	2.43	29.19	2.43	70.98	18	354	0.35	0.011	0.01	8.70	0.01	0.000
1.14	2.42	28.51	2.40	68.51	17	343	0.35	0.013	0.02	8.70	0.01	0.000
1.19	2.42	27.83	2.40	66.74	0	0	0.35	0.000	0.00	8.70	0.00	0.000
1.27	2.44	27.21	2.50	67.89	0	0	0.35	0.000	0.00	8.70	0.00	0.000
1.32	2.49	26.01	2.69	70.08	0	0	0.35	0.000	0.00	8.70	0.00	0.000
1.40	2.53	24.50	2.95	72.27	0	0	0.35	0.000	0.00	8.70	0.00	0.000
1.47	2.57	23.24	3.17	73.60	0	0	0.35	0.000	0.00	8.70	0.00	0.000
1.52	2.60	22.31	3.30	73.61	0	0	0.35	0.000	0.00	8.70	0.00	0.000
1.60	2.60	21.99	3.31	72.77	0	0	0.35	0.000	0.00	8.70	0.00	0.000
1.66	2.58	22.08	3.23	71.42	0	0	0.35	0.000	0.00	8.70	0.00	0.000
1.72	2.55	22.70	3.05	69.12	0	0	0.35	0.000	0.00	8.70	0.00	0.000
1.79	2.51	23.52	2.82	66.22	0	0	0.35	0.000	0.00	8.70	0.00	0.000
1.85	2.47	24.25	2.60	63.05	0	0	0.35	0.000	0.00	8.70	0.00	0.000
1.92	2.42	25.18	2.41	60.74	0	0	0.35	0.000	0.00	8.70	0.00	0.000
1.98	2.39	26.21	2.28	59.67	0	0	0.35	0.000	0.00	8.70	0.00	0.000
2.05	2.37	27.04	2.21	59.70	0	0	0.35	0.000	0.00	8.70	0.00	0.000
2.10	2.37	27.71	2.19	60.64	0	0	0.35	0.000	0.00	8.70	0.00	0.000
2.18	2.38	28.27	2.24	63.34	0	0	0.35	0.000	0.00	8.70	0.00	0.000
2.23	2.43	28.78	2.42	69.77	0	0	0.35	0.000	0.00	8.70	0.00	0.000
2.31	2.49	28.83	2.72	78.49	0	0	0.35	0.000	0.00	8.70	0.00	0.000
2.39	2.55	28.41	3.04	86.39	0	0	0.35	0.000	0.00	8.70	0.00	0.000
2.44	2.60	27.26	3.35	91.42	0	0	0.35	0.000	0.00	0.00	0.00	0.000
2.51	2.64	26.32	3.56	93.71	0	0	0.35	0.000	0.00	0.00	0.00	0.000
2.56	2.67	25.12	3.80	95.56	0	0	0.35	0.000	0.00	0.00	0.00	0.000
2.64	2.71	24.08	4.05	97.64	0	0	0.35	0.000	0.00	0.00	0.00	0.000
2.70	2.75	23.09	4.35	100.42	0	0	0.35	0.000	0.00	0.00	0.00	0.000
2.76	2.76	23.40	4.42	103.32	0	0	0.35	0.000	0.00	0.00	0.00	0.000
2.84	2.74	24.80	4.26	105.66	0	0	0.35	0.000	0.00	0.00	0.00	0.000
2.90	2.70	26.72	4.03	107.69	0	0	0.35	0.000	0.00	0.00	0.00	0.000
2.96	2.69	28.16	3.92	110.45	0	0	0.35	0.000	0.00	0.00	0.00	0.000
3.04	2.69	29.28	3.89	114.01	0	0	0.35	0.000	0.00	0.00	0.00	0.000
3.09	2.70	29.63	4.01	118.83	0	0	0.35	0.000	0.00	0.00	0.00	0.000
3.17	2.72	29.71	4.13	122.79	0	0	0.35	0.000	0.00	0.00	0.00	0.000

:: Post-earthquake settlement of dry sands :: (continued)

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
3.23	2.74	29.13	4.30	125.37	0	0	0.35	0.000	0.00	0.00	0.00	0.000
3.29	2.75	28.35	4.41	125.03	0	0	0.35	0.000	0.00	0.00	0.00	0.000
3.37	2.77	27.20	4.53	123.19	0	0	0.35	0.000	0.00	0.00	0.00	0.000
3.42	2.78	26.12	4.62	120.66	0	0	0.35	0.000	0.00	0.00	0.00	0.000
3.48	2.79	25.02	4.73	118.33	0	0	0.35	0.000	0.00	0.00	0.00	0.000
3.55	2.81	23.81	4.86	115.82	0	0	0.35	0.000	0.00	0.00	0.00	0.000
3.61	2.82	22.77	4.96	112.96	0	0	0.35	0.000	0.00	0.00	0.00	0.000
3.68	2.83	21.78	5.06	110.27	0	0	0.35	0.000	0.00	0.00	0.00	0.000
3.75	2.84	20.99	5.16	108.22	0	0	0.35	0.000	0.00	0.00	0.00	0.000
3.81	2.85	20.41	5.24	107.01	0	0	0.35	0.000	0.00	0.00	0.00	0.000
3.88	2.85	20.20	5.26	106.33	0	0	0.35	0.000	0.00	0.00	0.00	0.000
3.94	2.84	20.45	5.16	105.49	0	0	0.35	0.000	0.00	0.00	0.00	0.000
4.02	2.83	20.86	5.02	104.80	0	0	0.35	0.000	0.00	0.00	0.00	0.000
4.07	2.81	21.37	4.88	104.28	0	0	0.35	0.000	0.00	0.00	0.00	0.000
4.16	2.81	21.57	4.83	104.21	0	0	0.35	0.000	0.00	0.00	0.00	0.000
4.21	2.81	21.41	4.87	104.36	0	0	0.35	0.000	0.00	0.00	0.00	0.000
4.28	2.82	21.14	4.94	104.33	0	0	0.35	0.000	0.00	0.00	0.00	0.000
4.35	2.82	20.67	5.00	103.28	0	0	0.35	0.000	0.00	0.00	0.00	0.000
4.43	2.82	20.45	4.94	101.07	0	0	0.35	0.000	0.00	0.00	0.00	0.000
4.48	2.78	20.70	4.60	95.31	0	0	0.35	0.000	0.00	0.00	0.00	0.000
4.56	2.71	21.79	4.07	88.68	0	0	0.35	0.000	0.00	0.00	0.00	0.000
4.61	2.59	24.79	3.28	81.34	0	0	0.35	0.000	0.00	8.70	0.00	0.000
4.68	2.49	28.78	2.70	77.66	0	0	0.35	0.000	0.00	8.70	0.00	0.000
4.74	2.38	34.06	2.23	75.90	0	0	0.35	0.000	0.00	8.70	0.00	0.000
4.81	2.32	37.84	2.00	75.66	0	0	0.35	0.000	0.00	8.70	0.00	0.000
4.86	2.26	41.47	1.83	75.91	0	0	0.35	0.000	0.00	8.70	0.00	0.000
4.92	2.23	43.71	1.74	76.18	0	0	0.35	0.000	0.00	8.70	0.00	0.000

Total estimated settlement: 0.00

Abbreviations

Q_{tn}: Equivalent clean sand normalized cone resistance
K_c: Fines correction factor
$Q_{tn,cs}$: Post-liquefaction volumentric strain
G_{max}: Small strain shear modulus
CSR: Soil cyclic stress ratio
γ: Cyclic shear strain
$e_{vol(15)}$: Volumetric strain after 15 cycles
N_c: Equivalent number of cycles
e_v: Volumetric strain
Settle.: Calculated settlement

:: Post-earthquake settlement due to soil liquefaction ::

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
5.00	76.61	2.00	0.00	0.92	0.00	5.07	76.95	2.00	0.00	0.91	0.00
5.12	76.98	2.00	0.00	0.91	0.00	5.20	76.97	2.00	0.00	0.91	0.00
5.25	77.97	0.35	2.61	0.91	0.02	5.32	80.66	0.36	2.54	0.91	0.02
5.39	85.92	0.39	2.40	0.91	0.02	5.47	92.20	0.42	2.27	0.91	0.02
5.54	97.85	0.46	2.16	0.91	0.02	5.58	100.98	0.48	2.10	0.91	0.01
5.65	101.35	0.48	2.09	0.90	0.02	5.74	100.33	0.47	2.10	0.90	0.02
5.78	97.25	0.44	2.16	0.90	0.01	5.85	92.99	0.41	2.23	0.90	0.02
5.93	90.29	0.39	2.29	0.90	0.02	6.00	90.83	0.39	2.27	0.90	0.02

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
6.05	92.37	0.40	2.24	0.90	0.01	6.13	94.52	0.41	2.19	0.90	0.02
6.17	96.84	0.43	2.15	0.90	0.01	6.24	99.31	0.44	2.10	0.89	0.02
6.32	101.38	0.45	2.06	0.89	0.02	6.39	103.40	0.46	2.03	0.89	0.02
6.45	104.65	0.47	2.01	0.89	0.01	6.51	105.27	0.47	1.99	0.89	0.02
6.58	105.52	0.47	1.99	0.89	0.02	6.63	105.09	0.47	1.99	0.89	0.01
6.71	104.13	0.46	2.00	0.89	0.02	6.78	101.65	0.44	2.04	0.89	0.02
6.85	98.90	0.42	2.08	0.88	0.02	6.90	96.99	0.40	2.12	0.88	0.01
6.97	97.96	0.41	2.10	0.88	0.02	7.04	101.21	0.43	2.04	0.88	0.02
7.11	105.36	0.46	1.97	0.88	0.02	7.16	107.36	0.47	1.94	0.88	0.01
7.22	111.55	0.50	1.87	0.88	0.01	7.30	116.48	0.54	1.81	0.88	0.02
7.36	123.65	0.61	1.72	0.88	0.01	7.43	127.74	0.65	1.67	0.87	0.01
7.49	130.42	0.68	1.47	0.87	0.01	7.56	132.15	0.69	1.44	0.87	0.01
7.63	133.21	0.70	1.42	0.87	0.01	7.68	133.53	0.70	1.42	0.87	0.01
7.74	133.03	0.70	1.42	0.87	0.01	7.82	131.90	0.68	1.44	0.87	0.01
7.88	130.36	0.66	1.46	0.87	0.01	7.95	129.04	0.64	1.64	0.87	0.01
8.01	128.04	0.63	1.65	0.86	0.01	8.08	127.08	0.62	1.66	0.86	0.01
8.14	125.41	2.00	0.00	0.86	0.00	8.21	122.86	2.00	0.00	0.86	0.00
8.28	119.76	2.00	0.00	0.86	0.00	8.34	116.36	2.00	0.00	0.86	0.00
8.41	112.94	2.00	0.00	0.86	0.00	8.47	108.23	2.00	0.00	0.86	0.00
8.54	105.93	2.00	0.00	0.86	0.00	8.60	105.81	2.00	0.00	0.85	0.00
8.67	108.20	2.00	0.00	0.85	0.00	8.74	112.21	2.00	0.00	0.85	0.00
8.80	115.04	2.00	0.00	0.85	0.00	8.87	114.25	2.00	0.00	0.85	0.00
8.93	110.38	2.00	0.00	0.85	0.00	9.00	105.51	2.00	0.00	0.85	0.00
9.07	100.61	2.00	0.00	0.85	0.00	9.14	95.82	2.00	0.00	0.85	0.00
9.19	89.38	2.00	0.00	0.84	0.00	9.25	81.75	2.00	0.00	0.84	0.00
9.34	75.05	2.00	0.00	0.84	0.00	9.41	72.02	2.00	0.00	0.84	0.00
9.48	72.38	2.00	0.00	0.84	0.00	9.55	73.04	2.00	0.00	0.84	0.00
9.58	75.17	2.00	0.00	0.84	0.00	9.68	78.00	2.00	0.00	0.84	0.00
9.71	82.08	2.00	0.00	0.84	0.00	9.80	85.40	2.00	0.00	0.83	0.00
9.86	89.35	0.31	2.13	0.83	0.02	9.93	92.54	0.32	2.07	0.83	0.02
9.99	95.40	0.34	2.02	0.83	0.02	10.06	97.30	0.35	1.98	0.83	0.02
10.12	98.66	2.00	0.00	0.83	0.00	10.18	98.28	2.00	0.00	0.83	0.00
10.24	92.92	2.00	0.00	0.83	0.00	10.31	86.83	2.00	0.00	0.83	0.00
10.39	81.71	2.00	0.00	0.82	0.00	10.43	80.42	2.00	0.00	0.82	0.00
10.53	79.15	2.00	0.00	0.82	0.00	10.59	78.39	2.00	0.00	0.82	0.00
10.64	80.90	2.00	0.00	0.82	0.00	10.71	85.61	2.00	0.00	0.82	0.00
10.77	90.45	2.00	0.00	0.82	0.00	10.83	94.46	2.00	0.00	0.82	0.00
10.90	98.03	2.00	0.00	0.82	0.00	10.97	100.77	2.00	0.00	0.81	0.00
11.03	101.48	2.00	0.00	0.81	0.00	11.10	96.77	2.00	0.00	0.81	0.00
11.16	88.04	2.00	0.00	0.81	0.00	11.23	80.54	2.00	0.00	0.81	0.00
11.29	78.17	2.00	0.00	0.81	0.00	11.35	80.18	2.00	0.00	0.81	0.00
11.42	80.10	2.00	0.00	0.81	0.00	11.49	78.65	2.00	0.00	0.81	0.00
11.55	75.96	2.00	0.00	0.80	0.00	11.62	72.48	2.00	0.00	0.80	0.00
11.68	69.65	2.00	0.00	0.80	0.00	11.75	65.78	2.00	0.00	0.80	0.00
11.81	60.84	2.00	0.00	0.80	0.00	11.89	56.08	2.00	0.00	0.80	0.00
11.96	51.65	2.00	0.00	0.80	0.00	12.03	49.55	2.00	0.00	0.80	0.00
12.09	48.07	2.00	0.00	0.80	0.00	12.15	47.12	2.00	0.00	0.79	0.00
12.23	46.26	2.00	0.00	0.79	0.00	12.29	46.08	2.00	0.00	0.79	0.00

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
12.35	47.64	2.00	0.00	0.79	0.00	12.41	51.67	2.00	0.00	0.79	0.00
12.50	56.69	2.00	0.00	0.79	0.00	12.56	62.45	2.00	0.00	0.79	0.00
12.62	68.59	2.00	0.00	0.79	0.00	12.68	74.87	2.00	0.00	0.79	0.00
12.73	81.11	2.00	0.00	0.78	0.00	12.82	86.07	2.00	0.00	0.78	0.00
12.89	89.76	2.00	0.00	0.78	0.00	12.95	91.89	2.00	0.00	0.78	0.00
13.00	92.74	2.00	0.00	0.78	0.00	13.09	92.42	2.00	0.00	0.78	0.00
13.14	91.14	2.00	0.00	0.78	0.00	13.20	89.79	2.00	0.00	0.78	0.00
13.26	90.06	0.28	1.97	0.78	0.01	13.34	93.27	0.30	1.91	0.77	0.02
13.41	99.04	0.32	1.82	0.77	0.01	13.46	106.71	0.37	1.71	0.77	0.01
13.54	113.36	2.00	0.00	0.77	0.00	13.60	116.91	2.00	0.00	0.77	0.00
13.67	115.77	2.00	0.00	0.77	0.00	13.73	114.31	2.00	0.00	0.77	0.00
13.80	112.45	2.00	0.00	0.77	0.00	13.86	110.49	2.00	0.00	0.77	0.00
13.92	103.54	2.00	0.00	0.76	0.00	13.99	96.75	2.00	0.00	0.76	0.00
14.07	97.09	2.00	0.00	0.76	0.00	14.12	103.52	2.00	0.00	0.76	0.00
14.18	111.21	2.00	0.00	0.76	0.00	14.25	119.05	2.00	0.00	0.76	0.00
14.32	125.14	2.00	0.00	0.76	0.00	14.38	130.39	2.00	0.00	0.76	0.00
14.44	132.86	2.00	0.00	0.76	0.00	14.52	133.42	2.00	0.00	0.75	0.00
14.58	132.61	2.00	0.00	0.75	0.00	14.64	131.64	2.00	0.00	0.75	0.00
14.71	130.98	2.00	0.00	0.75	0.00	14.78	130.61	2.00	0.00	0.75	0.00
14.83	129.98	2.00	0.00	0.75	0.00	14.91	130.59	2.00	0.00	0.75	0.00
14.97	131.69	2.00	0.00	0.75	0.00	15.05	133.24	2.00	0.00	0.74	0.00
15.10	133.83	2.00	0.00	0.74	0.00	15.16	133.99	2.00	0.00	0.74	0.00
15.24	134.10	2.00	0.00	0.74	0.00	15.30	134.42	2.00	0.00	0.74	0.00
15.36	135.42	2.00	0.00	0.74	0.00	15.44	136.27	2.00	0.00	0.74	0.00
15.49	136.17	2.00	0.00	0.74	0.00	15.55	134.49	2.00	0.00	0.74	0.00
15.63	132.69	2.00	0.00	0.74	0.00	15.69	130.87	2.00	0.00	0.73	0.00
15.76	128.57	2.00	0.00	0.73	0.00	15.82	125.67	2.00	0.00	0.73	0.00
15.88	122.18	2.00	0.00	0.73	0.00	15.96	118.53	2.00	0.00	0.73	0.00
16.01	114.60	2.00	0.00	0.73	0.00	16.10	111.13	2.00	0.00	0.73	0.00
16.15	107.84	2.00	0.00	0.73	0.00	16.24	104.73	2.00	0.00	0.72	0.00
16.29	99.26	2.00	0.00	0.72	0.00	16.37	95.05	2.00	0.00	0.72	0.00
16.42	92.44	2.00	0.00	0.72	0.00	16.47	95.32	2.00	0.00	0.72	0.00
16.57	100.10	2.00	0.00	0.72	0.00	16.62	105.68	2.00	0.00	0.72	0.00
16.67	111.03	2.00	0.00	0.72	0.00	16.73	117.07	2.00	0.00	0.72	0.00
16.82	123.30	2.00	0.00	0.71	0.00	16.89	129.32	2.00	0.00	0.71	0.00
16.95	135.33	2.00	0.00	0.71	0.00	17.03	140.97	2.00	0.00	0.71	0.00
17.09	145.82	2.00	0.00	0.71	0.00	17.14	148.41	2.00	0.00	0.71	0.00
17.22	148.32	2.00	0.00	0.71	0.00	17.27	141.91	2.00	0.00	0.71	0.00
17.35	129.64	2.00	0.00	0.71	0.00	17.41	117.75	2.00	0.00	0.70	0.00
17.45	112.53	0.38	1.49	0.70	0.01	17.54	113.45	0.38	1.48	0.70	0.02
17.59	113.53	0.38	1.48	0.70	0.01	17.67	112.83	0.38	1.48	0.70	0.01
17.73	110.71	0.37	1.50	0.70	0.01	17.80	109.39	0.36	1.52	0.70	0.01
17.86	112.04	0.37	1.48	0.70	0.01	17.94	118.38	0.42	1.42	0.70	0.01
18.00	125.28	0.47	1.35	0.69	0.01	18.05	128.99	2.00	0.00	0.69	0.00
18.13	129.65	2.00	0.00	0.69	0.00	18.18	127.44	2.00	0.00	0.69	0.00
18.26	123.62	2.00	0.00	0.69	0.00	18.31	120.63	2.00	0.00	0.69	0.00
18.39	119.58	2.00	0.00	0.69	0.00	18.44	119.21	2.00	0.00	0.69	0.00
18.51	118.58	2.00	0.00	0.69	0.00	18.58	118.52	2.00	0.00	0.69	0.00

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
18.65	118.94	2.00	0.00	0.68	0.00	18.71	121.11	2.00	0.00	0.68	0.00
18.78	123.88	2.00	0.00	0.68	0.00	18.84	127.29	2.00	0.00	0.68	0.00
18.91	130.39	2.00	0.00	0.68	0.00	18.96	133.89	2.00	0.00	0.68	0.00
19.04	137.19	2.00	0.00	0.68	0.00	19.11	140.36	0.59	1.20	0.68	0.01
19.17	143.00	0.62	1.18	0.68	0.01	19.24	145.42	0.64	1.16	0.67	0.01
19.30	147.78	0.67	0.95	0.67	0.01	19.36	150.14	0.69	0.93	0.67	0.01
19.43	152.41	0.72	0.91	0.67	0.01	19.50	154.41	0.74	0.89	0.67	0.01
19.56	156.25	0.76	0.71	0.67	0.01	19.62	157.84	0.78	0.70	0.67	0.01
19.69	159.72	0.80	0.68	0.67	0.01	19.78	160.31	0.81	0.68	0.66	0.01
19.82	159.53	0.80	0.68	0.66	0.00	19.88	158.94	0.79	0.68	0.66	0.00
19.95	160.06	0.80	0.68	0.66	0.01	20.02	163.20	0.84	0.66	0.66	0.01
20.09	165.29	0.87	0.49	0.66	0.00	20.15	166.66	0.89	0.48	0.66	0.00
20.21	167.53	0.90	0.48	0.66	0.00	20.29	168.60	0.92	0.47	0.66	0.00
20.36	169.64	0.93	0.47	0.65	0.00	20.42	170.84	0.95	0.46	0.65	0.00
20.49	171.93	0.96	0.35	0.65	0.00	20.55	172.92	0.98	0.35	0.65	0.00
20.62	173.60	0.98	0.34	0.65	0.00	20.68	174.14	0.99	0.34	0.65	0.00
20.75	174.40	1.00	0.34	0.65	0.00	20.81	174.06	0.99	0.34	0.65	0.00
20.88	172.96	0.97	0.34	0.65	0.00	20.95	171.32	0.95	0.35	0.65	0.00
21.00	169.01	0.92	0.46	0.64	0.00	21.08	166.62	0.89	0.47	0.64	0.00
21.13	164.20	0.85	0.48	0.64	0.00	21.20	161.92	0.82	0.64	0.64	0.01
21.27	159.72	0.80	0.66	0.64	0.01	21.33	157.99	0.77	0.67	0.64	0.00
21.39	156.92	0.76	0.67	0.64	0.00	21.46	156.04	0.75	0.68	0.64	0.01
21.53	155.10	0.74	0.84	0.64	0.01	21.59	154.54	0.73	0.84	0.63	0.01
21.67	155.02	0.74	0.83	0.63	0.01	21.73	158.93	0.78	0.65	0.63	0.00
21.79	164.25	0.85	0.47	0.63	0.00	21.86	170.46	0.94	0.45	0.63	0.00
21.92	174.74	1.00	0.33	0.63	0.00	21.99	177.24	1.03	0.33	0.63	0.00
22.05	177.44	1.04	0.32	0.63	0.00	22.12	176.04	1.02	0.33	0.63	0.00
22.19	174.41	0.99	0.33	0.62	0.00	22.25	172.64	0.96	0.33	0.62	0.00
22.32	170.48	0.93	0.44	0.62	0.00	22.38	167.65	0.89	0.45	0.62	0.00
22.46	164.24	0.85	0.61	0.62	0.01	22.51	159.27	0.79	0.64	0.62	0.00
22.59	154.84	2.00	0.00	0.62	0.00	22.64	151.84	2.00	0.00	0.62	0.00
22.72	151.81	2.00	0.00	0.61	0.00	22.79	151.20	2.00	0.00	0.61	0.00
22.84	151.25	2.00	0.00	0.61	0.00	22.91	151.00	2.00	0.00	0.61	0.00
22.98	150.26	2.00	0.00	0.61	0.00	23.04	147.91	2.00	0.00	0.61	0.00
23.11	145.24	2.00	0.00	0.61	0.00	23.17	144.37	2.00	0.00	0.61	0.00
23.24	142.52	2.00	0.00	0.61	0.00	23.30	140.68	2.00	0.00	0.61	0.00
23.37	143.47	2.00	0.00	0.60	0.00	23.44	149.69	2.00	0.00	0.60	0.00
23.50	153.86	0.72	0.80	0.60	0.01	23.57	155.53	0.74	0.79	0.60	0.01
23.63	154.22	0.72	0.80	0.60	0.01	23.70	152.69	0.71	0.81	0.60	0.01
23.77	151.32	0.69	0.82	0.60	0.01	23.84	150.03	0.68	0.82	0.60	0.01
23.89	149.63	0.67	0.83	0.60	0.01	23.97	150.59	0.68	0.82	0.59	0.01
24.02	153.04	0.71	0.80	0.59	0.00	24.09	156.64	0.75	0.62	0.59	0.01
24.16	161.04	0.81	0.60	0.59	0.01	24.23	165.69	0.86	0.44	0.59	0.00
24.29	169.07	0.91	0.42	0.59	0.00	24.36	170.83	0.93	0.42	0.59	0.00
24.43	171.26	2.00	0.00	0.59	0.00	24.49	170.87	2.00	0.00	0.58	0.00
24.54	169.78	2.00	0.00	0.58	0.00	24.61	167.87	2.00	0.00	0.58	0.00
24.68	165.05	2.00	0.00	0.58	0.00	24.75	161.25	2.00	0.00	0.58	0.00
24.81	154.32	2.00	0.00	0.58	0.00	24.87	142.18	2.00	0.00	0.58	0.00

