

APPENDIX C

GEOTECHNICAL REPORT



February 21, 2025

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Geotechnical Engineering Report

1030 KAISER ROAD WAREHOUSE

Napa, California

File No. 3315-003.00

INTRODUCTION

As requested, our firm has completed this geotechnical engineering report for the Kaiser Road Warehouse project to be constructed at 1030 Kaiser Road in Napa, California. The purposes of our work have been to explore the existing soil and groundwater conditions at the site, and to provide geotechnical engineering conclusions and recommendations for the design and construction of the proposed structures and associated improvements. This report presents the results of our work.

Scope of Services

Our scope of services for this project included the following tasks:

1. Performance of a site reconnaissance;
2. review of previous geotechnical work performed at the site and in the vicinity of the site by others;

3. review of historical aerial photographs and available groundwater information;
4. performance of subsurface explorations, including the drilling and sampling of six borings to depths of about 20 to 21½ feet below the existing ground surface and the penetration of nine cone penetration tests (CPTs) to depths of about 30 to 50 feet below the existing ground surface;
5. coring of existing asphalt concrete pavements to determine the existing pavement section thickness at three locations on Syar Way;
6. collection of representative bulk samples of soils;
7. laboratory testing of selected soil samples;
8. engineering analyses; and,
9. preparation of this report.

Previous Geotechnical Studies

As input to this report, we reviewed a *Preliminary Geotechnical Investigation – Proposed Office Development – 1030 Kaiser Road – Napa, California* dated November 3, 2023 prepared by Rockridge Geotechnical (Rockridge) for the site. The Rockridge report included the performance of eight CPTs to depths of about 50 feet below the existing ground surface. The Rockridge CPTs are included in Appendix B. Liquefaction results are included in Appendix C.

Figures and Attachments

This report contains a Site Plan showing the boring and CPT locations as Plate 1 and the Logs of Borings as Plates 2 through 7. Included on Plate 8 is the Unified Soil Classification System nomenclature used to describe the soils on the logs. Laboratory test results are included as Plates 9 through 14. Appendix A contains CPT logs obtained at the site for this evaluation in November of 2024. Appendix B contains CPT logs obtained at the site by Rockridge in October of 2023. Appendix C contains the results of the liquefaction analysis performed at the site using both Raney Geotechnical, Inc. (RGI) CPTs (2024) and Rockridge CPTs (2023).

Proposed Construction

We understand the project consists of the design and construction of a single-story, slab-on-grade warehouse building covering about 153,360 square feet in plan area. We understand at least a portion of the building may support above-ground storage tanks. Associated development is anticipated to consist of loading docks, parking and drive areas, underground utilities, stormwater retention, and landscape areas. We understand Syar Way will also be reconstructed. We understand Syar Way will be support traffic loading equivalent to a Traffic Index (TI) of 7.0.

Based on our correspondence, we understand existing site grades will be raised about four feet above the existing ground surface.

Grading plans were not available at the time this report was prepared; however, based on the existing site topography, we anticipate site grading will require up to five to 14 feet of excavation/grading to remove the existing soil stockpiles and fills on the order of four feet may be required to establish final site grades.

FINDINGS

Site Description

The project site is located at 1030 Kaiser Road in Napa, California, and is identified as Napa County Assessor Parcel Number 046-370-004. The property is bound to the north by Basalt Road, beyond which is industrial property; to the south by Kaiser Road, beyond which is a mixed-use development currently under construction; to the east by Syar Way, beyond which is commercial development; and, to the west by industrial development.

At the time of our field exploration in November of 2024, a vast majority of the site was covered in a low to moderate growth of dried volunteer grass and weeds. We also observed several trees and shrubs throughout the site. Three relatively large stockpiles are located across the site. Two stockpiles are located at the north end of the site and one stockpile is located in the middle of the south half of the site. The stockpiles are about three to 14 feet higher than the surrounding subgrade and appear to have been rough graded.

Review of historic aerial photographs indicates the stockpiles were placed between October of 2014 and May of 2018. We understand the stockpiled soil was generated from adjacent grading projects in the vicinity of the site.

In general, the original site (i.e., site not including the stockpiles) is relatively flat and slopes slightly downward from north to south. Review of topographic information provided on a *Topographic Survey* dated 10/5/2023 prepared by BKF Engineers indicates the original site grades vary from about +15 to +20 feet relative to the North American Vertical Datum of 1988 (NAVD88). The existing soil stockpiles vary in height from about +20 to +32 feet based on topographic information provided on the *Topographic Survey*.

Syar Way Existing Pavement Sections

We performed coring at three locations (C1 through C3) on Syar Way as shown on the attached Site Plan (Plate 1). About two inches of existing asphalt concrete was encountered at the core locations on Syar Way. The asphalt concrete pavements were underlain by approximately two inches of aggregate base.

The near-surface soil conditions underlying the aggregate base at the core locations generally consisted of brown silty sand with varying amounts of clay, silt, and sand.

The existing asphalt concrete pavements along Syar Way are generally in a poor condition. We observed longitudinal and alligator cracking along the entire roadway.

Soil Conditions

Results of our field exploration indicate the surface and near-surface soils at the boring locations generally consist of about five feet of lean clay with varying clay, silt, and sand contents overlying clayey and/or silty sands with varying clay, silt, and sand contents extending to the explored 20 to 21½ foot depths of the borings.

At the CPT locations, both the Rockridge locations and RGI locations, the soil conditions generally consist of clays with interbedded layers of sands with varying clay, silt, and sand contents extending to the explored 30 to 50 foot depths of the CPTs.

We also drilled within the existing stockpiles at the north end (boring B4) and south end (boring B6) of the site. The stockpile generally consisted of clay and/or sand fill overlying native clay soils. Based on our observations of the stockpiles, the soils within the stockpiles appear to consist of a mixture of sand, silt, and clay.

At the completion of the subsurface exploration, the borings and CPTs were backfilled with neat cement and native soils in accordance with Napa County Environmental Health Division's standards.

For more specific descriptions of the soil conditions at a particular boring location, please refer to the Logs of Borings presented in Plates 2 through 11 and Appendices A and B.

Groundwater

Free groundwater was encountered about 10 to 18 feet below the existing ground surface at borings B1, B3, and B4 performed on November 18, 2024. Free groundwater was not encountered at borings B2, B5, or B6.

Pore pressure dissipation testing at CPT locations SCPT-4 and SCPT-5 performed on November 21, 2024 and SCPT-8 performed on November 22, 2024 indicates groundwater was measured about nine to 10 feet bgs within the explored 50-foot depths of the CPTs. Pore pressure dissipation testing and direct groundwater measurements performed at the Rockridge CPTs in October of 2023 indicates groundwater was measured about seven to 14 feet bgs at those locations.

Review of historical groundwater data in the area, including the Rockridge report, indicates groundwater can be as high as about five feet below the existing ground surface at the site.

CONCLUSIONS

Shear Wave Velocities and Seismic Site Class

Shear wave velocities obtained at locations SCPT-4, SCPT-5, and SCPT-8 varied from about 711 to 1543 feet per second (fps) within the upper 50 feet of the soil profile.

Based on Table 20.3-1 of American Society of Civil Engineers (ASCE), a seismic Site Class D applies to sites with average shear wave velocities between 600 to 1200 fps for the upper 100 feet of the ground surface. Based on the shear wave velocity data collected from the CPT locations, and assuming the soils from a depth of 50 to 100 feet have at least the average shear wave velocity calculated in the upper 50 feet, and it is our opinion that a Site Class D is applicable to the site, in accordance with Table 20.3-1 of ASCE 7-16 and the 2022 edition of the California Building Code (CBC).

Seismic Design - 2022 CBC/ASCE 7-16 Seismic Design Criteria

The 2022 CBC references the ASCE Standard 7-16 for seismic design. To assist with the structural design of this project, we have provided seismic design parameters for the 2022 CBC, which have been determined based on the sites locations and the web interface developed by ASCE (<https://asce7hazardtool.online/>).

A ground motion hazard analysis is required for structures on Site Class D sites with S_1 greater than or equal to 0.2 unless the following exception is used per *ASCE 7-16 Supplement 3*. A ground motion hazard analysis is not required where the value of the parameter S_{M1} determined by ASCE 7-16 Equation 11.4-2 is increased by 50% for all applications of S_{M1} and the resulting value of the parameter S_{D1} determined by ASCE 7-16 Equation 11.4.4 is used for all applications of S_{D1} in ASCE 7-16.

The seismic design parameters summarized below in Table 1 may be used for seismic design of the planned improvements at the sites. Note that the value of S_{D1} has already been increased in the table.

Table 1: 2022 CBC Seismic Design Parameters

Latitude: 38.2590° N Longitude: 122.2780° W	ASCE 7-16 Table/Figure	2022 CBC Figure/Section/Table	Factor/ Coefficient	2022 CBC Values
0.2-second Period MCE	Figure 22-1	Figure: 1613.2.1(1)	S_s	2.101 g
1.0 second Period MCE_R	Figure 22-2	Figure: 1113.2.1(2)	S_1	0.739 g
Soil Class	Table 20.3-1	Section: 1613.2.2	Site Class	D
Site Coefficient	Table 11.4-1	Table: 1613.2.3 (1)	F_a	1.0
Site Coefficient	Table 11.4-2	Table: 1613.2.3(2)	F_v	1.7
Adjusted MCE Spectral Response Parameters	Equation 11.4-1	Equation: 16-36	S_{MS}	2.101 g
	Equation 11.4-2	Equation: 16-37	S_{M1}	1.884 g**
Design Spectral Acceleration Parameters	Equation 11.4-3	Equation: 16-38	S_{DS}	1.400 g
	Equation 11.4-4	Equation: 16-39	S_{D1}	1.256 g**
Seismic Design Category	Table 11.6-1	Table: 1613.2.5(1)	Risk Category I to IV	D
	Table 11.6-2	Table: 1613.2.5(2)	Risk Category I to IV	D

Notes: MCE_R = Risk-Targeted Maximum Considered Earthquake; g = gravity

* Determined by linear interpolation per Table 11.4.2 of ASCE 7-16

** Value has been increased by 50% per the Exception of Section 11.4.8 of ASCE 7-16.

Liquefaction Potential

Liquefaction is a soil strength loss phenomenon that typically occurs in loose, saturated cohesionless soils as a result of strong ground shaking during earthquakes. The potential for liquefaction at a site usually is determined based on the results of a subsurface soil investigation and the groundwater conditions beneath the site. Hazards to buildings associated with liquefaction include shallow and deep foundation bearing capacity failure, lateral spreading of soil, and differential settlement of soils below foundations, all of which can contribute to structural damage or collapse.

A liquefaction analysis to determine factors of safety against liquefaction was performed for the soil and groundwater conditions encountered at the Rockridge and RGI CPTs performed at the site.

Seismic Settlement

We performed a liquefaction analysis of data obtained from the CPTs using a historic high groundwater level of five feet below the ground surface during a seismic event. The analysis was performed using soil liquefaction assessment software Cliq (Version 3.5.2.22) developed by GeoLogismiki. The software utilizes data collected from CPT soundings to determine factors of safety against liquefaction for varying earthquake input energies and uses the results of the National Center for Earthquake Engineering Research (NCEER) liquefaction evaluation methods summarized by Youd, et al (2001). Input values were obtained using the results of the CPT soundings referenced above.

A peak ground acceleration (PGAM) of 0.96 g was used in the liquefaction analysis based on Equation 11.8-1 of American Society of Civil Engineers (ASCE) 7-16. A mode magnitude earthquake of 6.8 was used for this analysis using the 2014 USGS National Seismic Hazard Mapping Project (NSHMP) Probabilistic Seismic Hazard Analysis (PSHA) Interactive Deaggregation web site.

Liquefaction potential at the site also was evaluated based on the Liquefaction Potential Index (LPI). The LPI is a measure of the liquefaction potential based on an analysis of the entire vertical soil profile, and not just discrete layers (Iwasaki, 1986; Toprak and Holzer, 2003). Factors taken into consideration for the LPI calculations include: thickness of the liquefied layer; proximity of the liquefied layer to the surface; and, the factor of safety. The LPI ranges from 0 to 100 with the value zero representing no liquefaction potential. Surface manifestations of liquefaction occur at $LPI \geq 5$. The LPI for the soil conditions at the CPT locations varied from

about 0.03 to 4.31, indicating very low potential for liquefaction during the design seismic event (mode magnitude earthquake of 6.8 and a PGA of 0.96 g).

The results of the liquefaction analysis at the CPT locations using Cliq indicate calculated seismic settlements varies from about 0.02 (negligible) to about 0.80 inches. Given the results of our analysis performed for this investigation, the worst-case estimate of total post-liquefaction settlement is calculated to be about 0.80 inches. Differential seismic induced settlement across 50 feet, or the shortest dimension of the structure, whichever is less, is estimated to be about ½ inch. These estimates of post-liquefaction seismic settlements represent free-field ground settlement, not settlement of the proposed structure. The presence of non-liquefiable soil layers overlying and interbedded within the liquefiable layers will likely mitigate the impact of seismically induced settlement at the ground surface.

A summary of the LPI and calculated seismic settlement for each CPT performed at the site is provided in Tables 2a and 2b below.

Table 2a: Rockridge CPTs LPI and Calculated Seismic Settlement

Rockridge CPT Location	LPI	Calculated Seismic Settlement (inches)
CPT-1	1.26	0.26
CPT-2	0.08	0.02
CPT-3	1.26	0.32
CPT-4	0.03	0.02
CPT-5	0.15	0.05
CPT-6	0.27	0.05
CPT-7	1.72	0.43
CPT-8	0.11	0.03

Table 2b: RGI CPTs LPI and Calculated Seismic Settlement

Rockridge CPT Location	LPI	Calculated Seismic Settlement (inches)
CPT-1	2.05	0.60
CPT-2	4.31	0.80
CPT-3	0.94	0.19
SCPT-4	0.76	0.28
SCPT-5	1.80	0.53
CPT-6	0.03	0.05
CPT-7	2.45	0.47
SCPT-8	0.35	0.20
CPT-9	2.93	0.55

The potential for dry sand seismic settlement was also evaluated for soils above the groundwater table. Due to the near-surface clayey nature of the native soils and relatively dense granular soils encountered at the boring and CPT locations, dry sand seismic settlement within the upper five feet of the site is anticipated to be negligible at the site.

Based on the results of our analysis, it is our opinion that the potential for loss of bearing capacity (strength) beneath the prepared building pad is very low and does not need to be further mitigated in the design of the structure, provided the recommendations of this report are incorporated into the design of the building.

Soil Expansion Potential

Laboratory tests conducted on samples of the near-surface clays indicate these materials possess “low” to “moderate” expansion potential when tested in accordance with ASTM International (ASTM) D4829 test method (Plates 9 through 11). Additional laboratory tests performed on near-surface clays revealed these materials possess medium plasticity indexes when tested in accordance with ASTM D4318 test method (see Plate 12).

Based on the laboratory test results and our experience with similar soil conditions in the area, we conclude the native clays are capable of exerting significant expansion pressures on foundations, interior floor slabs and exterior flatwork.

Recommendations to mitigate the effects of potentially expansive clays, such as granular import material to construct the structural pads and/or chemical treatment of the clays are provided in this report. Specifically, at least 12 inches of imported, compactable, non-expansive (Expansion

Index less than 20) soils and/or aggregate base is recommended beneath interior slabs-on-grade and exterior flatwork, including sidewalks. Chemical amendment of the clay soils (i.e., lime-treatment) also may be considered to reduce the expansion potential of the on-site clays.

Bearing Capacity

Based on our field exploration and laboratory test results, it is our opinion that the undisturbed surface and near-surface soils are capable of supporting the proposed improvements provided the recommendations of this report are followed. Engineered fill that is properly placed and compacted during earthwork also would be suitable for support of the proposed structures and related improvements.

The existing fill within the soil stockpile does not appear to have been placed as engineered fill and will not be suitable for the proposed improvements unless the stockpile soils are processed and recompacted. We understand the existing soil stockpiles will be removed during the site grading operations and may be used as engineered fill on the site.

Due to the expansion potential of the near-surface clay soils and undisturbed native clay soils below the stockpiles, these soils are not considered suitable for direct support of slabs-on-grade unless these soils are lime-treated as described in the Lime Treated Subgrade - Alternative section of this report.

Pavement Subgrade Quality

Laboratory test indicates that the anticipated clay subgrade soils possess Resistance (“R”) values of 15 to 27 when tested in accordance with California Test 301 (Plates 13 and 14). Based on these test results, it is our opinion that the anticipated clay subgrade soils are considered moderate quality materials for support of asphalt concrete pavements. However, chemical treatment may be considered to increase the pavement subgrade quality of the near-surface soils and reduce the overall pavement section required at the site.

Chemical Treatment of Pavement Subgrade Soil

Chemical treatment of soil can be an effective and economical method of enhancing pavement subgrade properties of clayey soils facilitating dry up of near-saturated soils, enabling construction to proceed during or shortly after the rainy season; and, to reduce the expansive characteristics of near-surface clayey soils. Chemical treatment of the near-surface clayey soils

in the structural pads and pavement areas will substantially reduce the risk of post-construction differential movements associated with the near-surface subgrade soils.

We anticipate chemical treatment of the near-surface soils can improve the support quality of the soils and reduce the required thickness of the base materials. Based upon our experience with similar soil types, it is our opinion that pavements supported on native soils treated with at least five pounds of lime per square foot of treated area to a depth of 12 inches can be improved to an R-value greater than 50.

The performance of chemically stabilized soils is dependent on uniform mixing of the lime into the subgrade soil and the provisions of adequate curing following amendment with the lime. An experienced chemical-stabilization contractor and a comprehensive quality control program are generally required to achieve the best possible results.

Syar Way Rehabilitation

Based on the asphalt concrete and aggregate base thicknesses encountered at the core locations along Syar Way and the results of the R-value testing, Syar Way is not considered suitable for support of the anticipated traffic loading in its current condition. Based on our analysis, Syar Way should be completely removed and replaced with an appropriate pavement section as noted in the Pavement Design section of this report for a TI of 7.0.

Groundwater Effect on Development

Groundwater was encountered between seven to 18 feet below the existing ground surface at the borings and CPTs performed in November of 2024 and the CPT. Groundwater was encountered between about seven to 14 feet below the existing ground surface at the CPTs performed by Rockridge in October of 2023. Review of historical groundwater in the area indicates groundwater has been encountered as high as about five feet below the existing ground surface in the vicinity of the site.

Based on explorations performed at the site and available groundwater data, we anticipate excavations extending below a depth of about five feet below the existing ground surface may encounter groundwater and require dewatering (depending on the time of year of construction).

If groundwater is encountered, the use of sumps, submersible pumps, deep wells, or a well point system could be used as methods to lower the groundwater level. The dewatering method used will depend on the soil conditions, depth of the excavation, and amount of groundwater present

within the excavation. Dewatering, if required, should be the contractor's responsibility. The dewatering system should be designed and constructed by a dewatering contractor with local experience.

We recommend the selected dewatering system lower the groundwater level to at least two feet below the bottom of the proposed excavations where groundwater is encountered during construction.

Seasonal Water

During the wet season, infiltrating surface runoff likely will create a saturated surface condition. It is probable that grading operations attempted following the onset of winter rains will be hampered by high soil moisture contents. Soil intended for use as engineered fill likely will require a prolonged period of dry weather and/or considerable aeration to reach a moisture content suitable to achieve required compaction. This should be considered in the construction schedule for the project.

Soils beneath existing pavements (i.e., Syar Way) will likely be at an elevated moisture content regardless of the time of year and will require drying before compaction or use as fill. Such soils, intended for use as engineered fill, will require considerable aeration and/or drying to reach a moisture content that will permit the soils to be properly compacted. This should be considered in the construction schedule for the project.

Typical remedial measures include discing and aerating the soils during dry weather, mixing the soils with dryer materials, removing and replacing the soils with an approved fill material, stabilization with a geogrid reinforcement, and/or mixing the soils with an approved hydrating agent such as a lime or cement. Our firm should be consulted prior to implementing any remedial measure to observe the unstable subgrade condition and provide site-specific recommendations.

Excavation Conditions

The surface and near-surface soils should be readily excavatable with conventional construction equipment. Based on the borings and CPTs performed at the site, excavations associated with structure foundations, shallow trenches for utilities, and other excavations less than five feet deep associated with the planned construction, should stand vertically for short periods of time (i.e., less than one day). Contractors should be prepared to brace or shore the excavations, if necessary.

Excavations deeper than five feet that will be entered by workers should be sloped, braced, or shored in accordance with current Occupational Safety and Health Administration (OSHA) regulations. The contractor must provide an adequately constructed and braced shoring system in accordance with federal, state, and local safety regulations for individuals working in an excavation that may expose them to the danger of moving ground.

Excavated materials should not be stockpiled directly adjacent to an open trench to prevent surcharge loading of the trench sidewalls. Excessive truck and equipment traffic also should be avoided near open trenches. If material is stored or heavy equipment is operated near an excavation, stronger shoring would be needed to resist the extra pressure due to the superimposed loads.

Soil Suitability for Engineered Fill Construction

The existing on-site soils, including the stockpiled soils, are considered suitable for use as engineered fill provided that they do not contain significant concentrations of organics, rubble, and deleterious debris, and are at a proper moisture content to achieve the desired degree of compaction.

The stockpile clayey soils and near-surface clay soils below the stockpile present beneath the site are not suitable for support of interior or exterior slab-on-grade concrete unless they are chemically treated, and these soils should be prepared as recommended in this report. Specific recommendations for subgrade preparation have been presented in this report to mitigate the effect of expansive clayey soils on the planned structures and slabs.

Soil Corrosion Potential

Three samples of near-surface soil were submitted to Sunland Analytical Lab of Rancho Cordova, California for testing to determine minimum resistivity, pH, and chloride and sulfate concentrations to help evaluate the potential for corrosive attack upon reinforced concrete and buried metal. The results of the corrosivity testing are summarized in Table 3. Copies of the corrosion test reports are presented on Plates 15 through 17.

Table 3: Corrosion Test Results

Sample Location	Depth (feet)	Soil Type	Analyte / Test Method			
			pH	Chloride Content (ppm)	Sulfate Content (ppm)	Resistivity (ohm-cm)
			CA DOT 643 Modified*	CA DOT 422	CA DOT 417	CA DOT 643 Modified*
B1	2-3	CL	5.12	67.1	32.7	1070
B2	0-5	CL	7.19	16.2	37.0	1690
B3	2-3	CL	6.75	23.5	70.5	1770

Notes: * = Small cell method CA DOT = California Department of Transportation
 Ω-cm = Ohm-centimeters ppm = Parts per million

The California Department of Transportation Corrosion and Structural Concrete Field Investigation Branch, Corrosion Guidelines, Version 3.2, dated March 2021, considers a site to be corrosive to foundation elements if one or more of the following conditions exists for the representative soil and/or water samples taken: has a chloride concentration greater than or equal to 500 ppm, sulfate concentration greater than or equal to 2000 ppm, or the pH is 5.5 or less.

Based on the above test results, the on-site soils are not considered corrosive to buried metal or to concrete for the samples tested. However, the low resistivity may indicate a higher corrosion potential to metal in direct contact with soil.

Table 19.3.1.1 – Exposure Categories and Classes, of American Concrete Institute (ACI) 318-19, Section 19.3 – Concrete Durability Requirements, as referenced in Section 1904.1 of the 2022 CBC, indicates the severity of sulfate exposure for the samples tested is Exposure Class S0. Exposure Class S0 is assigned for conditions where the water-soluble sulfate concentration in contact with concrete is low and injurious sulfate attack is not a concern. The project structural engineer should review the requirements of ACI 318 and determine their applicability to the site.

Raney Geotechnical, Inc. does not perform corrosion engineering. Therefore, if it is desired to further define the soil corrosion potential at the site a corrosion engineer should be consulted.

RECOMMENDATIONS

General

The recommendations presented below are appropriate for typical construction in the late spring through fall months. The on-site soils likely will be saturated by rainfall in the winter and early spring months and will not be compactable without drying by aeration or chemical treatment. Should the construction schedule require work to continue during the rainy season, additional recommendations can be provided, as conditions dictate.

Site preparation should be accomplished in accordance with the provisions of this report. A representative of the Geotechnical Engineer should be present during all earthwork operations to evaluate compliance with the recommendations included in this report. The Geotechnical Engineer of Record referenced herein should be considered the Geotechnical Engineer that is retained to provide geotechnical engineering observation and testing services during construction.

Site Clearing

The site should be cleared of all stockpiled soils, surface and subsurface debris; remnants of prior structures, if any; utilities to be relocated or abandoned, including trench backfill and associated pipe bedding material, if any; and, any other items designated for removal. Depressions resulting from the removal of the above items, as well as any loose, soft, or saturated soils should be cleaned out to firm native soils and backfilled with engineered fill in accordance with the recommendations in this report.

Surface vegetation should be removed by stripping. Strippings may be stockpiled for later use in landscape areas or disposed of off-site. Strippings should not be used in general fill construction, but may be used in landscaped areas, provided they are kept at least five feet from any structure, including adjacent flatwork and pavements, moisture conditioned, and receive compactive effort.

Discing of organics into the surface soils may be a suitable alternative to stripping, depending upon the quantity and condition of the surface vegetation at the time of grading. Discing should be allowed only with our prior approval and discing operations must be continuous until organics are adequately mixed with the soil to provide a compactable mixture. Localized concentrations of organics will not be acceptable.

Vegetation designated for removal should include the entire rootball and roots larger than ½-inch in diameter. Adequate removal of debris and roots may require laborers and handpicking to clear the subgrade soils to the satisfaction of the Geotechnical Engineer's on-site representative.

Depressions resulting from removal of the above items, as well as any loose, soft, or saturated soils should be cleaned out to firm native soil and backfilled with engineered fill in accordance with the recommendations in this report. It is important that the Geotechnical Engineer's representative be present on a periodic basis during clearing operations to verify appropriate removal of the surface and subsurface items, as well as the proper backfilling of resulting excavations.

Subgrade Preparation

Due to the potential expansion characteristics of the native soils, the upper 12 inches of the final structural pad and exterior flatwork subgrades should consist of imported non-expansive engineered fill, or native clay soils chemically amended as noted below.

Following site clearing and stripping operations, areas to receive fill, achieved by excavation, or to remain at-grade should be scarified to a depth of at least 12 inches, moisture conditioned to at least two percent above the optimum moisture content and uniformly compacted to not less than 90 percent of the ASTM D1557 maximum dry density or to the highest degree possible for the soil moisture content and stability at the time of construction. Scarification and recompaction should extend at least five feet beyond the perimeter of the structures and two feet beyond the outer edge of pavements.

It is possible that soils present at the bottom of required excavations will initially be too wet to properly compact and will require a period of drying and/or aeration for the soils to dry to a workable moisture content. Alternative recommendations to stabilize the bottom of excavations can be provided during construction by the Geotechnical Engineer based on actual field conditions. The use of lime stabilization or use of geotextile fabrics or geogrids is typically recommended to stabilize soils during construction.

Compaction of all subgrade soils should be performed using a heavy, self-propelled, sheepfoot compactor capable of achieving the required compaction and must be performed in the presence of the Geotechnical Engineer's representative who will evaluate the performance of subgrade when subject to compactive effort. Difficulty in achieving subgrade compaction may be an indication of loose, soft, or unstable soil conditions that could require additional excavation.

If these conditions exist, additional subgrade stabilization recommendations may be required at the time of construction.

The upper six inches of pavement subgrades should be uniformly compacted to at least 95 percent relative compaction at a moisture content of at least the optimum moisture content, regardless of whether final grade is established by excavation, engineered fill, or left at grade. Additional recommendations regarding pavement subgrades are provided in the Pavement Design section of this report.

Lime-Treated Subgrade - Alternative

Where 12-inches of lime-treated soil will be used as non-expansive fill, the upper 12 inches of final subgrade soils should be treated with at least five percent (by dry weight of soil) high-calcium or dolomitic quicklime. At least five pounds of lime per square foot of treated area to a depth of 12 inches should be used to achieve the five percent mixture.

Concrete slabs-on-grade in areas that have been lime-treated should be underlain by at least four inches of aggregate base. However, additional aggregate base may be required, depending on the overlying structure. Final subgrade for slab-on-grade concrete is the surface on which aggregate base or capillary break materials are placed. Lime-treatment of the subgrade soils should be performed in general conformance with Section 24 of the *Caltrans Standard Specifications*, latest edition.

Lime-treated soil for support of concrete slabs should be moisture conditioned to at least two percent above the optimum moisture content and compacted to not less than 90 percent of the ASTM D1557 maximum dry density and maintained in that condition until covered by capillary break gravel or aggregate base.

Lime-treated soil for support of pavements should be moisture conditioned to at least two percent above the optimum moisture content and compacted to not less than 92 percent of the ASTM D1557 maximum dry density and maintained in that condition until covered by aggregate base.

If undisturbed native soils are to be lime-treated, the scarification and compaction procedures outlined in the Subgrade Preparation section of this report are not required within the upper 12 inches of the final subgrade, prior to lime-treatment.

Engineered Fill Construction

In general, the on-site soils (native and stockpiled soils) are suitable for engineered fill construction in structural areas provided the materials do not contain rubbish, rubble greater than three inches in maximum dimension, and significant organic concentrations. Imported fill materials, if required, should be compactable, granular soils with an Expansion Index of 20 or less, and contain no particles greater than three inches in maximum dimension. However, if the imported fill will be lime-treated, the materials should be clayey and similar to the existing onsite soils.

Imported soils should be approved by the Geotechnical Engineer prior to being transported to the site. Also, if imported fills are required (other than aggregate base), the contractor must provide appropriate documentation that the import is free of known contamination per Department of Toxic Substances Control (DTSC) and within acceptable corrosion limits.

Engineered fill should be placed in lifts that do not exceed 12 inches in compacted thickness. Native or imported clayey materials should be thoroughly moisture conditioned to at least two percent above the optimum moisture content and uniformly compacted to at least 90 percent of the ASTM D1557 maximum dry density. Approved granular imported fill materials should be uniformly moisture conditioned to at least the optimum moisture content and compacted to at least 90 percent relative compaction. Relative compaction should be based on the ASTM D1557 maximum dry density.

The upper 12 inches of final structural pad subgrades, including adjacent exterior flatwork areas, should consist of non-expansive granular on-site or import soils compacted to at least 90 percent relative compaction at the optimum moisture content or above.

Alternatively, the upper 12 inches may consist of lime-treated native clays compacted to at least 90 percent relative compaction at a moisture content of at least two percent above the optimum moisture content.

The upper six inches of untreated pavement subgrades should be uniformly compacted to at least 95 percent of the maximum dry density at a moisture content of at least the optimum moisture content and must be stable under construction traffic prior to placement of aggregate base. Alternatively, the upper 12 inches of lime-treated subgrade soils should be compacted to at least 92 percent relative compaction at not less than two percent over the optimum moisture content.

Permanent excavation and fill slopes should be constructed no steeper than two horizontal to one vertical (2:1) and should be vegetated as soon as practical following grading to minimize erosion. Slopes should be over-built and cutback to design grades and inclinations.

Utility Trench Backfill

Bedding of utilities and initial backfill should be in accordance with the manufacturer's recommendations for the pipe materials selected and governing jurisdiction's standards. We recommend that native soil be used to backfill utility trenches, especially within structural areas.

We recommend that on-site soil be used as trench backfill, especially below the non-expansive or lime-treated material within the footprint of the interior concrete slabs. Utility trench backfill should be placed in maximum 12-inch thick lifts (loose thickness) and moisture conditioned to at least two percent above the optimum moisture content. All backfill should be mechanically compacted to not less than 90 percent relative compaction. Within the upper six inches of pavement areas the minimum compaction should be increased to 95 percent relative compaction.

If the top 12 inches of the concrete slabs, including exterior flatwork, subgrades consist of lime-treated soils, the upper 12 inches of trench backfill should consist of controlled density fill (CDF) or aggregate base compacted to at least 90 percent relative compaction. Within the upper six inches of untreated pavement subgrade soils and upper 12 inches of lime-treated pavement subgrade soils, compaction should be increased to at least 95 percent relative compaction at no less than two percent above the optimum moisture content.

We recommend that underground utility trenches that are aligned nearly parallel with foundations be at least three feet from the outer edges of foundations, wherever possible. As a general rule, trenches should not encroach into the zone extending outward at a one horizontal to one vertical (1:1) inclination below the bottom of the foundations. Additionally, trenches parallel to existing foundations should not remain open longer than 72 hours. The intent of these recommendations is to prevent loss of both lateral and vertical support of foundations, resulting in possible settlement.

Foundation Design

Conventional Shallow Foundations

The proposed structures may be supported upon continuous and/or isolated spread foundations extending at least 18 inches into the compacted structural pad, as measured from lowest adjacent

soil grade. For this project, the structural pad subgrade is defined as the soil surface on which gravel is placed or the adjacent subgrade level, whichever is deeper. Continuous foundations should be at least 12 inches wide and isolated spread foundations should maintain a minimum 18-inch dimension.

Foundations bearing on undisturbed native soils and/or engineered fill may be sized for maximum vertical compressive loads utilizing a maximum allowable soil bearing pressures of 3000 pounds per square foot (psf) for dead plus live load; this bearing value may be increased by one-third to include the effects of seismic or wind forces. The weight of foundation concrete extending below lowest adjacent soil grade may be disregarded in sizing computations.

We recommend that all foundations be adequately reinforced to provide structural continuity, mitigate cracking, and enable spanning of local soil irregularities. Reinforcement should be determined by the project structural engineer.

Resistance to lateral displacement of shallow foundations may be computed using an ultimate friction factor of 0.25 multiplied by the effective vertical load on each foundation. Additional lateral resistance may be achieved using an ultimate passive earth pressure against the vertical projection of the foundation equal to an equivalent fluid pressure of 300 psf per foot of depth. These two modes of resistance should not be added unless the passive earth pressure component is reduced by 50 percent. The upper one foot of passive resistance should be neglected if the area in front of the foundation does not contain flatwork or pavement for at least five lateral feet from the outside edge of the foundation.

Mat Foundations

The proposed tank structures may also be supported on a mat foundation extending at least six inches below the lowest adjacent soil subgrade and bearing on at least six inches of properly placed and compacted granular engineered fill (i.e., aggregate base).

Mat foundations so established may be sized for a maximum allowable vertical bearing capacity of 1500 pounds per square foot (psf) for dead plus live load, with a one-third increase available for total load, including wind or seismic forces. The deflection of the slab can be evaluated using a modulus of subgrade reaction of 100 pounds per square inch per inch (pci). The weight of foundation concrete extending below adjacent soil grade may be disregarded in bearing computations.

The mat foundation should be reinforced to provide continuity and to allow the foundation the ability to span isolated soil irregularities. Foundation reinforcement should be determined by the project structural engineer.

Resistance to lateral foundation displacement may be computed using an allowable friction factor of 0.25, which may be multiplied by the effective vertical load on each foundation. Additional lateral resistance may be computed using an allowable passive earth pressure against the vertical projection of foundations equivalent to a fluid pressure of 300 psf per foot of depth. These two modes of resistance should not be added unless the frictional value is reduced by 50 percent since mobilization of these resistances may occur at different degrees of horizontal movement. The upper one foot of passive resistance should be neglected if the area in front of the foundation does not contain flatwork or pavement for at least five lateral feet from the outside edge of the foundation.

Shallow Foundation Settlement

We estimate total static settlement for shallow or mat foundations using the recommended maximum net allowable bearing pressures presented above, should be $\frac{3}{4}$ inch or less. Differential settlements are estimated to be about one-half the total settlement over a distance of 50 feet or the least dimension of the structure, whichever is less. These settlement estimates are based on the available boring information, our experience with similar structures and soil conditions, and field verification of suitable bearing soils by our firm during foundation construction.

Drilled, Cast-in-Place Concrete Pier Design

Isolated, ancillary structures subject to more lateral load than vertical load may also be supported on drilled, cast-in-place concrete piers (drilled piers) extending at least five feet below lowest adjacent soil grade. Drilled piers should have a minimum shaft diameter of 18 inches to help facilitate proper cleaning of the bottom of the pier. Drilled piers extending at least five feet below the existing ground surface may be sized utilizing a maximum allowable end bearing capacity of 3000 psf or a maximum allowable skin friction of 250 psf for dead plus live loads, which may be applied over the surface of the pier extending deeper than 12 inches below grade. Those values may be increased by one-third to include short-term wind or seismic forces.

Uplift resistance of pier foundations may be computed using the following resisting forces, where applicable: 1) weight of the pier concrete (150 pounds per cubic foot [pcf]), and 2) an allowable skin friction of 250 psf applied over the shaft area of the pier. Increased uplift

resistance can be achieved by increasing the diameter of the pier or increasing the depth. The upper one foot of skin friction should be disregarded unless the pier is completely surrounded by slab concrete for a distance of at least feet from the edge of the foundation pier.

Torsional resistance may be computed using the allowable skin friction of 250 psf applied over the shaft area of the pier.

Sizing of drilled piers to resist lateral loads can be evaluated using Section 1807.3.2 of the 2022 CBC. An allowable value of 300 pcf for lateral bearing as defined in Table 1806.2 of the CBC may be used for the coefficients S_1 and S_3 for the nonconstrained and constrained conditions, respectively. The allowable lateral value may be increased 1/3 for total loading that includes wind and/or earthquake loads. The upper 12 inches of the subgrade should be neglected for the nonconstrained condition.

Reinforcement and concrete should be placed in the pier excavations as soon as possible after excavation is completed to minimize the chances of sidewall caving into the excavations. We recommend that the pier contractor be prepared to case the pier holes or use drilling slurry, if conditions require. Voids created by excessive sloughing may be backfilled with slurry and/or additional structure concrete, if approved by the project structural engineer.

If the drilled piers are constructed in the "dry" (with dry being less than two inches of water at the base of the excavation), the concrete may be placed by the free-fall method, using a short hopper or back-chute to direct the concrete flow out of the truck into a vertical stream of flowing concrete with a relatively small diameter. The stream is directed to avoid hitting the sides of the excavation or any reinforcing cages. For the free-fall method of concrete placement, we recommend the concrete mix be designed with a slump of five to seven inches.

We anticipate the drilled pier excavations will encounter groundwater within about five to 10 feet below the existing ground surface due to our experience and conditions encountered during our field explorations. Where groundwater will be encountered which cannot be controlled such that more than six inches of water accumulates at the bottom of the pier excavation, concrete should be placed using a tremie. For concrete placed using the tremie method, a slump of six to eight inches, and a maximum aggregate size of $\frac{3}{4}$ -inch is recommended. The required slump should be obtained by using plasticizers or water-reducing agents. Addition of water on-site to establish the recommended slump should not be allowed.

When extracting temporary casings or tremie methods from the excavation, care should be taken to maintain a head of concrete to prevent infiltration of water and soil into the shaft area. The head of concrete should always be greater than the head of water outside the pier or tremie, taking into account the differences in unit weights of concrete and water.

We estimate total settlement for drilled pier foundations using the recommended maximum net allowable bearing pressure and allowable capacities presented above, will be less than $\frac{3}{4}$ inch. Differential settlements may be as much as the total settlement between individual pier elements. The settlement estimates are based on the available soil information, our experience with similar structures and soil conditions, and field verification of suitable bearing soils during foundation construction.

Interior Floor Slab Support

Interior concrete slab-on-grade floors should be supported upon at least 12 inches of non-expansive imported soil or lime-treated soil subgrade prepared in accordance with the recommendations in this report and maintained in that condition (at least two percent over the optimum moisture content). Interior concrete slab-on-grade floors should be at least six inches thick and contain reinforcement for crack control. Final reinforcement and joint spacing should be determined by the project structural engineer. Proper and consistent location of the reinforcement near mid-slab is essential to its performance. The risk of uncontrolled shrinkage cracking is increased if the reinforcement is not properly located within the slab.

Floor slab areas that will be subjected to any vehicle/forklift traffic, as well as floor slab areas to support palletized construction materials, cranes and/or any other relatively heavy construction equipment or machinery, should be supported by at least six inches of Class 2 aggregate base. The aggregate base thickness can be reduced to four inches of Class 2 aggregate base if the slab is at least seven inches thick. The total aggregate base thickness below slab-on-grade concrete may be 12 inches total if the low-expansion potential import soil consists of aggregate base. The aggregate base should be compacted to at least 95 percent relative compaction to provide adequate support capacity. The aggregate base should be placed over a properly compacted subgrade in accordance with the recommendations of this report.

Floor slabs that will receive moisture sensitive floor covering (e.g. vinyl covering, wood-laminate, etc.) within office areas or less heavily loaded areas of the building should be underlain by a layer of free-draining crushed rock, serving as a deterrent to migration of capillary moisture. The crushed rock layer should be between four and six inches thick and graded such that 100 percent passes a one-inch sieve and no appreciable amount passes a No. 4 sieve. Additional

moisture protection may be provided by placing a vapor retarder membrane (at least 15-mils thick) directly over the crushed rock as recommended in the following section.

Provided the building pad is constructed in accordance with the recommendations included in this report (12 inches of non- to very low-expansive, granular soils or lime-treated clay soils, and aggregate base where applicable), a soil modulus of reaction (k_s) of 200 pounds per cubic inch (pci) may be utilized for design of floor slabs subjected to vehicle/forklift traffic or any other loading conditions described above. If additional soil-related parameters are required for design of the interior floor slabs, we can provide them upon request.

Floor slab construction over the past 30 years or more has included placement of a thin layer of sand or pea gravel over the vapor retarder membrane. The intent of the sand or pea gravel is to aid in the proper curing of the slab concrete and to protect the membrane prior to concrete placement. However, debate over excessive moisture vapor emissions from floor slabs includes concern for water trapped within the sand or pea gravel. Consequently, we consider the use of the sand or pea gravel layer as optional and not required from a geotechnical perspective. The concrete curing benefits should be weighed against efforts to reduce slab moisture vapor transmission.

The recommendations presented above are intended to mitigate any significant soils-related cracking of the slab-on-grade floors. More important to the performance and appearance of a Portland cement concrete slab is the quality of the concrete, the workmanship of the concrete contractor, the curing techniques utilized, and the spacing of control joints.

Floor Slab Moisture Penetration Resistance

It is likely that floor slab subgrade soils will become saturated at some time during the life of the structures, especially when the slab is constructed during the wet seasons, or when constantly wet ground or poor drainage conditions exist adjacent to the structures. For this reason, it should be assumed that the interior slab intended for moisture-sensitive floor coverings or materials, require protection against moisture or moisture vapor penetration. In order to mitigate the migration of moisture through the slab, we recommend that at minimum, all interior floor slabs that will require protection against moisture or moisture vapor penetration are underlain by a Stego® wrap vapor barrier (15 mils thick). Stego® describes this specific product as possessing an extremely low permeance, preventing water vapor and resulting in superior defense against floor failures. This subject Stego® wrap vapor barrier is engineered to exceed ASTM E1745 Class A standards and provide long-term moisture vapor protection. The Stego® wrap vapor barrier should be placed between the interior concrete slab and the recommended four to six inch

thick layer of Class 2 aggregate base and in strict conformance with the manufacturer's guidelines. We recommend that the installation of the vapor barrier is observed as recommended by a Stego® Industries, LLC representative.

We are recommending that the slab be constructed directly upon the Stego® wrap vapor barrier membrane. The slab designer should provide specifications for placement and curing of the slab concrete placed over an impermeable membrane.

Recommendations contained in this report concerning foundation and floor slab design are presented as minimum requirements only from the geotechnical engineering standpoint.

It is emphasized that the use of gravel/crushed rock and membrane below the slab will not "moisture proof" the slab, nor will it assure that slab moisture transmission levels will be low enough to prevent damage to floor coverings or other structural components. It is emphasized that we are not slab moisture proofing or moisture protection experts. The sub-slab gravel/crushed rock and vapor retarder membrane simply offers a first line of defense against soil-related moisture. If increased protection against moisture vapor penetration of the slab is desired, a concrete moisture protection specialist should be consulted. The design team should consider all available measures for slab moisture protection. It is commonly accepted that maintaining the lowest practical water-cement ratio in the slab concrete is one of the most effective ways to reduce future moisture vapor penetration of the completed slabs.

Below-Grade Wall Design

Below-grade walls, if any, may be supported on a continuous foundation extending at least 18 inches into firm native ground or engineered fill constructed in accordance with the recommendation in this report. Continuous footings for retaining walls may be designed based upon the recommendations contained in the Foundation Design section of this report.

Retaining walls that will be allowed to slightly rotate about their base (unrestrained at the top or sides) should be capable of resisting "active" lateral earth pressure equal to an equivalent fluid pressure of 50 psf per foot of wall backfill for horizontal backfill and fully drained conditions. Retaining walls that are fixed at the top should be capable of resisting "at-rest" lateral earth pressure equal to an equivalent fluid pressure of 65 psf per foot of wall backfill, again assuming horizontal backfill and fully drained conditions.

If drainage is not provided behind the walls, the effects of hydrostatic forces should be included in the wall design earth pressures. If the walls are designed to include the effects of hydrostatic forces (i.e., undrained soil conditions), active and at rest pressures would increase to 85 and 90 psf per foot of wall, respectively, to include the effect of hydrostatic pressures.

Lateral resistance may be computed using an allowable “passive” earth pressure of 300 psf per foot of depth for drained walls and 200 psf for undrained walls.

A seismic increment of earth pressure of 15 psf per foot of wall backfill should be added to the active earth pressure noted previously for design of retaining walls for seismic conditions. Specifically, the earth pressure for seismic conditions should be 65 psf per foot for active lateral earth pressures.

