Appendix D

GEOTECHNICAL ENGINEERING REPORT

GEOTECHNICAL ENGINEERING REPORT
PROPOSED GAS STATION, CONVENIENCE STORE,
AND CARWASH RENEWAL
1152 TULLY ROAD
SAN JOSE, CALIFORNIA

August 2, 2024

Prepared for:

Ms. Hamy Nguyen

Prepared by:

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August 2, 2024 File No.: 306705-001

Ms. Ha My Nguyen
1152 Tully Road,
San Jose, CA

PROJECT: PROPOSED GAS STATION, CONVENIENCE STORE, AND CARWASH BUILDINGS
1152 TULLY ROAD
SAN JOSE, CALIFORNIA

SUBJECT: Geotechnical Engineering Report

REF.: Proposal for a Geotechnical Engineering Report and Liquefaction Analysis, Proposed Gas Station, Convenience Store and Carwash Renewal, 1152 Tully Road, San Jose, California, by Earth Systems Pacific, dated May 21, 2024

Dear Ms. Nguyen:

Per your authorization of the above referenced proposal, Earth Systems Pacific (Earth Systems) has prepared this geotechnical engineering report for use in the development of plans and specifications for the proposed gas station, convenience store, and carwash buildings to be located on Tully Road in San Jose, California. The conclusions and recommendations presented herein are based on our understanding of the proposed development, a review of the subsurface conditions revealed by Cone Penetration Tests (CPT) sounding as a part of this investigation, and our engineering analysis.

We appreciate the opportunity to assist you on this project. Should you have any questions regarding the contents of this report, please contact the undersigned.

Sincerely,

Earth Systems Pacific

Prepared By:
Javad Shahmoradi,
Staff Engineer

Reviewed By:
Ajay Singh, GE 3057
Principal Engineer



Doc. No.: 2408-001.SER/mg

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1.0 INTRODUCTION

This report presents the results of the geotechnical engineering study performed by Earth Systems Pacific (Earth System), for the proposed gas station, convenience store and carwash buildings to be constructed at the captioned site in San Jose, California. The attached Site Vicinity Map (Figure 1) shows the general location of the site, and the attached Existing Site Condition (Figure 2) and Proposed Site Development Plan (Figure 3) show the locations of CPTs conducted at the site as part of this investigation.

Site Setting

The subject 28,616 square feet (SF) property is located on Tully Road in San Jose, California. The middle portion of the site area has a latitude of 37.3151°N and a longitude of 121.8358°W and is relatively flat. The site is bordered to the northwest by Tully Road, to the southwest by McLaughin Drive, developed non-residential parcel (temple) to the southeast, and to a developed commercial parcel to the northeast. At the time of our site investigation, the site was occupied by an operating gas station, car shop and convenience store. The rest of the site is covered with cement or asphaltic concrete pavement.

Project Description

Based on a review of the Site Plan provided by MI Architects, Inc. (August 15, 2022), the proposed developments will include removal of the existing gas station, car repair shop, convenience store, and construction of a new fueling canopy, car repair shop, convenience store, carwash buildings, etc. The underground storage tanks will be relocated to an area adjacent to Tully Road. A new fueling canopy will be constructed on the southeast side of the future storage tanks. A carwash tunnel will be constructed in the area adjacent and just to the south of the proposed location of the fueling tanks. A convenience store and car shop will be constructed in the southern portion of the site with the carwash tunnel being adjacent to the southern property line. The rest of the site will be covered with concrete pavement and landscape islands scattered throughout. Details of the site development plans are shown on Figure 3.

Scope of Services

The scope of work for the geotechnical engineering study included general site reconnaissance, exploration of subsurface soil and groundwater conditions from a geotechnical engineering standpoint, limited laboratory testing to measure pertinent engineering properties of soil samples collected from the site, evaluation of subsurface data collected from the site, and preparation of this report. The analysis and engineering recommendations presented in the following sections of this report are based on our understanding of the proposed development at the subject site and our experience with projects of a similar nature.

The report and recommendations are intended to comply with the considerations of Section 1803 of the California Building Code (CBC), 2022 Edition, and common geotechnical engineering practice in this area at this time under similar conditions.

Preliminary geotechnical recommendations for site preparation and grading, foundations, slabs-on-grade, exterior flatwork, flexible pavements sections, rigid pavement sections, utility trench backfill, site drainage management, and geotechnical observation and testing are presented to guide the development of project plans and specifications. It is our intent that this report be used by the client to form the geotechnical basis of the design of the project as described herein, and in the preparation of plans and specifications.

Detailed evaluation of the site geology and potential geologic hazards, and analyses of the soil for mold or other microbial content, asbestos, radioisotopes, hydrocarbons, or other chemical properties are beyond the scope of this report. This report also does not address issues in the domain of contractors such as, but not limited to, site safety, loss of volume due to stripping of the site, shrinkage of soils during compaction, excavatability, shoring, temporary slope angles, and construction means and methods. Ancillary features such as temporary access roads, fences, light poles, and non-structural fills are not within our scope and are also not addressed.

To verify that pertinent issues have been addressed and to aid in conformance with the intent of this report, it is requested that final grading and foundation plans be submitted to this office for review. In the event that there are any changes in the nature, design, or locations of improvements, or if any assumptions used in the preparation of this report prove to be incorrect,

the conclusions and recommendations contained herein should not be considered valid unless the changes are reviewed, and the conclusions of this report are verified or modified in writing by the Geotechnical Engineer. The criteria presented in this report are considered preliminary until such time as they are verified or modified in writing by the Geotechnical Engineer in the field during construction.

2.0 GEOLOGIC SETTING, GEOLOGIC HAZARD AND SEISMICITY

According to the geologic maps of the area, the site straddles Holocene-aged natural levee deposits (Qhl); loose, moderate- to well-sorted sandy or clayey silt grading to sandy or silty clay. Levee deposits border the channels of Guadalupe River, Coyote Creek and the lower course of Silver Creek. Textures of Qhl deposits along Coyote Creek tend to be coarser (sandy or clayey silt) than these along the Guadalupe River (sandy or silty clay). Levee deposits are generally well drained. There is little change in grain-size with distance downstream within the San Jose East Quadrangle (Helley, E.J., and Wesling, J.R.; 1990; Quaternary geologic map of the San Jose East quadrangle, Santa Clara County, California).

The site is located within a seismically active area but is outside an Alquist-Priolo Earthquake Fault Rupture Zone as delineated by the State of California. The subject site is located within an area delineated as liquefaction hazard zone on the maps issued by the State of California. Therefore, the scope of our services included an evaluation of the liquefaction potential as outlined in the California Division of Mines and Geology's Special Publication 117A.

The entire San Francisco Bay Area is considered to be an active seismic region due to the presence of several active faults. Three northwest-trending major earthquake faults that are responsible for the majority of the movement on the San Andreas fault system extend through the Bay Area. They include the San Andreas fault, the Hayward fault, and the Calaveras fault, which are respectively located approximately 13.2 miles to the southwest, 4.0 miles, and 6.0 miles to the northeast. The Silver Creek fault, another active fault, is located approximately 0.5 miles to the northeast.

Using information from recent earthquakes, improved mapping of active faults, and a new model for estimating earthquake probabilities, the 2014 Working Group on California Earthquake Probabilities updated the 30 years earthquake forecast for California. A list of prominent faults in the site vicinity, their respective distances and direction from the site and the probability of a magnitude 6.7 or greater earthquake on these faults in the next 30 years are listed below.

Major Active Faults, Distances, Direction, and Probability

Fault	Distance from Site (miles)	Probability of $M_w \geq 6.7$ within 30 Years[1]
Silver Creek	0.5 (NE)	0.1%
San Andreas (Peninsula)	13.2 (SW)	9.1%
Hayward (So)	4.0 (NE)	9.1%
Calaveras (Central)	6.0 (NE)	16.4%

[1] Working Group on California Earthquake Probabilities, 2014

3.0 FIELD INVESTIGATION

Subsurface Exploration

As a part of our geotechnical investigation, Earth Systems performed four cone penetration tests (CPT) on July 2, 2024 at the approximate locations shown on the Existing Site Condition (Figure 2) and Proposed Site Development Plan (Figure 3). Details of subsurface soil conditions revealed by the CPTs are included in Appendix A. The CPTs were performed by Middle Earth Geo Testing's (MEGT) using a 25-ton, truck mounted CPT rig. The soundings were conducted in accordance with ASTM specifications and pushed to final depths between 20 feet and 50 feet bgs.

A CPT involves pushing a standardized size instrument of a conical shape into the ground at a specified constant rate. The cone used for this project had a tip area of 15 cm^2 and a friction sleeve area of 225 cm^2. The cone was pushed into ground at a constant rate of 20-mm per second using the 25-ton truck as reaction weight. The cone was fitted with load cells, which recorded the total force acting on the tip of the cone (Q_c), sleeve friction (F_s), and pore pressure (u) readings at 5 cm depth intervals. The data collected from the CPT was used to interpret site stratigraphy, soil consistency, and strength using published relationships. Generally, cohesive soils (clays) have

high friction ratios (sleeve friction divided by cone bearing – R_f), low cone bearing, and generate large excess pore water pressures. Cohesionless soils (sands) have lower friction ratios, high cone bearing, and generate little in the way of excess pore water pressures. When the sounding was completed, the test hole was backfilled with cement grout.

The data collected from the CPT was used to interpret soil behavior type and various geotechnical parameters using currently published empirical correlations based on comprehensive review by Lunne, Robertson, and Powell (1997). Pore pressure dissipation tests (PPDT's) conducted at various intervals were used to measure equilibrium water pressure at the time of the CPT. Assuming the conditions are hydrostatic, the equilibrium water pressure was used to estimate the approximate depth to ground water table.

Subsurface Profile

The subsurface data from CPT-01, CPT-02, and CPT-03 shows that just below the aggregate base (fill) at the site, the subsurface soils are primarily clayey with thin layers of sands and silts sandwiched between clayey soil layers. The first loose to medium dense silty sand to sandy silt layer was encountered between 5 to 13 feet below ground surface. Secondly, a loose to dense silty sand to sandy silt layer was encountered between 40 to 45 feet bgs. CPT-04 indicated the presence of aggregate base (fill) near the surface followed by mostly clayey soils with sand/silt mixtures between 2 to 3 feet, 3.5 to 4.0 feet, 6 to 7.5 feet, 8.5 to 14.5 feet, and 16.0 to 17.5 feet bgs. The majority of the granular soil layers were interpreted to be medium dense to dense.

Groundwater was encountered at approximately 15 feet below the ground surface. The historic high depth to groundwater level is reported to be approximately 10-20 feet bgs by Santa Clara Water Valley District.

Laboratory Testing

Soil samples were taken from near surface soil were tested in the laboratory to measure Atterberg Limits (ASTM D 2937-17) and basic Corrosivity. The results of Atterberg Limits tests were also used to aid in interpretation of shrinkage/swell potential of tested soil. Copies of the laboratory test results and corrosivity analysis are included in Appendix B.

4.0 DATA ANALYSIS

Subsurface Soil Classification

Based on the penetration resistance data from the borings advanced at the site (Appendix A) and the site geology, the site is assigned to Site Class D ("Stiff Soil") as defined by Table 20.3-1 of the ASCE 7-16.

Seismic Design Parameters

The seismic design parameters for the site per Chapter 16 of the California Building Code (2022 Edition) are as follows. The parameters were determined using the OSHPD/U.S. Seismic Design Maps web site.

Summary of Seismic Parameters - CBC 2022

(Site Coordinates 37.3151° N, 121.8358° W)

Parameter	Design Value
Site Class	D
Mapped Short Term Spectral Response Parameter, (S_s)	1.5 g
Mapped 1-second Spectral Response Parameter, (S_1)	0.6 g
Site Coefficient, (F_a)	1
Site Coefficient, (F_v)	1.7
Site Modified Short Term Response Parameter, (S_{Ms})	1.5 g
Site Modified 1-second Response Parameter, (S_{M1})	1.0 g
Design Short Term Response Parameter, (S_{Ds})	1 g
Design 1-second Response Parameter, (S_{D1})	0.7 g
Site modified peak ground acceleration(PGAm)	0.7 g

Seismic (Liquefaction and Dry Sand) Settlement

Soil liquefaction is a phenomenon where saturated granular soils undergo a substantial loss of strength due to increased pore water pressure resulting from cyclic stress applications induced by earthquakes or other vibrations. In this process, the soil acquires mobility sufficient to permit both vertical and horizontal movements, which may result in significant deformations. Soils most

susceptible to liquefaction are loose, uniformly graded, fine-grained sands. In addition, recent literature indicates that fine grained soils may also be susceptible to liquefaction or cyclic strain softening. Examples of highly susceptible fine-grained soil include "non-plastic silts and clayey silts of low plasticity (PI<12) at high water content to liquid limit ratios (w_c/LL>0.85)." Examples of soils moderately susceptible to liquefaction include "clayey silts and silty clays of moderate plasticity (12<PI<18) at natural water content and Liquid Limits ratios (w_c/LL) greater than 0.80" (Bray and Sancio, 2006). It is generally acknowledged that liquefaction will not affect surface improvements if these deposits are located at a depth greater than 50 feet below the ground surface. In the deeper deposits, the greater overburden pressure is sufficient to prevent liquefaction effects from occurring.

Analysis

In order to evaluate liquefaction potential and estimate seismic settlement at the site, ESP performed engineering analyses using the subsurface data collected from the CPT performed at the site. The CPT data was analyzed with the aid of computer program CPeT-IT V3.9.3.14 and CLiq V.3.5.2.22 by using various methods including Boulanger and Idriss, 2014; Moss et al, 2006, Idriss and Boulanger, 2008, Robertson, 2009, and Robertson (NCEER, 2001). The analyses used the following input parameters; depth to groundwater of greater than 10.0 feet, subsurface data from the CPT-1, CPT-2, CPT-3, and CPT-4, the mapped site modified peak ground acceleration (PGA_M) of 0.69 times gravity (g) calculated in accordance with CBC 18.03A.5.12 (general procedure); and moment magnitude 6.83 earthquake, consistent with the mean characteristic moment magnitude for the Silver Creek.

Seismic settlement (dry sand settlement) of less than 2-inch was estimated in the planned building area. The results of our liquefaction analysis are presented in Appendix C. The differential settlement was estimated to be approximately 1-inch. The estimated total and differential dry sand settlements, additionally discussed in the geotechnical Recommendations sections of this report, should be considered in the design of foundations and other improvements.

As noted above, soils encountered in the CPT included two sandy layers. Based on this finding, and the relatively low seismically induced settlement estimated for the site (approximately 2 inches), we judge that surface manifestation of liquefaction, such as sand boils, is unlikely at the site.

Analysis Results

The calculated liquefaction related settlement with the Roberston (2009) method was calculated to be less than 2- inch. The liquefaction analysis results are included in Appendix C.

Discussion

The results of our subsurface exploration indicate that the majority of soils within the liquefiable zone are sandy. The total seismic settlement is estimated to be approximately 2 -inches. The results of the liquefaction analysis are shown in Appendix C.

Lateral Spreading

The nearest embankment is an west-facing slope on the east bank of the Coyote Creek drainage, located approximately 0.5 miles southwest of the site. These slopes are located sufficiently far from the project site that the potential for lateral displacement at the site is considered low.

5.0 CONCLUSIONS

General

Based on the results of the field investigation and the laboratory testing program, in our opinion, the site is suitable for the proposed development (as shown on Figure 3) from a geotechnical engineering standpoint provided the recommendations contained herein are incorporated in the design and implemented during site grading and foundation construction. The primary geotechnical concern are 1) locations of the new canopy foundations in backfilled old tank excavation; 2) anticipated severe ground shaking during the potential lifetime of the proposed structure. Groundwater may also be encountered in cavities drilled to install foundation piers for the proposed canopy. Procedures required to install the foundation piers are described in the following sections of the report.

Site Preparation and Grading

The demolition of the existing fuel canopy, and convenience store, associated footings, pavements, and flatwork is anticipated to result in some ground disturbance. A program of over-excavation and placement of new fill will be required. Additional grading work is anticipated to include removal of existing footings for the canopy and backfilling of the excavations, and backfilling of trenches used for installation of new utility lines. Plans showing the future grading activities were not provided for our review, but based on the site topography, the site grading should be minimal. The existing tanks will be removed and resulting excavations will be backfilled. Grading operations are discussed in detail in the Recommendations section of this report.

Soil Expansion Potential

The results of Atterberg Limits test performed on a sample representative of the near surface soil indicated a liquid limit (LL) of 28 and a plasticity index (PI) of 10. These values indicate that the near surface soils at the site have low shrinkage/swelling potential. Soils with low shrinkage-swelling potential do not undergo appreciable volume changes with moisture content fluctuations.

Foundations

Due to anticipated light loads of the proposed structures, the anticipated building loads with the exception of fueling canopy loads can be supported on conventional spread/strip footings. Due to higher lateral and uplift load bearing capacity requirements, the fueling canopy may be supported on drilled, cast-in-place, reinforced concrete piers. Details of foundation recommendations are provided in the following sections of the report.

Groundwater

Groundwater was encountered at 15.0 feet bgs in CPT-01, CPT-03, and CPT-04, and at 14.6 feet bgs in CPT-02 during our subsurface exploration. The historical high depth to groundwater was measured to be 10-20 feet bgs, as reported by the Santa Clara Valley Water District. Variations in rainfall, temperature, and other factors may affect water levels, and therefore groundwater levels should not be considered constant.

Corrosion Potential Screening Results

The results of tests performed on the soil sample submitted to Cerco Analytical Laboratory indicate soil resistivity of 2800 ohms-cm thus the near surface soil were classified as "moderately corrosive". The chloride ion and sulfate ions were not detected with reporting limit of 15 mg/kg. Based on the test results there is no requirement for a special cement type or increased clearance reinforcement steel. The pH of soil was measured to be 8.20 and it does not present corrosion problems for buried iron, steel, mortar coated steel and reinforced concrete structures. The redox potential of 94-mV is indicative of potentially "severely corrosive" soil resulting from anaerobic soil conditions.

Settlements

The estimated static settlement for the proposed structures founded on footings designed in compliance with the recommendations included in this report is estimated to be less than 1-inch with approximately ½-inch of differential settlement.

Seismicity

The San Fransisco Bay area is recognized by geologists and seismologists as one of the most seismically active regions in the United States. The significant earthquakes in this area are generally associated with crustal movement along well-defined, active fault zones which regionally trend in a northwesterly direction. Although research on earthquake prediction has greatly increased in recent years, seismologists cannot predict when and where an earthquake will occur. Nevertheless, on the basis of current technology, it is reasonable to assume that the proposed development will be subjected to at least one moderate to severe earthquake during its lifetime. During such an earthquake, the danger from fault offset on the site is low, but strong shaking of the site is likely to occur and, therefore, the project should be designed in accordance with the seismic design provisions of the latest California Building Code. It should be understood that the California Building Code seismic design parameters are not intended to prevent structural damage during an earthquake, but to reduce damage and minimize loss of life.

6.0 RECOMMENDATIONS

Site Preparation and Grading

General Site Preparation

1. The site should be prepared for grading by demolition of the existing fuel canopy, car shops and convenience store, associated footings, pavements, flatwork, removing vegetation, debris, and other potentially deleterious materials from areas to receive improvements. Existing loose fills also encountered during grading should be removed to undisturbed natural ground. Existing utility lines that will not be serving the proposed project should be either removed or abandoned. The appropriate method of utility abandonment will depend upon the type and depth of the utility. Recommendations for abandonment can be made as necessary.

2. Due to the demolition activities of the existing slabs and pavements at the site, a program of over-excavation and backfilling should be performed. Loose, disturbed and soft soil within the area of the proposed improvements should be cleaned out (excavated) to competent, undisturbed soil. Over-excavation of the upper 1 to 3 feet of existing ground may be needed, as established by the Geotechnical Engineer in the field. In other areas, prior to placing fill, the existing subgrade should be scarified, moisture conditioned to slightly above optimum moisture content and compacted in place to a relative compaction of 90 percent. The lateral extent of this area should extend at least 5 feet beyond the perimeter of the proposed improvements, as determined in the field by the Geotechnical Engineer during grading operations.

3. Ruts or depressions resulting from the removal of utilities, undocumented fill, footings associated with old canopy, and abandoned and/or buried structures, buried debris, and remnants of the former use of the site that are discovered during site grading should be removed and properly cleaned out down to undisturbed native soil. The bottoms of the resulting depressions should be scarified and cross-scarified at least 8 inches in depth, moisture conditioned and recompacted. The depressions should then be backfilled with approved, compacted, moisture conditioned structural fill, as recommended in other sections of this report. Should the removal of existing features result in a cut/fill transition or differential fill thickness greater than 5 feet under structures or pavements, the Geotechnical Engineer should be consulted to provide additional grading recommendations to mitigate potential distress to the overlying structures.

4. The excavation required for the underground storage tanks should be sloped at 1½H:1V for a 20-foot maximum height. Due to geologic nature of the native soil, localized areas of instability could be encountered within the excavation areas which may need further inspection and revised recommendations. Additional shoring recommendations will be needed should you excavate the slopes at a steeper angle. These recommendations are for native soils encountered in our CPTs. Separate slope recommendations may be needed for fill material present at the ste.

5. The fill material placed below the water table should be granular in nature. The granular fill material should be covered with a filter fabric prior to placing fine grained soil material on top of granular soil. Fill material proposed to be placed at the site should be approved by the Geotechnical Engineer or his field representative prior to importing it to the site. Laboratory testing associated with screening of the fill material for potential use at the site may take up to 5 working days; therefore, the Geotechnical Engineer should be provided with sufficient notice to complete the required laboratory testing.

6. The environmentally clean on-site soil, or fill material conforming to import fill recommendations, as discussed in the following sections of the report should be used for backfilling the old tank storage pit. The fill material should be approved by the Geotechnical Engineer and the backfilling operation of the old tank storage should be conducted under the field observation of the Geotechnical Engineer. Previously excavated pea gravel may be used for backfilling provided it is mixed with on-site soil.

7. “Organic” soil or soil contaminated with debris will not be suitable for use as structural fill and should be removed from the site or stockpiled for use in landscape areas.

8. Site clearing and backfilling operations should be conducted under the field observation of the Geotechnical Engineer. The Geotechnical Engineer should be notified at least 48 hours prior to commencement of grading operations.

Compaction Recommendations

1. Prior to placing new fill, the underlying undisturbed native soil should be scarified at least 8 inches, moisture conditioned to slightly above optimum moisture compacted, and compacted to the recommended relative compaction presented below, unless noted otherwise. This scarification operation should be performed at locations designated for proposed structural fill, concrete slabs-on-grade, exterior flatwork, foundations, and pavement areas.

2. Native soils and import fill should be compacted to a minimum of 90 percent relative compaction at slightly over optimum moisture content.

3. In areas to be paved, the upper 8 inches of subgrade soil should be compacted to a minimum of 92 percent relative compaction at slightly over optimum moisture content. The aggregate base courses should be compacted to a minimum 95 percent of maximum dry density at a moisture content that is slightly over optimum. The subgrade and base should be firm and unyielding when proof-rolled with heavy, rubber-tired equipment prior to paving. The pavement subgrade soils should be frequently lightly moistened as necessary prior to placement of the aggregate base to maintain the soil moisture content prior to it being covered with asphaltic or cement concrete.

Fill Recommendations

1. Structural fill is defined herein as a native or import fill material which, when properly compacted, will support foundations, pavements, and other fills. The on-site native soils that are free of debris, organics and other deleterious material, may be used as structural fill.

2. Imported fill soils at the site should meet the following criteria:

    a. Be coarse grained and have a plasticity index of less than 15 and/or an expansion index less than 20;
    b. Be free of organics, debris or other deleterious material;
    c. Have a maximum rock size of 3 inches; and
    d. Contain sufficient clay binder to allow for stable foundation and utility trench excavations.

3. A representative sample of the proposed imported soils should be submitted at least five working days before being transported to the site for evaluation by the Geotechnical Engineer. During importation to the site the material should be further reviewed on an intermittent basis.

Foundations

Spread/Strip Footings

1. The proposed convenience store, car shop, and carwash buildings may be supported by conventional strip/spread footings bearing on the dense native or engineered fill material. The footings should have minimum depths of 18 inches below the lowest adjacent soil grade into dense native soil or engineered fill. The footing excavations should be observed by the Geotechnical Engineer prior to placement of formwork or reinforcement.

2. The footings should be designed using a maximum allowable bearing capacity of 2,000 psf dead plus live load. This value may be increased by one-third when transient loads such as wind or seismicity are included. The allowable bearing capacity recommendations are based on a Safety factor of 3.0.

3. Resistance to lateral loads should be calculated based on a passive equivalent fluid pressure of 250 pcf and a friction factor of 0.50. Passive and frictional resistance can be combined in the calculations without reductions. These values are based on the assumption that backfill adjacent to foundations is properly compacted. These recommended values are based on a safety factor of 1.0.

Drilled Piers Foundation

1. The fueling canopies may be supported on a drilled, cast-in-place reinforced concrete pier foundation system. The piers should be designed for an allowable skin friction of 600 psf for supporting gravity and uplift loads. The weight of concrete in the pier holes may be included while calculating the resistance to uplift loads. This value may be increased by one-third to include short term wind and seismic effects. The piers should contain reinforcing steel for the entire depth of the foundations. The upper 2 feet of embedment should be discounted when calculating vertical support. Also, the skin friction should be ignored in the portion where the pier is surrounded by fill material.

2. To resist lateral loads, a passive equivalent fluid pressure of 250 pcf may be assumed. This passive design pressure may be increased by one third when including short term forces from wind and seismic forces. The passive resistance may be applied over a one and a half times the pier diameter tributary area. Ignore passive resistance value for the upper 2 feet of embedment in laterally supporting the piers due to soil disturbance. The passive pressure in the portion of the pier surrounded by fill material should be reduced to 100 pcf.

3. The piers should not deviate from a plumb line by more than 2 percent of the pier length, as measured from the top to the point of interest. Adequate pier oversize may be assumed to provide the recommended tolerance.

4. Foundation piers should be drilled under the observation of a representative from Earth Systems who will provide additional recommendations if unanticipated conditions are encountered during pier drilling operations.

Slab-on-Grade Construction

1. Slabs-on-grade should have a minimum thickness of 4 full inches and be reinforced as directed by the architect/engineer. A layer of felt expansion joint material should be placed between the foundation and the floor slab.

2. In areas where moisture transmitted from the subgrade would be undesirable, or where moisture sensitive materials will be stored directly on the slab, including the at grade and basement portions of the structure, a capillary break system that consists of a vapor retarder and a 4-inch-thick (at-grade portion), clean crushed rock layer should be placed above the pad subgrade to serve as a capillary break.

3. A vapor retarder should be provided above the drain blanket. The vapor retarder should comply with ASTM Standard Specification E 1745-17 and the latest recommendations of ACI Committee 302. The vapor retarder should be installed in accordance with ASTM Standard Practice E 1643-18a. Care should be taken to properly lap and seal the vapor retarder, particularly around utilities, and to protect it from damage during construction.

4. A sand layer over the vapor retarder is optional. If sand, gravel or other permeable material is to be placed over the vapor retarder, the material over the vapor retarder should be only lightly moistened and not saturated prior to casting the slab. Excess water above the vapor retarder would increase the potential for moisture damage to floor coverings. Recent studies, including those by ACI Committee 302, have concluded that excess water above the vapor retarder would increase the potential for moisture damage to floor coverings and could increase the potential for mold growth or other microbial contamination. These studies also concluded that it is preferable to eliminate the sand layer and place the slab in direct contact with the vapor retarder, particularly during wet weather construction. However, placing the concrete directly on the vapor retarder would require special attention to using the proper vapor retarder, concrete mix design, and finishing and curing techniques.

5. When concrete slabs are in direct contact with vapor retarders, the concrete water to cement (w/c) ratio must be correctly specified to control bleed water and plastic shrinkage and cracking. The concrete w/c ratio for this type of application is typically in the range of 0.45 to 0.50. The concrete should be properly cured to reduce slab curling and plastic shrinkage cracking. Concrete materials, placement, and curing methods should be specified by the architect/engineer.

Exterior Flatwork

1. Exterior concrete flatwork should have a minimum thickness of 4 full inches and should be reinforced as directed by the architect/engineer.

2. Assuming that movement (i.e., 1/4-inch or more) of exterior flatwork beyond the structure is acceptable, the flatwork should be designed to be independent of the building foundations. The flatwork should not be doweled to foundations, and a separator should be placed between the two.

3. Exterior flatwork adjacent to the structure should be designed to be independent of the foundation. The flatwork should not be doweled to foundations, and a separator should be placed between the two.

4. To reduce shrinkage cracks in concrete, the concrete aggregates should be of appropriate size and proportion, the water/cement ratio should be low, the concrete should be properly placed and finished, contraction joints should be installed, and the concrete should be properly cured. Concrete materials, placement and curing specifications should be at the direction of the architect/engineer; ACI 302.1R-04 and ACI 302.2R-04 are suggested as resources for the architect/engineer in preparing such specifications.

Flexible Pavement Sections

1. The asphalt pavement design sections were developed using the State of California Highway Design Manual, Chapter 630-Flexible Pavement. To account for variation in the subgrade soils an R-value of 10 was assumed for design purposes. Determination of the appropriate Traffic Index (TI) for each area to be paved is the province of the design engineer. The calculated Asphalt Concrete (AC) and aggregate base (AB) thicknesses are for compacted subgrade material. Normal Caltrans construction tolerances should apply. The aggregate base should conform to Caltrans Class 2.

Summary of Pavement Sections
R-Value of 10

Traffic Index	Asphaltic Concrete (AC) inches	Class II Aggregate Base (AB) inches
4.0	2½	7½ (minimum)
4.5	2½	9½ (minimum)
5.0	3	10 (minimum)
5.5	3	12
6.0	3½	12½
6.5	3½	14½
7.0	4	15½
7.5	4½	16½
8.0	5	17½
8.5	5	19½
9.0	5½	20½

2. The upper 8 inches of subgrade soil and the aggregate base should be compacted to a minimum 95 percent of maximum dry density. The subgrade and base should be firm and unyielding when proof-rolled with heavy, rubber-tired equipment prior to paving. The pavement subgrade soils should be periodically moistened as necessary prior to placement of the aggregate base to maintain the soil moisture content near optimum.

3. Pavement longevity will be enhanced if the surface grade drains away from the edges of the pavement. Finished AC surfaces should slope toward drainage facilities at 2 percent where practicable, but in no case, should water be allowed to pond.

4. Cutoff walls below curbs and around landscape islands may be used to extend the life of the pavement by reducing irrigation water and runoff that seeps into the aggregate base. Where utilized, cutoff walls should extend through the aggregate base to penetrate a minimum of 3 inches into the subgrade soils.

5. To reduce migration of surface drainage into the subgrade, maintenance of the paved areas is critical. Any cracks that develop in the AC should be promptly sealed.

Rigid Pavement Sections

1. Rigid Pavements in the light traffic areas should have a minimum thickness of 6 full inches with a minimum compressive strength of 3,400 psi and should be reinforced as directed by the architect/engineer. Rigid pavements should be cast on a minimum 6-inch layer of compacted Class 2 aggregate base conforming with Section 26-1.02B of the Caltrans Standard Specifications. Rigid pavement in the truck parking areas should consist of 8 inches of concrete with a minimum compressive strength of 3400 psi, reinforced as directed by the architect/engineer over 8 inches of aggregate baserock.

2. The upper 8 inches of subgrade soil and the aggregate base should be compacted to a minimum 92 percent of maximum dry density. The subgrade and base should be firm and unyielding when proof-rolled with heavy, rubber-tired equipment prior to paving. The pavement subgrade soils should be periodically moistened as necessary prior to placement of the aggregate base to maintain the soil moisture content near optimum.

Utility Trench Backfills

1. A select, noncorrosive, granular, easily compacted material should be used as bedding and shading immediately around utility pipes. The site soils may be used for trench backfill above the select material.

2. Trench backfill in the upper 8 inches of subgrade beneath pavement areas should be compacted to a minimum of 92 percent relative compaction. Trench backfill in other areas should be compacted to a minimum of 90 percent relative compaction. Jetting of utility trench backfill should not be allowed.

3. Where utility trenches extend under perimeter foundations, the trenches should be backfilled entirely with approved fill soil compacted to a minimum of 90 percent relative compaction. The zone of approved fill soil should extend a minimum distance of 2 feet on both sides of the foundation. If utility pipes pass through sleeves cast into the perimeter foundations, the annulus between the pipes and sleeves should be completely sealed.

4. Parallel trenches excavated in the area under foundations defined by a plane radiating at a 45-degree angle downward from the bottom edge of the footing should be avoided, if possible. Trench backfill within this zone, if necessary, should consist of Controlled Density Fill (Flowable Fill).

Post-Construction Site Drainage Management

1. Unpaved ground surfaces should be finish graded to direct surface runoff away from site improvements at a minimum 5 percent grade for a minimum distance of 10 feet. If this is not practical due to the terrain or other site features, swales with improved surfaces should be provided to divert drainage away from improvements. The landscaping should be planned and installed to maintain proper surface drainage conditions.

2. Runoff from driveways, roof gutters, downspouts, planter drains and other improvements should discharge in a non-erosive manner away from foundations, pavements, and other improvements. The downspouts may discharge onto splash blocks that direct the flow away from the foundation.

3. Stabilization of surface soils, particularly those disturbed during construction, by vegetation or other means during and following construction is essential to protect the site from erosion damage. Care should be taken to establish and maintain vegetation.

4. Open areas adjacent to exterior flatwork should be irrigated or otherwise maintained so that constant moisture conditions are created throughout the year. Irrigation systems should be controlled to the minimum levels that will sustain the vegetation without saturating the soil.

5. Bio-retention basins and swales located within 10 feet of foundation elements should be lined with a 20-mil pond liner.

Required Geotechnical Observation and Testing

1. It must be recognized that the recommendations contained in this report are based on a limited number of borings and rely on continuity of the subsurface conditions encountered.

2. It is assumed that the Geotechnical Engineer will be retained to provide consultation during the design phase, to interpret this report during construction, and to provide construction monitoring in the form of testing and observation.

3. Unless otherwise stated, the terms "compacted" and "recompacted" refer to soils placed in level lifts not exceeding 8 inches in loose thickness and compacted to a minimum of 90 percent of maximum dry density. The standard tests used to define maximum dry density and field density should be ASTM D 1557-12 and ASTM D 6938-17, respectively, or other methods acceptable to the Geotechnical Engineer and jurisdiction.

4. “Moisture conditioning” refers to adjusting the soil moisture to slightly over optimum moisture content prior to application of compactive effort. If the soils are overly moist so that they become unstable, or if the recommended compaction cannot be readily achieved, drying the soil to optimum moisture content or just above may be necessary. Placement of gravel layers or geotextiles may also be necessary to help stabilize unstable soils. The Geotechnical Engineer should be contacted for recommendations for mitigating unstable soils.

5. At a minimum, the following should be provided by the Geotechnical Engineer:

   - Review of final grading and foundation plans,
   - Professional observation during site preparation, grading, and foundation excavation,
   - Oversight of soil compaction testing during grading,
   - Oversight of soil special inspection during grading.

6. Special inspection of grading should be provided as per Sections 1705.6 and 1705.8 and Tables 1705.6 and 1705.8 of the CBC; the soils special inspector should be under the direction of the Geotechnical Engineer. In our opinion, the following operations should be subject to *continuous* soils special inspection:

   - Scarification and recompaction,
   - Fill placement and compaction,
   - Pier drilling operations,
   - Over-excavation to the recommended depth.

7. In our opinion, the following operations may be subject to *periodic* soils special inspection; subject to approval by the Building Official:

   - Site preparation,
   - Compaction of utility trench backfill,
   - Compaction of subgrade and aggregate base,
   - Observation of foundation excavations,
   - Building pad moisture conditioning.

8. It will be necessary to develop a program of quality control prior to beginning grading. It is the responsibility of the owner, contractor, or project manager to determine any additional inspection items required by the architect/engineer or the governing jurisdiction.

9. The locations and frequencies of compaction tests should be as per the recommendations of the Geotechnical Engineer at the time of construction. The recommended test locations and frequencies may be subject to modification by the Geotechnical Engineer based upon soil and moisture conditions encountered, the size and type of equipment used by the contractor, the general trend of the compaction test results, and other factors.

10. A preconstruction conference among a representative of the owner, the Geotechnical Engineer, soils special inspector, the architect/engineer, and contractors is recommended to discuss planned construction procedures and quality control requirements. Earth Systems should be notified at least 48 hours prior to beginning grading operations.

7.0 CLOSURE

This report is valid for conditions as they exist at this time for the type of project described herein. Our intent was to perform the investigation in a manner consistent with the level of care and skill ordinarily exercised by members of the profession currently practicing in the locality of this project at this time under similar conditions. No representation, warranty, or guarantee is either expressed or implied. This report is intended for the exclusive use by the client as discussed in the Scope of Services section. Application beyond the stated intent is strictly at the user's risk.

If changes with respect to the project type or location become necessary, if items not addressed in this report are incorporated into plans, or if any of the assumptions stated in this report are not correct, Earth Systems should be notified for modifications to this report. Any items not specifically addressed in this report should comply with the California Building Code and the requirements of the governing jurisdiction.

The preliminary recommendations of this report are based upon the geotechnical conditions encountered during the investigation and may be augmented by additional requirements of the architect/engineer, or by additional recommendations provided by this firm based on conditions exposed at the time of construction.

If Earth Systems is not retained to provide construction observation and testing services, it will not be responsible for the interpretation of the information by others or any consequences arising there from.

This document, the data, conclusions, and recommendations contained herein are the property of Earth Systems. This report should be used in its entirety, with no individual sections reproduced or used out of context. Copies may be made only by Earth Systems, the client, and his authorized agents for use exclusively on the subject project. Any other use is subject to federal copyright laws and the written approval of Earth Systems.