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
24.94	126.22	2.00	0.00	0.58	0.00	25.02	113.02	2.00	0.00	0.58	0.00
25.07	105.99	2.00	0.00	0.58	0.00	25.14	103.59	2.00	0.00	0.57	0.00
25.20	101.35	2.00	0.00	0.57	0.00	25.27	98.92	2.00	0.00	0.57	0.00
25.34	97.57	2.00	0.00	0.57	0.00	25.41	97.67	2.00	0.00	0.57	0.00
25.46	98.44	2.00	0.00	0.57	0.00	25.53	98.84	2.00	0.00	0.57	0.00
25.61	98.91	2.00	0.00	0.57	0.00	25.66	98.93	2.00	0.00	0.57	0.00
25.72	99.33	2.00	0.00	0.56	0.00	25.80	101.53	2.00	0.00	0.56	0.00
25.87	105.62	2.00	0.00	0.56	0.00	25.92	110.30	2.00	0.00	0.56	0.00
26.02	113.80	2.00	0.00	0.56	0.00	26.05	114.94	2.00	0.00	0.56	0.00
26.12	112.74	2.00	0.00	0.56	0.00	26.19	107.45	2.00	0.00	0.56	0.00
26.26	100.96	2.00	0.00	0.55	0.00	26.33	94.41	2.00	0.00	0.55	0.00
26.38	87.23	2.00	0.00	0.55	0.00	26.46	79.82	2.00	0.00	0.55	0.00
26.52	72.21	2.00	0.00	0.55	0.00	26.59	66.45	2.00	0.00	0.55	0.00
26.64	62.77	2.00	0.00	0.55	0.00	26.71	61.13	2.00	0.00	0.55	0.00
26.78	59.92	2.00	0.00	0.55	0.00	26.85	58.53	2.00	0.00	0.55	0.00
26.91	57.14	2.00	0.00	0.54	0.00	26.98	56.79	2.00	0.00	0.54	0.00
27.05	57.02	2.00	0.00	0.54	0.00	27.11	57.31	2.00	0.00	0.54	0.00
27.18	57.96	2.00	0.00	0.54	0.00	27.24	59.07	2.00	0.00	0.54	0.00
27.31	59.97	2.00	0.00	0.54	0.00	27.38	60.49	2.00	0.00	0.54	0.00
27.44	60.98	2.00	0.00	0.53	0.00	27.51	62.07	2.00	0.00	0.53	0.00
27.56	63.81	2.00	0.00	0.53	0.00	27.64	65.57	2.00	0.00	0.53	0.00
27.69	67.96	2.00	0.00	0.53	0.00	27.78	70.14	2.00	0.00	0.53	0.00
27.86	72.03	2.00	0.00	0.53	0.00	27.89	73.26	2.00	0.00	0.53	0.00
27.99	73.85	2.00	0.00	0.53	0.00	28.04	74.35	2.00	0.00	0.52	0.00
28.09	75.03	2.00	0.00	0.52	0.00	28.15	76.37	2.00	0.00	0.52	0.00
28.22	77.87	2.00	0.00	0.52	0.00	28.30	78.65	2.00	0.00	0.52	0.00
28.35	75.32	2.00	0.00	0.52	0.00	28.44	71.86	2.00	0.00	0.52	0.00
28.51	68.73	2.00	0.00	0.52	0.00	28.55	68.73	2.00	0.00	0.52	0.00
28.61	67.54	2.00	0.00	0.52	0.00	28.70	65.77	2.00	0.00	0.51	0.00
28.76	64.17	2.00	0.00	0.51	0.00	28.81	64.35	2.00	0.00	0.51	0.00
28.88	65.17	2.00	0.00	0.51	0.00	28.94	66.43	2.00	0.00	0.51	0.00
29.01	67.94	2.00	0.00	0.51	0.00	29.10	69.73	2.00	0.00	0.51	0.00
29.15	71.70	2.00	0.00	0.51	0.00	29.20	72.86	2.00	0.00	0.51	0.00
29.27	73.14	2.00	0.00	0.50	0.00	29.36	72.63	2.00	0.00	0.50	0.00
29.42	71.57	2.00	0.00	0.50	0.00	29.47	69.83	2.00	0.00	0.50	0.00
29.53	67.91	2.00	0.00	0.50	0.00	29.62	66.25	2.00	0.00	0.50	0.00
29.68	65.52	2.00	0.00	0.50	0.00	29.73	65.77	2.00	0.00	0.50	0.00
29.82	66.40	2.00	0.00	0.49	0.00	29.87	67.10	2.00	0.00	0.49	0.00
29.95	67.30	2.00	0.00	0.49	0.00	30.01	66.97	2.00	0.00	0.49	0.00
30.07	65.56	2.00	0.00	0.49	0.00	30.15	63.44	2.00	0.00	0.49	0.00
30.21	60.87	2.00	0.00	0.49	0.00	30.27	59.06	2.00	0.00	0.49	0.00
30.35	58.23	2.00	0.00	0.49	0.00	30.40	58.38	2.00	0.00	0.48	0.00
30.46	59.24	2.00	0.00	0.48	0.00	30.51	62.08	2.00	0.00	0.48	0.00
30.60	66.32	2.00	0.00	0.48	0.00	30.65	71.49	2.00	0.00	0.48	0.00
30.71	75.29	2.00	0.00	0.48	0.00	30.80	77.59	2.00	0.00	0.48	0.00
30.86	77.87	2.00	0.00	0.48	0.00	30.92	76.17	2.00	0.00	0.48	0.00
30.99	73.87	2.00	0.00	0.47	0.00	31.05	72.20	2.00	0.00	0.47	0.00
31.11	70.73	2.00	0.00	0.47	0.00	31.19	69.20	2.00	0.00	0.47	0.00

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
31.25	67.93	2.00	0.00	0.47	0.00	31.31	67.70	2.00	0.00	0.47	0.00
31.37	67.13	2.00	0.00	0.47	0.00	31.44	65.31	2.00	0.00	0.47	0.00
31.50	62.90	2.00	0.00	0.47	0.00	31.58	61.02	2.00	0.00	0.46	0.00
31.64	61.33	2.00	0.00	0.46	0.00	31.70	64.59	2.00	0.00	0.46	0.00
31.77	69.19	2.00	0.00	0.46	0.00	31.84	74.52	2.00	0.00	0.46	0.00
31.91	78.26	2.00	0.00	0.46	0.00	31.97	80.85	2.00	0.00	0.46	0.00
32.03	83.43	2.00	0.00	0.46	0.00	32.10	86.25	2.00	0.00	0.46	0.00
32.16	89.52	2.00	0.00	0.45	0.00	32.24	91.25	2.00	0.00	0.45	0.00
32.29	92.08	2.00	0.00	0.45	0.00	32.37	92.17	2.00	0.00	0.45	0.00
32.43	91.34	2.00	0.00	0.45	0.00	32.48	90.24	2.00	0.00	0.45	0.00
32.57	89.93	2.00	0.00	0.45	0.00	32.63	90.25	2.00	0.00	0.45	0.00
32.70	91.17	2.00	0.00	0.45	0.00	32.77	91.53	2.00	0.00	0.44	0.00
32.81	92.93	2.00	0.00	0.44	0.00	32.90	95.15	2.00	0.00	0.44	0.00
32.95	99.07	2.00	0.00	0.44	0.00	33.03	103.31	2.00	0.00	0.44	0.00
33.09	107.85	2.00	0.00	0.44	0.00	33.14	112.18	2.00	0.00	0.44	0.00
33.22	114.87	2.00	0.00	0.44	0.00	33.28	114.35	2.00	0.00	0.44	0.00
33.36	110.30	2.00	0.00	0.43	0.00	33.41	104.52	2.00	0.00	0.43	0.00
33.47	99.53	2.00	0.00	0.43	0.00	33.54	95.56	2.00	0.00	0.43	0.00
33.60	92.67	2.00	0.00	0.43	0.00	33.67	90.39	2.00	0.00	0.43	0.00
33.74	88.19	2.00	0.00	0.43	0.00	33.81	86.00	2.00	0.00	0.43	0.00
33.87	83.47	2.00	0.00	0.43	0.00	33.94	81.20	2.00	0.00	0.42	0.00
34.00	79.77	2.00	0.00	0.42	0.00	34.07	79.72	2.00	0.00	0.42	0.00
34.13	81.29	2.00	0.00	0.42	0.00	34.21	83.72	2.00	0.00	0.42	0.00
34.26	87.72	2.00	0.00	0.42	0.00	34.32	93.42	2.00	0.00	0.42	0.00
34.39	100.51	2.00	0.00	0.42	0.00	34.49	104.79	2.00	0.00	0.42	0.00
34.52	105.36	2.00	0.00	0.41	0.00	34.60	103.29	2.00	0.00	0.41	0.00
34.66	101.51	2.00	0.00	0.41	0.00	34.72	101.98	2.00	0.00	0.41	0.00
34.80	105.19	2.00	0.00	0.41	0.00	34.85	110.74	2.00	0.00	0.41	0.00
34.91	115.79	2.00	0.00	0.41	0.00	34.99	121.36	2.00	0.00	0.41	0.00
35.07	126.51	2.00	0.00	0.41	0.00	35.12	132.00	2.00	0.00	0.40	0.00
35.17	134.72	2.00	0.00	0.40	0.00	35.25	134.86	2.00	0.00	0.40	0.00
35.32	133.15	2.00	0.00	0.40	0.00	35.38	128.65	2.00	0.00	0.40	0.00
35.46	125.36	2.00	0.00	0.40	0.00	35.52	124.12	2.00	0.00	0.40	0.00
35.57	126.22	2.00	0.00	0.40	0.00	35.65	128.50	2.00	0.00	0.40	0.00
35.71	131.92	2.00	0.00	0.39	0.00	35.78	135.18	2.00	0.00	0.39	0.00
35.83	139.23	2.00	0.00	0.39	0.00	35.90	142.27	2.00	0.00	0.39	0.00
35.98	145.58	2.00	0.00	0.39	0.00	36.07	148.25	2.00	0.00	0.39	0.00
36.11	151.03	0.68	0.53	0.39	0.00	36.16	154.29	0.72	0.51	0.39	0.00
36.22	158.08	0.76	0.40	0.39	0.00	36.29	161.95	0.81	0.39	0.38	0.00
36.36	164.95	0.85	0.38	0.38	0.00	36.42	167.09	0.87	0.28	0.38	0.00
36.49	168.92	0.90	0.28	0.38	0.00	36.55	170.90	0.93	0.27	0.38	0.00
36.62	171.45	0.93	0.27	0.38	0.00	36.68	175.25	0.99	0.20	0.38	0.00
36.76	179.87	1.06	0.14	0.38	0.00	36.83	186.16	1.16	0.10	0.38	0.00
36.88	189.21	1.21	0.10	0.37	0.00	36.95	190.60	1.23	0.10	0.37	0.00
37.03	190.92	1.24	0.10	0.37	0.00	37.07	190.30	1.23	0.10	0.37	0.00
37.16	189.43	1.21	0.10	0.37	0.00	37.21	188.53	1.20	0.10	0.37	0.00
37.28	187.61	1.18	0.10	0.37	0.00	37.34	186.37	1.16	0.10	0.37	0.00
37.42	185.08	1.14	0.14	0.37	0.00	37.48	183.25	1.11	0.14	0.36	0.00

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
37.54	181.04	1.08	0.14	0.36	0.00	37.61	177.99	1.03	0.19	0.36	0.00
37.67	174.65	0.98	0.19	0.36	0.00	37.75	171.01	0.93	0.26	0.36	0.00
37.81	167.42	0.88	0.26	0.36	0.00	37.88	163.95	0.84	0.35	0.36	0.00
37.94	161.53	0.80	0.36	0.36	0.00	37.99	160.78	0.80	0.36	0.36	0.00
38.07	161.87	0.81	0.36	0.35	0.00	38.13	163.98	0.84	0.35	0.35	0.00
38.19	166.96	0.87	0.26	0.35	0.00	38.27	170.00	0.92	0.25	0.35	0.00
38.33	173.60	0.97	0.19	0.35	0.00	38.40	176.17	1.00	0.18	0.35	0.00
38.46	177.18	1.02	0.18	0.35	0.00	38.52	176.11	1.00	0.18	0.35	0.00
38.60	173.46	0.97	0.18	0.35	0.00	38.67	170.11	0.92	0.25	0.34	0.00
38.73	166.22	0.87	0.25	0.34	0.00	38.78	161.74	0.81	0.35	0.34	0.00
38.88	157.27	0.76	0.36	0.34	0.00	38.93	153.11	0.71	0.46	0.34	0.00
38.98	150.07	0.67	0.47	0.34	0.00	39.04	146.73	0.64	0.58	0.34	0.00
39.14	142.46	0.60	0.59	0.34	0.01	39.20	136.93	0.55	0.61	0.34	0.00
39.24	130.40	0.49	0.63	0.33	0.00	39.34	125.82	0.45	0.65	0.33	0.01
39.39	123.33	0.44	0.65	0.33	0.00	39.44	124.34	0.44	0.65	0.33	0.00
39.50	126.20	0.46	0.64	0.33	0.00	39.59	128.39	0.47	0.63	0.33	0.01
39.64	129.62	0.48	0.62	0.33	0.00	39.70	128.61	0.48	0.62	0.33	0.00
39.79	126.91	0.46	0.63	0.33	0.01	39.83	126.48	0.46	0.63	0.32	0.00
39.93	129.24	0.48	0.61	0.32	0.01	39.99	133.70	0.52	0.59	0.32	0.00
40.04	137.15	0.55	0.58	0.32	0.00	40.09	138.43	0.56	0.57	0.32	0.00
40.18	138.38	0.56	0.57	0.32	0.01	40.23	138.49	0.56	0.57	0.32	0.00
40.31	138.67	0.56	0.57	0.32	0.01	40.36	139.21	0.57	0.56	0.32	0.00
40.43	139.41	0.57	0.56	0.31	0.01	40.50	139.94	0.58	0.56	0.31	0.00
40.56	140.35	0.58	0.55	0.31	0.00	40.64	140.40	0.58	0.55	0.31	0.01
40.70	139.65	0.57	0.55	0.31	0.00	40.76	137.64	0.55	0.56	0.31	0.00
40.83	135.27	0.53	0.56	0.31	0.00	40.89	133.05	0.51	0.57	0.31	0.00
40.97	132.02	0.51	0.57	0.31	0.01	41.03	131.96	0.51	0.57	0.30	0.00
41.08	132.28	0.51	0.56	0.30	0.00	41.15	132.66	0.51	0.56	0.30	0.00
41.22	133.52	0.52	0.56	0.30	0.00	41.27	133.55	0.52	0.55	0.30	0.00
41.35	133.87	0.52	0.55	0.30	0.00	41.43	134.46	0.53	0.55	0.30	0.01
41.48	135.98	0.54	0.54	0.30	0.00	41.54	138.06	0.56	0.53	0.30	0.00
41.61	144.63	0.62	0.51	0.29	0.00	41.67	156.85	0.76	0.31	0.29	0.00
41.74	171.43	0.95	0.21	0.29	0.00	41.80	184.88	1.15	0.08	0.29	0.00
41.87	193.10	1.29	0.05	0.29	0.00	41.94	200.80	2.00	0.00	0.29	0.00
42.00	206.91	2.00	0.00	0.29	0.00	42.08	213.64	2.00	0.00	0.29	0.00
42.14	219.27	2.00	0.00	0.29	0.00	42.20	224.54	2.00	0.00	0.28	0.00
42.28	228.72	2.00	0.00	0.28	0.00	42.33	231.00	2.00	0.00	0.28	0.00
42.39	231.99	2.00	0.00	0.28	0.00	42.47	232.83	2.00	0.00	0.28	0.00
42.56	233.93	2.00	0.00	0.28	0.00	42.61	237.47	2.00	0.00	0.28	0.00
42.65	240.21	2.00	0.00	0.28	0.00	42.72	241.55	2.00	0.00	0.28	0.00
42.79	241.21	2.00	0.00	0.27	0.00	42.87	240.15	2.00	0.00	0.27	0.00
42.92	239.48	2.00	0.00	0.27	0.00	43.01	239.91	2.00	0.00	0.27	0.00
43.05	241.65	2.00	0.00	0.27	0.00	43.14	244.41	2.00	0.00	0.27	0.00
43.18	248.15	2.00	0.00	0.27	0.00	43.27	251.39	2.00	0.00	0.27	0.00
43.32	254.09	2.00	0.00	0.27	0.00	43.40	255.01	2.00	0.00	0.26	0.00
43.45	254.21	2.00	0.00	0.26	0.00	43.53	251.98	2.00	0.00	0.26	0.00
43.58	248.79	2.00	0.00	0.26	0.00	43.66	245.93	2.00	0.00	0.26	0.00
43.71	242.41	2.00	0.00	0.26	0.00	43.78	238.70	2.00	0.00	0.26	0.00

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
43.86	234.49	2.00	0.00	0.26	0.00	43.91	227.82	2.00	0.00	0.26	0.00
43.97	221.53	2.00	0.00	0.25	0.00	44.05	215.81	2.00	0.00	0.25	0.00
44.10	214.68	2.00	0.00	0.25	0.00	44.18	213.70	2.00	0.00	0.25	0.00
44.23	213.86	2.00	0.00	0.25	0.00	44.31	214.59	2.00	0.00	0.25	0.00
44.38	215.26	2.00	0.00	0.25	0.00	44.43	214.82	2.00	0.00	0.25	0.00
44.50	213.33	2.00	0.00	0.25	0.00	44.57	211.50	2.00	0.00	0.24	0.00
44.63	209.48	2.00	0.00	0.24	0.00	44.70	207.71	2.00	0.00	0.24	0.00
44.78	206.26	2.00	0.00	0.24	0.00	44.82	205.17	2.00	0.00	0.24	0.00
44.90	203.60	2.00	0.00	0.24	0.00	44.97	201.21	2.00	0.00	0.24	0.00
45.04	199.21	1.43	0.00	0.24	0.00	45.09	198.30	1.42	0.00	0.24	0.00
45.16	198.75	1.43	0.00	0.23	0.00	45.21	202.02	2.00	0.00	0.23	0.00
45.29	205.16	2.00	0.00	0.23	0.00	45.36	206.73	2.00	0.00	0.23	0.00
45.41	205.57	2.00	0.00	0.23	0.00	45.49	202.13	2.00	0.00	0.23	0.00
45.56	198.06	1.42	0.00	0.23	0.00	45.62	193.72	1.33	0.04	0.23	0.00
45.68	189.58	1.26	0.04	0.23	0.00	45.75	185.73	1.19	0.06	0.22	0.00
45.80	182.45	1.14	0.08	0.22	0.00	45.88	179.58	1.09	0.08	0.22	0.00
45.94	177.69	1.06	0.08	0.22	0.00	46.01	175.67	1.03	0.12	0.22	0.00
46.08	173.01	0.99	0.12	0.22	0.00	46.14	167.97	0.92	0.16	0.22	0.00
46.21	160.06	0.82	0.22	0.22	0.00	46.28	150.50	2.00	0.00	0.22	0.00
46.33	139.46	2.00	0.00	0.21	0.00	46.40	130.85	2.00	0.00	0.21	0.00
46.46	125.83	2.00	0.00	0.21	0.00	46.53	125.35	2.00	0.00	0.21	0.00
46.59	125.35	2.00	0.00	0.21	0.00	46.68	122.96	2.00	0.00	0.21	0.00
46.74	117.60	2.00	0.00	0.21	0.00	46.81	112.04	2.00	0.00	0.21	0.00
46.87	105.84	2.00	0.00	0.21	0.00	46.94	98.90	2.00	0.00	0.20	0.00
47.00	90.20	2.00	0.00	0.20	0.00	47.07	80.71	2.00	0.00	0.20	0.00
47.12	71.53	2.00	0.00	0.20	0.00	47.18	64.85	2.00	0.00	0.20	0.00
47.25	61.30	2.00	0.00	0.20	0.00	47.34	61.11	2.00	0.00	0.20	0.00
47.39	61.97	2.00	0.00	0.20	0.00	47.45	62.79	2.00	0.00	0.20	0.00
47.52	63.12	2.00	0.00	0.19	0.00	47.58	62.81	2.00	0.00	0.19	0.00
47.67	62.84	2.00	0.00	0.19	0.00	47.72	63.37	2.00	0.00	0.19	0.00
47.78	65.17	2.00	0.00	0.19	0.00	47.85	67.53	2.00	0.00	0.19	0.00
47.91	70.11	2.00	0.00	0.19	0.00	47.98	72.49	2.00	0.00	0.19	0.00
48.03	74.56	2.00	0.00	0.19	0.00	48.13	76.09	2.00	0.00	0.18	0.00
48.19	77.52	2.00	0.00	0.18	0.00	48.25	78.35	2.00	0.00	0.18	0.00
48.31	78.68	2.00	0.00	0.18	0.00	48.37	78.65	2.00	0.00	0.18	0.00
48.46	78.86	2.00	0.00	0.18	0.00	48.52	79.39	2.00	0.00	0.18	0.00
48.58	79.81	2.00	0.00	0.18	0.00	48.65	79.64	2.00	0.00	0.18	0.00
48.71	78.87	2.00	0.00	0.17	0.00	48.77	78.53	2.00	0.00	0.17	0.00
48.83	79.52	2.00	0.00	0.17	0.00	48.92	80.87	2.00	0.00	0.17	0.00
48.97	82.97	2.00	0.00	0.17	0.00	49.04	86.85	2.00	0.00	0.17	0.00
49.10	92.21	2.00	0.00	0.17	0.00	49.17	97.26	2.00	0.00	0.17	0.00
49.23	100.34	2.00	0.00	0.17	0.00	49.28	101.31	2.00	0.00	0.16	0.00
49.37	100.34	2.00	0.00	0.16	0.00	49.43	102.40	2.00	0.00	0.16	0.00
49.49	109.81	2.00	0.00	0.16	0.00	49.56	118.77	2.00	0.00	0.16	0.00
49.61	125.67	2.00	0.00	0.16	0.00	49.69	129.97	2.00	0.00	0.16	0.00
49.76	132.85	2.00	0.00	0.16	0.00	49.82	135.21	0.56	0.28	0.16	0.00
49.88	138.07	0.59	0.28	0.15	0.00	49.95	141.15	0.62	0.27	0.15	0.00
50.00	143.33	2.00	0.00	0.15	0.00	50.08	144.29	2.00	0.00	0.15	0.00

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)

Total estimated settlement: 1.51

Abbreviations

$Q_{tn,cs}$:	Equivalent clean sand normalized cone resistance
FS:	Factor of safety against liquefaction
e_v (%):	Post-liquefaction volumentric strain
DF:	e_v depth weighting factor
Settlement:	Calculated settlement

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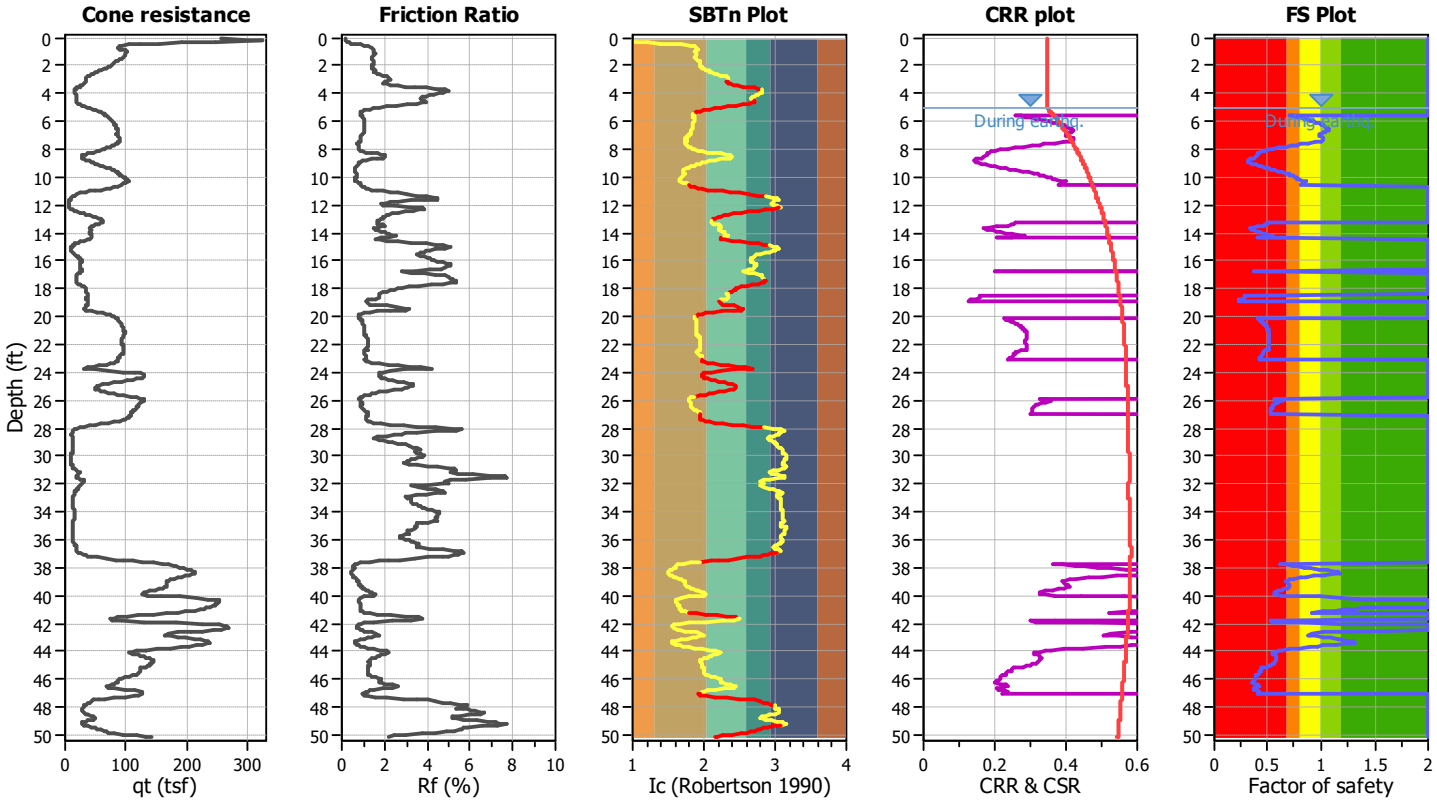
LIQUEFACTION ANALYSIS REPORT

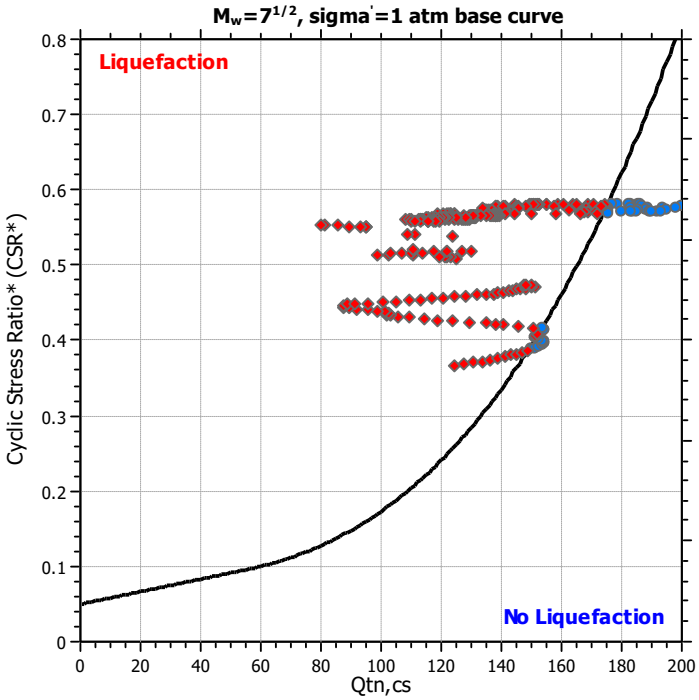
Project title : 7-Acre Site, Cypress Town Center **Location : Cypress, CA**