Appropriate set-backs for structures constructed behind the walls should be maintained so that such structures do not surcharge the walls. If retaining walls will experience additional surcharge loading from other structures or vehicles, surcharge loading should be evaluated by the wall designer on a case-by-case basis.

Backfill behind retaining walls should be fully drained to prevent the build-up of hydrostatic pressures behind the wall for walls that have been design using active or at-rest pressures and fully drained conditions. Retaining walls should be provided with a drainage blanket of Class 2 permeable material, Caltrans Specification Section 68-2.02F(3), at least one foot wide extending from the base of wall to within one foot of the top of the wall. The top foot above the drainage layer should consist of compacted on-site materials, unless covered by a concrete slab or pavement. Weep holes or perforated rigid pipe, as appropriate, should be provided at the base of the wall to collect accumulated water. Drainpipes, if used, should slope to discharge at no less than a one percent fall to suitable drainage facilities. Open-graded ½- to ¾-inch crushed rock may be used in lieu of the Class 2 permeable material, if the rock and drainpipe are completely enveloped in an approved non-woven, geotextile filter fabric.

In our opinion, retaining walls for loading dock walls that will be covered with a floor slab such that water cannot infiltrate into the backfill can be designed assuming no hydrostatic pressures will be present behind the wall and drainage is not required from a geotechnical perspective.

Structural backfill materials for retaining walls within a one horizontal to one vertical (1H:1V) projection from the bottom of the walls (other than the drainage layer) should consist of non- to very low-expansive (Expansion Index < 20), compactable granular material that does not contain significant quantities of rubbish, rubble, organics, and rock over six inches in size. Clays, pea

gravel, and/or crushed rock should not be used for wall backfill. Structural backfill should be placed in lifts not exceeding 12 inches in compacted thickness and should be mechanically compacted to at least 90 percent relative compaction.

Exterior Flatwork

Soil subgrade areas to support exterior concrete flatwork should be prepared in accordance with the Subgrade Preparation and Engineered Fill Construction recommendations included in this report (i.e., at least 12 inches of non-expansive fill and/or lime treated subgrade). Exterior flatwork subgrade soils, either native and/or lime-treated soils, should be moisture conditioned to at least two percent over the optimum moisture content and uniformly compacted to at 90 percent relative compaction prior to concrete placement. Proper moisture conditioning of the subgrade soils is considered essential to the performance of exterior flatwork.

Exterior flatwork should be underlain by at least four inches of aggregate base compacted to at least 90 percent relative compaction. The aggregate base should be placed over the 12 inches of low-expansion potential imported soil, or lime-treated soil. The total aggregate base thickness below exterior flatwork may be 12 inches if the low-expansion potential import soil consists of aggregate base.

Exterior flatwork concrete should be at least four inches thick and consideration should be given to thickening the outside edge of the flatwork to twice the slab thickness, and reinforcing the flatwork with rebar for crack control. Practices recommended by the Portland Cement Association (PCA) for proper placement and curing of concrete should be followed during exterior concrete flatwork construction.

Expansion joints should be provided to allow for minor vertical movement of the flatwork. Exterior flatwork should be constructed independent of the structural foundation and isolated column foundations by the placement of a layer of felt material between the flatwork and the foundation.

Areas adjacent to new exterior flatwork should be landscaped to maintain more uniform soil moisture conditions adjacent to and under the flatwork. We recommend that final landscaping plans not allow fallow ground adjacent to exterior concrete flatwork.

Pavement Design

We are providing several alternative pavement alternatives based on the soil conditions encountered at the site, the results of laboratory testing previously obtained at the site, and our experience.

Based on our laboratory test results, an R-value of 15 was used to evaluate pavement sections for untreated subgrades and an R-value of 50 was used to evaluate pavement sections for clay subgrades amended with at least five pounds of lime per square foot of treated area, mixed to a depth sufficient to produce a compacted lime-treated layer 12 inches thick, for design of pavements.

The procedures used to design the pavement sections are in general conformance with the California Highway Design Manual, Sixth Edition. The pavement sections provided below are considered appropriate for the anticipated traffic conditions at the site. Alternative pavement sections for different traffic indices (TI's) can be provided, upon request. The project civil engineer should determine the appropriate TI based on anticipated traffic conditions.

Table 4: Pavement Design Alternatives

Traffic Index (TI)	Pavement Use	Untreated Subgrades R-value = 15			Lime-Treated Subgrades Soils (a) R-value = 50		
		Asphalt Concrete (inches)	Class 2 Aggregate Base (inches)	Portland Cement Concrete (inches)	Asphalt Concrete (inches)	Class 2 Aggregate Base (inches)	Portland Cement Concrete (inches)
4.5	Light Automobile Parking Only	2½*	8	--	2½*	4	--
		--	4	4	--	4	4
6.0	Automobile, Light 2- to 3-axle Truck Traffic, Fire Lanes and Trash Enclosures	2½	13	--	2½	6	--
		3½*	11	--	3½*	4	--
		--	6	5	--	4	5

Traffic Index (TI)	Pavement Use	Untreated Subgrades R-value = 15			Lime-Treated Subgrades Soils (a) R-value = 50		
		Asphalt Concrete (inches)	Class 2 Aggregate Base (inches)	Portland Cement Concrete (inches)	Asphalt Concrete (inches)	Class 2 Aggregate Base (inches)	Portland Cement Concrete (inches)
7.0	Light to Moderate 2- to 3-axle Truck Traffic, Syar Way	3	15	--	3	7	--
		4*	13	--	4*	5	--
		--	6	6	--	6	5
9.0	Moderate 5-axle-Truck Traffic (AADTT $\approx$ 70)	4	20	--	4	9	--
		5½*	18	--	5½*	7	--
		--	8	6	--	6	6
10.0	Moderate to Heavy 5-axle-Truck Traffic (AADTT	5	22	--	5	10	--
		6½*	20	--	6½*	8	--
		--	10	9	--	6	7
11.0	Heavy 5-axle-Truck Traffic (AADTT $\approx$ 380)	5½	25	--	5½	11	--
		7*	222	--	7*	9	--
		--	12	10	--	6	8

* = Asphalt concrete thickness contains the Caltrans safety factor.

(a)= Lime-treated subgrade should be at least 12 inches thick and possess a minimum R-value of 50 when testing in accordance with California Test 301.

AADTT = Annual Average Daily Truck Traffic, assuming 5-axles trucks and 20-year Equivalent Single Axle Load (ESAL) Constant.

The upper six inches of untreated pavement subgrade soils whether achieved by excavation, fill, or remaining at grade, should be scarified at least six inches and recompactd at least the optimum moisture content to at least 95 percent relative compaction in accordance with the Subgrade Preparation section of this report.

Pavement design alternatives for chemically amended soil are based upon at least 12 inches of the pavement subgrade soils being chemically amended. Based on experience, we anticipate native soils mixed with at least five pounds per square foot of amended soil high-calcium or dolomitic quicklime, compacted at least two percent over the optimum moisture content to at least 92 percent relative compaction, will provide a subgrade capable of providing an R-value of 50.

We emphasize that the performance of the pavement is critically dependent upon adequate and uniform compaction of the subgrade soils, including utility trench backfill within the limits of the pavements. The upper six inches of untreated pavement subgrade should be compacted to at least 95 percent and the upper 12 inches of treated subgrades should be compacted to at least 92 percent of the maximum dry density as determined by ASTM D1557. Aggregate base materials should be compacted to at least 95 percent of the maximum dry density at least the optimum moisture content. Class 2 aggregate base should generally conform to Section 26 of the Caltrans Standard Specifications.

It has been our experience that pavement failures may occur where a non-uniform or disturbed subgrade soil condition is created. Subgrade disturbances can result if pavement subgrade preparation is performed prior to underground utility construction and/or if a significant time period passes between subgrade preparation and placement of aggregate base. Therefore, we recommend that final pavement subgrade preparation (i.e. scarification, moisture conditioning, and compaction) be performed just prior to aggregate base placement.

In the summer heat, high axle loads coupled with shear stresses induced by sharp turning movements can lead to distress in asphalt concrete pavements. Therefore, we recommend that consideration be given to using Portland concrete cement (PCC) pavements in areas subjected to concentrated heavy wheel loading, such as entry driveways and in front of trash enclosures. Alternate PCC pavement sections have been provided above in Table 4.

We suggest that concrete slabs be constructed with thickened edges at least two inches plus the slab thickness and 36 inches wide in accordance with ACI design standards and reinforced for crack control, if desired. Reinforcement must be located at mid-slab depth to be effective. Portland cement concrete should achieve a minimum compressive strength of 3500 pounds per square inch (psi) at 28 days. Concrete curing and joint spacing and details should conform to current PCA and ACI guidelines.

Pavement subgrades should be stable and unyielding under wheel loads of construction equipment. To help identify unstable subgrades within the pavement limits, a proof-roll should be performed with a fully-loaded water truck on the exposed subgrades prior to placement of aggregate base. The proof-roll should be observed by the Geotechnical Engineer's representative.

We suggest considering the use of full-depth curbs where pavements abut landscaping. The curbs should extend to at least six inches into the surface of the soil subgrade. Weep holes also could be provided at storm drain drop inlets, located at the subgrade-base interface, to allow water to drain from beneath the pavements.

Recommended Bioretention Slopes

We anticipate bioretention basin sidewalls in cut areas of the site will consist of undisturbed native clay soils and sidewalls in fill areas will consist of engineered fill. Consideration may be given to placing rip rap aggregate over the basin slopes to assist with erosion control and potentially steepen the sidewall slopes.

Due to the anticipated variable nature of the basin sidewalls, we are providing the following slope recommendations depending on how the sidewalls are constructed, including the use of rip rap.

Condition	Soil Condition	Maximum Slope (Horizontal to Vertical, H:V)
Bioretention Basin in Cut	Undisturbed Native Soil	2:1
Bioretention Basin in Cut with Rip Rap	Undisturbed Native Soil	1.75:1
Bioretention Basin in Fill	Engineered Fill	1.5:1
Bioretention Basin in Fill with Rip Rap	Engineered Fill	1.3:1

Rip rap specifications can be provided at a later date, if required.

Site Drainage

Final site grading should be accomplished to provide positive drainage of surface water away from structures and prevent ponding of water adjacent to foundations, slabs, or pavements. The grade adjacent to the proposed structures should be sloped away from foundations at a minimum

two percent slope for a distance of at least five feet, where possible. Roof gutter downspouts and surface drains should drain onto pavements or be connected to rigid non-perforated piping directed to an appropriate drainage point away from the houses. Ponding of surface water should not be allowed adjacent to structures or pavements. Landscape berms, if planned, should not be constructed in such a manner as to promote drainage toward structures.

Geotechnical Engineering Observation and Testing During Earthwork Construction

Site preparation should be accomplished in accordance with the recommendations of this report. Geotechnical testing and observation during construction is considered a continuation of our geotechnical engineering investigation. Raney Geotechnical, Inc. should be retained to provide testing and observation services during site clearing, preparation, earthwork, and foundation construction at the project to verify compliance with this geotechnical report and the project plans and specifications, and to provide consultation as required during construction.

These services are beyond the scope of work authorized for this investigation; however, we will submit a proposal to provide these services.

In the event that Raney Geotechnical, Inc. is not retained to provide geotechnical engineering observation and testing services during construction, the Geotechnical Engineer retained to provide these services should indicate in writing that they agree with the recommendations of this report or prepare supplemental recommendations as necessary. A final report by the “Geotechnical Engineer” should be prepared upon completion of the project.

Additional Services

We recommend that Raney Geotechnical, Inc. be retained to review the final plans and specifications to determine if the intent of our recommendations has been implemented in those documents. We would be pleased to submit a proposal to provide these services upon request.

LIMITATIONS

Our recommendations are based upon the information provided regarding the proposed project, combined with our analysis of site conditions revealed by the field exploration and laboratory testing programs. We have used our engineering judgment based upon the information provided and the data generated from our study. This report has been prepared in substantial compliance

with generally accepted geotechnical engineering practices that exist in the area of the project at the time the report was prepared. No warranty, either express or implied, is provided.

If the proposed construction is modified or re-sited; or, if it is found during construction that subsurface conditions differ from those we encountered at the boring and CPT locations, we should be afforded the opportunity to review the new information or changed conditions to determine if our conclusions and recommendations must be modified.

We emphasize that this report is applicable only to the proposed construction and the investigated site and should not be utilized for construction on any other site.

The conclusions and recommendations of this report are considered valid for a period of three years. If design is not completed and construction has not started within three years of the date of this report, the report must be reviewed and updated as necessary.

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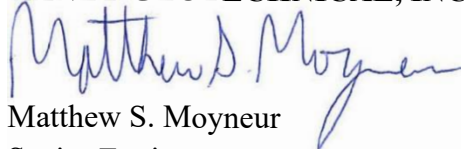
The following Plates are attached and complete this report:

Plate 1 – Plot Plan
Plates 2 through 7 – Logs of Borings
Plate 8 – Unified Soil Classification System
Plate 9 – Expansion Index Data
Plate 10 – Plasticity Index Data
Plate 11 – Resistance Value Data
Plates 12 through 14 - Corrosion Test Results

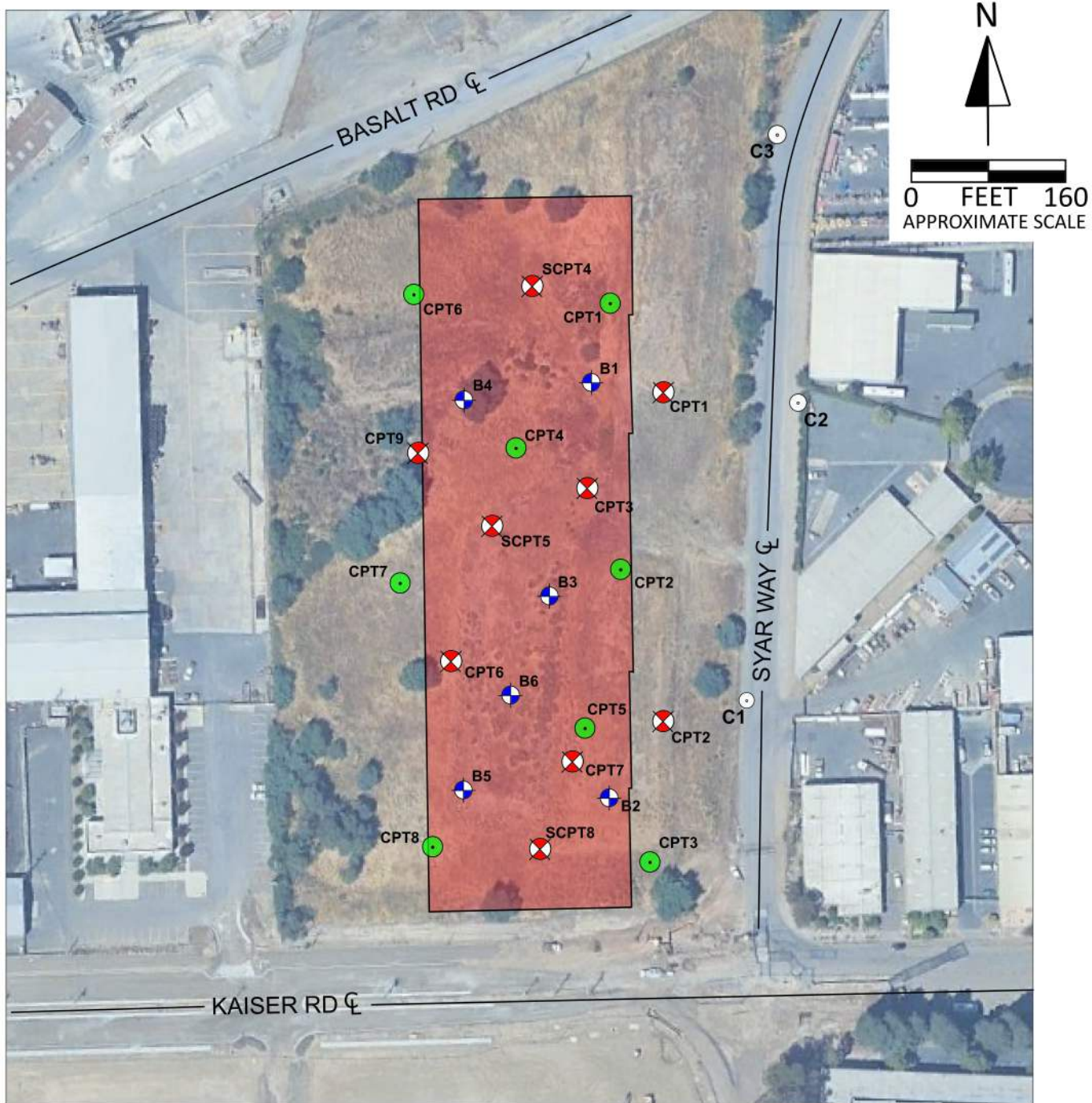
Appendix A – Greg Drilling CPT Report
Appendix B – Rockridge CPTs
Appendix C – Liquefaction Analysis Results

Very truly yours,

RANEY GEOTECHNICAL, INC


Matthew S. Moyneur
Senior Engineer





NOTES:

1. BORING AND CPT LOCATIONS SHOWN ARE APPROXIMATE.
2. PREPARED FROM A SITE PLAN BY RMW AND AN 8/25/2023 GOOGLE EARTH IMAGE.

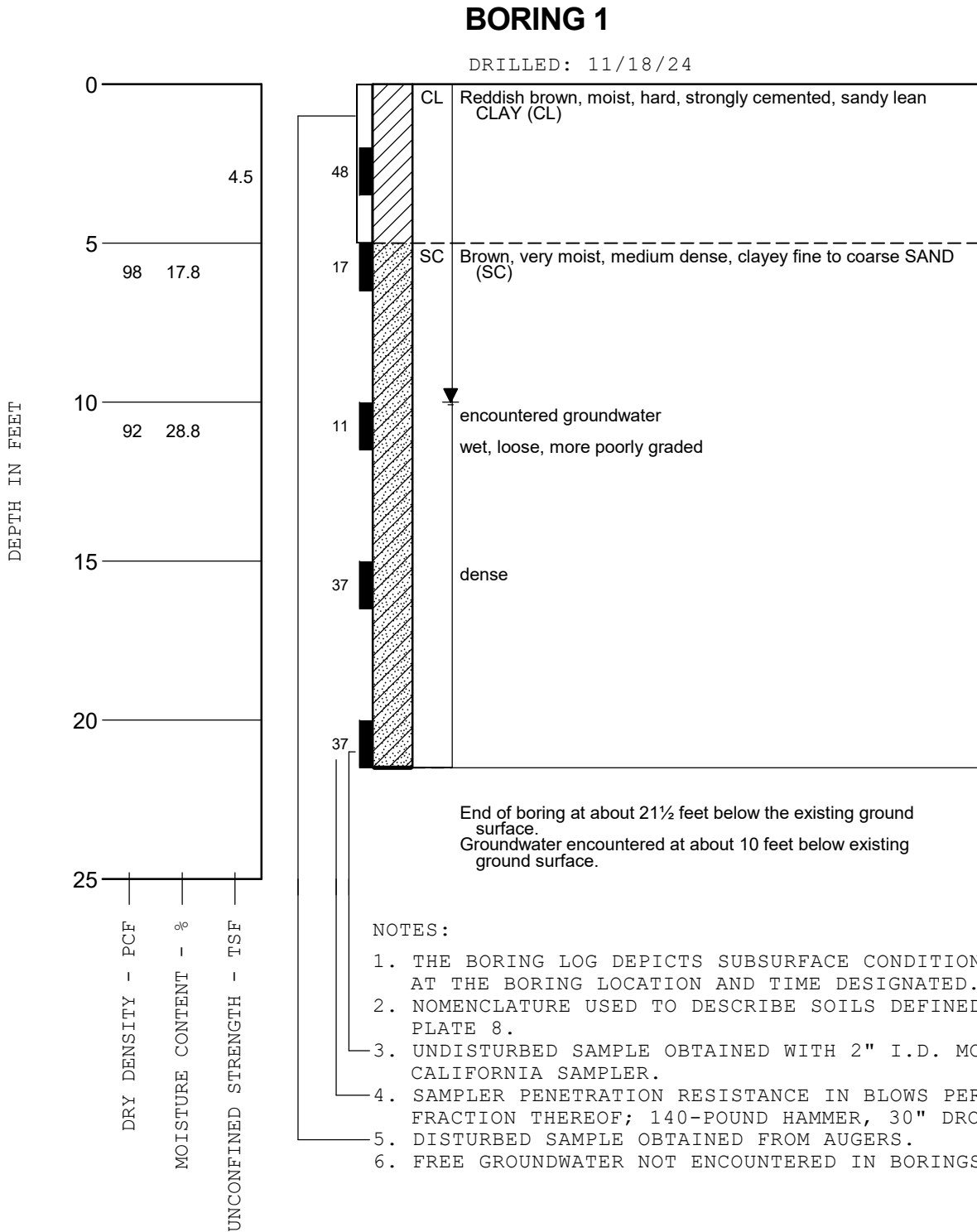
KEY:

-  B1 BORING LOCATION AND NUMBER, THIS STUDY
-  CPT1 CPT LOCATION AND NUMBER, THIS STUDY
-  C1 CORE LOCATION AND NUMBER, THIS STUDY
-  CPT1 CPT LOCATION AND NUMBER, 2022 STUDY

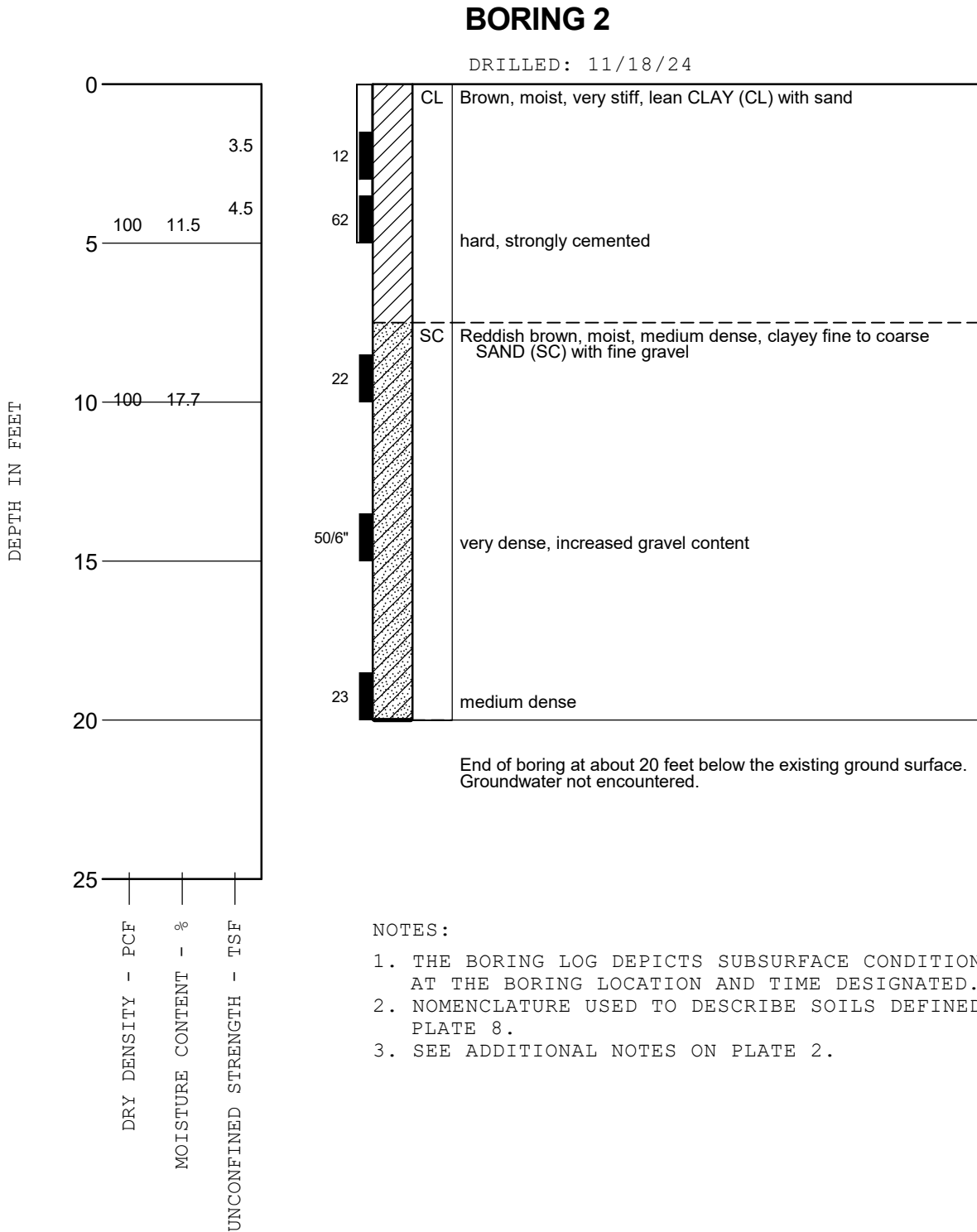
SITE PLAN



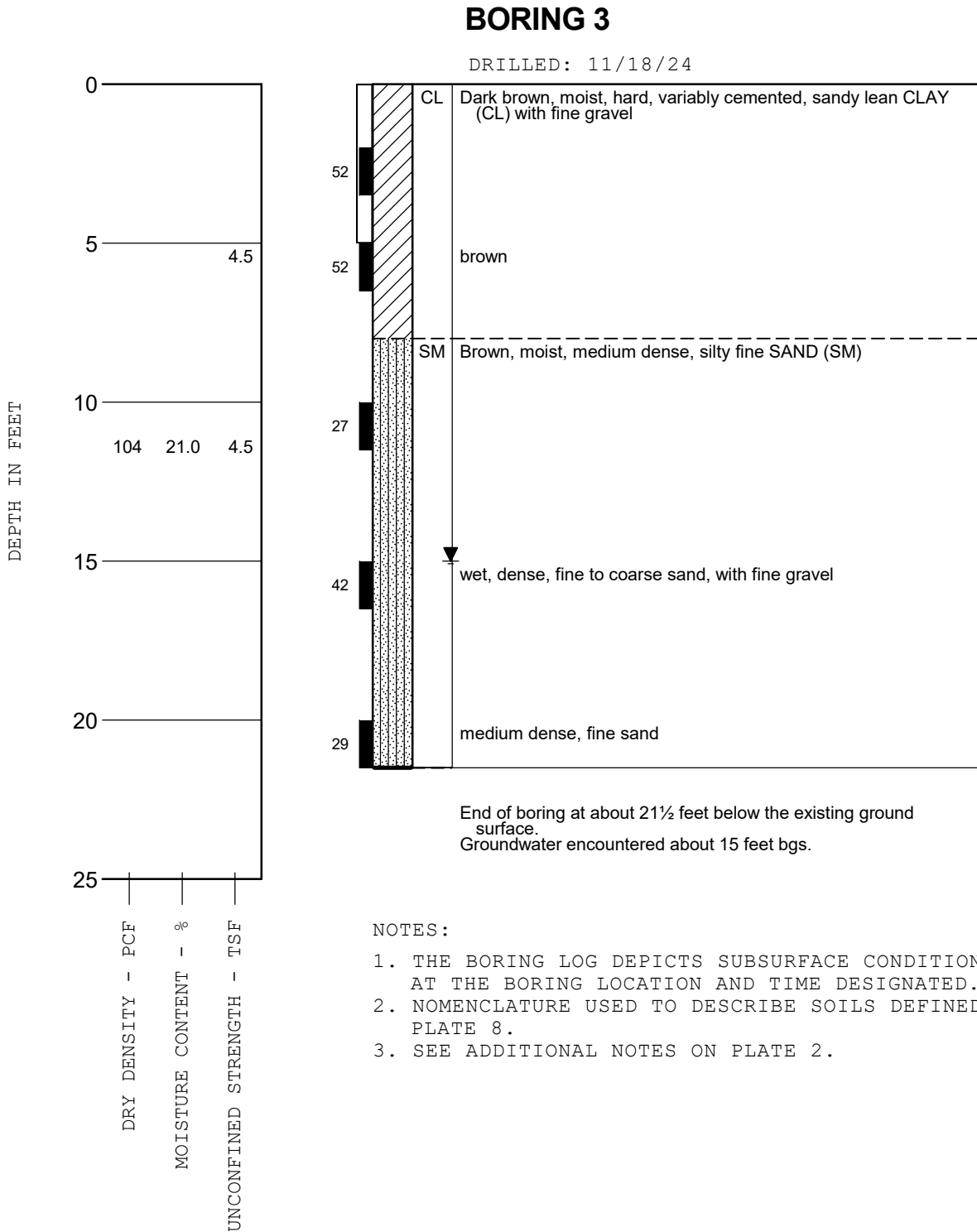
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DATE: 11/18/2024
DRAWN BY: HZ

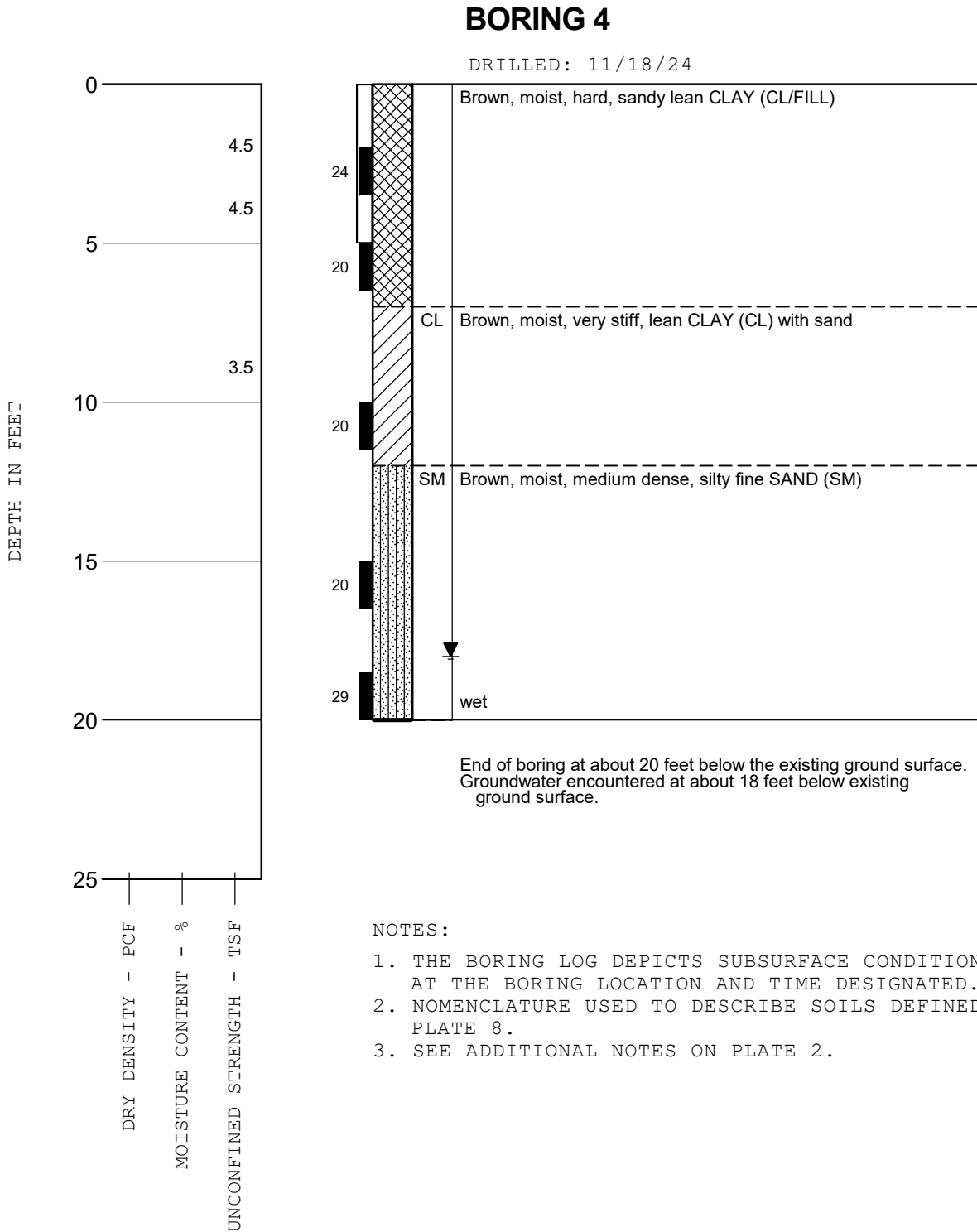


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DRAWN BY: HZ DATE: 11/18/2024

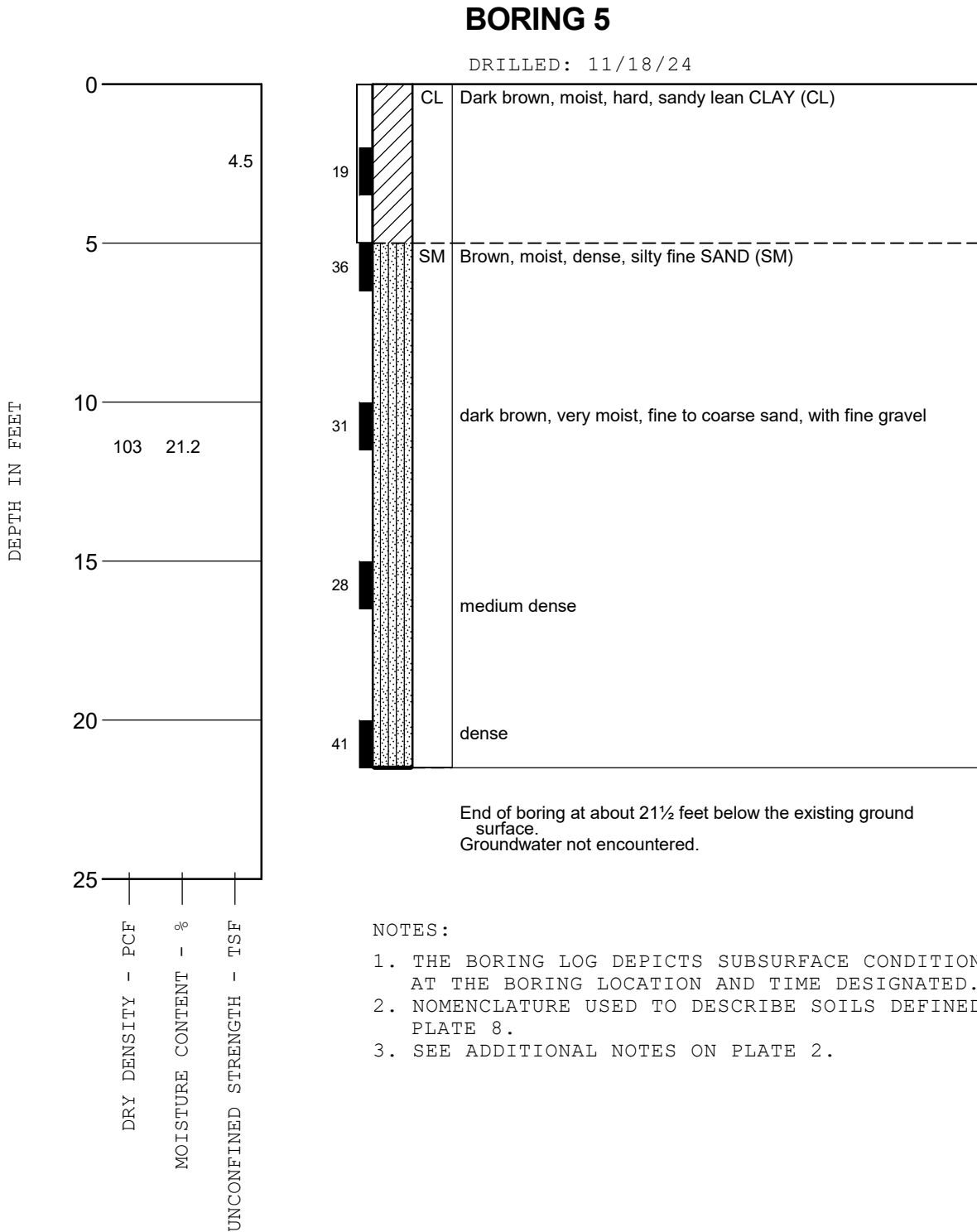


PROJECT NUMBER: 3315-003.00 PROJECT NAME: 1030 Kaiser Road Warehouse
DRAWN BY: HZ DATE: 11/18/2024





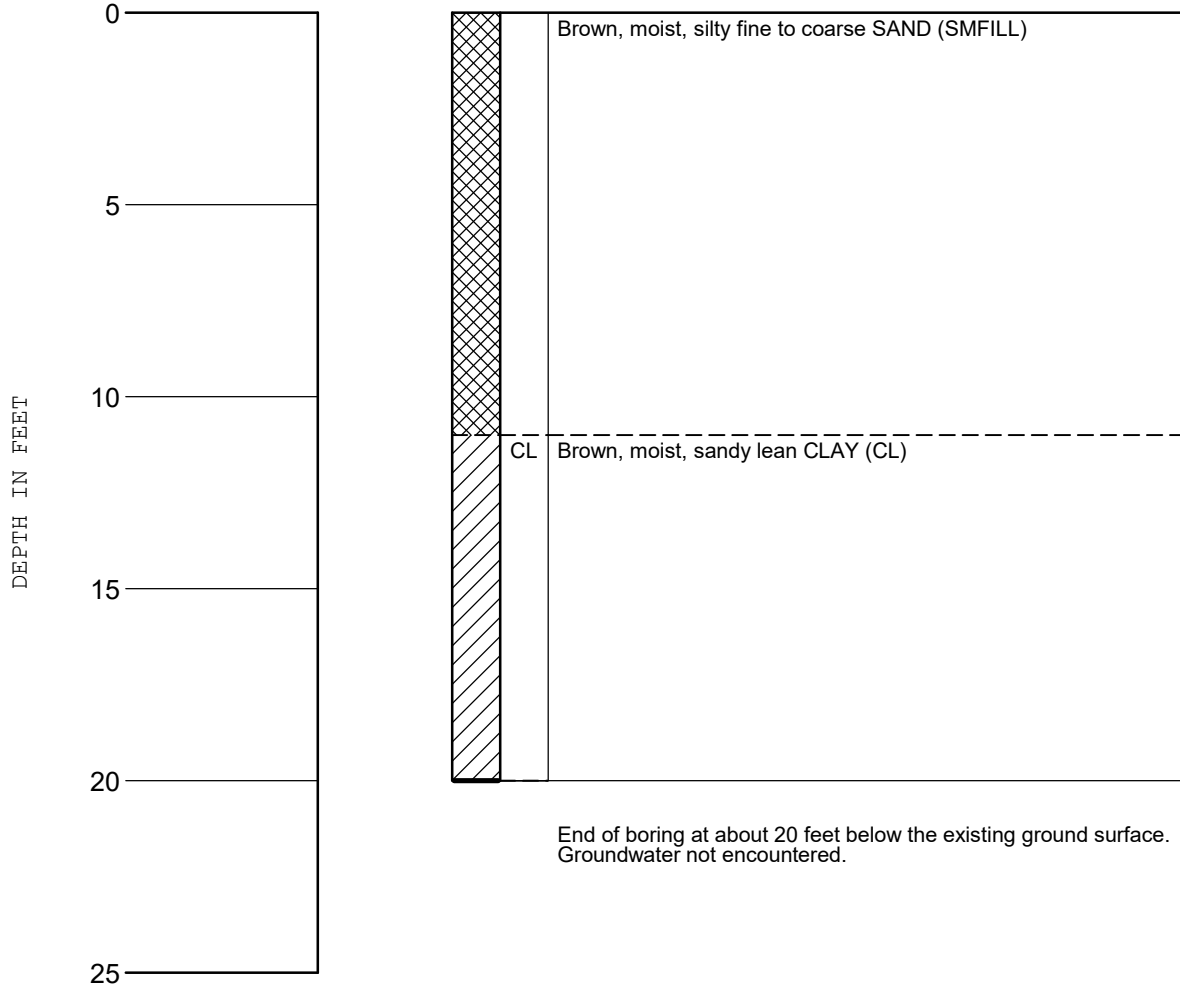
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DRAWN BY: HZ DATE: 11/18/2024



PROJECT NUMBER: 3315-003.00 PROJECT NAME: 1030 Kaiser Road Warehouse
DRAWN BY: HZ DATE: 11/18/2024

BORING 6

DRILLED: 11/18/24

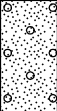
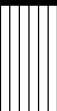


NOTES:

1. THE BORING LOG DEPICTS SUBSURFACE CONDITIONS ONLY AT THE BORING LOCATION AND TIME DESIGNATED.
2. NOMENCLATURE USED TO DESCRIBE SOILS DEFINED ON PLATE 8.
3. SEE ADDITIONAL NOTES ON PLATE 2.

LOG OF BORING



GRAPH	SYMBOL	DESCRIPTION	MAJOR DIVISIONS		
	GW	WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES	CLEAN GRAVELS WITH LESS THAN 5% FINES	GRAVEL AND GRAVELLY SOILS	COARSE GRAINED SOILS MORE THAN 50% <u>LARGER</u> THAN NO. 200 SIEVE
	GP	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES			
	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES	GRAVELS WITH MORE THAN 12% FINES	MORE THAN 50% OF COARSE FRACTION <u>RETAINED</u> ON NO. 4 SIEVE	
	GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES			
	SW	WELL GRADED SANDS, GRAVELLY SANDS	CLEAN SANDS WITH LESS THAN 5% FINES	SANDS AND SANDY SOILS	
	SP	POORLY GRADED SANDS, GRAVELLY SANDS			
	SM	SILTY SANDS, SAND-SILT MIXTURES	SANDS WITH MORE THAN 12% FINES	MORE THAN 50% OF COARSE FRACTION <u>PASSING</u> NO. 4 SIEVE	
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES			
	ML	INORGANIC SILTS, ROCK FLOUR, OR CLAYEY SILTS WITH SLIGHT PLASTICITY	LIQUID LIMIT <u>LESS</u> THAN 50		SILTS AND CLAYS
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS			
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY			
	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS SILTS, ELASTIC SILTS	LIQUID LIMIT <u>GREATER</u> THAN 50		SILTS AND CLAYS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS			
	OH	ORGANIC CLAYS AND ORGANIC SILTS OF MEDIUM TO HIGH PLASTICITY			
	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENT	HIGHLY ORGANIC SOILS		

UNIFIED SOIL CLASSIFICATION SYSTEM

Expansion Index Tests ASTM D4829

Sample Location: B1
Material Description: Brown, sandy lean CLAY (CL)
Method: ASTM D4829

Depth (ft)	Initial Moisture Content (%)	Final Moisture Content (%)	Dry Density (pcf)	Expansion Index
0-5'	12.5	27.9	95.0	39

Sample Location: B3
Material Description: Brown, lean CLAY with sand (CL)
Method: ASTM D4829

Depth (ft)	Initial Moisture Content (%)	Final Moisture Content (%)	Dry Density (pcf)	Expansion Index
0-5'	12.0	25.4	96.9	34

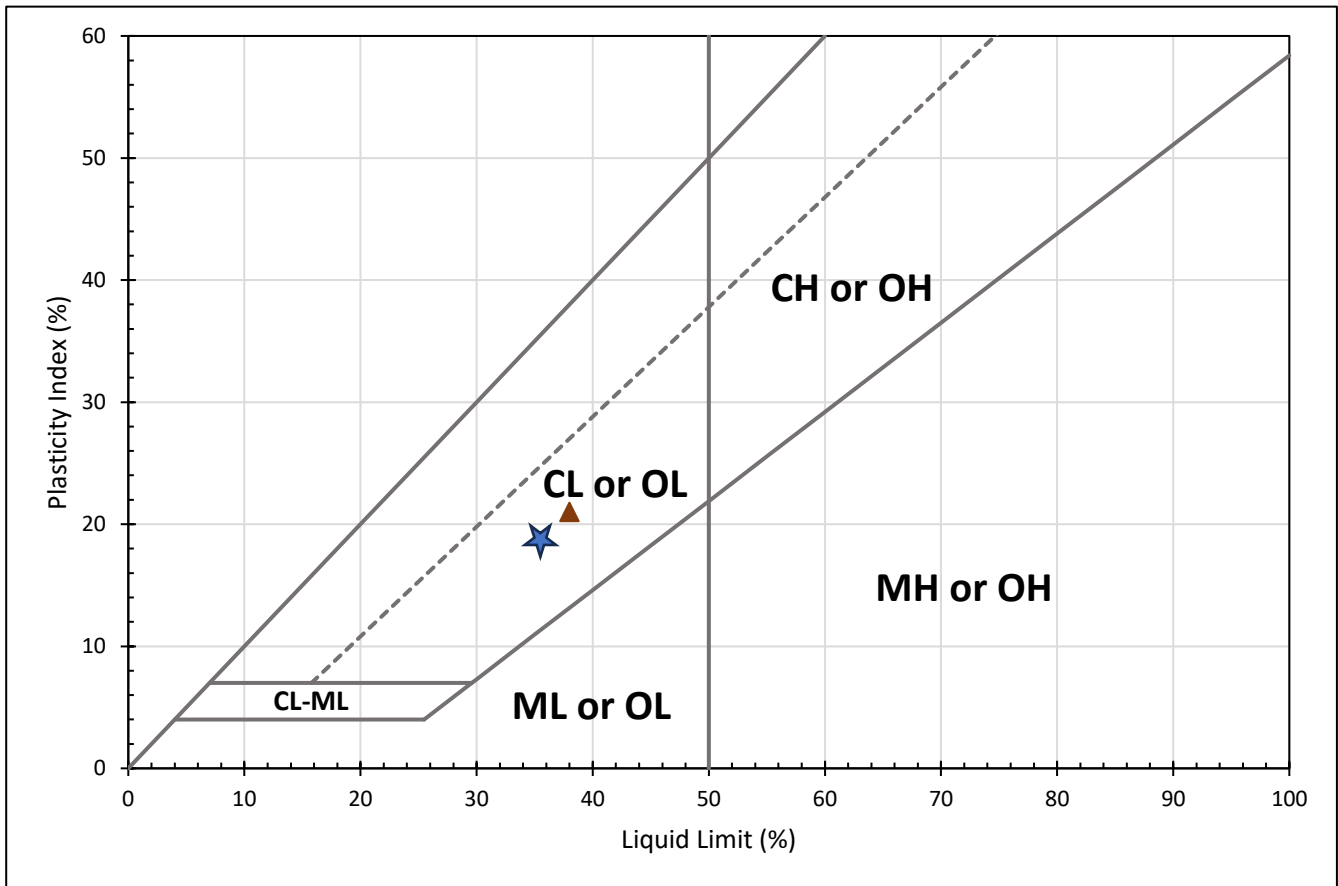
Sample Location: B5
Material Description: Brown, sandy lean CLAY (CL)
Method: ASTM D4829

Depth (ft)	Initial Moisture Content (%)	Final Moisture Content (%)	Dry Density (pcf)	Expansion Index
0-5'	14.0	29.6	91.1	55

Classification of Expansive Soil

Expansion Index	Expansion Potential
0-20	Very Low
21-50	Low
51-90	Moderate
91-130	High
Above 130	Very High

Atterberg Limits ASTM D4318



Symbol	Sample No.	Depth	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	USCS	Soil Description
▲	B3	0-5'	38	17	21	CL	Brown lean CLAY
★	B5	0-5'	36	19	17	CL	Brown lean CLAY

Resistance Value Test California Test Method 301G

Sample Location: B1
Depth: 0-5'
Material Description: Brown, silty lean CLAY (CL)

Test Number	Dry Density (Pcf)	Moisture Content (%)	Exudation Pressure (Psi)	Expansion Pressure (Psf)	Resistance Value
1	108.2	19.8	338	143	28
2	107.3	20.4	263	113	25
3	105.7	20.9	215	82	19

Resistance value at 300 psi exudation pressure = 27

Sample Location: B2
Depth: 0 – 5'
Material Description: Brown, Silty lean CLAY w/ minor gravel

Test Number	Dry Density (pcf)	Moisture Content (%)	Exudation Pressure (Psi)	Expansion Pressure (Psf)	Resistance Value
1	108	19.2	335	17	19
2	106.8	19.8	271	0	14
3	105.5	20.5	219	0	11

Resistance value at 300 psi exudation pressure = 16

Sample Location: B5
Depth: 0 – 5'
Material Description: Brown, lean CLAY with sand

Test Number	Dry Density (pcf)	Moisture Content (%)	Exudation Pressure (Psi)	Expansion Pressure (Psf)	Resistance Value
1	105.4	20.4	363	91	23
2	102.9	21.8	305	43	16
3	100.3	23.3	258	0	9

Resistance value at 300 psi exudation pressure = 15

RESISTANCE VALUE DATA



**Sunland Analytical**

11419 Sunrise Gold Circle, #10
Rancho Cordova, CA 95742
(916) 852-8557

Date Reported 11/26/2024
Date Submitted 11/21/2024

To: Hao Zhu
Raney Geotechnical
3140 Beacon Blvd.
West Sacramento, CA 95691

From: Gene Oliphant, Ph.D. \ Ty Bui 
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 3315-003.00 Site ID : BI-1I.
Thank you for your business.