FIGURES

Figure 1 – Site Location Map
Figure 2 – Existing Site Condition
Figure 3 – Proposed Development

Figure 1



Base: Google Earth (2024)

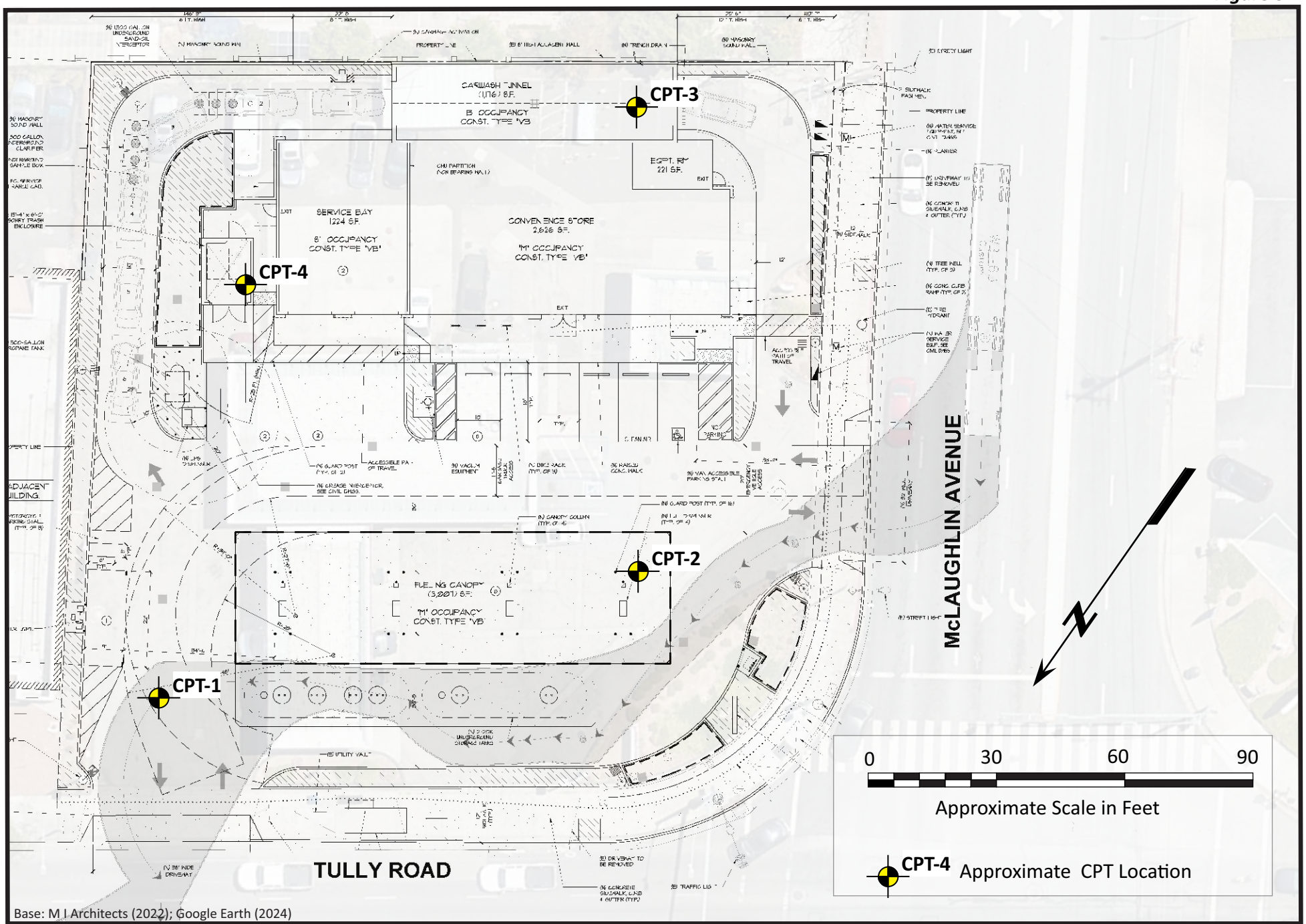
Earth Systems Pacific	Gas Station, Store and Carwash Renovation 1152 Tully Road San Jose, California	**Site Location Map** **306705-001**

Figure 2



Earth Systems Pacific	Gas Station, Store and Carwash Renovation 1152 Tully Road San Jose, California	Existing Site Condition File No.: 306705-001

Figure 3



Base: M I Architects (2022); Google Earth (2024)

Earth Systems Pacific

Gas Station, Store and Carwash Renovation
1152 Tully Road
San Jose, California

Proposed Site Development Plan

File No.: 306705-001

APPENDIX A

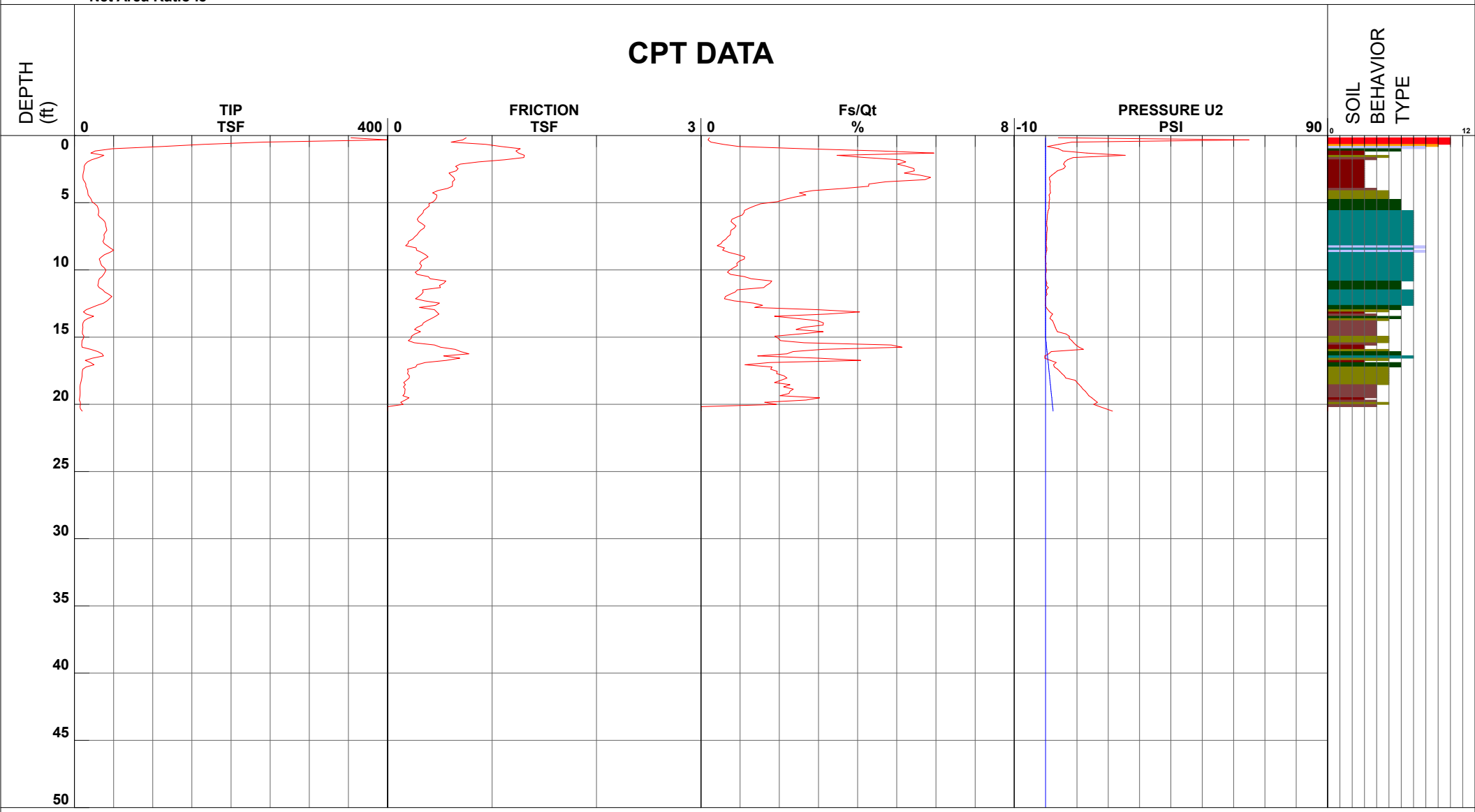
CPT Soundings (4)

Earth Systems

Project	1152 Tully Road SJ Gas Station	Operator	AJ-ER	Filename	SDF(353).cpt
Job Number	306705-001	Cone Number	DDG1596	GPS	
Hole Number	CPT-01	Date and Time	306705-001	Maximum Depth	20.51 ft
EST GW Depth During Test		15.00 ft			

Net Area Ratio .8

CPT DATA



1 - sensitive fine grained
2 - organic material
3 - clay
4 - silty clay to clay
5 - clayey silt to silty clay
6 - sandy silt to clayey silt
7 - silty sand to sandy silt
8 - sand to silty sand
9 - sand
10 - gravelly sand to sand
11 - very stiff fine grained (*)
12 - sand to clayey sand (*)

Cone Size 15cm squared

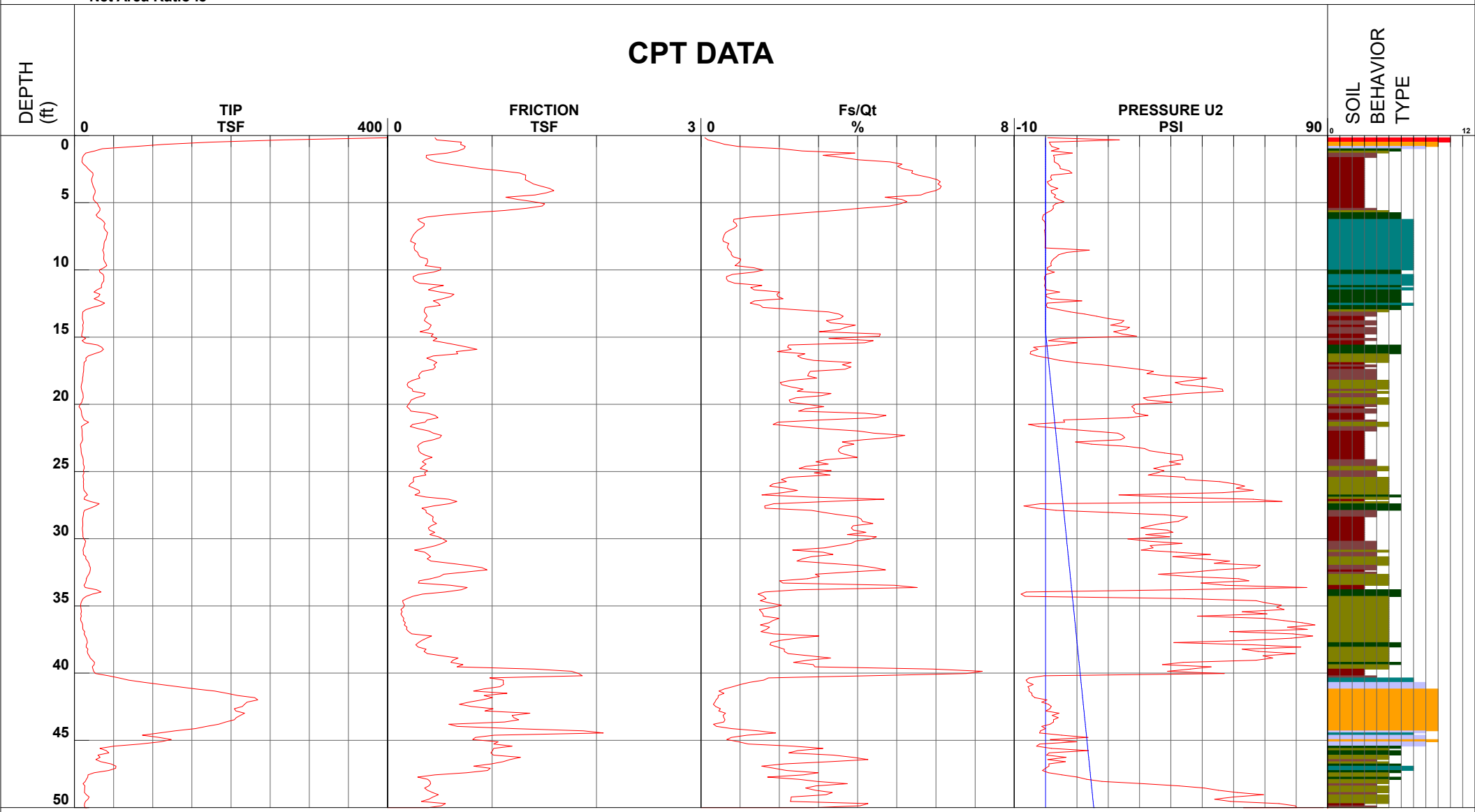
S*Soil behavior type and SPT based on data from UBC-1983

Earth Systems

Project	1152 Tully Road,SJ;Gas Station	Operator	AJ-ER	Filename	SDF(350).cpt
Job Number	306705-001	Cone Number	DDG1596	GPS	
Hole Number	CPT-02	Date and Time	306705-001	Maximum Depth	50.52 ft
EST GW Depth During Test		14.60 ft			

Net Area Ratio .8

CPT DATA



1 - sensitive fine grained
2 - organic material
3 - clay
4 - silty clay to clay
5 - clayey silt to silty clay
6 - sandy silt to clayey silt
7 - silty sand to sandy silt
8 - sand to silty sand
9 - sand
10 - gravelly sand to sand
11 - very stiff fine grained (*)
12 - sand to clayey sand (*)

Cone Size 15cm squared

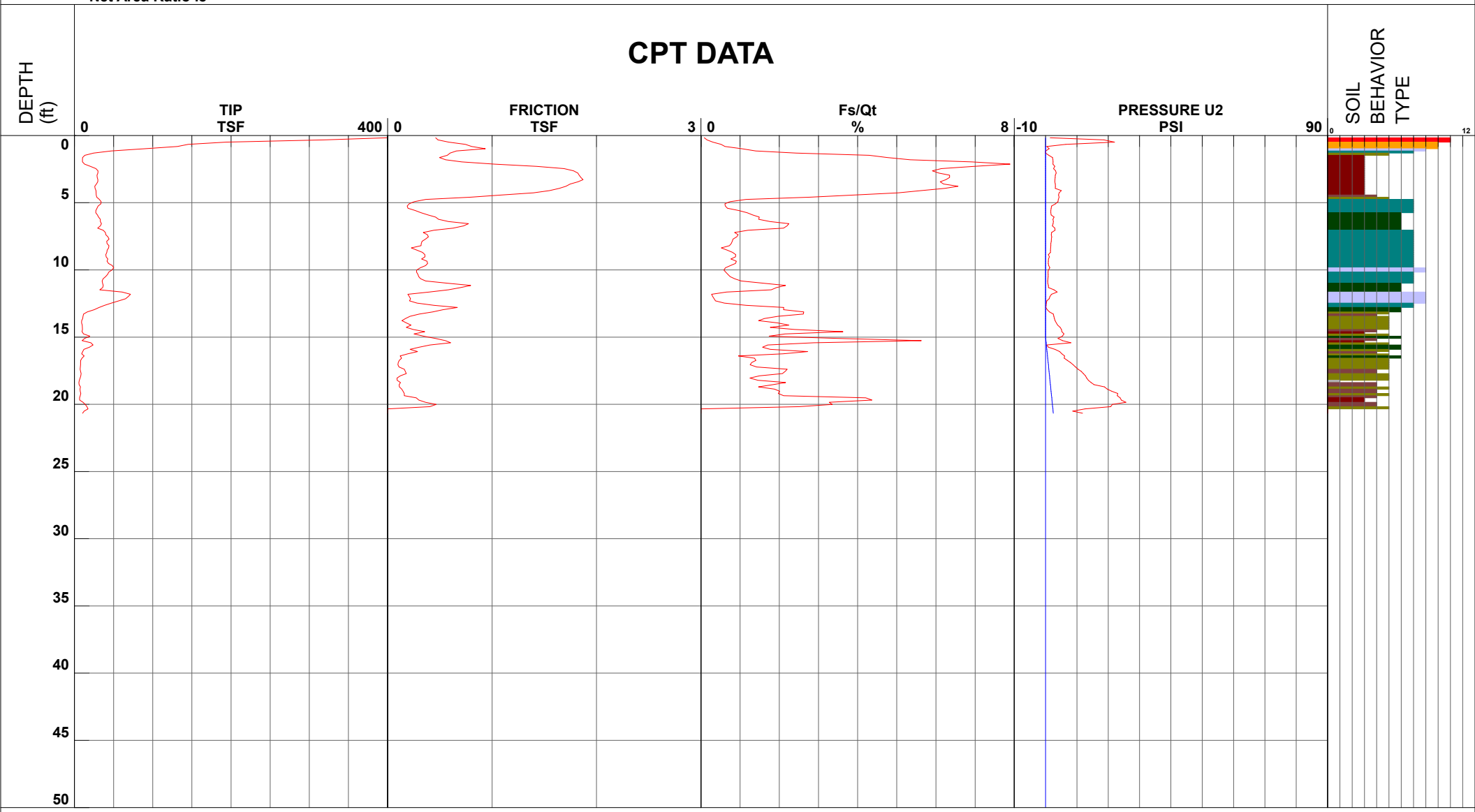
S*Soil behavior type and SPT based on data from UBC-1983

Earth Systems

Project	1152 Tully Road SJ Gas Station	Operator	AJ-ER	Filename	SDF(351).cpt
Job Number	306705-001	Cone Number	DDG1596	GPS	
Hole Number	CPT-03	Date and Time	306705-001	Maximum Depth	20.67 ft
EST GW Depth During Test		15.00 ft			

Net Area Ratio .8

CPT DATA



1 - sensitive fine grained
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4 - silty clay to clay
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6 - sandy silt to clayey silt
7 - silty sand to sandy silt
8 - sand to silty sand
9 - sand
10 - gravelly sand to sand
11 - very stiff fine grained (*)
12 - sand to clayey sand (*)

Cone Size 15cm squared

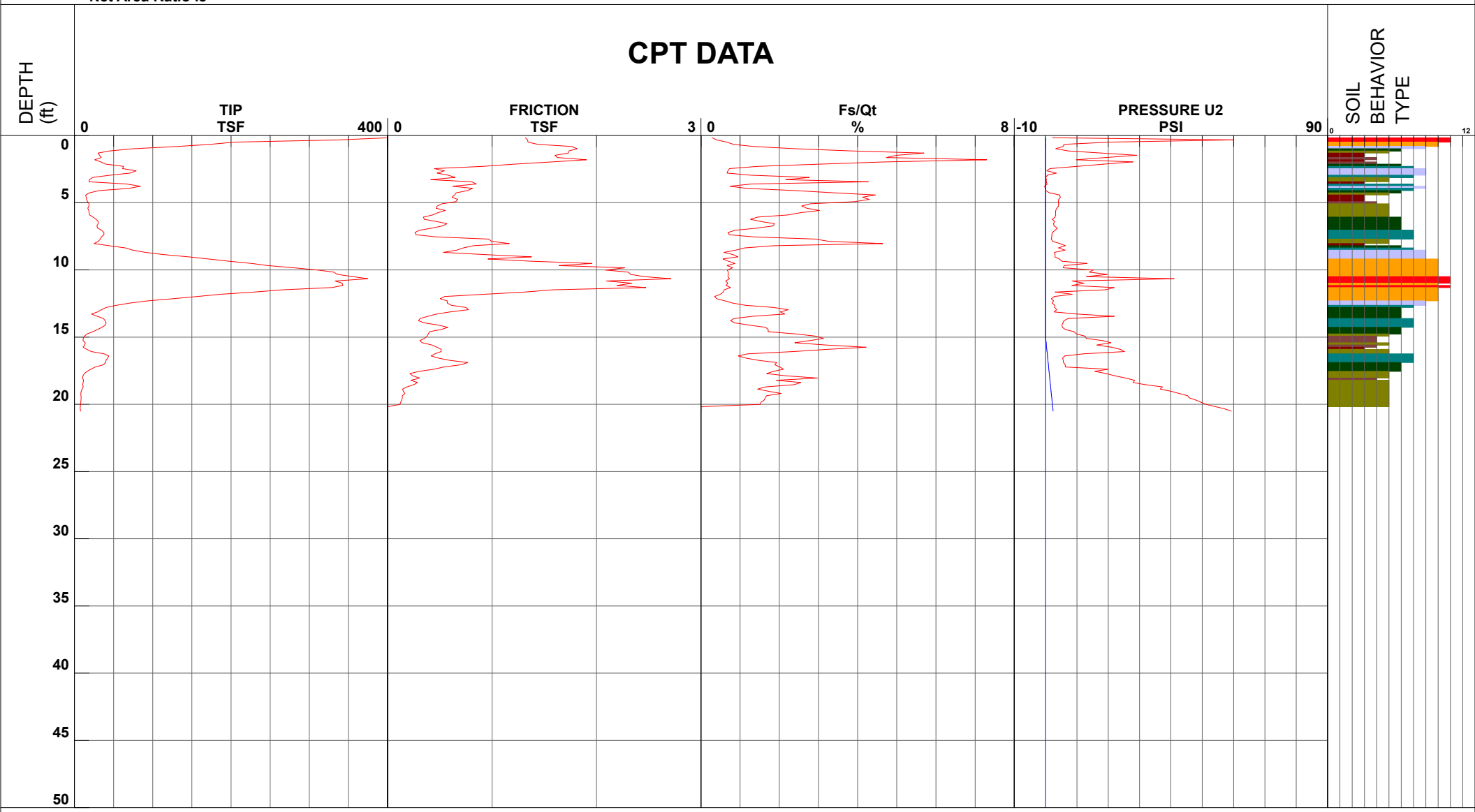
S*Soil behavior type and SPT based on data from UBC-1983

Earth Systems

Project	1152 Tully Road SJ Gas Station	Operator	AJ-ER	Filename	SDF(352).cpt
Job Number	306705-001	Cone Number	DDG1596	GPS	
Hole Number	CPT-04	Date and Time	306705-001	Maximum Depth	20.51 ft
EST GW Depth During Test		15.00 ft			

Net Area Ratio .8

CPT DATA



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8 - sand to silty sand
9 - sand
10 - gravelly sand to sand
11 - very stiff fine grained (*)
12 - sand to clayey sand (*)

Cone Size 15cm squared

S*Soil behavior type and SPT based on data from UBC-1983

APPENDIX B

Laboratory Test Results
Corrosivity Analysis

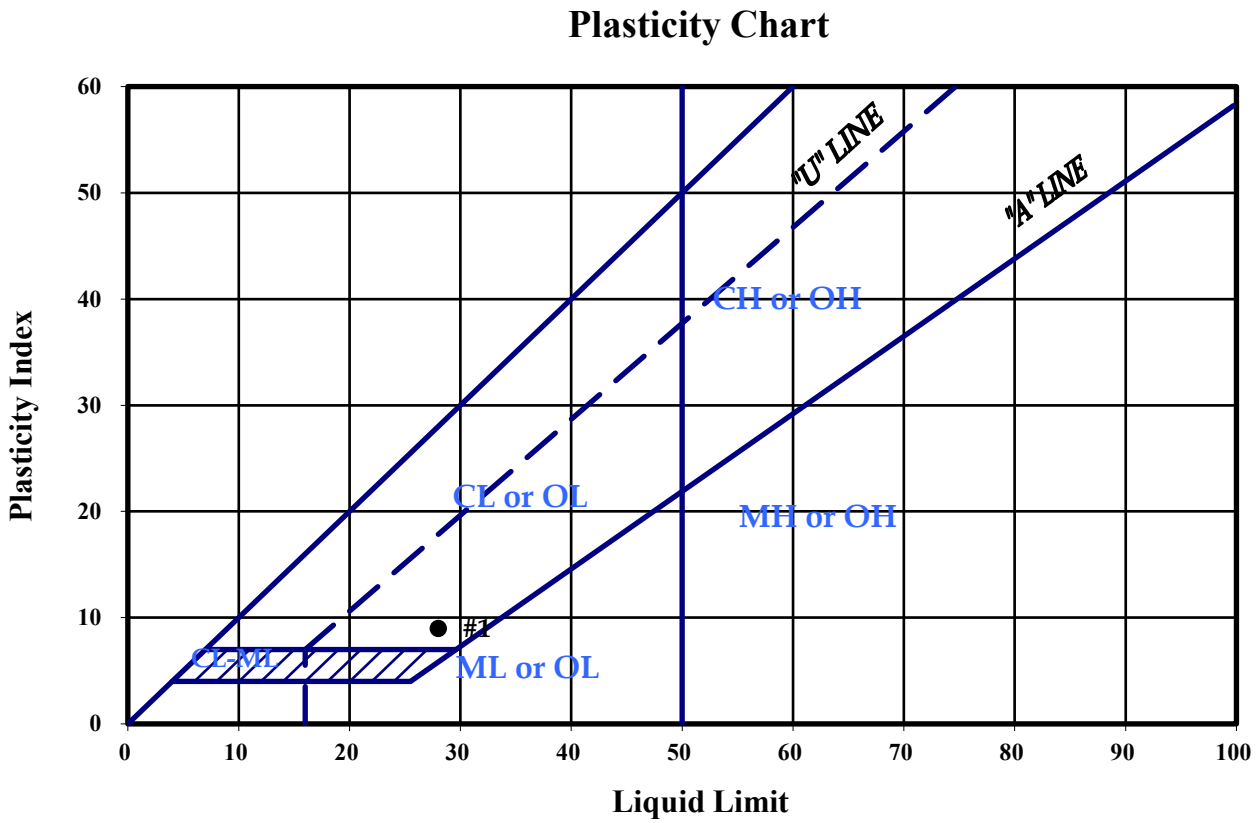
Gas Station GER, 1152 Tully Road, San Jose 306705-001

PLASTICITY INDEX

ASTM D 4318-17

August 1, 2024

Test No.:	1	2	3	4	5
Boring No.:	---				
Sample Depth:	---				
Liquid Limit:	28				
Plastic Limit:	19				
Plasticity Index:	9				



CERCO analytical
1100 Willow Pass Court, Suite A
Concord, CA 94520-1006
925 462 2771 Fax. 925 462 2775
www.cercoanalytical.com

26 July, 2024

Job No. 2407054
Cust. No. 12899

Mr. Javad Shahmoradi
Earth Systems Pacific, Inc.
48511 Warm Springs Blvd., Suite 210
Fremont, CA 94539

Subject: Project No.: 306705-001
Project Name: 1152 Tully Rd, San Jose, CA; CPT-4 (1.5-2.0 ft bgs)
Corrosivity Analysis – ASTM Test Methods

Dear Mr. Shahmoradi:

Pursuant to your request, CERCO Analytical has analyzed the soil sample submitted on July 22, 2024. Based on the analytical results, a brief corrosivity evaluation is enclosed for your consideration.

Based upon the resistivity measurement, the sample is classified as "moderately corrosive". All buried iron, steel, cast iron, ductile iron, galvanized steel and dielectric coated steel or iron should be properly protected against corrosion depending upon the critical nature of the structure. All buried metallic pressure piping such as ductile iron firewater pipelines should be protected against corrosion.

The chloride ion concentration reflects none detected with a reporting limit of 15 mg/kg.

The sulfate ion concentration reflects none detected with a reporting limit of 15 mg/kg.

The pH of the soil is 8.20, which does not present corrosion problems for buried iron, steel, mortar-coated steel and reinforced concrete structures.

The redox potential is 94-mV and is indicative of potentially "severely corrosive" soils resulting from anaerobic soil conditions.

This corrosivity evaluation is based on general corrosion engineering standards and is non-specific in nature. For specific long-term corrosion control design recommendations or consultation, please call *JDH Corrosion Consultants, Inc. at (925) 927-6630.*

We appreciate the opportunity of working with you on this project. If you have any questions, or if you require further information, please do not hesitate to contact us.

Very truly yours,
CERCO ANALYTICAL, INC.

J. Darby Howard, Jr., P.E.
President

JDH/jdl
Enclosure

CERCO analytical
1100 Willow Pass Court, Suite A
Concord, CA 94520-1006
925 462 2771 Fax. 925 462 2775
www.cercoanalytical.com

Client: Earth Systems Pacific, Inc.
Client's Project No.: 306705-001
Client's Project Name: 1152 Tully Rd, San Jose, CA; CPT-4 (1.5-2.0 ft bgs)
Date Sampled: 18-Jul-24
Date Received: 22-Jul-24
Matrix: Soil
Authorization: Chain of Custody

Date of Report: 26-Jul-2024

Job/Sample No.	Sample I.D.	Redox (mV)	pH	Conductivity (umhos/cm)*	Resistivity (100% Saturation) (ohms-cm)	Sulfide (mg/kg)*	Chloride (mg/kg)*	Sulfate (mg/kg)*
2407054-001	CPT-4	94	8.20	-	2,800	-	N.D.	N.D.

Method:	ASTM D1498	ASTM D4972	ASTM D1125M	ASTM G57	ASTM D4658M	ASTM D4327	ASTM D4327
Reporting Limit:	-	-	10	-	50	15	15
Date Analyzed:	23-Jul-2024	23-Jul-2024	-	23-Jul-2024	-	23-Jul-2024	23-Jul-2024

Julia Clauson
Chemist

* Results Reported on "As Received" Basis
N.D. - None Detected

Quality Control Summary - All laboratory quality control parameters were found to be within established limits

Chain of Custody

2407054

Page 1 of 1

1100 Willow Pass Court
Concord, CA 94520-1006
925 462 2771
Fax: 925 462 2775
CERCO analytical

Job No.	CU#		Client Project I.D.	Schedule	Date Sampled	Date Due
306705-001	12899			Analyte		

Full Name Javad Shahhmoradi **Phone** 510-766-2872 **Fax**

Company and/or Mailing Address Earth Systems Pacific **Cell** 707-590-1651 ☒

Sample Source 1152 Tully Rd, San Jose, CA; CPT-4 (1.5-2.0 ft bgs)

Lab No.	Sample I.D.	Date	Time	Matrix	Contain.	Size	Preserv.	Qtv.	Redox Potential	pH	Sulfate	Chloride	Resistivity-100% Saturated			Brief Evaluation						
									ANALYSIS												ASTM	
1	CPT-4	7/18/24	11:00 am	S				1	x	x	x	x	x			x						

MATRIX: DW - Drinking Water; GW - Ground Water; SW - Surface Water; WW - Waste Water Water; SL - Sludge; S - Soil; Product

ABBREVIATIONS: HB - Hosebib; PV - Petcock Valve; PT - Pressure Tank; PH - Pump House; RR - Restroom; GL - Glass; PL - Plastic; ST - Sterile

SAMPLE RECEIPT: Total No. of Containers; Rec'd Good Cond/Cold; Conforms to Record; Temp. a t Lab -°C; Sampler

Comments:

THERE IS AN ADDITIONAL CHARGE FOR EXTRUDING SOIL FROM METAL TUBES

Email Address: jshahmoradi@earthsystems.com

Relinquished By:	UPS	Date	Time
Received By:		Date 7/22/24	Time 1008
Relinquished By:		Date	Time
Received By:		Date	Time
Relinquished By:		Date	Time
Received By:		Date	Time

APPENDIX C

Liquefaction Analysis

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Basic results results

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Cyclic resistance ratio results	24
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Vertical settlements data report	36
Strength loss data report	41

GeoLogismiki
Geotechnical Engineers
Merarhias 56
http://www.geologismiki.gr

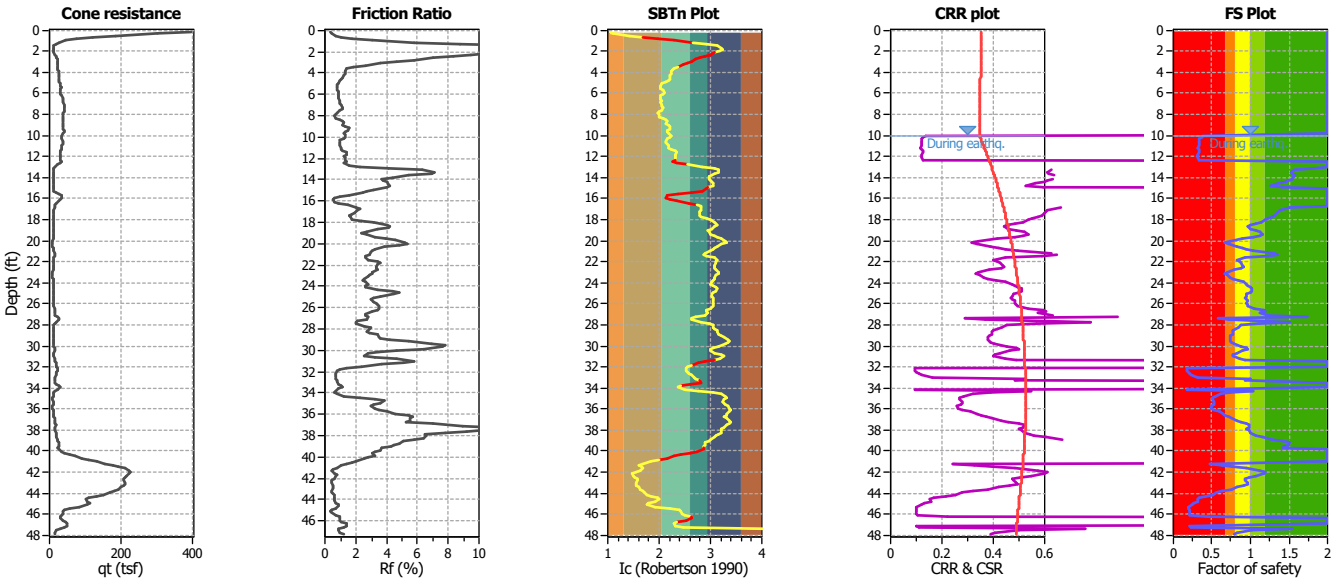
LIQUEFACTION ANALYSIS REPORT

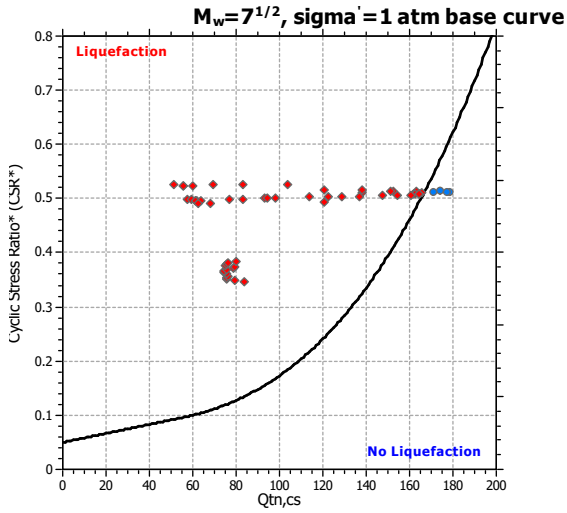
Project title : Proposed Gas Station, Convenience Store and Carwash Removal **Location : 1152 Tully Road, San Jose, CA**

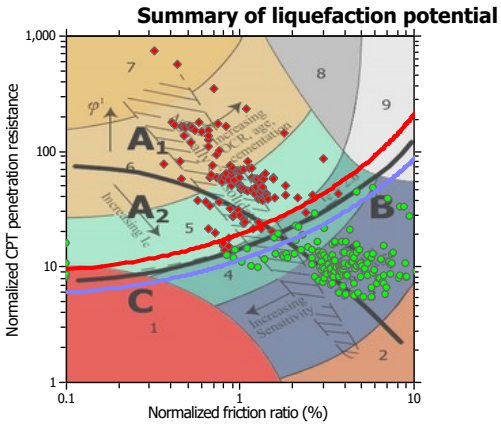
CPT file : Basic results

Input parameters and analysis data

Analysis method:	Robertson (2009)	G.W.T. (in-situ):	14.60 ft	Use fill:	No	Clay like behavior applied:	All soils
Fines correction method:	Robertson (2009)	G.W.T. (earthq.):	10.00 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:	60.00 ft
Earthquake magnitude M_w:	6.83	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.69	Unit weight calculation:	Based on SBT	K_σ applied:	No		

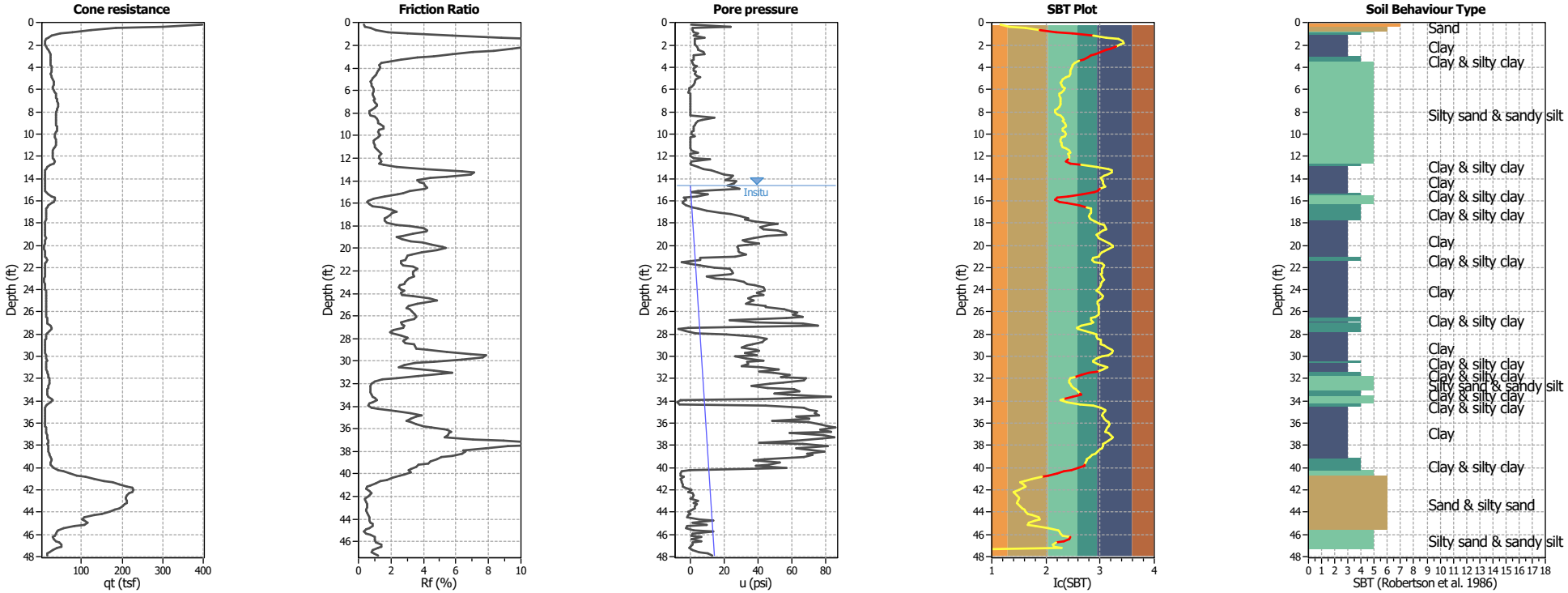






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



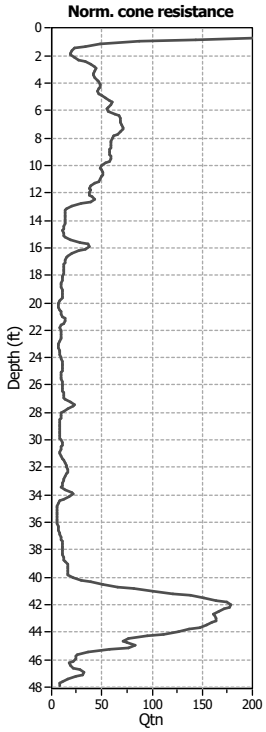
Input parameters and analysis data

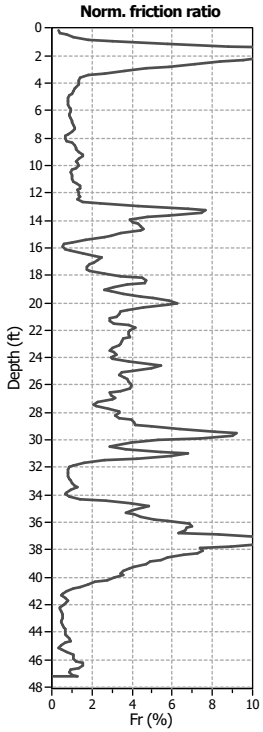
Analysis method:	Robertson (2009)	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.83	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.69	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	14.60 ft	Fill height:	N/A	Limit depth:	60.00 ft