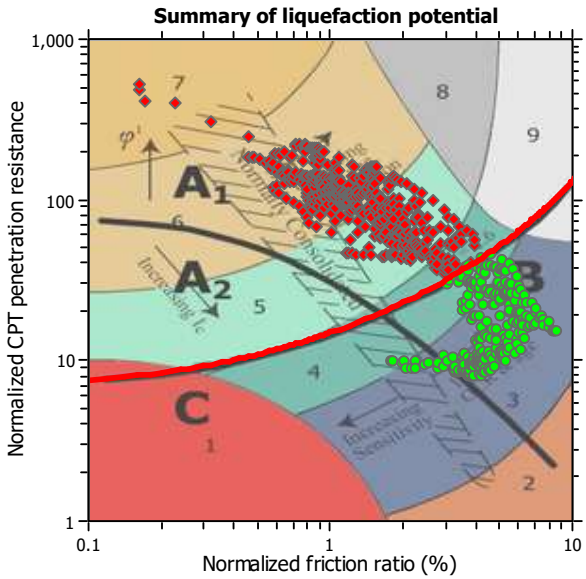
CPT file : CPT-3

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	6.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	5.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	50.00 ft
Earthquake magnitude M_w:	6.71	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.55	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

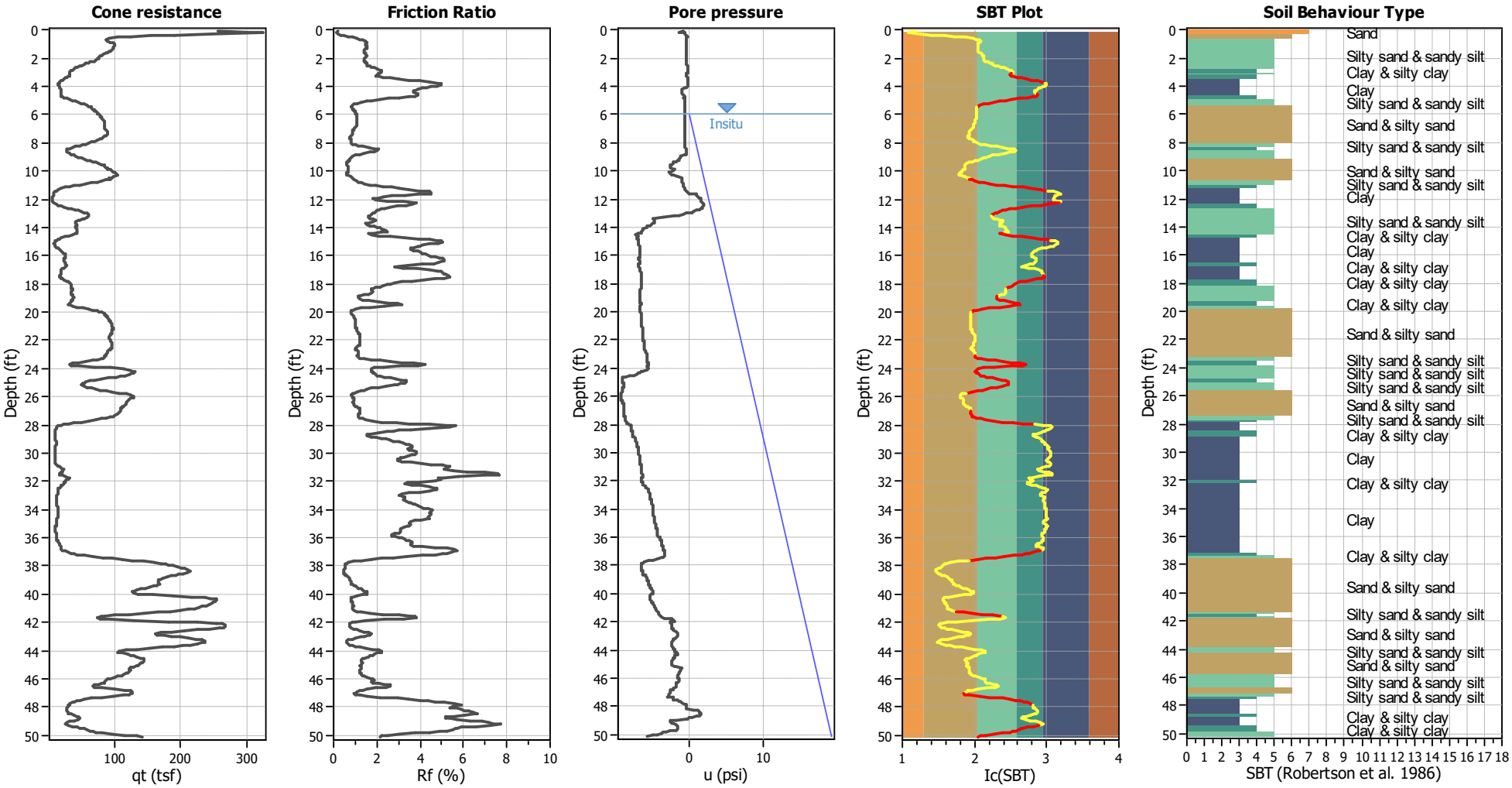






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



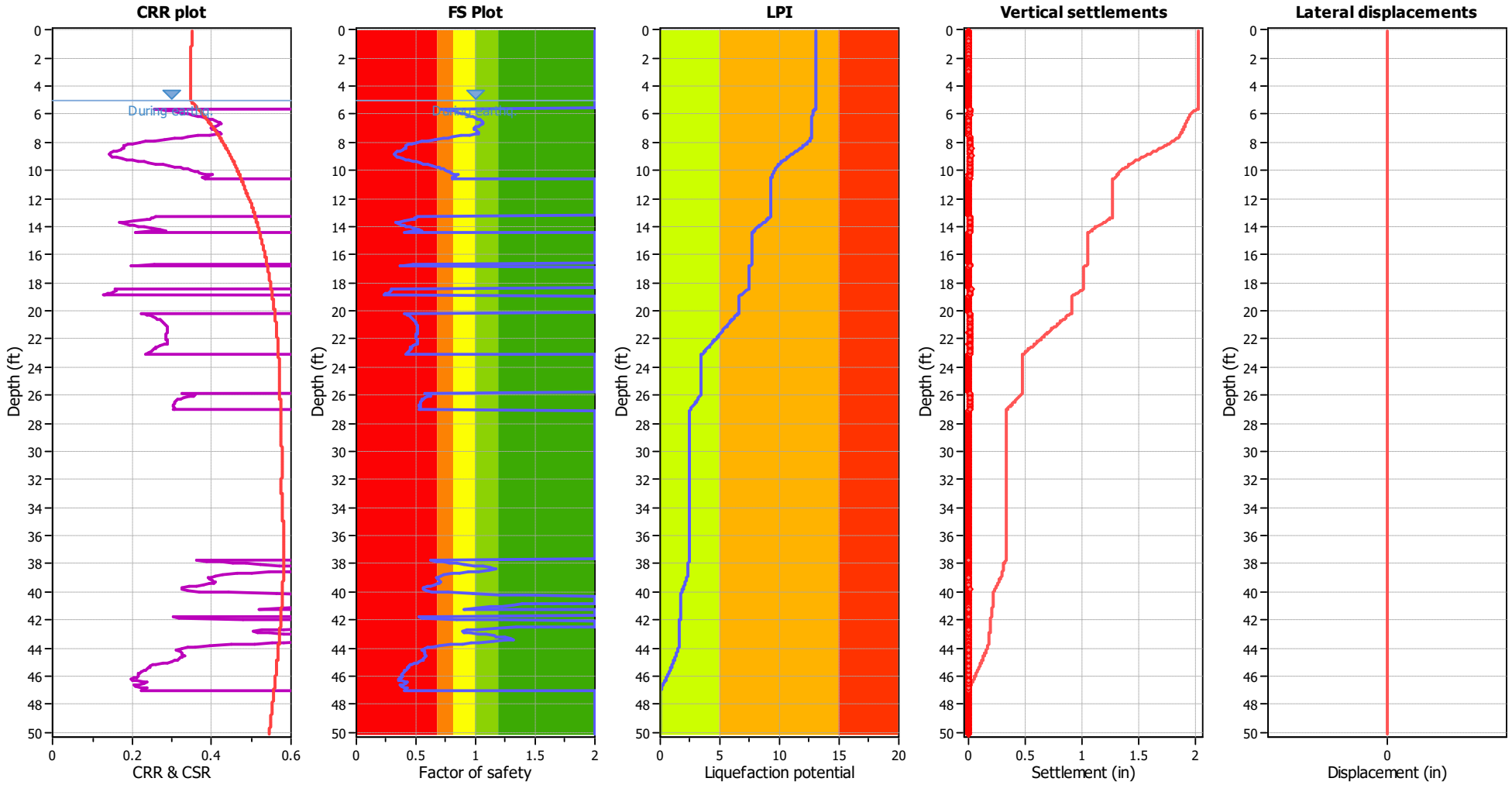
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.71	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	6.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

SBT legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.71	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	6.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

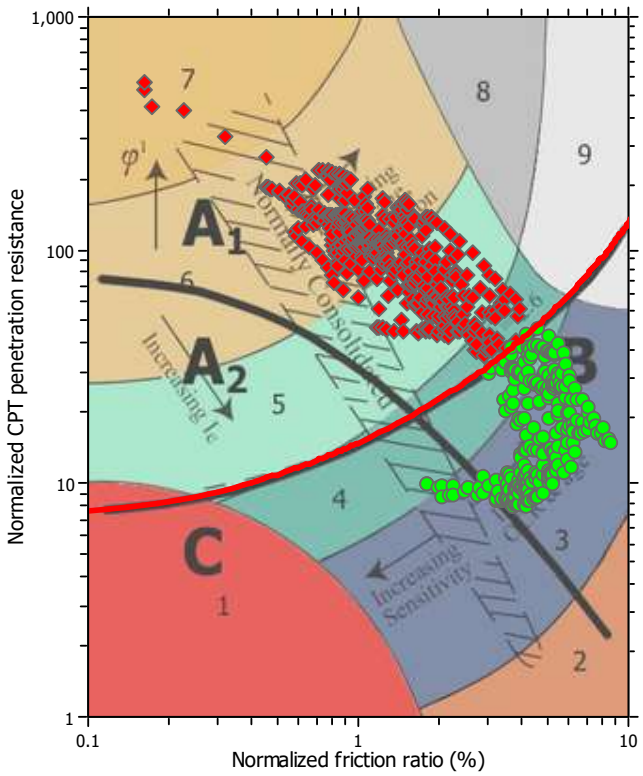
F.S. color scheme

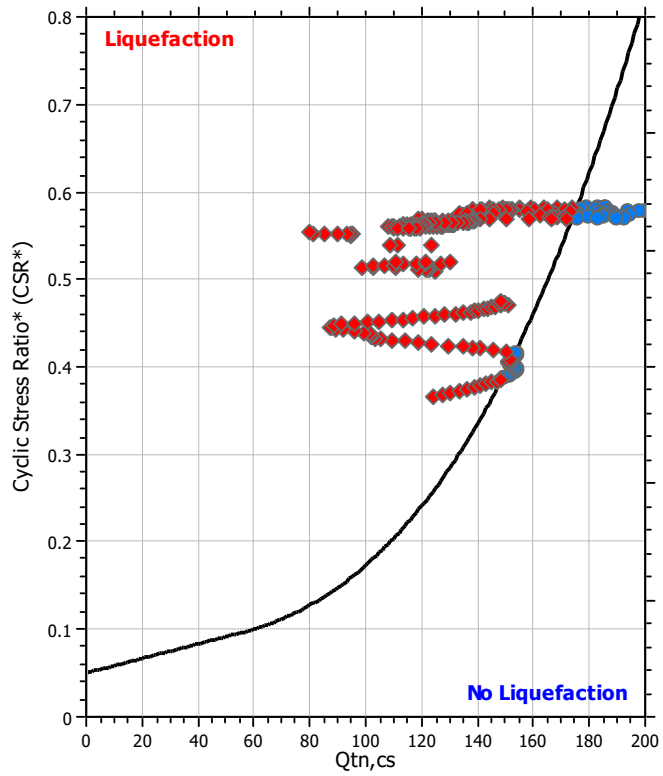
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

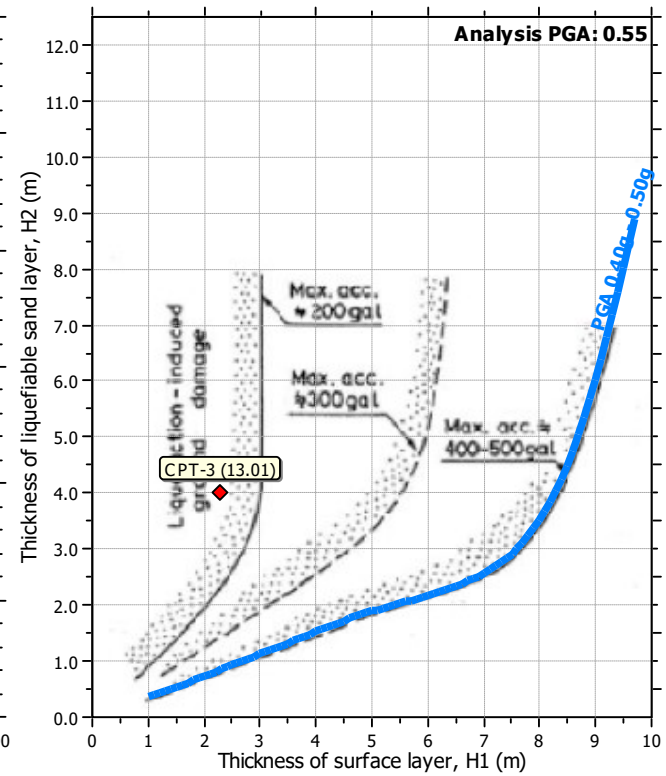
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots







Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.71	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	6.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

:: Post-earthquake settlement of dry sands ::

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
0.07	0.97	411.35	1.00	411.35	61	785	0.35	0.000	0.00	8.70	0.00	0.000
0.15	0.89	489.36	1.00	489.36	71	846	0.35	0.000	0.00	8.70	0.00	0.000
0.20	0.87	522.21	1.00	522.21	76	877	0.35	0.001	0.00	8.70	0.00	0.000
0.28	1.04	398.67	1.00	398.67	61	837	0.35	0.001	0.00	8.70	0.00	0.000
0.35	1.22	308.09	1.00	308.09	49	810	0.35	0.001	0.00	8.70	0.00	0.000
0.41	1.39	248.91	1.00	248.91	42	811	0.35	0.001	0.00	8.70	0.00	0.000
0.47	1.56	200.21	1.00	200.21	36	804	0.35	0.001	0.00	8.70	0.00	0.000
0.53	1.70	167.77	1.04	173.70	32	805	0.35	0.002	0.00	8.70	0.00	0.000
0.61	1.80	147.30	1.11	163.48	32	811	0.35	0.002	0.00	8.70	0.00	0.000
0.66	1.86	142.16	1.15	163.62	32	836	0.35	0.002	0.00	8.70	0.00	0.000
0.72	1.90	139.76	1.19	165.66	33	864	0.35	0.002	0.00	8.70	0.00	0.000
0.81	1.92	142.35	1.20	171.39	35	902	0.35	0.002	0.00	8.70	0.00	0.000
0.88	1.91	149.61	1.20	179.01	36	939	0.35	0.002	0.00	8.70	0.00	0.000
0.94	1.89	157.91	1.18	186.14	37	968	0.35	0.002	0.00	8.70	0.00	0.000
1.01	1.88	162.83	1.17	190.00	38	981	0.35	0.003	0.00	8.70	0.00	0.000
1.07	1.88	162.78	1.17	190.39	38	985	0.35	0.003	0.00	8.70	0.00	0.000
1.14	1.89	160.65	1.18	189.30	38	984	0.35	0.003	0.00	8.70	0.00	0.000
1.19	1.90	159.08	1.18	188.40	38	982	0.35	0.003	0.00	8.70	0.00	0.000
1.25	1.89	158.45	1.18	187.13	37	974	0.35	0.003	0.00	8.70	0.00	0.000
1.33	1.88	157.92	1.17	185.10	37	959	0.35	0.004	0.00	8.70	0.00	0.000
1.38	1.88	155.42	1.17	181.38	36	937	0.35	0.004	0.00	8.70	0.00	0.000
1.46	1.88	152.04	1.17	177.66	35	918	0.35	0.004	0.00	8.70	0.00	0.000
1.53	1.89	147.41	1.18	173.81	35	904	0.35	0.004	0.00	8.70	0.00	0.000
1.59	1.90	143.36	1.19	170.93	34	895	0.35	0.005	0.00	8.70	0.00	0.000
1.64	1.92	138.78	1.21	167.84	34	885	0.35	0.005	0.00	8.70	0.00	0.000
1.73	1.94	134.57	1.23	164.85	33	875	0.35	0.005	0.00	8.70	0.00	0.000
1.79	1.95	130.31	1.24	161.71	33	864	0.35	0.006	0.00	8.70	0.00	0.000
1.86	1.96	127.19	1.25	158.95	33	851	0.35	0.006	0.00	8.70	0.00	0.000
1.90	1.96	124.23	1.25	155.04	32	830	0.35	0.006	0.00	8.70	0.00	0.000
1.98	1.95	121.73	1.24	151.49	31	810	0.35	0.007	0.00	8.70	0.00	0.000
2.04	1.95	118.97	1.24	148.02	30	791	0.35	0.007	0.00	8.70	0.00	0.000
2.10	1.96	115.75	1.25	145.17	30	778	0.35	0.008	0.00	8.70	0.00	0.000
2.18	1.97	111.54	1.27	141.38	29	761	0.35	0.008	0.01	8.70	0.00	0.000
2.24	2.01	102.65	1.32	135.09	28	735	0.35	0.009	0.01	8.70	0.00	0.000
2.30	2.04	96.21	1.35	130.32	28	713	0.35	0.010	0.01	8.70	0.01	0.000
2.37	2.07	89.56	1.40	125.65	27	690	0.35	0.011	0.01	8.70	0.01	0.000
2.43	2.08	86.65	1.41	122.58	26	674	0.35	0.012	0.01	8.70	0.01	0.000
2.50	2.11	80.98	1.47	118.93	26	654	0.35	0.012	0.01	8.70	0.01	0.000
2.57	2.15	75.11	1.55	116.15	26	638	0.35	0.014	0.01	8.70	0.01	0.000
2.65	2.19	69.91	1.64	114.61	26	626	0.35	0.015	0.01	8.70	0.01	0.000
2.69	2.23	65.14	1.75	114.06	26	617	0.35	0.015	0.01	8.70	0.01	0.000
2.78	2.27	61.39	1.86	114.02	26	610	0.35	0.016	0.01	8.70	0.01	0.000
2.82	2.31	57.49	1.98	113.78	27	600	0.35	0.017	0.01	8.70	0.01	0.000
2.90	2.34	54.27	2.08	112.99	27	588	0.35	0.018	0.01	8.70	0.01	0.000
2.98	2.35	52.18	2.14	111.46	27	576	0.35	0.020	0.01	8.70	0.01	0.000
3.04	2.35	51.92	2.11	109.65	26	569	0.35	0.021	0.02	8.70	0.01	0.000
3.10	2.33	52.43	2.05	107.35	26	561	0.35	0.022	0.02	8.70	0.01	0.000
3.17	2.32	51.96	2.02	104.87	0	0	0.35	0.000	0.00	8.70	0.00	0.000

:: Post-earthquake settlement of dry sands :: (continued)

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
3.25	2.33	50.39	2.05	103.19	0	0	0.35	0.000	0.00	8.70	0.00	0.000
3.30	2.36	47.79	2.17	103.60	0	0	0.35	0.000	0.00	8.70	0.00	0.000
3.37	2.41	44.93	2.36	106.14	0	0	0.35	0.000	0.00	8.70	0.00	0.000
3.42	2.48	41.09	2.67	109.62	0	0	0.35	0.000	0.00	8.70	0.00	0.000
3.50	2.55	37.03	3.05	113.12	0	0	0.35	0.000	0.00	8.70	0.00	0.000
3.57	2.63	33.19	3.51	116.39	0	0	0.35	0.000	0.00	0.00	0.00	0.000
3.62	2.70	29.96	3.99	119.59	0	0	0.35	0.000	0.00	0.00	0.00	0.000
3.69	2.76	27.41	4.47	122.48	0	0	0.35	0.000	0.00	0.00	0.00	0.000
3.76	2.81	25.67	4.86	124.65	0	0	0.35	0.000	0.00	0.00	0.00	0.000
3.83	2.83	24.96	5.03	125.52	0	0	0.35	0.000	0.00	0.00	0.00	0.000
3.88	2.83	24.90	5.02	124.87	0	0	0.35	0.000	0.00	0.00	0.00	0.000
3.95	2.81	25.44	4.85	123.37	0	0	0.35	0.000	0.00	0.00	0.00	0.000
4.02	2.78	26.18	4.65	121.72	0	0	0.35	0.000	0.00	0.00	0.00	0.000
4.07	2.76	27.27	4.42	120.45	0	0	0.35	0.000	0.00	0.00	0.00	0.000
4.14	2.73	28.24	4.23	119.38	0	0	0.35	0.000	0.00	0.00	0.00	0.000
4.22	2.70	29.37	4.03	118.23	0	0	0.35	0.000	0.00	0.00	0.00	0.000
4.28	2.68	30.51	3.85	117.47	0	0	0.35	0.000	0.00	0.00	0.00	0.000
4.34	2.67	31.12	3.77	117.41	0	0	0.35	0.000	0.00	0.00	0.00	0.000
4.40	2.67	31.12	3.78	117.75	0	0	0.35	0.000	0.00	0.00	0.00	0.000
4.48	2.68	30.43	3.89	118.33	0	0	0.35	0.000	0.00	0.00	0.00	0.000
4.54	2.70	29.71	3.99	118.60	0	0	0.35	0.000	0.00	0.00	0.00	0.000
4.59	2.70	29.55	4.02	118.82	0	0	0.35	0.000	0.00	0.00	0.00	0.000
4.67	2.68	30.43	3.88	118.12	0	0	0.35	0.000	0.00	0.00	0.00	0.000
4.74	2.64	32.60	3.58	116.66	0	0	0.35	0.000	0.00	0.00	0.00	0.000
4.79	2.56	37.01	3.08	113.84	0	0	0.35	0.000	0.00	8.70	0.00	0.000
4.86	2.45	43.39	2.55	110.54	0	0	0.35	0.000	0.00	8.70	0.00	0.000
4.93	2.35	51.17	2.10	107.64	0	0	0.35	0.000	0.00	8.70	0.00	0.000
5.00	2.25	59.31	1.79	105.92	0	0	0.35	0.000	0.00	8.70	0.00	0.000

Total estimated settlement: 0.00

Abbreviations

Q_{tn}: Equivalent clean sand normalized cone resistance
K_c: Fines correction factor
$Q_{tn,cs}$: Post-liquefaction volumentric strain
G_{max}: Small strain shear modulus
CSR: Soil cyclic stress ratio
γ: Cyclic shear strain
$e_{vol(15)}$: Volumetric strain after 15 cycles
N_c: Equivalent number of cycles
e_v: Volumetric strain
Settle.: Calculated settlement

:: Post-earthquake settlement due to soil liquefaction ::

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
5.07	105.47	2.00	0.00	0.91	0.00	5.12	105.58	2.00	0.00	0.91	0.00
5.19	106.04	2.00	0.00	0.91	0.00	5.26	108.04	2.00	0.00	0.91	0.00
5.32	111.06	2.00	0.00	0.91	0.00	5.39	114.59	2.00	0.00	0.91	0.00
5.45	118.13	2.00	0.00	0.91	0.00	5.52	121.08	2.00	0.00	0.91	0.00
5.59	124.13	0.70	1.64	0.91	0.01	5.65	127.21	0.74	1.58	0.90	0.01
5.72	130.42	0.77	1.24	0.90	0.01	5.78	133.68	0.81	1.20	0.90	0.01
5.87	136.32	0.84	1.16	0.90	0.01	5.92	138.83	0.87	0.87	0.90	0.01