* For future reference to this analysis please use SUN # 93652-193653.

EVALUATION FOR SOIL CORROSION

Soil pH	5.12		
Minimum Resistivity	1.07 ohm-cm (x1000)		
Chloride	67.1 ppm	00.00671	%
Sulfate	32.7 ppm	00.00327	%

METHODS

pH and Min. Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422m

SOIL CORROSION POTENTIAL

Project Number: 3315-003.00



Sunland Analytical

11419 Sunrise Gold Circle, #10
Rancho Cordova, CA 95742
(916) 852-8557

Date Reported 11/26/2024
Date Submitted 11/21/2024

To: Hao Zhu
Raney Geotechnical
3140 Beacon Blvd.
West Sacramento, CA 95691

From: Gene Oliphant, Ph.D. \ Ty Bui
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 3315-003.00 Site ID : B2@0-5FT.
Thank you for your business.

* For future reference to this analysis please use SUN # 93652-193654.

EVALUATION FOR SOIL CORROSION

Soil pH	7.19		
Minimum Resistivity	1.69 ohm-cm (x1000)		
Chloride	16.2 ppm	00.00162	%
Sulfate	37.0 ppm	00.00370	%

METHODS

pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422m

SOIL CORROSION POTENTIAL





Sunland Analytical

11419 Sunrise Gold Circle, #10
Rancho Cordova, CA 95742
(916) 852-8557

Date Reported 11/26/2024
Date Submitted 11/21/2024

To: Hao Zhu
Raney Geotechnical
3140 Beacon Blvd.
West Sacramento, CA 95691

From: Gene Oliphant, Ph.D. \ Ty Bui
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 3315-003.00 Site ID : B3-11.
Thank you for your business.

* For future reference to this analysis please use SUN # 93652-193655.

EVALUATION FOR SOIL CORROSION

Soil pH	6.75		
Minimum Resistivity	1.77	ohm-cm (x1000)	
Chloride	23.5 ppm	00.00235	%
Sulfate	70.5 ppm	00.00705	%

METHODS

pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422m

SOIL CORROSION POTENTIAL



APPENDIX A

Gregg Drilling CPT Report



CONE PENETRATION TESTING (CPT) REPORT

Gregg Drilling LLC

**Prepared for: Raney Geotechnical
Project D2249083
November 25, 2024**

**Prepared by: Eleni Pateras
epateras@greggdrilling.com**

Table of Contents

Cone Penetration Testing (CPT) Procedure 3

15cm² Standard Cone Specifications 4

Cone Penetration Test Data & Interpretation 5

Pore Pressure Dissipation Tests (PPDTs)..... 6

Seismic Cone Penetration Tests (SCPT)..... 7

Soil Sampling 8

Ground Water Sampling 9

References 10

Table 1: Cone Penetration Testing Summary 11

- APPENDIX A: Cone Penetration Test Plots
- APPENDIX B: Pore Pressure Dissipation Test Plots
- APPENDIX C: Seismic Plots & Tables

Gregg Drilling CPT Report

November 25, 2024

Raney Geotechnical

Attn: Matt Mayneur

Subject: CPT Site Investigation
1030 Kaiser Rd.
Napa, CA
GREGG Project Number: D2249083

Dear Matt:

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

1	Cone Penetration Tests	(CPTU)	☒
2	Pore Pressure Dissipation Tests	(PPD)	☒
3	Seismic Cone Penetration Tests	(SCPTU)	☒
4	Groundwater Samples	(GWS)	☐
5	Soil Samples	(SS)	☐
6	Vapor Samples	(VS)	☐

A list of reference papers providing additional background on the specific tests conducted is provided in the bibliography following the text of the report. If you would like a copy of any of these publications or should you have any questions or comments regarding the contents of this report, please do not hesitate to email me at reports@greggdrilling.com.

Sincerely,

CPT Reports Team
Gregg Drilling, LLC.



Cone Penetration Testing (CPT) Procedure

Gregg Drilling carries out all Cone Penetration Tests (CPT) using an integrated electronic cone system, Figure CPT.

The cone takes measurements of tip resistance (q_c), sleeve resistance (f_s), and penetration pore water pressure (u_2). Measurements are taken at either 2.5 or 5cm intervals during penetration to provide a nearly continuous profile. CPT data reduction and basic interpretation is performed in real time facilitating on-site decision making. The above-mentioned parameters are stored electronically for further analysis and reference. All CPT soundings are performed in accordance with revised ASTM standards (D 5778-12).

The 5mm thick porous plastic filter element is located directly behind the cone tip in the u_2 location. A new saturated filter element is used on each sounding to measure both penetration pore pressures as well as measurements during a dissipation test (PPDT). Prior to each test, the filter element is fully saturated with oil under vacuum pressure to improve accuracy.

When the sounding is completed, the test hole is backfilled according to client specifications. If grouting is used, the procedure generally consists of pushing a hollow tremie pipe with a "knock out" plug to the termination depth of the CPT hole. Grout is then pumped under pressure as the tremie pipe is pulled from the hole. Disruption or further contamination to the site is therefore minimized.

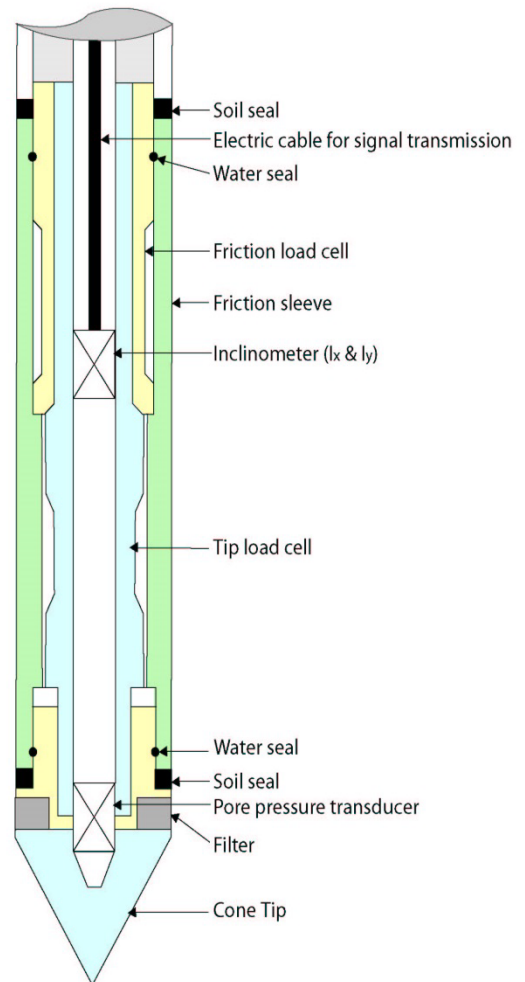


Figure CPT

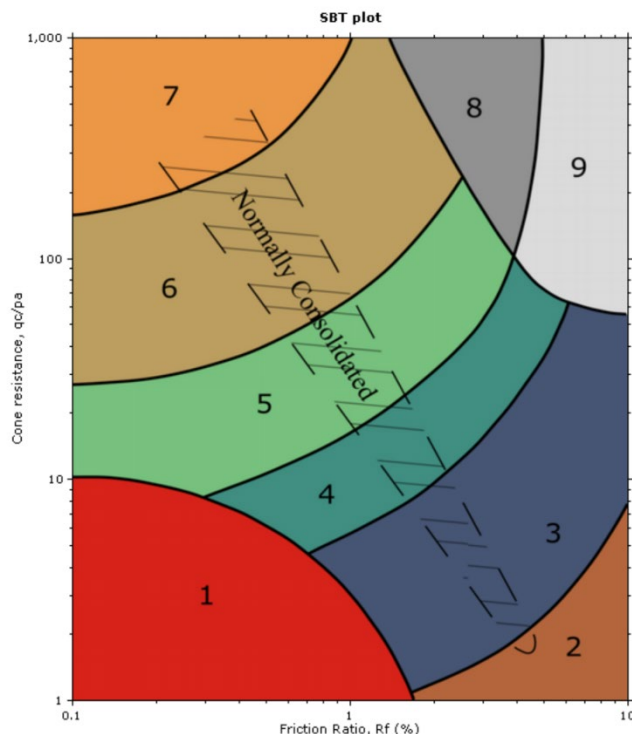
15cm² Standard Cone Specifications

Dimensions	
Cone base area	15 cm ²
Sleeve surface area	225 cm ²
Cone net area ratio	0.85
Specifications	
Cone load cell	
Full scale range	180 kN (20 tons)
Overload capacity	150%
Full scale tip stress	120 MPa (1,200 tsf)
Repeatability	120 kPa (1.2 tsf)
Sleeve load cell	
Full scale range	31 kN (3.5 tons)
Overload capacity	150%
Full scale sleeve stress	1,400 kPa (15 tsf)
Repeatability	1.4 kPa (0.015 tsf)
Pore pressure transducer	
Full scale range	7,000 kPa (1,000 psi)
Overload capacity	150%
Repeatability	7 kPa (1 psi)

Note: The repeatability during field use will depend somewhat on ground conditions, abrasion, maintenance and zero load stability.

Cone Penetration Test Data & Interpretation

The Cone Penetration Test (CPT) data collected are presented in graphical and electronic form in the report. The plots include interpreted Soil Behavior Type (SBT) based on the charts described by Robertson (2010) (Figure SBT). Typical plots display SBT based on the non-normalized charts of Robertson (2010) or normalized data (2009 and 2016). For CPT soundings deeper than 30m, we recommend the use of the normalized charts of Robertson (2009 and 2016) which can be displayed as SBTn. The report also includes spreadsheet output of computer calculations of basic interpretation in terms of SBT and SBTn and various geotechnical parameters using current published correlations based on the comprehensive review by Lunne, Robertson and Powell (1997), as well as recent updates by Robertson and Cabal (Guide to Cone Penetration Testing 7th Edition, 2022). The interpretations are presented only as a guide for geotechnical use and should be carefully reviewed. Gregg Drilling LLC does not warranty the correctness or the applicability of any of the geotechnical parameters interpreted by the software and does not assume any liability for use of the results in any design or review. The user should be fully aware of the techniques and limitations of any method used in the software. Some interpretation methods require input of the groundwater level to calculate vertical effective stress. An estimate of the in-situ groundwater level has been made based on field observations and/or CPT results but should be verified by the user.



A summary of locations and depths is available in Table 1. Note that all penetration depths referenced in the data are with respect to the existing ground surface.

Note that it is not always possible to clearly identify a soil type based solely on q_t , f_s , and u_2 . In these situations, experience, judgment, and an assessment of the pore pressure dissipation data should be used to infer the correct soil behavior type.

SBTn legend

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

Figure SBT (After Robertson 2010) – Note: Colors may vary slightly compared to plots

Pore Pressure Dissipation Tests (PPDTs)

Pore Pressure Dissipation Tests (PPDT's) conducted at various intervals can be used to measure equilibrium water pressure (at the time of the CPT). If conditions are hydrostatic, the equilibrium water pressure can be used to determine the approximate depth of the ground water table. A PPDT is conducted when penetration is halted at specific intervals determined by the field representative. The variation of the penetration pore pressure (u) with time is measured behind the tip of the cone and recorded.

Pore pressure dissipation data can be interpreted to provide estimates of:

- Equilibrium piezometric pressure
- Phreatic Surface
- In situ horizontal coefficient of consolidation (c_h)
- In situ horizontal coefficient of permeability (k_h)

To correctly interpret the equilibrium piezometric pressure and/or the phreatic surface, the pore pressure must be monitored until it reaches equilibrium, *Figure PPDT*. This time is commonly referred to as t_{100} , the point at which 100% of the excess pore pressure has dissipated.

A complete reference on pore pressure dissipation tests is presented by Robertson et al. 1992 and Lunne et al. 1997.

A summary of the pore pressure dissipation tests completed for this project is included in Table 1.

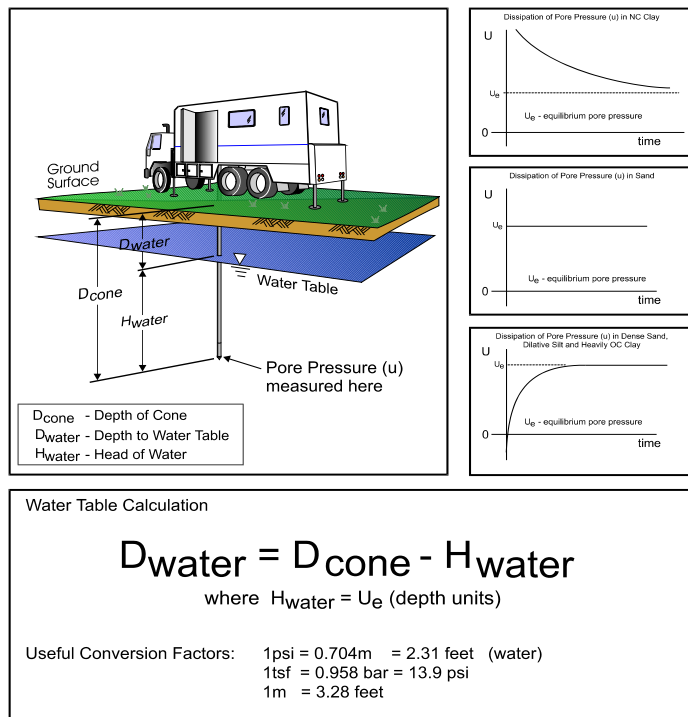


Figure PPDT

Seismic Cone Penetration Tests (SCPT)

Seismic Cone Penetration Testing (SCPT) can be conducted at various intervals during the Cone Penetration Test. Shear wave velocity (V_s) can then be calculated over a specified interval with depth. A small interval for seismic testing, such as 1-1.5m (3-5ft) allows for a detailed look at the shear wave profile with depth. Conversely, a larger interval such as 3-6m (10-20ft) allows for a more average shear wave velocity to be calculated. Gregg Drilling's cones have a horizontally active geophone located 0.2m (0.66ft) behind the tip.

To conduct the seismic shear wave test, the penetration of the cone is stopped and the rods are decoupled from the rig. An automatic hammer is triggered to send a shear wave into the soil. The distance from the source to the cone is calculated knowing the total depth of the cone and the horizontal offset distance between the source and the cone. To calculate an interval velocity, a minimum of two tests must be performed at two different depths. The arrival times between the two wave traces are compared to obtain the difference in time (Δt). The difference in depth is calculated (Δd) and velocity can be determined using the simple equation: $v = \Delta d / \Delta t$

Multiple wave traces can be recorded at the same depth to improve quality of the data.

A complete reference on seismic cone penetration tests is presented by Robertson et al. 1986 and Lunne et al. 1997.

A summary of the shear wave velocities, arrival times and wave traces are provided with the report.

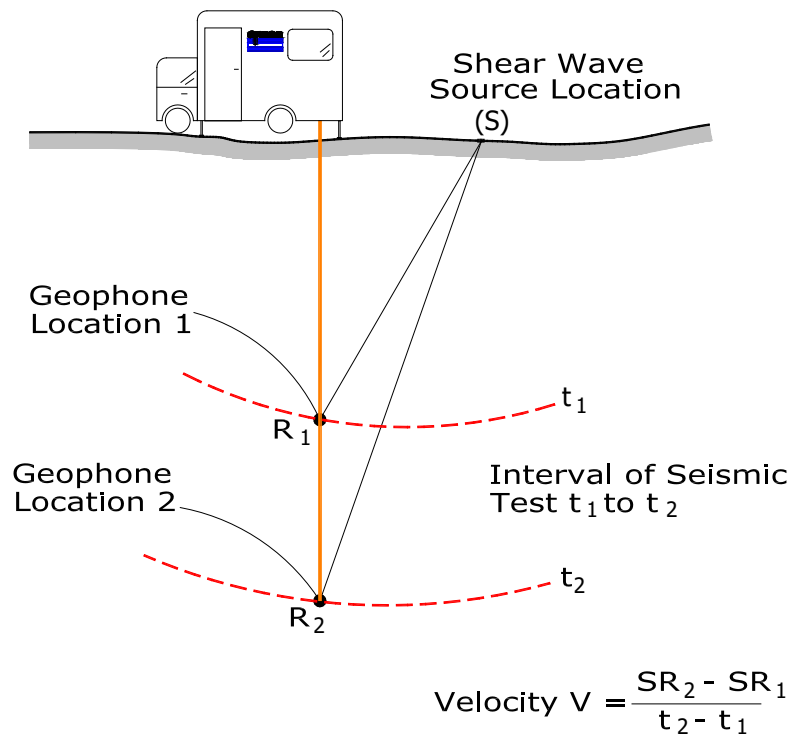


Figure SCPT

Soil Sampling

Gregg Drilling uses a piston-type push-in sampler to obtain small soil samples without generating any soil cuttings, *Figure SS*. Two different types of samplers (12 and 18 inch) are used depending on the soil type and density. The soil sampler is initially pushed in a "closed" position to the desired sampling interval using the CPT pushing equipment. Keeping the sampler closed minimizes the potential of cross contamination. The inner tip of the sampler is then retracted leaving a hollow soil sampler with inner 1¼" diameter sample tubes. The hollow sampler is then pushed in a locked "open" position to collect a soil sample. The filled sampler and push rods are then retrieved to the ground surface. Because the soil enters the sampler at a constant rate, the opportunity for 100% recovery is increased. For environmental analysis, the soil sample tube ends are sealed with Teflon and plastic caps. Often, a longer "split tube" can be used for geotechnical sampling.

For a detailed reference on direct push soil sampling, refer to Robertson et al, 1998.

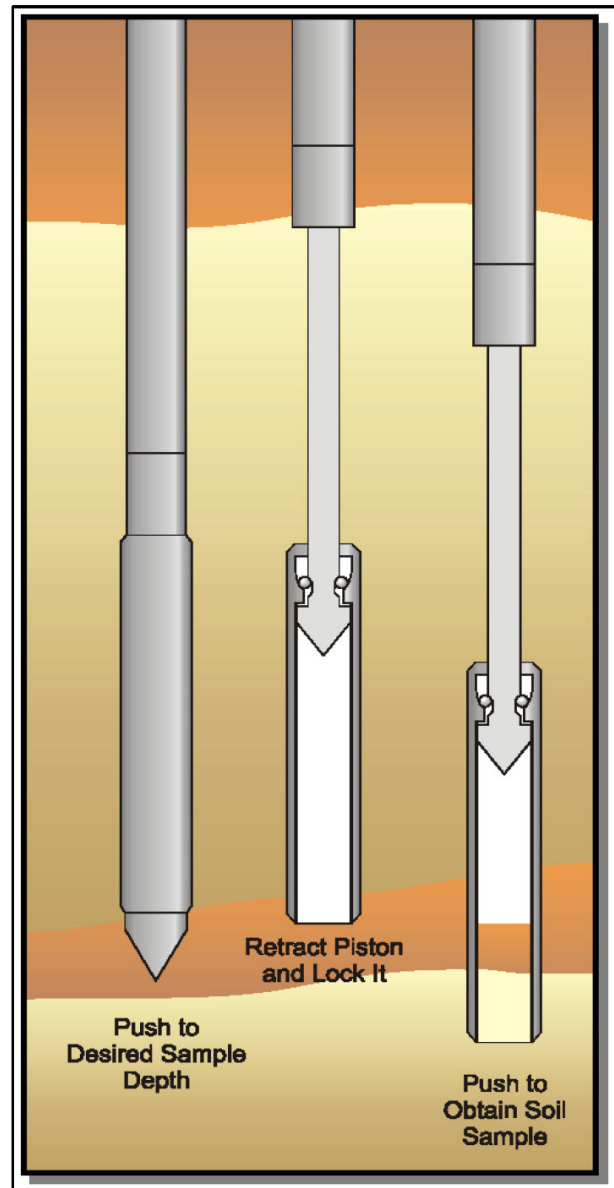


Figure SS

Ground Water Sampling

Gregg Drilling conducts groundwater sampling using a sampler as shown in *Figure GWS*. The groundwater sampler has a retrievable stainless steel or disposable PVC screen with steel drop off tip. This allows for samples to be taken at multiple depth intervals within the same sounding location. In areas of slower water recharge, provisions may be made to set temporary PVC well screens during sampling to allow the pushing equipment to advance to the next sample location while the groundwater is allowed to infiltrate.

The groundwater sampler operates by advancing 44.5mm (1¾ inch) hollow push rods with the filter tip in a closed configuration to the base of the desired sampling interval. Once at the desired sample depth, the push rods are retracted; exposing the encased filter screen and allowing groundwater to infiltrate hydrostatically from the formation into the inlet screen. A small diameter bailer (approximately ½ or ¾ inch) is lowered through the push rods into the screen section for sample collection. The number of downhole trips with the bailer and time necessary to complete the sample collection at each depth interval is a function of sampling protocols, volume requirements, and the yield characteristics and storage capacity of the formation. Upon completion of sample collection, the push rods and sampler, with the exception of the PVC screen and steel drop off tip are retrieved to the ground surface, decontaminated and prepared for the next sampling event.

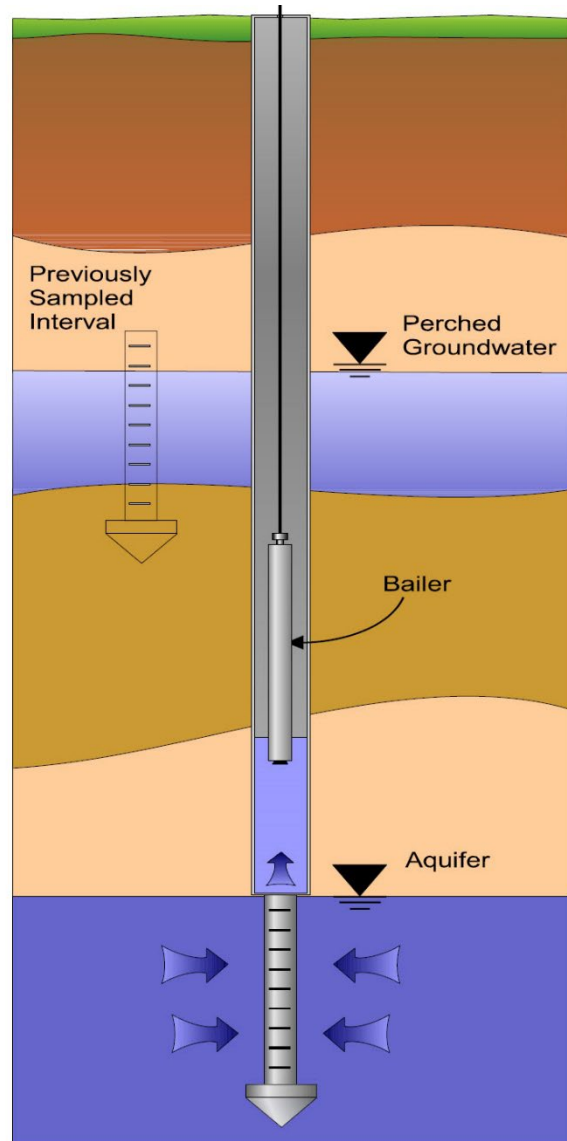


Figure GWS

For a detailed reference on direct push groundwater sampling, refer to Zemo et. al., 1992.

References

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

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

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

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

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

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

Table 1: Cone Penetration Testing Summary

CPT Sounding Identification	Date	Termination Depth (ft)	Depth of Soil Samples (ft)	Depth of Groundwater Samples (ft)	Depth of Pore Pressure Dissipation Tests (ft)
CPT-1	11/21/2024	30.35	-	-	-
CPT-2	11/22/2024	30.35	-	-	-
CPT-3	11/21/2024	30.18	-	-	-
SCPT-4	11/21/2024	50.36	-	-	20.18
SCPT-5	11/21/2024	50.36	-	-	42.81
CPT-6	11/21/2024	30.35	-	-	-
CPT-7	11/22/2024	30.18	-	-	-
SCPT-8	11/22/2024	50.36	-	-	17.22
CPT-9	11/21/2024	30.35	-	-	-

APPENDIX A:

CPT PLOTS

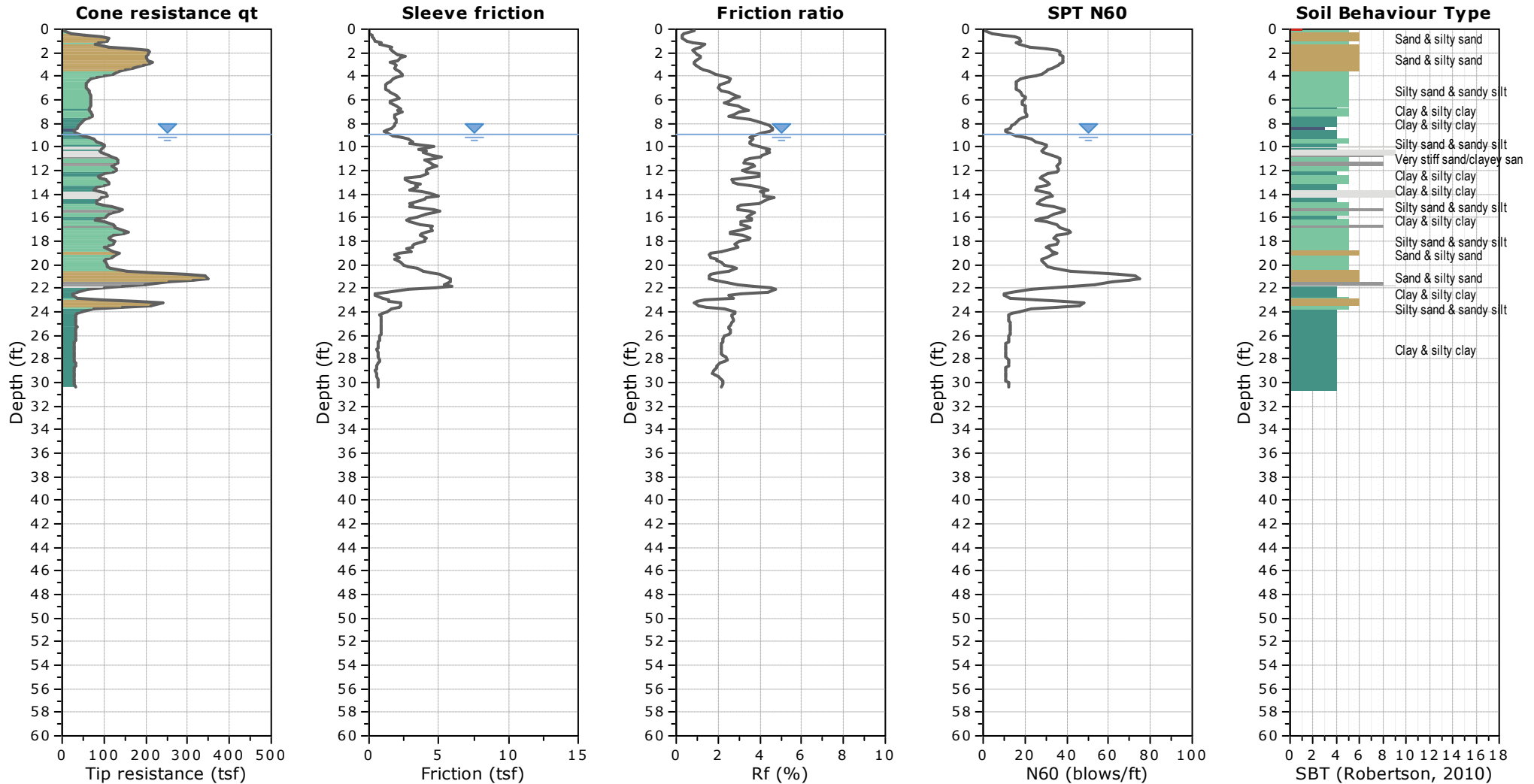


CLIENT: RANEY GEOTECHNICAL

SITE: 1030 KAISER RD, NAPA, CA

FIELD REP: MATT MOYNEUR
Cone ID: GDC-42

Total depth: 30.35 ft, Date: 11/21/2024



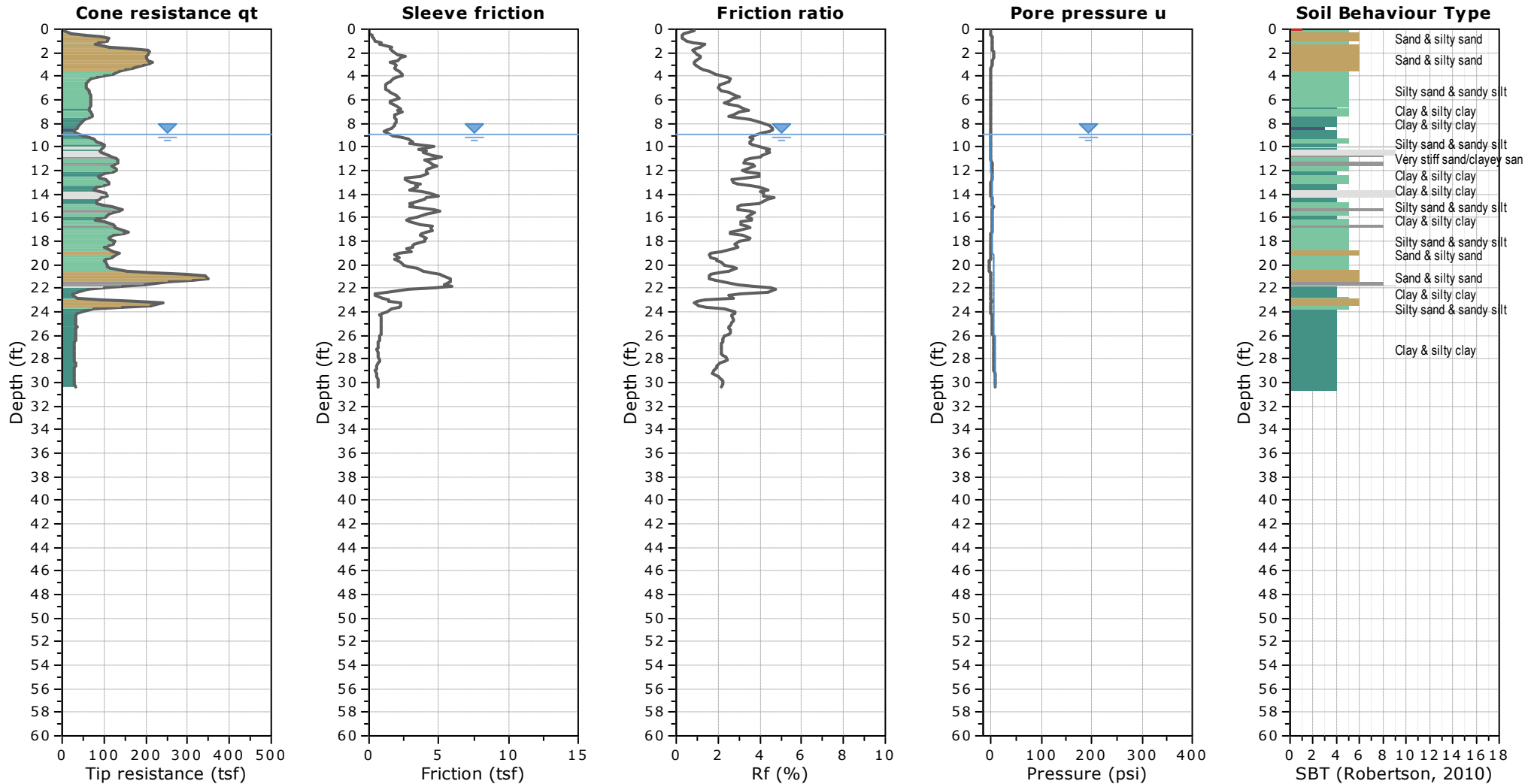


CLIENT: RANEY GEOTECHNICAL

SITE: 1030 KAISER RD, NAPA, CA

FIELD REP: MATT MOYNEUR
Cone ID: GDC-42

Total depth: 30.35 ft, Date: 11/21/2024



WATER TABLE FOR ESTIMATING PURPOSES ONLY

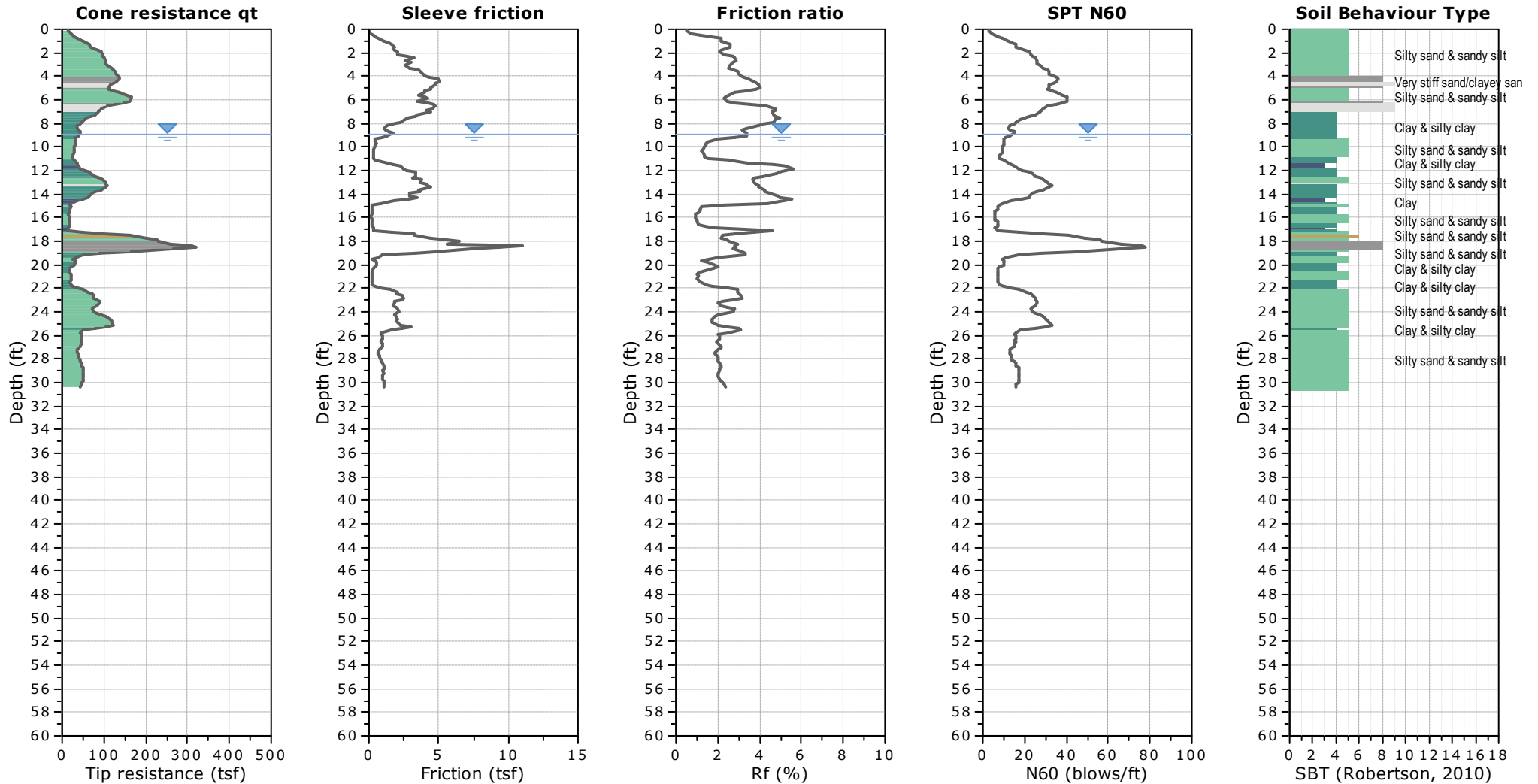


CLIENT: RANEY GEOTECHNICAL

SITE: 1030 KAISER RD, NAPA, CA

FIELD REP: MATT MOYNEUR
Cone ID: GDC-42

Total depth: 30.35 ft, Date: 11/22/2024

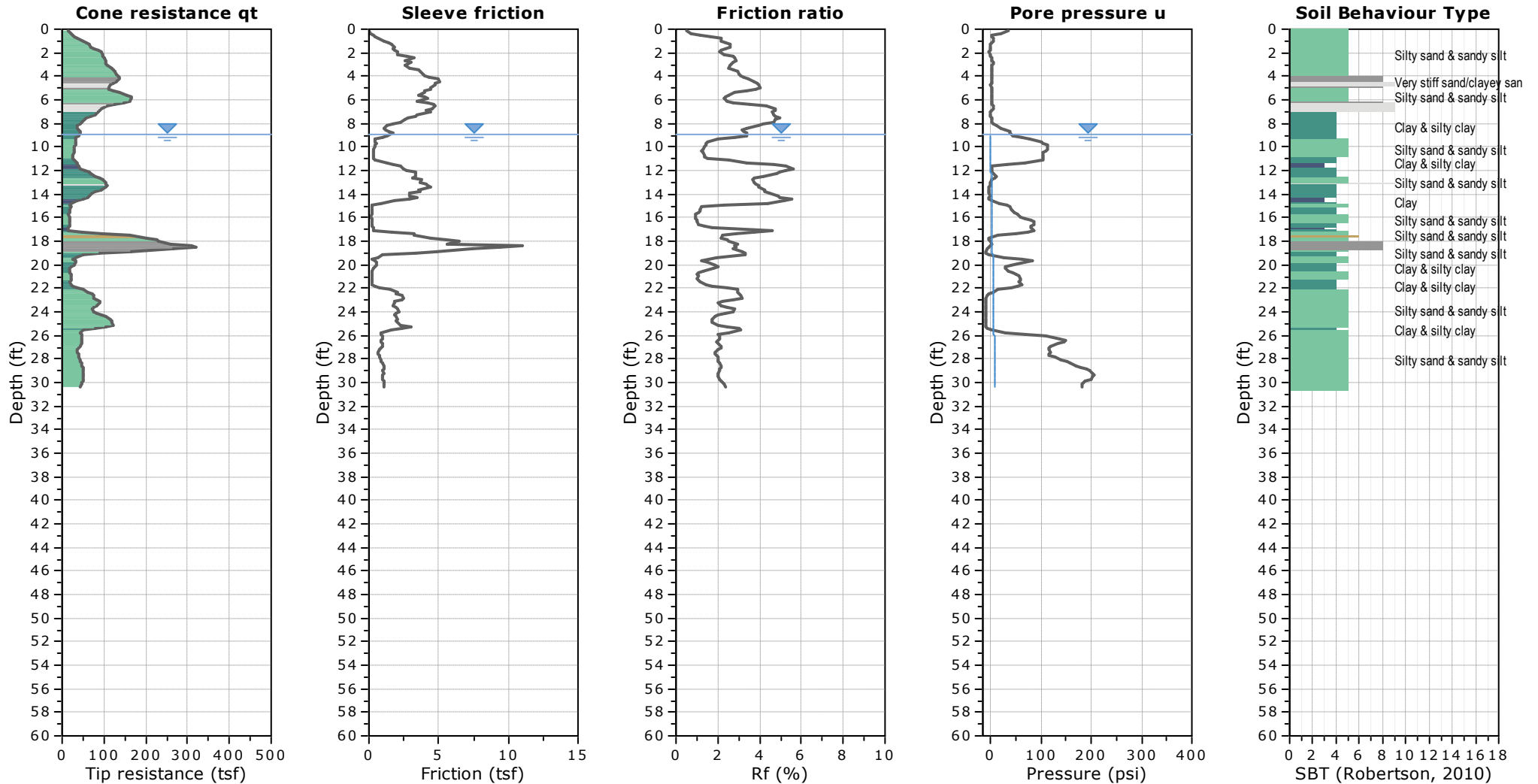




CLIENT: RANEY GEOTECHNICAL
SITE: 1030 KAISER RD, NAPA, CA

FIELD REP: MATT MOYNEUR
Cone ID: GDC-42

Total depth: 30.35 ft, Date: 11/22/2024



WATER TABLE FOR ESTIMATING PURPOSES ONLY



CLIENT: RANEY GEOTECHNICAL
SITE: 1030 KAISER RD, NAPA, CA

The figure displays five depth-based charts (0 to 60 ft depth) for a soil profile. A horizontal blue line is drawn at 9.5 ft depth, with a blue triangle and horizontal bars indicating the test location. The charts are:

- Cone resistance qt:** The left y-axis is Depth (ft) (0-60). The right y-axis is Tip resistance (tsf) (0-500). The chart shows a peak of approximately 250 tsf at 16 ft depth.
- Sleeve friction:** The left y-axis is Depth (ft) (0-60). The right y-axis is Friction (tsf) (0-15). The chart shows a peak of approximately 10 tsf at 16 ft depth.
- Friction ratio:** The left y-axis is Depth (ft) (0-60). The right y-axis is Rf (%) (0-10). The chart shows a peak of approximately 8% at 10 ft depth.
- SPT N60:** The left y-axis is Depth (ft) (0-60). The right y-axis is N60 (blows/ft) (0-100). The chart shows a peak of approximately 80 blows/ft at 16 ft depth.
- Soil Behaviour Type:** A bar chart on the right side of the figure, showing soil types at various depths. The types include Sand & silty sand, Silty sand & sandy silt, Clay & silty clay, Silty sand & sandy silt, Clay & silty clay, Silty sand & sandy silt, Silty sand & sandy silt, Silty sand & sandy silt, Sand & silty sand, Silty sand & sandy silt, Silty sand & sandy silt, Silty sand & sandy silt, Clay & silty clay, Silty sand & sandy silt, Silty sand & sandy silt, Silty sand & sandy silt, Silty sand & sandy silt, and Silty sand & sandy silt.