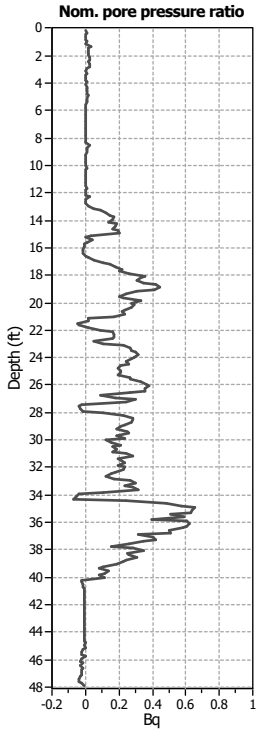
SBT legend

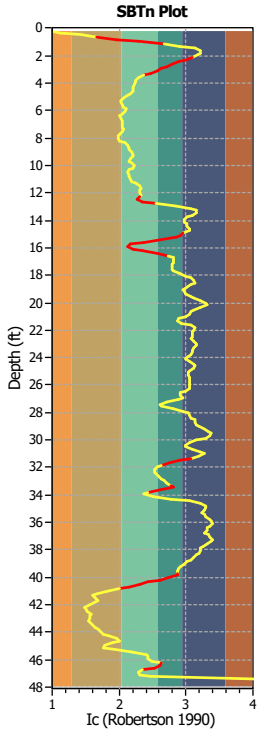
1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

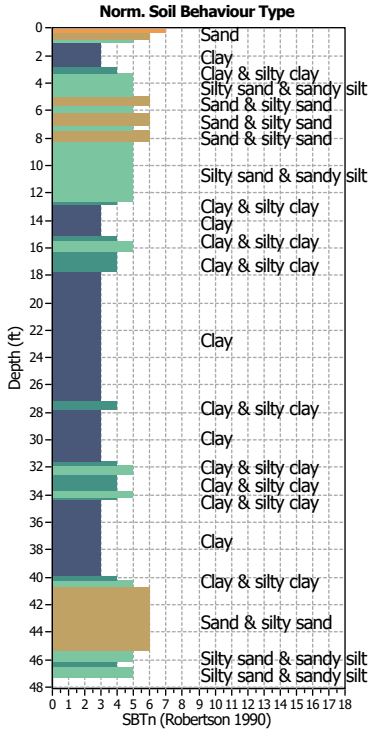
CPT basic interpretation plots (normalized)











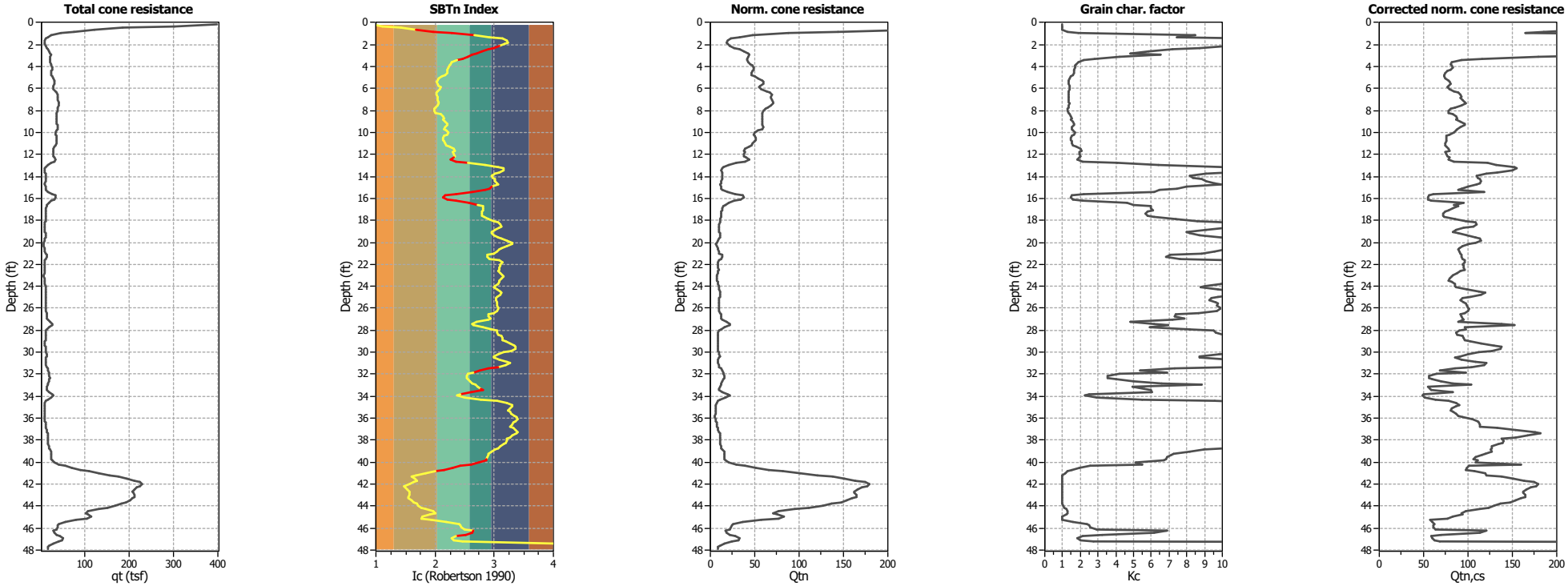
Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.83	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.69	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	14.60 ft	Fill height:	N/A	Limit depth:	60.00 ft

SBTn legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty clay
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

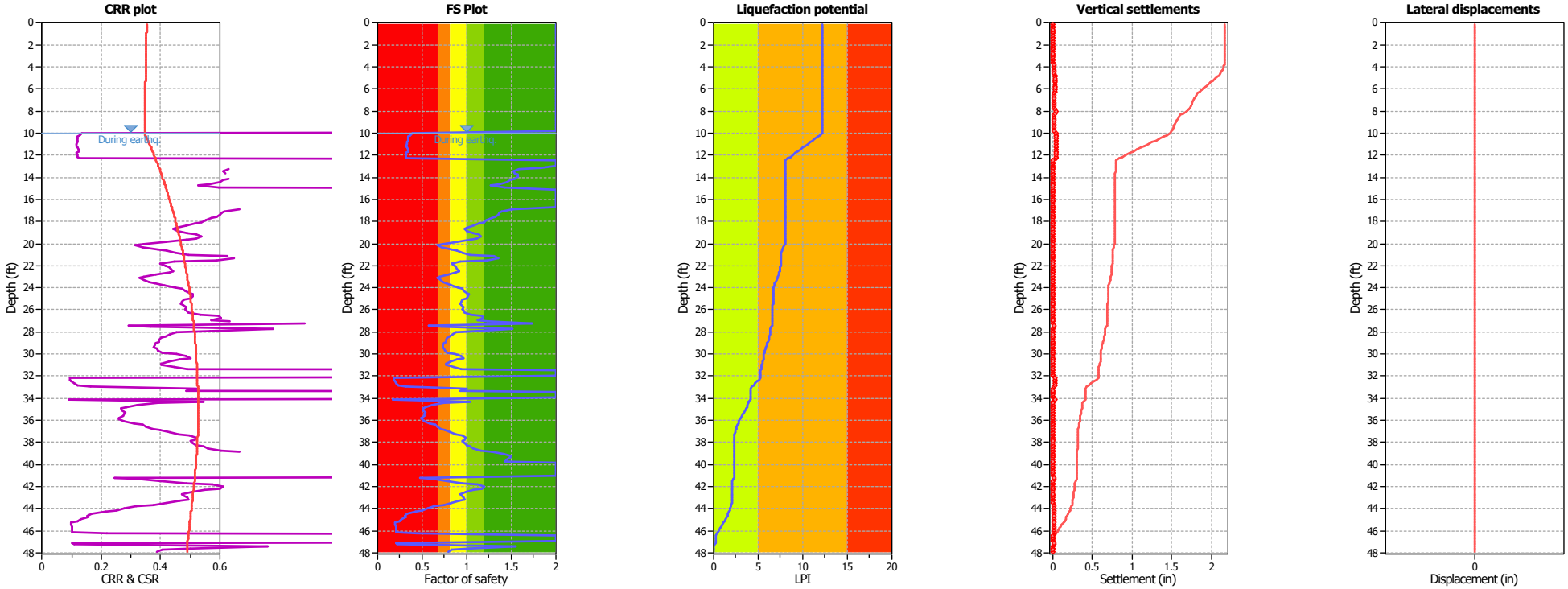
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.83	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.69	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	14.60 ft	Fill height:	N/A	Limit depth:	60.00 ft

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.83	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.69	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	14.60 ft	Fill height:	N/A	Limit depth:	60.00 ft

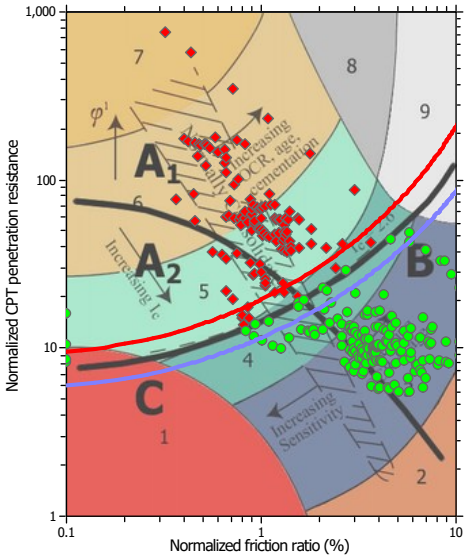
F.S. color scheme

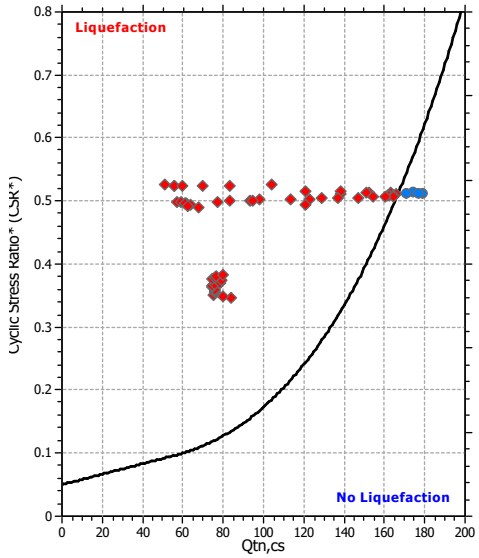
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

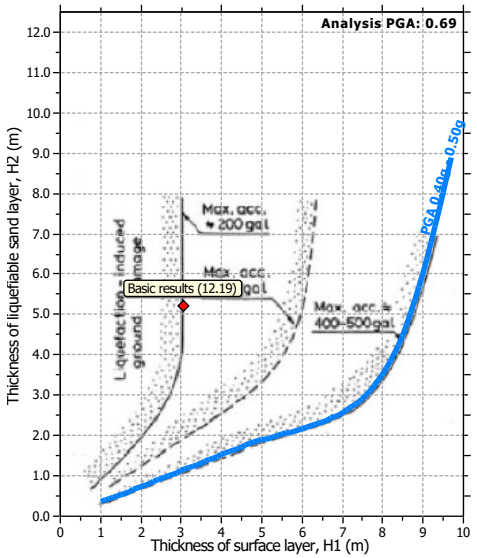
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots



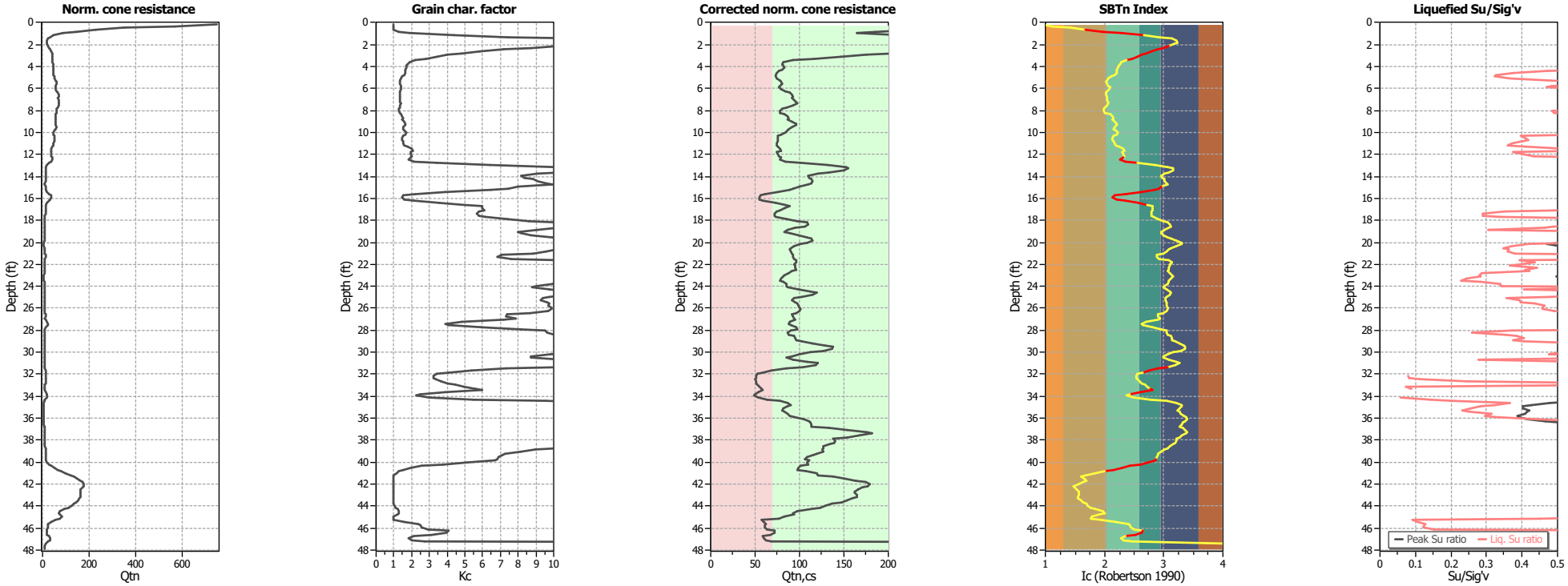




Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.83	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.69	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	14.60 ft	Fill height:	N/A	Limit depth:	60.00 ft

Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

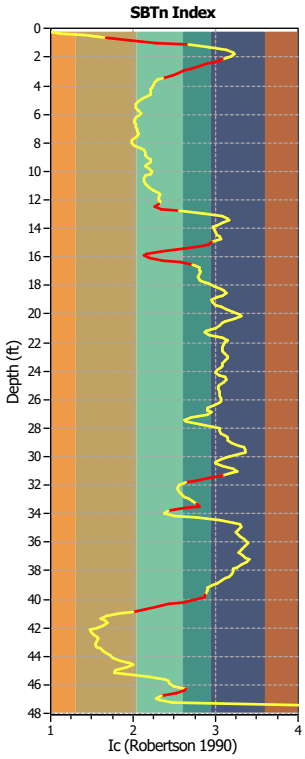
Analysis method:	Robertson (2009)	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.83	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.69	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	14.60 ft	Fill height:	N/A	Limit depth:	60.00 ft

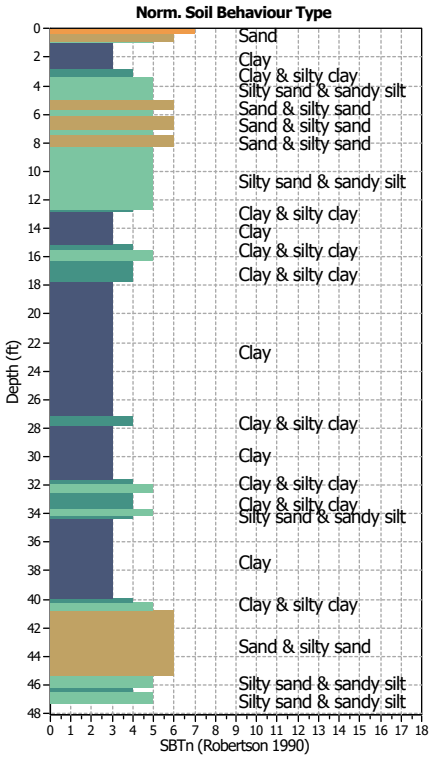
TRANSITION LAYER DETECTION ALGORITHM REPORT
Summary Details & Plots

Short description

The software will delete data when the cone is in transition from either clay to sand or vise-versa. To do this the software requires a range of I_c values over which the transition will be defined (typically somewhere between $1.80 < I_c < 3.0$) and a rate of change of I_c. Transitions typically occur when the rate of change of I_c is fast (i.e. delta I_c is small).

The SBT_n plot below, displays in red the detected transition layers based on the parameters listed below the graphs.





Transition layer algorithm properties		General statistics	
I_c minimum check value:	1.70	Total points in CPT file:	292
I_c maximum check value:	3.00	Total points excluded:	48
I_c change ratio value:	0.0250	Exclusion percentage:	16.44%
Minimum number of points in layer:	4	Number of layers detected:	9

Transition layer No	Number of points	Depth	SBT_n number	SBT_n description
Transition layer 1	4	Start depth: 0.82 (ft)	6	Sand & silty sand
		End depth: 1.31 (ft)	3	Clay
Transition layer 2	9	Start depth: 2.30 (ft)	3	Clay
		End depth: 3.61 (ft)	5	Silty sand & sandy silt
Transition layer 3	4	Start depth: 12.47 (ft)	5	Silty sand & sandy silt
		End depth: 12.96 (ft)	3	Clay
Transition layer 4	5	Start depth: 15.09 (ft)	3	Clay
		End depth: 15.75 (ft)	5	Silty sand & sandy silt
Transition layer 5	6	Start depth: 15.91 (ft)	5	Silty sand & sandy silt
		End depth: 16.73 (ft)	4	Clay & silty clay
Transition layer 6	4	Start depth: 31.50 (ft)	3	Clay
		End depth: 31.99 (ft)	5	Silty sand & sandy silt
Transition layer 7	4	Start depth: 33.46 (ft)	4	Clay & silty clay
		End depth: 33.96 (ft)	5	Silty sand & sandy silt
Transition layer 8	8	Start depth: 39.86 (ft)	3	Clay
		End depth: 41.01 (ft)	6	Sand & silty sand
Transition layer 9	4	Start depth: 46.42 (ft)	4	Clay & silty clay
		End depth: 46.92 (ft)	5	Silty sand & sandy silt

Start depth: Depth where the transition layer begins
End depth: Depth where the transition layer ends

:: Field input data ::

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
1	0.16	462.42	1.26	0.68	0.00	126.69
2	0.33	267.11	1.32	23.55	0.00	126.13
3	0.49	174.46	1.32	1.22	1.72	125.04
4	0.66	115.04	1.32	1.49	5.64	124.09
5	0.82	77.68	1.36	1.96	12.18	123.08
6	0.98	35.72	1.40	4.32	22.02	122.15
7	1.15	26.00	1.47	1.82	38.91	121.00
8	1.31	14.50	1.55	8.56	52.94	120.41
9	1.48	11.89	1.59	2.50	68.31	119.61
10	1.64	10.23	1.52	2.81	73.94	119.07
11	1.80	9.98	1.41	2.75	74.94	118.10
12	1.97	9.56	1.13	2.82	71.16	117.69
13	2.13	11.54	1.25	4.01	64.38	118.02
14	2.30	14.87	1.40	4.60	58.12	119.18
15	2.46	17.28	1.50	4.69	51.99	120.02
16	2.62	20.25	1.48	7.50	46.05	120.29
17	2.79	23.49	1.33	8.38	40.94	119.85
18	2.95	23.82	1.12	1.87	36.81	118.56
19	3.12	22.67	0.81	1.60	33.49	116.50
20	3.28	21.85	0.55	2.00	29.36	113.81
21	3.44	22.22	0.37	0.56	25.06	111.20
22	3.61	23.09	0.29	0.93	22.08	109.65
23	3.77	24.00	0.31	1.71	20.92	109.62
24	3.94	25.36	0.35	3.91	20.46	110.18
25	4.10	26.56	0.35	1.77	19.92	110.34
26	4.27	26.40	0.32	1.94	19.42	109.86
27	4.43	25.13	0.29	3.19	19.34	109.15
28	4.59	24.06	0.27	2.78	19.18	108.43
29	4.76	24.29	0.25	4.03	18.25	108.00
30	4.92	26.54	0.24	5.84	16.46	107.75
31	5.09	29.51	0.23	3.24	14.77	107.63
32	5.25	30.72	0.22	2.39	13.89	108.13
33	5.41	32.74	0.27	2.49	13.63	108.52
34	5.58	32.58	0.26	1.79	14.01	108.83
35	5.74	30.36	0.25	0.44	14.88	108.62
36	5.91	27.71	0.26	-0.68	15.79	108.82
37	6.07	29.60	0.29	-0.94	15.37	109.29
38	6.23	34.24	0.29	-1.05	14.03	109.97
39	6.40	37.30	0.31	-0.29	13.40	110.91
40	6.56	39.07	0.38	-0.17	13.60	111.62
41	6.73	37.84	0.38	-0.17	14.05	112.09
42	6.89	37.88	0.38	-0.01	13.97	111.97
43	7.05	39.73	0.36	-0.34	14.23	112.84
44	7.22	42.26	0.51	-0.22	14.53	113.62
45	7.38	41.59	0.50	-0.20	14.88	114.05
46	7.55	41.05	0.44	-0.13	14.15	112.85
47	7.71	40.48	0.29	-0.15	13.17	111.07
48	7.87	38.53	0.24	-0.14	12.41	109.38

:: Field input data :: (continued)

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
49	8.04	37.83	0.24	-0.15	12.61	108.98
50	8.20	37.67	0.26	-0.12	13.30	109.52
51	8.37	37.40	0.30	-0.20	15.56	111.74
52	8.53	36.13	0.54	13.98	16.84	112.85
53	8.69	37.21	0.44	6.82	17.37	113.33
54	8.86	37.87	0.39	4.23	17.11	113.18
55	9.02	37.58	0.50	3.42	18.28	114.19
56	9.19	37.41	0.64	2.51	19.44	115.15
57	9.35	38.34	0.60	1.90	19.27	115.31
58	9.51	40.11	0.53	1.69	17.78	114.52
59	9.68	41.35	0.44	1.79	17.39	113.92
60	9.84	37.62	0.48	0.50	18.75	113.63
61	10.01	31.71	0.50	0.68	20.03	113.03
62	10.17	32.56	0.36	2.80	19.50	112.25
63	10.33	36.63	0.35	0.25	17.50	111.40
64	10.50	37.68	0.35	-0.27	16.84	111.54
65	10.66	37.52	0.37	-0.38	16.98	111.74
66	10.83	37.57	0.38	-0.15	17.51	111.75
67	10.99	35.42	0.36	-0.17	18.07	111.57
68	11.15	34.31	0.35	-0.35	18.73	111.54
69	11.32	34.71	0.38	-0.15	20.56	111.76
70	11.48	28.76	0.42	0.28	23.18	111.85
71	11.65	25.01	0.41	4.47	23.87	111.84
72	11.81	32.76	0.39	0.19	22.66	111.22
73	11.98	30.80	0.31	0.18	23.03	111.43
74	12.14	25.10	0.44	1.79	23.52	111.59
75	12.30	32.03	0.42	11.58	22.98	112.73
76	12.47	38.47	0.47	0.49	21.31	112.93
77	12.63	33.40	0.43	0.25	24.37	113.40
78	12.80	22.91	0.55	0.54	33.30	113.60
79	12.96	14.53	0.66	4.25	48.48	114.02
80	13.12	10.74	0.77	7.91	63.65	114.36
81	13.29	10.42	0.86	12.48	69.54	114.06
82	13.45	10.40	0.66	16.36	69.64	113.70
83	13.62	10.11	0.67	19.95	64.36	112.19
84	13.78	10.99	0.44	24.98	59.57	111.00
85	13.94	11.52	0.38	24.13	56.09	109.75
86	14.11	10.57	0.43	20.75	56.86	109.96
87	14.27	10.97	0.47	26.79	58.73	110.29
88	14.44	10.98	0.44	25.62	59.73	110.41
89	14.60	10.28	0.46	21.73	61.64	110.11
90	14.76	9.51	0.44	24.40	62.85	109.33
91	14.93	9.15	0.33	29.11	55.22	108.67
92	15.09	14.42	0.31	4.72	53.02	107.65
93	15.26	9.89	0.30	0.90	48.74	107.73
94	15.42	13.14	0.31	10.10	36.34	107.99
95	15.58	29.58	0.24	4.06	24.80	108.02
96	15.75	34.81	0.20	-3.82	17.86	107.36

:: Field input data :: (continued)

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
97	15.91	37.12	0.19	-2.46	16.73	106.93
98	16.08	33.76	0.20	-4.72	18.98	107.18
99	16.24	25.27	0.24	-4.91	24.52	107.23
100	16.40	17.66	0.24	-2.83	34.21	108.11
101	16.57	14.55	0.36	1.11	41.90	108.53
102	16.73	15.01	0.34	4.51	46.59	108.49
103	16.90	12.27	0.27	9.79	46.51	107.28
104	17.06	12.21	0.23	17.83	46.99	105.88
105	17.22	11.95	0.21	23.69	45.78	105.08
106	17.39	11.86	0.20	29.85	45.18	104.58
107	17.55	11.82	0.18	34.42	45.79	104.48
108	17.72	11.20	0.21	32.36	47.27	104.70
109	17.88	10.88	0.22	38.46	52.63	106.67
110	18.04	10.43	0.38	51.47	57.78	108.55
111	18.21	10.41	0.45	46.61	63.42	110.07
112	18.37	9.71	0.48	41.36	65.82	109.92
113	18.54	9.01	0.38	43.57	67.39	109.23
114	18.70	8.59	0.36	51.59	64.11	107.56
115	18.86	9.05	0.24	56.36	59.59	106.33
116	19.03	9.77	0.22	56.64	55.33	105.90
117	19.19	10.81	0.30	44.91	56.05	107.44
118	19.36	11.18	0.40	37.17	58.35	109.10
119	19.52	11.26	0.44	31.20	63.03	110.32
120	19.69	9.98	0.52	32.50	67.20	110.74
121	19.85	9.37	0.50	40.37	74.39	110.42
122	20.01	7.28	0.44	28.66	80.92	109.08
123	20.18	5.87	0.34	27.50	81.84	107.68
124	20.34	7.84	0.30	28.41	74.70	106.73
125	20.51	8.92	0.28	28.08	67.06	106.73
126	20.67	9.17	0.30	28.80	63.82	106.85
127	20.83	9.62	0.30	32.70	61.50	107.25
128	21.00	10.84	0.32	26.30	58.66	107.92
129	21.16	12.30	0.36	5.72	51.32	109.36
130	21.33	18.25	0.42	6.08	50.48	109.74
131	21.49	12.95	0.36	-5.46	53.65	109.37
132	21.65	8.95	0.33	-2.19	64.16	108.39
133	21.82	9.48	0.37	5.48	68.62	107.98
134	21.98	9.84	0.34	14.36	66.11	107.95
135	22.15	9.89	0.31	22.99	65.31	108.09
136	22.31	9.90	0.38	24.53	64.73	108.27
137	22.47	10.32	0.35	25.26	64.71	108.69
138	22.64	10.56	0.37	24.00	63.68	107.71
139	22.80	9.40	0.25	9.56	66.26	106.61
140	22.97	7.75	0.24	14.63	68.89	105.30
141	23.13	7.87	0.25	25.90	69.48	104.90
142	23.29	8.47	0.22	31.60	66.47	104.56
143	23.46	8.50	0.20	33.25	64.45	104.71
144	23.62	8.88	0.25	38.04	64.41	105.69

:: Field input data :: (continued)

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
145	23.79	9.53	0.30	43.45	62.92	106.81
146	23.95	10.65	0.31	43.66	59.49	107.06
147	24.11	11.27	0.26	43.84	58.45	107.72
148	24.28	11.33	0.37	39.48	62.19	109.68
149	24.44	11.34	0.58	43.10	66.16	111.86
150	24.61	12.50	0.66	37.73	67.43	112.87
151	24.77	12.47	0.59	34.52	65.84	112.26
152	24.93	11.46	0.44	37.78	62.21	110.62
153	25.10	12.21	0.33	35.52	60.92	109.21
154	25.26	11.10	0.37	32.78	60.27	108.74
155	25.43	11.13	0.37	44.29	61.86	109.26
156	25.59	11.92	0.41	44.69	62.18	109.74
157	25.75	11.42	0.44	55.58	62.08	110.15
158	25.92	11.76	0.43	60.36	62.66	110.30
159	26.08	11.58	0.43	63.51	62.71	110.51
160	26.25	11.74	0.47	60.88	61.98	110.47
161	26.41	12.21	0.42	66.33	57.89	110.40
162	26.57	14.74	0.39	56.61	52.60	110.26
163	26.74	16.77	0.40	23.39	52.59	110.49
164	26.90	13.21	0.45	38.81	54.86	110.47
165	27.07	12.52	0.40	66.29	51.98	111.18
166	27.23	20.43	0.49	75.49	40.92	112.35
167	27.40	31.66	0.53	-1.64	36.32	113.58
168	27.56	26.83	0.57	-6.91	37.28	113.70
169	27.72	20.08	0.52	-2.74	46.38	112.72
170	27.89	13.00	0.46	3.33	56.00	111.04
171	28.05	11.70	0.37	21.21	61.42	108.98
172	28.22	11.51	0.26	38.04	61.75	108.14
173	28.38	10.92	0.35	45.30	63.34	108.20
174	28.54	10.52	0.39	43.96	67.40	109.18
175	28.71	10.53	0.41	42.37	68.51	109.30
176	28.87	10.66	0.38	37.00	68.98	109.48
177	29.04	10.74	0.41	33.28	72.90	110.50
178	29.20	10.13	0.60	30.34	78.78	112.26
179	29.36	10.30	0.76	38.84	84.34	114.04
180	29.53	10.71	0.90	40.69	86.69	115.15
181	29.69	10.81	0.95	31.97	85.69	115.16
182	29.86	10.85	0.75	39.59	80.09	114.15
183	30.02	12.18	0.54	26.22	69.97	112.73
184	30.18	14.35	0.50	32.73	62.54	111.36
185	30.35	13.58	0.41	43.58	58.29	110.12
186	30.51	13.19	0.30	33.35	58.24	108.62
187	30.68	11.73	0.29	34.30	64.74	109.71
188	30.84	11.03	0.60	30.49	73.61	111.97
189	31.00	11.40	0.76	41.76	78.55	113.59
190	31.17	11.45	0.71	52.61	72.55	113.65
191	31.33	14.60	0.55	40.58	63.71	112.11
192	31.50	14.64	0.33	49.26	52.36	109.86

:: Field input data :: (continued)

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
193	31.66	16.90	0.24	58.79	43.57	107.18
194	31.82	18.54	0.18	53.83	37.24	105.29
195	31.99	19.05	0.14	68.47	33.54	104.15
196	32.15	20.41	0.15	67.17	32.29	103.84
197	32.32	20.20	0.16	54.71	32.30	103.97
198	32.48	19.75	0.15	47.20	33.13	103.53
199	32.64	18.43	0.13	35.99	34.77	102.99
200	32.81	16.47	0.14	45.58	36.87	102.36
201	32.97	15.20	0.13	61.64	39.24	102.44
202	33.14	15.04	0.14	64.86	41.48	102.62
203	33.30	14.09	0.16	49.59	44.72	102.85
204	33.46	12.19	0.15	57.40	46.49	103.29
205	33.63	13.81	0.17	83.38	36.16	104.05
206	33.79	28.46	0.16	42.92	27.57	105.32
207	33.96	33.97	0.18	-6.20	25.31	105.69
208	34.12	22.81	0.18	-7.83	30.91	105.80
209	34.28	15.08	0.20	-6.57	44.32	105.48
210	34.45	11.13	0.23	44.26	61.56	107.20
211	34.61	9.48	0.42	67.19	73.47	108.14
212	34.78	8.47	0.37	70.45	81.04	108.57
213	34.94	7.86	0.33	75.23	81.39	107.60
214	35.10	8.20	0.29	73.77	78.98	106.82
215	35.27	8.54	0.27	76.12	76.20	106.61
216	35.43	9.03	0.29	62.73	78.33	107.19
217	35.60	8.05	0.37	70.68	80.50	107.77
218	35.76	8.77	0.35	48.41	85.03	108.29
219	35.93	7.81	0.38	69.83	87.51	109.26
220	36.09	8.18	0.52	76.02	89.47	111.08
221	36.25	9.75	0.67	81.91	86.51	112.38
222	36.42	10.53	0.63	85.97	83.13	112.90
223	36.58	10.55	0.61	77.16	81.89	113.16
224	36.75	10.81	0.72	83.56	78.81	113.44
225	36.91	13.12	0.66	58.69	83.49	116.04
226	37.07	12.54	1.40	78.91	86.67	118.54
227	37.24	13.93	1.76	85.25	90.14	120.62
228	37.40	15.31	1.83	78.41	87.98	121.44
229	37.57	16.22	1.86	63.48	81.78	120.40
230	37.73	16.52	0.98	40.90	78.10	119.17
231	37.89	15.28	1.11	66.39	74.50	117.56
232	38.06	14.93	1.11	81.48	74.37	117.91
233	38.22	17.25	1.11	62.72	73.05	117.88
234	38.39	16.38	1.07	67.87	69.73	117.55
235	38.55	17.09	0.92	79.70	66.32	116.91
236	38.71	18.75	0.82	69.36	63.38	117.27
237	38.88	20.39	1.14	72.50	59.12	117.50
238	39.04	23.03	0.92	67.14	56.04	118.18
239	39.21	25.64	1.00	43.88	52.21	117.72
240	39.37	25.16	0.90	37.26	51.62	117.33

:: Field input data :: (continued)

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
241	39.53	22.84	0.78	52.85	50.67	116.34
242	39.70	23.69	0.69	46.24	50.38	116.00
243	39.86	24.53	0.80	38.89	49.76	116.85
244	40.03	26.97	1.01	57.03	42.59	118.07
245	40.19	43.53	0.93	-0.47	35.51	120.13
246	40.35	56.59	1.36	-5.23	27.77	121.20
247	40.52	69.23	1.19	-6.21	22.48	122.34
248	40.68	89.07	1.21	-5.71	17.23	122.67
249	40.85	109.96	1.25	-3.96	13.04	123.04
250	41.01	132.42	1.12	-5.59	8.85	122.09
251	41.17	154.81	0.58	-5.25	5.61	120.86
252	41.34	179.20	0.67	-5.30	4.40	121.43
253	41.50	194.67	1.21	-4.38	5.28	124.75
254	41.67	208.81	1.88	-4.30	5.99	127.28
255	41.83	230.33	2.06	-3.44	5.10	127.15
256	41.99	234.07	1.02	0.44	3.80	125.49
257	42.16	220.47	0.84	-1.19	2.47	122.64
258	42.32	217.39	0.81	0.91	2.79	122.66
259	42.49	214.48	1.06	1.84	3.27	123.05
260	42.65	204.11	1.01	1.35	3.96	123.91
261	42.81	206.13	1.19	0.09	3.86	123.82
262	42.98	217.37	1.01	4.29	3.74	123.83
263	43.14	211.88	1.00	2.08	3.47	123.35
264	43.31	206.65	0.99	4.01	3.69	123.29
265	43.47	204.11	1.01	2.50	4.37	123.85
266	43.64	193.27	1.27	2.54	5.06	124.15
267	43.80	184.10	1.17	1.41	5.94	124.19
268	43.96	168.68	1.10	-1.24	6.42	123.41
269	44.13	154.62	0.99	-0.04	7.32	122.31
270	44.29	128.58	0.82	-1.63	9.09	121.65
271	44.46	108.42	0.98	-1.93	12.03	121.09
272	44.62	86.84	0.96	5.14	12.99	120.75
273	44.78	108.36	0.76	13.53	10.70	119.27
274	44.95	123.72	0.45	1.50	5.00	116.75
275	45.11	110.10	0.29	9.93	5.00	114.48
276	45.28	84.17	0.38	-1.88	5.00	113.53
277	45.44	50.51	0.41	-2.91	18.91	113.39
278	45.60	32.54	0.41	1.85	26.43	112.71
279	45.77	40.66	0.39	13.67	27.51	112.26
280	45.93	44.04	0.35	1.13	27.93	112.00
281	46.10	29.96	0.38	0.32	30.42	112.07
282	46.26	32.79	0.43	6.55	37.22	112.44
283	46.42	27.48	0.49	0.68	36.38	112.83
284	46.59	33.59	0.43	6.33	31.62	112.97
285	46.75	46.66	0.40	1.04	24.23	112.53
286	46.92	53.13	0.32	1.04	21.79	113.57
287	47.08	52.65	0.55	-0.02	23.11	114.18
288	47.24	43.72	0.51	-0.98	29.29	114.03

:: Field input data :: (continued)

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
289	47.41	25.25	0.39	0.92	100.00	87.36
290	47.57	17.31	-274310.26	5.25	100.00	87.36
291	47.74	16.96	-274310.26	10.14	100.00	87.36
292	47.90	15.36	-274310.26	13.12	100.00	87.36

Abbreviations

Depth:	Depth from free surface, at which CPT was performed (ft)
q_c:	Measured cone resistance (tsf)
f_s:	Sleeve friction resistance (tsf)
u:	Pore pressure (tsf)
Fines content:	Percentage of fines in soil (%)
Unit weight:	Bulk soil unit weight (pcf)

:: Cyclic Stress Ratio fully adjusted (CSR*) calculation data ::