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
5.98	141.05	0.90	0.85	0.90	0.01	6.05	143.17	0.93	0.83	0.90	0.01
6.12	145.11	0.95	0.56	0.90	0.00	6.17	146.91	0.98	0.55	0.90	0.00
6.25	148.51	1.00	0.55	0.89	0.01	6.31	149.98	1.02	0.54	0.89	0.00
6.37	151.36	1.03	0.54	0.89	0.00	6.46	152.62	1.05	0.53	0.89	0.01
6.52	153.72	1.06	0.37	0.89	0.00	6.60	154.25	1.07	0.37	0.89	0.00
6.63	154.46	1.07	0.37	0.89	0.00	6.70	154.27	1.06	0.37	0.89	0.00
6.76	153.52	1.04	0.53	0.89	0.00	6.84	152.50	1.02	0.53	0.88	0.00
6.90	151.46	1.00	0.53	0.88	0.00	6.96	151.00	0.99	0.53	0.88	0.00
7.05	151.17	0.99	0.53	0.88	0.01	7.11	151.91	0.99	0.53	0.88	0.00
7.17	153.02	1.01	0.52	0.88	0.00	7.26	153.88	1.02	0.52	0.88	0.01
7.31	154.35	1.02	0.52	0.88	0.00	7.38	154.47	1.02	0.52	0.87	0.00
7.44	153.71	1.00	0.52	0.87	0.00	7.48	150.36	0.95	0.75	0.87	0.00
7.55	145.41	0.87	0.79	0.87	0.01	7.64	140.60	0.81	1.08	0.87	0.01
7.70	138.39	0.77	1.10	0.87	0.01	7.75	134.76	0.73	1.40	0.87	0.01
7.82	129.22	0.66	1.48	0.87	0.01	7.89	123.67	0.60	1.70	0.87	0.01
7.95	118.58	0.55	1.76	0.87	0.01	8.03	114.09	0.51	1.81	0.86	0.02
8.09	109.18	0.47	1.88	0.86	0.02	8.15	105.42	0.44	1.93	0.86	0.01
8.21	103.11	0.42	1.96	0.86	0.01	8.27	102.15	0.41	1.97	0.86	0.01
8.33	102.17	0.41	1.97	0.86	0.02	8.42	102.26	0.41	1.97	0.86	0.02
8.48	101.55	0.40	1.98	0.86	0.01	8.54	99.01	0.39	2.01	0.86	0.02
8.62	95.64	0.37	2.07	0.85	0.02	8.68	92.12	0.35	2.13	0.85	0.02
8.74	89.28	0.33	2.18	0.85	0.02	8.80	87.79	0.32	2.21	0.85	0.02
8.86	87.52	0.32	2.22	0.85	0.02	8.94	88.70	0.32	2.19	0.85	0.02
9.00	91.47	0.34	2.13	0.85	0.02	9.06	95.64	0.36	2.05	0.85	0.02
9.13	100.59	0.39	1.97	0.85	0.01	9.21	104.98	0.41	1.89	0.84	0.02
9.27	109.41	0.45	1.83	0.84	0.01	9.32	113.21	0.47	1.78	0.84	0.01
9.39	117.11	0.50	1.73	0.84	0.01	9.47	120.60	0.53	1.68	0.84	0.02
9.53	124.54	0.57	1.64	0.84	0.01	9.59	128.33	0.60	1.60	0.84	0.01
9.65	132.12	0.64	1.56	0.84	0.01	9.73	135.03	0.67	1.34	0.84	0.01
9.79	137.29	0.69	1.31	0.83	0.01	9.85	138.83	0.71	1.29	0.83	0.01
9.91	140.60	0.73	1.26	0.83	0.01	9.99	142.35	0.75	1.24	0.83	0.01
10.05	143.89	0.77	0.99	0.83	0.01	10.11	145.12	0.78	0.98	0.83	0.01
10.17	146.24	0.79	0.97	0.83	0.01	10.26	148.41	0.82	0.94	0.83	0.01
10.31	151.33	0.86	0.70	0.83	0.00	10.40	149.71	0.83	0.93	0.82	0.01
10.44	149.70	0.83	0.93	0.82	0.01	10.50	147.53	0.80	0.95	0.82	0.01
10.58	148.30	0.81	0.94	0.82	0.01	10.64	143.79	2.00	0.00	0.82	0.00
10.72	138.90	2.00	0.00	0.82	0.00	10.78	133.81	2.00	0.00	0.82	0.00
10.83	128.12	2.00	0.00	0.82	0.00	10.92	122.47	2.00	0.00	0.81	0.00
10.97	118.21	2.00	0.00	0.81	0.00	11.03	114.04	2.00	0.00	0.81	0.00
11.11	111.83	2.00	0.00	0.81	0.00	11.16	109.73	2.00	0.00	0.81	0.00
11.25	106.84	2.00	0.00	0.81	0.00	11.31	103.42	2.00	0.00	0.81	0.00
11.38	100.57	2.00	0.00	0.81	0.00	11.44	98.26	2.00	0.00	0.81	0.00
11.49	94.23	2.00	0.00	0.81	0.00	11.58	89.13	2.00	0.00	0.80	0.00
11.63	82.01	2.00	0.00	0.80	0.00	11.71	75.23	2.00	0.00	0.80	0.00
11.76	67.99	2.00	0.00	0.80	0.00	11.81	61.91	2.00	0.00	0.80	0.00
11.90	57.26	2.00	0.00	0.80	0.00	11.96	54.76	2.00	0.00	0.80	0.00
12.04	56.28	2.00	0.00	0.80	0.00	12.09	61.87	2.00	0.00	0.80	0.00
12.16	70.17	2.00	0.00	0.79	0.00	12.23	79.07	2.00	0.00	0.79	0.00

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
12.28	87.94	2.00	0.00	0.79	0.00	12.36	94.90	2.00	0.00	0.79	0.00
12.42	100.11	2.00	0.00	0.79	0.00	12.47	103.55	2.00	0.00	0.79	0.00
12.55	106.56	2.00	0.00	0.79	0.00	12.61	110.21	2.00	0.00	0.79	0.00
12.69	113.82	2.00	0.00	0.78	0.00	12.75	117.33	2.00	0.00	0.78	0.00
12.80	121.32	2.00	0.00	0.78	0.00	12.88	125.42	2.00	0.00	0.78	0.00
12.94	129.08	2.00	0.00	0.78	0.00	13.01	131.27	2.00	0.00	0.78	0.00
13.07	132.11	2.00	0.00	0.78	0.00	13.13	130.63	2.00	0.00	0.78	0.00
13.21	127.82	2.00	0.00	0.78	0.00	13.27	124.71	0.51	1.51	0.78	0.01
13.35	122.82	0.49	1.53	0.77	0.01	13.40	122.02	0.49	1.53	0.77	0.01
13.46	121.42	0.48	1.54	0.77	0.01	13.53	119.10	0.46	1.56	0.77	0.01
13.59	110.46	0.40	1.66	0.77	0.01	13.67	102.80	0.35	1.76	0.77	0.02
13.72	98.86	0.33	1.81	0.77	0.01	13.80	102.85	0.35	1.75	0.77	0.02
13.85	106.79	0.38	1.69	0.77	0.01	13.93	110.26	0.40	1.65	0.76	0.02
13.99	113.70	0.42	1.60	0.76	0.01	14.05	117.79	0.45	1.56	0.76	0.01
14.13	121.74	0.48	1.51	0.76	0.02	14.18	127.18	0.52	1.46	0.76	0.01
14.26	130.14	0.55	1.43	0.76	0.01	14.31	121.61	0.48	1.51	0.76	0.01
14.40	110.92	0.40	1.62	0.76	0.02	14.45	100.59	2.00	0.00	0.76	0.00
14.53	101.05	2.00	0.00	0.75	0.00	14.57	102.87	2.00	0.00	0.75	0.00
14.66	106.44	2.00	0.00	0.75	0.00	14.70	111.39	2.00	0.00	0.75	0.00
14.78	114.25	2.00	0.00	0.75	0.00	14.84	113.99	2.00	0.00	0.75	0.00
14.92	111.45	2.00	0.00	0.75	0.00	14.98	107.45	2.00	0.00	0.75	0.00
15.03	102.43	2.00	0.00	0.75	0.00	15.11	97.59	2.00	0.00	0.74	0.00
15.17	93.38	2.00	0.00	0.74	0.00	15.24	91.53	2.00	0.00	0.74	0.00
15.30	92.03	2.00	0.00	0.74	0.00	15.37	94.82	2.00	0.00	0.74	0.00
15.43	98.52	2.00	0.00	0.74	0.00	15.49	102.58	2.00	0.00	0.74	0.00
15.56	107.38	2.00	0.00	0.74	0.00	15.62	114.03	2.00	0.00	0.74	0.00
15.70	120.94	2.00	0.00	0.73	0.00	15.76	127.20	2.00	0.00	0.73	0.00
15.81	133.01	2.00	0.00	0.73	0.00	15.91	137.85	2.00	0.00	0.73	0.00
15.96	142.33	2.00	0.00	0.73	0.00	16.02	145.51	2.00	0.00	0.73	0.00
16.09	148.14	2.00	0.00	0.73	0.00	16.15	150.04	2.00	0.00	0.73	0.00
16.22	151.18	2.00	0.00	0.73	0.00	16.28	151.62	2.00	0.00	0.72	0.00
16.34	151.20	2.00	0.00	0.72	0.00	16.41	149.91	2.00	0.00	0.72	0.00
16.51	148.12	2.00	0.00	0.72	0.00	16.56	146.27	2.00	0.00	0.72	0.00
16.63	137.44	2.00	0.00	0.72	0.00	16.69	123.80	0.48	1.41	0.72	0.01
16.75	111.22	0.39	1.53	0.72	0.01	16.80	108.51	0.37	1.56	0.72	0.01
16.87	113.11	2.00	0.00	0.71	0.00	16.94	118.69	2.00	0.00	0.71	0.00
17.00	124.26	2.00	0.00	0.71	0.00	17.07	128.34	2.00	0.00	0.71	0.00
17.13	130.71	2.00	0.00	0.71	0.00	17.19	131.45	2.00	0.00	0.71	0.00
17.28	132.11	2.00	0.00	0.71	0.00	17.34	132.77	2.00	0.00	0.71	0.00
17.41	133.63	2.00	0.00	0.70	0.00	17.47	134.45	2.00	0.00	0.70	0.00
17.53	135.26	2.00	0.00	0.70	0.00	17.60	135.33	2.00	0.00	0.70	0.00
17.65	134.51	2.00	0.00	0.70	0.00	17.73	132.32	2.00	0.00	0.70	0.00
17.78	128.05	2.00	0.00	0.70	0.00	17.87	123.12	2.00	0.00	0.70	0.00
17.94	118.13	2.00	0.00	0.70	0.00	18.00	114.48	2.00	0.00	0.69	0.00
18.06	111.13	2.00	0.00	0.69	0.00	18.12	107.28	2.00	0.00	0.69	0.00
18.19	102.76	2.00	0.00	0.69	0.00	18.25	98.28	2.00	0.00	0.69	0.00
18.31	95.52	2.00	0.00	0.69	0.00	18.38	94.38	2.00	0.00	0.69	0.00
18.48	94.69	0.29	1.68	0.69	0.02	18.54	95.15	0.29	1.67	0.69	0.01

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
18.59	94.81	0.29	1.67	0.68	0.01	18.66	93.21	0.28	1.69	0.68	0.01
18.71	89.67	0.27	1.74	0.68	0.01	18.78	85.41	0.25	1.81	0.68	0.02
18.84	81.39	0.24	1.88	0.68	0.01	18.90	80.07	0.23	1.91	0.68	0.01
18.96	79.77	2.00	0.00	0.68	0.00	19.05	80.87	2.00	0.00	0.68	0.00
19.11	83.08	2.00	0.00	0.68	0.00	19.17	89.35	2.00	0.00	0.68	0.00
19.24	99.38	2.00	0.00	0.67	0.00	19.33	109.37	2.00	0.00	0.67	0.00
19.39	117.25	2.00	0.00	0.67	0.00	19.45	121.67	2.00	0.00	0.67	0.00
19.52	118.80	2.00	0.00	0.67	0.00	19.58	109.39	2.00	0.00	0.67	0.00
19.64	100.11	2.00	0.00	0.67	0.00	19.70	96.74	2.00	0.00	0.67	0.00
19.76	98.60	2.00	0.00	0.67	0.00	19.85	99.91	2.00	0.00	0.66	0.00
19.89	103.17	2.00	0.00	0.66	0.00	19.97	106.36	2.00	0.00	0.66	0.00
20.03	110.86	2.00	0.00	0.66	0.00	20.09	113.62	2.00	0.00	0.66	0.00
20.16	115.83	0.40	1.36	0.66	0.01	20.22	117.69	0.41	1.34	0.66	0.01
20.28	119.51	0.43	1.33	0.66	0.01	20.35	121.17	0.44	1.31	0.66	0.01
20.41	122.77	0.45	1.29	0.65	0.01	20.47	124.32	0.46	1.28	0.65	0.01
20.56	125.62	0.47	1.26	0.65	0.01	20.63	126.74	0.48	1.25	0.65	0.01
20.69	127.49	0.49	1.24	0.65	0.01	20.75	128.15	0.49	1.24	0.65	0.01
20.82	128.69	0.50	1.23	0.65	0.01	20.87	129.20	0.50	1.22	0.65	0.01
20.94	129.64	0.50	1.22	0.65	0.01	21.00	130.18	0.51	1.21	0.64	0.01
21.09	130.69	0.51	1.21	0.64	0.01	21.16	131.12	0.51	1.20	0.64	0.01
21.22	131.32	0.52	1.20	0.64	0.01	21.28	131.33	0.52	1.19	0.64	0.01
21.34	131.30	0.52	1.19	0.64	0.01	21.40	131.30	0.52	1.19	0.64	0.01
21.49	131.16	0.51	1.19	0.64	0.01	21.53	130.99	0.51	1.19	0.64	0.00
21.62	130.60	0.51	1.19	0.63	0.01	21.68	130.29	0.51	1.19	0.63	0.01
21.74	130.11	0.50	1.19	0.63	0.01	21.80	129.99	0.50	1.19	0.63	0.01
21.86	130.02	0.50	1.19	0.63	0.01	21.92	130.25	0.51	1.18	0.63	0.01
22.01	130.55	0.51	1.18	0.63	0.01	22.07	130.92	0.51	1.17	0.63	0.01
22.14	131.04	0.51	1.17	0.62	0.01	22.20	130.98	0.51	1.17	0.62	0.01
22.25	130.78	0.51	1.17	0.62	0.01	22.34	130.78	0.51	1.17	0.62	0.01
22.38	129.57	0.50	1.17	0.62	0.01	22.47	127.39	0.48	1.19	0.62	0.01
22.53	125.13	0.46	1.20	0.62	0.01	22.59	124.31	0.46	1.21	0.62	0.01
22.66	124.51	0.46	1.20	0.62	0.01	22.72	123.42	0.45	1.21	0.61	0.01
22.77	123.03	0.45	1.21	0.61	0.01	22.85	122.34	0.44	1.21	0.61	0.01
22.91	122.06	0.44	1.21	0.61	0.01	22.98	120.44	0.43	1.22	0.61	0.01
23.04	118.49	0.41	1.24	0.61	0.01	23.10	117.41	2.00	0.00	0.61	0.00
23.19	117.49	2.00	0.00	0.61	0.00	23.25	118.68	2.00	0.00	0.61	0.00
23.31	120.90	2.00	0.00	0.60	0.00	23.37	125.30	2.00	0.00	0.60	0.00
23.43	130.35	2.00	0.00	0.60	0.00	23.50	132.71	2.00	0.00	0.60	0.00
23.56	133.43	2.00	0.00	0.60	0.00	23.65	133.41	2.00	0.00	0.60	0.00
23.70	135.20	2.00	0.00	0.60	0.00	23.76	133.69	2.00	0.00	0.60	0.00
23.82	132.01	2.00	0.00	0.60	0.00	23.91	135.93	2.00	0.00	0.59	0.00
23.96	148.28	2.00	0.00	0.59	0.00	24.02	161.11	2.00	0.00	0.59	0.00
24.09	170.73	2.00	0.00	0.59	0.00	24.18	176.28	2.00	0.00	0.59	0.00
24.24	178.85	2.00	0.00	0.59	0.00	24.30	178.63	2.00	0.00	0.59	0.00
24.36	177.16	2.00	0.00	0.59	0.00	24.43	175.22	2.00	0.00	0.59	0.00
24.49	173.18	2.00	0.00	0.58	0.00	24.56	171.01	2.00	0.00	0.58	0.00
24.62	168.30	2.00	0.00	0.58	0.00	24.68	165.38	2.00	0.00	0.58	0.00
24.75	163.12	2.00	0.00	0.58	0.00	24.80	160.49	2.00	0.00	0.58	0.00

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
24.89	156.48	2.00	0.00	0.58	0.00	24.95	150.27	2.00	0.00	0.58	0.00
25.02	143.32	2.00	0.00	0.58	0.00	25.08	137.13	2.00	0.00	0.57	0.00
25.14	132.46	2.00	0.00	0.57	0.00	25.20	128.23	2.00	0.00	0.57	0.00
25.27	122.53	2.00	0.00	0.57	0.00	25.36	117.32	2.00	0.00	0.57	0.00
25.41	114.63	2.00	0.00	0.57	0.00	25.47	115.06	2.00	0.00	0.57	0.00
25.54	117.18	2.00	0.00	0.57	0.00	25.60	119.62	2.00	0.00	0.57	0.00
25.66	122.72	2.00	0.00	0.57	0.00	25.75	127.07	2.00	0.00	0.56	0.00
25.80	132.75	2.00	0.00	0.56	0.00	25.87	138.23	0.57	1.01	0.56	0.01
25.93	142.36	0.61	0.98	0.56	0.01	25.99	144.21	0.63	0.97	0.56	0.01
26.06	143.65	0.62	0.97	0.56	0.01	26.12	141.39	0.60	0.98	0.56	0.01
26.20	139.02	0.58	0.99	0.56	0.01	26.26	137.23	0.56	1.00	0.55	0.01
26.32	136.14	0.55	1.00	0.55	0.01	26.39	135.40	0.54	1.01	0.55	0.01
26.47	134.88	0.54	1.01	0.55	0.01	26.54	134.62	0.54	1.01	0.55	0.01
26.59	134.36	0.53	1.01	0.55	0.01	26.66	134.09	0.53	1.01	0.55	0.01
26.72	133.94	0.53	1.01	0.55	0.01	26.79	134.02	0.53	1.00	0.55	0.01
26.85	134.25	0.53	1.00	0.54	0.01	26.91	134.49	0.53	1.00	0.54	0.01
26.98	134.39	0.53	1.00	0.54	0.01	27.04	133.66	0.53	1.00	0.54	0.01
27.10	132.36	2.00	0.00	0.54	0.00	27.17	130.25	2.00	0.00	0.54	0.00
27.26	127.65	2.00	0.00	0.54	0.00	27.32	124.80	2.00	0.00	0.54	0.00
27.38	121.90	2.00	0.00	0.54	0.00	27.44	118.82	2.00	0.00	0.54	0.00
27.51	115.38	2.00	0.00	0.53	0.00	27.57	112.06	2.00	0.00	0.53	0.00
27.63	109.53	2.00	0.00	0.53	0.00	27.70	108.73	2.00	0.00	0.53	0.00
27.79	110.29	2.00	0.00	0.53	0.00	27.82	113.47	2.00	0.00	0.53	0.00
27.92	115.23	2.00	0.00	0.53	0.00	27.98	115.67	2.00	0.00	0.53	0.00
28.03	112.62	2.00	0.00	0.52	0.00	28.09	106.45	2.00	0.00	0.52	0.00
28.15	96.94	2.00	0.00	0.52	0.00	28.25	86.44	2.00	0.00	0.52	0.00
28.31	76.46	2.00	0.00	0.52	0.00	28.37	70.41	2.00	0.00	0.52	0.00
28.43	67.11	2.00	0.00	0.52	0.00	28.49	63.76	2.00	0.00	0.52	0.00
28.55	60.17	2.00	0.00	0.52	0.00	28.61	56.00	2.00	0.00	0.52	0.00
28.68	54.41	2.00	0.00	0.51	0.00	28.77	54.60	2.00	0.00	0.51	0.00
28.83	56.91	2.00	0.00	0.51	0.00	28.90	59.23	2.00	0.00	0.51	0.00
28.95	61.83	2.00	0.00	0.51	0.00	29.01	64.29	2.00	0.00	0.51	0.00
29.08	67.03	2.00	0.00	0.51	0.00	29.14	69.94	2.00	0.00	0.51	0.00
29.20	72.73	2.00	0.00	0.51	0.00	29.30	74.60	2.00	0.00	0.50	0.00
29.36	75.85	2.00	0.00	0.50	0.00	29.43	76.46	2.00	0.00	0.50	0.00
29.48	76.53	2.00	0.00	0.50	0.00	29.54	75.79	2.00	0.00	0.50	0.00
29.61	74.68	2.00	0.00	0.50	0.00	29.66	73.72	2.00	0.00	0.50	0.00
29.76	73.67	2.00	0.00	0.50	0.00	29.82	74.17	2.00	0.00	0.49	0.00
29.88	74.82	2.00	0.00	0.49	0.00	29.93	74.97	2.00	0.00	0.49	0.00
29.99	74.83	2.00	0.00	0.49	0.00	30.06	73.81	2.00	0.00	0.49	0.00
30.14	72.06	2.00	0.00	0.49	0.00	30.20	69.67	2.00	0.00	0.49	0.00
30.27	67.78	2.00	0.00	0.49	0.00	30.33	66.95	2.00	0.00	0.49	0.00
30.39	66.87	2.00	0.00	0.48	0.00	30.46	66.81	2.00	0.00	0.48	0.00
30.52	66.95	2.00	0.00	0.48	0.00	30.58	69.25	2.00	0.00	0.48	0.00
30.68	72.59	2.00	0.00	0.48	0.00	30.71	78.08	2.00	0.00	0.48	0.00
30.80	84.17	2.00	0.00	0.48	0.00	30.86	92.15	2.00	0.00	0.48	0.00
30.93	99.89	2.00	0.00	0.48	0.00	30.98	107.45	2.00	0.00	0.47	0.00
31.05	113.68	2.00	0.00	0.47	0.00	31.11	117.69	2.00	0.00	0.47	0.00

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
31.17	120.60	2.00	0.00	0.47	0.00	31.26	122.83	2.00	0.00	0.47	0.00
31.33	125.22	2.00	0.00	0.47	0.00	31.39	126.56	2.00	0.00	0.47	0.00
31.46	127.36	2.00	0.00	0.47	0.00	31.51	128.90	2.00	0.00	0.47	0.00
31.57	131.33	2.00	0.00	0.46	0.00	31.64	133.43	2.00	0.00	0.46	0.00
31.72	134.29	2.00	0.00	0.46	0.00	31.79	134.40	2.00	0.00	0.46	0.00
31.85	133.65	2.00	0.00	0.46	0.00	31.91	129.97	2.00	0.00	0.46	0.00
31.98	122.03	2.00	0.00	0.46	0.00	32.04	109.23	2.00	0.00	0.46	0.00
32.11	99.42	2.00	0.00	0.46	0.00	32.16	95.89	2.00	0.00	0.45	0.00
32.25	98.34	2.00	0.00	0.45	0.00	32.31	100.32	2.00	0.00	0.45	0.00
32.37	100.31	2.00	0.00	0.45	0.00	32.44	99.05	2.00	0.00	0.45	0.00
32.50	96.33	2.00	0.00	0.45	0.00	32.57	93.39	2.00	0.00	0.45	0.00
32.63	90.80	2.00	0.00	0.45	0.00	32.68	87.84	2.00	0.00	0.45	0.00
32.75	83.80	2.00	0.00	0.44	0.00	32.84	79.22	2.00	0.00	0.44	0.00
32.90	75.27	2.00	0.00	0.44	0.00	32.96	72.95	2.00	0.00	0.44	0.00
33.03	72.15	2.00	0.00	0.44	0.00	33.09	72.18	2.00	0.00	0.44	0.00
33.15	72.37	2.00	0.00	0.44	0.00	33.22	72.23	2.00	0.00	0.44	0.00
33.27	72.23	2.00	0.00	0.44	0.00	33.35	72.82	2.00	0.00	0.43	0.00
33.42	74.06	2.00	0.00	0.43	0.00	33.48	75.46	2.00	0.00	0.43	0.00
33.55	76.90	2.00	0.00	0.43	0.00	33.61	78.37	2.00	0.00	0.43	0.00
33.67	79.96	2.00	0.00	0.43	0.00	33.73	81.42	2.00	0.00	0.43	0.00
33.79	83.14	2.00	0.00	0.43	0.00	33.88	85.08	2.00	0.00	0.43	0.00
33.95	86.92	2.00	0.00	0.42	0.00	34.01	87.99	2.00	0.00	0.42	0.00
34.07	88.29	2.00	0.00	0.42	0.00	34.13	88.35	2.00	0.00	0.42	0.00
34.22	88.34	2.00	0.00	0.42	0.00	34.27	88.23	2.00	0.00	0.42	0.00
34.34	87.69	2.00	0.00	0.42	0.00	34.39	86.88	2.00	0.00	0.42	0.00
34.46	86.15	2.00	0.00	0.42	0.00	34.52	85.56	2.00	0.00	0.41	0.00
34.61	85.13	2.00	0.00	0.41	0.00	34.67	83.92	2.00	0.00	0.41	0.00
34.73	81.20	2.00	0.00	0.41	0.00	34.79	78.89	2.00	0.00	0.41	0.00
34.85	76.94	2.00	0.00	0.41	0.00	34.91	76.57	2.00	0.00	0.41	0.00
35.00	75.21	2.00	0.00	0.41	0.00	35.06	73.58	2.00	0.00	0.41	0.00
35.12	71.68	2.00	0.00	0.40	0.00	35.18	69.44	2.00	0.00	0.40	0.00
35.27	67.83	2.00	0.00	0.40	0.00	35.33	66.62	2.00	0.00	0.40	0.00
35.39	66.33	2.00	0.00	0.40	0.00	35.45	66.48	2.00	0.00	0.40	0.00
35.51	67.14	2.00	0.00	0.40	0.00	35.59	67.76	2.00	0.00	0.40	0.00
35.66	67.13	2.00	0.00	0.40	0.00	35.72	65.65	2.00	0.00	0.39	0.00
35.78	64.62	2.00	0.00	0.39	0.00	35.84	65.05	2.00	0.00	0.39	0.00
35.92	66.18	2.00	0.00	0.39	0.00	35.98	67.51	2.00	0.00	0.39	0.00
36.03	69.49	2.00	0.00	0.39	0.00	36.11	71.61	2.00	0.00	0.39	0.00
36.17	73.90	2.00	0.00	0.39	0.00	36.24	76.81	2.00	0.00	0.39	0.00
36.32	80.08	2.00	0.00	0.38	0.00	36.38	82.83	2.00	0.00	0.38	0.00
36.44	84.23	2.00	0.00	0.38	0.00	36.50	85.61	2.00	0.00	0.38	0.00
36.57	88.49	2.00	0.00	0.38	0.00	36.63	92.73	2.00	0.00	0.38	0.00
36.69	98.20	2.00	0.00	0.38	0.00	36.76	103.34	2.00	0.00	0.38	0.00
36.81	110.23	2.00	0.00	0.38	0.00	36.91	117.30	2.00	0.00	0.37	0.00
36.96	124.89	2.00	0.00	0.37	0.00	37.02	131.32	2.00	0.00	0.37	0.00
37.09	136.79	2.00	0.00	0.37	0.00	37.15	141.08	2.00	0.00	0.37	0.00
37.21	144.11	2.00	0.00	0.37	0.00	37.28	144.98	2.00	0.00	0.37	0.00
37.36	144.02	2.00	0.00	0.37	0.00	37.42	142.29	2.00	0.00	0.37	0.00