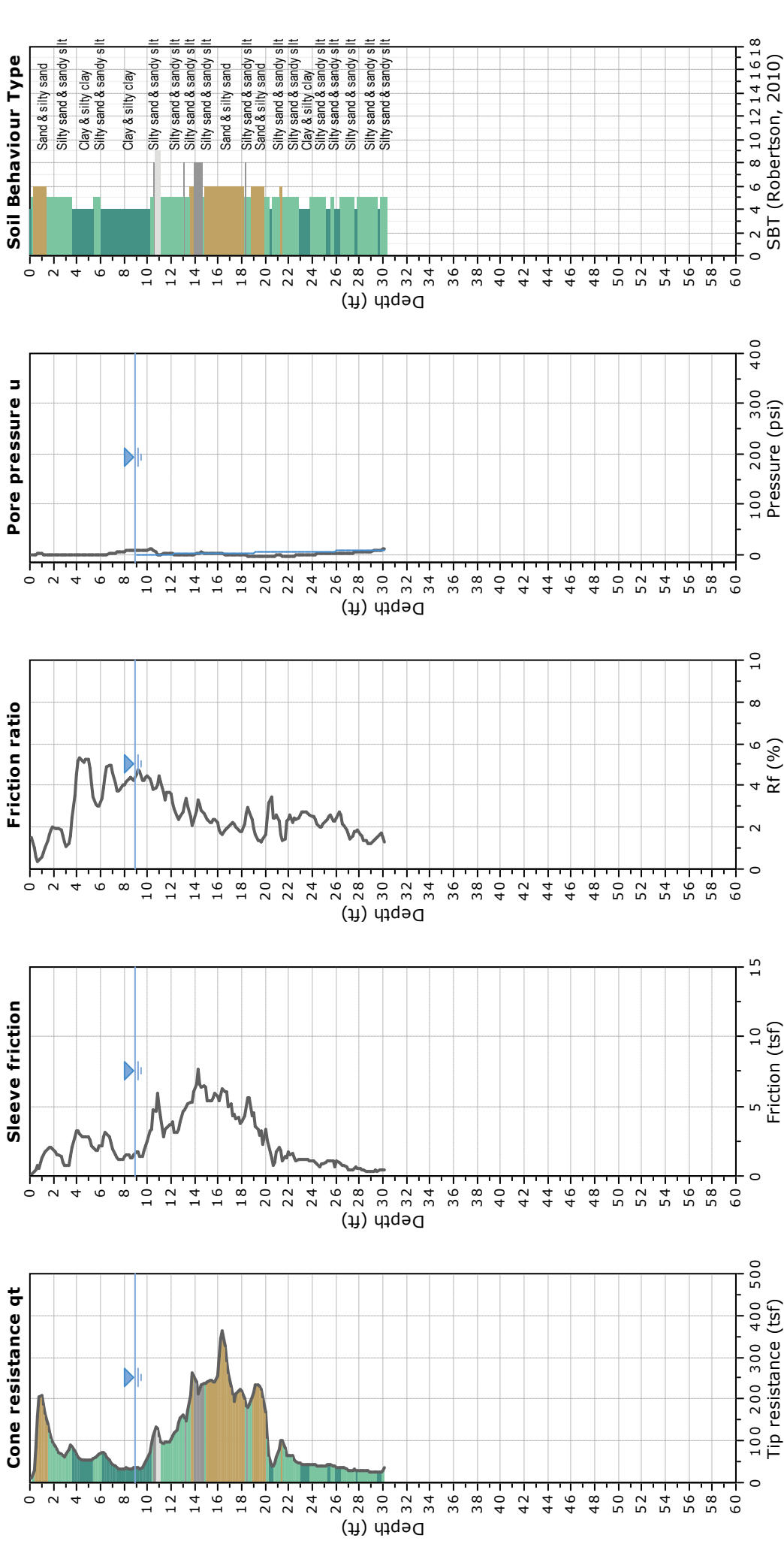
GREGG DRILLING, LLC
WWW.GREGGDRILLING.COM

CPT: CPT-3

FIELD REP: MATT MOYNEUR
Cone ID: GDC-42

CLIENT: RANEY GEOTECHNICAL
SITE: 1030 KAISER RD, NAPA, CA

Total depth: 30.18 ft, Date: 11/21/2024

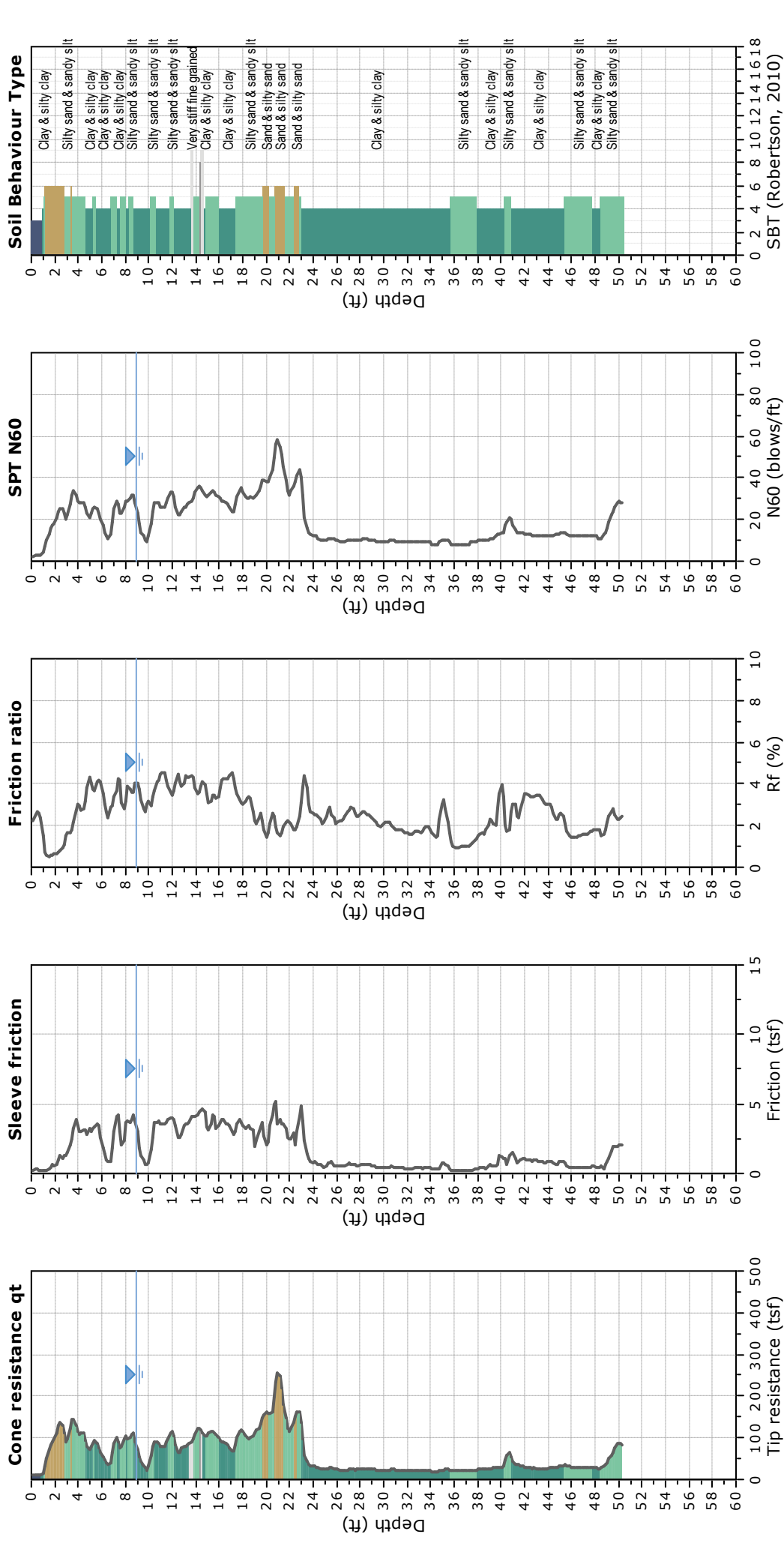


WATER TABLE FOR ESTIMATING PURPOSES ONLY



FIELD REP: MATT MOYNEUR
Cone ID: GDC-42

CLIENT: RANEY GEOTECHNICAL
SITE: 1030 KAISER RD, NAPA, CA





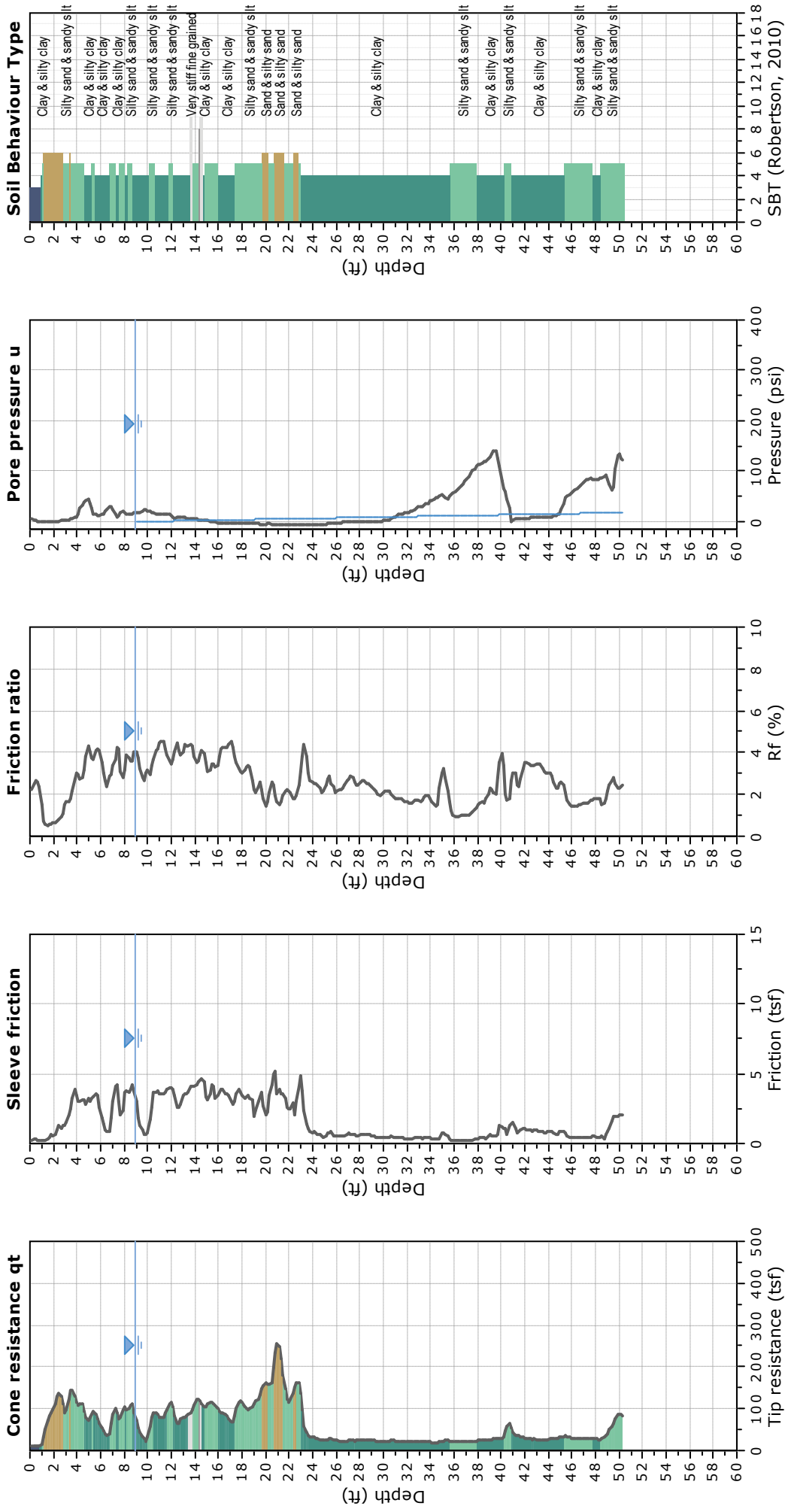
GREGG DRILLING, LLC
WWW.GREGGDRILLING.COM

CPT: SCPT-4

FIELD REP: MATT MOYNEUR
Cone ID: GDC-42

CLIENT: RANEY GEOTECHNICAL
SITE: 1030 KAISER RD, NAPA, CA

Total depth: 50.36 ft, Date: 11/21/2024



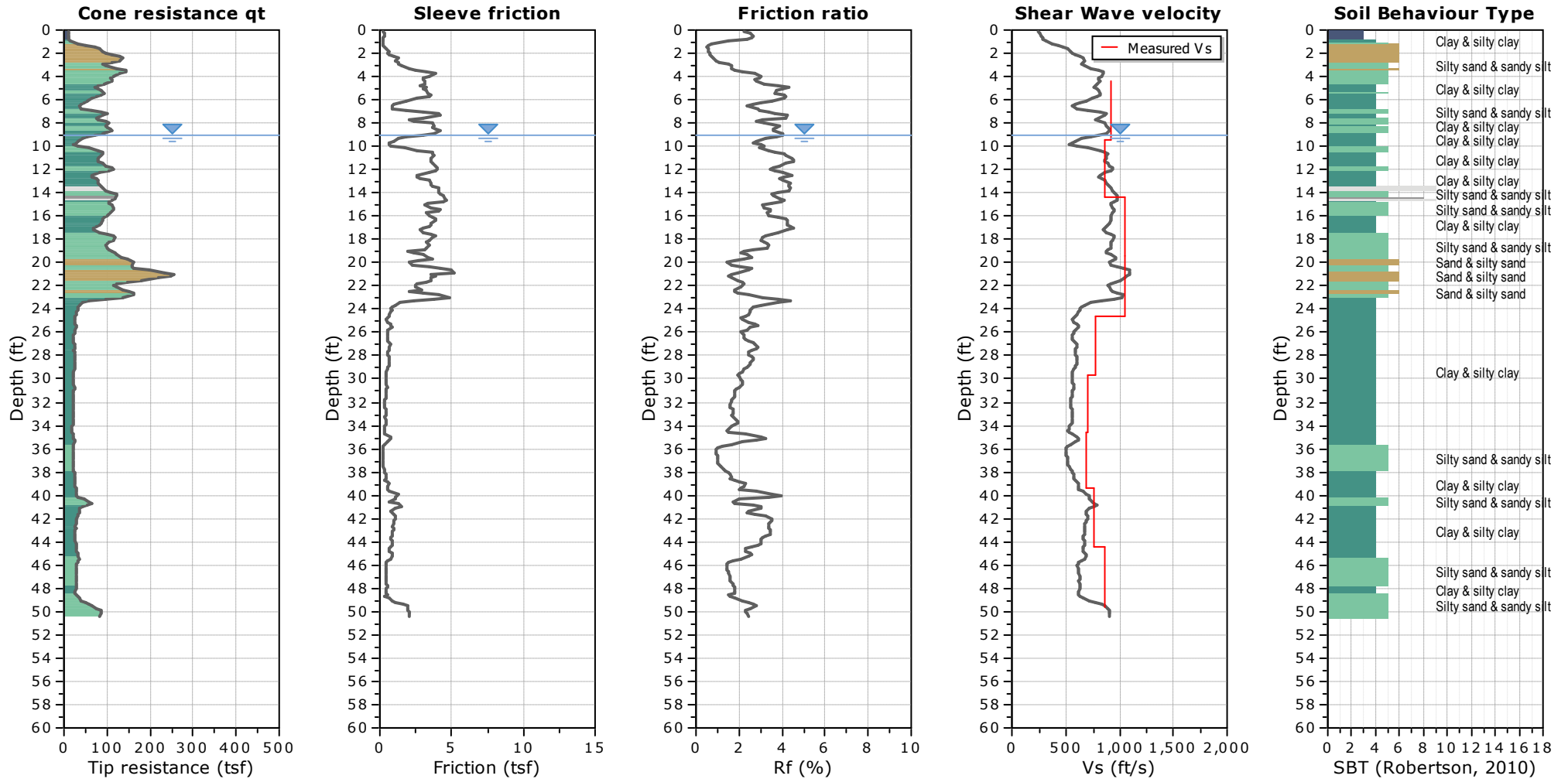
WATER TABLE FOR ESTIMATING PURPOSES ONLY



CLIENT: RANEY GEOTECHNICAL
SITE: 1030 KAISER RD, NAPA, CA

FIELD REP: MATT MOYNEUR
Cone ID: GDC-42

Total depth: 50.36 ft, Date: 11/21/2024



SBTn legend

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

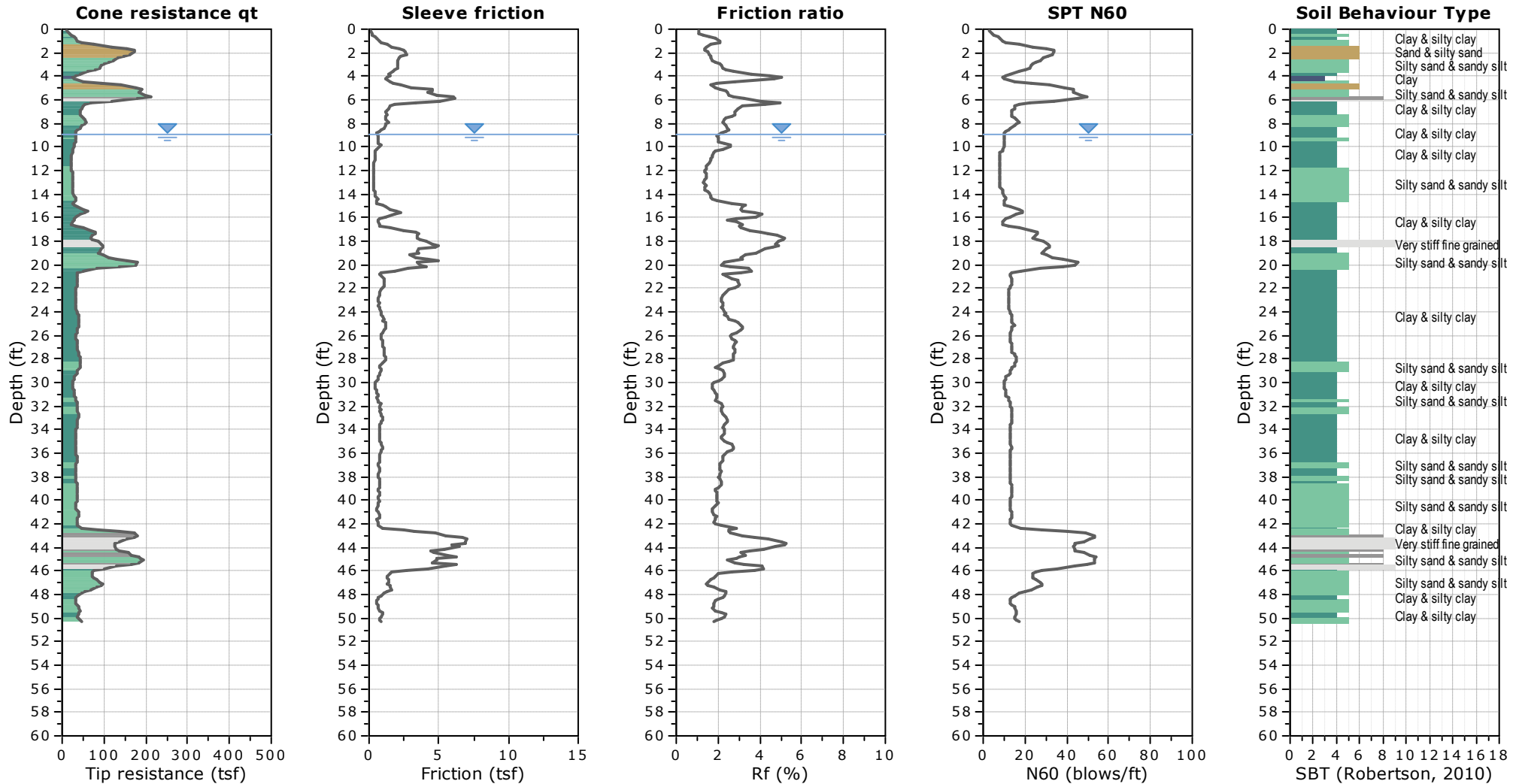


CLIENT: RANEY GEOTECHNICAL

SITE: 1030 KAISER RD, NAPA, CA

FIELD REP: MATT MOYNEUR
Cone ID: GDC-42

Total depth: 50.36 ft, Date: 11/21/2024





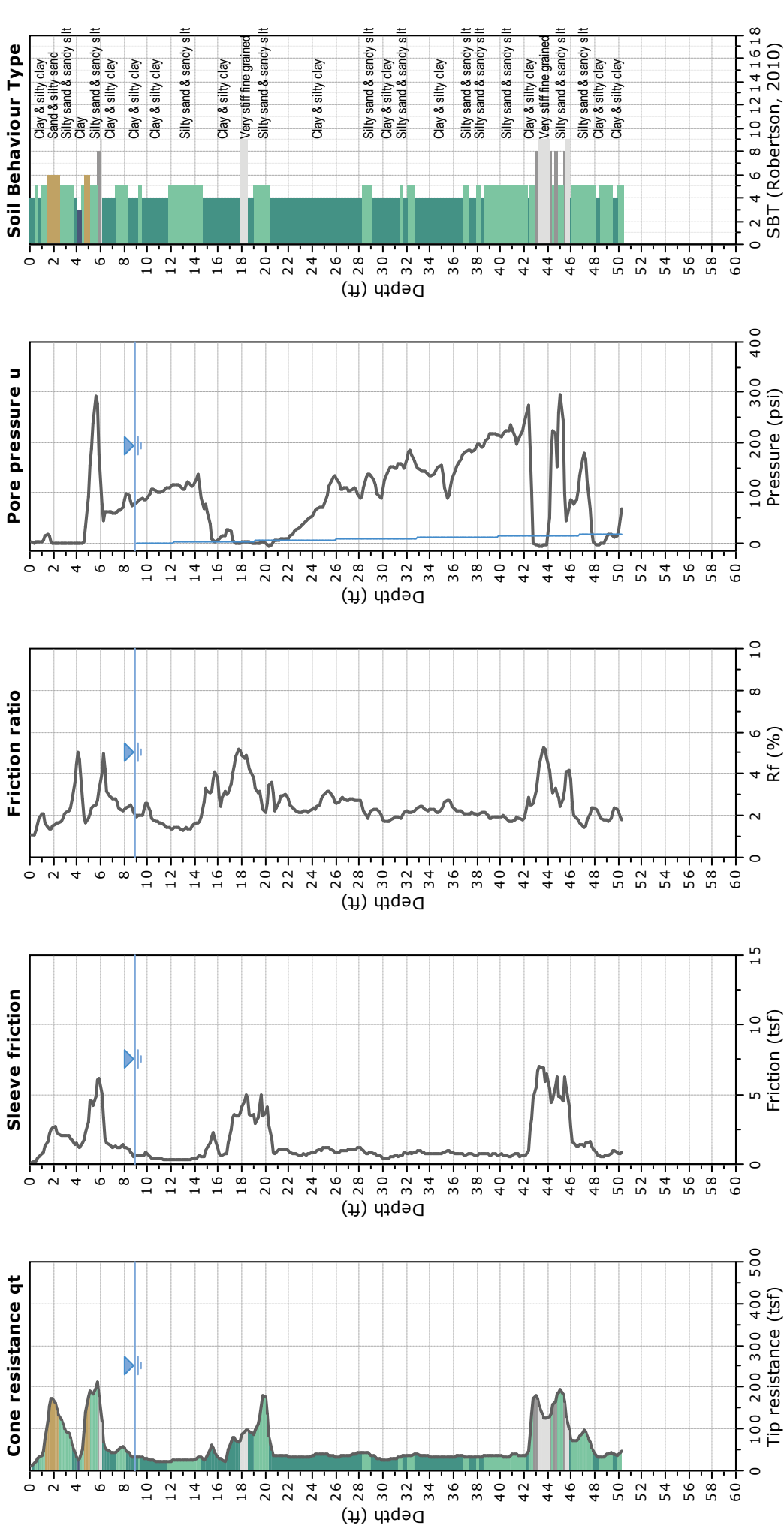
GREGG DRILLING, LLC
WWW.GREGGDRILLING.COM

CPT: SCPT-5

FIELD REP: MATT MOYNEUR
Cone ID: GDC-42

CLIENT: RANEY GEOTECHNICAL
SITE: 1030 KAISER RD, NAPA, CA

Total depth: 50.36 ft, Date: 11/21/2024



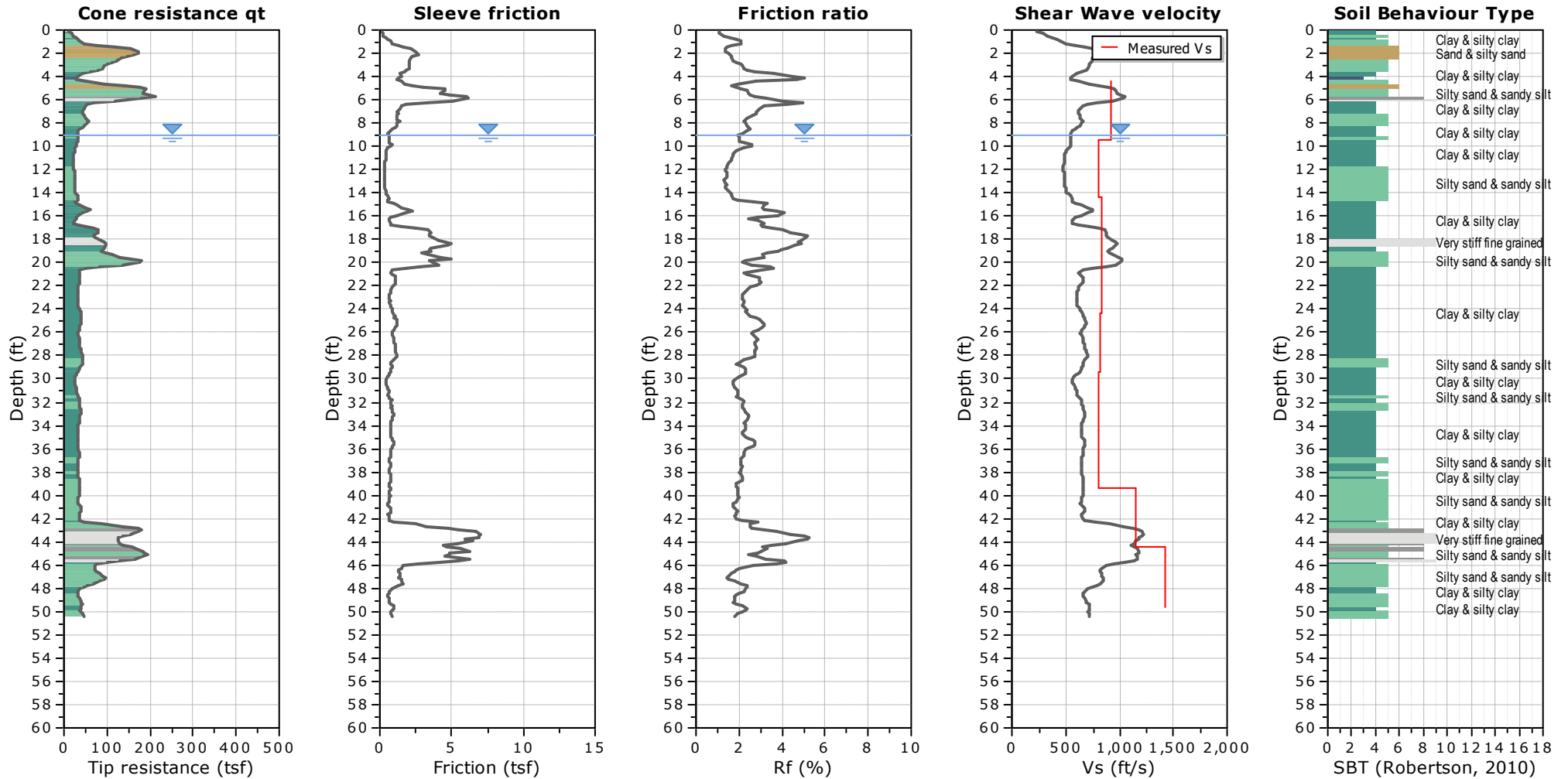
WATER TABLE FOR ESTIMATING PURPOSES ONLY