Point ID	Depth (ft)	σ_v (tsf)	u_0 (tsf)	σ_v' (tsf)	r_d	CSR	MSF	CSR_{eq}	K_σ	User FS	CSR^*	Belongs to transition
1	0.16	0.01	0.00	0.01	1.00	0.449	1.27	0.353	1.00	1.00	2.000	No
2	0.33	0.02	0.00	0.02	1.00	0.449	1.27	0.353	1.00	1.00	2.000	No
3	0.49	0.03	0.00	0.03	1.00	0.449	1.27	0.353	1.00	1.00	2.000	No
4	0.66	0.04	0.00	0.04	1.00	0.449	1.27	0.353	1.00	1.00	2.000	No
5	0.82	0.05	0.00	0.05	1.00	0.448	1.27	0.353	1.00	1.00	2.000	Yes
6	0.98	0.06	0.00	0.06	1.00	0.448	1.27	0.353	1.00	1.00	2.000	Yes
7	1.15	0.07	0.00	0.07	1.00	0.448	1.27	0.353	1.00	1.00	2.000	Yes
8	1.31	0.08	0.00	0.08	1.00	0.448	1.27	0.353	1.00	1.00	2.000	Yes
9	1.48	0.09	0.00	0.09	1.00	0.448	1.27	0.353	1.00	1.00	2.000	No
10	1.64	0.10	0.00	0.10	1.00	0.448	1.27	0.352	1.00	1.00	2.000	No
11	1.80	0.11	0.00	0.11	1.00	0.448	1.27	0.352	1.00	1.00	2.000	No
12	1.97	0.12	0.00	0.12	1.00	0.447	1.27	0.352	1.00	1.00	2.000	No
13	2.13	0.13	0.00	0.13	1.00	0.447	1.27	0.352	1.00	1.00	2.000	No
14	2.30	0.14	0.00	0.14	1.00	0.447	1.27	0.352	1.00	1.00	2.000	Yes
15	2.46	0.15	0.00	0.15	1.00	0.447	1.27	0.352	1.00	1.00	2.000	Yes
16	2.62	0.16	0.00	0.16	1.00	0.447	1.27	0.352	1.00	1.00	2.000	Yes
17	2.79	0.17	0.00	0.17	1.00	0.446	1.27	0.351	1.00	1.00	2.000	Yes
18	2.95	0.18	0.00	0.18	1.00	0.446	1.27	0.351	1.00	1.00	2.000	Yes
19	3.12	0.19	0.00	0.19	0.99	0.446	1.27	0.351	1.00	1.00	2.000	Yes
20	3.28	0.20	0.00	0.20	0.99	0.446	1.27	0.351	1.00	1.00	2.000	Yes
21	3.44	0.21	0.00	0.21	0.99	0.446	1.27	0.351	1.00	1.00	2.000	Yes
22	3.61	0.22	0.00	0.22	0.99	0.446	1.27	0.351	1.00	1.00	2.000	Yes
23	3.77	0.22	0.00	0.22	0.99	0.445	1.27	0.351	1.00	1.00	2.000	No
24	3.94	0.23	0.00	0.23	0.99	0.445	1.27	0.351	1.00	1.00	2.000	No
25	4.10	0.24	0.00	0.24	0.99	0.445	1.27	0.350	1.00	1.00	2.000	No
26	4.27	0.25	0.00	0.25	0.99	0.445	1.27	0.350	1.00	1.00	2.000	No
27	4.43	0.26	0.00	0.26	0.99	0.445	1.27	0.350	1.00	1.00	2.000	No
28	4.59	0.27	0.00	0.27	0.99	0.445	1.27	0.350	1.00	1.00	2.000	No
29	4.76	0.28	0.00	0.28	0.99	0.444	1.27	0.350	1.00	1.00	2.000	No
30	4.92	0.29	0.00	0.29	0.99	0.444	1.27	0.350	1.00	1.00	2.000	No
31	5.09	0.30	0.00	0.30	0.99	0.444	1.27	0.350	1.00	1.00	2.000	No
32	5.25	0.31	0.00	0.31	0.99	0.444	1.27	0.349	1.00	1.00	2.000	No
33	5.41	0.31	0.00	0.31	0.99	0.444	1.27	0.349	1.00	1.00	2.000	No
34	5.58	0.32	0.00	0.32	0.99	0.444	1.27	0.349	1.00	1.00	2.000	No
35	5.74	0.33	0.00	0.33	0.99	0.443	1.27	0.349	1.00	1.00	2.000	No
36	5.91	0.34	0.00	0.34	0.99	0.443	1.27	0.349	1.00	1.00	2.000	No
37	6.07	0.35	0.00	0.35	0.99	0.443	1.27	0.349	1.00	1.00	2.000	No
38	6.23	0.36	0.00	0.36	0.99	0.443	1.27	0.349	1.00	1.00	2.000	No
39	6.40	0.37	0.00	0.37	0.99	0.443	1.27	0.349	1.00	1.00	2.000	No
40	6.56	0.38	0.00	0.38	0.99	0.443	1.27	0.348	1.00	1.00	2.000	No
41	6.73	0.39	0.00	0.39	0.99	0.442	1.27	0.348	1.00	1.00	2.000	No
42	6.89	0.40	0.00	0.40	0.99	0.442	1.27	0.348	1.00	1.00	2.000	No
43	7.05	0.40	0.00	0.40	0.99	0.442	1.27	0.348	1.00	1.00	2.000	No
44	7.22	0.41	0.00	0.41	0.99	0.442	1.27	0.348	1.00	1.00	2.000	No
45	7.38	0.42	0.00	0.42	0.98	0.442	1.27	0.348	1.00	1.00	2.000	No
46	7.55	0.43	0.00	0.43	0.98	0.442	1.27	0.348	1.00	1.00	2.000	No
47	7.71	0.44	0.00	0.44	0.98	0.441	1.27	0.347	1.00	1.00	2.000	No
48	7.87	0.45	0.00	0.45	0.98	0.441	1.27	0.347	1.00	1.00	2.000	No

:: Cyclic Stress Ratio fully adjusted (CSR*) calculation data :: (continued)

Point ID	Depth (ft)	σ_v (tsf)	u_0 (tsf)	σ_v' (tsf)	r_d	CSR	MSF	CSR_{eq}	K_σ	User FS	CSR^*	Belongs to transition
49	8.04	0.46	0.00	0.46	0.98	0.441	1.27	0.347	1.00	1.00	2.000	No
50	8.20	0.47	0.00	0.47	0.98	0.441	1.27	0.347	1.00	1.00	2.000	No
51	8.37	0.48	0.00	0.48	0.98	0.441	1.27	0.347	1.00	1.00	2.000	No
52	8.53	0.49	0.00	0.49	0.98	0.441	1.27	0.347	1.00	1.00	2.000	No
53	8.69	0.50	0.00	0.50	0.98	0.440	1.27	0.347	1.00	1.00	2.000	No
54	8.86	0.51	0.00	0.51	0.98	0.440	1.27	0.347	1.00	1.00	2.000	No
55	9.02	0.51	0.00	0.51	0.98	0.440	1.27	0.346	1.00	1.00	2.000	No
56	9.19	0.52	0.00	0.52	0.98	0.440	1.27	0.346	1.00	1.00	2.000	No
57	9.35	0.53	0.00	0.53	0.98	0.440	1.27	0.346	1.00	1.00	2.000	No
58	9.51	0.54	0.00	0.54	0.98	0.440	1.27	0.346	1.00	1.00	2.000	No
59	9.68	0.55	0.00	0.55	0.98	0.439	1.27	0.346	1.00	1.00	2.000	No
60	9.84	0.56	0.00	0.56	0.98	0.439	1.27	0.346	1.00	1.00	2.000	No
61	10.01	0.57	0.00	0.57	0.98	0.439	1.27	0.346	1.00	1.00	0.346	No
62	10.17	0.58	0.01	0.57	0.98	0.443	1.27	0.349	1.00	1.00	0.349	No
63	10.33	0.59	0.01	0.58	0.98	0.447	1.27	0.352	1.00	1.00	0.352	No
64	10.50	0.60	0.02	0.58	0.98	0.450	1.27	0.355	1.00	1.00	0.355	No
65	10.66	0.61	0.02	0.59	0.98	0.454	1.27	0.357	1.00	1.00	0.357	No
66	10.83	0.62	0.03	0.59	0.98	0.457	1.27	0.360	1.00	1.00	0.360	No
67	10.99	0.63	0.03	0.60	0.98	0.461	1.27	0.363	1.00	1.00	0.363	No
68	11.15	0.64	0.04	0.60	0.98	0.464	1.27	0.366	1.00	1.00	0.366	No
69	11.32	0.64	0.04	0.60	0.98	0.468	1.27	0.368	1.00	1.00	0.368	No
70	11.48	0.65	0.05	0.61	0.98	0.471	1.27	0.371	1.00	1.00	0.371	No
71	11.65	0.66	0.05	0.61	0.98	0.474	1.27	0.373	1.00	1.00	0.373	No
72	11.81	0.67	0.06	0.62	0.98	0.478	1.27	0.376	1.00	1.00	0.376	No
73	11.98	0.68	0.06	0.62	0.97	0.481	1.27	0.378	1.00	1.00	0.378	No
74	12.14	0.69	0.07	0.62	0.97	0.484	1.27	0.381	1.00	1.00	0.381	No
75	12.30	0.70	0.07	0.63	0.97	0.487	1.27	0.383	1.00	1.00	0.383	No
76	12.47	0.71	0.08	0.63	0.97	0.490	1.27	0.386	1.00	1.00	2.000	Yes
77	12.63	0.72	0.08	0.64	0.97	0.493	1.27	0.388	1.00	1.00	2.000	Yes
78	12.80	0.73	0.09	0.64	0.97	0.496	1.27	0.390	1.00	1.00	2.000	Yes
79	12.96	0.74	0.09	0.64	0.97	0.499	1.27	0.393	1.00	1.00	2.000	Yes
80	13.12	0.75	0.10	0.65	0.97	0.502	1.27	0.395	1.00	1.00	0.395	No
81	13.29	0.76	0.10	0.65	0.97	0.505	1.27	0.397	1.00	1.00	0.397	No
82	13.45	0.76	0.11	0.66	0.97	0.507	1.27	0.399	1.00	1.00	0.399	No
83	13.62	0.77	0.11	0.66	0.97	0.510	1.27	0.402	1.00	1.00	0.402	No
84	13.78	0.78	0.12	0.67	0.97	0.513	1.27	0.404	1.00	1.00	0.404	No
85	13.94	0.79	0.12	0.67	0.97	0.515	1.27	0.406	1.00	1.00	0.406	No
86	14.11	0.80	0.13	0.67	0.97	0.518	1.27	0.408	1.00	1.00	0.408	No
87	14.27	0.81	0.13	0.68	0.97	0.521	1.27	0.410	1.00	1.00	0.410	No
88	14.44	0.82	0.14	0.68	0.97	0.523	1.27	0.412	1.00	1.00	0.412	No
89	14.60	0.83	0.14	0.68	0.97	0.526	1.27	0.414	1.00	1.00	0.414	No
90	14.76	0.84	0.15	0.69	0.97	0.528	1.27	0.416	1.00	1.00	0.416	No
91	14.93	0.85	0.15	0.69	0.97	0.531	1.27	0.418	1.00	1.00	0.418	No
92	15.09	0.85	0.16	0.70	0.97	0.533	1.27	0.420	1.00	1.00	2.000	Yes
93	15.26	0.86	0.16	0.70	0.97	0.536	1.27	0.422	1.00	1.00	2.000	Yes
94	15.42	0.87	0.17	0.70	0.97	0.538	1.27	0.424	1.00	1.00	2.000	Yes
95	15.58	0.88	0.17	0.71	0.97	0.541	1.27	0.426	1.00	1.00	2.000	Yes
96	15.75	0.89	0.18	0.71	0.97	0.543	1.27	0.428	1.00	1.00	2.000	Yes

:: Cyclic Stress Ratio fully adjusted (CSR*) calculation data :: (continued)

Point ID	Depth (ft)	σ_v (tsf)	u_0 (tsf)	σ_v' (tsf)	r_d	CSR	MSF	CSR_{eq}	K_σ	User FS	CSR^*	Belongs to transition
97	15.91	0.90	0.18	0.71	0.97	0.545	1.27	0.429	1.00	1.00	2.000	Yes
98	16.08	0.91	0.19	0.72	0.97	0.548	1.27	0.431	1.00	1.00	2.000	Yes
99	16.24	0.92	0.19	0.72	0.97	0.550	1.27	0.433	1.00	1.00	2.000	Yes
100	16.40	0.93	0.20	0.73	0.97	0.552	1.27	0.435	1.00	1.00	2.000	Yes
101	16.57	0.93	0.20	0.73	0.97	0.554	1.27	0.437	1.00	1.00	2.000	Yes
102	16.73	0.94	0.21	0.73	0.96	0.557	1.27	0.438	1.00	1.00	2.000	Yes
103	16.90	0.95	0.22	0.74	0.96	0.559	1.27	0.440	1.00	1.00	0.440	No
104	17.06	0.96	0.22	0.74	0.96	0.561	1.27	0.442	1.00	1.00	0.442	No
105	17.22	0.97	0.23	0.74	0.96	0.563	1.27	0.443	1.00	1.00	0.443	No
106	17.39	0.98	0.23	0.75	0.96	0.565	1.27	0.445	1.00	1.00	0.445	No
107	17.55	0.99	0.24	0.75	0.96	0.567	1.27	0.447	1.00	1.00	0.447	No
108	17.72	1.00	0.24	0.75	0.96	0.569	1.27	0.448	1.00	1.00	0.448	No
109	17.88	1.00	0.25	0.76	0.96	0.571	1.27	0.450	1.00	1.00	0.450	No
110	18.04	1.01	0.25	0.76	0.96	0.573	1.27	0.451	1.00	1.00	0.451	No
111	18.21	1.02	0.26	0.77	0.96	0.575	1.27	0.453	1.00	1.00	0.453	No
112	18.37	1.03	0.26	0.77	0.96	0.577	1.27	0.454	1.00	1.00	0.454	No
113	18.54	1.04	0.27	0.77	0.96	0.579	1.27	0.456	1.00	1.00	0.456	No
114	18.70	1.05	0.27	0.78	0.96	0.581	1.27	0.457	1.00	1.00	0.457	No
115	18.86	1.06	0.28	0.78	0.96	0.583	1.27	0.459	1.00	1.00	0.459	No
116	19.03	1.07	0.28	0.78	0.96	0.585	1.27	0.460	1.00	1.00	0.460	No
117	19.19	1.07	0.29	0.79	0.96	0.587	1.27	0.462	1.00	1.00	0.462	No
118	19.36	1.08	0.29	0.79	0.96	0.588	1.27	0.463	1.00	1.00	0.463	No
119	19.52	1.09	0.30	0.80	0.96	0.590	1.27	0.465	1.00	1.00	0.465	No
120	19.69	1.10	0.30	0.80	0.96	0.592	1.27	0.466	1.00	1.00	0.466	No
121	19.85	1.11	0.31	0.80	0.96	0.594	1.27	0.467	1.00	1.00	0.467	No
122	20.01	1.12	0.31	0.81	0.96	0.595	1.27	0.469	1.00	1.00	0.469	No
123	20.18	1.13	0.32	0.81	0.96	0.597	1.27	0.470	1.00	1.00	0.470	No
124	20.34	1.14	0.32	0.81	0.96	0.599	1.27	0.471	1.00	1.00	0.471	No
125	20.51	1.15	0.33	0.82	0.96	0.600	1.27	0.473	1.00	1.00	0.473	No
126	20.67	1.15	0.33	0.82	0.96	0.602	1.27	0.474	1.00	1.00	0.474	No
127	20.83	1.16	0.34	0.83	0.95	0.603	1.27	0.475	1.00	1.00	0.475	No
128	21.00	1.17	0.34	0.83	0.95	0.605	1.27	0.476	1.00	1.00	0.476	No
129	21.16	1.18	0.35	0.83	0.95	0.607	1.27	0.477	1.00	1.00	0.477	No
130	21.33	1.19	0.35	0.84	0.95	0.608	1.27	0.479	1.00	1.00	0.479	No
131	21.49	1.20	0.36	0.84	0.95	0.610	1.27	0.480	1.00	1.00	0.480	No
132	21.65	1.21	0.36	0.84	0.95	0.611	1.27	0.481	1.00	1.00	0.481	No
133	21.82	1.22	0.37	0.85	0.95	0.612	1.27	0.482	1.00	1.00	0.482	No
134	21.98	1.23	0.37	0.85	0.95	0.614	1.27	0.483	1.00	1.00	0.483	No
135	22.15	1.24	0.38	0.86	0.95	0.615	1.27	0.484	1.00	1.00	0.484	No
136	22.31	1.24	0.38	0.86	0.95	0.617	1.27	0.486	1.00	1.00	0.486	No
137	22.47	1.25	0.39	0.86	0.95	0.618	1.27	0.487	1.00	1.00	0.487	No
138	22.64	1.26	0.39	0.87	0.95	0.619	1.27	0.488	1.00	1.00	0.488	No
139	22.80	1.27	0.40	0.87	0.95	0.621	1.27	0.489	1.00	1.00	0.489	No
140	22.97	1.28	0.40	0.87	0.95	0.622	1.27	0.490	1.00	1.00	0.490	No
141	23.13	1.29	0.41	0.88	0.95	0.624	1.27	0.491	1.00	1.00	0.491	No
142	23.29	1.30	0.41	0.88	0.95	0.625	1.27	0.492	1.00	1.00	0.492	No
143	23.46	1.30	0.42	0.88	0.95	0.626	1.27	0.493	1.00	1.00	0.493	No
144	23.62	1.31	0.43	0.89	0.95	0.628	1.27	0.494	1.00	1.00	0.494	No

:: Cyclic Stress Ratio fully adjusted (CSR*) calculation data :: (continued)

Point ID	Depth (ft)	σ_v (tsf)	u_0 (tsf)	σ_v' (tsf)	r_d	CSR	MSF	CSR_{eq}	K_σ	User FS	CSR^*	Belongs to transition
145	23.79	1.32	0.43	0.89	0.95	0.629	1.27	0.495	1.00	1.00	0.495	No
146	23.95	1.33	0.44	0.90	0.95	0.630	1.27	0.496	1.00	1.00	0.496	No
147	24.11	1.34	0.44	0.90	0.94	0.631	1.27	0.497	1.00	1.00	0.497	No
148	24.28	1.35	0.45	0.90	0.94	0.632	1.27	0.498	1.00	1.00	0.498	No
149	24.44	1.36	0.45	0.91	0.94	0.633	1.27	0.499	1.00	1.00	0.499	No
150	24.61	1.37	0.46	0.91	0.94	0.635	1.27	0.500	1.00	1.00	0.500	No
151	24.77	1.38	0.46	0.92	0.94	0.636	1.27	0.500	1.00	1.00	0.500	No
152	24.93	1.39	0.47	0.92	0.94	0.637	1.27	0.501	1.00	1.00	0.501	No
153	25.10	1.39	0.47	0.92	0.94	0.638	1.27	0.502	1.00	1.00	0.502	No
154	25.26	1.40	0.48	0.93	0.94	0.639	1.27	0.503	1.00	1.00	0.503	No
155	25.43	1.41	0.48	0.93	0.94	0.640	1.27	0.504	1.00	1.00	0.504	No
156	25.59	1.42	0.49	0.93	0.94	0.641	1.27	0.504	1.00	1.00	0.504	No
157	25.75	1.43	0.49	0.94	0.94	0.642	1.27	0.505	1.00	1.00	0.505	No
158	25.92	1.44	0.50	0.94	0.94	0.643	1.27	0.506	1.00	1.00	0.506	No
159	26.08	1.45	0.50	0.95	0.94	0.644	1.27	0.507	1.00	1.00	0.507	No
160	26.25	1.46	0.51	0.95	0.94	0.644	1.27	0.507	1.00	1.00	0.507	No
161	26.41	1.47	0.51	0.95	0.94	0.645	1.27	0.508	1.00	1.00	0.508	No
162	26.57	1.48	0.52	0.96	0.94	0.646	1.27	0.509	1.00	1.00	0.509	No
163	26.74	1.48	0.52	0.96	0.94	0.647	1.27	0.509	1.00	1.00	0.509	No
164	26.90	1.49	0.53	0.97	0.93	0.648	1.27	0.510	1.00	1.00	0.510	No
165	27.07	1.50	0.53	0.97	0.93	0.649	1.27	0.511	1.00	1.00	0.511	No
166	27.23	1.51	0.54	0.97	0.93	0.649	1.27	0.511	1.00	1.00	0.511	No
167	27.40	1.52	0.54	0.98	0.93	0.650	1.27	0.512	1.00	1.00	0.512	No
168	27.56	1.53	0.55	0.98	0.93	0.651	1.27	0.512	1.00	1.00	0.512	No
169	27.72	1.54	0.55	0.99	0.93	0.652	1.27	0.513	1.00	1.00	0.513	No
170	27.89	1.55	0.56	0.99	0.93	0.652	1.27	0.514	1.00	1.00	0.514	No
171	28.05	1.56	0.56	0.99	0.93	0.653	1.27	0.514	1.00	1.00	0.514	No
172	28.22	1.57	0.57	1.00	0.93	0.654	1.27	0.515	1.00	1.00	0.515	No
173	28.38	1.58	0.57	1.00	0.93	0.655	1.27	0.515	1.00	1.00	0.515	No
174	28.54	1.58	0.58	1.01	0.93	0.655	1.27	0.516	1.00	1.00	0.516	No
175	28.71	1.59	0.58	1.01	0.93	0.656	1.27	0.516	1.00	1.00	0.516	No
176	28.87	1.60	0.59	1.01	0.93	0.657	1.27	0.517	1.00	1.00	0.517	No
177	29.04	1.61	0.59	1.02	0.93	0.657	1.27	0.517	1.00	1.00	0.517	No
178	29.20	1.62	0.60	1.02	0.92	0.658	1.27	0.518	1.00	1.00	0.518	No
179	29.36	1.63	0.60	1.03	0.92	0.658	1.27	0.518	1.00	1.00	0.518	No
180	29.53	1.64	0.61	1.03	0.92	0.659	1.27	0.519	1.00	1.00	0.519	No
181	29.69	1.65	0.61	1.03	0.92	0.659	1.27	0.519	1.00	1.00	0.519	No
182	29.86	1.66	0.62	1.04	0.92	0.660	1.27	0.519	1.00	1.00	0.519	No
183	30.02	1.67	0.62	1.04	0.92	0.660	1.27	0.520	1.00	1.00	0.520	No
184	30.18	1.68	0.63	1.05	0.92	0.660	1.27	0.520	1.00	1.00	0.520	No
185	30.35	1.69	0.63	1.05	0.92	0.661	1.27	0.520	1.00	1.00	0.520	No
186	30.51	1.69	0.64	1.05	0.92	0.661	1.27	0.521	1.00	1.00	0.521	No
187	30.68	1.70	0.65	1.06	0.92	0.662	1.27	0.521	1.00	1.00	0.521	No
188	30.84	1.71	0.65	1.06	0.92	0.662	1.27	0.521	1.00	1.00	0.521	No
189	31.00	1.72	0.66	1.07	0.92	0.663	1.27	0.522	1.00	1.00	0.522	No
190	31.17	1.73	0.66	1.07	0.91	0.663	1.27	0.522	1.00	1.00	0.522	No
191	31.33	1.74	0.67	1.08	0.91	0.663	1.27	0.522	1.00	1.00	0.522	No
192	31.50	1.75	0.67	1.08	0.91	0.664	1.27	0.522	1.00	1.00	2.000	Yes

:: Cyclic Stress Ratio fully adjusted (CSR*) calculation data :: (continued)

Point ID	Depth (ft)	σ_v (tsf)	u_0 (tsf)	σ_v' (tsf)	r_d	CSR	MSF	CSR_{eq}	K_σ	User FS	CSR^*	Belongs to transition
193	31.66	1.76	0.68	1.08	0.91	0.664	1.27	0.523	1.00	1.00	2.000	Yes
194	31.82	1.77	0.68	1.09	0.91	0.664	1.27	0.523	1.00	1.00	2.000	Yes
195	31.99	1.78	0.69	1.09	0.91	0.665	1.27	0.523	1.00	1.00	2.000	Yes
196	32.15	1.78	0.69	1.09	0.91	0.665	1.27	0.524	1.00	1.00	0.524	No
197	32.32	1.79	0.70	1.10	0.91	0.666	1.27	0.524	1.00	1.00	0.524	No
198	32.48	1.80	0.70	1.10	0.91	0.666	1.27	0.524	1.00	1.00	0.524	No
199	32.64	1.81	0.71	1.10	0.91	0.666	1.27	0.525	1.00	1.00	0.525	No
200	32.81	1.82	0.71	1.11	0.90	0.667	1.27	0.525	1.00	1.00	0.525	No
201	32.97	1.83	0.72	1.11	0.90	0.667	1.27	0.525	1.00	1.00	0.525	No
202	33.14	1.84	0.72	1.11	0.90	0.668	1.27	0.526	1.00	1.00	0.526	No
203	33.30	1.84	0.73	1.12	0.90	0.668	1.27	0.526	1.00	1.00	0.526	No
204	33.46	1.85	0.73	1.12	0.90	0.668	1.27	0.526	1.00	1.00	2.000	Yes
205	33.63	1.86	0.74	1.12	0.90	0.668	1.27	0.526	1.00	1.00	2.000	Yes
206	33.79	1.87	0.74	1.13	0.90	0.669	1.27	0.526	1.00	1.00	2.000	Yes
207	33.96	1.88	0.75	1.13	0.90	0.669	1.27	0.527	1.00	1.00	2.000	Yes
208	34.12	1.89	0.75	1.13	0.90	0.669	1.27	0.527	1.00	1.00	0.527	No
209	34.28	1.90	0.76	1.14	0.90	0.669	1.27	0.527	1.00	1.00	0.527	No
210	34.45	1.90	0.76	1.14	0.89	0.669	1.27	0.527	1.00	1.00	0.527	No
211	34.61	1.91	0.77	1.14	0.89	0.669	1.27	0.527	1.00	1.00	0.527	No
212	34.78	1.92	0.77	1.15	0.89	0.669	1.27	0.527	1.00	1.00	0.527	No
213	34.94	1.93	0.78	1.15	0.89	0.669	1.27	0.527	1.00	1.00	0.527	No
214	35.10	1.94	0.78	1.16	0.89	0.670	1.27	0.527	1.00	1.00	0.527	No
215	35.27	1.95	0.79	1.16	0.89	0.670	1.27	0.527	1.00	1.00	0.527	No
216	35.43	1.96	0.79	1.16	0.89	0.670	1.27	0.527	1.00	1.00	0.527	No
217	35.60	1.97	0.80	1.17	0.89	0.670	1.27	0.527	1.00	1.00	0.527	No
218	35.76	1.97	0.80	1.17	0.89	0.670	1.27	0.527	1.00	1.00	0.527	No
219	35.93	1.98	0.81	1.17	0.88	0.669	1.27	0.527	1.00	1.00	0.527	No
220	36.09	1.99	0.81	1.18	0.88	0.669	1.27	0.527	1.00	1.00	0.527	No
221	36.25	2.00	0.82	1.18	0.88	0.669	1.27	0.527	1.00	1.00	0.527	No
222	36.42	2.01	0.82	1.19	0.88	0.669	1.27	0.527	1.00	1.00	0.527	No
223	36.58	2.02	0.83	1.19	0.88	0.669	1.27	0.527	1.00	1.00	0.527	No
224	36.75	2.03	0.83	1.20	0.88	0.669	1.27	0.526	1.00	1.00	0.526	No
225	36.91	2.04	0.84	1.20	0.88	0.668	1.27	0.526	1.00	1.00	0.526	No
226	37.07	2.05	0.84	1.20	0.88	0.668	1.27	0.526	1.00	1.00	0.526	No
227	37.24	2.06	0.85	1.21	0.87	0.668	1.27	0.526	1.00	1.00	0.526	No
228	37.40	2.07	0.85	1.21	0.87	0.667	1.27	0.525	1.00	1.00	0.525	No
229	37.57	2.08	0.86	1.22	0.87	0.667	1.27	0.525	1.00	1.00	0.525	No
230	37.73	2.09	0.87	1.22	0.87	0.666	1.27	0.525	1.00	1.00	0.525	No
231	37.89	2.10	0.87	1.23	0.87	0.666	1.27	0.524	1.00	1.00	0.524	No
232	38.06	2.11	0.88	1.23	0.87	0.665	1.27	0.524	1.00	1.00	0.524	No
233	38.22	2.12	0.88	1.24	0.87	0.665	1.27	0.524	1.00	1.00	0.524	No
234	38.39	2.13	0.89	1.24	0.86	0.665	1.27	0.523	1.00	1.00	0.523	No
235	38.55	2.14	0.89	1.25	0.86	0.664	1.27	0.523	1.00	1.00	0.523	No
236	38.71	2.15	0.90	1.25	0.86	0.664	1.27	0.522	1.00	1.00	0.522	No
237	38.88	2.16	0.90	1.26	0.86	0.663	1.27	0.522	1.00	1.00	0.522	No
238	39.04	2.17	0.91	1.26	0.86	0.663	1.27	0.522	1.00	1.00	0.522	No
239	39.21	2.18	0.91	1.26	0.86	0.662	1.27	0.521	1.00	1.00	0.521	No
240	39.37	2.18	0.92	1.27	0.86	0.662	1.27	0.521	1.00	1.00	0.521	No

:: Cyclic Stress Ratio fully adjusted (CSR*) calculation data :: (continued)

Point ID	Depth (ft)	σ_v (tsf)	u_0 (tsf)	σ_v' (tsf)	r_d	CSR	MSF	CSR_{eq}	K_σ	User FS	CSR^*	Belongs to transition
241	39.53	2.19	0.92	1.27	0.86	0.661	1.27	0.520	1.00	1.00	0.520	No
242	39.70	2.20	0.93	1.28	0.85	0.661	1.27	0.520	1.00	1.00	0.520	No
243	39.86	2.21	0.93	1.28	0.85	0.660	1.27	0.520	1.00	1.00	2.000	Yes
244	40.03	2.22	0.94	1.29	0.85	0.659	1.27	0.519	1.00	1.00	2.000	Yes
245	40.19	2.23	0.94	1.29	0.85	0.659	1.27	0.519	1.00	1.00	2.000	Yes
246	40.35	2.24	0.95	1.30	0.85	0.658	1.27	0.518	1.00	1.00	2.000	Yes
247	40.52	2.25	0.95	1.30	0.85	0.657	1.27	0.518	1.00	1.00	2.000	Yes
248	40.68	2.26	0.96	1.31	0.84	0.657	1.27	0.517	1.00	1.00	2.000	Yes
249	40.85	2.27	0.96	1.31	0.84	0.656	1.27	0.516	1.00	1.00	2.000	Yes
250	41.01	2.28	0.97	1.32	0.84	0.655	1.27	0.516	1.00	1.00	2.000	Yes
251	41.17	2.29	0.97	1.32	0.84	0.655	1.27	0.515	1.00	1.00	0.515	No
252	41.34	2.30	0.98	1.33	0.84	0.654	1.27	0.515	1.00	1.00	0.515	No
253	41.50	2.31	0.98	1.33	0.84	0.653	1.27	0.514	1.00	1.00	0.514	No
254	41.67	2.32	0.99	1.34	0.84	0.652	1.27	0.513	1.00	1.00	0.513	No
255	41.83	2.33	0.99	1.34	0.83	0.651	1.27	0.513	1.00	1.00	0.513	No
256	41.99	2.34	1.00	1.35	0.83	0.651	1.27	0.512	1.00	1.00	0.512	No
257	42.16	2.35	1.00	1.35	0.83	0.650	1.27	0.511	1.00	1.00	0.511	No
258	42.32	2.36	1.01	1.36	0.83	0.649	1.27	0.511	1.00	1.00	0.511	No
259	42.49	2.37	1.01	1.36	0.83	0.648	1.27	0.510	1.00	1.00	0.510	No
260	42.65	2.38	1.02	1.37	0.83	0.647	1.27	0.510	1.00	1.00	0.510	No
261	42.81	2.40	1.02	1.37	0.83	0.646	1.27	0.509	1.00	1.00	0.509	No
262	42.98	2.41	1.03	1.38	0.82	0.645	1.27	0.508	1.00	1.00	0.508	No
263	43.14	2.42	1.03	1.38	0.82	0.645	1.27	0.507	1.00	1.00	0.507	No
264	43.31	2.43	1.04	1.39	0.82	0.644	1.27	0.507	1.00	1.00	0.507	No
265	43.47	2.44	1.04	1.39	0.82	0.643	1.27	0.506	1.00	1.00	0.506	No
266	43.64	2.45	1.05	1.40	0.82	0.642	1.27	0.505	1.00	1.00	0.505	No
267	43.80	2.46	1.05	1.40	0.82	0.641	1.27	0.505	1.00	1.00	0.505	No
268	43.96	2.47	1.06	1.41	0.81	0.640	1.27	0.504	1.00	1.00	0.504	No
269	44.13	2.48	1.06	1.41	0.81	0.639	1.27	0.503	1.00	1.00	0.503	No
270	44.29	2.49	1.07	1.42	0.81	0.638	1.27	0.502	1.00	1.00	0.502	No
271	44.46	2.50	1.08	1.42	0.81	0.637	1.27	0.502	1.00	1.00	0.502	No
272	44.62	2.51	1.08	1.43	0.81	0.636	1.27	0.501	1.00	1.00	0.501	No
273	44.78	2.52	1.09	1.43	0.81	0.636	1.27	0.500	1.00	1.00	0.500	No
274	44.95	2.53	1.09	1.43	0.80	0.635	1.27	0.500	1.00	1.00	0.500	No
275	45.11	2.53	1.10	1.44	0.80	0.634	1.27	0.499	1.00	1.00	0.499	No
276	45.28	2.54	1.10	1.44	0.80	0.633	1.27	0.498	1.00	1.00	0.498	No
277	45.44	2.55	1.11	1.45	0.80	0.632	1.27	0.498	1.00	1.00	0.498	No
278	45.60	2.56	1.11	1.45	0.80	0.631	1.27	0.497	1.00	1.00	0.497	No
279	45.77	2.57	1.12	1.46	0.80	0.631	1.27	0.496	1.00	1.00	0.496	No
280	45.93	2.58	1.12	1.46	0.79	0.630	1.27	0.496	1.00	1.00	0.496	No
281	46.10	2.59	1.13	1.46	0.79	0.629	1.27	0.495	1.00	1.00	0.495	No
282	46.26	2.60	1.13	1.47	0.79	0.628	1.27	0.494	1.00	1.00	0.494	No
283	46.42	2.61	1.14	1.47	0.79	0.627	1.27	0.494	1.00	1.00	2.000	Yes
284	46.59	2.62	1.14	1.48	0.79	0.626	1.27	0.493	1.00	1.00	2.000	Yes
285	46.75	2.63	1.15	1.48	0.79	0.625	1.27	0.492	1.00	1.00	2.000	Yes
286	46.92	2.64	1.15	1.48	0.78	0.625	1.27	0.492	1.00	1.00	2.000	Yes
287	47.08	2.65	1.16	1.49	0.78	0.624	1.27	0.491	1.00	1.00	0.491	No
288	47.24	2.66	1.16	1.49	0.78	0.623	1.27	0.490	1.00	1.00	0.490	No

:: Cyclic Stress Ratio fully adjusted (CSR*) calculation data :: (continued)

Point ID	Depth (ft)	σ_v (tsf)	u_0 (tsf)	σ_v' (tsf)	r_d	CSR	MSF	CSR_{eq}	K_σ	User FS	CSR^*	Belongs to transition
289	47.41	2.66	1.17	1.50	0.78	0.622	1.27	0.490	1.00	1.00	0.490	No
290	47.57	2.67	1.17	1.50	0.78	0.622	1.27	0.489	1.00	1.00	0.489	No
291	47.74	2.68	1.18	1.50	0.78	0.621	1.27	0.489	1.00	1.00	0.489	No
292	47.90	2.68	1.18	1.50	0.77	0.621	1.27	0.489	1.00	1.00	0.489	No

Abbreviations

Depth: Depth from free surface, at which CPT was performed (ft)
σ_v: Total overburden pressure at test point (tsf)
u_0: Water pressure at test point (tsf)
σ_v': Effective overburden pressure based on GWT during earthquake (tsf)
r_d: Nonlinear shear mass factor
CSR: Cyclic Stress Ratio
MSF: Magnitude Scaling Factor
CSR_{eq}: CSR adjusted for M=7.5
K_σ: Effective overburden stress factor
CSR^*: CSR fully adjusted

:: Cyclic Resistance Ratio (CRR) calculation data ::

Point ID	Depth (ft)	q_t (tsf)	I_c	Fr (%)	n	Q_{tn}	K_c	$Q_{tn,cs}$	$CRR_{7.5}$	Belongs to trans. layer	Clay-like behaviour	FS
1	0.16	397.44	0.94	0.32	0.21	751.20	1.00	751.20	4.000	No	No	2.00
2	0.33	301.45	1.11	0.43	0.28	569.75	1.00	569.75	4.000	No	No	2.00
3	0.49	185.66	1.42	0.71	0.39	350.87	1.00	350.87	4.000	No	No	2.00
4	0.66	122.41	1.67	1.09	0.49	231.31	1.00	231.31	4.000	No	No	2.00
5	0.82	76.18	1.97	1.78	0.60	143.90	1.28	184.90	4.000	Yes	No	2.00
6	0.98	46.51	2.29	3.03	0.72	87.79	1.87	164.56	4.000	Yes	No	2.00
7	1.15	25.48	2.67	5.80	0.87	48.02	8.48	407.01	4.000	Yes	No	2.00
8	1.31	17.53	2.92	8.82	0.96	32.98	7.43	244.97	4.000	Yes	Yes	2.00
9	1.48	12.28	3.14	12.75	1.00	23.03	11.39	262.39	4.000	No	Yes	2.00
10	1.64	10.74	3.21	14.17	1.00	20.11	13.01	261.63	4.000	No	Yes	2.00
11	1.80	9.97	3.22	13.74	1.00	18.63	13.31	247.88	4.000	No	Yes	2.00
12	1.97	10.41	3.18	12.27	1.00	19.45	12.20	237.31	4.000	No	Yes	2.00
13	2.13	12.05	3.08	10.55	1.00	22.52	10.32	232.39	4.000	No	Yes	2.00
14	2.30	14.63	2.99	9.53	1.00	27.39	8.69	238.06	4.000	Yes	Yes	2.00
15	2.46	17.55	2.90	8.39	0.96	32.89	7.20	236.90	4.000	Yes	Yes	2.00
16	2.62	20.44	2.80	7.09	0.92	38.34	5.87	224.85	4.000	Yes	Yes	2.00
17	2.79	22.61	2.71	5.84	0.89	42.41	4.80	203.70	4.000	Yes	Yes	2.00
18	2.95	23.38	2.63	4.68	0.86	43.86	6.53	286.35	4.000	Yes	No	2.00
19	3.12	22.80	2.56	3.65	0.83	42.75	4.20	179.57	4.000	Yes	No	2.00
20	3.28	22.26	2.47	2.61	0.80	41.71	2.78	115.96	4.000	Yes	No	2.00
21	3.44	22.40	2.37	1.82	0.76	41.95	2.21	92.56	4.000	Yes	No	2.00
22	3.61	23.12	2.29	1.41	0.73	43.29	1.88	81.39	4.000	Yes	No	2.00
23	3.77	24.18	2.26	1.32	0.72	45.28	1.77	80.21	4.000	No	No	2.00
24	3.94	25.34	2.24	1.34	0.72	47.46	1.73	82.17	4.000	No	No	2.00
25	4.10	26.14	2.23	1.31	0.71	48.96	1.69	82.55	4.000	No	No	2.00
26	4.27	26.06	2.21	1.24	0.70	48.79	1.65	80.32	4.000	No	No	2.00
27	4.43	25.24	2.21	1.17	0.70	47.21	1.64	77.43	4.000	No	No	2.00
28	4.59	24.54	2.21	1.10	0.70	45.88	1.63	74.68	4.000	No	No	2.00
29	4.76	25.02	2.18	1.01	0.69	46.77	1.56	73.03	4.000	No	No	2.00
30	4.92	26.84	2.12	0.89	0.67	50.19	1.45	72.88	4.000	No	No	2.00
31	5.09	28.98	2.07	0.79	0.65	54.21	1.37	74.39	4.000	No	No	2.00
32	5.25	31.03	2.03	0.77	0.64	58.07	1.34	77.72	4.000	No	No	2.00
33	5.41	32.05	2.02	0.78	0.64	59.98	1.33	79.73	4.000	No	No	2.00
34	5.58	31.91	2.04	0.82	0.64	59.71	1.34	80.17	4.000	No	No	2.00
35	5.74	30.22	2.07	0.86	0.65	56.50	1.38	77.79	4.000	No	No	2.00
36	5.91	29.22	2.10	0.92	0.67	54.59	1.42	77.39	4.000	No	No	2.00
37	6.07	30.51	2.09	0.93	0.66	57.00	1.40	79.70	4.000	No	No	2.00
38	6.23	33.71	2.04	0.89	0.64	63.03	1.34	84.68	4.000	No	No	2.00
39	6.40	36.87	2.02	0.90	0.64	67.56	1.32	89.29	4.000	No	No	2.00
40	6.56	38.07	2.02	0.95	0.64	68.93	1.33	91.55	4.000	No	No	2.00
41	6.73	38.26	2.04	1.00	0.65	68.67	1.34	92.28	4.000	No	No	2.00
42	6.89	38.48	2.04	0.98	0.65	67.99	1.34	91.19	4.000	No	No	2.00
43	7.05	39.95	2.05	1.05	0.65	69.72	1.35	94.18	4.000	No	No	2.00
44	7.22	41.19	2.06	1.12	0.65	71.13	1.36	96.91	4.000	No	No	2.00
45	7.38	41.63	2.07	1.17	0.66	71.17	1.38	97.98	4.000	No	No	2.00
46	7.55	41.04	2.04	1.02	0.65	68.56	1.35	92.39	4.000	No	No	2.00
47	7.71	40.02	2.01	0.82	0.64	65.18	1.31	85.64	4.000	No	No	2.00
48	7.87	38.95	1.98	0.68	0.63	62.04	1.29	80.11	4.000	No	No	2.00