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
37.48	139.60	2.00	0.00	0.36	0.00	37.54	136.77	2.00	0.00	0.36	0.00
37.61	136.29	2.00	0.00	0.36	0.00	37.67	139.91	2.00	0.00	0.36	0.00
37.75	144.60	0.62	0.62	0.36	0.01	37.82	149.21	0.67	0.50	0.36	0.00
37.87	154.74	0.73	0.47	0.36	0.00	37.94	158.93	0.78	0.37	0.36	0.00
38.00	163.59	0.84	0.35	0.36	0.00	38.08	168.46	0.90	0.26	0.35	0.00
38.15	174.07	0.98	0.19	0.35	0.00	38.20	179.02	1.06	0.13	0.35	0.00
38.27	183.25	1.12	0.13	0.35	0.00	38.33	185.66	1.16	0.09	0.35	0.00
38.39	185.97	1.17	0.09	0.35	0.00	38.46	182.74	1.12	0.13	0.35	0.00
38.53	176.88	1.02	0.18	0.35	0.00	38.60	170.81	0.94	0.25	0.35	0.00
38.66	165.30	0.86	0.26	0.34	0.00	38.72	160.39	0.80	0.35	0.34	0.00
38.78	155.13	0.74	0.45	0.34	0.00	38.85	152.46	0.71	0.46	0.34	0.00
38.95	150.52	0.68	0.47	0.34	0.01	39.01	149.63	0.68	0.47	0.34	0.00
39.06	149.92	0.68	0.47	0.34	0.00	39.12	150.48	0.68	0.46	0.34	0.00
39.18	151.30	0.69	0.46	0.34	0.00	39.25	152.08	0.70	0.45	0.33	0.00
39.31	152.42	0.71	0.45	0.33	0.00	39.37	151.95	0.70	0.45	0.33	0.00
39.44	150.38	0.68	0.46	0.33	0.00	39.53	147.89	0.66	0.47	0.33	0.01
39.58	144.76	0.63	0.57	0.33	0.00	39.64	141.54	0.59	0.58	0.33	0.00
39.71	138.54	0.57	0.58	0.33	0.00	39.77	138.30	0.56	0.58	0.33	0.00
39.86	138.05	0.56	0.58	0.32	0.01	39.92	140.79	0.59	0.57	0.32	0.00
39.98	145.88	0.64	0.55	0.32	0.00	40.03	157.45	0.77	0.34	0.32	0.00
40.09	173.24	0.97	0.17	0.32	0.00	40.19	186.94	1.19	0.08	0.32	0.00
40.25	199.76	1.42	0.00	0.32	0.00	40.31	208.46	2.00	0.00	0.32	0.00
40.37	214.20	2.00	0.00	0.32	0.00	40.42	214.62	2.00	0.00	0.31	0.00
40.49	212.88	2.00	0.00	0.31	0.00	40.57	210.27	2.00	0.00	0.31	0.00
40.63	209.62	2.00	0.00	0.31	0.00	40.69	207.85	2.00	0.00	0.31	0.00
40.75	205.35	2.00	0.00	0.31	0.00	40.81	202.46	2.00	0.00	0.31	0.00
40.88	198.09	1.39	0.00	0.31	0.00	40.98	193.98	1.32	0.06	0.31	0.00
41.01	188.67	1.22	0.08	0.30	0.00	41.10	182.96	1.13	0.11	0.30	0.00
41.16	175.51	1.01	0.16	0.30	0.00	41.21	168.04	0.91	0.22	0.30	0.00
41.27	160.65	2.00	0.00	0.30	0.00	41.34	154.61	2.00	0.00	0.30	0.00
41.43	154.15	2.00	0.00	0.30	0.00	41.50	157.83	2.00	0.00	0.30	0.00
41.55	160.58	2.00	0.00	0.30	0.00	41.61	159.84	2.00	0.00	0.29	0.00
41.67	155.85	2.00	0.00	0.29	0.00	41.76	145.88	0.64	0.50	0.29	0.01
41.82	133.73	0.53	0.54	0.29	0.00	41.88	136.58	0.55	0.53	0.29	0.00
41.93	162.67	0.84	0.29	0.29	0.00	42.02	187.96	1.22	0.08	0.29	0.00
42.08	209.88	2.00	0.00	0.29	0.00	42.13	218.30	2.00	0.00	0.29	0.00
42.22	220.99	2.00	0.00	0.28	0.00	42.28	221.33	2.00	0.00	0.28	0.00
42.35	219.35	2.00	0.00	0.28	0.00	42.41	212.49	2.00	0.00	0.28	0.00
42.47	203.78	2.00	0.00	0.28	0.00	42.54	194.84	1.34	0.05	0.28	0.00
42.59	185.39	1.18	0.07	0.28	0.00	42.65	175.45	1.02	0.15	0.28	0.00
42.75	168.73	0.92	0.20	0.28	0.00	42.81	166.03	0.88	0.20	0.27	0.00
42.87	167.34	0.90	0.20	0.27	0.00	42.93	171.02	0.95	0.15	0.27	0.00
42.99	175.43	1.02	0.14	0.27	0.00	43.05	179.97	1.09	0.10	0.27	0.00
43.11	183.87	1.15	0.07	0.27	0.00	43.20	185.06	1.17	0.07	0.27	0.00
43.26	189.24	1.25	0.07	0.27	0.00	43.32	192.13	1.30	0.05	0.27	0.00
43.39	192.88	1.31	0.05	0.26	0.00	43.45	189.78	1.26	0.05	0.26	0.00
43.53	183.32	1.15	0.10	0.26	0.00	43.60	175.51	1.02	0.14	0.26	0.00
43.65	171.79	0.97	0.14	0.26	0.00	43.71	166.43	0.89	0.19	0.26	0.00

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
43.78	158.24	0.79	0.27	0.26	0.00	43.86	150.06	0.69	0.35	0.26	0.00
43.91	144.26	0.63	0.44	0.26	0.00	43.97	140.95	0.60	0.45	0.25	0.00
44.04	137.97	0.57	0.46	0.25	0.00	44.10	135.71	0.55	0.46	0.25	0.00
44.20	135.52	0.55	0.46	0.25	0.01	44.25	137.80	0.57	0.45	0.25	0.00
44.31	138.03	0.57	0.45	0.25	0.00	44.36	138.28	0.57	0.44	0.25	0.00
44.42	138.27	0.57	0.44	0.25	0.00	44.52	139.26	0.58	0.44	0.25	0.00
44.58	138.73	0.58	0.44	0.24	0.00	44.63	137.95	0.57	0.44	0.24	0.00
44.69	137.40	0.57	0.44	0.24	0.00	44.75	136.96	0.56	0.44	0.24	0.00
44.84	136.19	0.56	0.44	0.24	0.00	44.90	134.74	0.54	0.44	0.24	0.00
44.98	132.97	0.53	0.44	0.24	0.00	45.04	130.67	0.51	0.44	0.24	0.00
45.11	128.43	0.49	0.45	0.24	0.00	45.16	124.73	0.46	0.46	0.23	0.00
45.22	122.55	0.45	0.46	0.23	0.00	45.31	121.02	0.43	0.46	0.23	0.00
45.37	121.15	0.44	0.46	0.23	0.00	45.43	120.48	0.43	0.46	0.23	0.00
45.49	119.48	0.42	0.46	0.23	0.00	45.55	118.27	0.42	0.46	0.23	0.00
45.63	117.04	0.41	0.47	0.23	0.00	45.70	115.87	0.40	0.47	0.23	0.00
45.75	114.79	0.39	0.47	0.22	0.00	45.82	113.70	0.39	0.47	0.22	0.00
45.90	113.27	0.38	0.47	0.22	0.00	45.96	113.49	0.38	0.47	0.22	0.00
46.02	113.41	0.38	0.46	0.22	0.00	46.08	112.25	0.38	0.47	0.22	0.00
46.14	109.92	0.36	0.47	0.22	0.00	46.20	108.19	0.35	0.48	0.22	0.00
46.29	109.23	0.36	0.47	0.22	0.01	46.35	112.95	0.38	0.45	0.21	0.00
46.41	117.36	0.41	0.44	0.21	0.00	46.46	118.93	0.42	0.43	0.21	0.00
46.55	117.32	0.41	0.43	0.21	0.00	46.61	113.28	0.38	0.44	0.21	0.00
46.67	109.86	0.36	0.45	0.21	0.00	46.73	111.23	0.37	0.45	0.21	0.00
46.81	115.90	0.40	0.43	0.21	0.00	46.87	119.29	0.43	0.42	0.21	0.00
46.93	117.87	0.42	0.42	0.20	0.00	47.00	115.59	0.40	0.42	0.20	0.00
47.07	113.43	2.00	0.00	0.20	0.00	47.13	112.08	2.00	0.00	0.20	0.00
47.19	111.08	2.00	0.00	0.20	0.00	47.25	111.22	2.00	0.00	0.20	0.00
47.33	114.69	2.00	0.00	0.20	0.00	47.39	120.60	2.00	0.00	0.20	0.00
47.44	123.38	2.00	0.00	0.20	0.00	47.51	123.97	2.00	0.00	0.19	0.00
47.59	123.46	2.00	0.00	0.19	0.00	47.65	123.36	2.00	0.00	0.19	0.00
47.70	124.07	2.00	0.00	0.19	0.00	47.79	124.41	2.00	0.00	0.19	0.00
47.85	124.37	2.00	0.00	0.19	0.00	47.91	120.09	2.00	0.00	0.19	0.00
47.97	116.86	2.00	0.00	0.19	0.00	48.05	114.30	2.00	0.00	0.19	0.00
48.11	115.85	2.00	0.00	0.18	0.00	48.16	117.05	2.00	0.00	0.18	0.00
48.26	118.66	2.00	0.00	0.18	0.00	48.31	121.36	2.00	0.00	0.18	0.00
48.38	125.18	2.00	0.00	0.18	0.00	48.44	130.09	2.00	0.00	0.18	0.00
48.51	134.52	2.00	0.00	0.18	0.00	48.56	137.15	2.00	0.00	0.18	0.00
48.64	138.50	2.00	0.00	0.18	0.00	48.71	139.63	2.00	0.00	0.17	0.00
48.77	141.48	2.00	0.00	0.17	0.00	48.83	143.53	2.00	0.00	0.17	0.00
48.89	143.96	2.00	0.00	0.17	0.00	48.96	140.37	2.00	0.00	0.17	0.00
49.03	134.45	2.00	0.00	0.17	0.00	49.10	128.37	2.00	0.00	0.17	0.00
49.16	126.27	2.00	0.00	0.17	0.00	49.22	127.96	2.00	0.00	0.17	0.00
49.29	132.95	2.00	0.00	0.16	0.00	49.37	137.87	2.00	0.00	0.16	0.00
49.43	142.72	2.00	0.00	0.16	0.00	49.49	148.02	2.00	0.00	0.16	0.00
49.55	153.94	2.00	0.00	0.16	0.00	49.61	159.27	2.00	0.00	0.16	0.00
49.70	161.34	2.00	0.00	0.16	0.00	49.76	160.14	2.00	0.00	0.16	0.00
49.82	155.80	2.00	0.00	0.16	0.00	49.87	149.85	2.00	0.00	0.15	0.00
49.94	144.52	2.00	0.00	0.15	0.00	50.02	144.06	2.00	0.00	0.15	0.00

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
50.08	148.96	2.00	0.00	0.15	0.00	50.14	153.17	2.00	0.00	0.15	0.00

Total estimated settlement: 2.03

Abbreviations

$Q_{tn,cs}$: Equivalent clean sand normalized cone resistance
FS: Factor of safety against liquefaction
e_v (%): Post-liquefaction volumentric strain
DF: e_v depth weighting factor
Settlement: Calculated settlement

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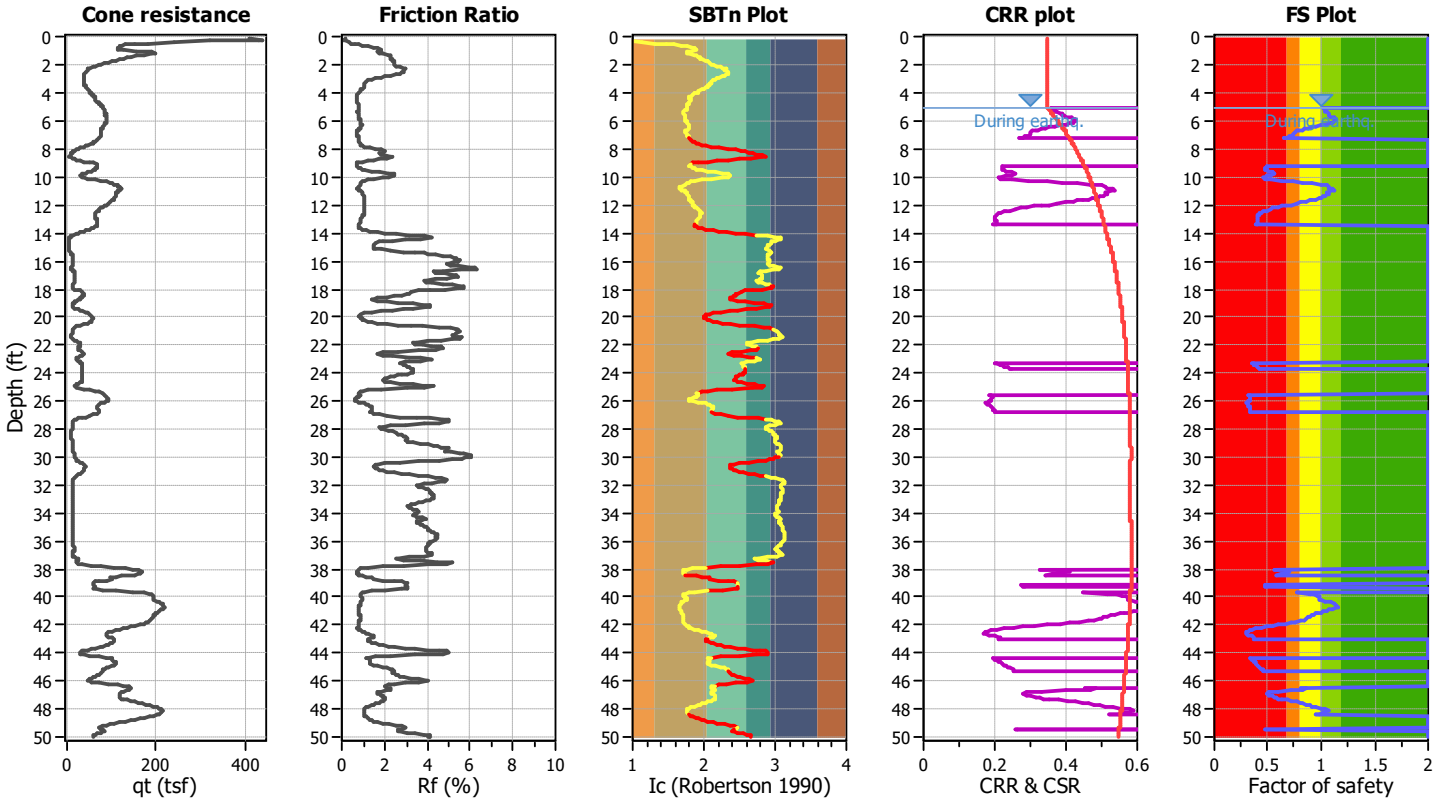
LIQUEFACTION ANALYSIS REPORT

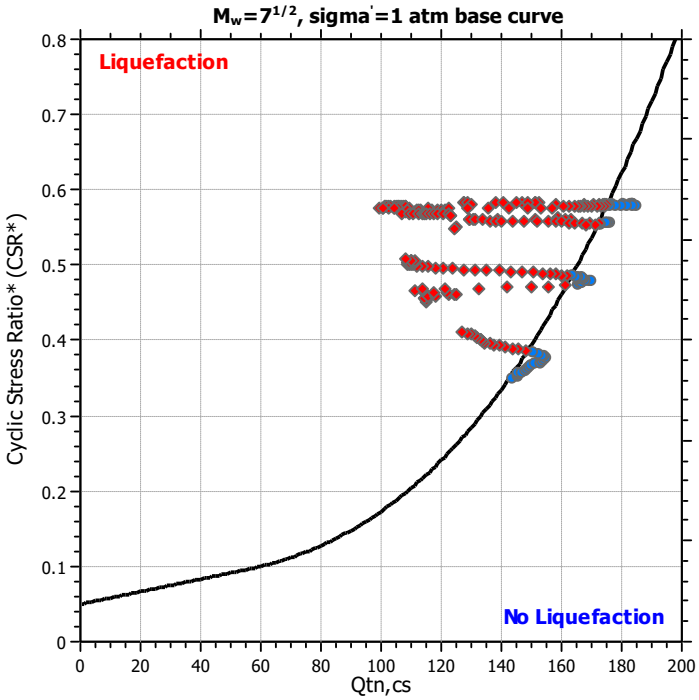
Project title : 7-Acre Site, Cypress Town Center **Location : Cypress, CA**

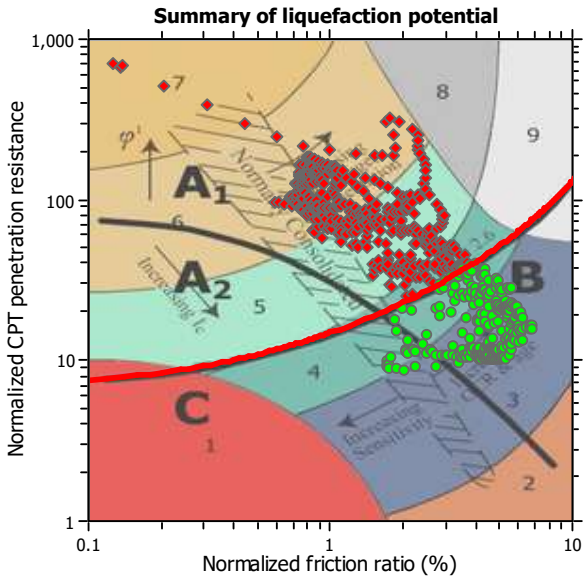
CPT file : CPT-4

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	7.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	5.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	50.00 ft
Earthquake magnitude M_w:	6.71	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.55	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

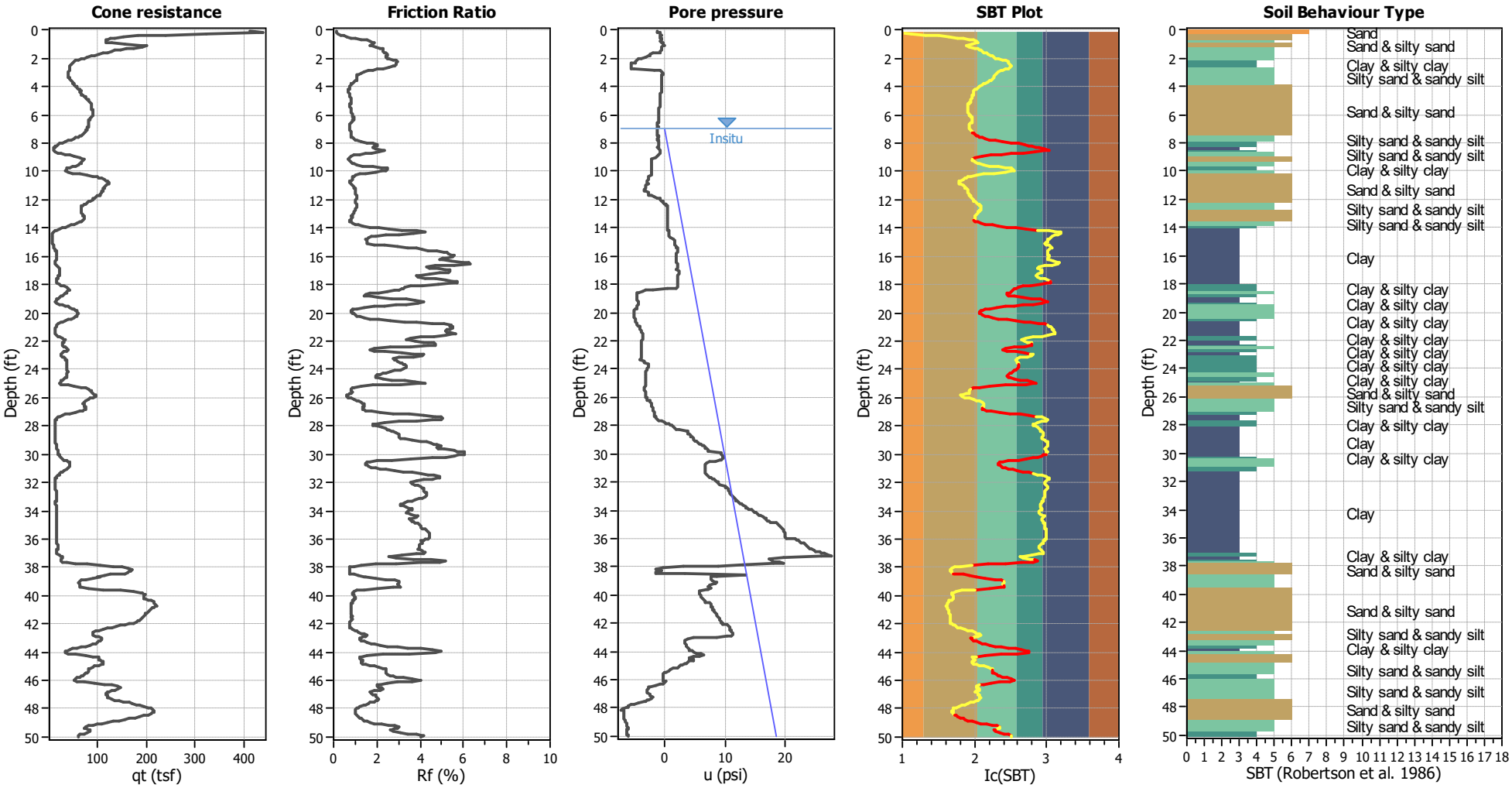






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



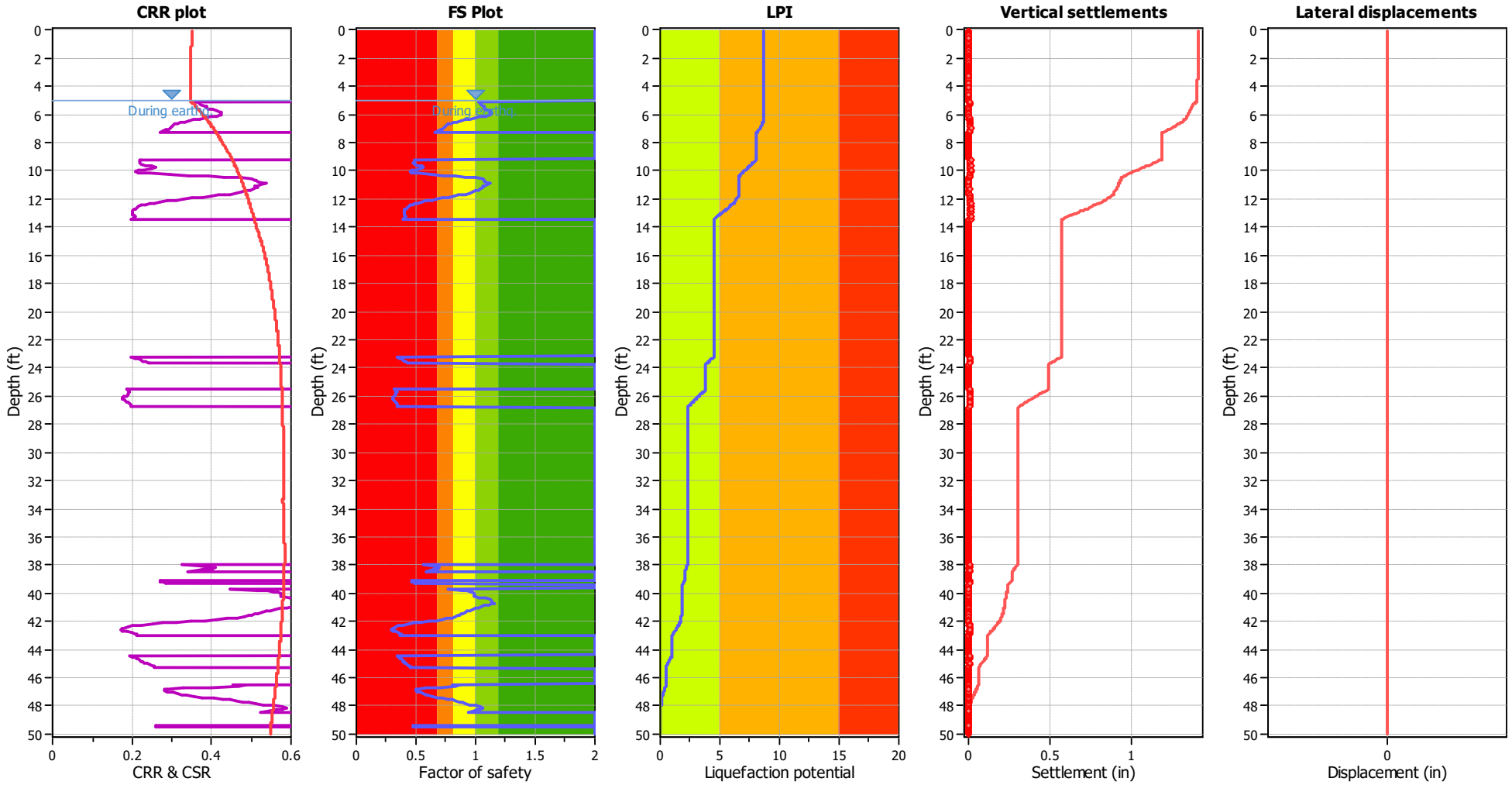
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.71	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	7.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

SBT legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.71	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	7.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