CLIENT: RANEY GEOTECHNICAL
SITE: 1030 KAISER RD, NAPA, CA

FIELD REP: MATT MOYNEUR
Cone ID: GDC-42

Total depth: 50.36 ft, Date: 11/21/2024



SBTn legend

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

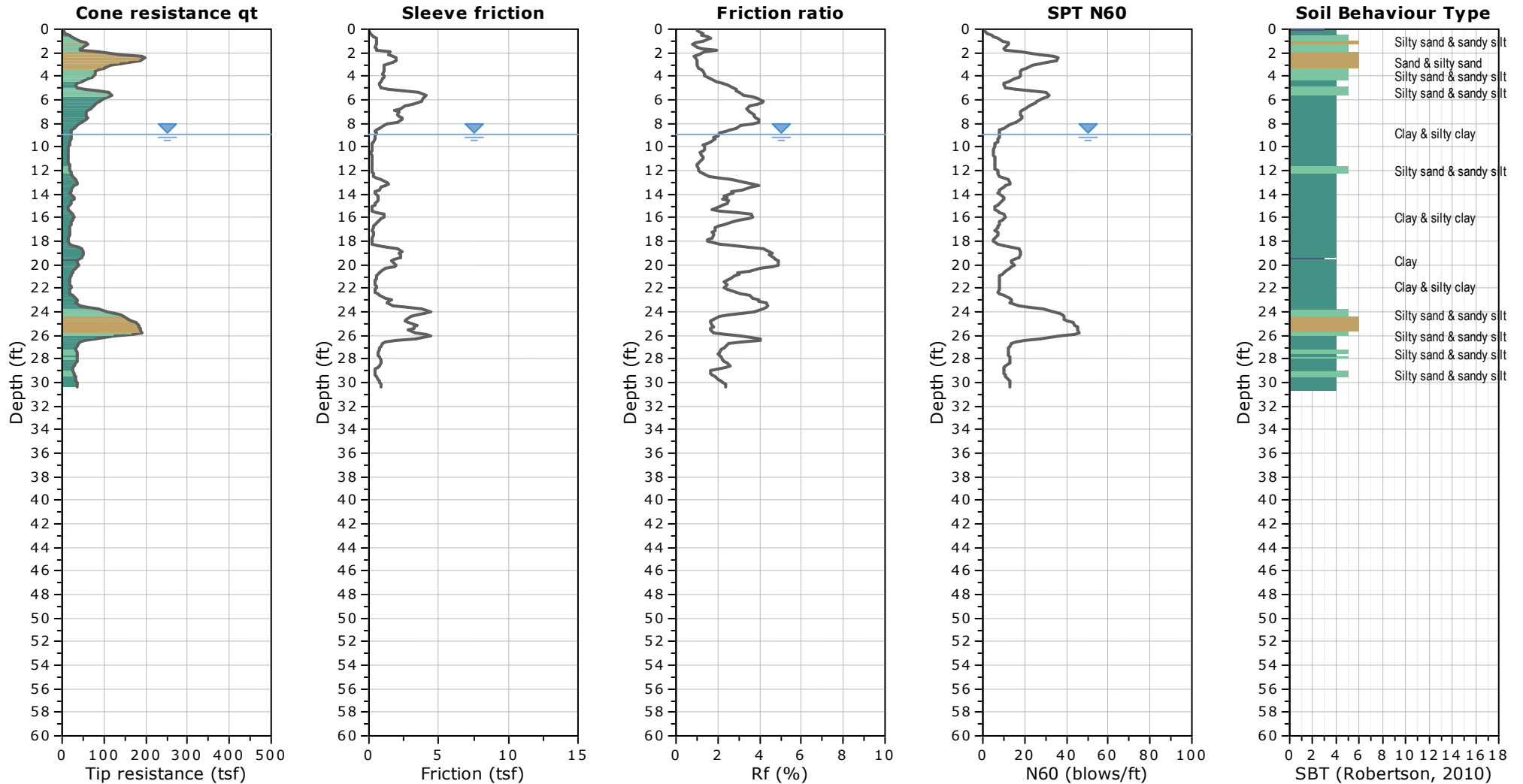


CLIENT: RANEY GEOTECHNICAL

SITE: 1030 KAISER RD, NAPA, CA

FIELD REP: MATT MOYNEUR
Cone ID: GDC-42

Total depth: 30.35 ft, Date: 11/21/2024



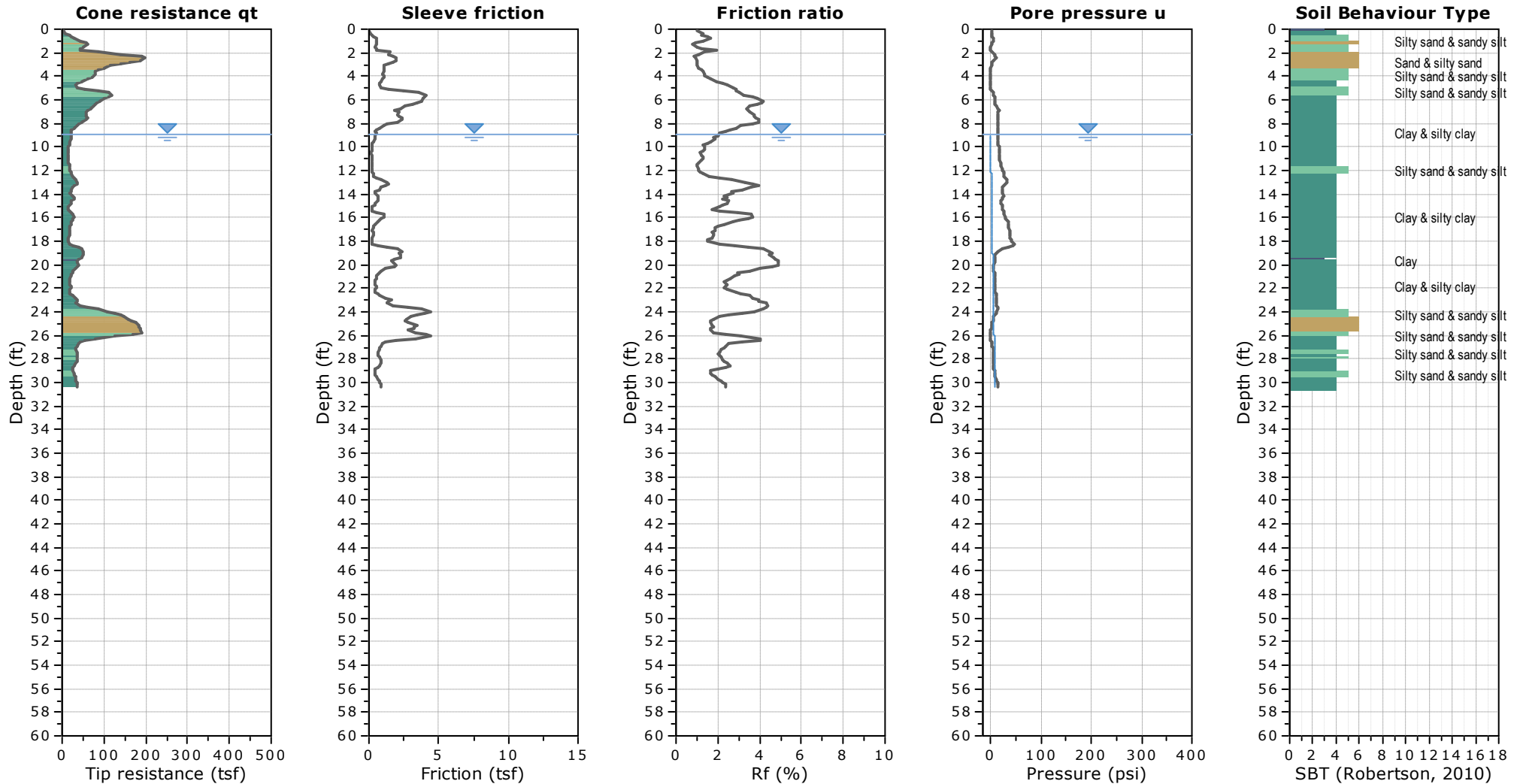


CLIENT: RANEY GEOTECHNICAL

SITE: 1030 KAISER RD, NAPA, CA

FIELD REP: MATT MOYNEUR
Cone ID: GDC-42

Total depth: 30.35 ft, Date: 11/21/2024



WATER TABLE FOR ESTIMATING PURPOSES ONLY

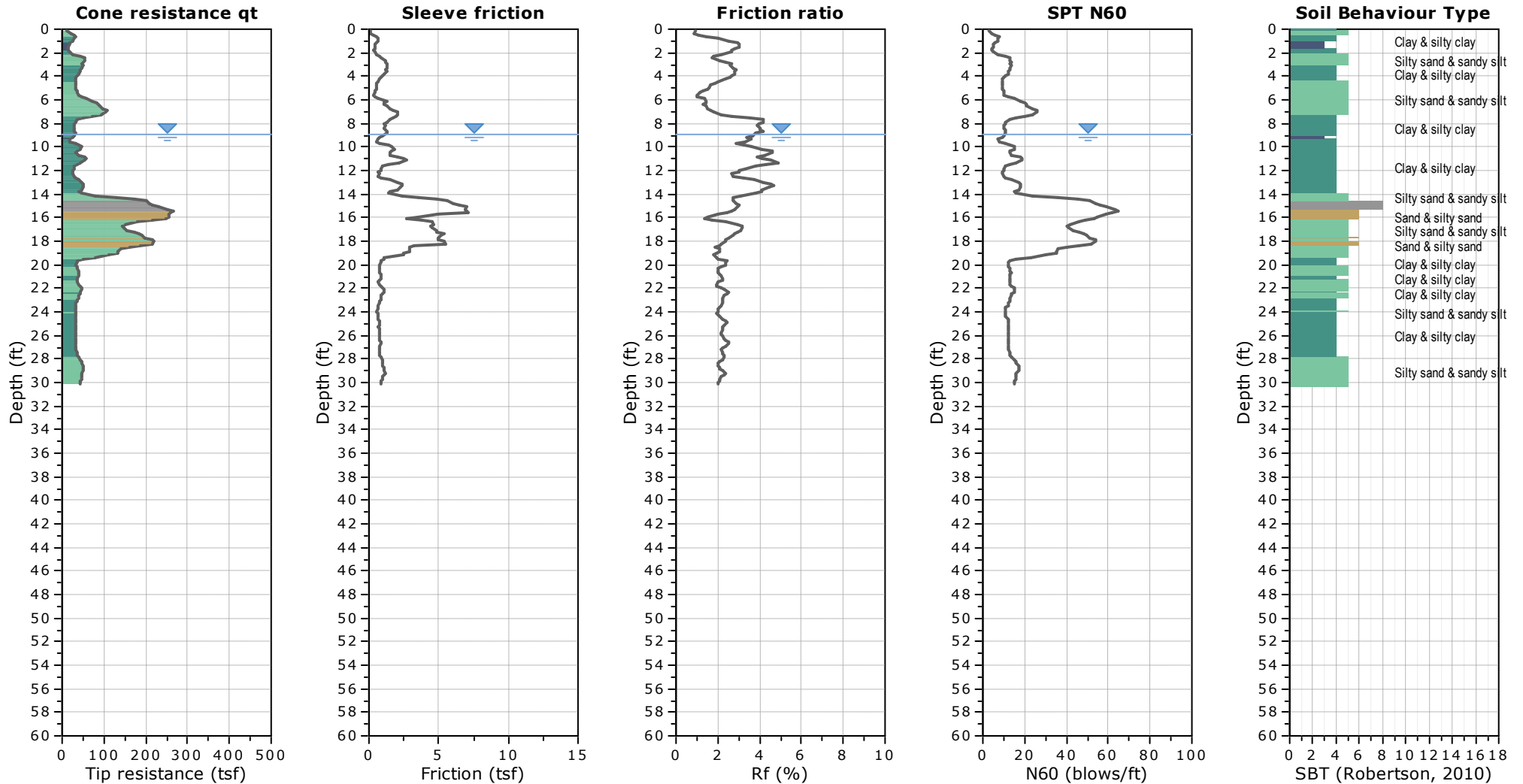


CLIENT: RANEY GEOTECHNICAL

SITE: 1030 KAISER RD, NAPA, CA

FIELD REP: MATT MOYNEUR
Cone ID: GDC-42

Total depth: 30.18 ft, Date: 11/22/2024



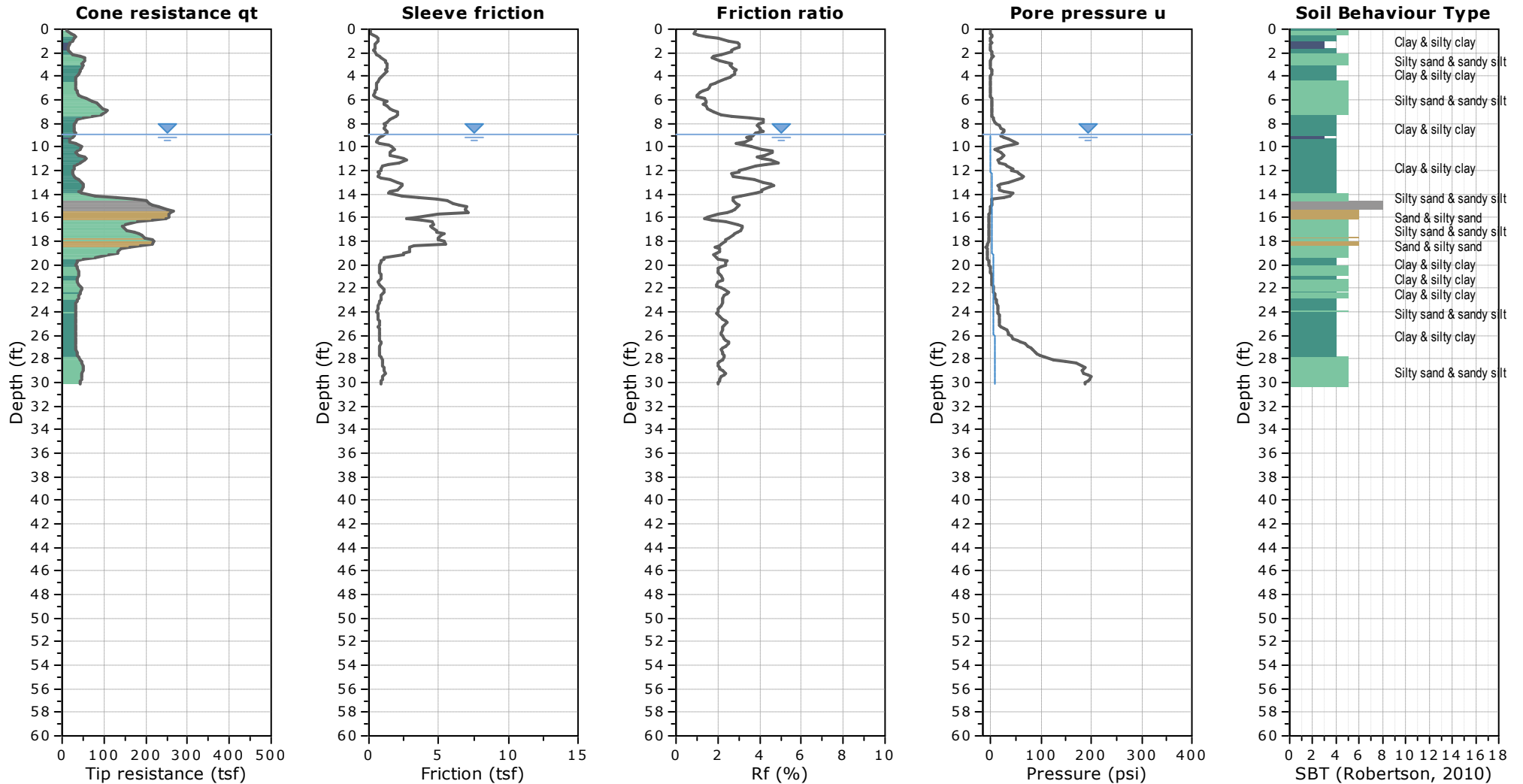


CLIENT: RANEY GEOTECHNICAL

SITE: 1030 KAISER RD, NAPA, CA

FIELD REP: MATT MOYNEUR
Cone ID: GDC-42

Total depth: 30.18 ft, Date: 11/22/2024



WATER TABLE FOR ESTIMATING PURPOSES ONLY

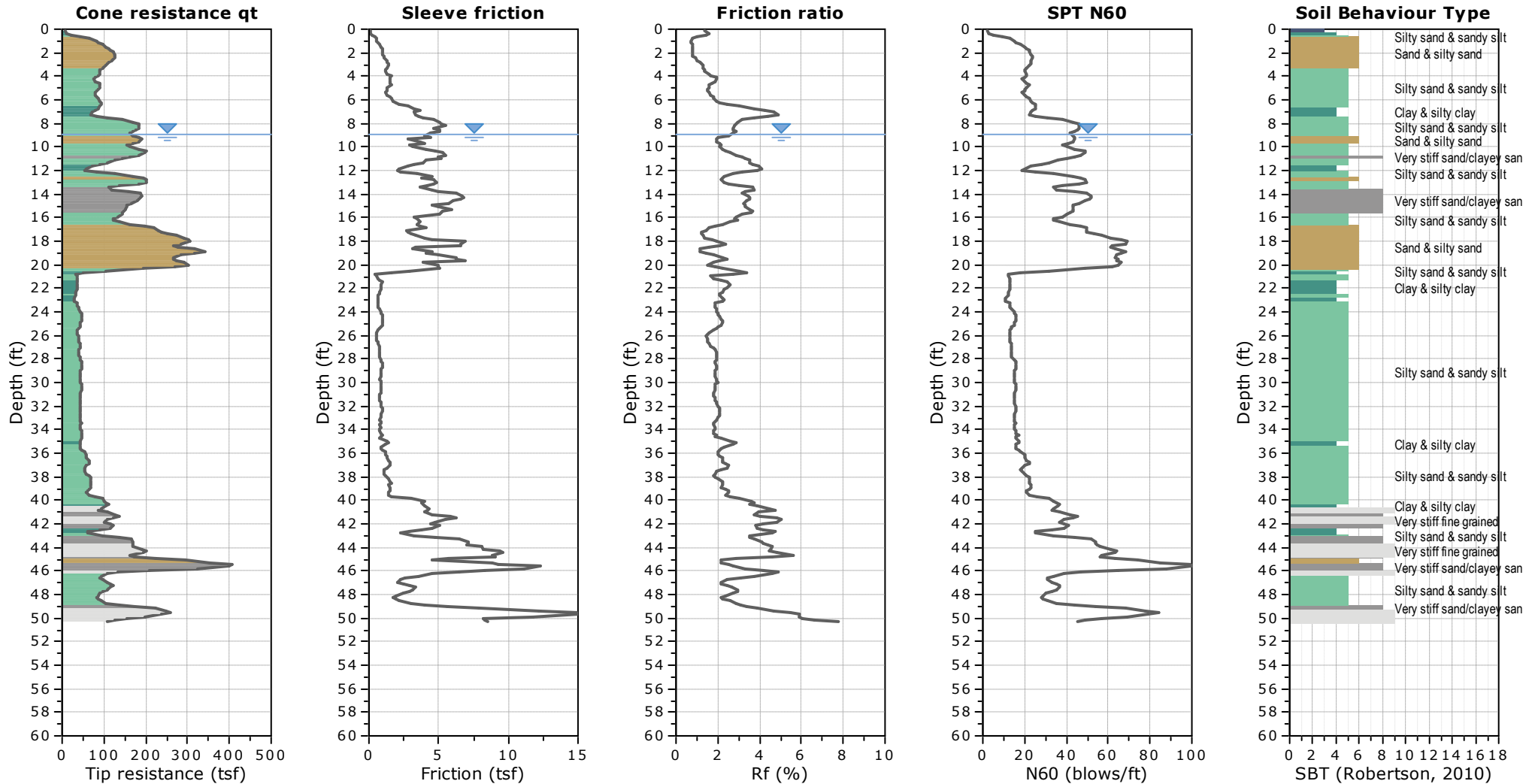


CLIENT: RANEY GEOTECHNICAL

SITE: 1030 KAISER RD, NAPA, CA

FIELD REP: MATT MOYNEUR
Cone ID: GDC-42

Total depth: 50.36 ft, Date: 11/22/2024



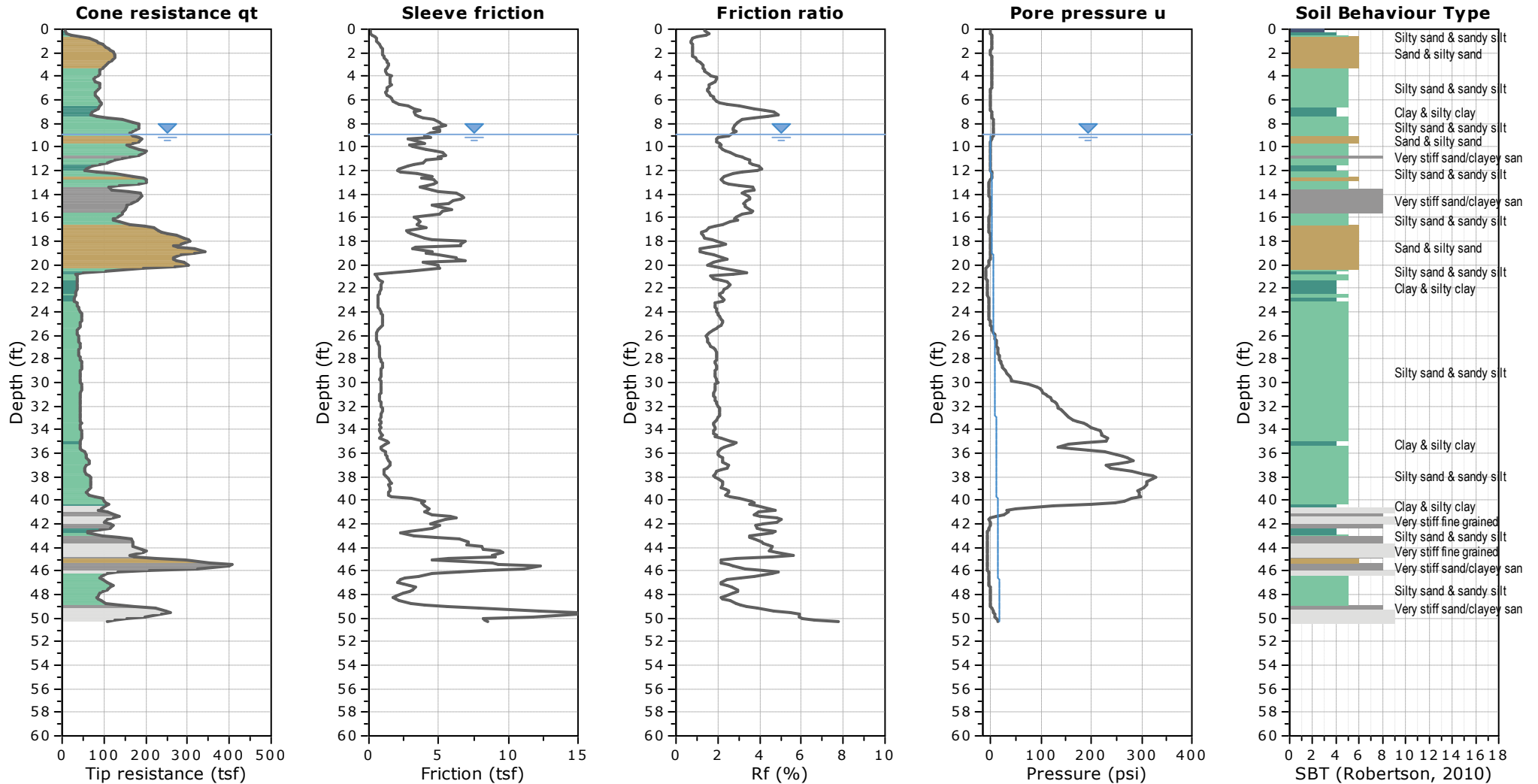


CLIENT: RANEY GEOTECHNICAL

SITE: 1030 KAISER RD, NAPA, CA

FIELD REP: MATT MOYNEUR
Cone ID: GDC-42

Total depth: 50.36 ft, Date: 11/22/2024



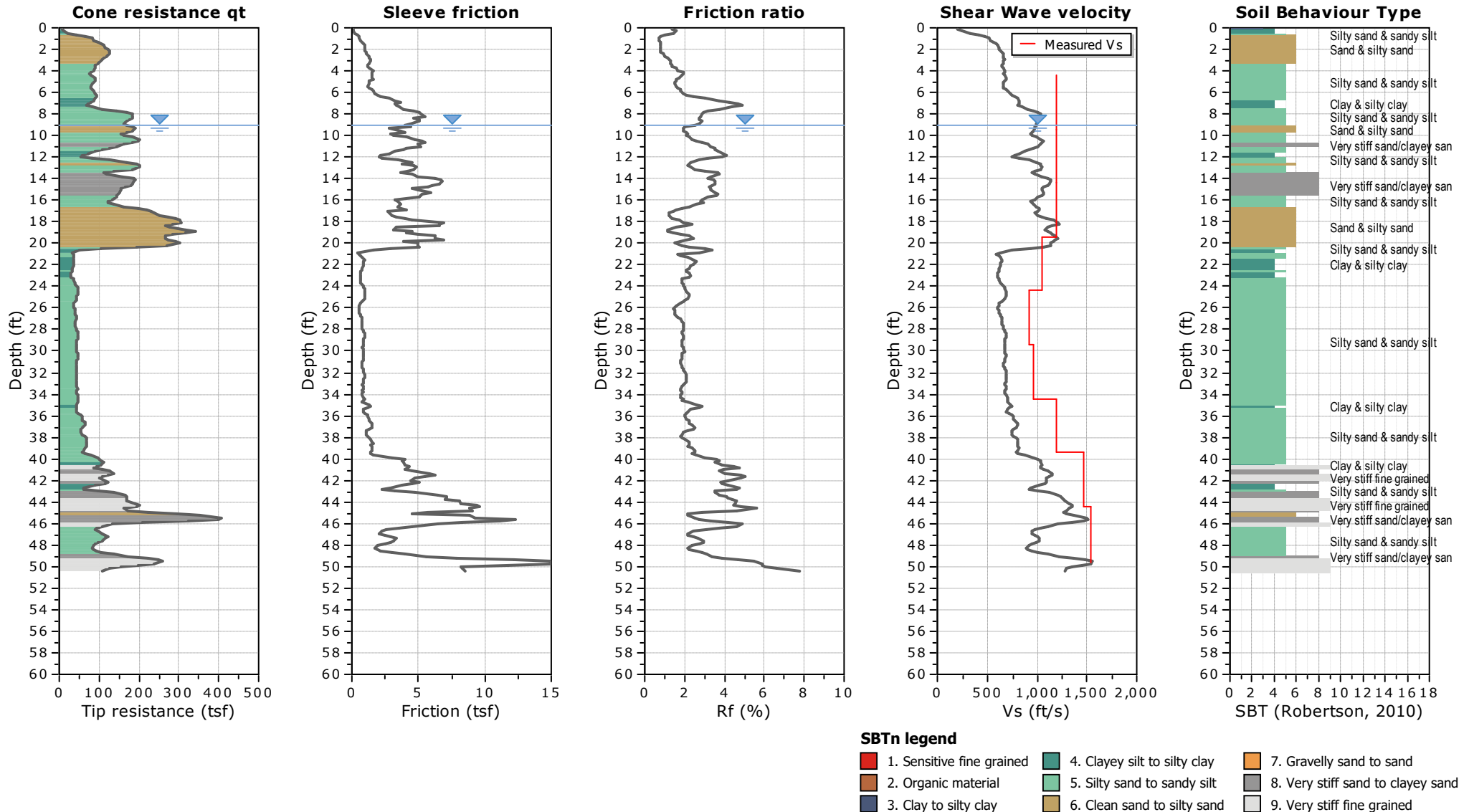
WATER TABLE FOR ESTIMATING PURPOSES ONLY



CLIENT: RANEY GEOTECHNICAL
SITE: 1030 KAISER RD, NAPA, CA

FIELD REP: MATT MOYNEUR
Cone ID: GDC-42

Total depth: 50.36 ft, Date: 11/22/2024



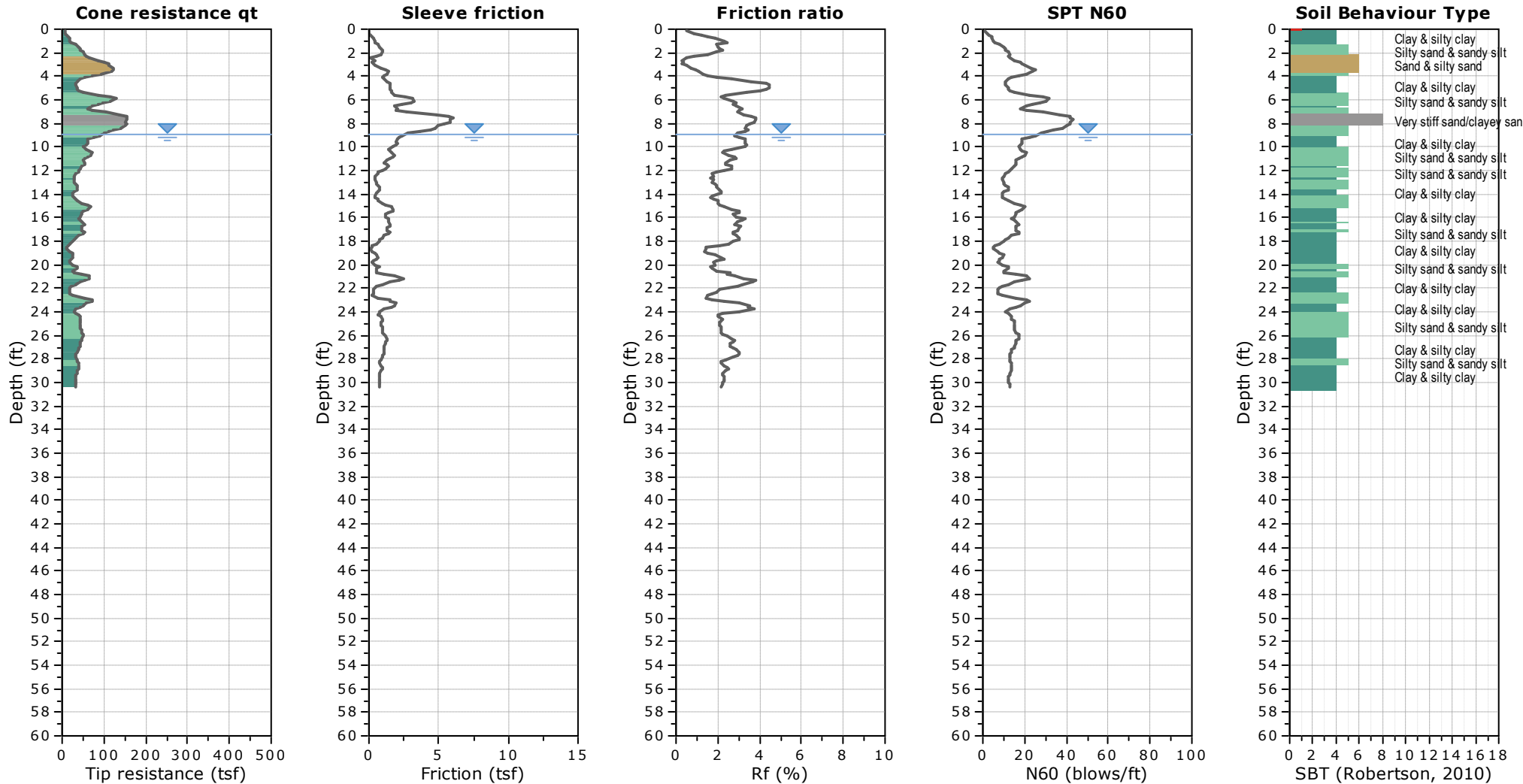


CLIENT: RANEY GEOTECHNICAL

SITE: 1030 KAISER RD, NAPA, CA

FIELD REP: MATT MOYNEUR
Cone ID: GDC-42

Total depth: 30.35 ft, Date: 11/21/2024



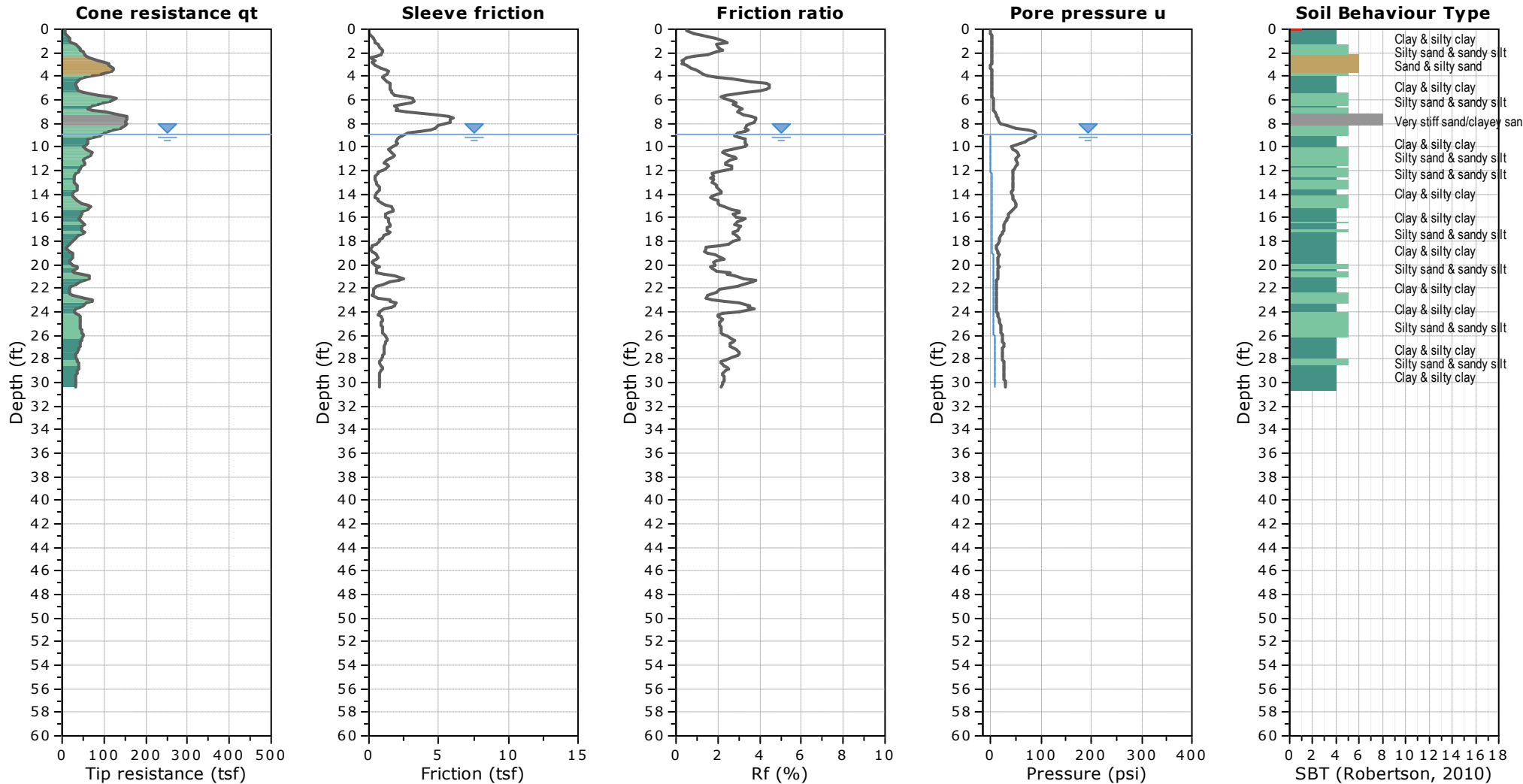


CLIENT: RANEY GEOTECHNICAL

SITE: 1030 KAISER RD, NAPA, CA

FIELD REP: MATT MOYNEUR
Cone ID: GDC-42

Total depth: 30.35 ft, Date: 11/21/2024



WATER TABLE FOR ESTIMATING PURPOSES ONLY

APPENDIX B:

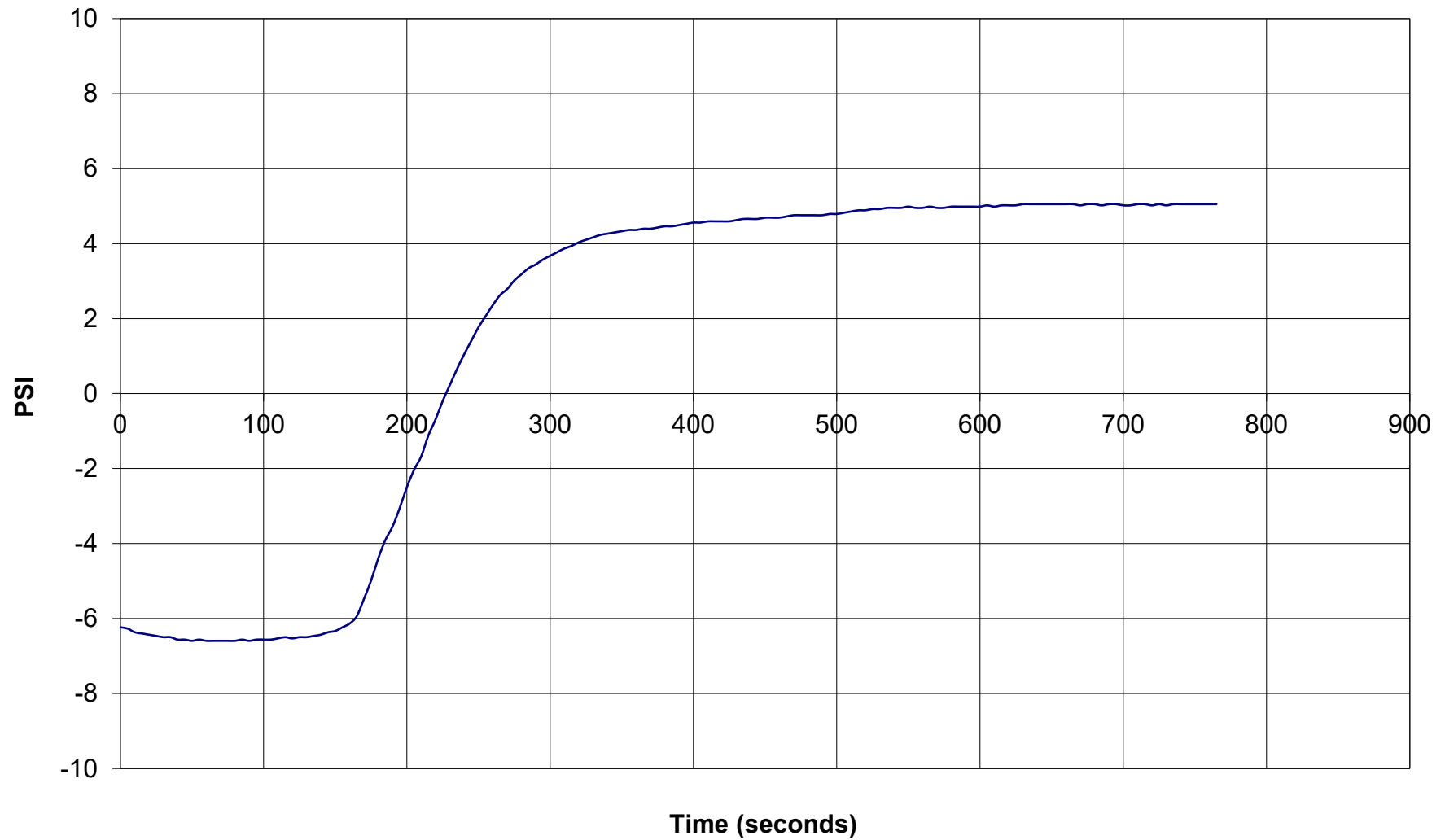
PORE PRESSURE DISSIPATION
TEST PLOTS



GREGG DRILLING & TESTING

Pore Pressure Dissipation Test

Sounding: SCPT-4
Depth (ft): 20.18
Site: 1030 Kaiser Rd
Engineer: Matt Moyneur

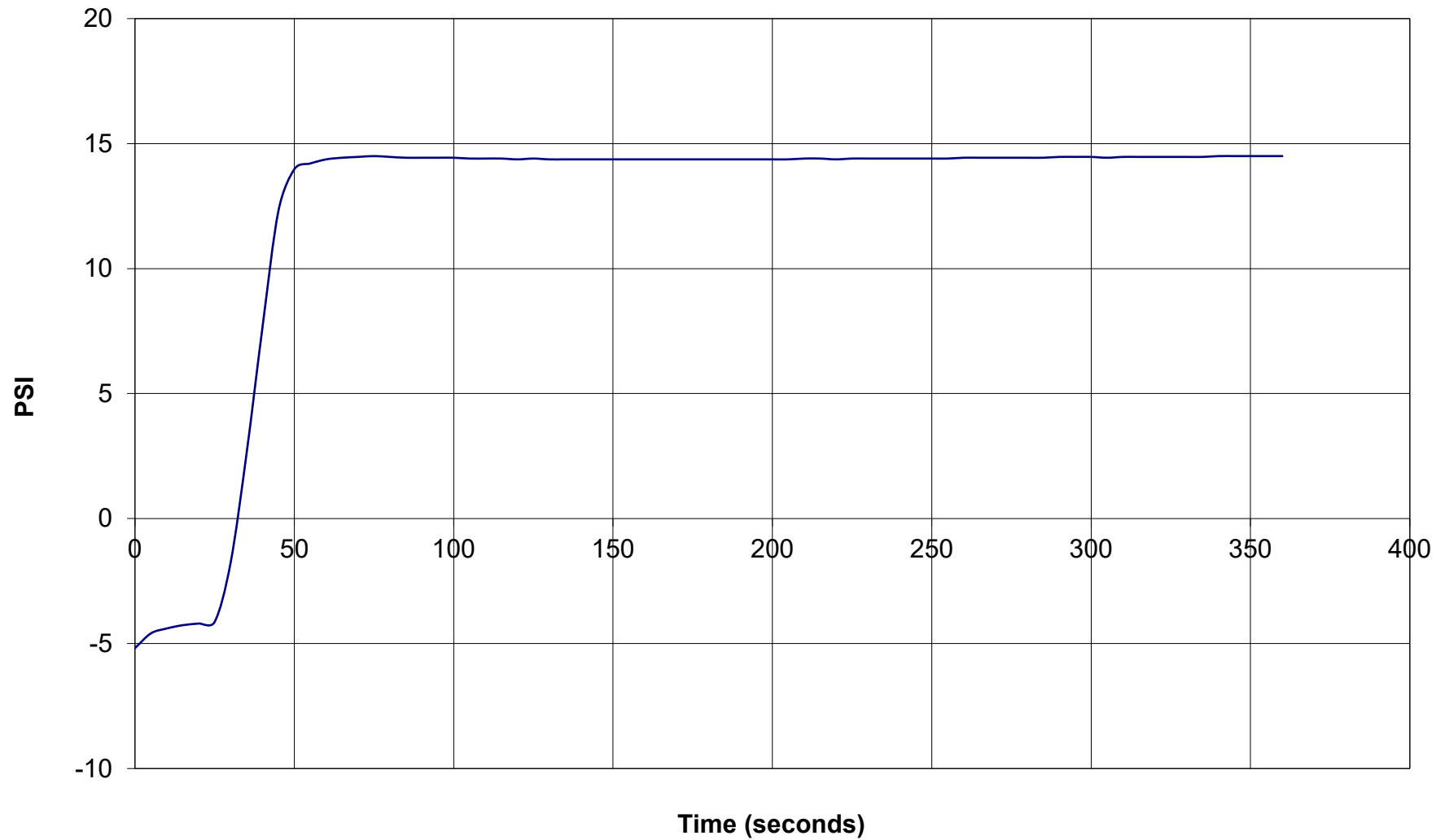




GREGG DRILLING & TESTING

Pore Pressure Dissipation Test

Sounding: SCPT-5
Depth (ft): 42.81
Site: 1030 Kaiser Rd
Engineer: Matt Moyneur

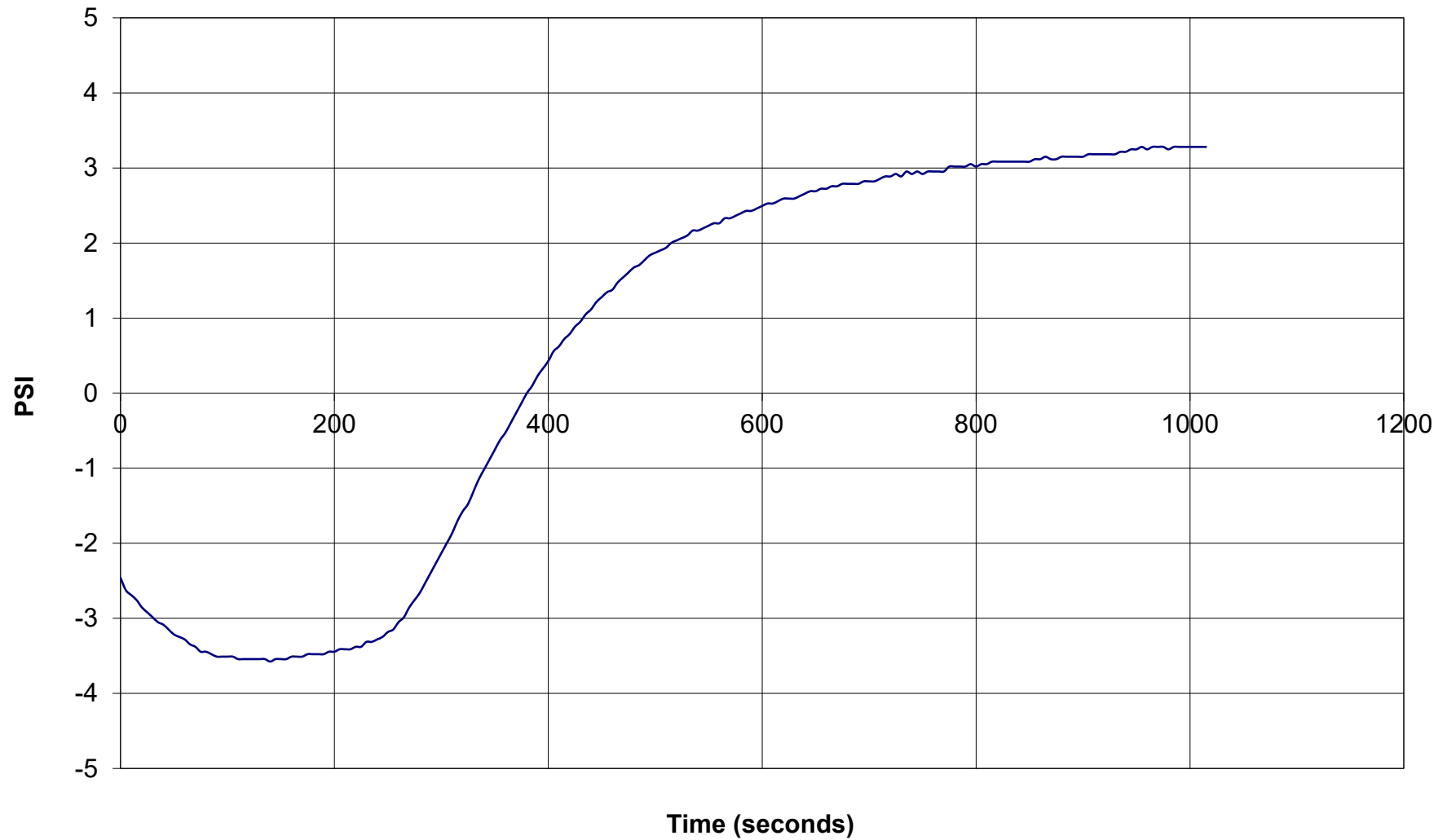




GREGG DRILLING & TESTING

Pore Pressure Dissipation Test

Sounding: SCPT-8
Depth (ft): 17.22
Site: 1030 Kaiser Rd
Engineer: Matt Moyneur



APPENDIX C:

SEISMIC

PLOTS & TABLES



Shear Wave Velocity Calculations

1030 Kaiser Rd

SCPT-4

Geophone Offset: 0.66 Feet

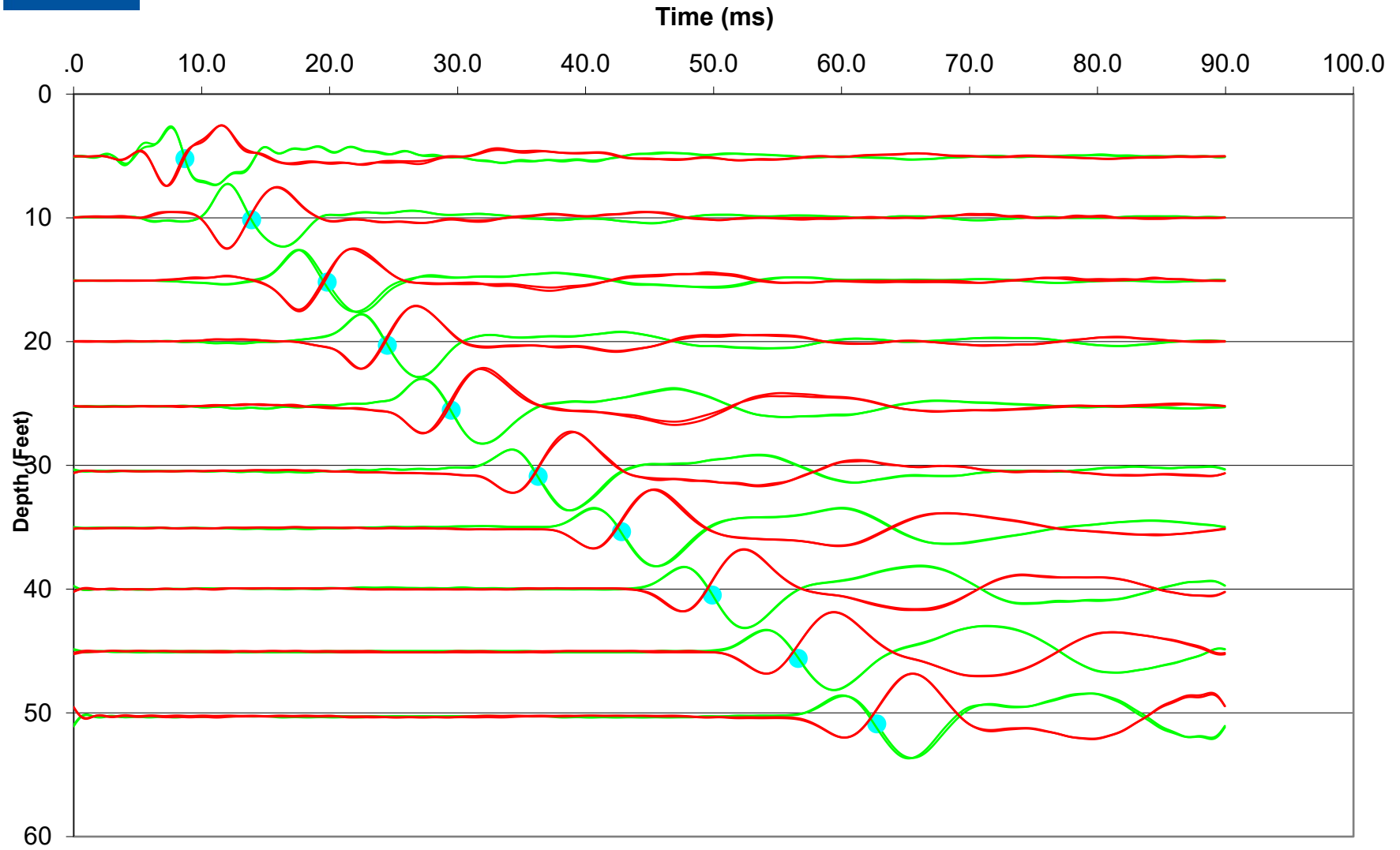
Source Offset: 1.67 Feet

11/21/24

Test Depth (Feet)	Geophone Depth (Feet)	Waveform Ray Path (Feet)	Incremental Distance (Feet)	Characteristic Arrival Time (ms)	Incremental Time Interval (ms)	Interval Velocity (Ft/Sec)	Interval Depth (Feet)
5.09	4.43	4.73	4.73	8.6500			
10.01	9.35	9.49	4.76	13.8500	5.2000	916.3	6.89
15.09	14.43	14.53	5.03	19.7000	5.8500	860.4	11.89
20.01	19.35	19.42	4.90	24.3500	4.6500	1053.1	16.89
25.26	24.60	24.66	5.23	29.3500	5.0000	1046.8	21.98
30.51	29.85	29.90	5.24	36.1000	6.7500	776.2	27.23
35.10	34.44	34.49	4.59	42.5500	6.4500	711.2	32.15
40.03	39.37	39.40	4.92	49.6000	7.0500	697.3	36.91
45.11	44.45	44.48	5.08	56.2500	6.6500	764.1	41.91
50.36	49.70	49.73	5.25	62.3500	6.1000	860.0	47.08



Waveforms for Sounding SCPT-4





Shear Wave Velocity Calculations

1030 Kaiser Rd
SCPT-5

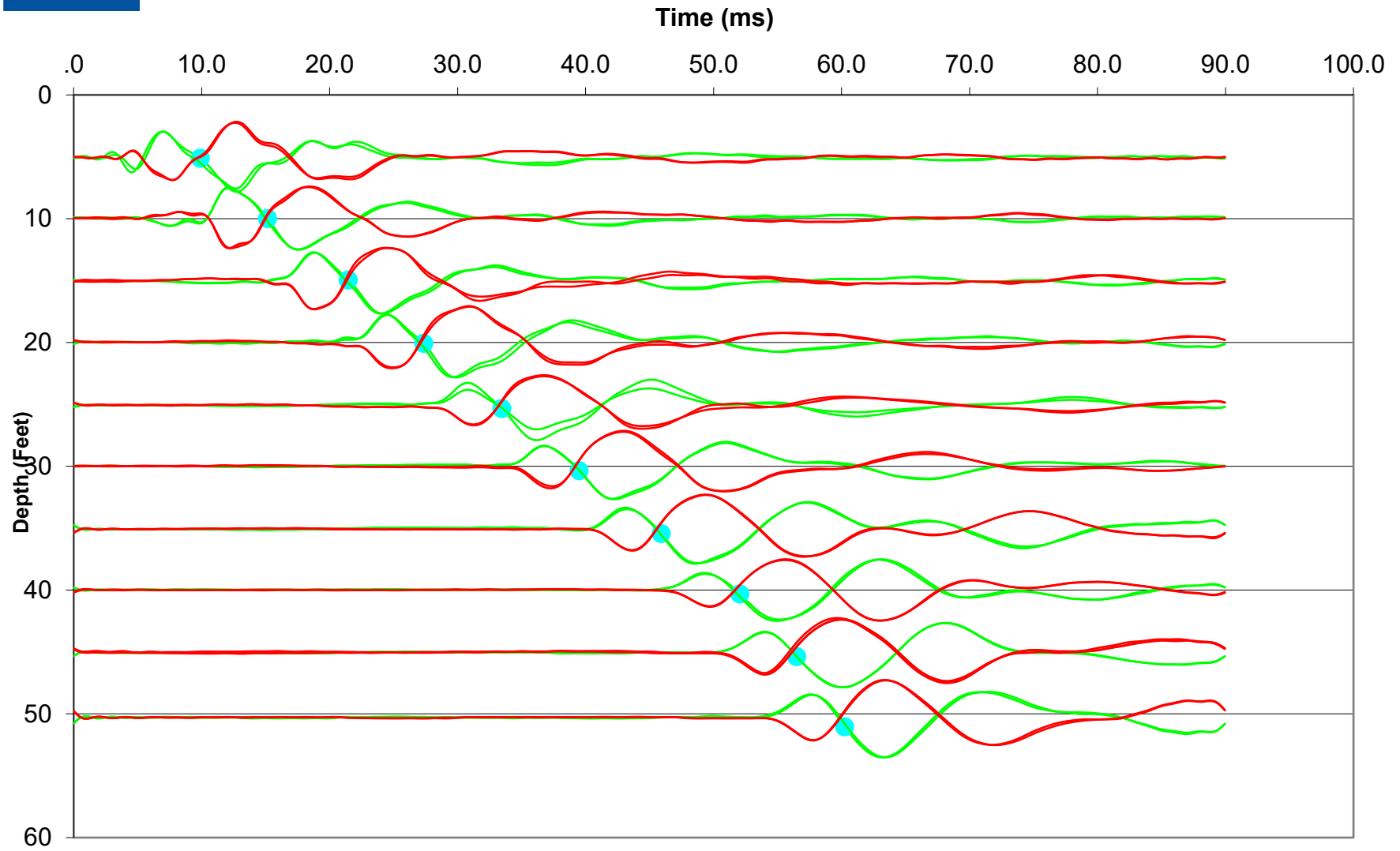
Geophone Offset: 0.66 Feet
Source Offset: 1.67 Feet

11/21/24

Test Depth (Feet)	Geophone Depth (Feet)	Waveform Ray Path (Feet)	Incremental Distance (Feet)	Characteristic Arrival Time (ms)	Incremental Time Interval (ms)	Interval Velocity (Ft/Sec)	Interval Depth (Feet)
5.09	4.43	4.73	4.73	9.8500			
10.01	9.35	9.49	4.76	15.0500	5.2000	916.3	6.89
15.09	14.43	14.53	5.03	21.3500	6.3000	799.0	11.89
20.01	19.35	19.42	4.90	27.2000	5.8500	837.1	16.89
25.10	24.44	24.50	5.07	33.2500	6.0500	838.1	21.90
30.02	29.36	29.41	4.91	39.2500	6.0000	818.6	26.90
35.10	34.44	34.49	5.08	45.6000	6.3500	799.7	31.90
40.03	39.37	39.40	4.92	51.7500	6.1500	799.4	36.91
45.11	44.45	44.48	5.08	56.1500	4.4000	1154.8	41.91
50.36	49.70	49.73	5.25	59.8500	3.7000	1417.8	47.08



Waveforms for Sounding SCPT-5





Shear Wave Velocity Calculations

1030 Kaiser Rd
SCPT-8

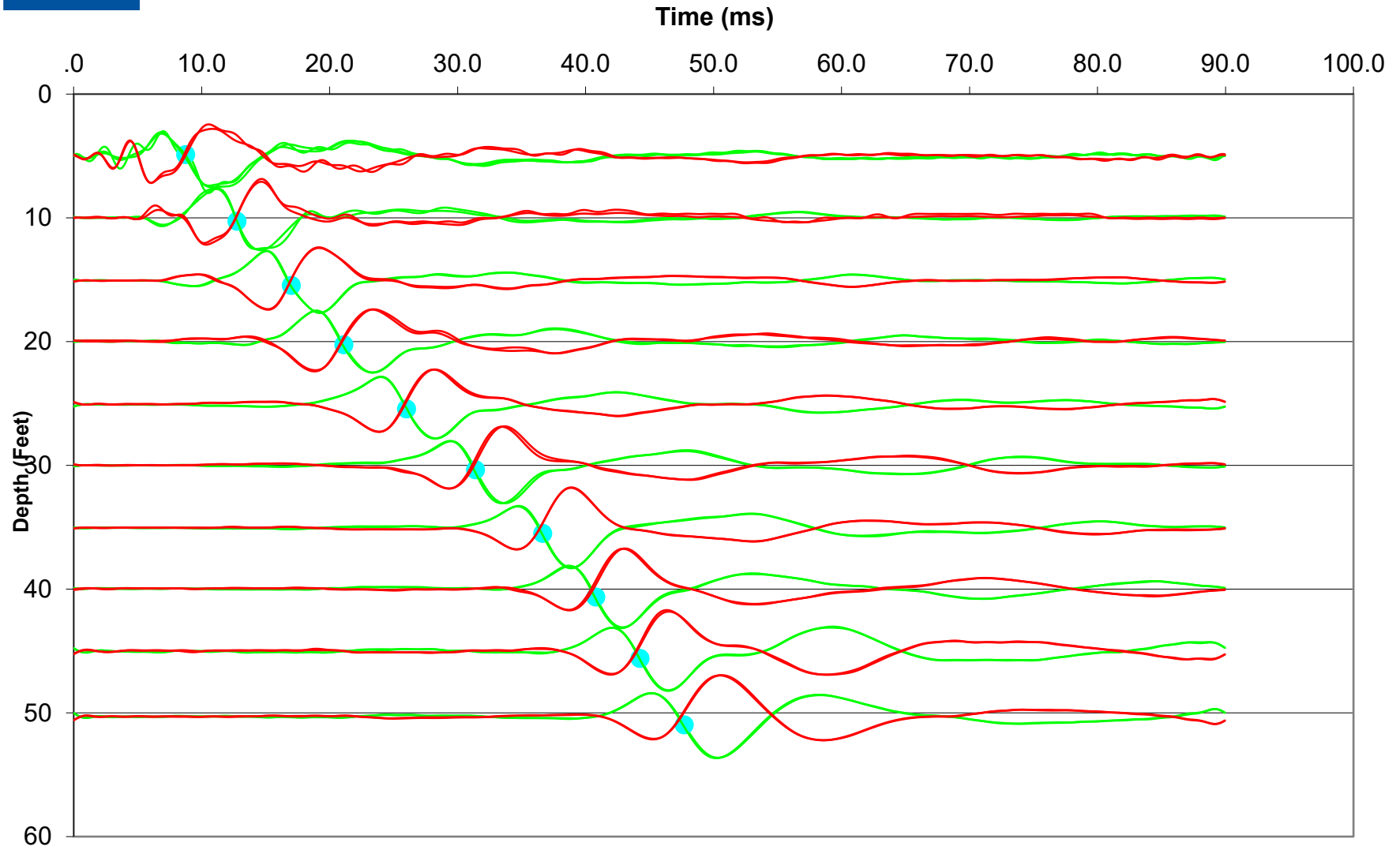
Geophone Offset: 0.66 Feet
Source Offset: 1.67 Feet

11/22/24

Test Depth (Feet)	Geophone Depth (Feet)	Waveform Ray Path (Feet)	Incremental Distance (Feet)	Characteristic Arrival Time (ms)	Incremental Time Interval (ms)	Interval Velocity (Ft/Sec)	Interval Depth (Feet)
5.09	4.43	4.73	4.73	8.7000			
10.01	9.35	9.49	4.76	12.7000	4.0000	1191.2	6.89
15.09	14.43	14.53	5.03	16.9000	4.2000	1198.5	11.89
20.01	19.35	19.42	4.90	21.0000	4.1000	1194.4	16.89
25.10	24.44	24.50	5.07	25.8500	4.8500	1045.4	21.90
30.02	29.36	29.41	4.91	31.2000	5.3500	918.1	26.90
35.10	34.44	34.49	5.08	36.4500	5.2500	967.3	31.90
40.03	39.37	39.40	4.92	40.5500	4.1000	1199.1	36.91
45.11	44.45	44.48	5.08	44.0000	3.4500	1472.8	41.91
50.36	49.70	49.73	5.25	47.4000	3.4000	1542.9	47.08

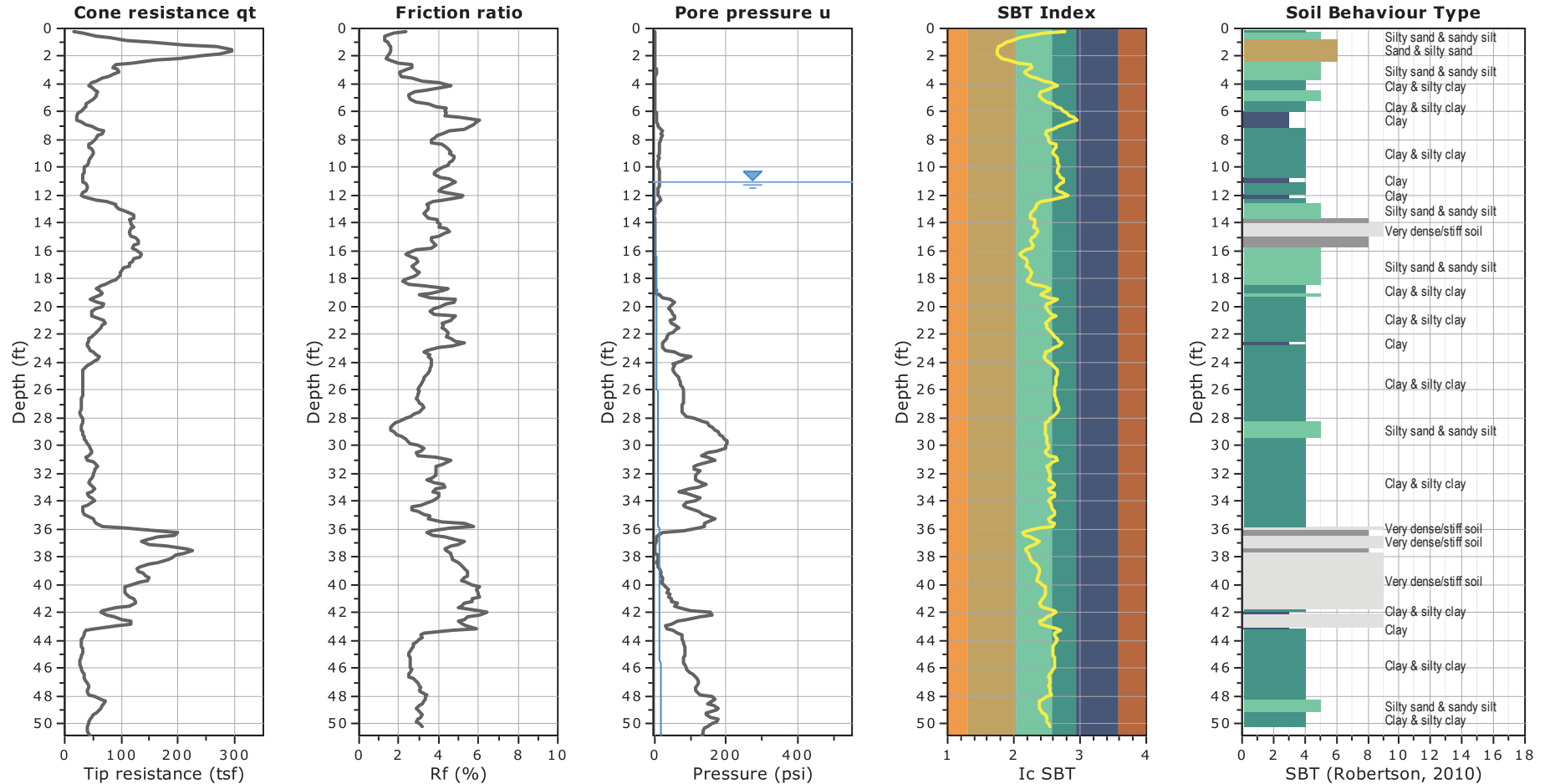


Waveforms for Sounding SCPT-8



APPENDIX B

Rockridge Logs of CPTs



Ground Surface Elevation: 19.0 feet
 Total Depth: 50.9 ft, Date: October 2, 2023
 Depth to Groundwater: 11 feet (measured with weighted tape)
 Cone Operator: Middle Earth Geo Testing, Inc.