:: Cyclic Resistance Ratio (CRR) calculation data :: (continued)

Point ID	Depth (ft)	q_t (tsf)	I_c	Fr (%)	n	Q_{tn}	K_c	$Q_{tn,cs}$	$CRR_{7.5}$	Belongs to trans. layer	Clay-like behaviour	FS
49	8.04	38.01	1.99	0.66	0.63	59.94	1.30	77.75	4.000	No	No	2.00
50	8.20	37.63	2.01	0.72	0.64	59.10	1.32	77.90	4.000	No	No	2.00
51	8.37	37.13	2.09	1.00	0.67	58.99	1.41	82.99	4.000	No	No	2.00
52	8.53	37.01	2.13	1.17	0.69	58.77	1.47	86.56	4.000	No	No	2.00
53	8.69	37.19	2.15	1.24	0.69	58.58	1.50	88.12	4.000	No	No	2.00
54	8.86	37.62	2.14	1.20	0.69	58.38	1.49	86.90	4.000	No	No	2.00
55	9.02	37.67	2.18	1.37	0.70	58.31	1.56	91.16	4.000	No	No	2.00
56	9.19	37.81	2.21	1.56	0.72	58.34	1.65	96.14	4.000	No	No	2.00
57	9.35	38.65	2.21	1.54	0.72	58.81	1.63	96.15	4.000	No	No	2.00
58	9.51	39.96	2.16	1.33	0.70	59.40	1.53	90.90	4.000	No	No	2.00
59	9.68	39.71	2.15	1.23	0.70	58.15	1.51	87.56	4.000	No	No	2.00
60	9.84	36.91	2.19	1.31	0.71	53.90	1.60	86.05	4.000	No	No	2.00
61	10.01	33.98	2.23	1.35	0.73	49.42	1.70	83.79	0.135	No	No	0.39
62	10.17	33.65	2.21	1.23	0.72	48.20	1.65	79.65	0.127	No	No	0.36
63	10.33	35.64	2.15	1.01	0.70	49.84	1.51	75.38	0.120	No	No	0.34
64	10.50	37.27	2.13	0.97	0.69	51.38	1.47	75.69	0.120	No	No	0.34
65	10.66	37.58	2.14	0.99	0.69	51.32	1.48	76.00	0.121	No	No	0.34
66	10.83	36.83	2.15	1.02	0.70	49.93	1.51	75.55	0.120	No	No	0.33
67	10.99	35.76	2.17	1.03	0.71	48.12	1.55	74.55	0.119	No	No	0.33
68	11.15	34.81	2.19	1.07	0.72	46.52	1.59	74.19	0.118	No	No	0.32
69	11.32	32.59	2.25	1.20	0.74	43.49	1.74	75.69	0.120	No	No	0.33
70	11.48	29.52	2.32	1.39	0.76	39.41	1.99	78.56	0.125	No	No	0.34
71	11.65	28.87	2.34	1.43	0.77	38.23	2.07	79.07	0.126	No	No	0.34
72	11.81	29.55	2.30	1.28	0.76	38.53	1.94	74.72	0.119	No	No	0.32
73	11.98	29.56	2.31	1.31	0.76	38.21	1.98	75.56	0.120	No	No	0.32
74	12.14	29.37	2.33	1.35	0.77	37.66	2.03	76.45	0.122	No	No	0.32
75	12.30	31.93	2.31	1.41	0.76	40.50	1.97	79.85	0.127	No	No	0.33
76	12.47	34.69	2.27	1.30	0.75	43.33	1.81	78.29	4.000	Yes	No	2.00
77	12.63	31.60	2.35	1.57	0.78	39.47	2.13	83.89	4.000	Yes	No	2.00
78	12.80	23.64	2.56	2.40	0.86	29.88	4.09	122.19	4.000	Yes	No	2.00
79	12.96	16.12	2.84	4.30	0.97	20.64	6.40	132.11	4.000	Yes	Yes	2.00
80	13.12	12.01	3.07	6.77	1.00	15.10	10.12	152.92	0.721	No	Yes	1.82
81	13.29	10.70	3.15	7.66	1.00	13.16	11.74	154.49	0.628	No	Yes	1.58
82	13.45	10.54	3.16	7.45	1.00	12.79	11.77	150.46	0.610	No	Yes	1.53
83	13.62	10.79	3.08	5.87	1.00	12.95	10.31	133.54	0.618	No	Yes	1.54
84	13.78	11.21	3.02	4.74	1.00	13.31	9.06	120.60	0.635	No	Yes	1.57
85	13.94	11.36	2.96	3.92	1.00	13.35	8.19	109.28	0.637	No	Yes	1.57
86	14.11	11.36	2.98	4.03	1.00	13.19	8.38	110.48	0.629	No	Yes	1.54
87	14.27	11.19	3.00	4.32	1.00	12.82	8.84	113.35	0.611	No	Yes	1.49
88	14.44	11.10	3.02	4.44	1.00	12.55	9.10	114.23	0.599	No	Yes	1.45
89	14.60	10.60	3.05	4.55	1.00	11.80	9.59	113.23	0.563	No	Yes	1.36
90	14.76	10.01	3.06	4.45	1.00	11.02	9.91	109.26	0.526	No	Yes	1.26
91	14.93	11.31	2.95	3.42	1.00	12.52	7.97	99.82	0.597	No	Yes	1.43
92	15.09	11.32	2.92	2.97	1.00	12.47	7.45	92.83	4.000	Yes	Yes	2.00
93	15.26	12.56	2.85	2.60	0.97	13.79	6.46	89.05	4.000	Yes	Yes	2.00
94	15.42	17.61	2.62	1.68	0.89	19.27	6.15	118.50	4.000	Yes	No	2.00
95	15.58	25.89	2.36	0.99	0.79	28.08	2.17	61.06	4.000	Yes	No	2.00
96	15.75	33.82	2.17	0.63	0.72	36.27	1.54	55.68	4.000	Yes	No	2.00

:: Cyclic Resistance Ratio (CRR) calculation data :: (continued)

Point ID	Depth (ft)	q_t (tsf)	I_c	Fr (%)	n	Q_{tn}	K_c	$Q_{tn,cs}$	$CRR_{7.5}$	Belongs to trans. layer	Clay-like behaviour	FS
97	15.91	35.18	2.13	0.56	0.70	37.53	1.47	55.06	4.000	Yes	No	2.00
98	16.08	31.99	2.20	0.66	0.73	34.12	1.61	55.03	4.000	Yes	No	2.00
99	16.24	25.50	2.35	0.91	0.79	27.22	2.14	58.31	4.000	Yes	No	2.00
100	16.40	19.13	2.58	1.53	0.87	20.43	4.64	94.75	4.000	Yes	No	2.00
101	16.57	15.76	2.73	2.12	0.93	16.75	4.99	83.68	4.000	Yes	Yes	2.00
102	16.73	14.02	2.81	2.49	0.96	14.81	5.98	88.57	4.000	Yes	Yes	2.00
103	16.90	13.32	2.81	2.27	0.96	13.95	5.96	83.19	0.665	No	Yes	1.51
104	17.06	12.39	2.82	2.07	0.97	12.85	6.07	77.99	0.613	No	Yes	1.39
105	17.22	12.35	2.80	1.87	0.96	12.73	5.81	73.90	0.607	No	Yes	1.37
106	17.39	12.30	2.79	1.76	0.95	12.60	5.68	71.56	0.601	No	Yes	1.35
107	17.55	12.09	2.80	1.78	0.96	12.33	5.81	71.61	0.588	No	Yes	1.32
108	17.72	11.81	2.82	1.90	0.97	11.98	6.13	73.44	0.571	No	Yes	1.27
109	17.88	11.42	2.91	2.60	1.00	11.56	7.36	85.02	0.551	No	Yes	1.23
110	18.04	11.23	2.99	3.46	1.00	11.28	8.61	97.11	0.538	No	Yes	1.19
111	18.21	10.85	3.07	4.47	1.00	10.81	10.06	108.80	0.516	No	Yes	1.14
112	18.37	10.34	3.10	4.70	1.00	10.20	10.71	109.19	0.486	No	Yes	1.07
113	18.54	9.76	3.13	4.65	1.00	9.51	11.14	105.95	0.454	No	Yes	1.00
114	18.70	9.61	3.08	3.79	1.00	9.30	10.24	95.31	0.444	No	Yes	0.97
115	18.86	9.93	3.02	3.06	1.00	9.60	9.06	87.00	0.458	No	Yes	1.00
116	19.03	10.64	2.95	2.62	1.00	10.31	8.00	82.54	0.492	No	Yes	1.07
117	19.19	11.25	2.96	2.98	1.00	10.93	8.18	89.35	0.521	No	Yes	1.13
118	19.36	11.63	3.00	3.57	1.00	11.27	8.75	98.61	0.538	No	Yes	1.16
119	19.52	11.29	3.07	4.40	1.00	10.86	9.96	108.12	0.518	No	Yes	1.11
120	19.69	10.71	3.12	5.04	1.00	10.18	11.09	112.88	0.486	No	Yes	1.04
121	19.85	9.36	3.22	5.87	1.00	8.71	13.14	114.52	0.416	No	Yes	0.89
122	20.01	7.97	3.30	6.21	1.00	7.20	15.14	109.05	0.344	No	Yes	0.73
123	20.18	7.40	3.31	5.74	1.00	6.57	15.43	101.38	0.313	No	Yes	0.67
124	20.34	7.95	3.22	4.54	1.00	7.10	13.23	94.02	0.339	No	Yes	0.72
125	20.51	9.05	3.12	3.74	1.00	8.22	11.05	90.76	0.392	No	Yes	0.83
126	20.67	9.66	3.08	3.46	1.00	8.81	10.17	89.60	0.420	No	Yes	0.89
127	20.83	10.30	3.04	3.33	1.00	9.42	9.56	90.05	0.449	No	Yes	0.95
128	21.00	11.23	3.00	3.22	1.00	10.34	8.83	91.27	0.493	No	Yes	1.04
129	21.16	13.98	2.89	2.86	1.00	13.10	7.05	92.31	0.625	No	Yes	1.31
130	21.33	14.53	2.88	2.86	0.99	13.59	6.85	93.16	0.648	No	Yes	1.35
131	21.49	13.37	2.93	3.06	1.00	12.37	7.60	93.92	0.590	No	Yes	1.23
132	21.65	10.45	3.08	3.83	1.00	9.35	10.26	95.90	0.446	No	Yes	0.93
133	21.82	9.51	3.14	4.17	1.00	8.36	11.48	95.94	0.399	No	Yes	0.83
134	21.98	9.94	3.11	3.89	1.00	8.75	10.79	94.41	0.418	No	Yes	0.86
135	22.15	10.17	3.10	3.83	1.00	8.94	10.57	94.52	0.427	No	Yes	0.88
136	22.31	10.39	3.09	3.81	1.00	9.11	10.41	94.90	0.435	No	Yes	0.90
137	22.47	10.62	3.09	3.92	1.00	9.30	10.41	96.76	0.444	No	Yes	0.91
138	22.64	10.38	3.07	3.54	1.00	9.02	10.13	91.36	0.430	No	Yes	0.88
139	22.80	9.47	3.11	3.50	1.00	8.08	10.83	87.50	0.385	No	Yes	0.79
140	22.97	8.58	3.15	3.39	1.00	7.17	11.56	82.88	0.342	No	Yes	0.70
141	23.13	8.37	3.15	3.33	1.00	6.94	11.72	81.33	0.331	No	Yes	0.67
142	23.29	8.71	3.11	3.00	1.00	7.24	10.89	78.79	0.345	No	Yes	0.70
143	23.46	9.11	3.09	2.87	1.00	7.59	10.34	78.46	0.362	No	Yes	0.73
144	23.62	9.52	3.09	3.07	1.00	7.95	10.33	82.13	0.379	No	Yes	0.77

:: Cyclic Resistance Ratio (CRR) calculation data :: (continued)

Point ID	Depth (ft)	q_t (tsf)	I_c	Fr (%)	n	Q_{tn}	K_c	$Q_{tn,cs}$	$CRR_{7.5}$	Belongs to trans. layer	Clay-like behaviour	FS
145	23.79	10.29	3.06	3.20	1.00	8.66	9.93	85.94	0.413	No	Yes	0.83
146	23.95	11.11	3.01	2.95	1.00	9.41	9.04	85.08	0.449	No	Yes	0.91
147	24.11	11.69	3.00	3.00	1.00	9.93	8.78	87.11	0.474	No	Yes	0.95
148	24.28	11.92	3.05	3.82	1.00	10.10	9.74	98.34	0.482	No	Yes	0.97
149	24.44	12.30	3.11	4.92	1.00	10.41	10.80	112.48	0.497	No	Yes	1.00
150	24.61	12.66	3.13	5.42	1.00	10.70	11.15	119.29	0.510	No	Yes	1.02
151	24.77	12.67	3.11	4.98	1.00	10.66	10.71	114.24	0.509	No	Yes	1.02
152	24.93	12.56	3.05	4.04	1.00	10.51	9.74	102.45	0.502	No	Yes	1.00
153	25.10	12.10	3.04	3.52	1.00	10.03	9.41	94.37	0.479	No	Yes	0.95
154	25.26	12.02	3.03	3.34	1.00	9.92	9.24	91.62	0.473	No	Yes	0.94
155	25.43	11.97	3.05	3.61	1.00	9.82	9.65	94.79	0.469	No	Yes	0.93
156	25.59	12.18	3.05	3.75	1.00	9.98	9.73	97.14	0.476	No	Yes	0.94
157	25.75	12.47	3.05	3.84	1.00	10.20	9.71	98.99	0.486	No	Yes	0.96
158	25.92	12.45	3.06	3.94	1.00	10.13	9.86	99.92	0.483	No	Yes	0.96
159	26.08	12.58	3.06	3.99	1.00	10.21	9.88	100.82	0.487	No	Yes	0.96
160	26.25	12.76	3.05	3.89	1.00	10.33	9.68	99.99	0.493	No	Yes	0.97
161	26.41	13.78	2.99	3.45	1.00	11.21	8.64	96.82	0.535	No	Yes	1.05
162	26.57	15.28	2.91	2.92	1.00	12.52	7.35	92.01	0.597	No	Yes	1.17
163	26.74	15.48	2.91	2.96	1.00	12.65	7.35	92.93	0.603	No	Yes	1.18
164	26.90	14.78	2.95	3.15	1.00	11.97	7.89	94.44	0.571	No	Yes	1.12
165	27.07	16.25	2.90	3.03	1.00	13.24	7.20	95.36	0.632	No	Yes	1.24
166	27.23	22.21	2.71	2.28	0.93	18.58	4.80	89.13	0.886	No	Yes	1.73
167	27.40	26.63	2.62	2.10	0.90	22.50	6.13	138.02	0.292	No	No	0.57
168	27.56	26.14	2.64	2.19	0.91	21.97	6.93	152.25	0.367	No	No	0.72
169	27.72	19.94	2.81	2.80	0.97	16.31	5.94	96.80	0.778	No	Yes	1.52
170	27.89	15.03	2.96	3.34	1.00	11.88	8.16	97.03	0.567	No	Yes	1.10
171	28.05	12.37	3.04	3.35	1.00	9.50	9.53	90.57	0.453	No	Yes	0.88
172	28.22	11.88	3.05	3.18	1.00	9.03	9.62	86.87	0.431	No	Yes	0.84
173	28.38	11.59	3.07	3.32	1.00	8.74	10.04	87.78	0.417	No	Yes	0.81
174	28.54	11.29	3.13	3.96	1.00	8.44	11.14	94.02	0.403	No	Yes	0.78
175	28.71	11.16	3.14	4.10	1.00	8.29	11.45	94.95	0.396	No	Yes	0.77
176	28.87	11.18	3.15	4.19	1.00	8.28	11.58	95.86	0.395	No	Yes	0.76
177	29.04	10.99	3.20	4.95	1.00	8.08	12.70	102.61	0.385	No	Yes	0.74
178	29.20	10.88	3.27	6.40	1.00	7.95	14.47	114.98	0.379	No	Yes	0.73
179	29.36	10.91	3.34	8.14	1.00	7.93	16.24	128.79	0.378	No	Yes	0.73
180	29.53	11.14	3.37	9.18	1.00	8.09	17.01	137.67	0.386	No	Yes	0.74
181	29.69	11.33	3.35	8.97	1.00	8.21	16.68	137.02	0.392	No	Yes	0.76
182	29.86	11.75	3.29	7.41	1.00	8.53	14.88	126.94	0.407	No	Yes	0.78
183	30.02	12.94	3.16	5.29	1.00	9.49	11.86	112.62	0.453	No	Yes	0.87
184	30.18	13.86	3.06	3.96	1.00	10.23	9.83	100.59	0.488	No	Yes	0.94
185	30.35	14.23	3.00	3.22	1.00	10.50	8.73	91.74	0.501	No	Yes	0.96
186	30.51	13.37	3.00	2.88	1.00	9.74	8.72	84.96	0.465	No	Yes	0.89
187	30.68	12.45	3.09	3.71	1.00	8.94	10.42	93.13	0.426	No	Yes	0.82
188	30.84	11.90	3.21	5.43	1.00	8.44	12.91	108.99	0.403	No	Yes	0.77
189	31.00	11.89	3.27	6.79	1.00	8.40	14.40	120.94	0.401	No	Yes	0.77
190	31.17	13.13	3.19	5.90	1.00	9.38	12.60	118.24	0.448	No	Yes	0.86
191	31.33	14.25	3.08	4.24	1.00	10.26	10.14	104.02	0.489	No	Yes	0.94
192	31.50	16.09	2.91	2.61	1.00	11.73	7.29	85.50	4.000	Yes	Yes	2.00

:: Cyclic Resistance Ratio (CRR) calculation data :: (continued)

Point ID	Depth (ft)	q_t (tsf)	I_c	Fr (%)	n	Q_{tn}	K_c	$Q_{tn,cs}$	$CRR_{7.5}$	Belongs to trans. layer	Clay-like behaviour	FS
193	31.66	17.47	2.76	1.61	0.96	12.89	5.34	68.82	4.000	Yes	Yes	2.00
194	31.82	19.03	2.64	1.10	0.91	14.22	6.89	98.03	4.000	Yes	No	2.00
195	31.99	20.24	2.56	0.86	0.88	15.24	4.23	64.46	4.000	Yes	No	2.00
196	32.15	20.80	2.54	0.79	0.87	15.68	3.55	55.65	0.096	No	No	0.18
197	32.32	20.93	2.54	0.80	0.87	15.74	3.55	55.92	0.096	No	No	0.18
198	32.48	20.12	2.55	0.80	0.88	15.01	4.00	59.99	0.100	No	No	0.19
199	32.64	18.84	2.59	0.82	0.89	13.89	5.00	69.50	0.111	No	No	0.21
200	32.81	17.39	2.63	0.84	0.91	12.64	6.58	83.17	0.120	No	No	0.23
201	32.97	16.40	2.68	0.93	0.93	11.76	8.82	103.74	0.165	No	No	0.31
202	33.14	15.62	2.72	1.02	0.95	11.07	4.91	54.38	0.528	No	Yes	1.01
203	33.30	14.60	2.78	1.16	0.97	10.18	5.58	56.80	0.486	No	Yes	0.92
204	33.46	14.28	2.81	1.28	0.98	9.87	5.96	58.82	4.000	Yes	Yes	2.00
205	33.63	19.04	2.62	0.93	0.91	13.79	6.01	82.85	4.000	Yes	No	2.00
206	33.79	25.99	2.43	0.71	0.84	19.57	2.53	49.45	4.000	Yes	No	2.00
207	33.96	28.55	2.37	0.66	0.81	21.67	2.24	48.46	4.000	Yes	No	2.00
208	34.12	23.85	2.51	0.86	0.86	17.64	2.90	51.16	0.092	No	No	0.18
209	34.28	16.49	2.77	1.40	0.97	11.46	5.49	62.99	0.547	No	Yes	1.04
210	34.45	12.40	3.04	2.70	1.00	8.17	9.57	78.23	0.390	No	Yes	0.74
211	34.61	10.57	3.21	3.94	1.00	6.72	12.87	86.46	0.320	No	Yes	0.61
212	34.78	9.63	3.30	4.84	1.00	5.96	15.18	90.49	0.284	No	Yes	0.54
213	34.94	9.23	3.30	4.53	1.00	5.63	15.29	86.11	0.269	No	Yes	0.51
214	35.10	9.28	3.27	4.04	1.00	5.65	14.53	82.12	0.270	No	Yes	0.51
215	35.27	9.61	3.24	3.72	1.00	5.88	13.68	80.45	0.280	No	Yes	0.53
216	35.43	9.55	3.27	4.08	1.00	5.81	14.33	83.23	0.277	No	Yes	0.53
217	35.60	9.49	3.29	4.46	1.00	5.74	15.01	86.14	0.274	No	Yes	0.52
218	35.76	9.12	3.35	5.12	1.00	5.43	16.46	89.44	0.259	No	Yes	0.49
219	35.93	9.19	3.38	5.77	1.00	5.46	17.29	94.44	0.261	No	Yes	0.49
220	36.09	9.67	3.40	6.83	1.00	5.81	17.95	104.27	0.277	No	Yes	0.53
221	36.25	10.66	3.36	7.00	1.00	6.53	16.95	110.64	0.311	No	Yes	0.59
222	36.42	11.45	3.32	6.73	1.00	7.10	15.85	112.45	0.339	No	Yes	0.64
223	36.58	11.82	3.31	6.65	1.00	7.34	15.45	113.38	0.350	No	Yes	0.67
224	36.75	12.55	3.27	6.31	1.00	7.86	14.48	113.76	0.375	No	Yes	0.71
225	36.91	13.22	3.33	8.32	1.00	8.32	15.96	132.85	0.397	No	Yes	0.75
226	37.07	14.26	3.37	10.45	1.00	9.06	17.01	154.12	0.432	No	Yes	0.82
227	37.24	15.09	3.40	12.78	1.00	9.63	18.18	175.18	0.460	No	Yes	0.87
228	37.40	16.24	3.38	12.83	1.00	10.44	17.45	182.17	0.498	No	Yes	0.95
229	37.57	16.89	3.31	10.51	1.00	10.88	15.41	167.59	0.519	No	Yes	0.99
230	37.73	16.82	3.26	8.93	1.00	10.78	14.26	153.72	0.514	No	Yes	0.98
231	37.89	16.48	3.22	7.40	1.00	10.49	13.18	138.17	0.500	No	Yes	0.95
232	38.06	16.83	3.22	7.53	1.00	10.70	13.14	140.55	0.510	No	Yes	0.97
233	38.22	17.20	3.20	7.27	1.00	10.93	12.75	139.30	0.521	No	Yes	1.00
234	38.39	17.92	3.16	6.55	1.00	11.40	11.79	134.42	0.544	No	Yes	1.04
235	38.55	18.45	3.11	5.75	1.00	11.74	10.84	127.27	0.560	No	Yes	1.07
236	38.71	19.81	3.07	5.44	1.00	12.67	10.05	127.33	0.604	No	Yes	1.16
237	38.88	21.73	3.01	4.92	1.00	13.99	8.95	125.17	0.667	No	Yes	1.28
238	39.04	23.90	2.96	4.71	1.00	15.49	8.18	126.66	0.739	No	Yes	1.42
239	39.21	25.32	2.90	4.07	1.00	16.44	7.25	119.29	0.784	No	Yes	1.50
240	39.37	25.19	2.89	3.89	1.00	16.29	7.12	115.95	0.777	No	Yes	1.49

:: Cyclic Resistance Ratio (CRR) calculation data :: (continued)

Point ID	Depth (ft)	q_t (tsf)	I_c	Fr (%)	n	Q_{tn}	K_c	$Q_{tn,cs}$	$CRR_{7.5}$	Belongs to trans. layer	Clay-like behaviour	FS
241	39.53	24.55	2.88	3.53	1.00	15.78	6.90	108.84	0.753	No	Yes	1.45
242	39.70	24.35	2.87	3.41	1.00	15.58	6.83	106.44	0.743	No	Yes	1.43
243	39.86	25.75	2.86	3.54	1.00	16.51	6.69	110.41	4.000	Yes	Yes	2.00
244	40.03	32.14	2.74	3.05	0.96	21.16	5.14	108.70	4.000	Yes	Yes	2.00
245	40.19	42.61	2.60	2.73	0.91	28.93	5.52	159.57	4.000	Yes	No	2.00
246	40.35	56.40	2.43	2.15	0.85	39.45	2.55	100.79	4.000	Yes	No	2.00
247	40.52	71.55	2.30	1.81	0.79	51.14	1.92	98.24	4.000	Yes	No	2.00
248	40.68	89.35	2.15	1.40	0.74	65.28	1.50	97.67	4.000	Yes	No	2.00
249	40.85	110.41	2.00	1.10	0.68	82.27	1.31	107.76	4.000	Yes	No	2.00
250	41.01	132.33	1.83	0.76	0.62	100.78	1.19	119.57	4.000	Yes	No	2.00
251	41.17	155.40	1.67	0.52	0.56	120.78	1.00	120.78	0.244	No	No	0.47
252	41.34	176.16	1.60	0.47	0.53	138.09	1.00	138.09	0.325	No	No	0.63
253	41.50	194.16	1.65	0.65	0.55	151.10	1.00	151.10	0.401	No	No	0.78
254	41.67	211.21	1.69	0.82	0.57	163.36	1.00	163.36	0.485	No	No	0.95
255	41.83	224.37	1.64	0.74	0.55	174.39	1.00	174.39	0.573	No	No	1.12
256	41.99	228.27	1.56	0.58	0.52	178.93	1.00	178.93	0.613	No	No	1.20
257	42.16	223.98	1.47	0.40	0.48	177.31	1.00	177.31	0.598	No	No	1.17
258	42.32	217.45	1.50	0.42	0.49	171.27	1.00	171.27	0.547	No	No	1.07
259	42.49	212.01	1.53	0.46	0.50	165.91	1.00	165.91	0.505	No	No	0.99
260	42.65	208.26	1.57	0.53	0.52	161.65	1.00	161.65	0.473	No	No	0.93
261	42.81	209.23	1.57	0.52	0.52	162.24	1.00	162.24	0.477	No	No	0.94
262	42.98	211.83	1.56	0.51	0.52	164.16	1.00	164.16	0.491	No	No	0.97
263	43.14	212.02	1.54	0.48	0.51	164.41	1.00	164.41	0.493	No	No	0.97
264	43.31	207.59	1.56	0.49	0.52	160.32	1.00	160.32	0.463	No	No	0.91
265	43.47	201.39	1.60	0.55	0.53	154.24	1.00	154.24	0.421	No	No	0.83
266	43.64	193.86	1.64	0.60	0.55	147.27	1.00	147.27	0.377	No	No	0.75
267	43.80	182.03	1.69	0.66	0.57	136.93	1.00	136.93	0.319	No	No	0.63
268	43.96	169.14	1.72	0.65	0.58	126.37	1.02	129.01	0.280	No	No	0.56
269	44.13	150.61	1.76	0.66	0.59	111.36	1.10	122.77	0.252	No	No	0.50
270	44.29	130.52	1.84	0.73	0.63	94.90	1.20	113.46	0.216	No	No	0.43
271	44.46	107.96	1.97	0.87	0.67	76.61	1.28	98.12	0.168	No	No	0.33
272	44.62	101.29	2.00	0.91	0.69	71.22	1.31	93.18	0.155	No	No	0.31
273	44.78	106.41	1.91	0.70	0.65	75.75	1.25	94.33	0.158	No	No	0.32
274	44.95	114.18	1.78	0.45	0.60	82.93	1.00	82.93	0.133	No	No	0.27
275	45.11	106.04	1.77	0.36	0.60	76.91	1.00	76.91	0.122	No	No	0.25
276	45.28	81.62	1.92	0.45	0.66	57.23	1.00	57.23	0.097	No	No	0.20
277	45.44	55.73	2.20	0.75	0.76	36.82	1.61	59.21	0.099	No	No	0.20
278	45.60	41.29	2.40	1.04	0.84	25.92	2.38	61.59	0.102	No	No	0.20
279	45.77	39.16	2.43	1.06	0.85	24.33	2.52	61.30	0.101	No	No	0.20
280	45.93	38.29	2.44	1.05	0.85	23.66	2.58	60.94	0.101	No	No	0.20
281	46.10	35.64	2.49	1.18	0.88	21.65	2.94	63.62	0.104	No	No	0.21
282	46.26	30.11	2.64	1.57	0.93	17.57	6.88	120.93	0.220	No	No	0.44
283	46.42	31.35	2.62	1.57	0.93	18.36	6.18	113.44	4.000	Yes	No	2.00
284	46.59	35.95	2.52	1.32	0.89	21.59	3.22	69.53	4.000	Yes	No	2.00
285	46.75	44.50	2.35	0.92	0.82	27.85	2.11	58.73	4.000	Yes	No	2.00
286	46.92	50.82	2.28	0.88	0.80	32.32	1.85	59.87	4.000	Yes	No	2.00
287	47.08	49.83	2.32	0.98	0.81	31.40	1.99	62.33	0.103	No	No	0.21
288	47.24	40.54	2.47	1.28	0.87	24.52	2.77	67.92	0.109	No	No	0.22

:: Cyclic Resistance Ratio (CRR) calculation data :: (continued)

Point ID	Depth (ft)	q_t (tsf)	I_c	Fr (%)	n	Q_{tn}	K_c	$Q_{tn,cs}$	$CRR_{7.5}$	Belongs to trans. layer	Clay-like behaviour	FS
289	47.41	28.79	4.06	-350024.05	1.00	15.94	54.25	864.79	0.760	No	Yes	1.55
290	47.57	19.92	4.06	-1060025.09	1.00	10.51	54.25	570.40	0.502	No	Yes	1.02
291	47.74	16.68	4.06	-1958447.55	1.00	8.53	54.25	462.52	0.407	No	Yes	0.83
292	47.90	16.07	4.06	-2049164.33	1.00	8.14	54.25	441.50	0.388	No	Yes	0.79

Abbreviations

Depth: Depth from free surface, at which CPT was performed (ft)
q_t: Total cone resistance
I_c: Soil behavior type index
Fr: Normalized friction ratio (%)
n: Stress exponent
Q_{tn}: Normalized cone resistance
K_c: Cone resistance correction factor due to fines
$Q_{tn,cs}$: Normalized and adjusted cone resistance
$CRR_{7.5}$: Cyclic resistance ratio for M_w=7.5
FS: Factor of safety against soil liquefaction

:: Liquefaction Potential Index calculation data ::

Depth (ft)	FS	F_L	w_z	d_z	LPI	Depth (ft)	FS	F_L	w_z	d_z	LPI
0.16	2.00	0.00	0.00	0.16	0.00	0.33	2.00	0.00	0.00	0.16	0.00
0.49	2.00	0.00	0.00	0.16	0.00	0.66	2.00	0.00	0.00	0.16	0.00
0.82	2.00	0.00	0.00	0.16	0.00	0.98	2.00	0.00	0.00	0.16	0.00
1.15	2.00	0.00	0.00	0.16	0.00	1.31	2.00	0.00	0.00	0.16	0.00
1.48	2.00	0.00	0.00	0.16	0.00	1.64	2.00	0.00	0.00	0.16	0.00
1.80	2.00	0.00	0.00	0.16	0.00	1.97	2.00	0.00	0.00	0.16	0.00
2.13	2.00	0.00	0.00	0.16	0.00	2.30	2.00	0.00	0.00	0.16	0.00
2.46	2.00	0.00	0.00	0.16	0.00	2.62	2.00	0.00	0.00	0.16	0.00
2.79	2.00	0.00	0.00	0.16	0.00	2.95	2.00	0.00	0.00	0.16	0.00
3.12	2.00	0.00	0.00	0.16	0.00	3.28	2.00	0.00	0.00	0.16	0.00
3.44	2.00	0.00	0.00	0.16	0.00	3.61	2.00	0.00	0.00	0.16	0.00
3.77	2.00	0.00	0.00	0.16	0.00	3.94	2.00	0.00	0.00	0.16	0.00
4.10	2.00	0.00	0.00	0.16	0.00	4.27	2.00	0.00	0.00	0.16	0.00
4.43	2.00	0.00	0.00	0.16	0.00	4.59	2.00	0.00	0.00	0.16	0.00
4.76	2.00	0.00	0.00	0.16	0.00	4.92	2.00	0.00	0.00	0.16	0.00
5.09	2.00	0.00	0.00	0.16	0.00	5.25	2.00	0.00	0.00	0.16	0.00
5.41	2.00	0.00	0.00	0.16	0.00	5.58	2.00	0.00	0.00	0.16	0.00
5.74	2.00	0.00	0.00	0.16	0.00	5.91	2.00	0.00	0.00	0.16	0.00
6.07	2.00	0.00	0.00	0.16	0.00	6.23	2.00	0.00	0.00	0.16	0.00
6.40	2.00	0.00	0.00	0.16	0.00	6.56	2.00	0.00	0.00	0.16	0.00
6.73	2.00	0.00	0.00	0.16	0.00	6.89	2.00	0.00	0.00	0.16	0.00
7.05	2.00	0.00	0.00	0.16	0.00	7.22	2.00	0.00	0.00	0.16	0.00
7.38	2.00	0.00	0.00	0.16	0.00	7.55	2.00	0.00	0.00	0.16	0.00
7.71	2.00	0.00	0.00	0.16	0.00	7.87	2.00	0.00	0.00	0.16	0.00
8.04	2.00	0.00	0.00	0.16	0.00	8.20	2.00	0.00	0.00	0.16	0.00
8.37	2.00	0.00	0.00	0.16	0.00	8.53	2.00	0.00	0.00	0.16	0.00
8.69	2.00	0.00	0.00	0.16	0.00	8.86	2.00	0.00	0.00	0.16	0.00
9.02	2.00	0.00	0.00	0.16	0.00	9.19	2.00	0.00	0.00	0.16	0.00
9.35	2.00	0.00	0.00	0.16	0.00	9.51	2.00	0.00	0.00	0.16	0.00
9.68	2.00	0.00	0.00	0.16	0.00	9.84	2.00	0.00	0.00	0.16	0.00
10.01	0.39	0.61	0.38	0.16	0.26	10.17	0.36	0.64	0.36	0.16	0.27
10.33	0.34	0.66	0.35	0.16	0.28	10.50	0.34	0.66	0.34	0.16	0.28
10.66	0.34	0.66	0.34	0.16	0.28	10.83	0.33	0.67	0.34	0.16	0.28
10.99	0.33	0.67	0.34	0.16	0.28	11.15	0.32	0.68	0.33	0.16	0.28
11.32	0.33	0.67	0.34	0.16	0.28	11.48	0.34	0.66	0.34	0.16	0.27
11.65	0.34	0.66	0.34	0.16	0.27	11.81	0.32	0.68	0.33	0.16	0.28
11.98	0.32	0.68	0.33	0.16	0.28	12.14	0.32	0.68	0.33	0.16	0.28
12.30	0.33	0.67	0.34	0.16	0.27	12.47	2.00	0.00	0.00	0.16	0.00
12.63	2.00	0.00	0.00	0.16	0.00	12.80	2.00	0.00	0.00	0.16	0.00
12.96	2.00	0.00	0.00	0.16	0.00	13.12	1.82	0.00	0.00	0.16	0.00
13.29	1.58	0.00	0.00	0.16	0.00	13.45	1.53	0.00	0.00	0.16	0.00
13.62	1.54	0.00	0.00	0.16	0.00	13.78	1.57	0.00	0.00	0.16	0.00
13.94	1.57	0.00	0.00	0.16	0.00	14.11	1.54	0.00	0.00	0.16	0.00
14.27	1.49	0.00	0.00	0.16	0.00	14.44	1.45	0.00	0.00	0.16	0.00
14.60	1.36	0.00	0.00	0.16	0.00	14.76	1.26	0.00	0.00	0.16	0.00
14.93	1.43	0.00	0.00	0.16	0.00	15.09	2.00	0.00	0.00	0.16	0.00
15.26	2.00	0.00	0.00	0.16	0.00	15.42	2.00	0.00	0.00	0.16	0.00
15.58	2.00	0.00	0.00	0.16	0.00	15.75	2.00	0.00	0.00	0.16	0.00

:: Liquefaction Potential Index calculation data :: (continued)