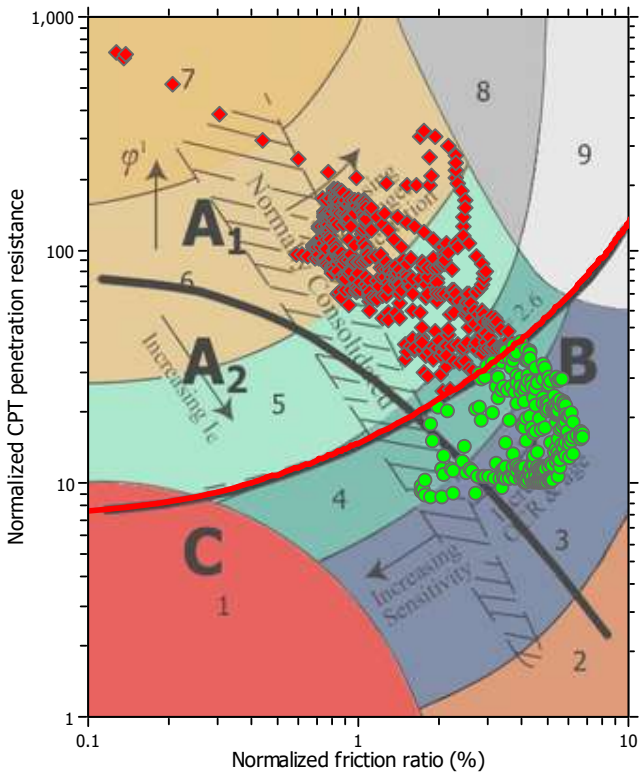
F.S. color scheme

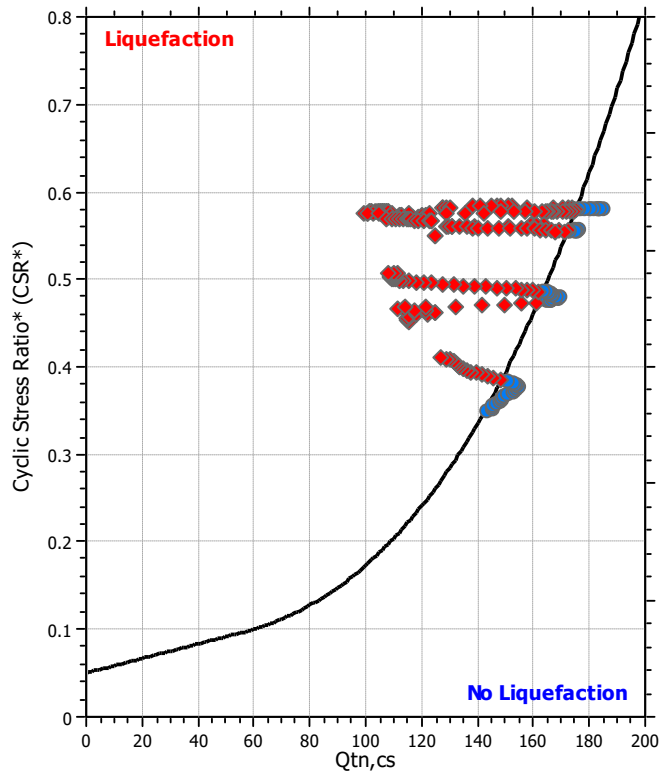
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

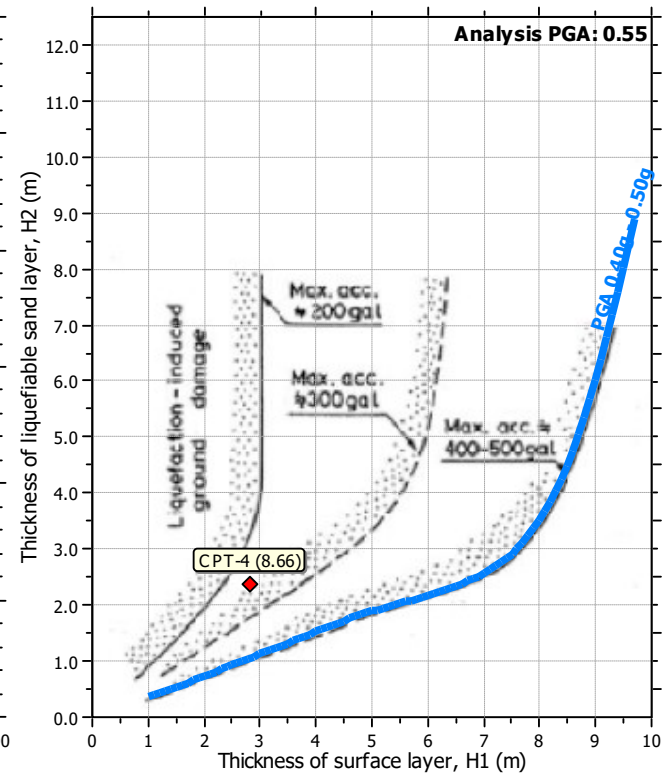
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots







Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.71	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	7.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

:: Post-earthquake settlement of dry sands ::

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
0.07	0.74	662.13	1.00	662.13	93	945	0.35	0.000	0.00	8.70	0.00	0.000
0.14	0.70	706.53	1.00	706.53	98	960	0.35	0.000	0.00	8.70	0.00	0.000
0.20	0.73	690.58	1.00	690.58	96	971	0.35	0.000	0.00	8.70	0.00	0.000
0.27	0.92	517.33	1.00	517.33	76	933	0.35	0.001	0.00	8.70	0.00	0.000
0.34	1.13	385.77	1.00	385.77	60	907	0.35	0.001	0.00	8.70	0.00	0.000
0.42	1.32	294.99	1.00	294.99	49	883	0.35	0.001	0.00	8.70	0.00	0.000
0.47	1.47	244.82	1.00	244.82	42	883	0.35	0.001	0.00	8.70	0.00	0.000
0.54	1.59	214.74	1.00	214.74	39	901	0.35	0.001	0.00	8.70	0.00	0.000
0.60	1.68	202.58	1.02	207.52	38	953	0.35	0.002	0.00	8.70	0.00	0.000
0.67	1.77	193.28	1.09	210.37	40	1024	0.35	0.002	0.00	8.70	0.00	0.000
0.73	1.84	189.89	1.14	215.79	42	1092	0.35	0.002	0.00	8.70	0.00	0.000
0.79	1.87	188.92	1.16	219.16	43	1127	0.35	0.002	0.00	8.70	0.00	0.000
0.86	1.90	188.45	1.19	224.53	45	1175	0.35	0.002	0.00	8.70	0.00	0.000
0.92	1.88	208.29	1.17	244.61	49	1268	0.35	0.002	0.00	8.70	0.00	0.000
0.99	1.83	252.04	1.13	284.33	56	1430	0.35	0.002	0.00	8.70	0.00	0.000
1.07	1.75	304.64	1.07	327.46	62	1575	0.35	0.002	0.00	8.70	0.00	0.000
1.13	1.75	321.20	1.07	344.93	66	1657	0.35	0.002	0.00	8.70	0.00	0.000
1.19	1.80	306.90	1.10	338.83	65	1672	0.35	0.002	0.00	8.70	0.00	0.000
1.26	1.86	277.13	1.16	320.44	63	1644	0.35	0.002	0.00	8.70	0.00	0.000
1.32	1.90	255.78	1.19	304.63	61	1593	0.35	0.002	0.00	8.70	0.00	0.000
1.39	1.93	235.47	1.22	286.38	58	1515	0.35	0.002	0.00	8.70	0.00	0.000
1.46	1.94	218.75	1.23	269.92	55	1438	0.35	0.003	0.00	8.70	0.00	0.000
1.52	1.96	206.06	1.25	257.23	53	1377	0.35	0.003	0.00	8.70	0.00	0.000
1.58	1.98	192.44	1.28	246.18	51	1329	0.35	0.003	0.00	8.70	0.00	0.000
1.65	2.01	177.98	1.32	234.67	49	1277	0.35	0.003	0.00	8.70	0.00	0.000
1.71	2.04	163.68	1.36	223.12	47	1222	0.35	0.004	0.00	8.70	0.00	0.000
1.77	2.07	150.63	1.40	211.03	45	1159	0.35	0.004	0.00	8.70	0.00	0.000
1.85	2.09	138.36	1.43	198.10	43	1089	0.35	0.004	0.00	8.70	0.00	0.000
1.91	2.11	126.03	1.47	185.78	40	1022	0.35	0.005	0.00	8.70	0.00	0.000
1.99	2.14	115.78	1.53	176.86	39	972	0.35	0.006	0.00	8.70	0.00	0.000
2.04	2.18	106.21	1.61	170.97	38	936	0.35	0.006	0.00	8.70	0.00	0.000
2.10	2.23	94.67	1.75	165.81	38	897	0.35	0.007	0.00	8.70	0.00	0.000
2.17	2.27	86.97	1.86	161.90	38	865	0.35	0.007	0.00	8.70	0.00	0.000
2.24	2.30	80.68	1.96	158.41	37	837	0.35	0.008	0.00	8.70	0.00	0.000
2.30	2.30	79.05	1.96	154.71	36	818	0.35	0.008	0.00	8.70	0.00	0.000
2.38	2.32	75.46	2.00	151.04	36	794	0.35	0.009	0.00	8.70	0.00	0.000
2.43	2.33	71.76	2.05	147.00	35	768	0.35	0.010	0.00	8.70	0.00	0.000
2.50	2.34	68.64	2.08	142.63	34	743	0.35	0.011	0.01	8.70	0.00	0.000
2.57	2.34	66.24	2.07	137.30	33	716	0.35	0.012	0.01	8.70	0.00	0.000
2.63	2.32	65.20	2.01	131.13	31	689	0.35	0.013	0.01	8.70	0.01	0.000
2.70	2.29	65.04	1.92	124.78	29	663	0.35	0.014	0.01	8.70	0.01	0.000
2.76	2.25	65.17	1.81	117.84	27	633	0.35	0.016	0.01	8.70	0.01	0.000
2.84	2.22	65.30	1.72	112.03	25	608	0.35	0.018	0.01	8.70	0.01	0.000
2.89	2.18	65.12	1.63	106.16	24	580	0.35	0.020	0.02	8.70	0.01	0.000
2.96	2.16	64.45	1.57	100.97	22	554	0.35	0.022	0.02	8.70	0.01	0.000
3.04	2.13	63.51	1.51	95.75	21	527	0.35	0.026	0.02	8.70	0.02	0.000
3.11	2.11	62.88	1.47	92.43	20	509	0.35	0.029	0.03	8.70	0.02	0.000
3.15	2.10	62.62	1.45	90.90	20	500	0.35	0.031	0.03	8.70	0.02	0.000

:: Post-earthquake settlement of dry sands :: (continued)

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
3.24	2.09	62.92	1.44	90.79	20	499	0.35	0.032	0.03	8.70	0.02	0.000
3.30	2.09	63.59	1.44	91.29	20	502	0.35	0.033	0.03	8.70	0.02	0.000
3.35	2.08	64.84	1.43	92.39	20	508	0.35	0.033	0.03	8.70	0.02	0.000
3.42	2.07	66.44	1.41	93.69	20	515	0.35	0.032	0.03	8.70	0.02	0.000
3.49	2.06	68.51	1.39	95.10	20	522	0.35	0.032	0.03	8.70	0.02	0.000
3.56	2.04	70.63	1.36	96.22	20	527	0.35	0.033	0.03	8.70	0.02	0.000
3.61	2.02	73.07	1.33	97.12	20	529	0.35	0.033	0.03	8.70	0.02	0.000
3.68	2.00	75.60	1.29	97.83	20	530	0.35	0.034	0.03	8.70	0.02	0.000
3.75	1.96	78.45	1.26	98.53	20	529	0.35	0.035	0.03	8.70	0.03	0.000
3.83	1.93	81.30	1.22	99.41	20	527	0.35	0.036	0.04	8.70	0.03	0.000
3.90	1.91	83.89	1.20	100.46	20	527	0.35	0.037	0.04	8.70	0.03	0.000
3.95	1.89	86.64	1.18	102.02	20	530	0.35	0.037	0.04	8.70	0.03	0.000
4.01	1.87	89.64	1.16	104.26	21	537	0.35	0.037	0.04	8.70	0.03	0.000
4.09	1.85	93.12	1.15	106.84	21	545	0.35	0.037	0.03	8.70	0.03	0.000
4.16	1.83	96.65	1.13	109.46	21	553	0.35	0.036	0.03	8.70	0.02	0.000
4.22	1.82	99.60	1.12	111.47	22	557	0.35	0.037	0.03	8.70	0.02	0.000
4.27	1.80	102.19	1.11	113.17	22	560	0.35	0.037	0.03	8.70	0.02	0.000
4.34	1.79	104.52	1.10	114.99	22	566	0.35	0.037	0.03	8.70	0.02	0.000
4.41	1.81	103.01	1.11	114.45	22	568	0.35	0.037	0.03	8.70	0.02	0.000
4.47	1.81	104.77	1.11	116.45	23	578	0.35	0.036	0.03	8.70	0.02	0.000
4.55	1.81	106.37	1.11	118.23	23	587	0.35	0.036	0.03	8.70	0.02	0.000
4.60	1.79	112.18	1.10	122.97	24	603	0.35	0.034	0.03	8.70	0.02	0.000
4.67	1.78	115.09	1.09	125.92	24	616	0.35	0.033	0.03	8.70	0.02	0.000
4.74	1.78	118.56	1.09	129.47	25	632	0.35	0.032	0.02	8.70	0.02	0.000
4.81	1.78	122.19	1.09	133.09	26	648	0.35	0.031	0.02	8.70	0.02	0.000
4.88	1.77	125.72	1.09	136.53	26	663	0.35	0.030	0.02	8.70	0.02	0.000
4.95	1.77	128.51	1.08	139.21	27	675	0.35	0.030	0.02	8.70	0.02	0.000
4.99	1.76	131.15	1.08	141.69	27	685	0.35	0.029	0.02	8.70	0.01	0.000

Total estimated settlement: 0.01

Abbreviations

Q_{tn}: Equivalent clean sand normalized cone resistance
K_c: Fines correction factor
$Q_{tn,cs}$: Post-liquefaction volumentric strain
G_{max}: Small strain shear modulus
CSR: Soil cyclic stress ratio
γ: Cyclic shear strain
$e_{vol(15)}$: Volumetric strain after 15 cycles
N_c: Equivalent number of cycles
e_v: Volumetric strain
Settle.: Calculated settlement

:: Post-earthquake settlement due to soil liquefaction ::

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
5.09	143.88	1.02	0.58	0.91	0.01	5.13	145.35	1.04	0.57	0.91	0.00
5.20	145.71	1.04	0.57	0.91	0.00	5.27	145.92	1.04	0.57	0.91	0.00
5.34	146.91	1.05	0.56	0.91	0.00	5.41	148.43	1.07	0.39	0.91	0.00
5.45	149.06	1.07	0.39	0.91	0.00	5.52	149.09	1.07	0.39	0.91	0.00
5.58	149.79	1.07	0.38	0.91	0.00	5.66	151.17	1.09	0.38	0.90	0.00
5.71	153.01	1.12	0.38	0.90	0.00	5.80	153.99	1.13	0.38	0.90	0.00
5.85	154.64	1.13	0.37	0.90	0.00	5.94	154.78	1.13	0.37	0.90	0.00

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
5.99	154.56	1.12	0.37	0.90	0.00	6.05	153.96	1.10	0.37	0.90	0.00
6.12	152.79	1.08	0.38	0.90	0.00	6.18	150.83	1.04	0.54	0.90	0.00
6.27	148.40	1.00	0.55	0.89	0.01	6.33	145.85	0.95	0.56	0.89	0.00
6.39	143.55	0.91	0.82	0.89	0.01	6.46	141.38	0.88	0.84	0.89	0.01
6.52	139.40	0.85	1.11	0.89	0.01	6.58	137.74	0.82	1.13	0.89	0.01
6.65	136.29	0.80	1.15	0.89	0.01	6.71	134.67	0.77	1.17	0.89	0.01
6.77	133.71	0.76	1.18	0.89	0.01	6.83	133.32	0.75	1.45	0.88	0.01
6.89	132.95	0.74	1.45	0.88	0.01	6.99	132.14	0.73	1.46	0.88	0.02
7.05	131.44	0.72	1.47	0.88	0.01	7.11	130.31	0.70	1.48	0.88	0.01
7.18	128.73	0.68	1.51	0.88	0.01	7.23	126.76	0.66	1.54	0.88	0.01
7.29	124.35	2.00	0.00	0.88	0.00	7.36	121.22	2.00	0.00	0.88	0.00
7.44	117.82	2.00	0.00	0.87	0.00	7.50	114.27	2.00	0.00	0.87	0.00
7.57	110.70	2.00	0.00	0.87	0.00	7.63	106.19	2.00	0.00	0.87	0.00
7.69	100.51	2.00	0.00	0.87	0.00	7.76	94.16	2.00	0.00	0.87	0.00
7.83	88.84	2.00	0.00	0.87	0.00	7.88	85.83	2.00	0.00	0.87	0.00
7.97	85.73	2.00	0.00	0.86	0.00	8.03	85.99	2.00	0.00	0.86	0.00
8.09	84.07	2.00	0.00	0.86	0.00	8.16	79.60	2.00	0.00	0.86	0.00
8.23	73.80	2.00	0.00	0.86	0.00	8.29	67.94	2.00	0.00	0.86	0.00
8.35	64.78	2.00	0.00	0.86	0.00	8.42	64.05	2.00	0.00	0.86	0.00
8.47	66.95	2.00	0.00	0.86	0.00	8.54	71.30	2.00	0.00	0.86	0.00
8.60	76.07	2.00	0.00	0.85	0.00	8.69	79.07	2.00	0.00	0.85	0.00
8.75	81.87	2.00	0.00	0.85	0.00	8.82	84.78	2.00	0.00	0.85	0.00
8.87	90.39	2.00	0.00	0.85	0.00	8.93	97.60	2.00	0.00	0.85	0.00
8.99	105.99	2.00	0.00	0.85	0.00	9.08	112.03	2.00	0.00	0.85	0.00
9.15	115.03	2.00	0.00	0.84	0.00	9.21	115.17	0.49	1.76	0.84	0.01
9.28	114.91	0.49	1.76	0.84	0.01	9.34	114.71	0.48	1.76	0.84	0.01
9.40	114.55	0.48	1.76	0.84	0.01	9.46	114.55	0.48	1.76	0.84	0.01
9.52	115.77	0.49	1.74	0.84	0.01	9.60	118.28	0.51	1.70	0.84	0.02
9.67	122.21	0.54	1.66	0.84	0.01	9.73	124.64	0.56	1.63	0.84	0.01
9.79	124.73	0.56	1.63	0.83	0.01	9.86	121.69	0.53	1.66	0.83	0.01
9.91	117.32	0.50	1.71	0.83	0.01	10.00	113.66	0.47	1.75	0.83	0.02
10.06	111.47	0.45	1.77	0.83	0.01	10.12	113.91	0.47	1.74	0.83	0.01
10.18	121.35	0.53	1.65	0.83	0.01	10.24	132.24	0.63	1.54	0.83	0.01
10.32	141.82	0.73	1.24	0.83	0.01	10.39	149.70	0.83	0.93	0.82	0.01
10.45	155.56	0.91	0.67	0.82	0.01	10.51	161.31	0.99	0.47	0.82	0.00
10.58	165.43	1.06	0.33	0.82	0.00	10.64	166.45	1.07	0.32	0.82	0.00
10.71	166.70	1.07	0.32	0.82	0.00	10.79	167.18	1.08	0.32	0.82	0.00
10.85	169.24	1.11	0.32	0.82	0.00	10.91	169.99	1.12	0.32	0.82	0.00
10.97	168.36	1.09	0.32	0.81	0.00	11.04	167.36	1.07	0.32	0.81	0.00
11.10	166.33	1.06	0.32	0.81	0.00	11.16	167.13	1.07	0.32	0.81	0.00
11.22	166.68	1.06	0.32	0.81	0.00	11.32	165.80	1.04	0.45	0.81	0.01
11.39	164.78	1.02	0.45	0.81	0.00	11.44	163.55	1.00	0.45	0.81	0.00
11.50	162.06	0.98	0.45	0.81	0.00	11.55	160.02	0.95	0.63	0.80	0.00
11.66	157.95	0.91	0.64	0.80	0.01	11.68	155.96	0.89	0.65	0.80	0.00
11.75	153.86	0.86	0.66	0.80	0.01	11.81	150.65	0.81	0.89	0.80	0.01
11.90	146.96	0.76	0.92	0.80	0.01	11.96	143.01	0.72	1.18	0.80	0.01
12.02	139.17	0.67	1.22	0.80	0.01	12.08	135.16	0.63	1.45	0.80	0.01
12.14	131.32	0.59	1.48	0.79	0.01	12.21	127.39	0.55	1.52	0.79	0.01

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
12.30	123.80	0.52	1.55	0.79	0.02	12.36	120.68	0.49	1.58	0.79	0.01
12.42	118.20	0.47	1.61	0.79	0.01	12.48	115.75	0.45	1.63	0.79	0.01
12.56	113.72	0.43	1.66	0.79	0.02	12.60	112.04	0.42	1.67	0.79	0.01
12.69	110.86	0.41	1.69	0.78	0.02	12.75	109.82	0.41	1.70	0.78	0.01
12.81	109.21	0.40	1.70	0.78	0.01	12.87	108.98	0.40	1.70	0.78	0.01
12.95	108.90	0.40	1.70	0.78	0.02	13.01	109.07	0.40	1.70	0.78	0.01
13.07	109.26	0.40	1.69	0.78	0.01	13.14	109.70	0.40	1.68	0.78	0.01
13.20	110.20	0.40	1.68	0.78	0.01	13.29	111.11	0.41	1.66	0.77	0.02
13.35	110.13	0.40	1.67	0.77	0.01	13.41	108.00	0.39	1.70	0.77	0.01
13.47	104.58	2.00	0.00	0.77	0.00	13.53	102.09	2.00	0.00	0.77	0.00
13.59	99.62	2.00	0.00	0.77	0.00	13.65	96.03	2.00	0.00	0.77	0.00
13.72	93.06	2.00	0.00	0.77	0.00	13.78	91.13	2.00	0.00	0.77	0.00
13.87	91.35	2.00	0.00	0.76	0.00	13.93	93.16	2.00	0.00	0.76	0.00
13.99	95.51	2.00	0.00	0.76	0.00	14.04	97.42	2.00	0.00	0.76	0.00
14.14	98.14	2.00	0.00	0.76	0.00	14.20	96.95	2.00	0.00	0.76	0.00
14.25	92.18	2.00	0.00	0.76	0.00	14.32	85.24	2.00	0.00	0.76	0.00
14.40	77.34	2.00	0.00	0.76	0.00	14.46	69.15	2.00	0.00	0.75	0.00
14.52	62.25	2.00	0.00	0.75	0.00	14.58	57.42	2.00	0.00	0.75	0.00
14.64	54.51	2.00	0.00	0.75	0.00	14.70	52.93	2.00	0.00	0.75	0.00
14.78	51.96	2.00	0.00	0.75	0.00	14.84	52.04	2.00	0.00	0.75	0.00
14.92	52.67	2.00	0.00	0.75	0.00	14.98	53.05	2.00	0.00	0.75	0.00
15.04	53.40	2.00	0.00	0.75	0.00	15.11	55.05	2.00	0.00	0.74	0.00
15.16	59.76	2.00	0.00	0.74	0.00	15.25	66.72	2.00	0.00	0.74	0.00
15.31	75.29	2.00	0.00	0.74	0.00	15.37	83.71	2.00	0.00	0.74	0.00
15.43	91.77	2.00	0.00	0.74	0.00	15.49	99.52	2.00	0.00	0.74	0.00
15.57	107.11	2.00	0.00	0.74	0.00	15.63	114.62	2.00	0.00	0.74	0.00
15.69	121.16	2.00	0.00	0.73	0.00	15.76	125.05	2.00	0.00	0.73	0.00
15.84	126.92	2.00	0.00	0.73	0.00	15.90	127.45	2.00	0.00	0.73	0.00
15.96	127.63	2.00	0.00	0.73	0.00	16.02	126.01	2.00	0.00	0.73	0.00
16.09	123.38	2.00	0.00	0.73	0.00	16.15	120.34	2.00	0.00	0.73	0.00
16.22	117.98	2.00	0.00	0.73	0.00	16.28	116.42	2.00	0.00	0.72	0.00
16.36	115.72	2.00	0.00	0.72	0.00	16.41	116.05	2.00	0.00	0.72	0.00
16.47	117.26	2.00	0.00	0.72	0.00	16.54	119.92	2.00	0.00	0.72	0.00
16.60	121.23	2.00	0.00	0.72	0.00	16.69	118.83	2.00	0.00	0.72	0.00
16.73	119.76	2.00	0.00	0.72	0.00	16.83	124.37	2.00	0.00	0.71	0.00
16.88	132.83	2.00	0.00	0.71	0.00	16.94	137.46	2.00	0.00	0.71	0.00
17.00	140.09	2.00	0.00	0.71	0.00	17.08	140.03	2.00	0.00	0.71	0.00
17.13	137.77	2.00	0.00	0.71	0.00	17.20	131.60	2.00	0.00	0.71	0.00
17.29	123.93	2.00	0.00	0.71	0.00	17.35	116.86	2.00	0.00	0.71	0.00
17.41	113.46	2.00	0.00	0.70	0.00	17.46	112.91	2.00	0.00	0.70	0.00
17.55	114.33	2.00	0.00	0.70	0.00	17.61	116.82	2.00	0.00	0.70	0.00
17.66	119.55	2.00	0.00	0.70	0.00	17.75	121.62	2.00	0.00	0.70	0.00
17.80	123.37	2.00	0.00	0.70	0.00	17.86	124.71	2.00	0.00	0.70	0.00
17.91	127.03	2.00	0.00	0.70	0.00	18.00	128.85	2.00	0.00	0.69	0.00
18.07	129.75	2.00	0.00	0.69	0.00	18.13	129.86	2.00	0.00	0.69	0.00
18.18	131.00	2.00	0.00	0.69	0.00	18.26	132.61	2.00	0.00	0.69	0.00
18.33	133.53	2.00	0.00	0.69	0.00	18.39	132.11	2.00	0.00	0.69	0.00
18.44	125.04	2.00	0.00	0.69	0.00	18.53	113.65	2.00	0.00	0.69	0.00