SBT legend

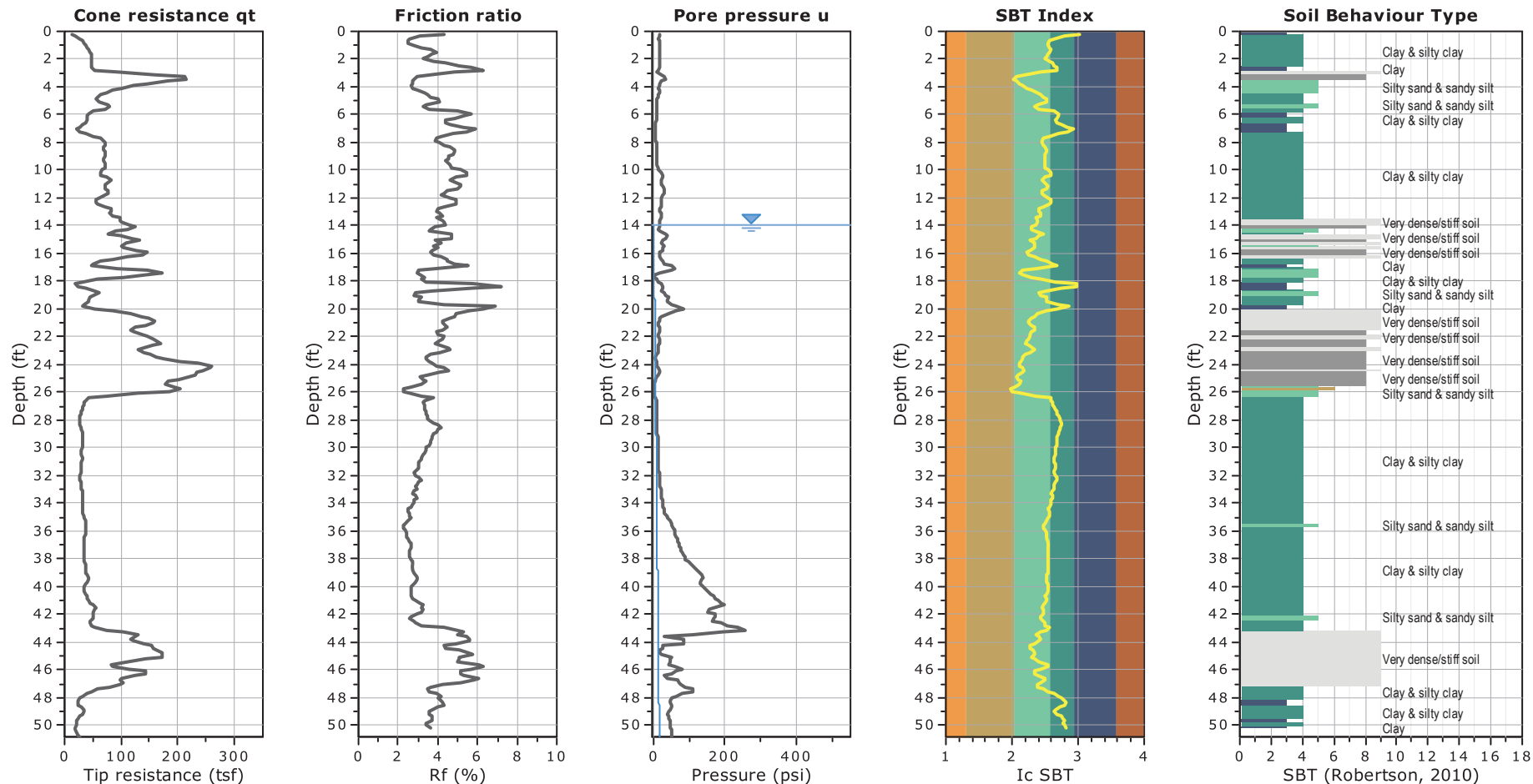
- | | | |
|---------------------------|------------------------------|-----------------------------------|
| 1. Sensitive fine grained | 4. Clayey silt to silty clay | 7. Gravely sand to sand |
| 2. Organic material | 5. Silty sand to sandy silt | 8. Very stiff sand to clayey sand |
| 3. Clay to silty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

1030 KAISER ROAD
Napa, California



**CONE PENETRATION TEST RESULTS
CPT-1**

Date 10/23/23	Project No. 23-2491	Figure A-1
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Ground Surface Elevation: 19.0 feet
 Total Depth: 50.9 ft, Date: October 2, 2023
 Depth to Groundwater: 14 feet (measured with weighted tape)
 Cone Operator: Middle Earth Geo Testing, Inc.

SBT legend

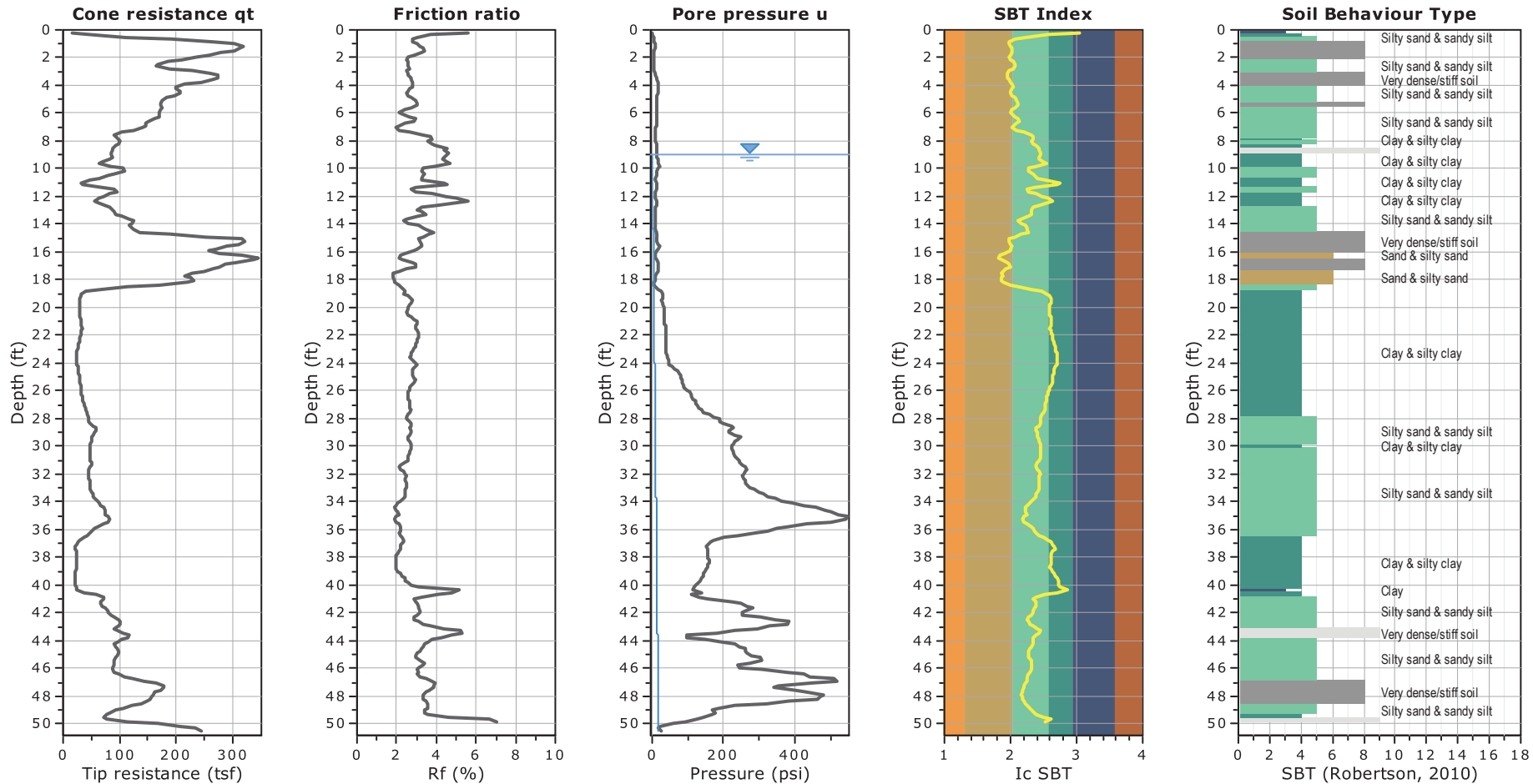
- | | | |
|---------------------------|------------------------------|-----------------------------------|
| 1. Sensitive fine grained | 4. Clayey silt to silty clay | 7. Gravely sand to sand |
| 2. Organic material | 5. Silty sand to sandy silt | 8. Very stiff sand to clayey sand |
| 3. Clay to silty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

1030 KAISER ROAD
 Napa, California

ROCKRIDGE
 GEOTECHNICAL

CONE PENETRATION TEST RESULTS
CPT-2

Date 10/23/23	Project No. 23-2491	Figure A-2
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Ground Surface Elevation: 15.5 feet
 Total Depth: 50.5 ft, Date: October 2, 2023
 Depth to Groundwater: 9 feet (measured with weighted tape)
 Cone Operator: Middle Earth Geo Testing, Inc.

SBT legend

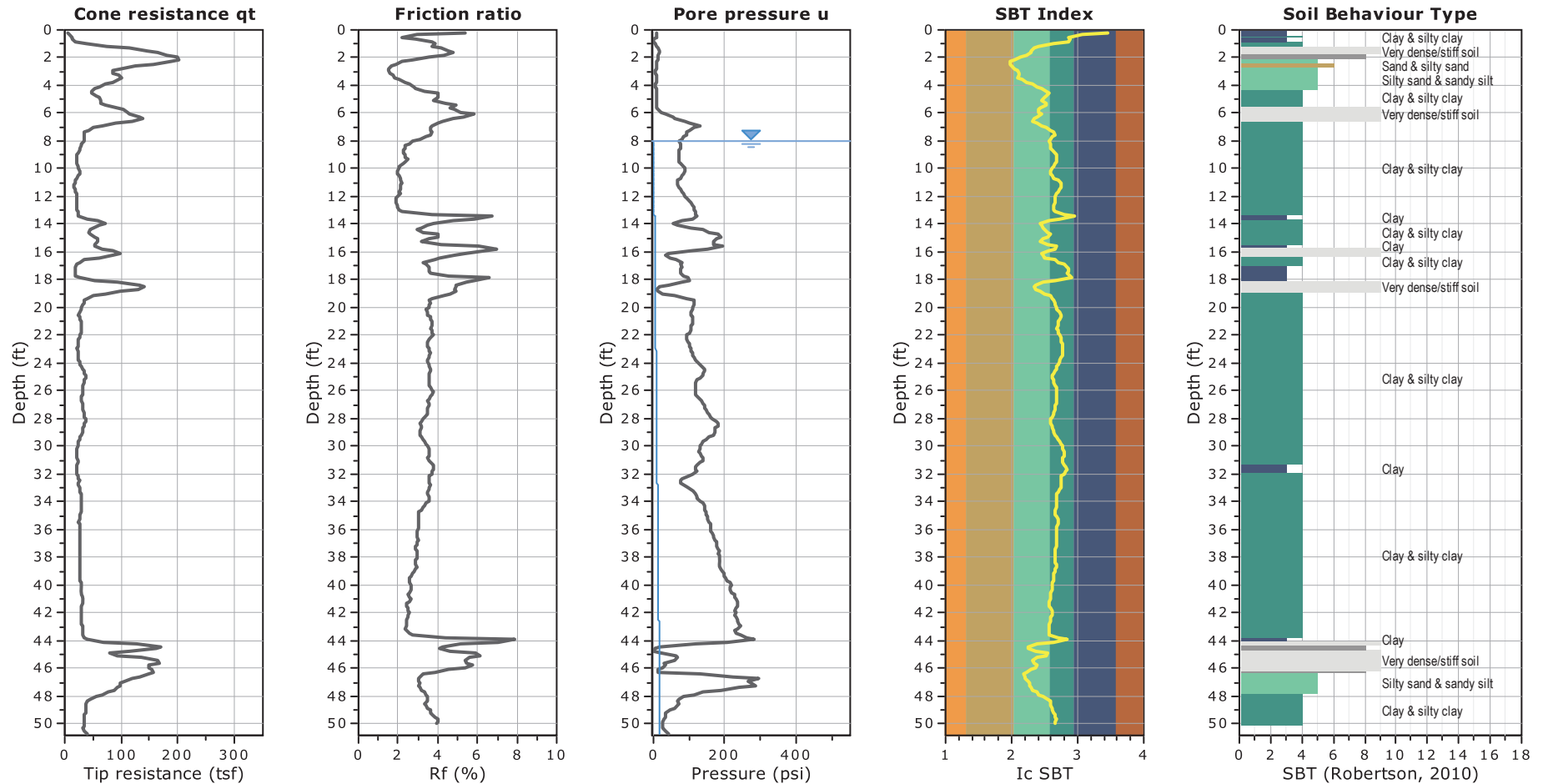
- | | | |
|---------------------------|------------------------------|-----------------------------------|
| 1. Sensitive fine grained | 4. Clayey silt to silty clay | 7. Gravely sand to sand |
| 2. Organic material | 5. Silty sand to sandy silt | 8. Very stiff sand to clayey sand |
| 3. Clay to silty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

1030 KAISER ROAD
 Napa, California



**CONE PENETRATION TEST RESULTS
 CPT-3**

Date 10/23/23	Project No. 23-2491	Figure A-3
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Ground Surface Elevation: 19.0 feet
 Total Depth: 50.7 ft, Date: October 2, 2023
 Depth to Groundwater: 8 feet (measured with weighted tape)
 Cone Operator: Middle Earth Geo Testing, Inc.

SBT legend

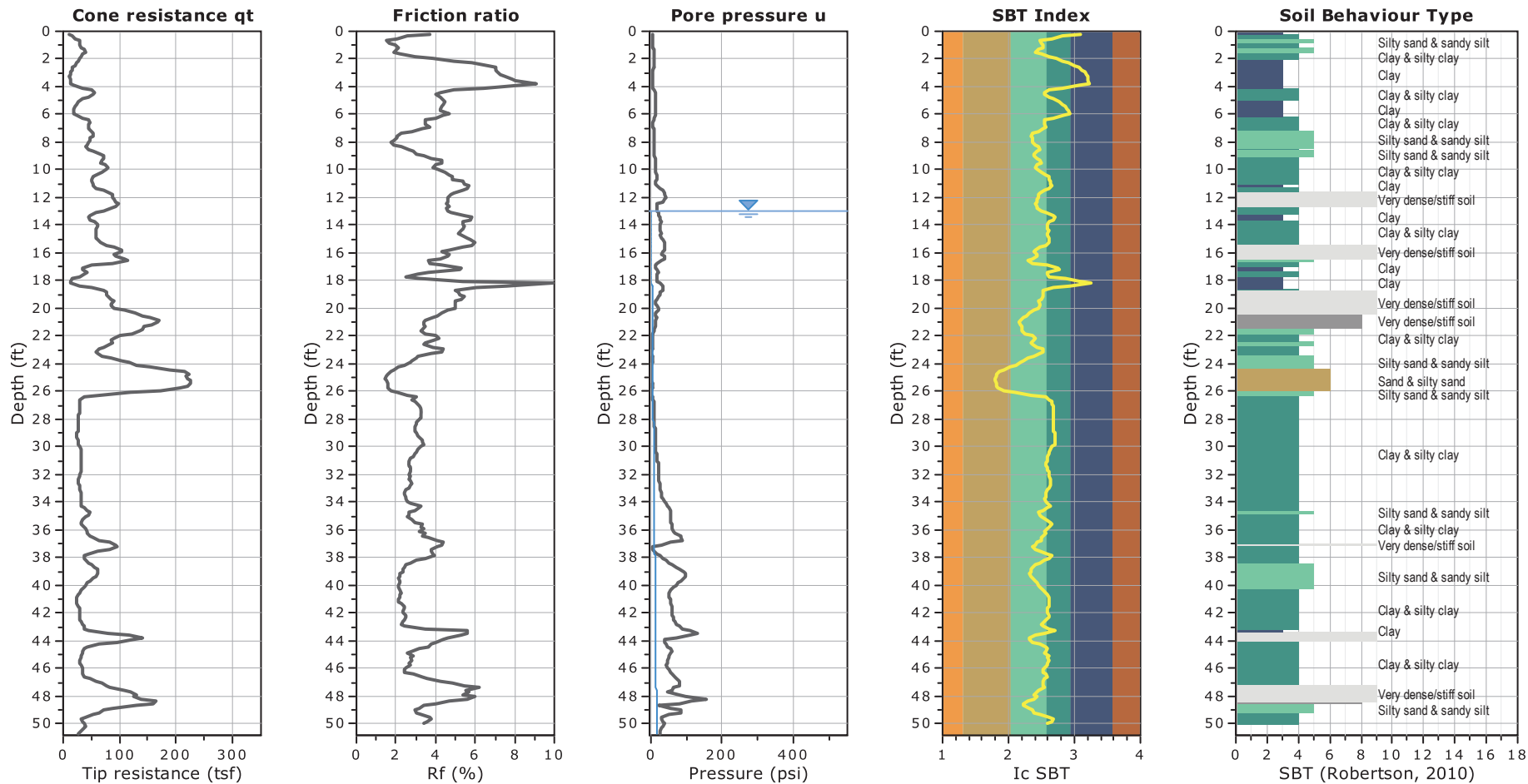
- | | | |
|---------------------------|------------------------------|-----------------------------------|
| 1. Sensitive fine grained | 4. Clayey silt to silty clay | 7. Gravely sand to sand |
| 2. Organic material | 5. Silty sand to sandy silt | 8. Very stiff sand to clayey sand |
| 3. Clay to silty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

1030 KAISER ROAD
 Napa, California

ROCKRIDGE
GEOTECHNICAL

CONE PENETRATION TEST RESULTS CPT-4

Date 10/23/23	Project No. 23-2491	Figure A-4
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Ground Surface Elevation: 20.0 feet
 Total Depth: 50.7 ft, Date: October 2, 2023
 Depth to Groundwater: 13 feet (measured with weighted tape)
 Cone Operator: Middle Earth Geo Testing, Inc.

SBT legend

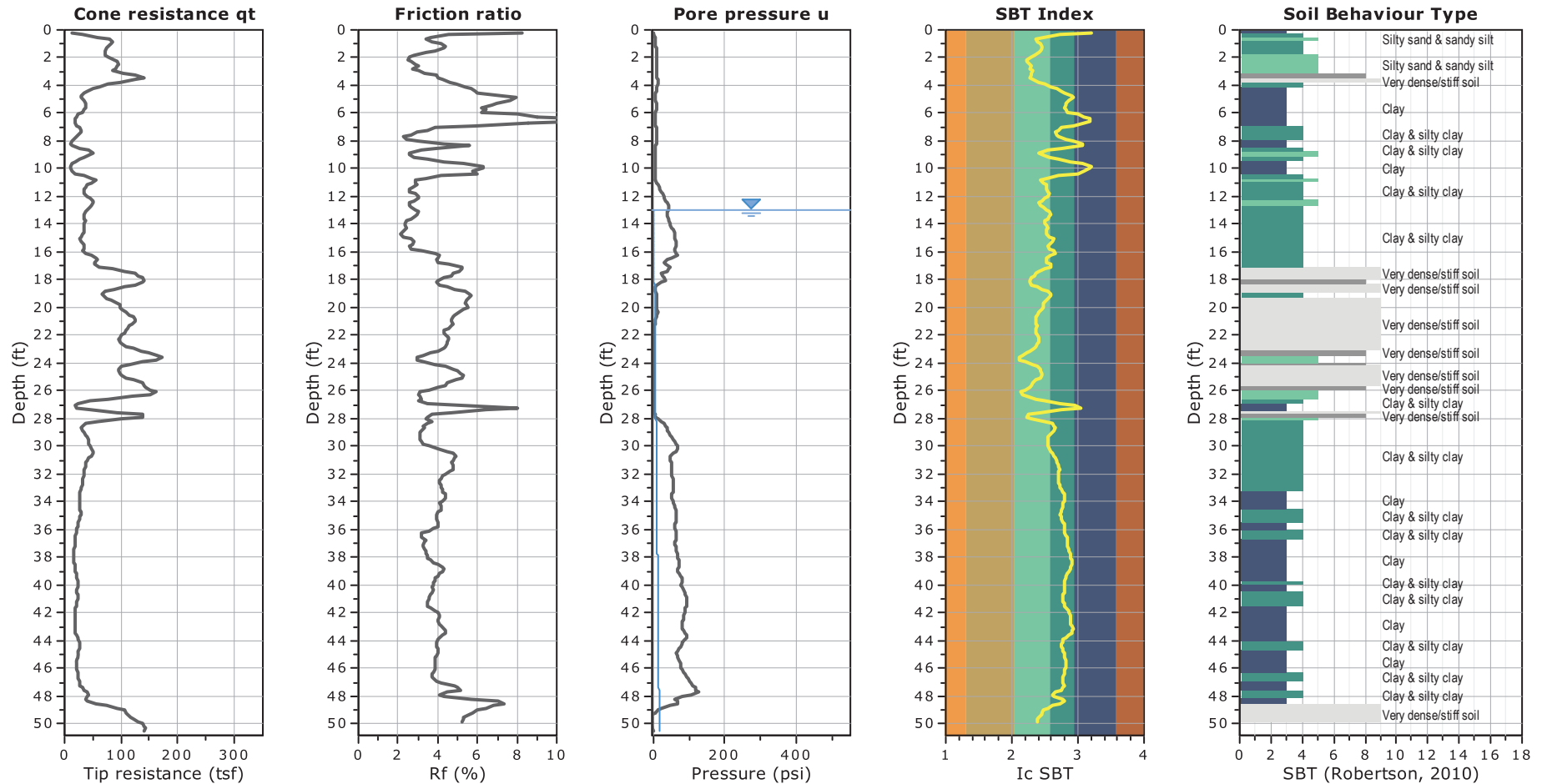
- | | | |
|---------------------------|------------------------------|-----------------------------------|
| 1. Sensitive fine grained | 4. Clayey silt to silty clay | 7. Gravely sand to sand |
| 2. Organic material | 5. Silty sand to sandy silt | 8. Very stiff sand to clayey sand |
| 3. Clay to silty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

1030 KAISER ROAD
 Napa, California



**CONE PENETRATION TEST RESULTS
 CPT-5**

Date 10/23/23	Project No. 23-2491	Figure A-5
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Ground Surface Elevation: 24.5 feet
 Total Depth: 50.5 ft, Date: October 2, 2023
 Depth to Groundwater: 13 feet (measured with weighted tape)
 Cone Operator: Middle Earth Geo Testing, Inc.

SBT legend

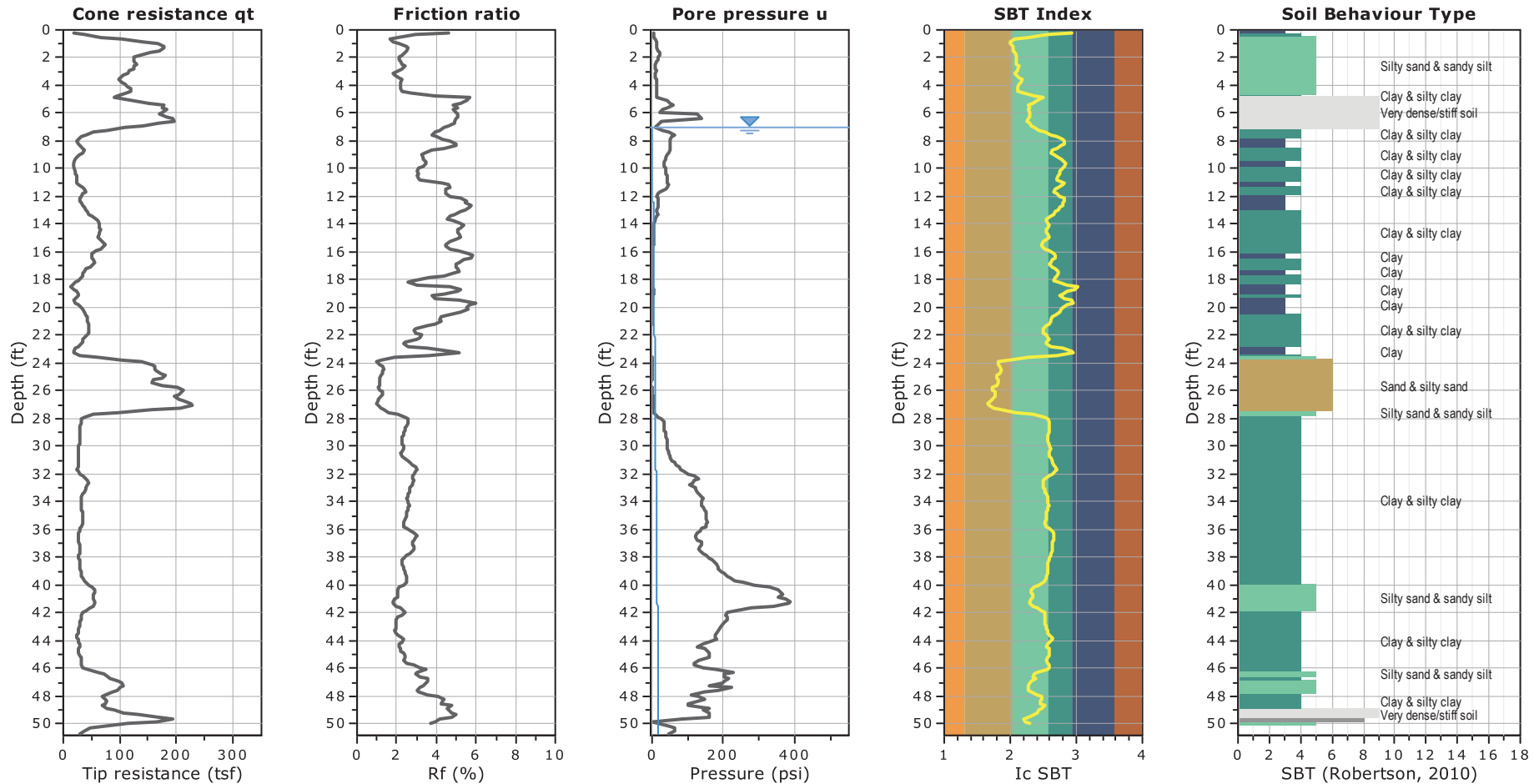
- | | | |
|---------------------------|------------------------------|-----------------------------------|
| 1. Sensitive fine grained | 4. Clayey silt to silty clay | 7. Gravely sand to sand |
| 2. Organic material | 5. Silty sand to sandy silt | 8. Very stiff sand to clayey sand |
| 3. Clay to silty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

1030 KAISER ROAD
 Napa, California

ROCKRIDGE
 GEOTECHNICAL

CONE PENETRATION TEST RESULTS
CPT-6

Date 10/23/23	Project No. 23-2491	Figure A-6
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Ground Surface Elevation: 16.9 feet
 Total Depth: 50.7 ft, Date: October 2, 2023
 Depth to Groundwater: 7 feet (measured with weighted tape)
 Cone Operator: Middle Earth Geo Testing, Inc.

SBT legend

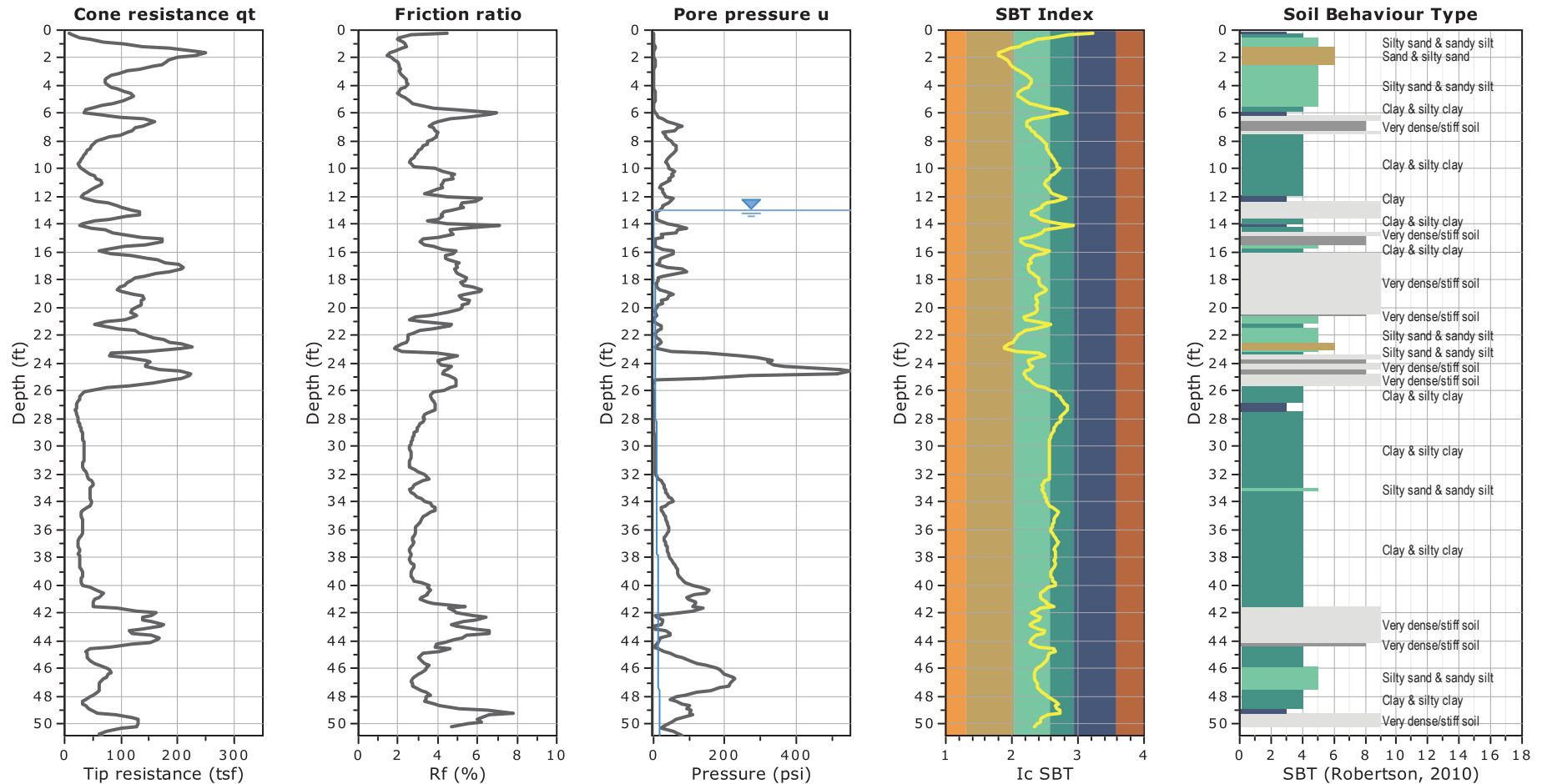
- | | | |
|---------------------------|------------------------------|-----------------------------------|
| 1. Sensitive fine grained | 4. Clayey silt to silty clay | 7. Gravely sand to sand |
| 2. Organic material | 5. Silty sand to sandy silt | 8. Very stiff sand to clayey sand |
| 3. Clay to silty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

1030 KAISER ROAD
 Napa, California

ROCKRIDGE
GEOTECHNICAL

CONE PENETRATION TEST RESULTS
CPT-7

Date 10/23/23	Project No. 23-2491	Figure A-7
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Ground Surface Elevation: 15.5 feet
 Total Depth: 50.9 ft, Date: October 2, 2023
 Depth to Groundwater: 13 feet (measured with weighted tape)
 Cone Operator: Middle Earth Geo Testing, Inc.

SBT legend

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

1030 KAISER ROAD
 Napa, California

ROCKRIDGE
 GEOTECHNICAL

CONE PENETRATION TEST RESULTS CPT-8

Date 10/23/23	Project No. 23-2491	Figure A-8
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APPENDIX C

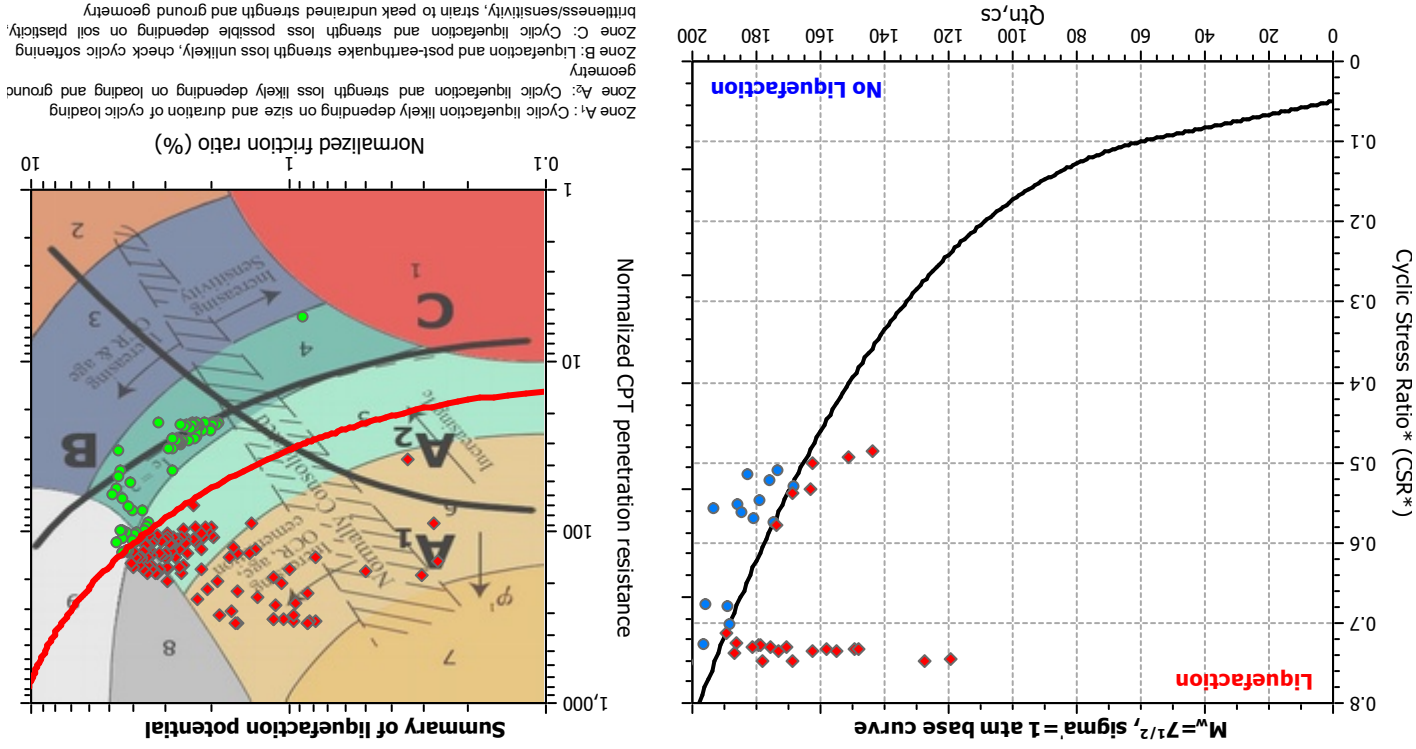
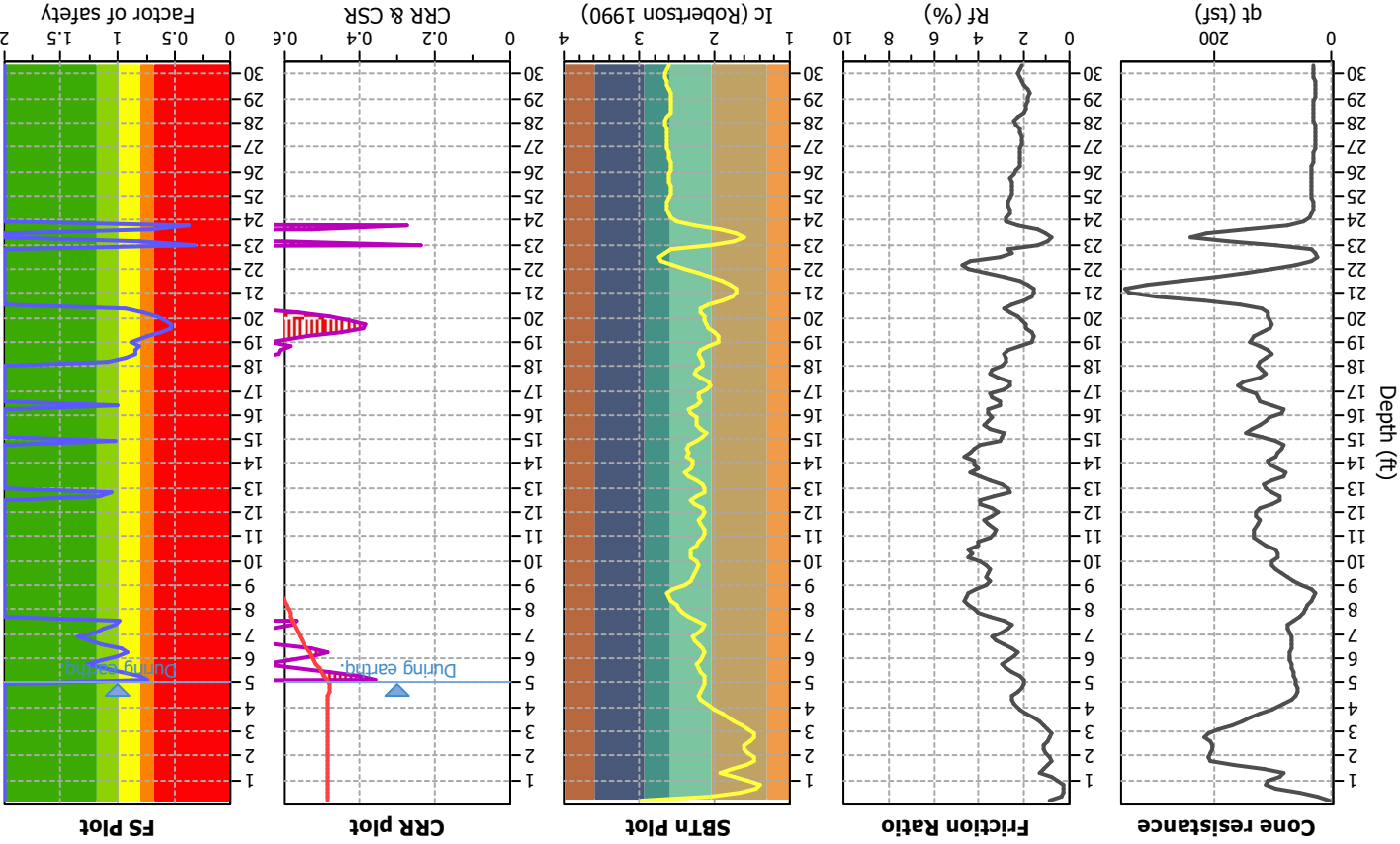
Liquefaction Analysis Results