Depth (ft)	FS	F_L	w_z	d_z	LPI	Depth (ft)	FS	F_L	w_z	d_z	LPI
15.91	2.00	0.00	0.00	0.16	0.00	16.08	2.00	0.00	0.00	0.16	0.00
16.24	2.00	0.00	0.00	0.16	0.00	16.40	2.00	0.00	0.00	0.16	0.00
16.57	2.00	0.00	0.00	0.16	0.00	16.73	2.00	0.00	0.00	0.16	0.00
16.90	1.51	0.00	0.00	0.16	0.00	17.06	1.39	0.00	0.00	0.16	0.00
17.22	1.37	0.00	0.00	0.16	0.00	17.39	1.35	0.00	0.00	0.16	0.00
17.55	1.32	0.00	0.00	0.16	0.00	17.72	1.27	0.00	0.00	0.16	0.00
17.88	1.23	0.00	0.00	0.16	0.00	18.04	1.19	0.00	0.00	0.16	0.00
18.21	1.14	0.00	0.00	0.16	0.00	18.37	1.07	0.00	0.00	0.16	0.00
18.54	1.00	0.00	0.00	0.16	0.00	18.70	0.97	0.00	0.00	0.16	0.01
18.86	1.00	0.00	0.00	0.16	0.00	19.03	1.07	0.00	0.00	0.16	0.00
19.19	1.13	0.00	0.00	0.16	0.00	19.36	1.16	0.00	0.00	0.16	0.00
19.52	1.11	0.00	0.00	0.16	0.00	19.69	1.04	0.00	0.00	0.16	0.00
19.85	0.89	0.00	0.00	0.16	0.04	20.01	0.73	0.00	0.00	0.16	0.09
20.18	0.67	0.33	0.80	0.16	0.12	20.34	0.72	0.00	0.00	0.16	0.10
20.51	0.83	0.00	0.00	0.16	0.06	20.67	0.89	0.00	0.00	0.16	0.04
20.83	0.95	0.00	0.00	0.16	0.02	21.00	1.04	0.00	0.00	0.16	0.00
21.16	1.31	0.00	0.00	0.16	0.00	21.33	1.35	0.00	0.00	0.16	0.00
21.49	1.23	0.00	0.00	0.16	0.00	21.65	0.93	0.00	0.00	0.16	0.02
21.82	0.83	0.00	0.00	0.16	0.06	21.98	0.86	0.00	0.00	0.16	0.05
22.15	0.88	0.00	0.00	0.16	0.04	22.31	0.90	0.00	0.00	0.16	0.03
22.47	0.91	0.00	0.00	0.16	0.03	22.64	0.88	0.00	0.00	0.16	0.04
22.80	0.79	0.00	0.00	0.16	0.07	22.97	0.70	0.30	0.91	0.16	0.10
23.13	0.67	0.33	0.82	0.16	0.11	23.29	0.70	0.30	0.93	0.16	0.10
23.46	0.73	0.00	0.00	0.16	0.09	23.62	0.77	0.00	0.00	0.16	0.07
23.79	0.83	0.00	0.00	0.16	0.05	23.95	0.91	0.00	0.00	0.16	0.03
24.11	0.95	0.00	0.00	0.16	0.01	24.28	0.97	0.00	0.00	0.16	0.01
24.44	1.00	0.00	0.00	0.16	0.00	24.61	1.02	0.00	0.00	0.16	0.00
24.77	1.02	0.00	0.00	0.16	0.00	24.93	1.00	0.00	0.00	0.16	0.00
25.10	0.95	0.00	0.00	0.16	0.01	25.26	0.94	0.00	0.00	0.16	0.02
25.43	0.93	0.00	0.00	0.16	0.02	25.59	0.94	0.00	0.00	0.16	0.02
25.75	0.96	0.00	0.00	0.16	0.01	25.92	0.96	0.00	0.00	0.16	0.01
26.08	0.96	0.00	0.00	0.16	0.01	26.25	0.97	0.00	0.00	0.16	0.01
26.41	1.05	0.00	0.00	0.16	0.00	26.57	1.17	0.00	0.00	0.16	0.00
26.74	1.18	0.00	0.00	0.16	0.00	26.90	1.12	0.00	0.00	0.16	0.00
27.07	1.24	0.00	0.00	0.16	0.00	27.23	1.73	0.00	0.00	0.16	0.00
27.40	0.57	0.43	0.58	0.16	0.13	27.56	0.72	0.00	0.00	0.16	0.08
27.72	1.52	0.00	0.00	0.16	0.00	27.89	1.10	0.00	0.00	0.16	0.00
28.05	0.88	0.00	0.00	0.16	0.03	28.22	0.84	0.00	0.00	0.16	0.05
28.38	0.81	0.00	0.00	0.16	0.05	28.54	0.78	0.00	0.00	0.16	0.06
28.71	0.77	0.00	0.00	0.16	0.07	28.87	0.76	0.00	0.00	0.16	0.07
29.04	0.74	0.00	0.00	0.16	0.07	29.20	0.73	0.00	0.00	0.16	0.07
29.36	0.73	0.00	0.00	0.16	0.07	29.53	0.74	0.00	0.00	0.16	0.07
29.69	0.76	0.00	0.00	0.16	0.07	29.86	0.78	0.00	0.00	0.16	0.06
30.02	0.87	0.00	0.00	0.16	0.03	30.18	0.94	0.00	0.00	0.16	0.02
30.35	0.96	0.00	0.00	0.16	0.01	30.51	0.89	0.00	0.00	0.16	0.03
30.68	0.82	0.00	0.00	0.16	0.05	30.84	0.77	0.00	0.00	0.16	0.06
31.00	0.77	0.00	0.00	0.16	0.06	31.17	0.86	0.00	0.00	0.16	0.04
31.33	0.94	0.00	0.00	0.16	0.02	31.50	2.00	0.00	0.00	0.16	0.00

:: Liquefaction Potential Index calculation data :: (continued)

Depth (ft)	FS	F_L	w_z	d_z	LPI	Depth (ft)	FS	F_L	w_z	d_z	LPI
31.66	2.00	0.00	0.00	0.16	0.00	31.82	2.00	0.00	0.00	0.16	0.00
31.99	2.00	0.00	0.00	0.16	0.00	32.15	0.18	0.82	0.27	0.16	0.21
32.32	0.18	0.82	0.27	0.16	0.21	32.48	0.19	0.81	0.27	0.16	0.20
32.64	0.21	0.79	0.28	0.16	0.20	32.81	0.23	0.77	0.29	0.16	0.19
32.97	0.31	0.69	0.33	0.16	0.17	33.14	1.01	0.00	0.00	0.16	0.00
33.30	0.92	0.00	0.00	0.16	0.02	33.46	2.00	0.00	0.00	0.16	0.00
33.63	2.00	0.00	0.00	0.16	0.00	33.79	2.00	0.00	0.00	0.16	0.00
33.96	2.00	0.00	0.00	0.16	0.00	34.12	0.18	0.82	0.27	0.16	0.20
34.28	1.04	0.00	0.00	0.16	0.00	34.45	0.74	0.00	0.00	0.16	0.06
34.61	0.61	0.39	0.65	0.16	0.09	34.78	0.54	0.46	0.53	0.16	0.11
34.94	0.51	0.49	0.49	0.16	0.11	35.10	0.51	0.49	0.49	0.16	0.11
35.27	0.53	0.47	0.52	0.16	0.11	35.43	0.53	0.47	0.51	0.16	0.11
35.60	0.52	0.48	0.50	0.16	0.11	35.76	0.49	0.51	0.47	0.16	0.12
35.93	0.49	0.51	0.47	0.16	0.11	36.09	0.53	0.47	0.51	0.16	0.11
36.25	0.59	0.41	0.61	0.16	0.09	36.42	0.64	0.36	0.73	0.16	0.08
36.58	0.67	0.33	0.79	0.16	0.07	36.75	0.71	0.29	0.97	0.16	0.06
36.91	0.75	0.00	0.00	0.16	0.05	37.07	0.82	0.00	0.00	0.16	0.04
37.24	0.87	0.00	0.00	0.16	0.03	37.40	0.95	0.00	0.00	0.16	0.01
37.57	0.99	0.00	0.00	0.16	0.00	37.73	0.98	0.00	0.00	0.16	0.00
37.89	0.95	0.00	0.00	0.16	0.01	38.06	0.97	0.00	0.00	0.16	0.01
38.22	1.00	0.00	0.00	0.16	0.00	38.39	1.04	0.00	0.00	0.16	0.00
38.55	1.07	0.00	0.00	0.16	0.00	38.71	1.16	0.00	0.00	0.16	0.00
38.88	1.28	0.00	0.00	0.16	0.00	39.04	1.42	0.00	0.00	0.16	0.00
39.21	1.50	0.00	0.00	0.16	0.00	39.37	1.49	0.00	0.00	0.16	0.00
39.53	1.45	0.00	0.00	0.16	0.00	39.70	1.43	0.00	0.00	0.16	0.00
39.86	2.00	0.00	0.00	0.16	0.00	40.03	2.00	0.00	0.00	0.16	0.00
40.19	2.00	0.00	0.00	0.16	0.00	40.35	2.00	0.00	0.00	0.16	0.00
40.52	2.00	0.00	0.00	0.16	0.00	40.68	2.00	0.00	0.00	0.16	0.00
40.85	2.00	0.00	0.00	0.16	0.00	41.01	2.00	0.00	0.00	0.16	0.00
41.17	0.47	0.53	0.45	0.16	0.10	41.34	0.63	0.37	0.70	0.16	0.07
41.50	0.78	0.00	0.00	0.16	0.04	41.67	0.95	0.00	0.00	0.16	0.01
41.83	1.12	0.00	0.00	0.16	0.00	41.99	1.20	0.00	0.00	0.16	0.00
42.16	1.17	0.00	0.00	0.16	0.00	42.32	1.07	0.00	0.00	0.16	0.00
42.49	0.99	0.00	0.00	0.16	0.00	42.65	0.93	0.00	0.00	0.16	0.01
42.81	0.94	0.00	0.00	0.16	0.01	42.98	0.97	0.00	0.00	0.16	0.01
43.14	0.97	0.00	0.00	0.16	0.00	43.31	0.91	0.00	0.00	0.16	0.01
43.47	0.83	0.00	0.00	0.16	0.03	43.64	0.75	0.00	0.00	0.16	0.04
43.80	0.63	0.37	0.70	0.16	0.06	43.96	0.56	0.44	0.55	0.16	0.07
44.13	0.50	0.50	0.48	0.16	0.08	44.29	0.43	0.57	0.41	0.16	0.09
44.46	0.33	0.67	0.34	0.16	0.11	44.62	0.31	0.69	0.33	0.16	0.11
44.78	0.32	0.68	0.33	0.16	0.11	44.95	0.27	0.73	0.31	0.16	0.12
45.11	0.25	0.75	0.30	0.16	0.12	45.28	0.20	0.80	0.28	0.16	0.12
45.44	0.20	0.80	0.28	0.16	0.12	45.60	0.20	0.80	0.28	0.16	0.12
45.77	0.20	0.80	0.28	0.16	0.12	45.93	0.20	0.80	0.28	0.16	0.12
46.10	0.21	0.79	0.28	0.16	0.12	46.26	0.44	0.56	0.42	0.16	0.08
46.42	2.00	0.00	0.00	0.16	0.00	46.59	2.00	0.00	0.00	0.16	0.00
46.75	2.00	0.00	0.00	0.16	0.00	46.92	2.00	0.00	0.00	0.16	0.00
47.08	0.21	0.79	0.28	0.16	0.11	47.24	0.22	0.78	0.29	0.16	0.11

:: Liquefaction Potential Index calculation data :: (continued)

Depth (ft)	FS	F_L	w_z	d_z	LPI	Depth (ft)	FS	F_L	w_z	d_z	LPI
47.41	1.55	0.00	0.00	0.16	0.00	47.57	1.02	0.00	0.00	0.16	0.00
47.74	0.83	0.00	0.00	0.16	0.02	47.90	0.79	0.00	0.00	0.16	0.03

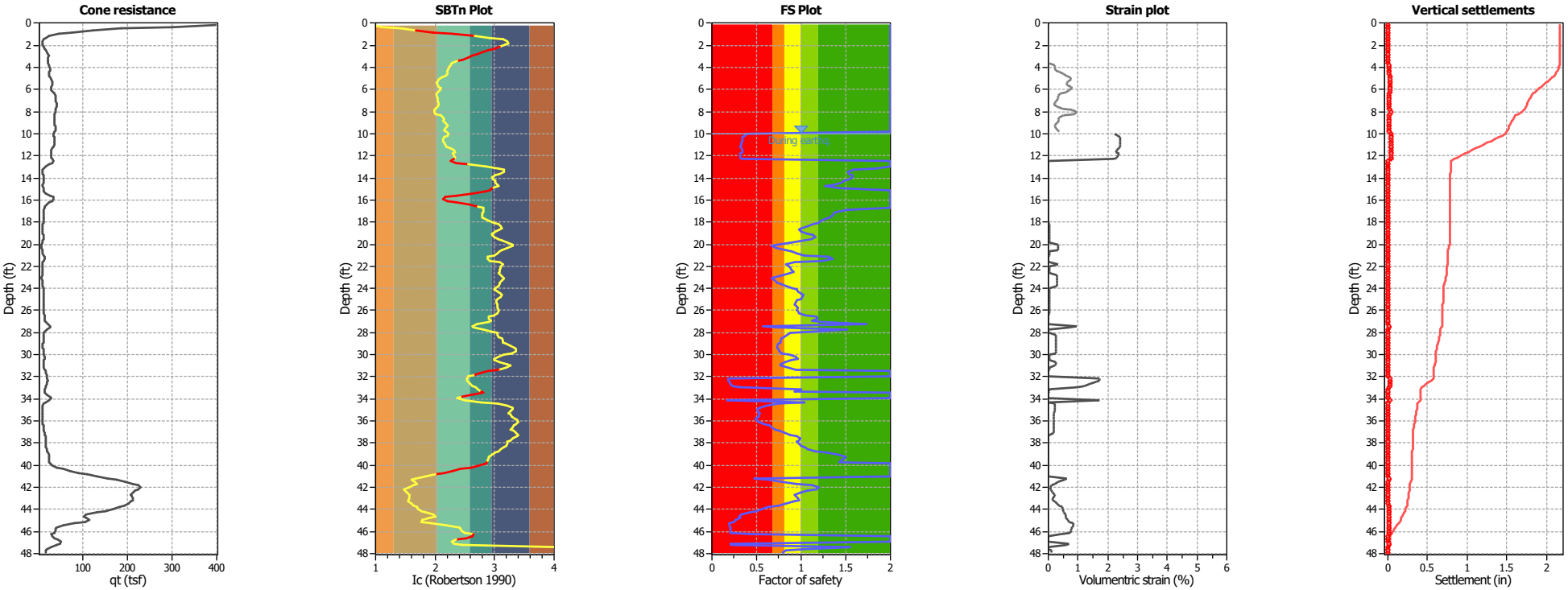
Overall liquefaction potential: 12.19

LPI = 0.00 - Liquefaction risk very low
LPI between 0.00 and 5.00 - Liquefaction risk low
LPI between 5.00 and 15.00 - Liquefaction risk high
LPI > 15.00 - Liquefaction risk very high

Abbreviations

FS: Calculated factor of safety for test point
F_L: 1 - FS
w_z: Function value of the extend of soil liquefaction according to depth
d_z: Layer thickness (ft)
LPI: Liquefaction potential index value for test point

Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

:: 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)
0.16	0.94	751.20	1.00	751.20	111	1177	0.35	0.000	0.00	9.56	0.00	0.000
0.33	1.11	569.75	1.00	569.75	88	1112	0.35	0.001	0.00	9.56	0.00	0.000
0.49	1.42	350.87	1.00	350.87	60	1003	0.35	0.002	0.00	9.56	0.00	0.000
0.66	1.67	231.31	1.00	231.31	43	917	0.35	0.002	0.00	9.56	0.00	0.000
0.82	1.97	143.90	1.28	184.90	0	0	0.35	0.000	0.00	0.00	0.00	0.000
0.98	2.29	87.79	1.87	164.56	0	0	0.35	0.000	0.00	0.00	0.00	0.000
1.15	2.67	48.02	4.41	211.63	0	0	0.35	0.000	0.00	0.00	0.00	0.000
1.31	2.92	32.98	7.43	244.97	0	0	0.35	0.000	0.00	0.00	0.00	0.000
1.48	3.14	23.03	11.39	262.39	0	0	0.35	0.000	0.00	0.00	0.00	0.000
1.64	3.21	20.11	13.01	261.63	0	0	0.35	0.000	0.00	0.00	0.00	0.000
1.80	3.22	18.63	13.31	247.88	0	0	0.35	0.000	0.00	0.00	0.00	0.000
1.97	3.18	19.45	12.20	237.31	0	0	0.35	0.000	0.00	0.00	0.00	0.000
2.13	3.08	22.52	10.32	232.39	0	0	0.35	0.000	0.00	0.00	0.00	0.000
2.30	2.99	27.39	8.69	238.06	0	0	0.35	0.000	0.00	0.00	0.00	0.000
2.46	2.90	32.89	7.20	236.90	0	0	0.35	0.000	0.00	0.00	0.00	0.000
2.62	2.80	38.34	5.87	224.85	0	0	0.35	0.000	0.00	0.00	0.00	0.000
2.79	2.71	42.41	4.80	203.70	0	0	0.35	0.000	0.00	0.00	0.00	0.000
2.95	2.63	43.86	4.01	176.02	0	0	0.35	0.000	0.00	0.00	0.00	0.000
3.12	2.56	42.75	3.43	146.64	0	0	0.35	0.000	0.00	0.00	0.00	0.000
3.28	2.47	41.71	2.78	115.96	0	0	0.35	0.000	0.00	0.00	0.00	0.000
3.44	2.37	41.95	2.21	92.56	0	0	0.35	0.000	0.00	0.00	0.00	0.000
3.61	2.29	43.29	1.88	81.39	0	0	0.35	0.000	0.00	0.00	0.00	0.000
3.77	2.26	45.28	1.77	80.21	19	375	0.35	0.259	0.28	9.56	0.22	0.009
3.94	2.24	47.46	1.73	82.17	19	387	0.35	0.247	0.26	9.56	0.20	0.008
4.10	2.23	48.96	1.69	82.55	19	391	0.35	0.257	0.28	9.56	0.21	0.008
4.27	2.21	48.79	1.65	80.32	18	383	0.35	0.316	0.35	9.56	0.27	0.011
4.43	2.21	47.21	1.64	77.43	18	369	0.35	0.418	0.49	9.56	0.37	0.015
4.59	2.21	45.88	1.63	74.68	17	357	0.35	0.555	0.68	9.56	0.51	0.020
4.76	2.18	46.77	1.56	73.03	16	351	0.35	0.667	0.85	9.56	0.64	0.025
4.92	2.12	50.19	1.45	72.88	16	351	0.35	0.734	0.97	9.56	0.72	0.028
5.09	2.07	54.21	1.37	74.39	16	353	0.35	0.776	1.02	9.56	0.76	0.030
5.25	2.03	58.07	1.34	77.72	16	363	0.35	0.711	0.90	9.56	0.67	0.026
5.41	2.02	59.98	1.33	79.73	17	371	0.35	0.686	0.85	9.56	0.63	0.025
5.58	2.04	59.71	1.34	80.17	17	376	0.35	0.692	0.85	9.56	0.62	0.025
5.74	2.07	56.50	1.38	77.79	17	369	0.35	0.826	1.03	9.56	0.76	0.030
5.91	2.10	54.59	1.42	77.39	17	371	0.35	0.872	1.08	9.56	0.79	0.031
6.07	2.09	57.00	1.40	79.70	17	381	0.35	0.809	0.97	9.56	0.71	0.028
6.23	2.04	63.03	1.34	84.68	18	397	0.35	0.684	0.78	9.56	0.57	0.022
6.40	2.02	67.56	1.32	89.29	19	422	0.35	0.522	0.57	9.56	0.41	0.016
6.56	2.02	68.93	1.33	91.55	19	440	0.35	0.450	0.47	9.56	0.34	0.013
6.73	2.04	68.67	1.34	92.28	20	451	0.35	0.421	0.43	9.56	0.31	0.012
6.89	2.04	67.99	1.34	91.19	19	452	0.35	0.443	0.46	9.56	0.33	0.013
7.05	2.05	69.72	1.35	94.18	20	475	0.35	0.368	0.37	9.56	0.27	0.010
7.22	2.06	71.13	1.36	96.91	21	496	0.35	0.316	0.30	9.56	0.22	0.009
7.38	2.07	71.17	1.38	97.98	21	509	0.35	0.296	0.28	9.56	0.20	0.008
7.55	2.04	68.56	1.35	92.39	20	486	0.35	0.391	0.40	9.56	0.29	0.011
7.71	2.01	65.18	1.31	85.64	18	453	0.35	0.593	0.68	9.56	0.48	0.019
7.87	1.98	62.04	1.29	80.11	17	425	0.35	0.893	1.12	9.56	0.79	0.031

:: 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)
8.04	1.99	59.94	1.30	77.75	16	419	0.35	1.033	1.34	9.56	0.94	0.037
8.20	2.01	59.10	1.32	77.90	16	428	0.35	0.962	1.23	9.56	0.87	0.034
8.37	2.09	58.99	1.41	82.99	18	466	0.35	0.628	0.72	9.56	0.50	0.020
8.53	2.13	58.77	1.47	86.56	19	490	0.35	0.511	0.54	9.56	0.38	0.015
8.69	2.15	58.58	1.50	88.12	19	503	0.35	0.471	0.49	9.56	0.34	0.013
8.86	2.14	58.38	1.49	86.90	19	503	0.35	0.492	0.52	9.56	0.36	0.014
9.02	2.18	58.31	1.56	91.16	20	528	0.35	0.408	0.40	9.56	0.28	0.011
9.19	2.21	58.34	1.65	96.14	22	553	0.35	0.341	0.31	9.56	0.21	0.008
9.35	2.21	58.81	1.63	96.15	22	562	0.35	0.331	0.30	9.56	0.21	0.008
9.51	2.16	59.40	1.53	90.90	20	549	0.35	0.386	0.38	9.56	0.26	0.010
9.68	2.15	58.15	1.51	87.56	19	537	0.35	0.448	0.47	9.56	0.32	0.013
9.84	2.19	53.90	1.60	86.05	19	526	0.35	0.522	0.54	9.56	0.37	0.015

Total estimated settlement: 0.68

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)
10.01	83.79	0.39	2.24	0.83	0.04	10.17	79.65	0.36	2.33	0.83	0.05
10.33	75.38	0.34	2.43	0.82	0.05	10.50	75.69	0.34	2.41	0.82	0.05
10.66	76.00	0.34	2.40	0.82	0.05	10.83	75.55	0.33	2.40	0.82	0.05
10.99	74.55	0.33	2.42	0.81	0.05	11.15	74.19	0.32	2.42	0.81	0.05
11.32	75.69	0.33	2.37	0.81	0.05	11.48	78.56	0.34	2.29	0.81	0.05
11.65	79.07	0.34	2.27	0.80	0.04	11.81	74.72	0.32	2.37	0.80	0.05
11.98	75.56	0.32	2.34	0.80	0.05	12.14	76.45	0.32	2.31	0.79	0.05
12.30	79.85	0.33	2.22	0.79	0.04	12.47	78.29	2.00	0.00	0.79	0.00
12.63	83.89	2.00	0.00	0.79	0.00	12.80	122.19	2.00	0.00	0.78	0.00
12.96	132.11	2.00	0.00	0.78	0.00	13.12	152.92	1.82	0.00	0.78	0.00
13.29	154.49	1.58	0.01	0.77	0.00	13.45	150.46	1.53	0.01	0.77	0.00
13.62	133.54	1.54	0.01	0.77	0.00	13.78	120.60	1.57	0.01	0.77	0.00
13.94	109.28	1.57	0.01	0.76	0.00	14.11	110.48	1.54	0.01	0.76	0.00
14.27	113.35	1.49	0.01	0.76	0.00	14.44	114.23	1.45	0.01	0.76	0.00
14.60	113.23	1.36	0.01	0.75	0.00	14.76	109.26	1.26	0.02	0.75	0.00
14.93	99.82	1.43	0.01	0.75	0.00	15.09	92.83	2.00	0.00	0.74	0.00
15.26	89.05	2.00	0.00	0.74	0.00	15.42	118.50	2.00	0.00	0.74	0.00
15.58	61.06	2.00	0.00	0.74	0.00	15.75	55.68	2.00	0.00	0.73	0.00
15.91	55.06	2.00	0.00	0.73	0.00	16.08	55.03	2.00	0.00	0.73	0.00
16.24	58.31	2.00	0.00	0.72	0.00	16.40	94.75	2.00	0.00	0.72	0.00
16.57	83.68	2.00	0.00	0.72	0.00	16.73	88.57	2.00	0.00	0.72	0.00
16.90	83.19	1.51	0.01	0.71	0.00	17.06	77.99	1.39	0.01	0.71	0.00
17.22	73.90	1.37	0.01	0.71	0.00	17.39	71.56	1.35	0.01	0.71	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)
17.55	71.61	1.32	0.01	0.70	0.00	17.72	73.44	1.27	0.01	0.70	0.00
17.88	85.02	1.23	0.02	0.70	0.00	18.04	97.11	1.19	0.02	0.69	0.00
18.21	108.80	1.14	0.02	0.69	0.00	18.37	109.19	1.07	0.03	0.69	0.00
18.54	105.95	1.00	0.04	0.69	0.00	18.70	95.31	0.97	0.04	0.68	0.00
18.86	87.00	1.00	0.03	0.68	0.00	19.03	82.54	1.07	0.03	0.68	0.00
19.19	89.35	1.13	0.02	0.67	0.00	19.36	98.61	1.16	0.02	0.67	0.00
19.52	108.12	1.11	0.02	0.67	0.00	19.69	112.88	1.04	0.03	0.67	0.00
19.85	114.52	0.89	0.05	0.66	0.00	20.01	109.05	0.73	0.33	0.66	0.01
20.18	101.38	0.67	0.33	0.66	0.01	20.34	94.02	0.72	0.33	0.66	0.01
20.51	90.76	0.83	0.33	0.65	0.01	20.67	89.60	0.89	0.05	0.65	0.00
20.83	90.05	0.95	0.04	0.65	0.00	21.00	91.27	1.04	0.03	0.64	0.00
21.16	92.31	1.31	0.01	0.64	0.00	21.33	93.16	1.35	0.01	0.64	0.00
21.49	93.92	1.23	0.01	0.64	0.00	21.65	95.90	0.93	0.04	0.63	0.00
21.82	95.94	0.83	0.32	0.63	0.01	21.98	94.41	0.86	0.05	0.63	0.00
22.15	94.52	0.88	0.04	0.62	0.00	22.31	94.90	0.90	0.04	0.62	0.00
22.47	96.76	0.91	0.04	0.62	0.00	22.64	91.36	0.88	0.04	0.62	0.00
22.80	87.50	0.79	0.31	0.61	0.01	22.97	82.88	0.70	0.31	0.61	0.01
23.13	81.33	0.67	0.30	0.61	0.01	23.29	78.79	0.70	0.30	0.61	0.01
23.46	78.46	0.73	0.30	0.60	0.01	23.62	82.13	0.77	0.30	0.60	0.01
23.79	85.94	0.83	0.30	0.60	0.01	23.95	85.08	0.91	0.04	0.59	0.00
24.11	87.11	0.95	0.03	0.59	0.00	24.28	98.34	0.97	0.03	0.59	0.00
24.44	112.48	1.00	0.02	0.59	0.00	24.61	119.29	1.02	0.02	0.58	0.00
24.77	114.24	1.02	0.02	0.58	0.00	24.93	102.45	1.00	0.02	0.58	0.00
25.10	94.37	0.95	0.03	0.57	0.00	25.26	91.62	0.94	0.03	0.57	0.00
25.43	94.79	0.93	0.03	0.57	0.00	25.59	97.14	0.94	0.03	0.57	0.00
25.75	98.99	0.96	0.03	0.56	0.00	25.92	99.92	0.96	0.03	0.56	0.00
26.08	100.82	0.96	0.03	0.56	0.00	26.25	99.99	0.97	0.02	0.56	0.00
26.41	96.82	1.05	0.02	0.55	0.00	26.57	92.01	1.17	0.01	0.55	0.00
26.74	92.93	1.18	0.01	0.55	0.00	26.90	94.44	1.12	0.01	0.54	0.00
27.07	95.36	1.24	0.01	0.54	0.00	27.23	89.13	1.73	0.00	0.54	0.00
27.40	138.02	0.57	0.96	0.54	0.02	27.56	152.25	0.72	0.72	0.53	0.01
27.72	96.80	1.52	0.00	0.53	0.00	27.89	97.03	1.10	0.01	0.53	0.00
28.05	90.57	0.88	0.03	0.52	0.00	28.22	86.87	0.84	0.26	0.52	0.01
28.38	87.78	0.81	0.26	0.52	0.01	28.54	94.02	0.78	0.26	0.52	0.01
28.71	94.95	0.77	0.26	0.51	0.01	28.87	95.86	0.76	0.26	0.51	0.01
29.04	102.61	0.74	0.25	0.51	0.00	29.20	114.98	0.73	0.25	0.51	0.00
29.36	128.79	0.73	0.25	0.50	0.00	29.53	137.67	0.74	0.25	0.50	0.00
29.69	137.02	0.76	0.25	0.50	0.00	29.86	126.94	0.78	0.25	0.49	0.00
30.02	112.62	0.87	0.03	0.49	0.00	30.18	100.59	0.94	0.02	0.49	0.00
30.35	91.74	0.96	0.02	0.49	0.00	30.51	84.96	0.89	0.03	0.48	0.00
30.68	93.13	0.82	0.24	0.48	0.00	30.84	108.99	0.77	0.24	0.48	0.00
31.00	120.94	0.77	0.24	0.47	0.00	31.17	118.24	0.86	0.03	0.47	0.00
31.33	104.02	0.94	0.02	0.47	0.00	31.50	85.50	2.00	0.00	0.47	0.00
31.66	68.82	2.00	0.00	0.46	0.00	31.82	98.03	2.00	0.00	0.46	0.00
31.99	64.46	2.00	0.00	0.46	0.00	32.15	55.65	0.18	1.72	0.46	0.03
32.32	55.92	0.18	1.70	0.45	0.03	32.48	59.99	0.19	1.60	0.45	0.03
32.64	69.50	0.21	1.41	0.45	0.03	32.81	83.17	0.23	1.21	0.44	0.02
32.97	103.74	0.31	1.00	0.44	0.02	33.14	54.38	1.01	0.02	0.44	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)
33.30	56.80	0.92	0.02	0.44	0.00	33.46	58.82	2.00	0.00	0.43	0.00
33.63	82.85	2.00	0.00	0.43	0.00	33.79	49.45	2.00	0.00	0.43	0.00
33.96	48.46	2.00	0.00	0.42	0.00	34.12	51.16	0.18	1.71	0.42	0.03
34.28	62.99	1.04	0.01	0.42	0.00	34.45	78.23	0.74	0.21	0.42	0.00
34.61	86.46	0.61	0.21	0.41	0.00	34.78	90.49	0.54	0.21	0.41	0.00
34.94	86.11	0.51	0.20	0.41	0.00	35.10	82.12	0.51	0.20	0.41	0.00
35.27	80.45	0.53	0.20	0.40	0.00	35.43	83.23	0.53	0.20	0.40	0.00
35.60	86.14	0.52	0.20	0.40	0.00	35.76	89.44	0.49	0.20	0.39	0.00
35.93	94.44	0.49	0.20	0.39	0.00	36.09	104.27	0.53	0.19	0.39	0.00
36.25	110.64	0.59	0.19	0.39	0.00	36.42	112.45	0.64	0.19	0.38	0.00
36.58	113.38	0.67	0.19	0.38	0.00	36.75	113.76	0.71	0.19	0.38	0.00
36.91	132.85	0.75	0.19	0.37	0.00	37.07	154.12	0.82	0.19	0.37	0.00
37.24	175.18	0.87	0.02	0.37	0.00	37.40	182.17	0.95	0.02	0.37	0.00
37.57	167.59	0.99	0.01	0.36	0.00	37.73	153.72	0.98	0.01	0.36	0.00
37.89	138.17	0.95	0.02	0.36	0.00	38.06	140.55	0.97	0.01	0.35	0.00
38.22	139.30	1.00	0.01	0.35	0.00	38.39	134.42	1.04	0.01	0.35	0.00
38.55	127.27	1.07	0.01	0.35	0.00	38.71	127.33	1.16	0.01	0.34	0.00
38.88	125.17	1.28	0.00	0.34	0.00	39.04	126.66	1.42	0.00	0.34	0.00
39.21	119.29	1.50	0.00	0.34	0.00	39.37	115.95	1.49	0.00	0.33	0.00
39.53	108.84	1.45	0.00	0.33	0.00	39.70	106.44	1.43	0.00	0.33	0.00
39.86	110.41	2.00	0.00	0.32	0.00	40.03	108.70	2.00	0.00	0.32	0.00
40.19	159.57	2.00	0.00	0.32	0.00	40.35	100.79	2.00	0.00	0.32	0.00
40.52	98.24	2.00	0.00	0.31	0.00	40.68	97.67	2.00	0.00	0.31	0.00
40.85	107.76	2.00	0.00	0.31	0.00	41.01	119.57	2.00	0.00	0.30	0.00
41.17	120.78	0.47	0.60	0.30	0.01	41.34	138.09	0.63	0.54	0.30	0.01
41.50	151.10	0.78	0.33	0.30	0.01	41.67	163.36	0.95	0.22	0.29	0.00
41.83	174.39	1.12	0.11	0.29	0.00	41.99	178.93	1.20	0.08	0.29	0.00
42.16	177.31	1.17	0.08	0.29	0.00	42.32	171.27	1.07	0.11	0.28	0.00
42.49	165.91	0.99	0.15	0.28	0.00	42.65	161.65	0.93	0.21	0.28	0.00
42.81	162.24	0.94	0.21	0.27	0.00	42.98	164.16	0.97	0.15	0.27	0.00
43.14	164.41	0.97	0.15	0.27	0.00	43.31	160.32	0.91	0.21	0.27	0.00
43.47	154.24	0.83	0.28	0.26	0.01	43.64	147.27	0.75	0.37	0.26	0.01
43.80	136.93	0.63	0.47	0.26	0.01	43.96	129.01	0.56	0.48	0.25	0.01
44.13	122.77	0.50	0.50	0.25	0.01	44.29	113.46	0.43	0.53	0.25	0.01
44.46	98.12	0.33	0.59	0.25	0.01	44.62	93.18	0.31	0.60	0.24	0.01
44.78	94.33	0.32	0.59	0.24	0.01	44.95	82.93	0.27	0.65	0.24	0.01
45.11	76.91	0.25	0.68	0.24	0.01	45.28	57.23	0.20	0.86	0.23	0.02
45.44	59.21	0.20	0.83	0.23	0.02	45.60	61.59	0.20	0.79	0.23	0.02
45.77	61.30	0.20	0.78	0.22	0.02	45.93	60.94	0.20	0.78	0.22	0.02
46.10	63.62	0.21	0.74	0.22	0.01	46.26	120.93	0.44	0.43	0.22	0.01
46.42	113.44	2.00	0.00	0.21	0.00	46.59	69.53	2.00	0.00	0.21	0.00
46.75	58.73	2.00	0.00	0.21	0.00	46.92	59.87	2.00	0.00	0.20	0.00
47.08	62.33	0.21	0.70	0.20	0.01	47.24	67.92	0.22	0.64	0.20	0.01
47.41	864.79	1.55	0.00	0.20	0.00	47.57	570.40	1.02	0.01	0.19	0.00
47.74	462.52	0.83	0.10	0.19	0.00	47.90	441.50	0.79	0.09	0.19	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: 1.48

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

:: Strength loss calculation (Robertson (2009) ::

Depth (ft)	q_t (tsf)	Q_{tn}	K_c	$Q_{tn,cs}$	I_c	$S_{u(liq)}/\sigma'_v$	$S_{u(peak)}/\sigma'_v$
0.16	397.44	751.20	1.00	751.20	0.94	1.22	1.22
0.33	301.45	569.75	1.00	569.75	1.11	1.14	1.14
0.49	185.66	350.87	1.00	350.87	1.42	1.02	1.02
0.66	122.41	231.31	1.00	231.31	1.67	0.92	0.92
0.82	76.18	143.90	1.28	184.90	1.97	0.87	0.87
0.98	46.51	87.79	1.87	164.56	2.29	0.85	0.85
1.15	25.48	48.02	4.41	211.63	2.67	1.05	1.05
1.31	17.53	32.98	7.43	244.97	2.92	0.93	0.93
1.48	12.28	23.03	11.39	262.39	3.14	17.51	9.57
1.64	10.74	20.11	13.01	261.63	3.21	15.09	7.55
1.80	9.97	18.63	13.31	247.88	3.22	12.80	6.38
1.97	10.41	19.45	12.20	237.31	3.18	9.42	6.12
2.13	12.05	22.52	10.32	232.39	3.08	9.61	6.56
2.30	14.63	27.39	8.69	238.06	2.99	0.92	0.92
2.46	17.55	32.89	7.20	236.90	2.90	0.92	0.92
2.62	20.44	38.34	5.87	224.85	2.80	0.91	0.91
2.79	22.61	42.41	4.80	203.70	2.71	0.89	0.89
2.95	23.38	43.86	4.01	176.02	2.63	0.97	0.97
3.12	22.80	42.75	3.43	146.64	2.56	0.86	0.86
3.28	22.26	41.71	2.78	115.96	2.47	0.78	0.78
3.44	22.40	41.95	2.21	92.56	2.37	0.73	0.73
3.61	23.12	43.29	1.88	81.39	2.29	0.66	0.71
3.77	24.18	45.28	1.77	80.21	2.26	0.59	0.71
3.94	25.34	47.46	1.73	82.17	2.24	0.70	0.71
4.10	26.14	48.96	1.69	82.55	2.23	0.71	0.71
4.27	26.06	48.79	1.65	80.32	2.21	0.60	0.71
4.43	25.24	47.21	1.64	77.43	2.21	0.47	0.70
4.59	24.54	45.88	1.63	74.68	2.21	0.38	0.69
4.76	25.02	46.77	1.56	73.03	2.18	0.33	0.69
4.92	26.84	50.19	1.45	72.88	2.12	0.32	0.69
5.09	28.98	54.21	1.37	74.39	2.07	0.37	0.69
5.25	31.03	58.07	1.34	77.72	2.03	0.48	0.70
5.41	32.05	59.98	1.33	79.73	2.02	0.57	0.71
5.58	31.91	59.71	1.34	80.17	2.04	0.59	0.71
5.74	30.22	56.50	1.38	77.79	2.07	0.49	0.70
5.91	29.22	54.59	1.42	77.39	2.10	0.47	0.70
6.07	30.51	57.00	1.40	79.70	2.09	0.57	0.71
6.23	33.71	63.03	1.34	84.68	2.04	0.72	0.72
6.40	36.87	67.56	1.32	89.29	2.02	0.73	0.73
6.56	38.07	68.93	1.33	91.55	2.02	0.73	0.73
6.73	38.26	68.67	1.34	92.28	2.04	0.73	0.73
6.89	38.48	67.99	1.34	91.19	2.04	0.73	0.73
7.05	39.95	69.72	1.35	94.18	2.05	0.74	0.74
7.22	41.19	71.13	1.36	96.91	2.06	0.74	0.74
7.38	41.63	71.17	1.38	97.98	2.07	0.74	0.74
7.55	41.04	68.56	1.35	92.39	2.04	0.73	0.73
7.71	40.02	65.18	1.31	85.64	2.01	0.72	0.72
7.87	38.95	62.04	1.29	80.11	1.98	0.59	0.71