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
18.59	100.02	2.00	0.00	0.68	0.00	18.64	87.73	2.00	0.00	0.68	0.00
18.72	80.17	2.00	0.00	0.68	0.00	18.78	76.93	2.00	0.00	0.68	0.00
18.84	78.86	2.00	0.00	0.68	0.00	18.91	82.82	2.00	0.00	0.68	0.00
18.98	87.70	2.00	0.00	0.68	0.00	19.04	93.59	2.00	0.00	0.68	0.00
19.10	96.85	2.00	0.00	0.68	0.00	19.18	98.09	2.00	0.00	0.67	0.00
19.24	99.23	2.00	0.00	0.67	0.00	19.30	102.00	2.00	0.00	0.67	0.00
19.39	104.57	2.00	0.00	0.67	0.00	19.44	105.49	2.00	0.00	0.67	0.00
19.50	102.54	2.00	0.00	0.67	0.00	19.57	96.99	2.00	0.00	0.67	0.00
19.63	89.23	2.00	0.00	0.67	0.00	19.69	84.23	2.00	0.00	0.67	0.00
19.78	82.58	2.00	0.00	0.66	0.00	19.83	83.95	2.00	0.00	0.66	0.00
19.88	85.51	2.00	0.00	0.66	0.00	19.95	87.46	2.00	0.00	0.66	0.00
20.04	89.30	2.00	0.00	0.66	0.00	20.09	90.84	2.00	0.00	0.66	0.00
20.18	91.89	2.00	0.00	0.66	0.00	20.23	93.14	2.00	0.00	0.66	0.00
20.28	94.84	2.00	0.00	0.66	0.00	20.34	96.69	2.00	0.00	0.66	0.00
20.43	98.75	2.00	0.00	0.65	0.00	20.48	102.96	2.00	0.00	0.65	0.00
20.56	108.28	2.00	0.00	0.65	0.00	20.62	114.18	2.00	0.00	0.65	0.00
20.68	116.87	2.00	0.00	0.65	0.00	20.76	118.81	2.00	0.00	0.65	0.00
20.80	118.65	2.00	0.00	0.65	0.00	20.87	117.69	2.00	0.00	0.65	0.00
20.93	115.60	2.00	0.00	0.65	0.00	21.02	113.22	2.00	0.00	0.64	0.00
21.07	110.04	2.00	0.00	0.64	0.00	21.13	106.68	2.00	0.00	0.64	0.00
21.22	103.88	2.00	0.00	0.64	0.00	21.27	101.31	2.00	0.00	0.64	0.00
21.36	100.61	2.00	0.00	0.64	0.00	21.42	101.37	2.00	0.00	0.64	0.00
21.47	104.23	2.00	0.00	0.64	0.00	21.53	107.89	2.00	0.00	0.64	0.00
21.62	111.46	2.00	0.00	0.63	0.00	21.67	114.47	2.00	0.00	0.63	0.00
21.73	115.76	2.00	0.00	0.63	0.00	21.81	116.70	2.00	0.00	0.63	0.00
21.87	118.57	2.00	0.00	0.63	0.00	21.93	121.96	2.00	0.00	0.63	0.00
21.98	127.52	2.00	0.00	0.63	0.00	22.07	132.96	2.00	0.00	0.63	0.00
22.13	137.23	2.00	0.00	0.62	0.00	22.18	137.22	2.00	0.00	0.62	0.00
22.27	135.21	2.00	0.00	0.62	0.00	22.33	130.88	2.00	0.00	0.62	0.00
22.38	121.03	2.00	0.00	0.62	0.00	22.47	107.13	2.00	0.00	0.62	0.00
22.53	94.72	2.00	0.00	0.62	0.00	22.58	89.68	2.00	0.00	0.62	0.00
22.66	88.80	2.00	0.00	0.62	0.00	22.72	91.61	2.00	0.00	0.61	0.00
22.77	97.54	2.00	0.00	0.61	0.00	22.85	106.14	2.00	0.00	0.61	0.00
22.91	112.74	2.00	0.00	0.61	0.00	22.97	118.71	2.00	0.00	0.61	0.00
23.05	119.37	2.00	0.00	0.61	0.00	23.11	115.50	2.00	0.00	0.61	0.00
23.18	109.70	2.00	0.00	0.61	0.00	23.25	108.30	0.35	1.33	0.61	0.01
23.31	111.12	0.36	1.30	0.61	0.01	23.38	113.33	0.38	1.27	0.60	0.01
23.44	115.09	0.39	1.26	0.60	0.01	23.50	116.69	0.40	1.24	0.60	0.01
23.56	118.58	0.41	1.22	0.60	0.01	23.65	120.17	0.42	1.20	0.60	0.01
23.70	121.53	0.43	1.19	0.60	0.01	23.76	122.75	2.00	0.00	0.60	0.00
23.84	123.45	2.00	0.00	0.60	0.00	23.90	123.55	2.00	0.00	0.59	0.00
23.96	121.83	2.00	0.00	0.59	0.00	24.04	118.83	2.00	0.00	0.59	0.00
24.10	114.69	2.00	0.00	0.59	0.00	24.16	110.05	2.00	0.00	0.59	0.00
24.24	105.50	2.00	0.00	0.59	0.00	24.30	101.30	2.00	0.00	0.59	0.00
24.36	97.83	2.00	0.00	0.59	0.00	24.41	94.76	2.00	0.00	0.59	0.00
24.50	92.95	2.00	0.00	0.58	0.00	24.56	92.10	2.00	0.00	0.58	0.00
24.61	92.29	2.00	0.00	0.58	0.00	24.70	94.30	2.00	0.00	0.58	0.00
24.76	99.09	2.00	0.00	0.58	0.00	24.82	105.10	2.00	0.00	0.58	0.00

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
24.87	109.76	2.00	0.00	0.58	0.00	24.95	111.96	2.00	0.00	0.58	0.00
25.01	108.47	2.00	0.00	0.58	0.00	25.09	101.05	2.00	0.00	0.57	0.00
25.14	90.39	2.00	0.00	0.57	0.00	25.22	88.24	2.00	0.00	0.57	0.00
25.28	91.77	2.00	0.00	0.57	0.00	25.33	95.65	2.00	0.00	0.57	0.00
25.40	98.92	2.00	0.00	0.57	0.00	25.46	101.86	2.00	0.00	0.57	0.00
25.53	104.24	0.32	1.28	0.57	0.01	25.60	106.17	0.33	1.26	0.57	0.01
25.66	107.12	0.34	1.25	0.57	0.01	25.73	106.57	0.33	1.25	0.56	0.01
25.79	106.06	0.33	1.25	0.56	0.01	25.86	105.61	0.33	1.25	0.56	0.01
25.92	105.48	0.33	1.25	0.56	0.01	25.99	104.36	0.32	1.26	0.56	0.01
26.07	102.31	0.31	1.28	0.56	0.01	26.13	101.29	0.31	1.29	0.56	0.01
26.18	101.15	0.31	1.29	0.56	0.01	26.25	102.04	0.31	1.28	0.56	0.01
26.31	103.36	0.32	1.26	0.55	0.01	26.40	104.78	0.32	1.24	0.55	0.01
26.45	106.14	0.33	1.23	0.55	0.01	26.52	107.02	0.34	1.22	0.55	0.01
26.59	107.70	0.34	1.21	0.55	0.01	26.65	108.11	0.34	1.20	0.55	0.01
26.73	108.15	0.34	1.20	0.55	0.01	26.80	108.03	2.00	0.00	0.55	0.00
26.85	107.96	2.00	0.00	0.54	0.00	26.93	107.93	2.00	0.00	0.54	0.00
26.98	108.66	2.00	0.00	0.54	0.00	27.06	111.19	2.00	0.00	0.54	0.00
27.12	116.15	2.00	0.00	0.54	0.00	27.17	120.31	2.00	0.00	0.54	0.00
27.24	121.04	2.00	0.00	0.54	0.00	27.31	118.13	2.00	0.00	0.54	0.00
27.38	112.86	2.00	0.00	0.54	0.00	27.45	106.26	2.00	0.00	0.53	0.00
27.51	99.44	2.00	0.00	0.53	0.00	27.56	91.81	2.00	0.00	0.53	0.00
27.63	83.51	2.00	0.00	0.53	0.00	27.71	74.69	2.00	0.00	0.53	0.00
27.77	67.16	2.00	0.00	0.53	0.00	27.84	62.48	2.00	0.00	0.53	0.00
27.91	60.45	2.00	0.00	0.53	0.00	27.97	60.54	2.00	0.00	0.53	0.00
28.02	62.45	2.00	0.00	0.53	0.00	28.09	64.73	2.00	0.00	0.52	0.00
28.16	66.79	2.00	0.00	0.52	0.00	28.23	67.82	2.00	0.00	0.52	0.00
28.30	68.46	2.00	0.00	0.52	0.00	28.36	69.33	2.00	0.00	0.52	0.00
28.44	70.45	2.00	0.00	0.52	0.00	28.50	71.66	2.00	0.00	0.52	0.00
28.55	72.43	2.00	0.00	0.52	0.00	28.62	72.96	2.00	0.00	0.51	0.00
28.69	73.53	2.00	0.00	0.51	0.00	28.76	74.33	2.00	0.00	0.51	0.00
28.83	75.27	2.00	0.00	0.51	0.00	28.90	76.51	2.00	0.00	0.51	0.00
28.94	79.01	2.00	0.00	0.51	0.00	29.01	82.42	2.00	0.00	0.51	0.00
29.08	85.66	2.00	0.00	0.51	0.00	29.15	87.93	2.00	0.00	0.51	0.00
29.22	89.85	2.00	0.00	0.50	0.00	29.28	91.96	2.00	0.00	0.50	0.00
29.35	94.20	2.00	0.00	0.50	0.00	29.40	97.12	2.00	0.00	0.50	0.00
29.47	98.21	2.00	0.00	0.50	0.00	29.54	98.34	2.00	0.00	0.50	0.00
29.61	100.18	2.00	0.00	0.50	0.00	29.67	104.53	2.00	0.00	0.50	0.00
29.74	110.16	2.00	0.00	0.50	0.00	29.80	113.44	2.00	0.00	0.49	0.00
29.87	115.81	2.00	0.00	0.49	0.00	29.92	117.83	2.00	0.00	0.49	0.00
30.01	119.53	2.00	0.00	0.49	0.00	30.06	121.20	2.00	0.00	0.49	0.00
30.13	121.99	2.00	0.00	0.49	0.00	30.20	120.61	2.00	0.00	0.49	0.00
30.27	116.57	2.00	0.00	0.49	0.00	30.32	107.61	2.00	0.00	0.49	0.00
30.40	97.65	2.00	0.00	0.48	0.00	30.46	88.32	2.00	0.00	0.48	0.00
30.52	84.38	2.00	0.00	0.48	0.00	30.59	82.84	2.00	0.00	0.48	0.00
30.66	82.55	2.00	0.00	0.48	0.00	30.72	82.55	2.00	0.00	0.48	0.00
30.79	83.36	2.00	0.00	0.48	0.00	30.86	84.87	2.00	0.00	0.48	0.00
30.91	87.06	2.00	0.00	0.48	0.00	30.98	89.57	2.00	0.00	0.47	0.00
31.05	92.83	2.00	0.00	0.47	0.00	31.11	96.43	2.00	0.00	0.47	0.00

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
31.18	99.87	2.00	0.00	0.47	0.00	31.24	102.48	2.00	0.00	0.47	0.00
31.31	104.00	2.00	0.00	0.47	0.00	31.38	104.31	2.00	0.00	0.47	0.00
31.43	103.40	2.00	0.00	0.47	0.00	31.50	100.97	2.00	0.00	0.47	0.00
31.57	97.35	2.00	0.00	0.46	0.00	31.64	93.28	2.00	0.00	0.46	0.00
31.70	89.40	2.00	0.00	0.46	0.00	31.77	85.73	2.00	0.00	0.46	0.00
31.83	82.23	2.00	0.00	0.46	0.00	31.90	79.09	2.00	0.00	0.46	0.00
31.97	77.38	2.00	0.00	0.46	0.00	32.03	77.04	2.00	0.00	0.46	0.00
32.10	78.02	2.00	0.00	0.46	0.00	32.16	79.20	2.00	0.00	0.45	0.00
32.23	80.45	2.00	0.00	0.45	0.00	32.29	81.42	2.00	0.00	0.45	0.00
32.36	82.13	2.00	0.00	0.45	0.00	32.43	82.99	2.00	0.00	0.45	0.00
32.49	84.03	2.00	0.00	0.45	0.00	32.56	85.03	2.00	0.00	0.45	0.00
32.62	85.93	2.00	0.00	0.45	0.00	32.68	86.81	2.00	0.00	0.45	0.00
32.75	87.64	2.00	0.00	0.44	0.00	32.81	88.13	2.00	0.00	0.44	0.00
32.88	88.17	2.00	0.00	0.44	0.00	32.95	87.99	2.00	0.00	0.44	0.00
33.01	87.41	2.00	0.00	0.44	0.00	33.08	85.95	2.00	0.00	0.44	0.00
33.15	83.67	2.00	0.00	0.44	0.00	33.22	81.33	2.00	0.00	0.44	0.00
33.28	79.18	2.00	0.00	0.44	0.00	33.35	77.31	2.00	0.00	0.43	0.00
33.42	75.41	2.00	0.00	0.43	0.00	33.49	74.00	2.00	0.00	0.43	0.00
33.53	73.69	2.00	0.00	0.43	0.00	33.63	74.21	2.00	0.00	0.43	0.00
33.67	76.07	2.00	0.00	0.43	0.00	33.73	78.06	2.00	0.00	0.43	0.00
33.80	79.72	2.00	0.00	0.43	0.00	33.88	80.36	2.00	0.00	0.43	0.00
33.92	80.42	2.00	0.00	0.43	0.00	33.99	80.39	2.00	0.00	0.42	0.00
34.08	80.39	2.00	0.00	0.42	0.00	34.12	80.26	2.00	0.00	0.42	0.00
34.19	80.27	2.00	0.00	0.42	0.00	34.26	80.43	2.00	0.00	0.42	0.00
34.32	81.09	2.00	0.00	0.42	0.00	34.39	81.91	2.00	0.00	0.42	0.00
34.46	81.34	2.00	0.00	0.42	0.00	34.53	79.72	2.00	0.00	0.41	0.00
34.60	78.25	2.00	0.00	0.41	0.00	34.66	78.11	2.00	0.00	0.41	0.00
34.73	78.67	2.00	0.00	0.41	0.00	34.80	79.00	2.00	0.00	0.41	0.00
34.86	79.57	2.00	0.00	0.41	0.00	34.91	80.37	2.00	0.00	0.41	0.00
34.98	80.92	2.00	0.00	0.41	0.00	35.04	81.16	2.00	0.00	0.41	0.00
35.12	81.15	2.00	0.00	0.40	0.00	35.18	81.47	2.00	0.00	0.40	0.00
35.25	82.06	2.00	0.00	0.40	0.00	35.32	82.83	2.00	0.00	0.40	0.00
35.38	83.59	2.00	0.00	0.40	0.00	35.45	84.31	2.00	0.00	0.40	0.00
35.51	85.08	2.00	0.00	0.40	0.00	35.58	85.63	2.00	0.00	0.40	0.00
35.64	85.70	2.00	0.00	0.40	0.00	35.71	85.48	2.00	0.00	0.39	0.00
35.77	85.33	2.00	0.00	0.39	0.00	35.84	85.31	2.00	0.00	0.39	0.00
35.90	84.97	2.00	0.00	0.39	0.00	35.98	84.10	2.00	0.00	0.39	0.00
36.03	83.47	2.00	0.00	0.39	0.00	36.10	83.14	2.00	0.00	0.39	0.00
36.16	83.11	2.00	0.00	0.39	0.00	36.22	83.67	2.00	0.00	0.39	0.00
36.29	84.71	2.00	0.00	0.38	0.00	36.36	86.20	2.00	0.00	0.38	0.00
36.42	87.64	2.00	0.00	0.38	0.00	36.49	88.94	2.00	0.00	0.38	0.00
36.55	89.35	2.00	0.00	0.38	0.00	36.62	88.18	2.00	0.00	0.38	0.00
36.68	86.64	2.00	0.00	0.38	0.00	36.75	85.61	2.00	0.00	0.38	0.00
36.84	85.75	2.00	0.00	0.38	0.00	36.88	85.90	2.00	0.00	0.37	0.00
36.97	85.75	2.00	0.00	0.37	0.00	37.01	85.23	2.00	0.00	0.37	0.00
37.07	84.86	2.00	0.00	0.37	0.00	37.15	84.27	2.00	0.00	0.37	0.00
37.21	83.87	2.00	0.00	0.37	0.00	37.28	85.62	2.00	0.00	0.37	0.00
37.34	90.41	2.00	0.00	0.37	0.00	37.42	97.52	2.00	0.00	0.37	0.00

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
37.48	105.05	2.00	0.00	0.36	0.00	37.54	112.54	2.00	0.00	0.36	0.00
37.61	118.71	2.00	0.00	0.36	0.00	37.67	121.97	2.00	0.00	0.36	0.00
37.74	119.84	2.00	0.00	0.36	0.00	37.80	115.94	2.00	0.00	0.36	0.00
37.87	117.78	2.00	0.00	0.36	0.00	37.94	127.55	2.00	0.00	0.36	0.00
38.00	138.32	0.56	0.64	0.36	0.01	38.07	146.89	0.64	0.60	0.35	0.00
38.13	151.20	0.69	0.48	0.35	0.00	38.21	152.22	0.70	0.48	0.35	0.00
38.26	151.12	0.69	0.48	0.35	0.00	38.32	148.57	0.66	0.49	0.35	0.00
38.40	145.29	0.63	0.60	0.35	0.01	38.46	140.89	0.58	0.61	0.35	0.00
38.53	123.51	2.00	0.00	0.35	0.00	38.59	119.04	2.00	0.00	0.35	0.00
38.66	116.43	2.00	0.00	0.34	0.00	38.72	122.52	2.00	0.00	0.34	0.00
38.80	122.88	2.00	0.00	0.34	0.00	38.85	126.01	2.00	0.00	0.34	0.00
38.92	128.25	2.00	0.00	0.34	0.00	38.99	128.53	2.00	0.00	0.34	0.00
39.05	127.93	2.00	0.00	0.34	0.00	39.11	127.24	0.47	0.65	0.34	0.00
39.19	127.27	0.47	0.64	0.34	0.01	39.24	128.68	0.48	0.64	0.33	0.00
39.32	130.07	0.49	0.63	0.33	0.01	39.38	129.55	2.00	0.00	0.33	0.00
39.44	124.83	2.00	0.00	0.33	0.00	39.52	119.34	2.00	0.00	0.33	0.00
39.60	124.25	2.00	0.00	0.33	0.00	39.65	142.43	2.00	0.00	0.33	0.00
39.73	157.83	0.77	0.34	0.33	0.00	39.78	167.24	0.89	0.24	0.33	0.00
39.83	170.53	0.93	0.23	0.32	0.00	39.92	172.39	0.96	0.17	0.32	0.00
39.97	173.66	0.98	0.17	0.32	0.00	40.05	174.35	0.99	0.17	0.32	0.00
40.10	174.59	0.99	0.17	0.32	0.00	40.18	174.34	0.99	0.17	0.32	0.00
40.23	175.15	1.00	0.17	0.32	0.00	40.31	177.17	1.03	0.16	0.32	0.00
40.36	180.71	1.08	0.12	0.32	0.00	40.45	183.40	1.13	0.12	0.31	0.00
40.49	183.48	1.13	0.12	0.31	0.00	40.57	183.98	1.14	0.12	0.31	0.00
40.62	183.96	1.14	0.12	0.31	0.00	40.70	184.96	1.15	0.08	0.31	0.00
40.75	183.94	1.14	0.11	0.31	0.00	40.82	182.19	1.11	0.12	0.31	0.00
40.89	180.22	1.08	0.12	0.31	0.00	40.96	178.26	1.05	0.16	0.31	0.00
41.02	176.39	1.02	0.16	0.30	0.00	41.09	174.62	0.99	0.16	0.30	0.00
41.15	172.94	0.97	0.16	0.30	0.00	41.21	171.62	0.95	0.16	0.30	0.00
41.27	170.27	0.93	0.21	0.30	0.00	41.34	168.78	0.91	0.22	0.30	0.00
41.42	167.38	0.89	0.22	0.30	0.00	41.47	166.32	0.88	0.22	0.30	0.00
41.54	165.35	0.87	0.22	0.30	0.00	41.61	164.26	0.85	0.22	0.29	0.00
41.70	162.80	0.83	0.29	0.29	0.00	41.74	160.35	0.80	0.30	0.29	0.00
41.82	156.86	0.76	0.31	0.29	0.00	41.89	152.93	0.72	0.39	0.29	0.00
41.93	148.47	0.67	0.41	0.29	0.00	42.00	142.39	0.60	0.50	0.29	0.00
42.07	135.71	0.54	0.52	0.29	0.00	42.13	128.73	0.48	0.54	0.29	0.00
42.21	122.62	0.44	0.56	0.28	0.01	42.26	115.75	0.39	0.59	0.28	0.00
42.33	109.68	0.35	0.61	0.28	0.01	42.40	105.39	0.33	0.63	0.28	0.00
42.47	102.63	0.31	0.64	0.28	0.01	42.53	100.34	0.30	0.65	0.28	0.00
42.60	99.19	0.30	0.65	0.28	0.01	42.67	100.47	0.30	0.64	0.28	0.01
42.73	104.58	0.32	0.62	0.28	0.00	42.80	108.86	0.35	0.60	0.27	0.01
42.86	111.87	0.37	0.58	0.27	0.00	42.93	112.93	0.37	0.58	0.27	0.00
42.99	112.59	0.37	0.58	0.27	0.00	43.06	111.57	2.00	0.00	0.27	0.00
43.12	111.40	2.00	0.00	0.27	0.00	43.19	112.26	2.00	0.00	0.27	0.00
43.25	113.56	2.00	0.00	0.27	0.00	43.32	114.73	2.00	0.00	0.27	0.00
43.38	116.13	2.00	0.00	0.26	0.00	43.46	117.81	2.00	0.00	0.26	0.00
43.51	120.34	2.00	0.00	0.26	0.00	43.58	123.09	2.00	0.00	0.26	0.00
43.64	126.41	2.00	0.00	0.26	0.00	43.72	128.81	2.00	0.00	0.26	0.00

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
43.77	129.99	2.00	0.00	0.26	0.00	43.85	128.69	2.00	0.00	0.26	0.00
43.90	125.62	2.00	0.00	0.26	0.00	43.97	120.88	2.00	0.00	0.25	0.00
44.06	116.01	2.00	0.00	0.25	0.00	44.10	108.26	2.00	0.00	0.25	0.00
44.19	100.50	2.00	0.00	0.25	0.00	44.23	97.06	2.00	0.00	0.25	0.00
44.32	100.65	2.00	0.00	0.25	0.00	44.36	104.79	2.00	0.00	0.25	0.00
44.44	107.15	0.34	0.54	0.25	0.01	44.52	109.06	0.35	0.53	0.25	0.01
44.56	110.92	0.36	0.53	0.24	0.00	44.62	112.25	0.37	0.52	0.24	0.00
44.70	113.76	0.38	0.51	0.24	0.01	44.75	114.60	0.39	0.50	0.24	0.00
44.83	115.23	0.39	0.50	0.24	0.00	44.89	116.19	0.40	0.49	0.24	0.00
44.97	117.36	0.41	0.49	0.24	0.00	45.01	119.03	0.42	0.48	0.24	0.00
45.09	120.74	0.43	0.47	0.24	0.00	45.15	122.52	0.44	0.46	0.23	0.00
45.22	123.43	0.45	0.46	0.23	0.00	45.28	123.31	0.45	0.46	0.23	0.00
45.35	122.17	2.00	0.00	0.23	0.00	45.44	120.79	2.00	0.00	0.23	0.00
45.47	119.36	2.00	0.00	0.23	0.00	45.57	118.70	2.00	0.00	0.23	0.00
45.64	118.23	2.00	0.00	0.23	0.00	45.69	118.60	2.00	0.00	0.23	0.00
45.76	119.66	2.00	0.00	0.22	0.00	45.82	122.35	2.00	0.00	0.22	0.00
45.89	125.75	2.00	0.00	0.22	0.00	45.94	128.69	2.00	0.00	0.22	0.00
46.02	129.77	2.00	0.00	0.22	0.00	46.07	129.75	2.00	0.00	0.22	0.00
46.15	129.73	2.00	0.00	0.22	0.00	46.22	132.26	2.00	0.00	0.22	0.00
46.27	138.17	2.00	0.00	0.22	0.00	46.35	144.90	2.00	0.00	0.21	0.00
46.40	153.14	2.00	0.00	0.21	0.00	46.48	159.00	0.81	0.22	0.21	0.00
46.53	163.42	0.86	0.16	0.21	0.00	46.59	160.97	0.83	0.21	0.21	0.00
46.67	150.99	0.71	0.29	0.21	0.00	46.72	139.04	0.59	0.37	0.21	0.00
46.80	130.69	0.51	0.39	0.21	0.00	46.87	129.08	0.50	0.39	0.21	0.00
46.92	129.22	0.50	0.39	0.20	0.00	47.00	131.04	0.52	0.38	0.20	0.00
47.06	133.62	0.54	0.37	0.20	0.00	47.13	135.96	0.56	0.37	0.20	0.00
47.19	138.11	0.58	0.36	0.20	0.00	47.26	140.18	0.60	0.35	0.20	0.00
47.31	143.45	0.63	0.34	0.20	0.00	47.39	147.43	0.68	0.28	0.20	0.00
47.46	151.74	0.73	0.27	0.20	0.00	47.51	155.37	0.77	0.21	0.19	0.00
47.59	157.97	0.80	0.20	0.19	0.00	47.66	160.24	0.83	0.20	0.19	0.00
47.72	162.53	0.86	0.15	0.19	0.00	47.78	164.68	0.89	0.14	0.19	0.00
47.86	166.66	0.92	0.14	0.19	0.00	47.91	169.27	0.95	0.10	0.19	0.00
47.98	172.20	1.00	0.10	0.19	0.00	48.05	174.95	1.04	0.10	0.19	0.00
48.11	176.32	1.06	0.07	0.18	0.00	48.17	175.92	1.06	0.07	0.18	0.00
48.26	174.88	1.04	0.10	0.18	0.00	48.30	173.11	1.01	0.10	0.18	0.00
48.39	171.18	0.99	0.10	0.18	0.00	48.43	168.10	0.94	0.13	0.18	0.00
48.51	163.51	2.00	0.00	0.18	0.00	48.58	158.19	2.00	0.00	0.18	0.00
48.63	152.20	2.00	0.00	0.18	0.00	48.71	146.59	2.00	0.00	0.17	0.00
48.75	140.34	2.00	0.00	0.17	0.00	48.84	134.33	2.00	0.00	0.17	0.00
48.90	129.17	2.00	0.00	0.17	0.00	48.96	125.82	2.00	0.00	0.17	0.00
49.04	124.60	2.00	0.00	0.17	0.00	49.10	125.34	2.00	0.00	0.17	0.00
49.15	126.95	2.00	0.00	0.17	0.00	49.23	127.75	2.00	0.00	0.17	0.00
49.30	127.37	2.00	0.00	0.16	0.00	49.35	126.04	2.00	0.00	0.16	0.00
49.42	124.83	0.47	0.32	0.16	0.00	49.49	124.51	0.47	0.31	0.16	0.00
49.55	125.80	2.00	0.00	0.16	0.00	49.61	128.70	2.00	0.00	0.16	0.00
49.69	132.04	2.00	0.00	0.16	0.00	49.76	134.32	2.00	0.00	0.16	0.00
49.81	135.70	2.00	0.00	0.16	0.00	49.88	136.41	2.00	0.00	0.15	0.00
49.95	136.20	2.00	0.00	0.15	0.00	50.01	135.28	2.00	0.00	0.15	0.00

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)

Total estimated settlement: 1.40

Abbreviations

$Q_{tn,cs}$:	Equivalent clean sand normalized cone resistance
FS:	Factor of safety against liquefaction
e_v (%):	Post-liquefaction volumentric strain
DF:	e_v depth weighting factor
Settlement:	Calculated settlement

APPENDIX E

GENERAL EARTHWORK AND GRADING GUIDELINES

Geotechnical Evaluation
Proposed Multi-Family Residential Development, Cypress, California
Project No. 2155-CR

GEOTEK

GENERAL GRADING GUIDELINES

Guidelines presented herein are intended to address general construction procedures for earthwork construction. Specific situations and conditions often arise which cannot reasonably be discussed in general guidelines, when anticipated these are discussed in the text of the report. Often unanticipated conditions are encountered which may necessitate modification or changes to these guidelines. It is our hope that these will assist the contractor to more efficiently complete the project by providing a reasonable understanding of the procedures that would be expected during earthwork and the testing and observation used to evaluate those procedures.