:: Strength loss calculation (Robertson (2009) :: (continued)

Depth (ft)	q_t (tsf)	Q_{tn}	K_c	$Q_{tn,cs}$	I_c	$S_{u(liq)}/\sigma'_v$	$S_{u(peak)}/\sigma'_v$
8.04	38.01	59.94	1.30	77.75	1.99	0.48	0.70
8.20	37.63	59.10	1.32	77.90	2.01	0.49	0.70
8.37	37.13	58.99	1.41	82.99	2.09	0.71	0.71
8.53	37.01	58.77	1.47	86.56	2.13	0.72	0.72
8.69	37.19	58.58	1.50	88.12	2.15	0.72	0.72
8.86	37.62	58.38	1.49	86.90	2.14	0.72	0.72
9.02	37.67	58.31	1.56	91.16	2.18	0.73	0.73
9.19	37.81	58.34	1.65	96.14	2.21	0.74	0.74
9.35	38.65	58.81	1.63	96.15	2.21	0.74	0.74
9.51	39.96	59.40	1.53	90.90	2.16	0.73	0.73
9.68	39.71	58.15	1.51	87.56	2.15	0.72	0.72
9.84	36.91	53.90	1.60	86.05	2.19	0.72	0.72
10.01	33.98	49.42	1.70	83.79	2.23	0.72	0.72
10.17	33.65	48.20	1.65	79.65	2.21	0.57	0.71
10.33	35.64	49.84	1.51	75.38	2.15	0.40	0.70
10.50	37.27	51.38	1.47	75.69	2.13	0.41	0.70
10.66	37.58	51.32	1.48	76.00	2.14	0.42	0.70
10.83	36.83	49.93	1.51	75.55	2.15	0.40	0.70
10.99	35.76	48.12	1.55	74.55	2.17	0.37	0.69
11.15	34.81	46.52	1.59	74.19	2.19	0.36	0.69
11.32	32.59	43.49	1.74	75.69	2.25	0.41	0.70
11.48	29.52	39.41	1.99	78.56	2.32	0.52	0.70
11.65	28.87	38.23	2.07	79.07	2.34	0.54	0.71
11.81	29.55	38.53	1.94	74.72	2.30	0.38	0.69
11.98	29.56	38.21	1.98	75.56	2.31	0.40	0.70
12.14	29.37	37.66	2.03	76.45	2.33	0.43	0.70
12.30	31.93	40.50	1.97	79.85	2.31	0.58	0.71
12.47	34.69	43.33	1.81	78.29	2.27	0.51	0.70
12.63	31.60	39.47	2.13	83.89	2.35	0.72	0.72
12.80	23.64	29.88	3.40	101.52	2.56	0.79	0.79
12.96	16.12	20.64	6.40	132.11	2.84	0.80	0.80
13.12	12.01	15.10	10.12	152.92	3.07	1.19	1.08
13.29	10.70	13.16	11.74	154.49	3.15	1.31	0.94
13.45	10.54	12.79	11.77	150.46	3.16	1.00	0.91
13.62	10.79	12.95	10.31	133.54	3.08	1.01	0.92
13.78	11.21	13.31	9.06	120.60	3.02	0.66	0.95
13.94	11.36	13.35	8.19	109.28	2.96	0.76	0.76
14.11	11.36	13.19	8.38	110.48	2.98	0.77	0.77
14.27	11.19	12.82	8.84	113.35	3.00	0.70	0.92
14.44	11.10	12.55	9.10	114.23	3.02	0.65	0.90
14.60	10.60	11.80	9.59	113.23	3.05	0.67	0.84
14.76	10.01	11.02	9.91	109.26	3.06	0.63	0.79
14.93	11.31	12.52	7.97	99.82	2.95	0.75	0.75
15.09	11.32	12.47	7.45	92.83	2.92	0.73	0.73
15.26	12.56	13.79	6.46	89.05	2.85	0.73	0.73
15.42	17.61	19.27	3.93	75.71	2.62	0.78	0.78
15.58	25.89	28.08	2.17	61.06	2.36	0.12	0.66
15.75	33.82	36.27	1.54	55.68	2.17	0.08	0.64

:: Strength loss calculation (Robertson (2009) :: (continued)

Depth (ft)	q_t (tsf)	Q_{tn}	K_c	$Q_{tn,cs}$	I_c	$S_{u(liq)}/\sigma'_v$	$S_{u(peak)}/\sigma'_v$
15.91	35.18	37.53	1.47	55.06	2.13	0.08	0.64
16.08	31.99	34.12	1.61	55.03	2.20	0.08	0.64
16.24	25.50	27.22	2.14	58.31	2.35	0.10	0.65
16.40	19.13	20.43	3.55	72.57	2.58	0.74	0.74
16.57	15.76	16.75	4.99	83.68	2.73	0.72	0.72
16.73	14.02	14.81	5.98	88.57	2.81	0.73	0.73
16.90	13.32	13.95	5.96	83.19	2.81	0.71	0.71
17.06	12.39	12.85	6.07	77.99	2.82	0.49	0.70
17.22	12.35	12.73	5.81	73.90	2.80	0.35	0.69
17.39	12.30	12.60	5.68	71.56	2.79	0.29	0.69
17.55	12.09	12.33	5.81	71.61	2.80	0.29	0.69
17.72	11.81	11.98	6.13	73.44	2.82	0.34	0.69
17.88	11.42	11.56	7.36	85.02	2.91	0.72	0.72
18.04	11.23	11.28	8.61	97.11	2.99	0.74	0.74
18.21	10.85	10.81	10.06	108.80	3.07	0.59	0.77
18.37	10.34	10.20	10.71	109.19	3.10	0.63	0.73
18.54	9.76	9.51	11.14	105.95	3.13	0.49	0.68
18.70	9.61	9.30	10.24	95.31	3.08	0.46	0.66
18.86	9.93	9.60	9.06	87.00	3.02	0.30	0.69
19.03	10.64	10.31	8.00	82.54	2.95	0.71	0.71
19.19	11.25	10.93	8.18	89.35	2.96	0.73	0.73
19.36	11.63	11.27	8.75	98.61	3.00	0.75	0.75
19.52	11.29	10.86	9.96	108.12	3.07	0.55	0.78
19.69	10.71	10.18	11.09	112.88	3.12	0.64	0.73
19.85	9.36	8.71	13.14	114.52	3.22	0.62	0.62
20.01	7.97	7.20	15.14	109.05	3.30	0.54	0.51
20.18	7.40	6.57	15.43	101.38	3.31	0.42	0.47
20.34	7.95	7.10	13.23	94.02	3.22	0.37	0.51
20.51	9.05	8.22	11.05	90.76	3.12	0.35	0.59
20.67	9.66	8.81	10.17	89.60	3.08	0.36	0.63
20.83	10.30	9.42	9.56	90.05	3.04	0.36	0.67
21.00	11.23	10.34	8.83	91.27	3.00	0.38	0.74
21.16	13.98	13.10	7.05	92.31	2.89	0.73	0.73
21.33	14.53	13.59	6.85	93.16	2.88	0.73	0.73
21.49	13.37	12.37	7.60	93.92	2.93	0.74	0.74
21.65	10.45	9.35	10.26	95.90	3.08	0.39	0.67
21.82	9.51	8.36	11.48	95.94	3.14	0.43	0.60
21.98	9.94	8.75	10.79	94.41	3.11	0.39	0.63
22.15	10.17	8.94	10.57	94.52	3.10	0.36	0.64
22.31	10.39	9.11	10.41	94.90	3.09	0.44	0.65
22.47	10.62	9.30	10.41	96.76	3.09	0.41	0.66
22.64	10.38	9.02	10.13	91.36	3.07	0.42	0.64
22.80	9.47	8.08	10.83	87.50	3.11	0.29	0.58
22.97	8.58	7.17	11.56	82.88	3.15	0.28	0.51
23.13	8.37	6.94	11.72	81.33	3.15	0.28	0.50
23.29	8.71	7.24	10.89	78.79	3.11	0.25	0.52
23.46	9.11	7.59	10.34	78.46	3.09	0.23	0.54
23.62	9.52	7.95	10.33	82.13	3.09	0.28	0.57

:: Strength loss calculation (Robertson (2009) :: (continued)

Depth (ft)	q_t (tsf)	Q_{tn}	K_c	$Q_{tn,cs}$	I_c	$S_{u(liq)}/\sigma'_v$	$S_{u(peak)}/\sigma'_v$
23.79	10.29	8.66	9.93	85.94	3.06	0.34	0.62
23.95	11.11	9.41	9.04	85.08	3.01	0.34	0.67
24.11	11.69	9.93	8.78	87.11	3.00	0.72	0.72
24.28	11.92	10.10	9.74	98.34	3.05	0.41	0.72
24.44	12.30	10.41	10.80	112.48	3.11	0.64	0.74
24.61	12.66	10.70	11.15	119.29	3.13	0.73	0.76
24.77	12.67	10.66	10.71	114.24	3.11	0.64	0.76
24.93	12.56	10.51	9.74	102.45	3.05	0.48	0.75
25.10	12.10	10.03	9.41	94.37	3.04	0.36	0.72
25.26	12.02	9.92	9.24	91.62	3.03	0.39	0.71
25.43	11.97	9.82	9.65	94.79	3.05	0.40	0.70
25.59	12.18	9.98	9.73	97.14	3.05	0.44	0.71
25.75	12.47	10.20	9.71	98.99	3.05	0.46	0.73
25.92	12.45	10.13	9.86	99.92	3.06	0.46	0.72
26.08	12.58	10.21	9.88	100.82	3.06	0.46	0.73
26.25	12.76	10.33	9.68	99.99	3.05	0.49	0.74
26.41	13.78	11.21	8.64	96.82	2.99	0.74	0.74
26.57	15.28	12.52	7.35	92.01	2.91	0.73	0.73
26.74	15.48	12.65	7.35	92.93	2.91	0.73	0.73
26.90	14.78	11.97	7.89	94.44	2.95	0.74	0.74
27.07	16.25	13.24	7.20	95.36	2.90	0.74	0.74
27.23	22.21	18.58	4.80	89.13	2.71	0.73	0.73
27.40	26.63	22.50	3.92	88.31	2.62	0.81	0.81
27.56	26.14	21.97	4.10	90.07	2.64	0.83	0.83
27.72	19.94	16.31	5.94	96.80	2.81	0.74	0.74
27.89	15.03	11.88	8.16	97.03	2.96	0.74	0.74
28.05	12.37	9.50	9.53	90.57	3.04	0.37	0.68
28.22	11.88	9.03	9.62	86.87	3.05	0.26	0.64
28.38	11.59	8.74	10.04	87.78	3.07	0.35	0.62
28.54	11.29	8.44	11.14	94.02	3.13	0.38	0.60
28.71	11.16	8.29	11.45	94.95	3.14	0.41	0.59
28.87	11.18	8.28	11.58	95.86	3.15	0.37	0.59
29.04	10.99	8.08	12.70	102.61	3.20	0.41	0.58
29.20	10.88	7.95	14.47	114.98	3.27	0.59	0.57
29.36	10.91	7.93	16.24	128.79	3.34	0.74	0.57
29.53	11.14	8.09	17.01	137.67	3.37	0.88	0.58
29.69	11.33	8.21	16.68	137.02	3.35	0.92	0.59
29.86	11.75	8.53	14.88	126.94	3.29	0.72	0.61
30.02	12.94	9.49	11.86	112.62	3.16	0.52	0.68
30.18	13.86	10.23	9.83	100.59	3.06	0.48	0.73
30.35	14.23	10.50	8.73	91.74	3.00	0.73	0.73
30.51	13.37	9.74	8.72	84.96	3.00	0.72	0.72
30.68	12.45	8.94	10.42	93.13	3.09	0.28	0.64
30.84	11.90	8.44	12.91	108.99	3.21	0.57	0.60
31.00	11.89	8.40	14.40	120.94	3.27	0.71	0.60
31.17	13.13	9.38	12.60	118.24	3.19	0.66	0.67
31.33	14.25	10.26	10.14	104.02	3.08	0.51	0.73
31.50	16.09	11.73	7.29	85.50	2.91	0.72	0.72

:: Strength loss calculation (Robertson (2009) :: (continued)

Depth (ft)	q_t (tsf)	Q_{tn}	K_c	$Q_{tn,cs}$	I_c	$S_{u(liq)}/\sigma'_v$	$S_{u(peak)}/\sigma'_v$
31.66	17.47	12.89	5.34	68.82	2.76	0.23	0.68
31.82	19.03	14.22	4.09	58.19	2.64	0.74	0.74
31.99	20.24	15.24	3.44	52.41	2.56	0.16	0.67
32.15	20.80	15.68	3.23	50.69	2.54	0.08	0.64
32.32	20.93	15.74	3.23	50.91	2.54	0.08	0.64
32.48	20.12	15.01	3.37	50.60	2.55	0.11	0.66
32.64	18.84	13.89	3.65	50.70	2.59	0.24	0.68
32.81	17.39	12.64	4.02	50.86	2.63	0.71	0.71
32.97	16.40	11.76	4.47	52.58	2.68	0.75	0.75
33.14	15.62	11.07	4.91	54.38	2.72	0.07	0.64
33.30	14.60	10.18	5.58	56.80	2.78	0.09	0.65
33.46	14.28	9.87	5.96	58.82	2.81	0.10	0.65
33.63	19.04	13.79	3.90	53.72	2.62	0.71	0.71
33.79	25.99	19.57	2.53	49.45	2.43	0.05	0.62
33.96	28.55	21.67	2.24	48.46	2.37	0.05	0.62
34.12	23.85	17.64	3.01	53.16	2.51	0.06	0.63
34.28	16.49	11.46	5.49	62.99	2.77	0.14	0.66
34.45	12.40	8.17	9.57	78.23	3.04	0.20	0.58
34.61	10.57	6.72	12.87	86.46	3.21	0.37	0.48
34.78	9.63	5.96	15.18	90.49	3.30	0.32	0.43
34.94	9.23	5.63	15.29	86.11	3.30	0.28	0.40
35.10	9.28	5.65	14.53	82.12	3.27	0.26	0.40
35.27	9.61	5.88	13.68	80.45	3.24	0.23	0.42
35.43	9.55	5.81	14.33	83.23	3.27	0.25	0.41
35.60	9.49	5.74	15.01	86.14	3.29	0.31	0.41
35.76	9.12	5.43	16.46	89.44	3.35	0.30	0.39
35.93	9.19	5.46	17.29	94.44	3.38	0.32	0.39
36.09	9.67	5.81	17.95	104.27	3.40	0.44	0.41
36.25	10.66	6.53	16.95	110.64	3.36	0.57	0.47
36.42	11.45	7.10	15.85	112.45	3.32	0.53	0.51
36.58	11.82	7.34	15.45	113.38	3.31	0.51	0.52
36.75	12.55	7.86	14.48	113.76	3.27	0.60	0.56
36.91	13.22	8.32	15.96	132.85	3.33	0.55	0.59
37.07	14.26	9.06	17.01	154.12	3.37	1.17	0.65
37.24	15.09	9.63	18.18	175.18	3.40	1.46	0.69
37.40	16.24	10.44	17.45	182.17	3.38	1.51	0.75
37.57	16.89	10.88	15.41	167.59	3.31	1.53	0.78
37.73	16.82	10.78	14.26	153.72	3.26	0.80	0.77
37.89	16.48	10.49	13.18	138.17	3.22	0.90	0.75
38.06	16.83	10.70	13.14	140.55	3.22	0.90	0.76
38.22	17.20	10.93	12.75	139.30	3.20	0.90	0.78
38.39	17.92	11.40	11.79	134.42	3.16	0.86	0.81
38.55	18.45	11.74	10.84	127.27	3.11	0.74	0.84
38.71	19.81	12.67	10.05	127.33	3.07	0.66	0.90
38.88	21.73	13.99	8.95	125.17	3.01	0.91	1.00
39.04	23.90	15.49	8.18	126.66	2.96	0.79	0.79
39.21	25.32	16.44	7.25	119.29	2.90	0.78	0.78
39.37	25.19	16.29	7.12	115.95	2.89	0.78	0.78

:: Strength loss calculation (Robertson (2009) :: (continued)

Depth (ft)	q_t (tsf)	Q_{tn}	K_c	$Q_{tn,cs}$	I_c	$S_{u(liq)}/\sigma'_v$	$S_{u(peak)}/\sigma'_v$
39.53	24.55	15.78	6.90	108.84	2.88	0.76	0.76
39.70	24.35	15.58	6.83	106.44	2.87	0.76	0.76
39.86	25.75	16.51	6.69	110.41	2.86	0.77	0.77
40.03	32.14	21.16	5.14	108.70	2.74	0.76	0.76
40.19	42.61	28.93	3.78	109.31	2.60	0.84	0.84
40.35	56.40	39.45	2.55	100.79	2.43	0.75	0.75
40.52	71.55	51.14	1.92	98.24	2.30	0.74	0.74
40.68	89.35	65.28	1.50	97.67	2.15	0.74	0.74
40.85	110.41	82.27	1.31	107.76	2.00	0.76	0.76
41.01	132.33	100.78	1.19	119.57	1.83	0.78	0.78
41.17	155.40	120.78	1.00	120.78	1.67	0.78	0.78
41.34	176.16	138.09	1.00	138.09	1.60	0.81	0.81
41.50	194.16	151.10	1.00	151.10	1.65	0.83	0.83
41.67	211.21	163.36	1.00	163.36	1.69	0.84	0.84
41.83	224.37	174.39	1.00	174.39	1.64	0.86	0.86
41.99	228.27	178.93	1.00	178.93	1.56	0.86	0.86
42.16	223.98	177.31	1.00	177.31	1.47	0.86	0.86
42.32	217.45	171.27	1.00	171.27	1.50	0.85	0.85
42.49	212.01	165.91	1.00	165.91	1.53	0.85	0.85
42.65	208.26	161.65	1.00	161.65	1.57	0.84	0.84
42.81	209.23	162.24	1.00	162.24	1.57	0.84	0.84
42.98	211.83	164.16	1.00	164.16	1.56	0.85	0.85
43.14	212.02	164.41	1.00	164.41	1.54	0.85	0.85
43.31	207.59	160.32	1.00	160.32	1.56	0.84	0.84
43.47	201.39	154.24	1.00	154.24	1.60	0.83	0.83
43.64	193.86	147.27	1.00	147.27	1.64	0.82	0.82
43.80	182.03	136.93	1.00	136.93	1.69	0.81	0.81
43.96	169.14	126.37	1.02	129.01	1.72	0.80	0.80
44.13	150.61	111.36	1.10	122.77	1.76	0.79	0.79
44.29	130.52	94.90	1.20	113.46	1.84	0.77	0.77
44.46	107.96	76.61	1.28	98.12	1.97	0.74	0.74
44.62	101.29	71.22	1.31	93.18	2.00	0.73	0.73
44.78	106.41	75.75	1.25	94.33	1.91	0.74	0.74
44.95	114.18	82.93	1.00	82.93	1.78	0.71	0.71
45.11	106.04	76.91	1.00	76.91	1.77	0.45	0.70
45.28	81.62	57.23	1.00	57.23	1.92	0.09	0.65
45.44	55.73	36.82	1.61	59.21	2.20	0.11	0.65
45.60	41.29	25.92	2.38	61.59	2.40	0.13	0.66
45.77	39.16	24.33	2.52	61.30	2.43	0.13	0.66
45.93	38.29	23.66	2.58	60.94	2.44	0.12	0.66
46.10	35.64	21.65	2.94	63.62	2.49	0.15	0.67
46.26	30.11	17.57	4.09	71.87	2.64	0.78	0.78
46.42	31.35	18.36	3.93	72.25	2.62	0.77	0.77
46.59	35.95	21.59	3.13	67.47	2.52	0.25	0.68
46.75	44.50	27.85	2.11	58.73	2.35	0.10	0.65
46.92	50.82	32.32	1.85	59.87	2.28	0.11	0.66
47.08	49.83	31.40	1.99	62.33	2.32	0.14	0.66
47.24	40.54	24.52	2.77	67.92	2.47	0.21	0.68

:: Strength loss calculation (Robertson (2009) :: (continued)

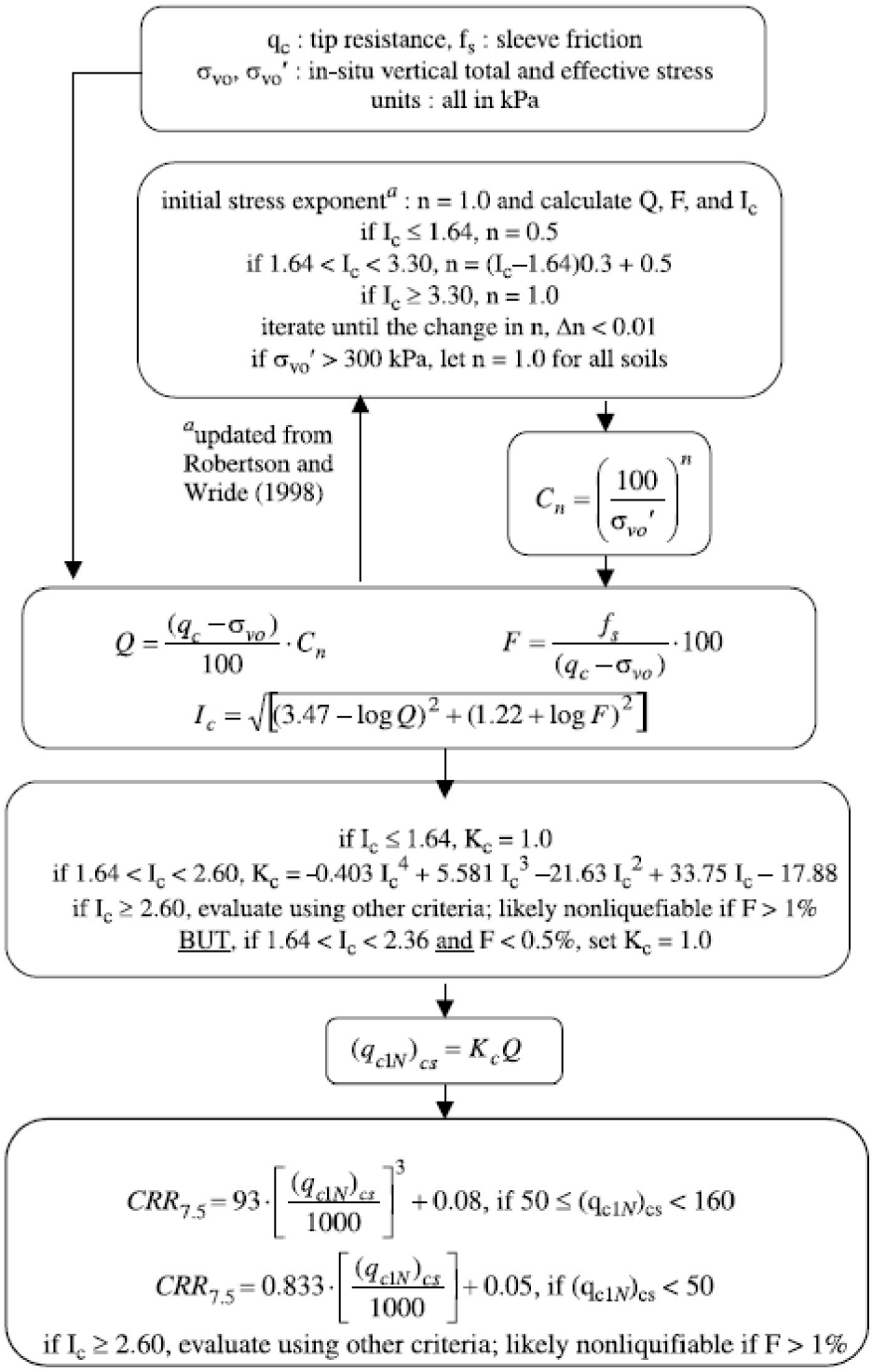
Depth (ft)	q_t (tsf)	Q_{tn}	K_c	$Q_{tn,cs}$	I_c	$S_{u(liq)}/\sigma'_v$	$S_{u(peak)}/\sigma'_v$
47.41	28.79	15.94	54.25	864.79	4.06	0.26	1.14
47.57	19.92	10.51	54.25	570.40	4.06	0.00	0.75
47.74	16.68	8.53	54.25	462.52	4.06	0.00	0.61
47.90	16.07	8.14	54.25	441.50	4.06	0.00	0.58

Abbreviations

q_t: Total cone resistance
K_c: Cone resistance correction factor due to fines
$Q_{tn,cs}$: Adjusted and corrected cone resistance due to fines
I_c: Soil behavior type index
$S_{u(liq)}/\sigma'_v$: Calculated liquefied undrained strength ratio
$S_{u(peak)}/\sigma'_v$: Calculated peak undrained strength ratio

Procedure for the evaluation of soil liquefaction resistance, NCEER (1998)

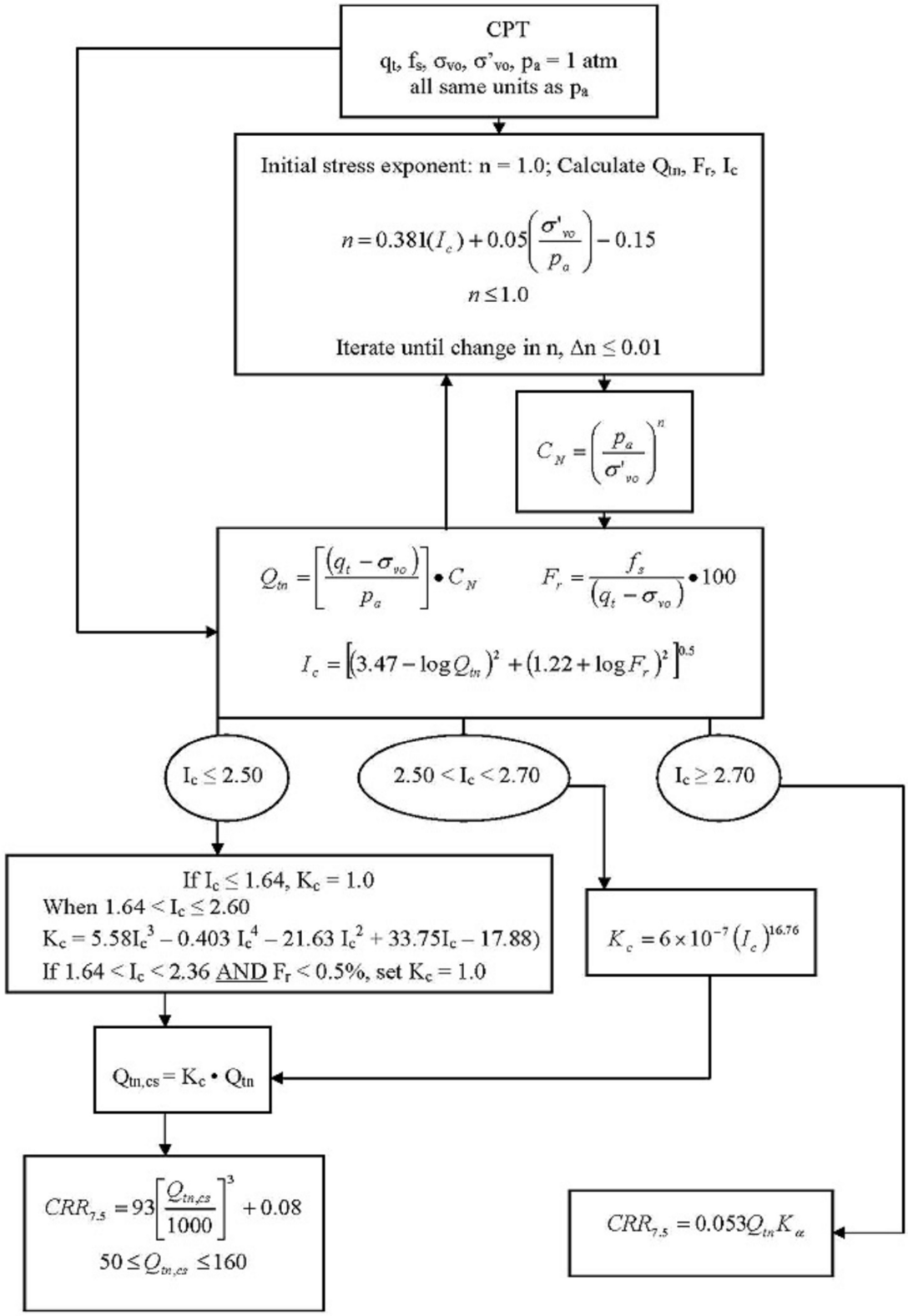
Calculation of soil resistance against liquefaction is performed according to the Robertson & Wride (1998) procedure. The procedure used in the software, slightly differs from the one originally published in NCEER-97-0022 (Proceedings of the NCEER Workshop on Evaluation of Liquefaction Resistance of Soils). The revised procedure is presented below in the form of a flowchart[1]:



[1] "Estimating liquefaction-induced ground settlements from CPT for level ground", G. Zhang, P.K. Robertson, and R.W.I. Brachman

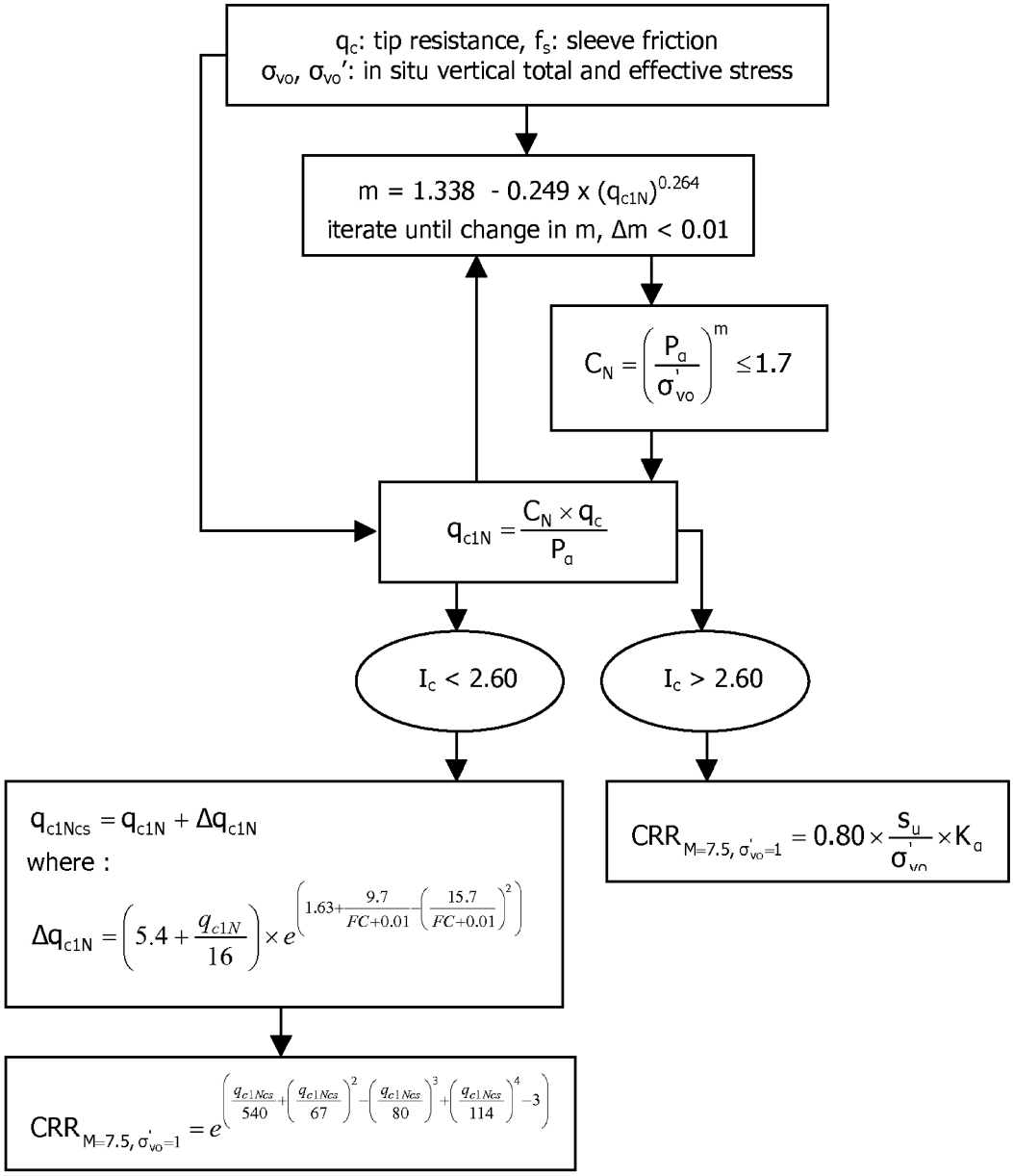
Procedure for the evaluation of soil liquefaction resistance (all soils), Robertson (2010)

Calculation of soil resistance against liquefaction is performed according to the Robertson & Wride (1998) procedure. This procedure used in the software, slightly differs from the one originally published in NCEER-97-0022 (Proceedings of the NCEER Workshop on Evaluation of Liquefaction Resistance of Soils). The revised procedure is presented below in the form of a flowchart[1]:

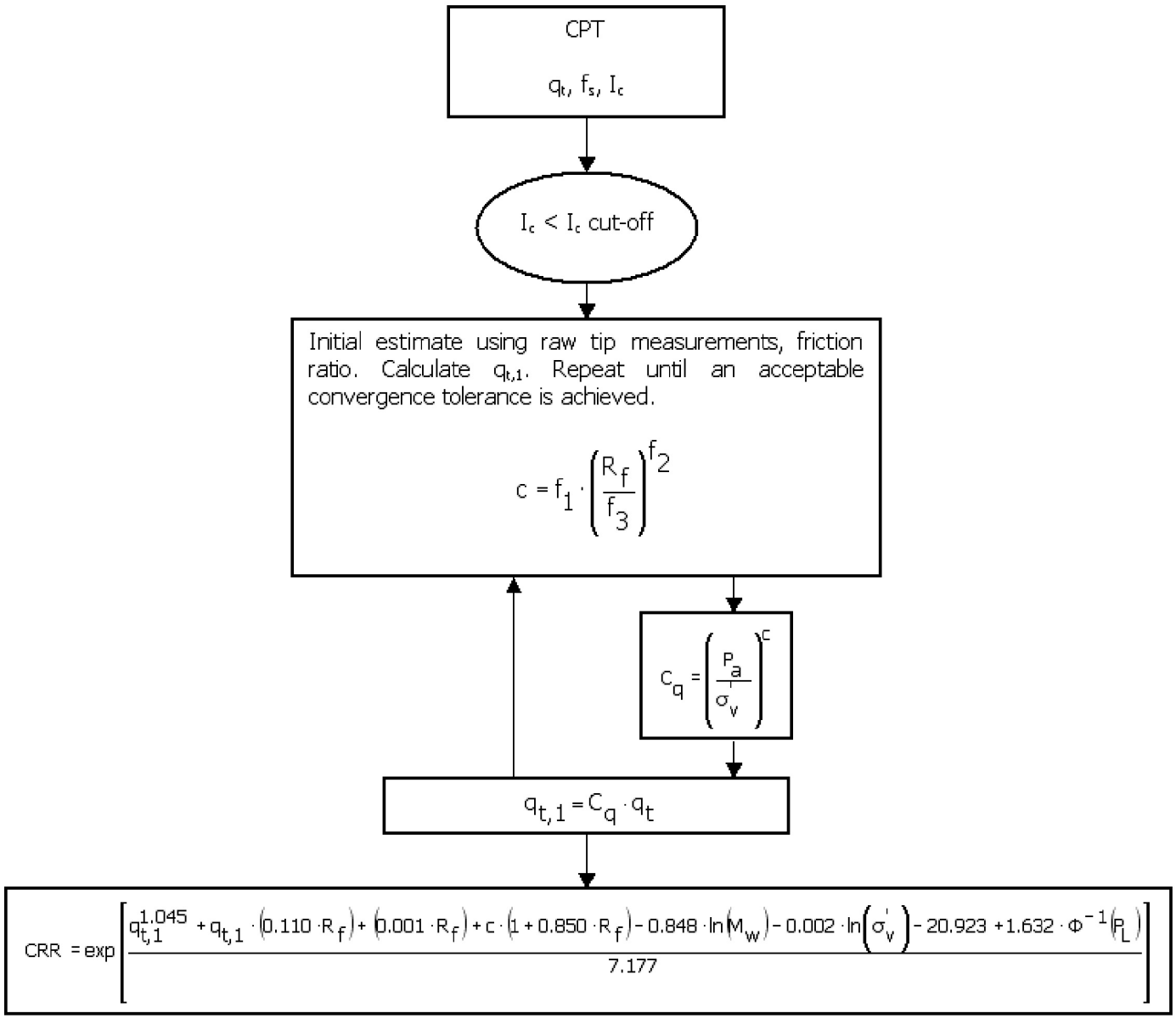


[1] P.K. Robertson, 2009. "Performance based earthquake design using the CPT", Keynote Lecture, International Conference on Performance-based Design in Earthquake Geotechnical Engineering – from case history to practice, IS-Tokyo, June 2009

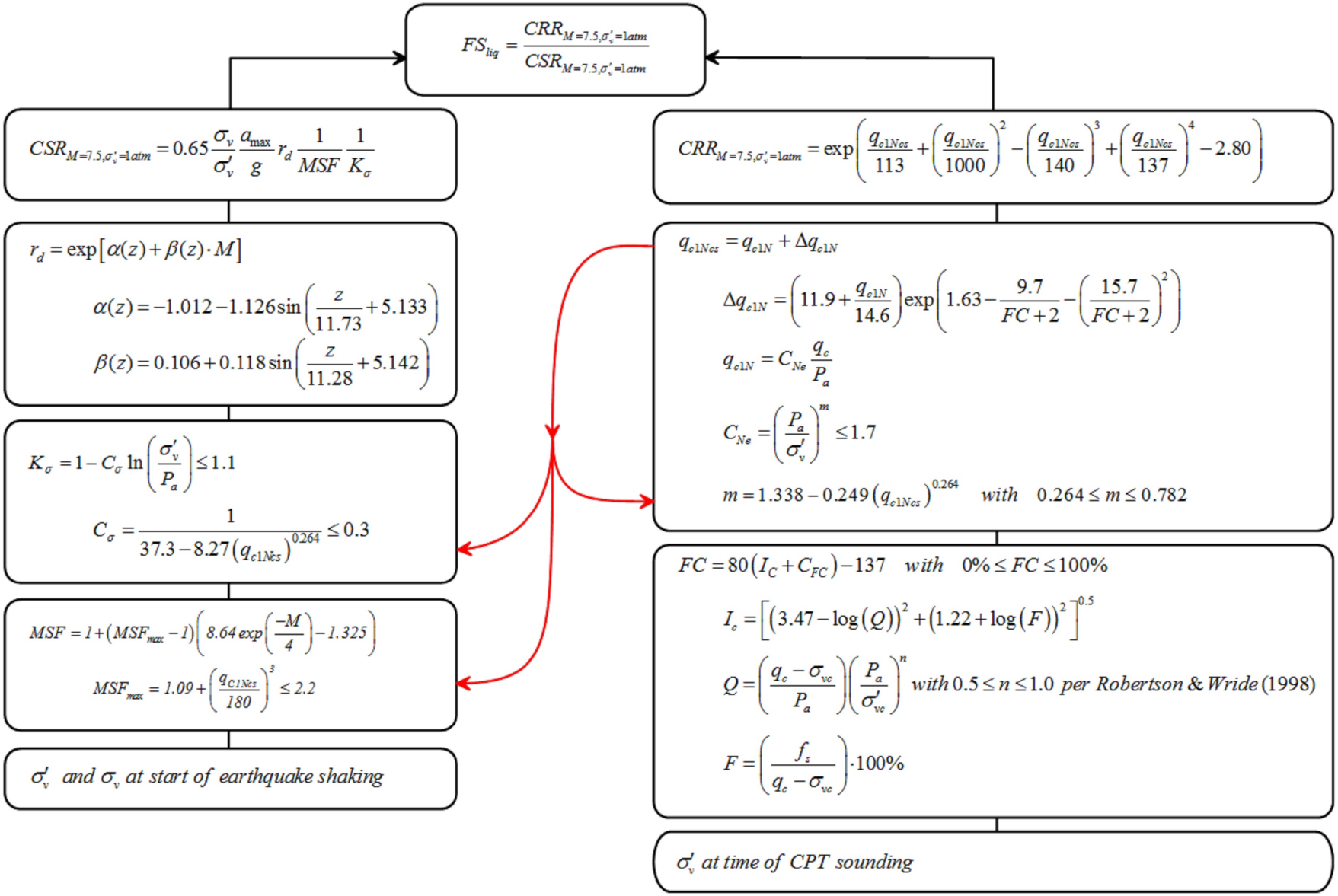
Procedure for the evaluation of soil liquefaction resistance, Idriss & Boulanger (2008)



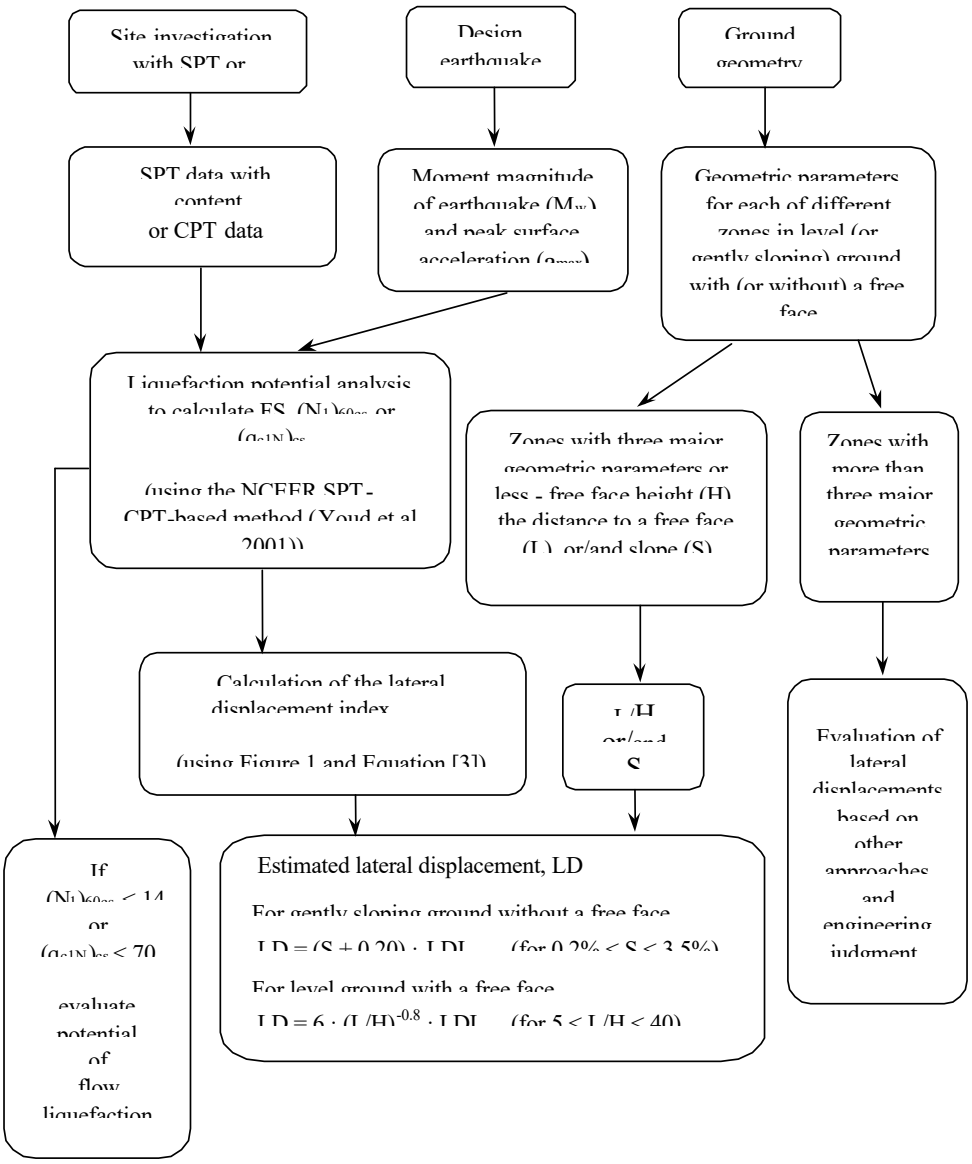
Procedure for the evaluation of soil liquefaction resistance (sandy soils), Moss et al. (2006)



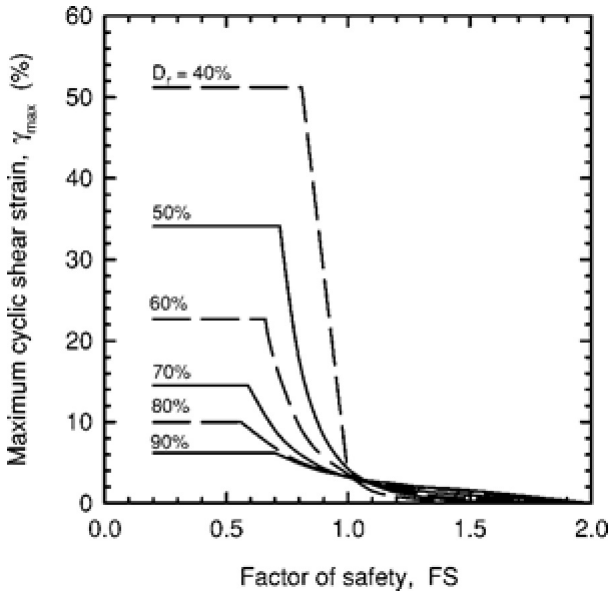
Procedure for the evaluation of soil liquefaction resistance, Boulanger & Idriss(2014)



Procedure for the evaluation of liquefaction-induced lateral spreading displacements



[1] Flow chart illustrating major steps in estimating liquefaction-induced lateral spreading displacements using the proposed approach



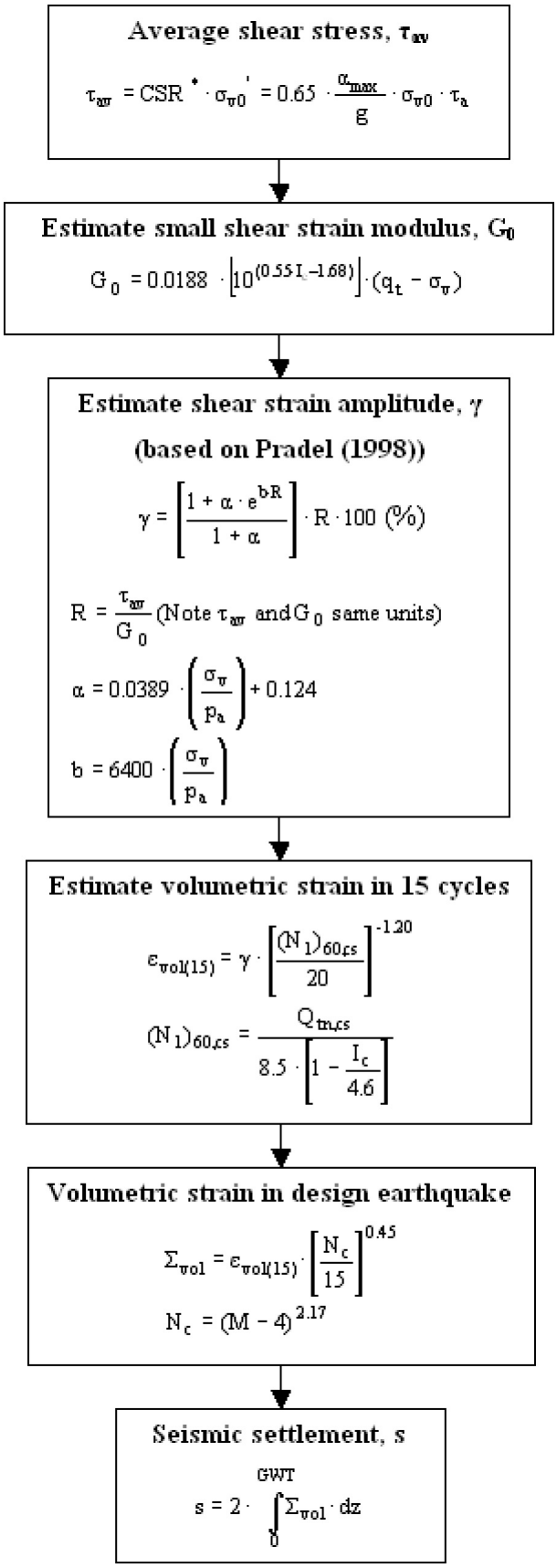
[1] **Figure 1**

$$LDI = \int_0^{z_{max}} \gamma_{max} dz$$

[1] **Equation [3]**

[1] "Estimating liquefaction-induced ground settlements from CPT for level ground", G. Zhang, P.K. Robertson, and R.W.I. Brachman

Procedure for the estimation of seismic induced settlements in dry sands



Robertson, P.K. and Lisheng, S., 2010, "Estimation of seismic compression in dry soils using the CPT" FIFTH INTERNATIONAL CONFERENCE ON RECENT ADVANCES IN GEOTECHNICAL EARTHQUAKE ENGINEERING AND SOIL DYNAMICS, Symposium in honor of professor I. M. Idriss, San Diego, CA

Liquefaction Potential Index (LPI) calculation procedure

Calculation of the Liquefaction Potential Index (LPI) is used to interpret the liquefaction assessment calculations in terms of severity over depth. The calculation procedure is based on the methology developed by Iwasaki (1982) and is adopted by AFPS.

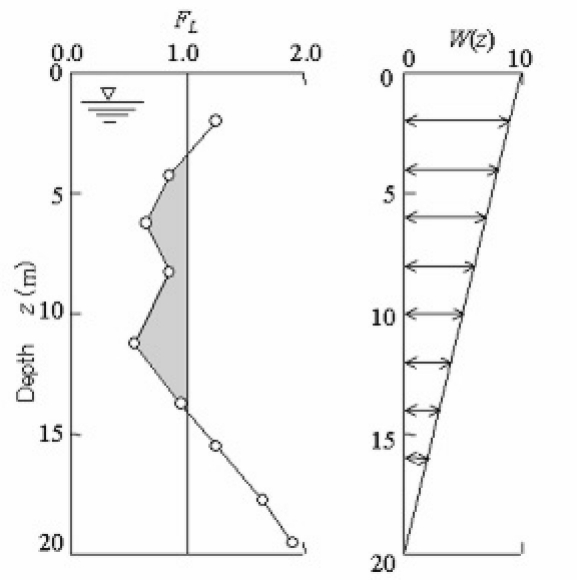
To estimate the severity of liquefaction extent at a given site, LPI is calculated based on the following equation:

$$\mathbf{LPI} = \int_0^{20} (10 - 0{,}5z) \times F_L \times dz$$

where:
F_L = 1 - F.S. when F.S. less than 1
F_L = 0 when F.S. greater than 1
z depth of measurment in meters

Values of LPI range between zero (0) when no test point is characterized as liquefiable and 100 when all points are characterized as susceptible to liquefaction. Iwasaki proposed four (4) discrete categories based on the numeric value of LPI:

- LPI = 0 : Liquefaction risk is very low
- 0 < LPI <= 5 : Liquefaction risk is low
- 5 < LPI <= 15 : Liquefaction risk is high
- LPI > 15 : Liquefaction risk is very high



Graphical presentation of the LPI calculation procedure

Shear-Induced Building Settlement (Ds) calculation procedure

The shear-induced building settlement (Ds) due to liquefaction below the building can be estimated using the relationship developed by Bray and Macedo (2017):

$$Ln(Ds) = c1 + c2 * LBS + 0.58 * Ln\left(Tanh\left(\frac{HL}{6}\right)\right) + 4.59 * Ln(Q) - 0.42 * Ln(Q)^2 - 0.02 * B + 0.84 * Ln(CAVdp) + 0.41 * Ln(Sa1) + \varepsilon$$

where Ds is in the units of mm, c1= -8.35 and c2= 0.072 for LBS ≤ 16, and c1= -7.48 and c2= 0.014 otherwise. Q is the building contact pressure in units of kPa, HL is the cumulative thickness of the liquefiable layers in the units of m, B is the building width in the units of m, CAVdp is a standardized version of the cumulative absolute velocity in the units of g-s, Sa1 is 5%-damped pseudo-acceleration response spectral value at a period of 1 s in the units of g, and ε is a normal random variable with zero mean and 0.50 standard deviation in Ln units. The liquefaction-induced building settlement index (LBS) is:

$$LBS = \sum W * \frac{\varepsilon_{shear}}{z} dz$$

where z (m) is the depth measured from the ground surface > 0, W is a foundation-weighting factor wherein W = 0.0 for z less than Df, which is the embedment depth of the foundation, and W = 1.0 otherwise. The shear strain parameter (ε_shear) is the liquefaction-induced free-field shear strain (in %) estimated using Zhang et al. (2004). It is calculated based on the estimated Dr of the liquefied soil layer and the calculated safety factor against liquefaction triggering (FSL).

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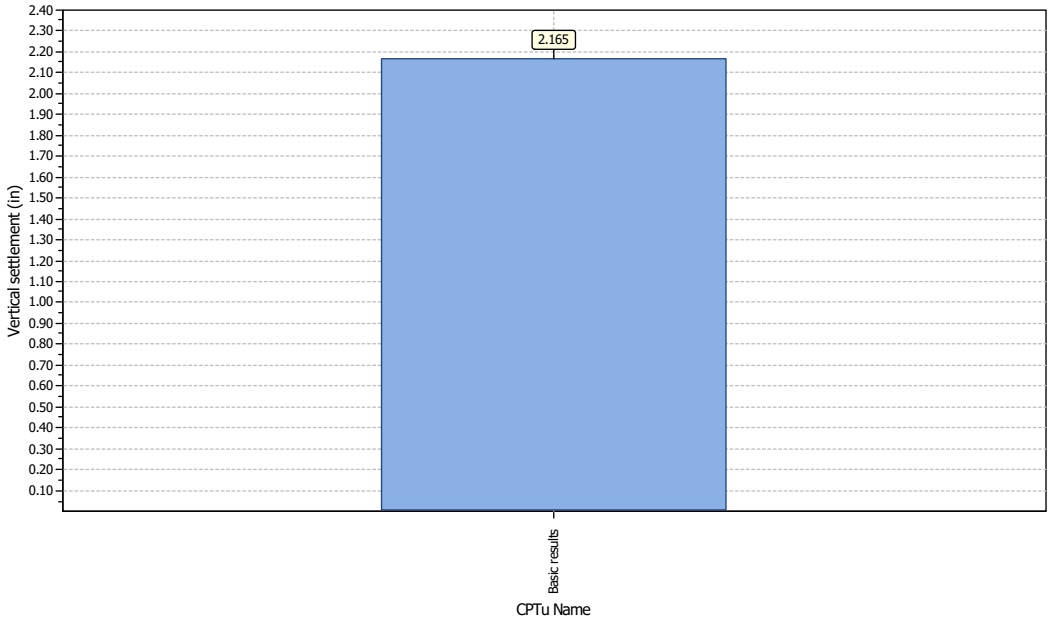
Project title : Proposed Gas Station, Convenience Store and Carwash Renewal

Location : 1152 Tully Road, San Jose, CA

Overall vertical settlements report



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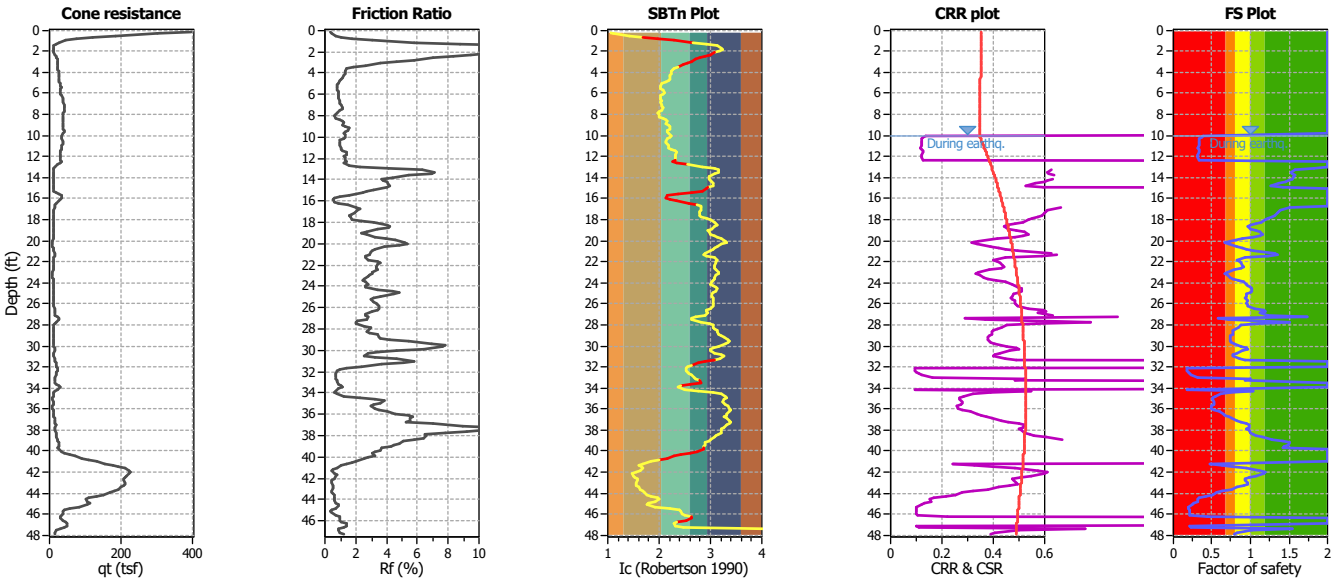
LIQUEFACTION ANALYSIS REPORT

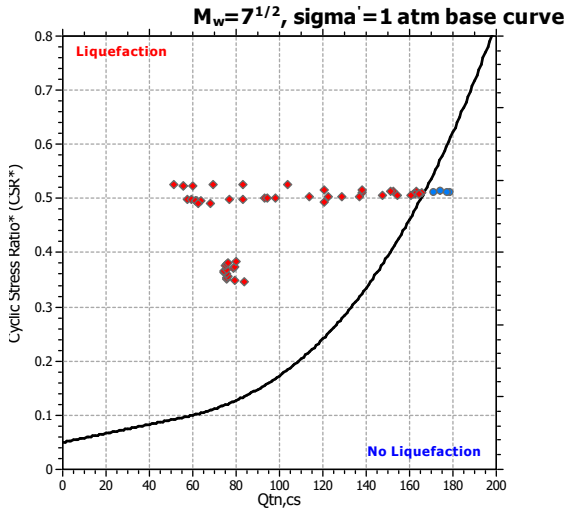
Project title : Proposed Gas Station, Convenience Store and Carwash Removal **Location : 1152 Tully Road, San Jose, CA**

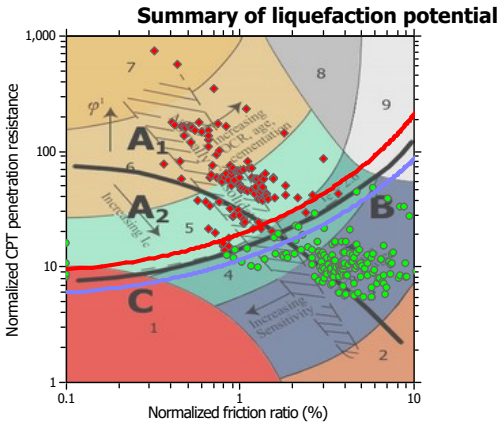
CPT file : Basic results

Input parameters and analysis data

Analysis method:	Robertson (2009)	G.W.T. (in-situ):	14.60 ft	Use fill:	No	Clay like behavior applied:	All soils
Fines correction method:	Robertson (2009)	G.W.T. (earthq.):	10.00 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:	60.00 ft
Earthquake magnitude M_w:	6.83	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.69	Unit weight calculation:	Based on SBT	K_σ applied:	No		

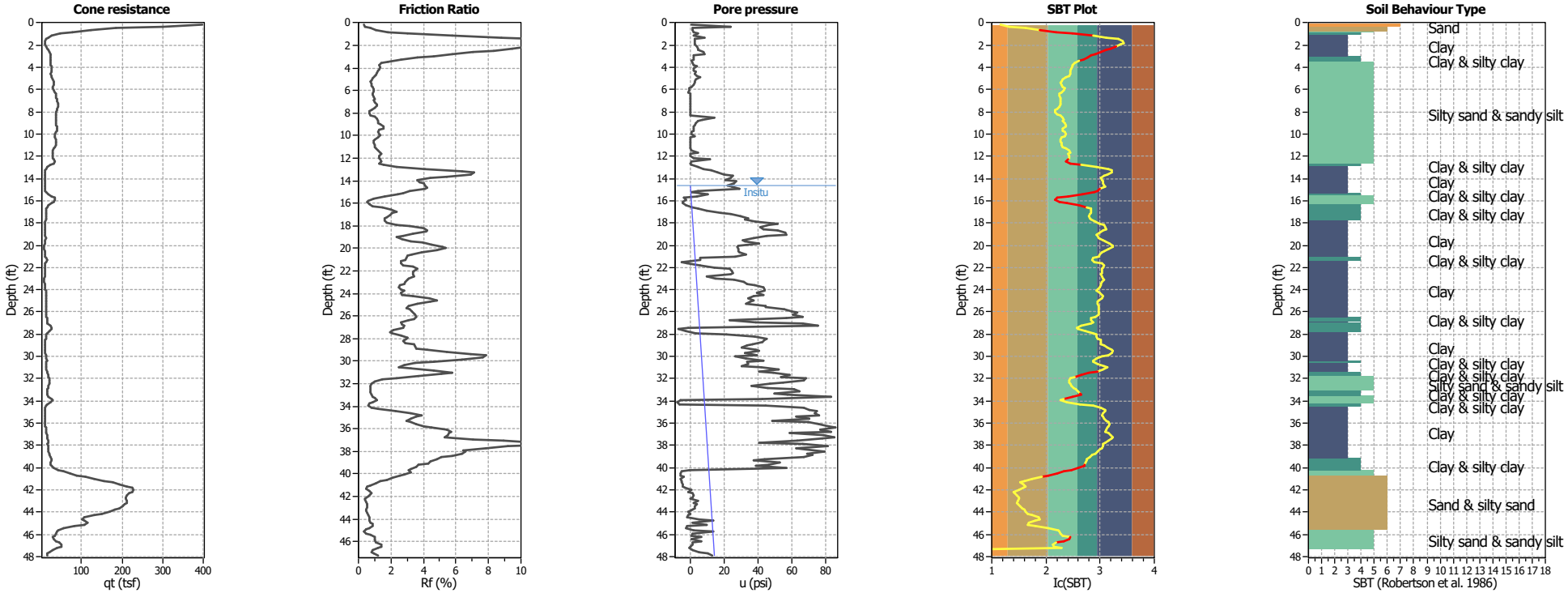






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



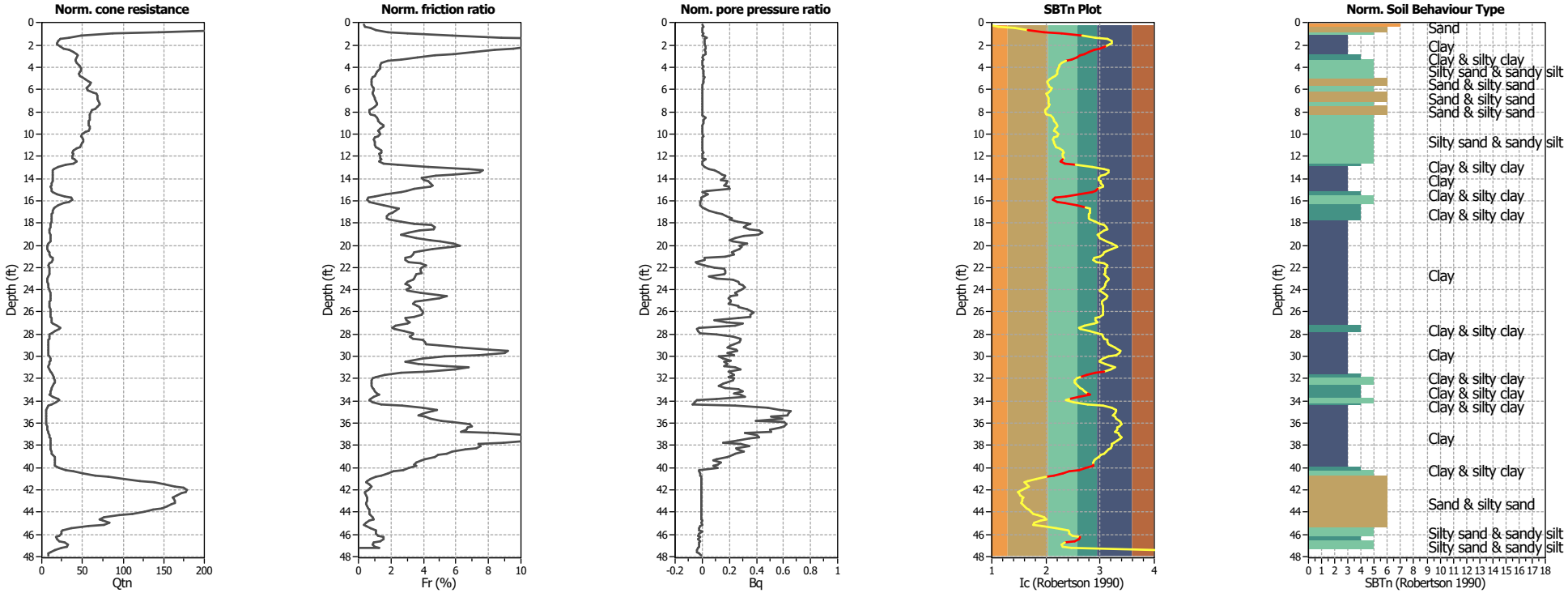
Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.83	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.69	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	14.60 ft	Fill height:	N/A	Limit depth:	60.00 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

CPT basic interpretation plots (normalized)



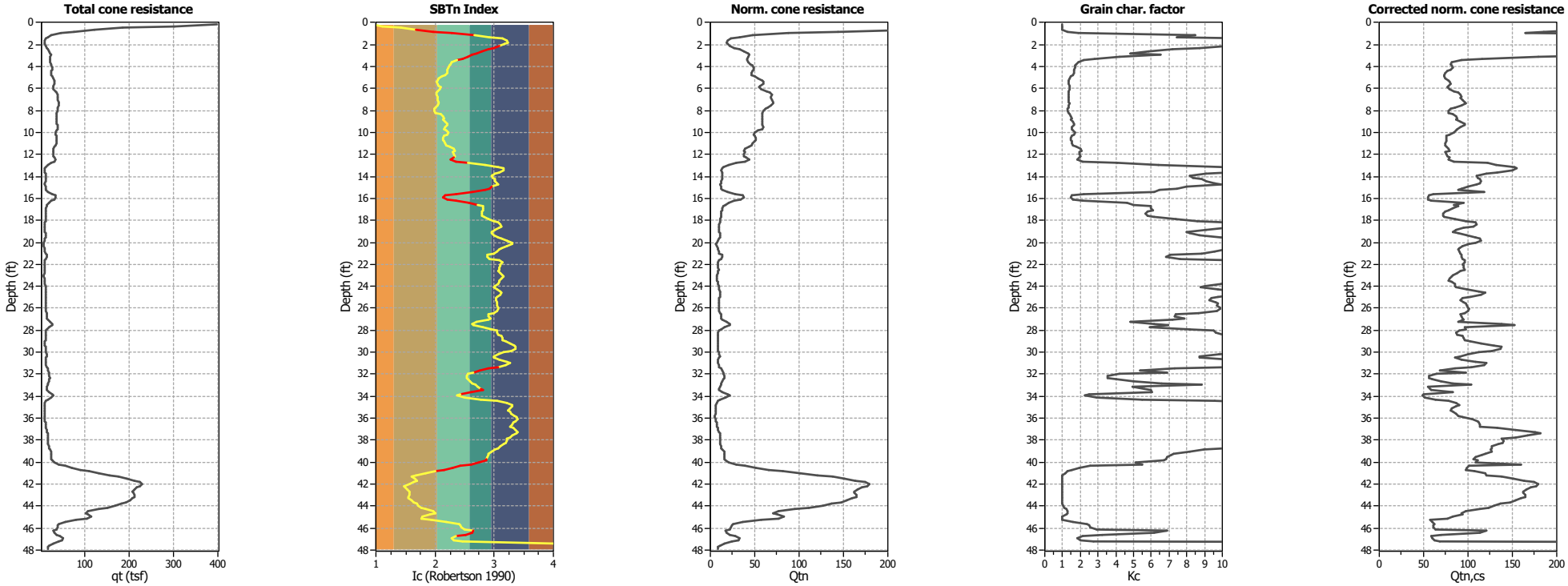
Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.83	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.69	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	14.60 ft	Fill height:	N/A	Limit depth:	60.00 ft

SBTn 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

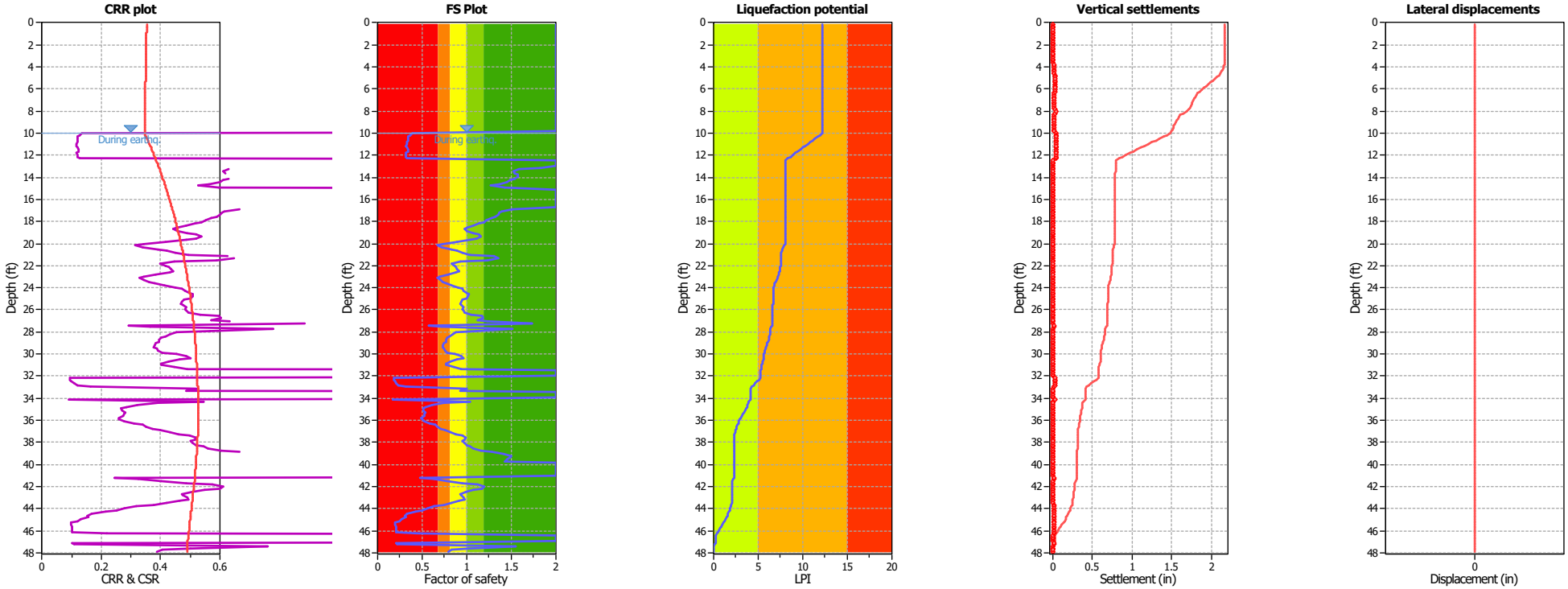
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.83	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.69	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	14.60 ft	Fill height:	N/A	Limit depth:	60.00 ft

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.83	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.69	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	14.60 ft	Fill height:	N/A	Limit depth:	60.00 ft

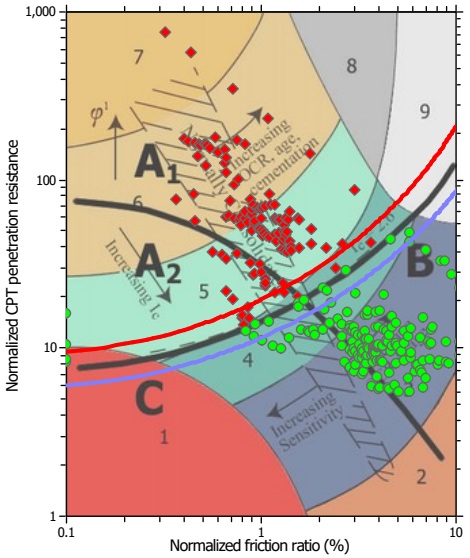
F.S. color scheme

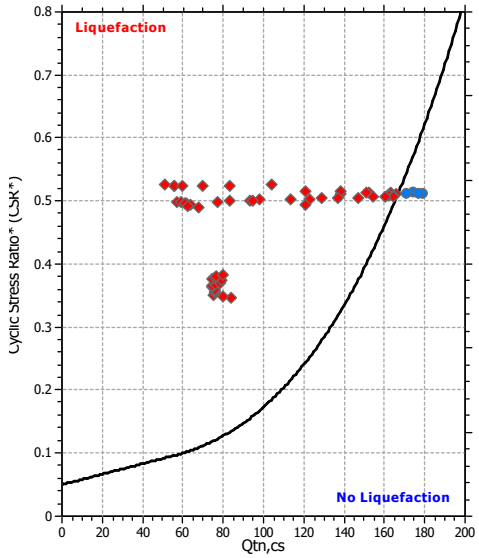
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

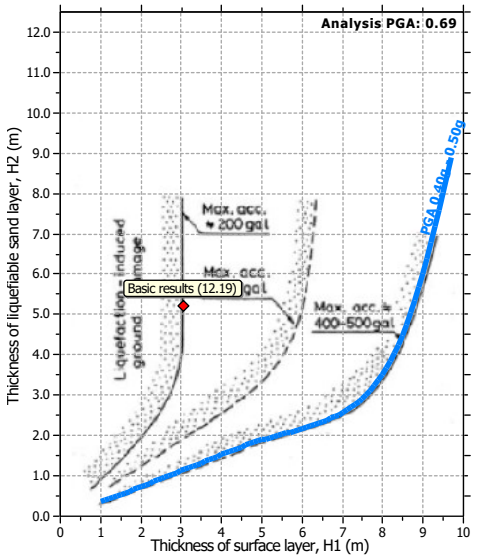
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots



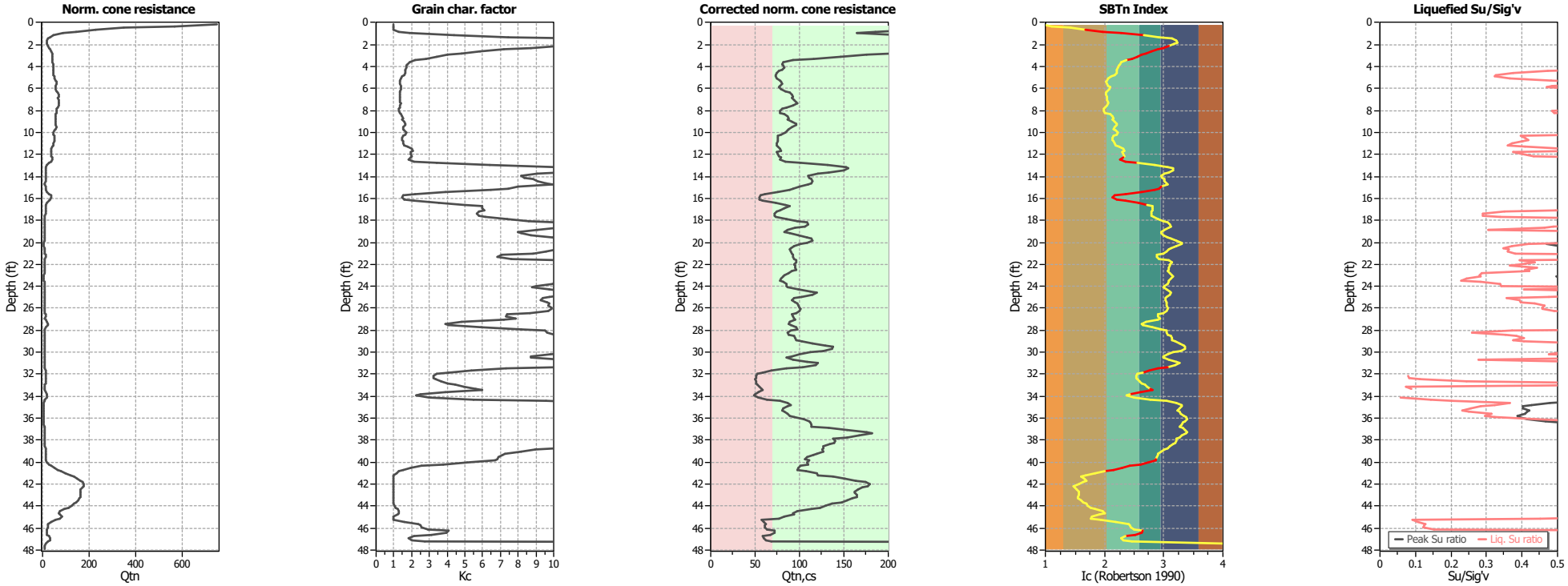




Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.83	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.69	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	14.60 ft	Fill height:	N/A	Limit depth:	60.00 ft

Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.83	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.69	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	14.60 ft	Fill height:	N/A	Limit depth:	60.00 ft