General

Grading should be performed to at least the minimum requirements of governing agencies, Chapters 18 and 33 of the California Building Code, CBC (2016) and the guidelines presented below.

Preconstruction Meeting

A preconstruction meeting should be held prior to site earthwork. Any questions the contractor has regarding our recommendations, general site conditions, apparent discrepancies between reported and actual conditions and/or differences in procedures the contractor intends to use should be brought up at that meeting. The contractor (including the main onsite representative) should review our report and these guidelines in advance of the meeting. Any comments the contractor may have regarding these guidelines should be brought up at that meeting.

Grading Observation and Testing

1. Observation of the fill placement should be provided by our representative during grading. Verbal communication during the course of each day will be used to inform the contractor of test results. The contractor should receive a copy of the "Daily Field Report" indicating results of field density tests that day. If our representative does not provide the contractor with these reports, our office should be notified.
2. Testing and observation procedures are, by their nature, specific to the work or area observed and location of the tests taken, variability may occur in other locations. The contractor is responsible for the uniformity of the grading operations; our observations and test results are intended to evaluate the contractor's overall level of efforts during grading. The contractor's personnel are the only individuals participating in all aspect of site work. Compaction testing and observation should not be considered as relieving the contractor's responsibility to properly compact the fill.
3. Cleanouts, processed ground to receive fill, key excavations, and subdrains should be observed by our representative prior to placing any fill. It will be the contractor's responsibility to notify our representative or office when such areas are ready for observation.
4. Density tests may be made on the surface material to receive fill, as considered warranted by this firm.
5. In general, density tests would be made at maximum intervals of two feet of fill height or every 1,000 cubic yards of fill placed. Criteria will vary depending on soil conditions and size of the fill. More frequent testing may be performed. In any case, an adequate number of field density tests should be made to evaluate the required compaction and moisture content is generally being obtained.

6. Laboratory testing to support field test procedures will be performed, as considered warranted, based on conditions encountered (e.g. change of material sources, types, etc.) Every effort will be made to process samples in the laboratory as quickly as possible and in progress construction projects are our first priority. However, laboratory workloads may cause in delays and some soils may require a **minimum of 48 to 72 hours to complete test procedures**. Whenever possible, our representative(s) should be informed in advance of operational changes that might result in different source areas for materials.
7. Procedures for testing of fill slopes are as follows:
   a) Density tests should be taken periodically during grading on the flat surface of the fill, three to five feet horizontally from the face of the slope.
   b) If a method other than over building and cutting back to the compacted core is to be employed, slope compaction testing during construction should include testing the outer six inches to three feet in the slope face to determine if the required compaction is being achieved.
8. Finish grade testing of slopes and pad surfaces should be performed after construction is complete.

Site Clearing

1. All vegetation, and other deleterious materials, should be removed from the site. If material is not immediately removed from the site it should be stockpiled in a designated area(s) well outside of all current work areas and delineated with flagging or other means. Site clearing should be performed in advance of any grading in a specific area.
2. Efforts should be made by the contractor to remove all organic or other deleterious material from the fill, as even the most diligent efforts may result in the incorporation of some materials. This is especially important when grading is occurring near the natural grade. All equipment operators should be aware of these efforts. Laborers may be required as root pickers.
3. Nonorganic debris or concrete may be placed in deeper fill areas provided the procedures used are observed and found acceptable by our representative.

Treatment of Existing Ground

1. Following site clearing, all surficial deposits of alluvium and colluvium as well as weathered or creep effected bedrock, should be removed unless otherwise specifically indicated in the text of this report.
2. In some cases, removal may be recommended to a specified depth (e.g. flat sites where partial alluvial removals may be sufficient). The contractor should not exceed these depths unless directed otherwise by our representative.
3. Groundwater existing in alluvial areas may make excavation difficult. Deeper removals than indicated in the text of the report may be necessary due to saturation during winter months.
4. Subsequent to removals, the natural ground should be processed to a depth of six inches, moistened to near optimum moisture conditions and compacted to fill standards.
5. Exploratory back hoe or dozer trenches still remaining after site removal should be excavated and filled with compacted fill if they can be located.

Fill Placement

1. Unless otherwise indicated, all site soil and bedrock may be reused for compacted fill; however, some special processing or handling may be required (see text of report).

2. Material used in the compacting process should be evenly spread, moisture conditioned, processed, and compacted in thin lifts six (6) to eight (8) inches in compacted thickness to obtain a uniformly dense layer. The fill should be placed and compacted on a nearly horizontal plane, unless otherwise found acceptable by our representative.
3. If the moisture content or relative density varies from that recommended by this firm, the contractor should rework the fill until it is in accordance with the following:
   a) Moisture content of the fill should be at or above optimum moisture. Moisture should be evenly distributed without wet and dry pockets. Pre-watering of cut or removal areas should be considered in addition to watering during fill placement, particularly in clay or dry surficial soils. The ability of the contractor to obtain the proper moisture content will control production rates.
   b) Each six-inch layer should be compacted to at least 90 percent of the maximum dry density in compliance with the testing method specified by the controlling governmental agency. In most cases, the testing method is ASTM Test Designation D 1557.
4. Rock fragments less than eight inches in diameter may be utilized in the fill, provided:
   a) They are not placed in concentrated pockets;
   b) There is a sufficient percentage of fine-grained material to surround the rocks;
   c) The distribution of the rocks is observed by, and acceptable to, our representative.
5. Rocks exceeding eight (8) inches in diameter should be taken off site, broken into smaller fragments, or placed in accordance with recommendations of this firm in areas designated suitable for rock disposal. On projects where significant large quantities of oversized materials are anticipated, alternate guidelines for placement may be included. If significant oversize materials are encountered during construction, these guidelines should be requested.
6. In clay soil, dry or large chunks or blocks are common. If in excess of eight (8) inches minimum dimension, then they are considered as oversized. Sheepsfoot compactors or other suitable methods should be used to break up blocks. When dry, they should be moisture conditioned to provide a uniform condition with the surrounding fill.

Slope Construction

1. The contractor should obtain a minimum relative compaction of 90 percent out to the finished slope face of fill slopes. This may be achieved by either overbuilding the slope and cutting back to the compacted core, or by direct compaction of the slope face with suitable equipment.
2. Slopes trimmed to the compacted core should be overbuilt by at least three (3) feet with compaction efforts out to the edge of the false slope. Failure to properly compact the outer edge results in trimming not exposing the compacted core and additional compaction after trimming may be necessary.
3. If fill slopes are built "at grade" using direct compaction methods, then the slope construction should be performed so that a constant gradient is maintained throughout construction. Soil should not be "spilled" over the slope face nor should slopes be "pushed out" to obtain grades. Compaction equipment should compact each lift along the immediate top of slope. Slopes should be back rolled or otherwise compacted at approximately every 4 feet vertically as the slope is built.
4. Corners and bends in slopes should have special attention during construction as these are the most difficult areas to obtain proper compaction.
5. Cut slopes should be cut to the finished surface. Excessive undercutting and smoothing of the face with fill may necessitate stabilization.

UTILITY TRENCH CONSTRUCTION AND BACKFILL

Utility trench excavation and backfill is the contractors responsibility. The geotechnical consultant typically provides periodic observation and testing of these operations. While efforts are made to make sufficient observations and tests to verify that the contractors' methods and procedures are adequate to achieve proper compaction, it is typically impractical to observe all backfill procedures. As such, it is critical that the contractor use consistent backfill procedures.

Compaction methods vary for trench compaction and experience indicates many methods can be successful. However, procedures that "worked" on previous projects may or may not prove effective on a given site. The contractor(s) should outline the procedures proposed, so that we may discuss them **prior** to construction. We will offer comments based on our knowledge of site conditions and experience.

1. Utility trench backfill in slopes, structural areas, in streets and beneath flat work or hardscape should be brought to at least optimum moisture and compacted to at least 90 percent of the laboratory standard. Soil should be moisture conditioned prior to placing in the trench.
2. Flooding and jetting are not typically recommended or acceptable for native soils. Flooding or jetting may be used with select sand having a Sand Equivalent (SE) of 30 or higher. This is typically limited to the following uses:
   a) shallow (12 + inches) under slab interior trenches and,
   b) as bedding in pipe zone.

   The water should be allowed to dissipate prior to pouring slabs or completing trench compaction.
3. Care should be taken not to place soils at high moisture content within the upper three feet of the trench backfill in street areas, as overly wet soils may impact subgrade preparation. Moisture may be reduced to 2% below optimum moisture in areas to be paved within the upper three feet below sub grade.
4. Sand backfill should not be allowed in exterior trenches adjacent to and within an area extending below a 1:1 projection from the outside bottom edge of a footing, unless it is similar to the surrounding soil.
5. Trench compaction testing is generally at the discretion of the geotechnical consultant. Testing frequency will be based on trench depth and the contractors procedures. A probing rod would be used to assess the consistency of compaction between tested areas and untested areas. If zones are found that are considered less compact than other areas, this would be brought to the contractors attention.

JOB SAFETY

General

Personnel safety is a primary concern on all job sites. The following summaries are safety considerations for use by all our employees on multi-employer construction sites. On ground personnel are at highest risk of injury and possible fatality on grading construction projects. The company recognizes that construction activities will vary on each site and that job site safety is the contractor's responsibility. However, it is, imperative that all personnel be safety conscious to avoid accidents and potential injury.

In an effort to minimize risks associated with geotechnical testing and observation, the following precautions are to be implemented for the safety of our field personnel on grading and construction projects.

1. Safety Meetings: Our field personnel are directed to attend the contractor's regularly scheduled safety meetings.
2. Safety Vests: Safety vests are provided for and are to be worn by our personnel while on the job site.
3. Safety Flags: Safety flags are provided to our field technicians; one is to be affixed to the vehicle when on site, the other is to be placed atop the spoil pile on all test pits.

In the event that the contractor's representative observes any of our personnel not following the above, we request that it be brought to the attention of our office.

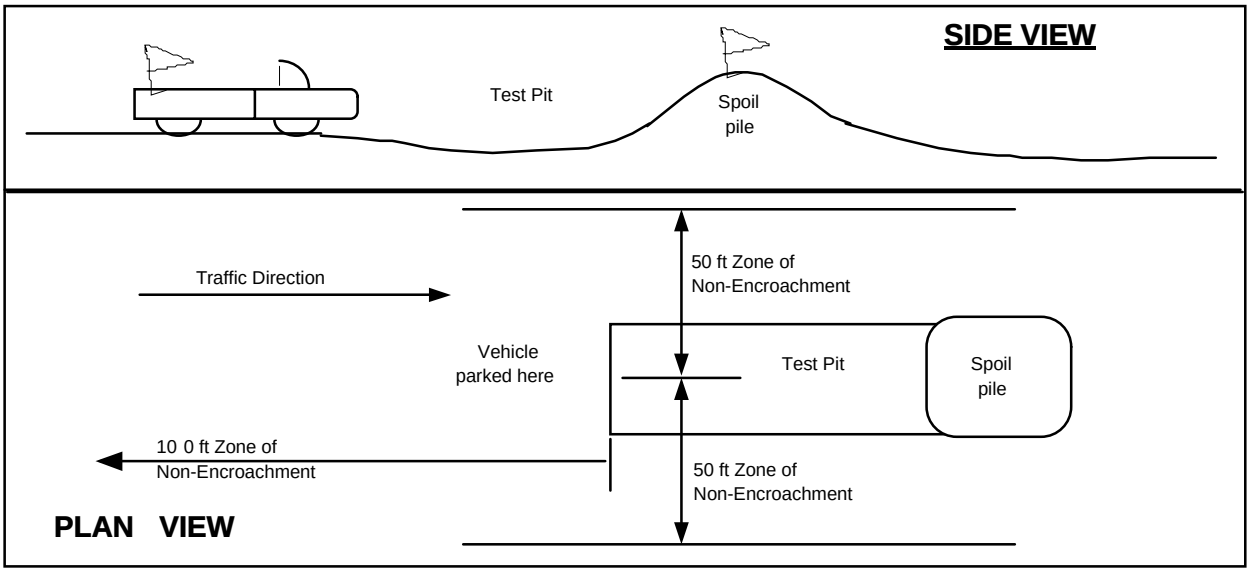
Test Pits Location, Orientation and Clearance

The technician is responsible for selecting test pit locations. The primary concern is the technician's safety. However, it is necessary to take sufficient tests at various locations to obtain a representative sampling of the fill. As such, efforts will be made to coordinate locations with the grading contractors authorized representatives (e.g. dump man, operator, supervisor, grade checker, etc.), and to select locations following or behind the established traffic pattern, preferably outside of current traffic. The contractors authorized representative should direct excavation of the pit and safety during the test period. Again, safety is the paramount concern.

Test pits should be excavated so that the spoil pile is placed away from oncoming traffic. The technician's vehicle is to be placed next to the test pit, opposite the spoil pile. This necessitates that the fill be maintained in a drivable condition. Alternatively, the contractor may opt to park a piece of equipment in front of test pits, particularly in small fill areas or those with limited access.

A zone of non-encroachment should be established for all test pits (see diagram below). No grading equipment should enter this zone during the test procedure. The zone should extend outward to the sides approximately 50 feet from the center of the test pit and 100 feet in the direction of traffic flow. This zone is established both for safety and to avoid excessive ground vibration, which typically decreases test results.

TEST PIT SAFETY PLAN



Slope Tests

When taking slope tests, the technician should park their vehicle directly above or below the test location on the slope. The contractor's representative should effectively keep all equipment at a safe operation distance (e.g. 50 feet) away from the slope during testing.

The technician is directed to withdraw from the active portion of the fill as soon as possible following testing. The technician's vehicle should be parked at the perimeter of the fill in a highly visible location.

Trench Safety

It is the contractor's responsibility to provide safe access into trenches where compaction testing is needed. Trenches for all utilities should be excavated in accordance with CAL-OSHA and any other applicable safety standards. Safe conditions will be required to enable compaction testing of the trench backfill.

All utility trench excavations in excess of 5 feet deep, which a person enters, are to be shored or laid back. Trench access should be provided in accordance with OSHA standards. Our personnel are directed not to enter any trench by being lowered or "riding down" on the equipment.

Our personnel are directed not to enter any excavation which;

1. is 5 feet or deeper unless shored or laid back,
2. exit points or ladders are not provided,
3. displays any evidence of instability, has any loose rock or other debris which could fall into the trench, or
4. displays any other evidence of any unsafe conditions regardless of depth.

If the contractor fails to provide safe access to trenches for compaction testing, our company policy requires that the soil technician withdraws and notifies their supervisor. The contractors representative will then be contacted in an effort to effect a solution. All backfill not tested due to safety concerns or other reasons is subject to reprocessing and/or removal.

Procedures

In the event that the technician's safety is jeopardized or compromised as a result of the contractor's failure to comply with any of the above, the technician is directed to inform both the developer's and contractor's representatives. If the condition is not rectified, the technician is required, by company policy, to immediately withdraw and notify their supervisor. The contractor's representative will then be contacted in an effort to effect a solution. No further testing will be performed until the situation is rectified. Any fill placed in the interim can be considered unacceptable and subject to reprocessing, recompaction or removal.

In the event that the soil technician does not comply with the above or other established safety guidelines, we request that the contractor bring this to technicians attention and notify our project manager or office. Effective communication and coordination between the contractors' representative and the field technician(s) is strongly encouraged in order to implement the above safety program and safety in general.

The safety procedures outlined above should be discussed at the contractor's safety meetings. This will serve to inform and remind equipment operators of these safety procedures particularly the zone of non-encroachment.

The safety procedures outlined above should be discussed at the contractor's safety meetings. This will serve to inform and remind equipment operators of these safety procedures particularly the zone of non-encroachment.

Natural History Museum
of Los Angeles County
900 Exposition Boulevard
Los Angeles, CA 90007

tel 213.763.DINO
www.nhm.org

Research & Collections

e-mail: paleorecords@nhm.org

October 2, 2020

LSA
20 Executive Park, Suite 200
Irvine, California 92614

Attn: Sarah Rieboldt

re: Paleontological resources for the Cypress Town Center Project, Cypress, Orange County, California (LSA Proj. No. CCP1603.08)

Dear Sarah:

I have conducted a thorough search of our paleontology collection records for the locality and specimen data for proposed development at Cypress Town Center project area as outlined on the portion of the Los Alamitos USGS topographic quadrangle map that you sent to me via e-mail on September 30, 2020. We do not have any fossil localities that lie directly within the proposed project area, but we do have fossil localities nearby from the same sedimentary deposits that occur in the proposed project area, either at the surface or at depth.

The following table shows the closest known localities in the collection of the Natural History Museum of Los Angeles County.

Locality Number	Location	Formation	Taxa	Depth
LACM VP 3291	Sunset Beach at low tide, 50 yards north of Anderson Street & west of Pacific Coast Highway	Unknown Formation (Pleistocene)	Camel (*Camelops hesternus*)	Surface
LACM IP 17427	810 feet north of Pacific Coast Highway, 125 feet east of 1st Street, Huntington Beach	Alluvium-dune deposits (Pleistocene)	Invertebrates	Unknown (found during excavations of an abandoned oil field)
LACM VP 4196	In bed of Coyote Creek approximately 800 feet N of La Mirada	La Habra Formation (greenish brown silt)	Mammals, plants, vertebrates (unspecified)	Surface

	Boulevard Bridge			
LACM VP 3524	North of Malvern Avenue & approximately 1/2 mile west of Gilbert Street; Fullerton	Terrace deposits (silty sandstone)	Plants; Invertebrates; Fish (Chondrichthyes)	unknown
LACM VP 1652	Rio Vista Avenue south of Lincoln Avenue	Alluvium (Pleistocene)	Sheep (*Ovis*)	Unknown (excavations for housing project)

VP, Vertebrate Paleontology; IP, Invertebrate Paleontology; bgs, below ground surface

This records search covers only the records of the Natural History Museum of Los Angeles County ("NHMLA"). It is not intended as a paleontological assessment of the project area for the purposes of CEQA or NEPA. Potentially fossil-bearing units are present in the project area, either at the surface or in the subsurface. As such, NHMLA recommends that a full paleontological assessment of the project area be conducted by a paleontologist meeting Bureau of Land Management or Society of Vertebrate Paleontology standards.

Sincerely,

Alyssa Bell, Ph.D.
Natural History Museum of Los Angeles County

enclosure: invoice

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APPENDIX E-2

PALEONTOLOGICAL MEMORANDUM

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BERKELEY
CARLSBAD
FRESNO
IRVINE
LOS ANGELES
PALM SPRINGS
POINT RICHMOND
RIVERSIDE
ROSEVILLE
SAN LUIS OBISPO

September 30, 2020

Natural History Museum of Los Angeles County
900 Exposition Boulevard
Los Angeles, CA 90007

Subject: Fossil Locality Search for the Cypress Town Center Project, Cypress, Orange County, California

Dear Sir/Madam:

LSA Associates, Inc. (LSA) is requesting the Natural History Museum of Los Angeles County conduct a fossil locality search for the Cypress Town Center Project (project) in Cypress, Orange County, California. The project involves the construction of a multi-family residential community consisting of 135 dwelling units. The attached figure (Fossil Locality Search Map) depicts the project area on the *Los Alamitos, California* 7.5-minute United States Geological Survey (USGS) topographic map in Township 4 South, Range 11 West, Section 21 San Bernardino Baseline and Meridian (USGS, 1981).

LSA is interested in knowing the location of fossil localities within an approximately 1-mile radius around the project area. In addition, LSA would like to know what specimens have been found from those localities. If there are no known fossils localities within a 1-mile radius, please provide the location of the closest localities within similar sediments to those found within the project area, as well as the fossils recovered.

Please send an invoice to my attention, including a reference to LSA project number **CCP1603.08**.

If possible, LSA is requesting receipt of the results by **October 21, 2020**. Please send the results via e-mail to sarah.rieboldt@lsa.net.

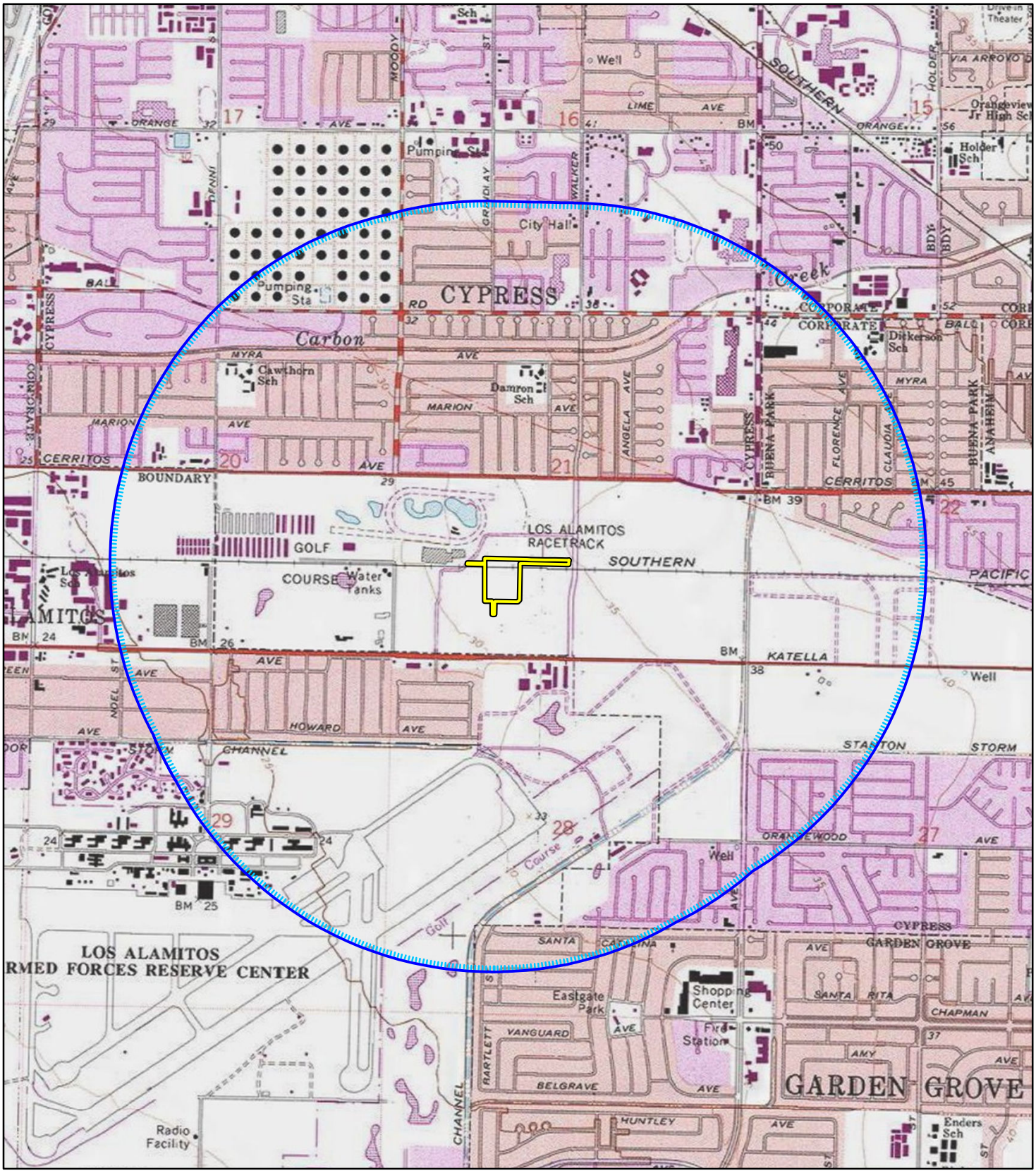
Thank you.

Sincerely,

LSA ASSOCIATES, INC.

Sarah Rieboldt, Ph.D.
Associate/Senior Paleontologist

Attachment: Fossil Locality Search Map



LEGEND

Project Location

1-mile Radius of Project Location

FIGURE 1

0 1000 2000
FEET

SOURCE: USGS 7.5' Quad - *Los Alamitos*, CA (1981)

I:\CCP1603.08\GIS\MXD\Paleo\FossilLocalitySearch.mxd (9/30/2020)

Cypress Town Center

Fossil Locality Search Map