LIQUEFACTION ANALYSIS REPORT

Project title : 1030 Kaiser Road Warehouse
CPT file : CPT-1

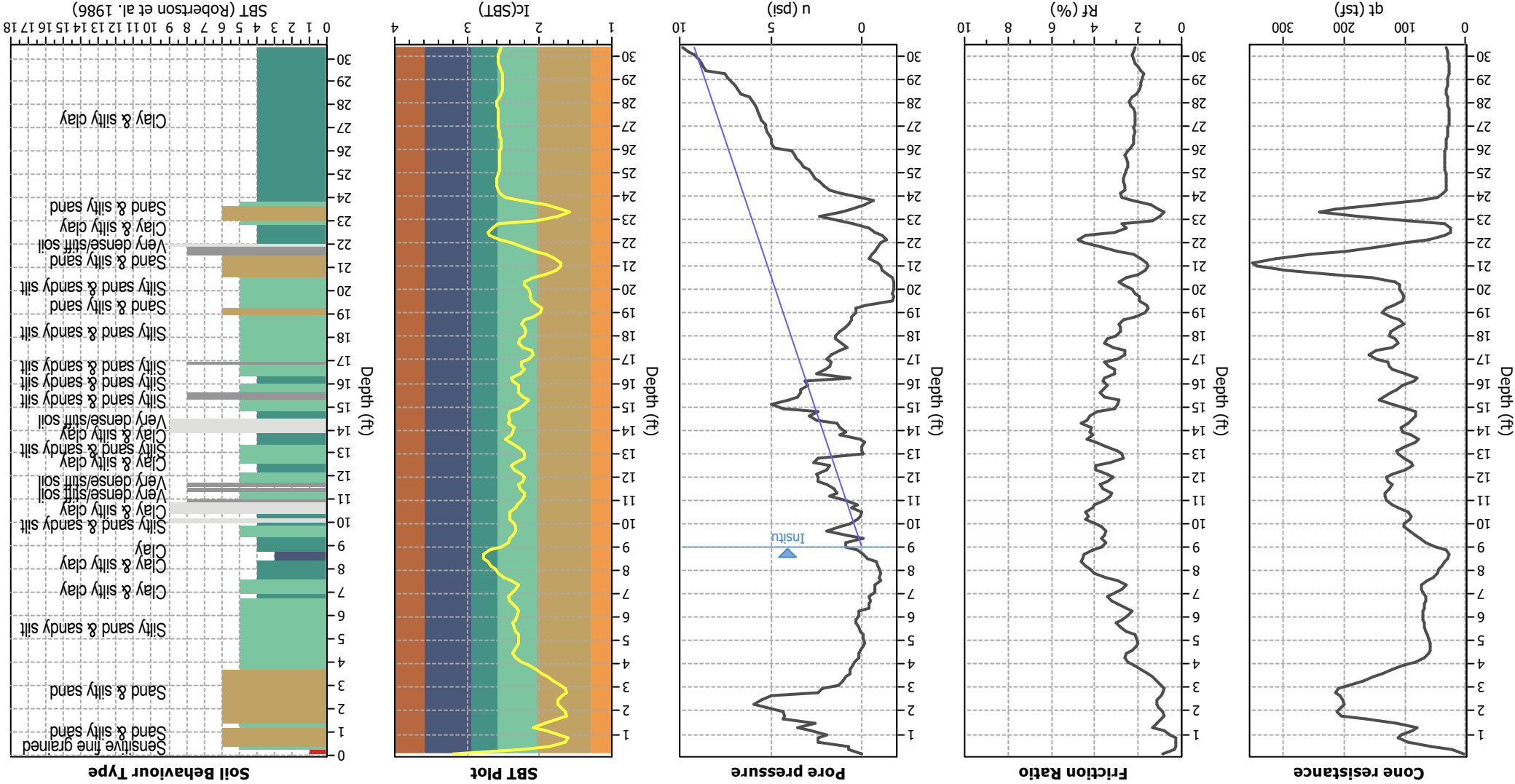
Input parameters and analysis data

Analysis method:	NCEER (1998)
Fines correction method:	NCEER (1998)
Points to test:	Based on Ic value
Earthquake magnitude M_w :	6.80
Peak ground acceleration:	0.96
G.W.T. (in-situ):	G.W.T. (earthq.):
Average results interval:	3
Ic cut-off value:	2.30
Unit weight calculation:	Based on SBT
Use fill:	Fill height:
Fill weight:	N/A
Trans. detect. applied:	No
K_0 applied:	Yes
Clay like behavior	MSF method:
Limit depth applied:	No
Limit depth:	N/A
Sands only	Method based



Zone A₁: Cyclic liquefaction likely depending on size and duration of cyclic loading geometry
Zone A₂: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss possible depending on soil plasticity
Zone C: Cyclic liquefaction and strength loss unlikely, check cyclic softening brittleness/sensitivity, strain to peak undrained strength and ground geometry

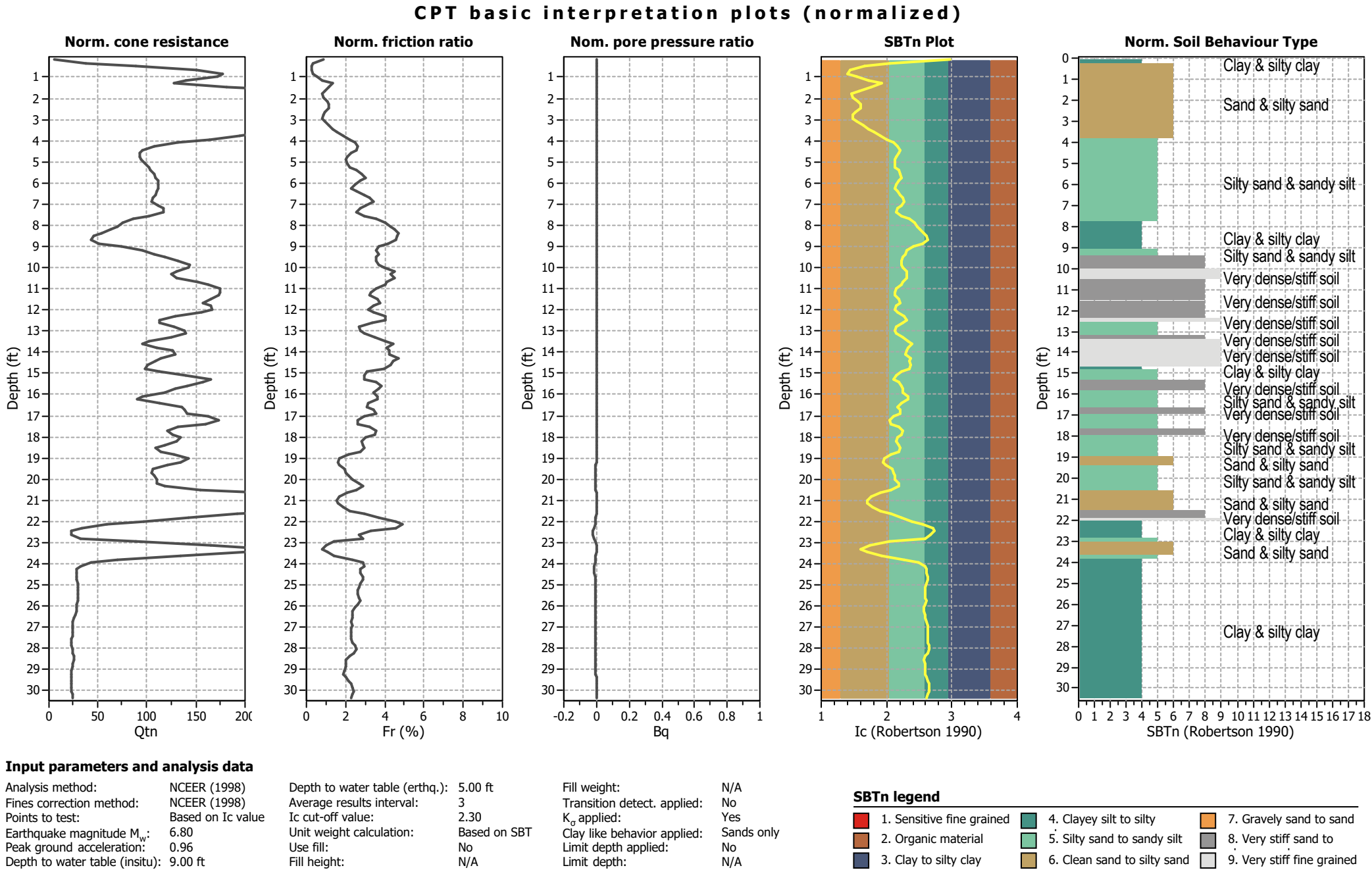
CPT basic interpretation plots



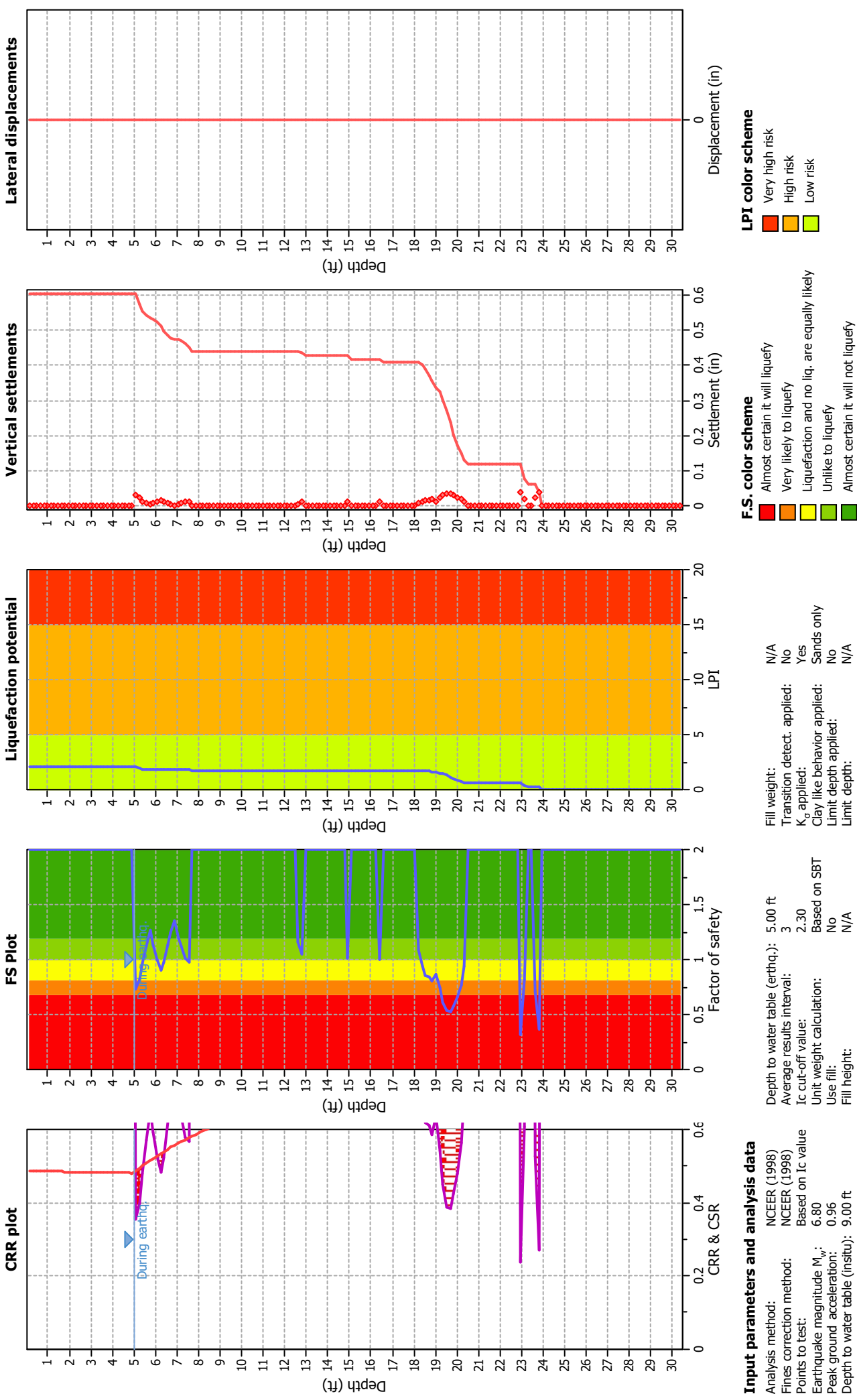
Input parameters and analysis data

Analysis method:	NCEER (1998)
Fines correction method:	NCEER (1998)
Points to test:	Based on Ic value
Earthquake magnitude M_w :	6.80
Peak ground acceleration:	0.96
Depth to water table (insitu):	9.00 ft
Depth to water table (earthq.):	5.00 ft
Average results interval:	3
Unit weight calculation:	Based on SBT
Use fill:	No
Fill height:	N/A
Limit depth applied:	No
Limit depth:	N/A
Clay like behavior applied:	Sands only
K_g applied:	Yes
Transition detect. applied:	No
Fill weight:	N/A

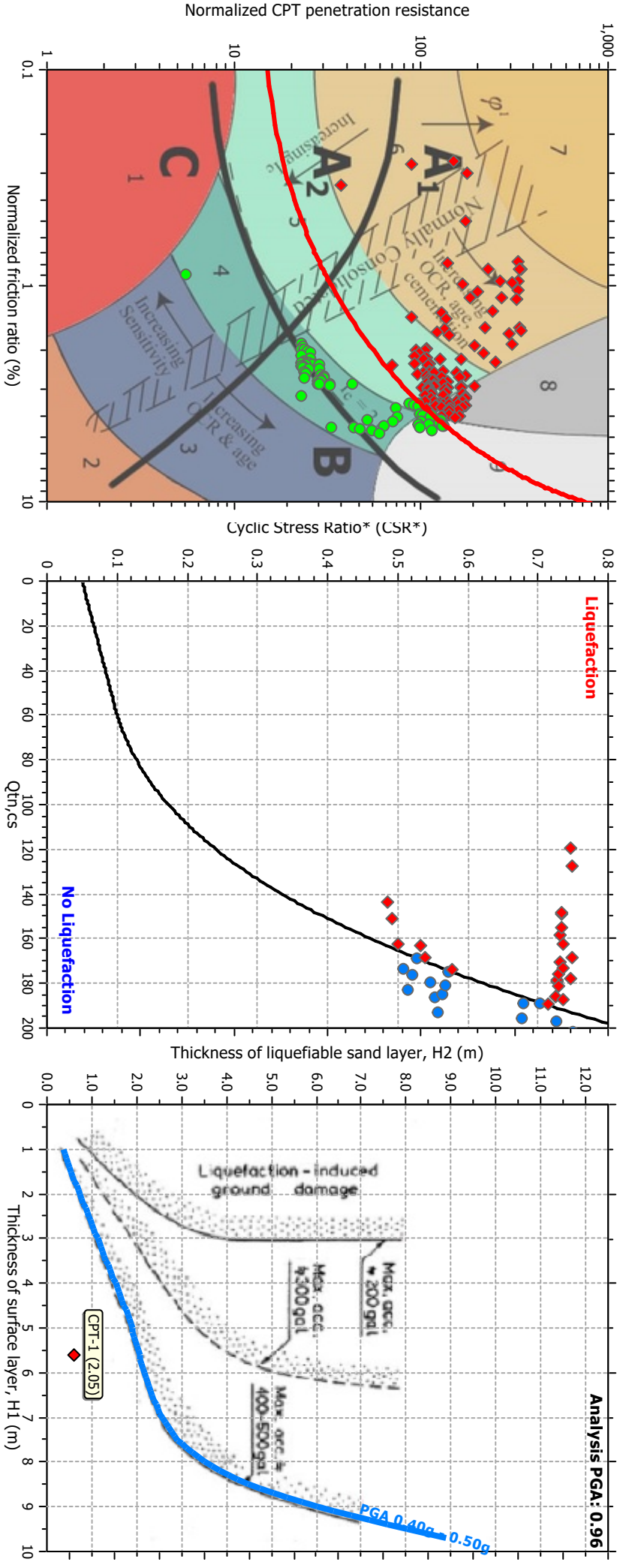
SBT legend	
1. Sensitive fine grained	2. Organic material
3. Clay to silty clay	4. Clayey silt to silty
5. Silty sand to sandy silt	6. Clean sand to silty sand
7. Gravely sand to sand	8. Very stiff sand to
9. Very stiff fine grained	



Liquefaction analysis overall plots



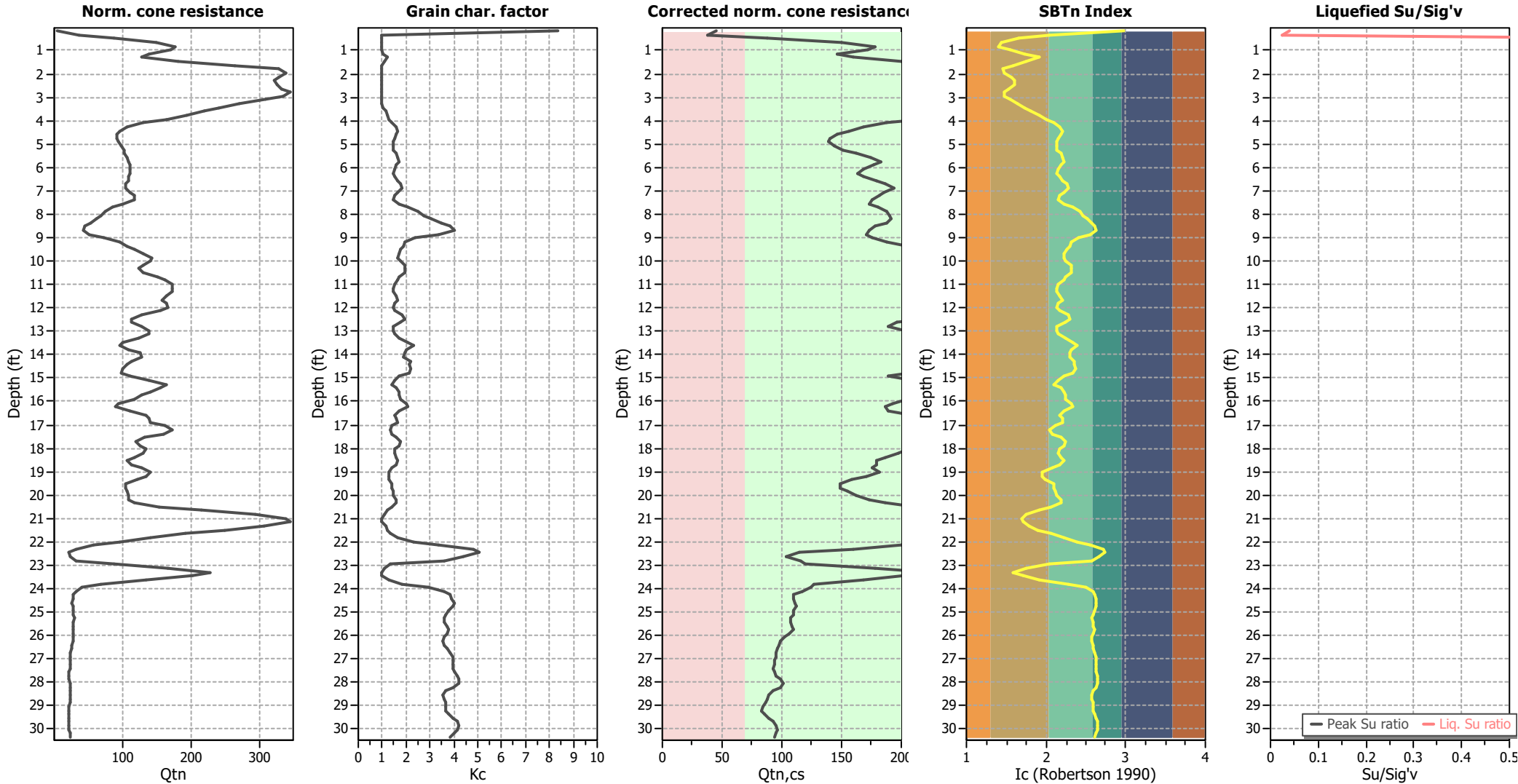
Liquefaction analysis summary plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (ethq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on I_c value	I_c cut-off value:	2.30	K_u applied:	Yes
Earthquake magnitude M_w :	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.96	Use fill:	No	Limit depth applied:	No
Depth to water table (instn):	9.00 ft	Fill height:	N/A	Limit depth:	N/A

Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.30	K _o applied:	Yes
Earthquake magnitude M _w :	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.96	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	9.00 ft	Fill height:	N/A	Limit depth:	N/A

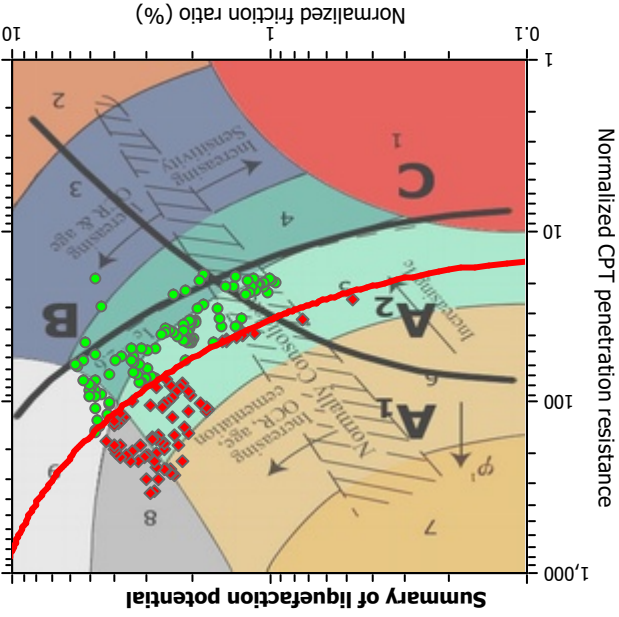
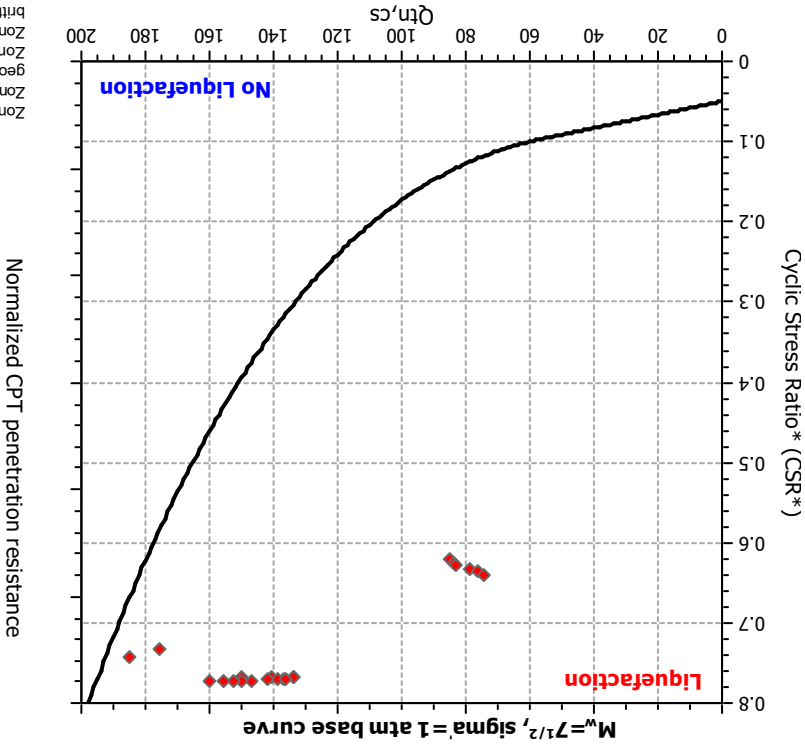
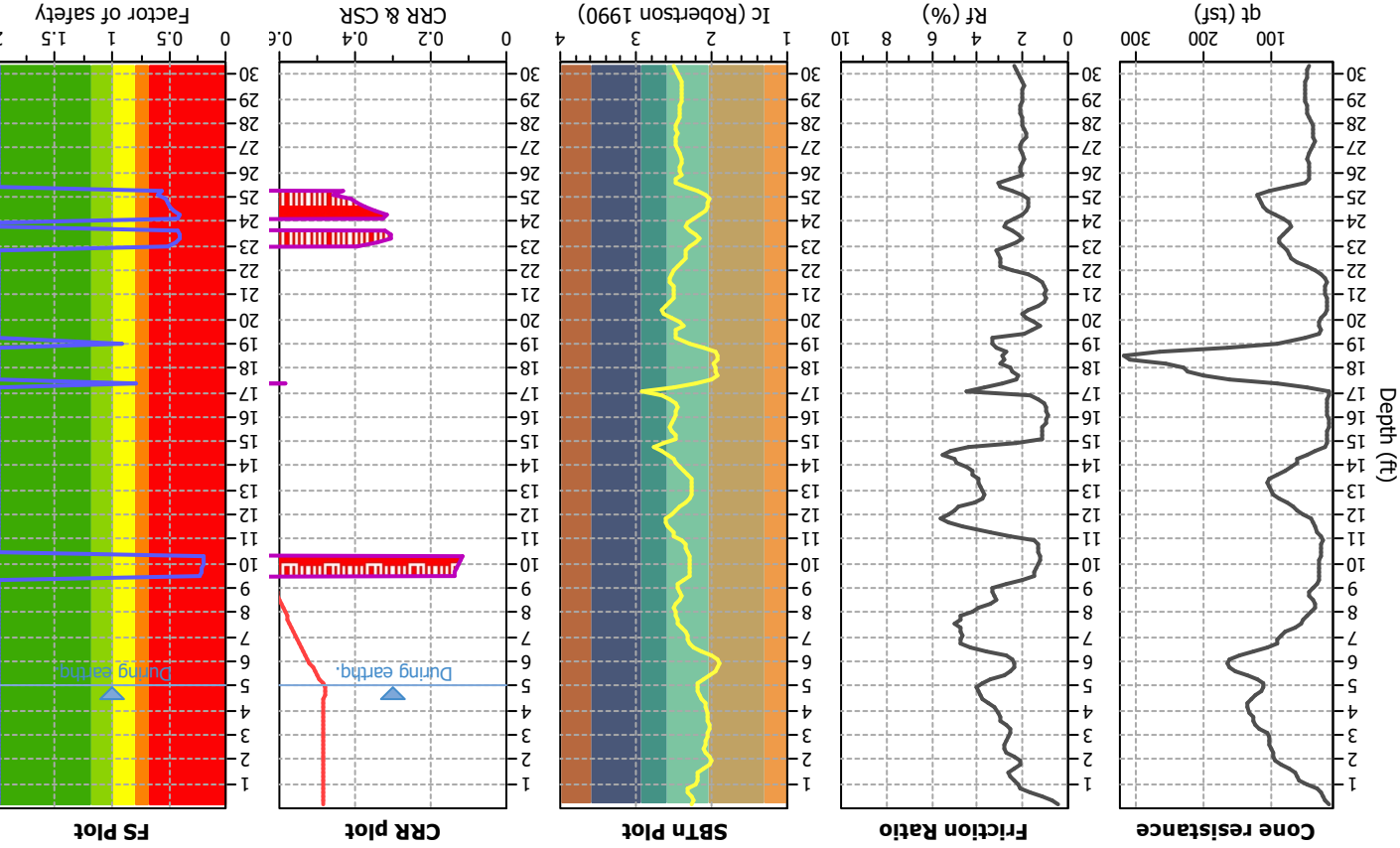
LIQUEFACTION ANALYSIS REPORT

Project title : 1030 Kaiser Road Warehouse
CPT file : CPT-2

Location : 1030 Kaiser Road, Napa, CA

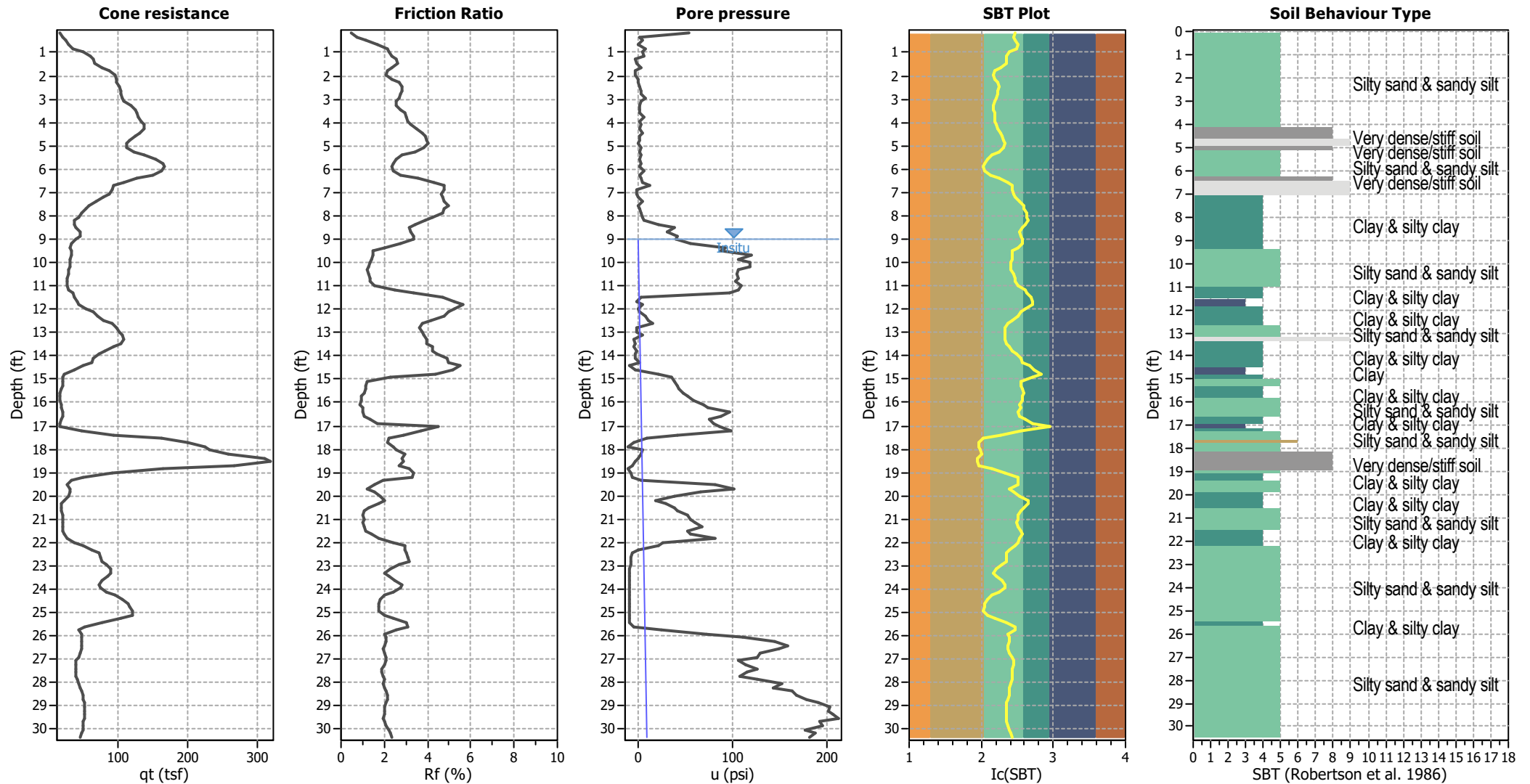
Input parameters and analysis data

Analysis method:	NCEER (1998)
Fines correction method:	NCEER (1998)
Points to test:	Based on Ic value
Earthquake magnitude M_w :	6.80
Peak ground acceleration:	0.96
G.W.T. (in-situ):	G.W.T. (earthq.):
Average results interval:	3
Ic cut-off value:	2.30
Unit weight calculation:	Based on SBT
Use fill:	Fill height:
Fill weight:	N/A
Trans. detect. applied:	No
K_0 applied:	Yes
MSF method:	Limit depth:
Limit depth:	N/A
Method based:	Sands only
Clay like behavior	applied:
Limit depth applied:	No



Zone A₁: Cyclic liquefaction likely depending on size and duration of cyclic loading geometry
Zone A₂: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



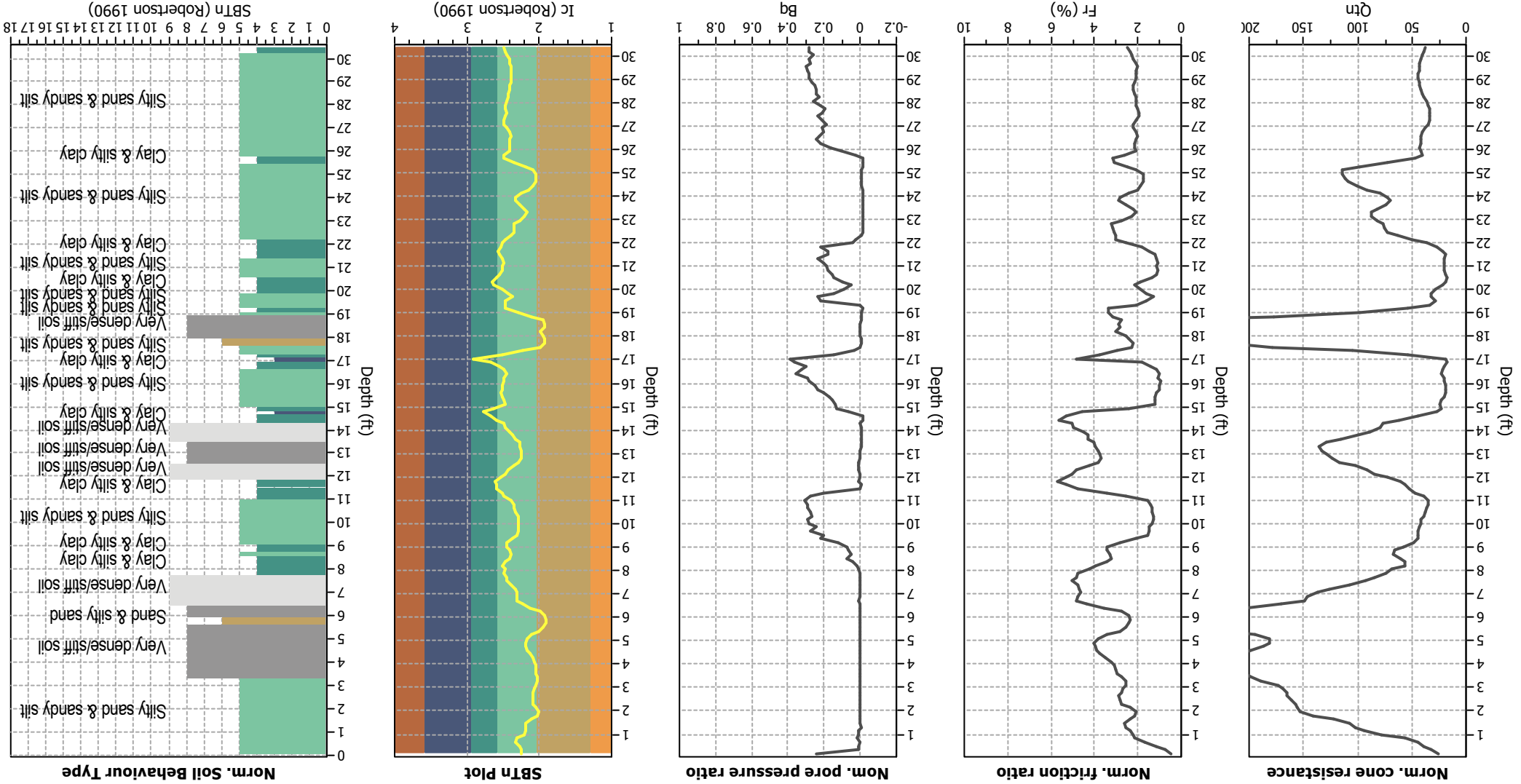
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.30	K _o applied:	Yes
Earthquake magnitude M _w :	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.96	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	9.00 ft	Fill height:	N/A	Limit depth:	N/A

SBT legend

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

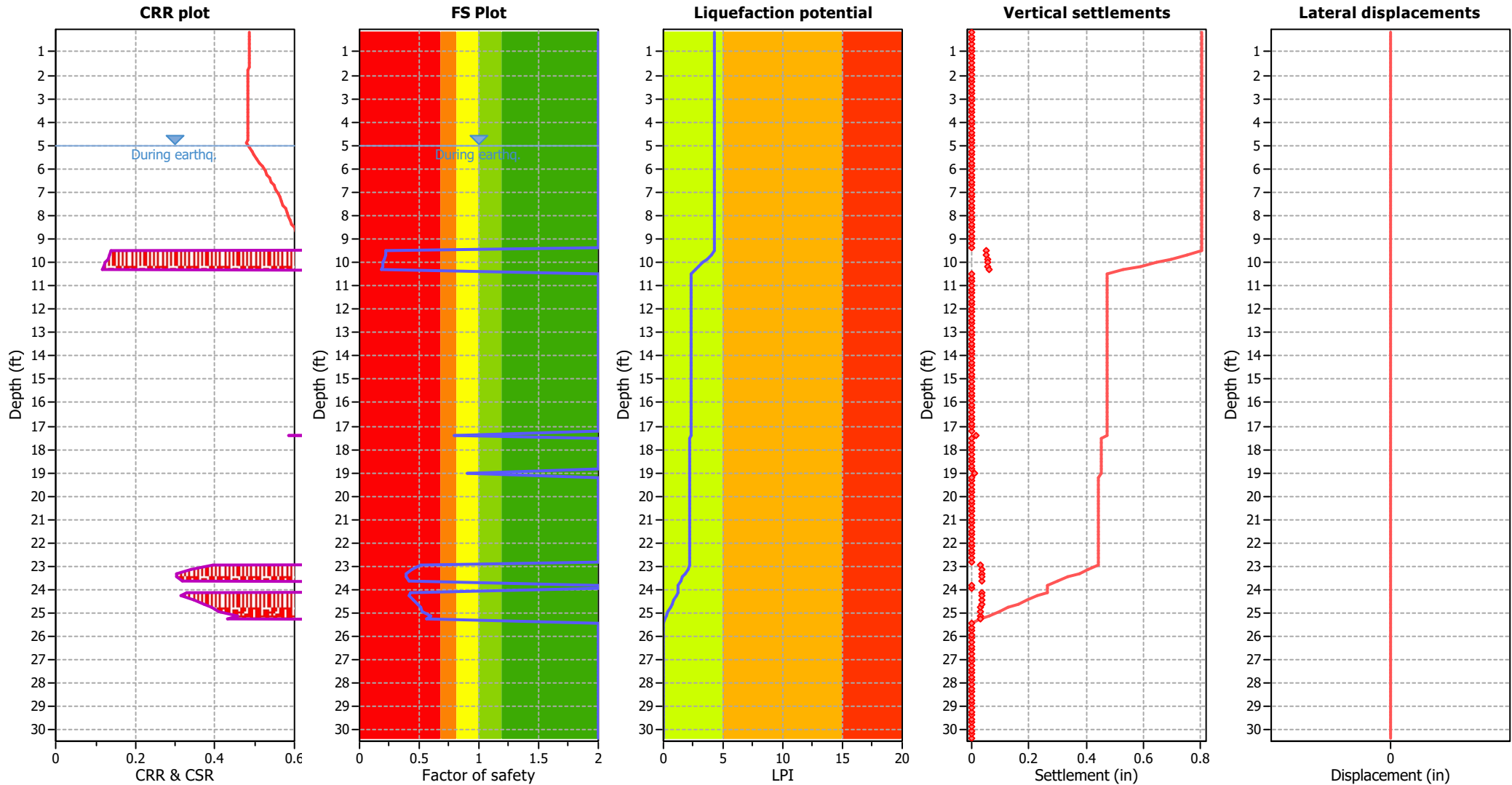
CPT basic interpretation plots (normalized)



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (earthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.30	K _g applied:	Yes
Earthquake magnitude M _w :	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.96	Use fill:	No	Limit depth applied:	No
Depth to water table (instn):	9.00 ft	Fill height:	N/A	Limit depth:	N/A

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (earthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.30	K _o applied:	Yes
Earthquake magnitude M _w :	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.96	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	9.00 ft	Fill height:	N/A	Limit depth:	N/A

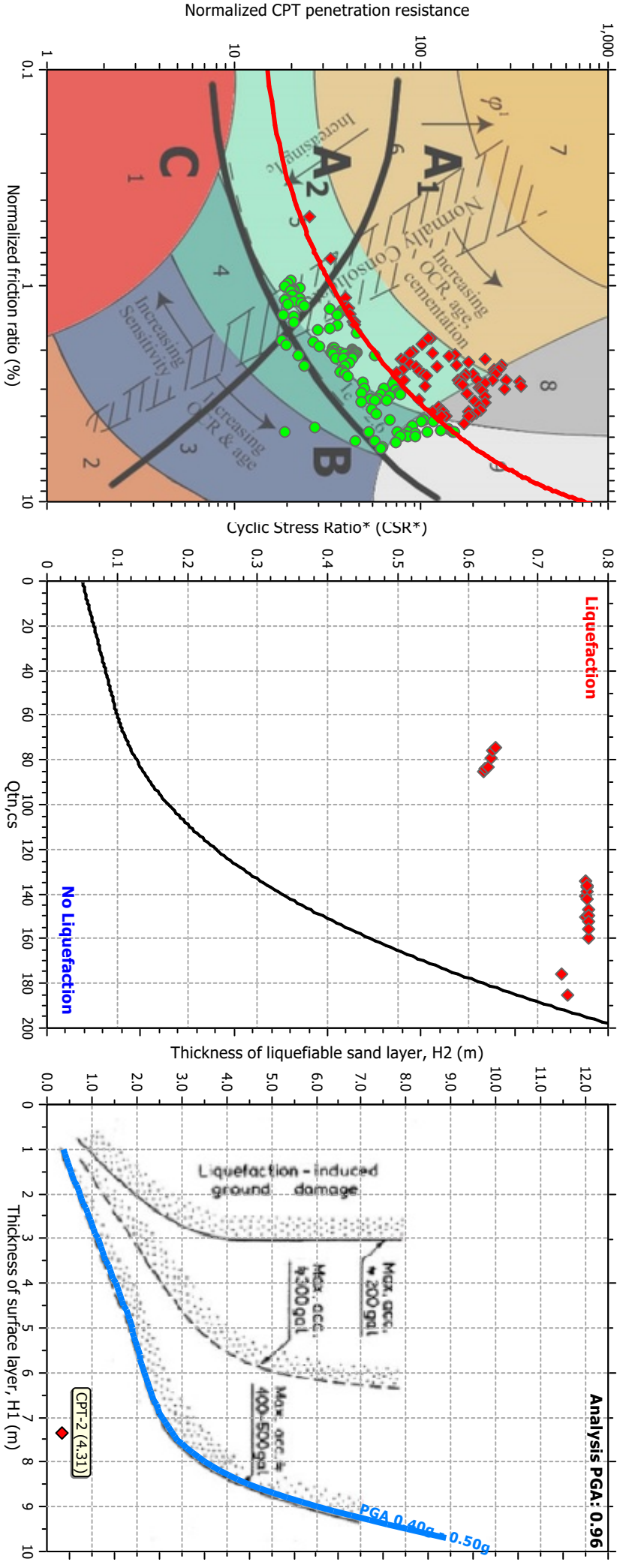
F.S. color scheme

Red	Almost certain it will liquefy
Orange	Very likely to liquefy
Yellow	Liquefaction and no liq. are equally likely
Light Green	Unlike to liquefy
Dark Green	Almost certain it will not liquefy

LPI color scheme

Red	Very high risk
Orange	High risk
Yellow	Low risk

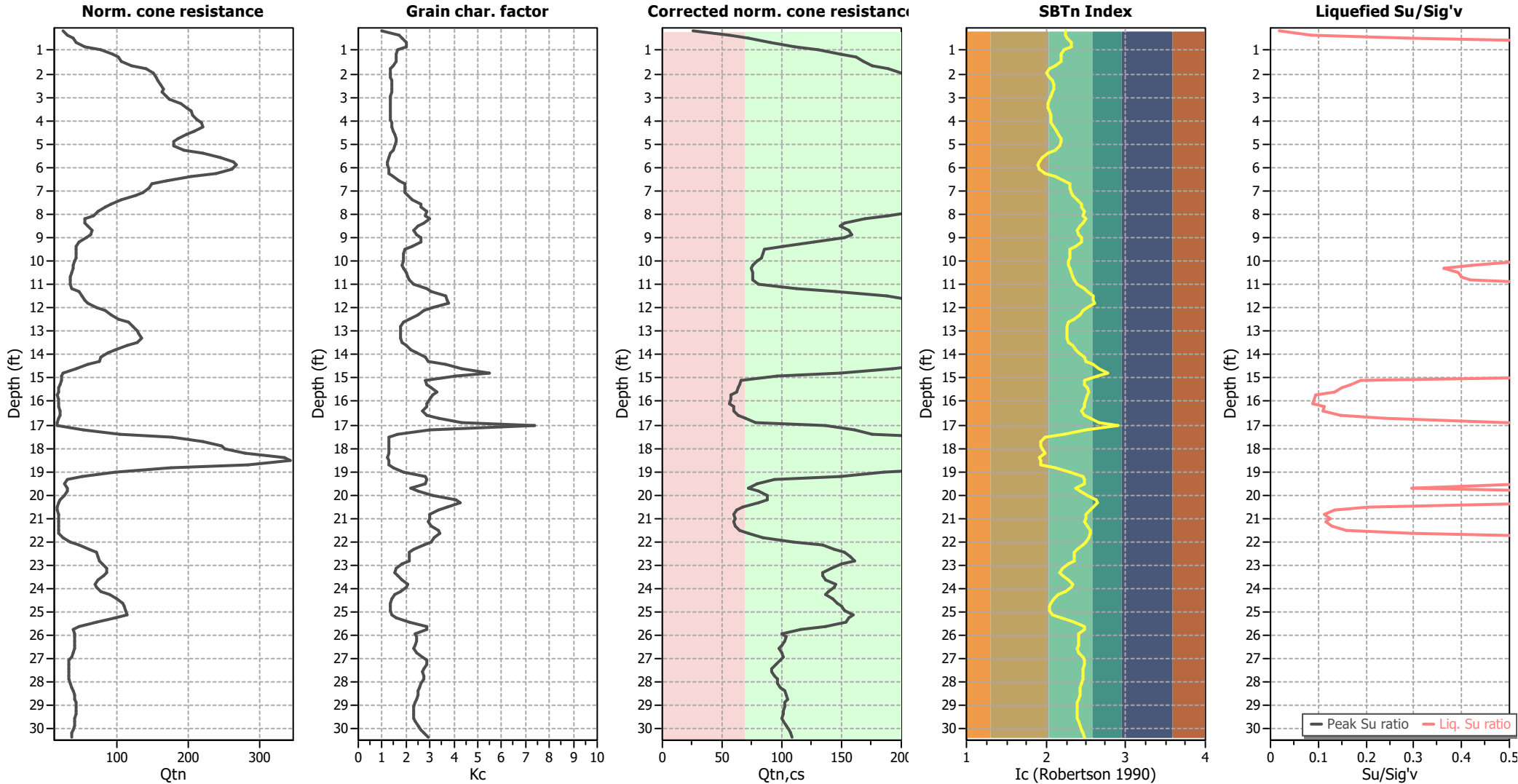
Liquefaction analysis summary plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (ethq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.30	K_p applied:	Yes
Earthquake magnitude M_w :	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.96	Use fill:	No	Limit depth applied:	No
Depth to water table (instn):	9.00 ft	Fill height:	N/A	Limit depth:	N/A

Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.30	K _o applied:	Yes
Earthquake magnitude M _w :	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.96	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	9.00 ft	Fill height:	N/A	Limit depth:	N/A

LIQUEFACTION ANALYSIS REPORT

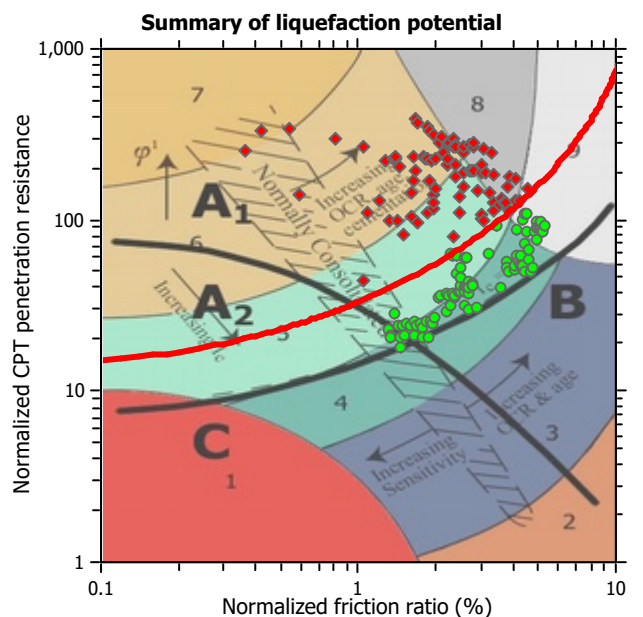
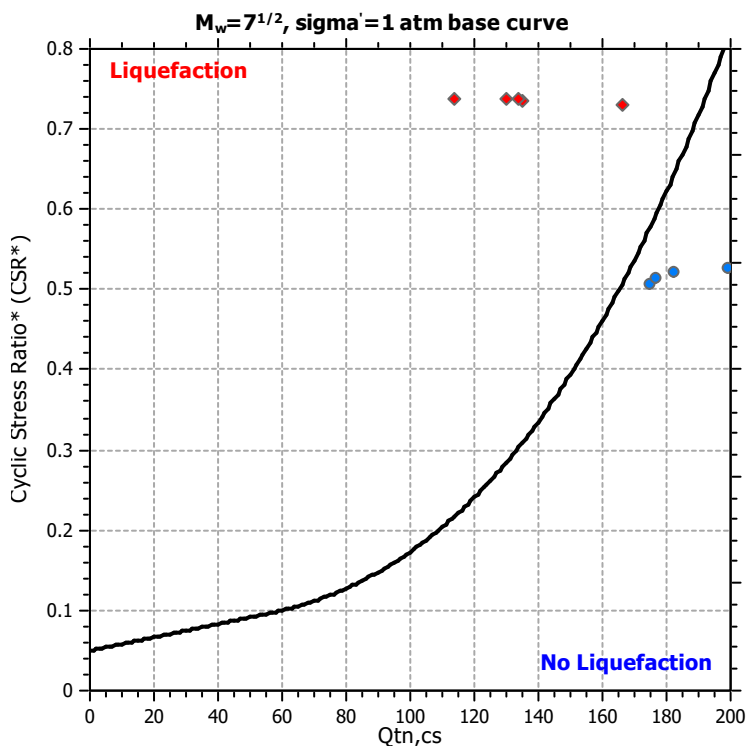
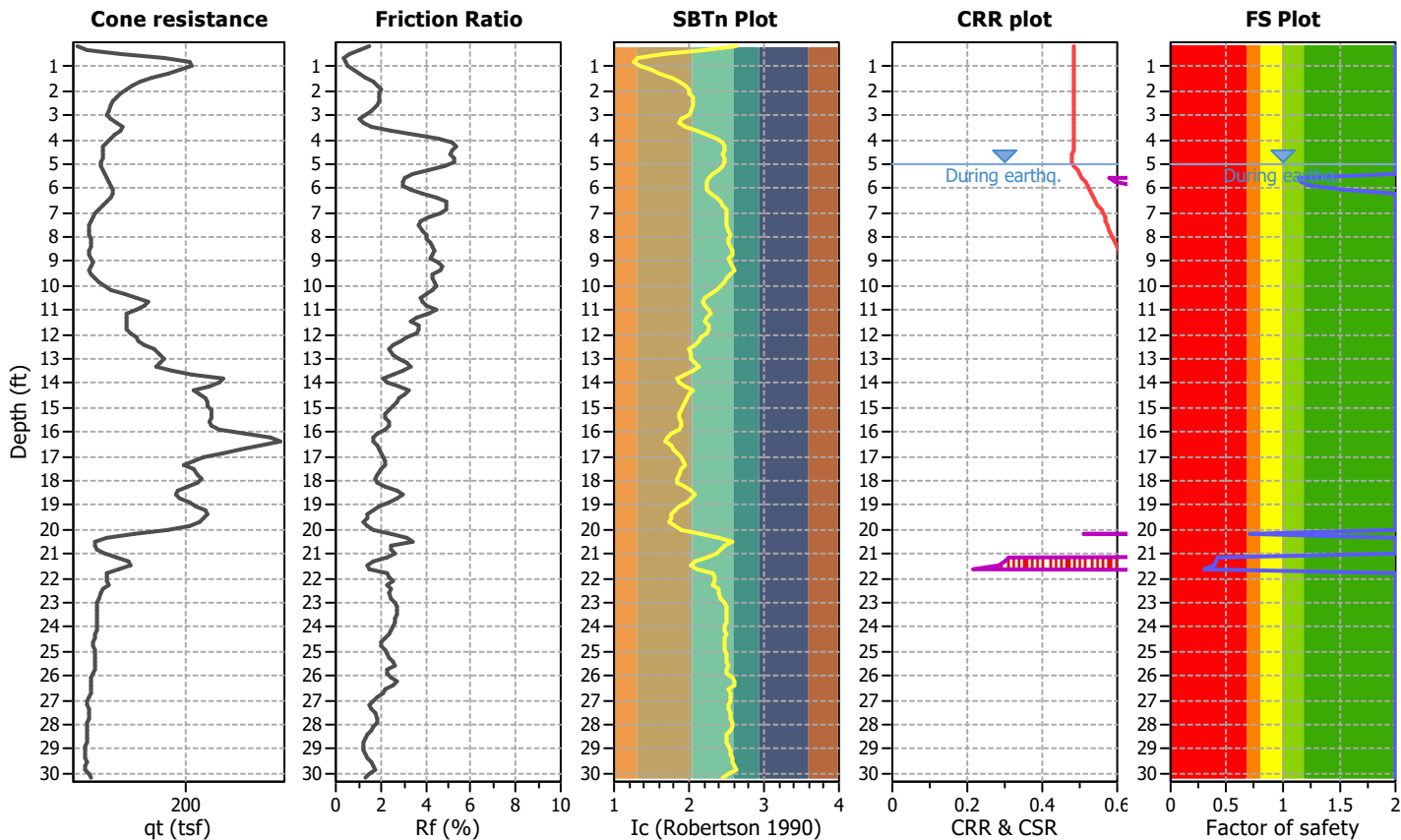
Project title : 1030 Kaiser Road Warehouse

Location : 1030 Kaiser Road, Napa, CA

CPT file : CPT-3

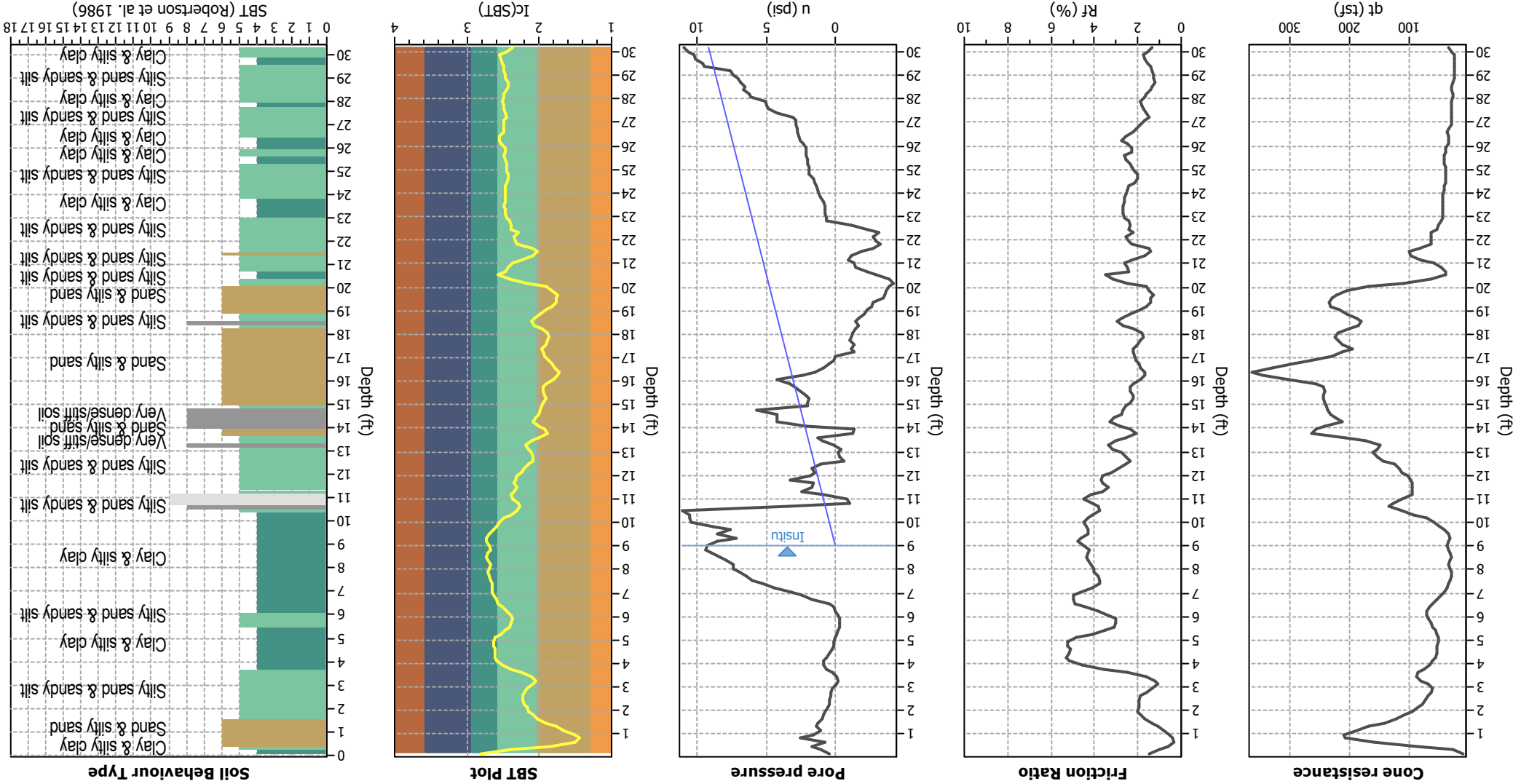
Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	9.00 ft	Use fill:	No	Clay like behavior	
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	5.00 ft	Fill height:	N/A	applied:	Sands only
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	No
Earthquake magnitude M_w :	6.80	Ic cut-off value:	2.30	Trans. detect. applied:	No	Limit depth:	N/A
Peak ground acceleration:	0.96	Unit weight calculation:	Based on SBT	K_o applied:	Yes	MSF method:	Method based



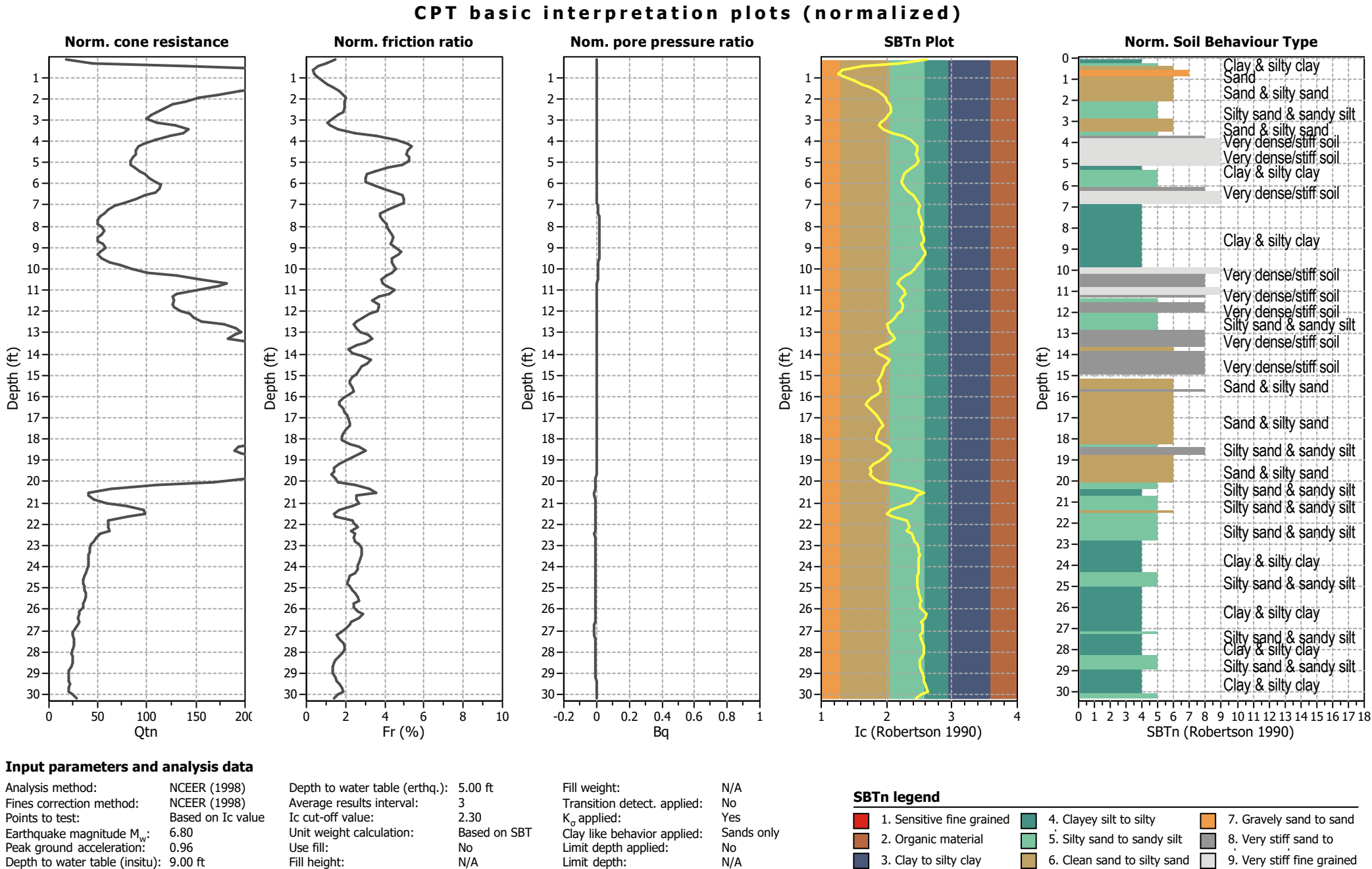
Zone A₁: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A₂: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

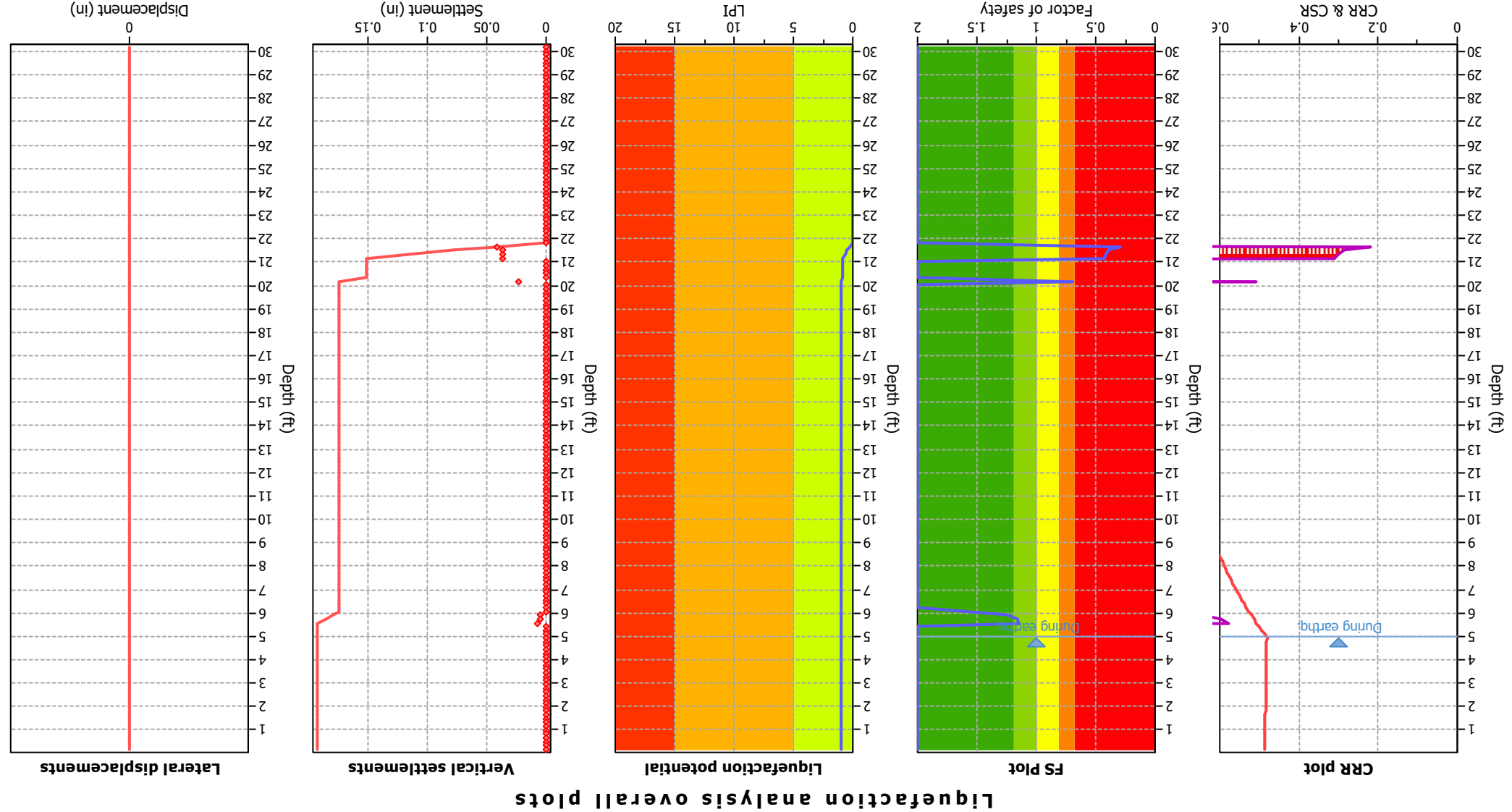
CPT basic interpretation plots



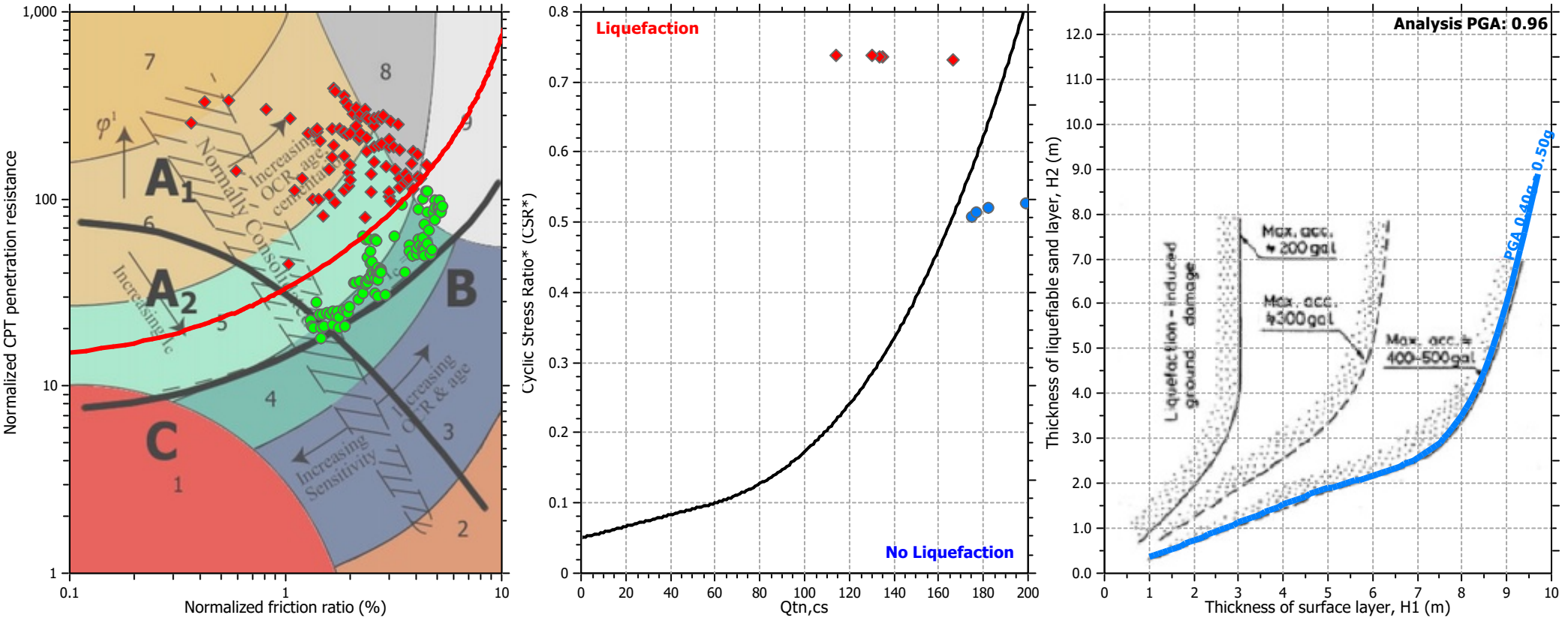
Input parameters and analysis data

Analysis method:	NCEER (1998)
Fines correction method:	NCEER (1998)
Points to test:	Based on Ic value
Earthquake magnitude M_w :	6.80
Peak ground acceleration:	0.96
Depth to water table (insitu):	9.00 ft
Depth to water table (earthq.):	5.00 ft
Average results interval:	3
Unit weight calculation:	Based on SBT
Use fill:	No
Fill height:	N/A
Limit depth applied:	No
Limit depth:	N/A
Clay like behavior applied:	Sands only
K_0 applied:	Yes
Transition detect. applied:	No
Fill weight:	N/A





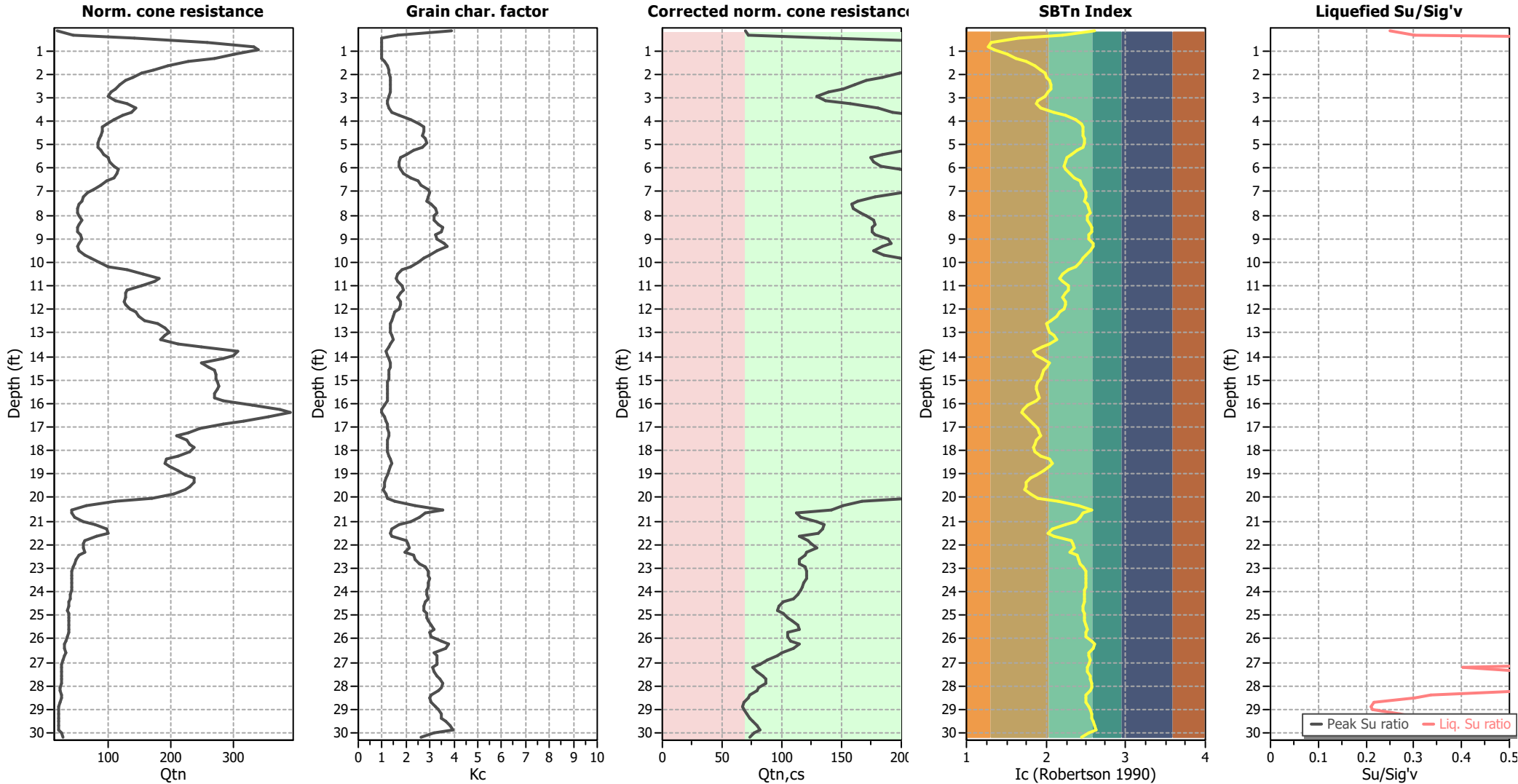
Liquefaction analysis summary plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.30	K_0 applied:	Yes
Earthquake magnitude M_w :	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.96	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	9.00 ft	Fill height:	N/A	Limit depth:	N/A

Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.30	K _o applied:	Yes
Earthquake magnitude M _w :	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.96	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	9.00 ft	Fill height:	N/A	Limit depth:	N/A

LIQUEFACTION ANALYSIS REPORT

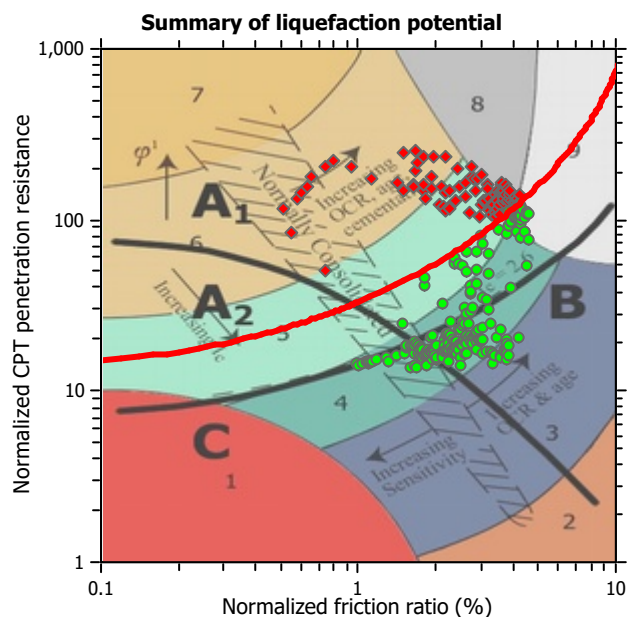
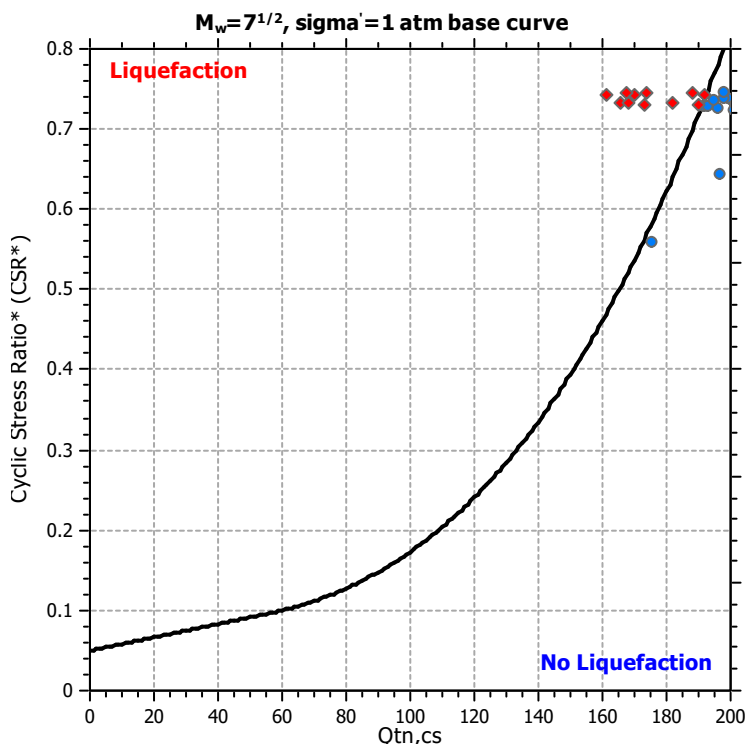
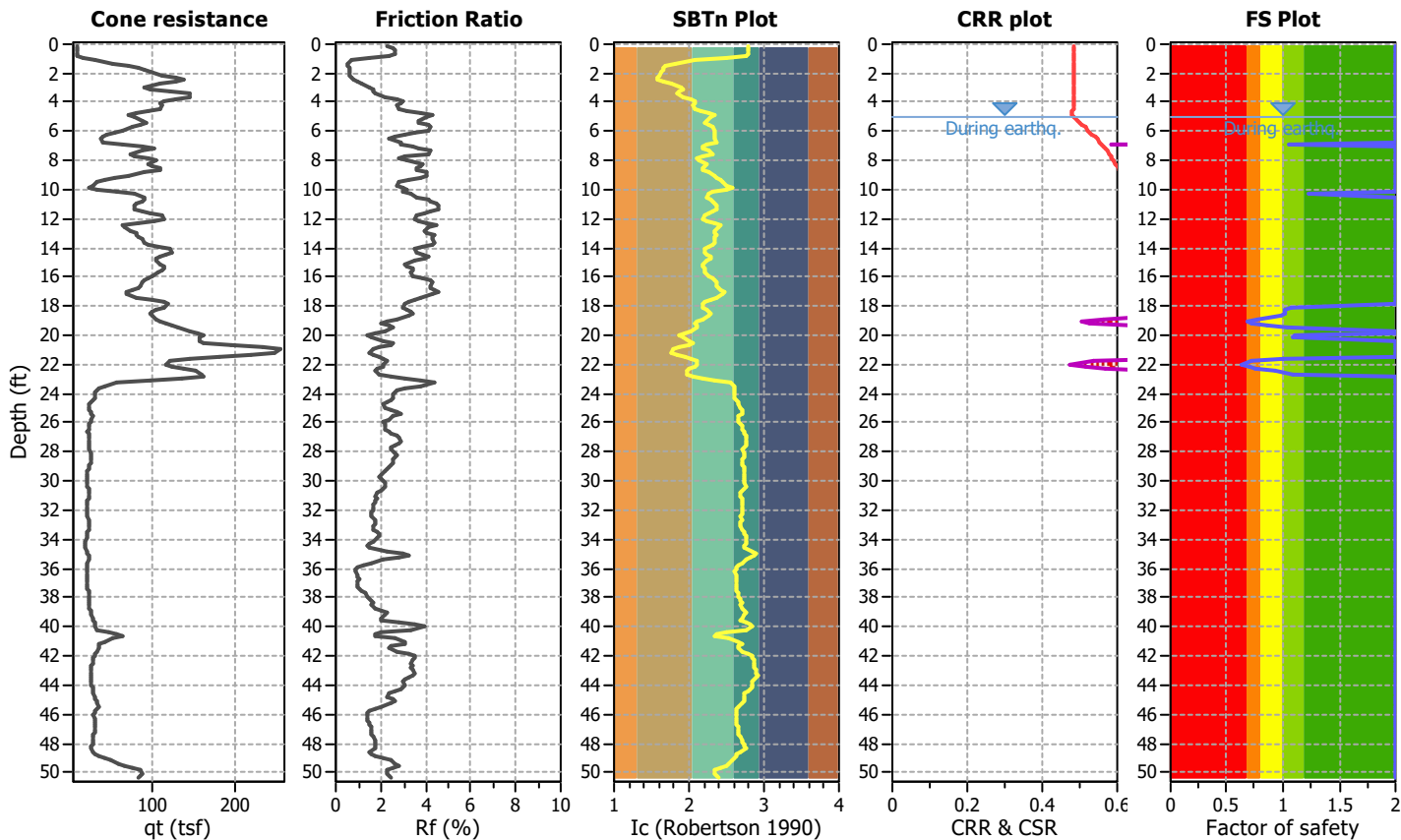
Project title : 1030 Kaiser Road Warehouse

Location : 1030 Kaiser Road, Napa, CA

CPT file : SCPT-4

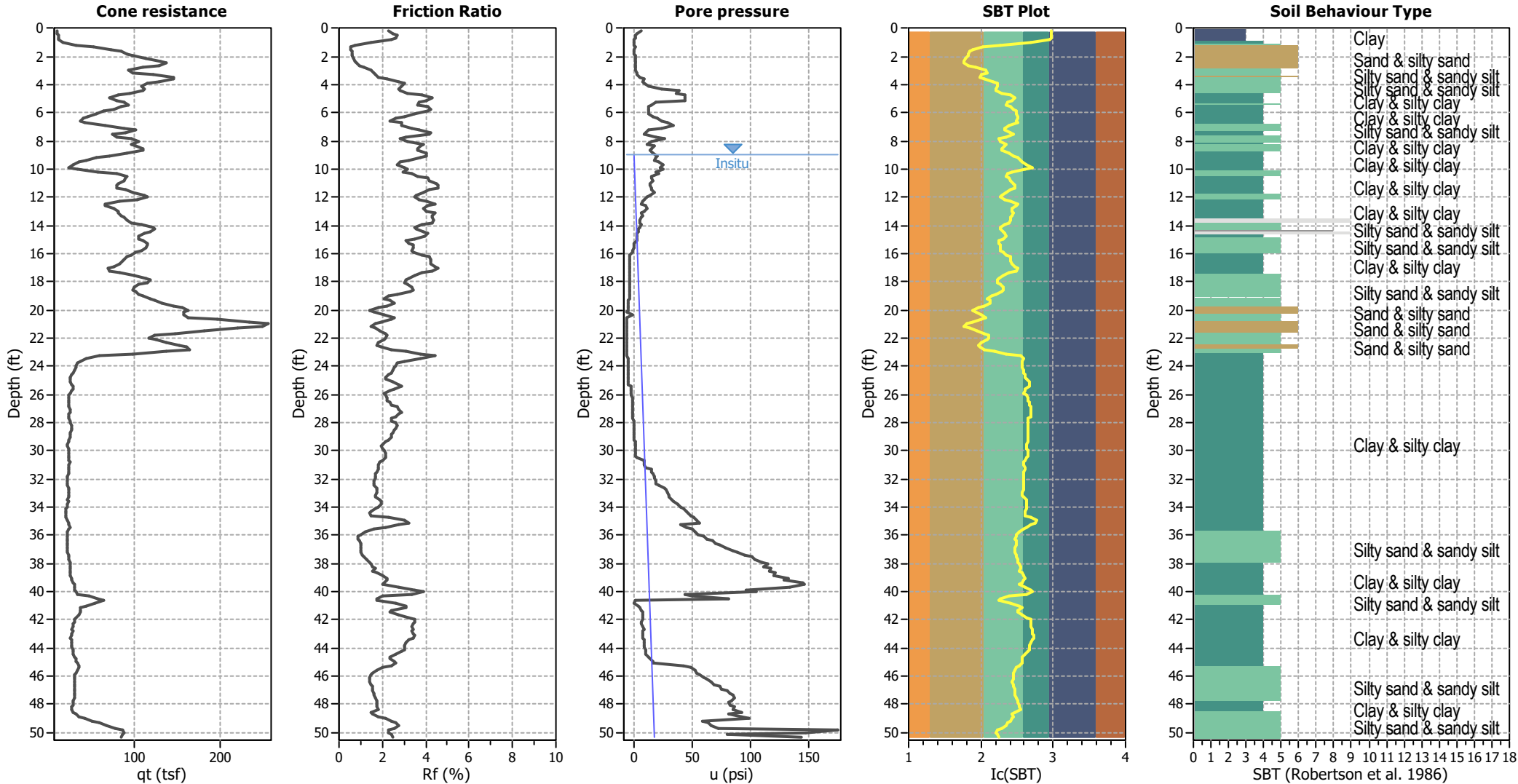
Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	9.00 ft	Use fill:	No	Clay like behavior	
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	5.00 ft	Fill height:	N/A	applied:	Sands only
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	No
Earthquake magnitude M_w :	6.80	Ic cut-off value:	2.30	Trans. detect. applied:	No	Limit depth:	N/A
Peak ground acceleration:	0.96	Unit weight calculation:	Based on SBT	K_o applied:	Yes	MSF method:	Method based



Zone A1: Cyclic liquefaction likely depending on size and duration of cyclic loading
 Zone A2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
 Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
 Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots

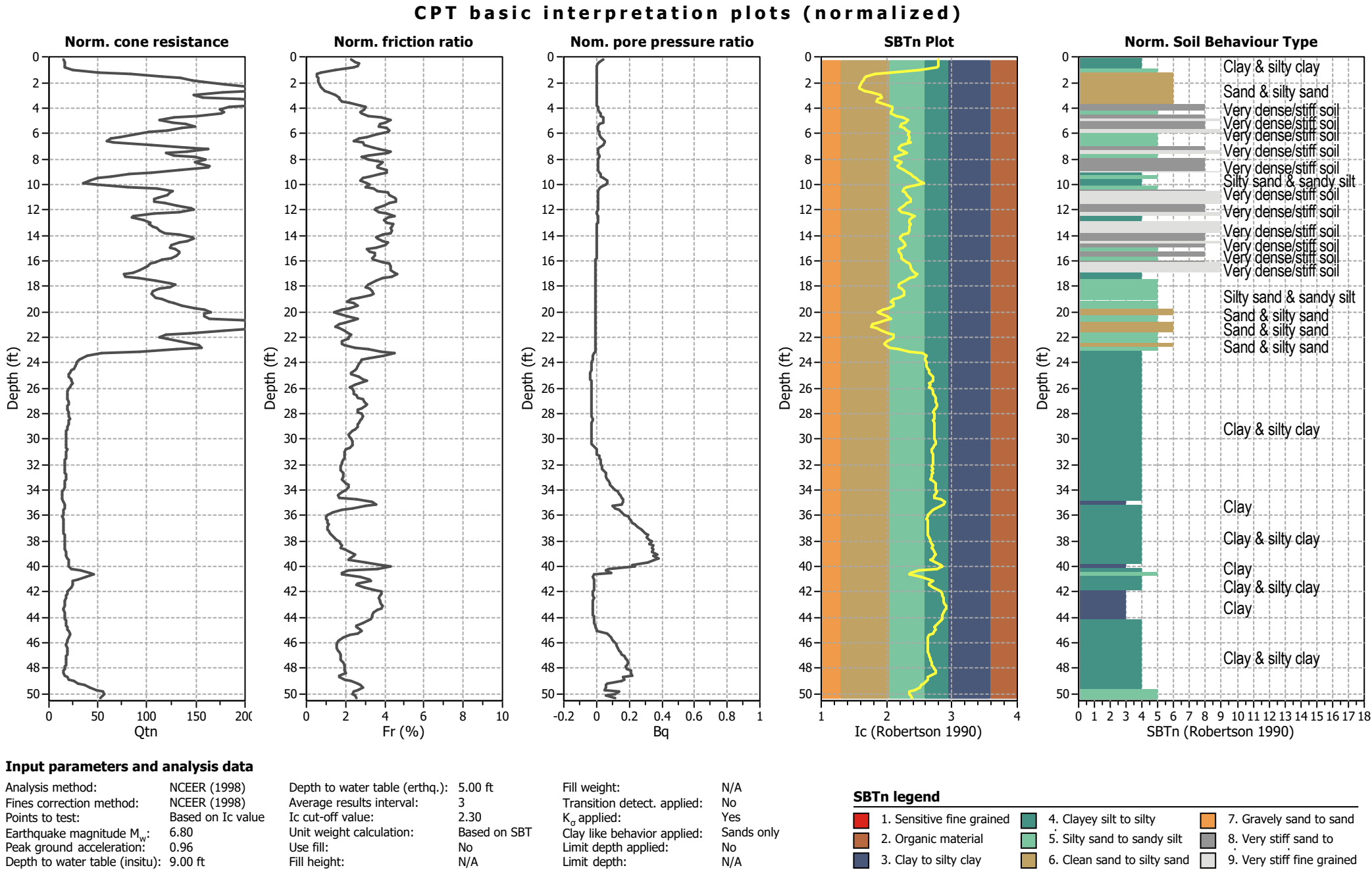


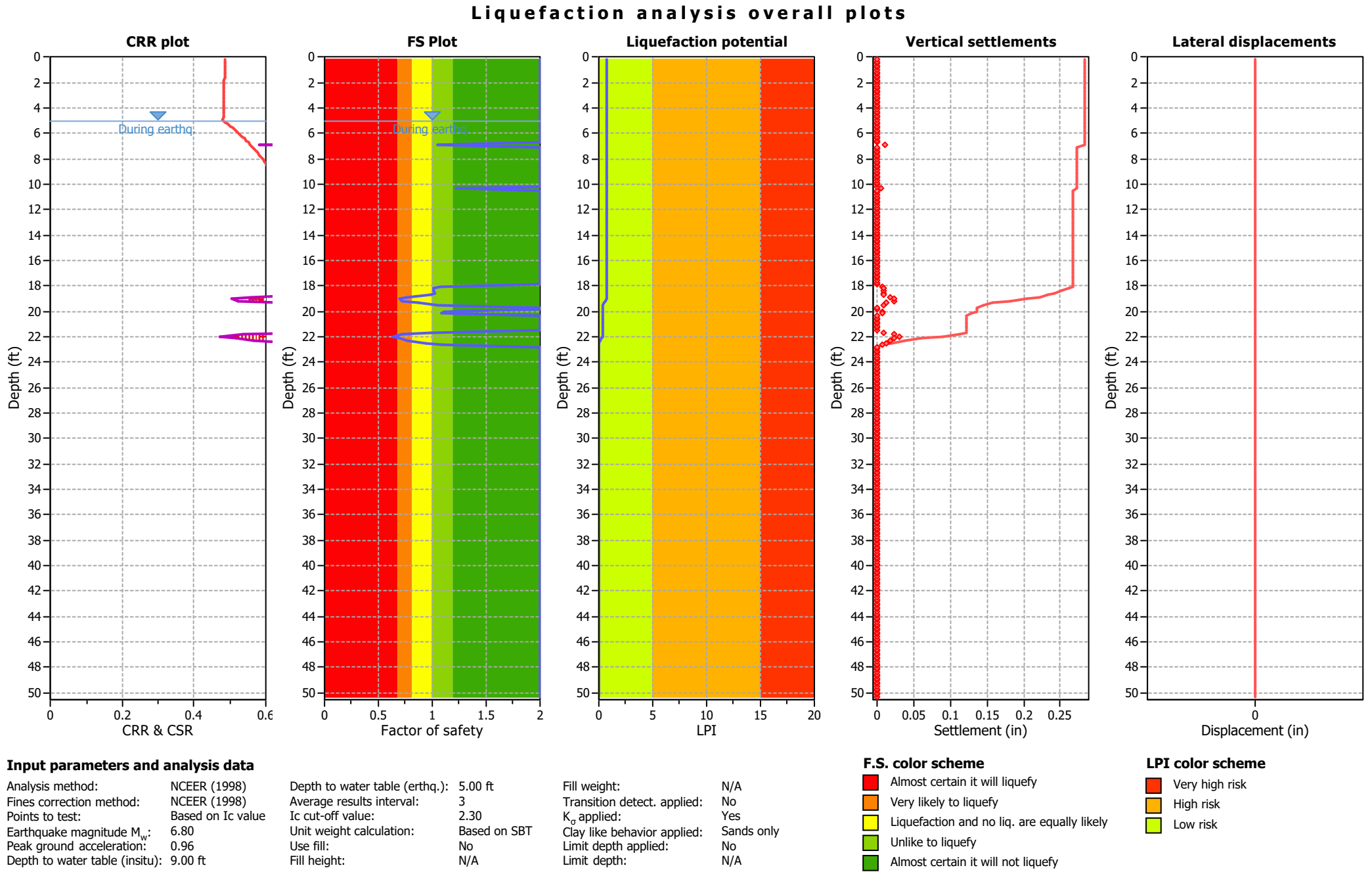
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.30	K _o applied:	Yes
Earthquake magnitude M _w :	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.96	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	9.00 ft	Fill height:	N/A	Limit depth:	N/A

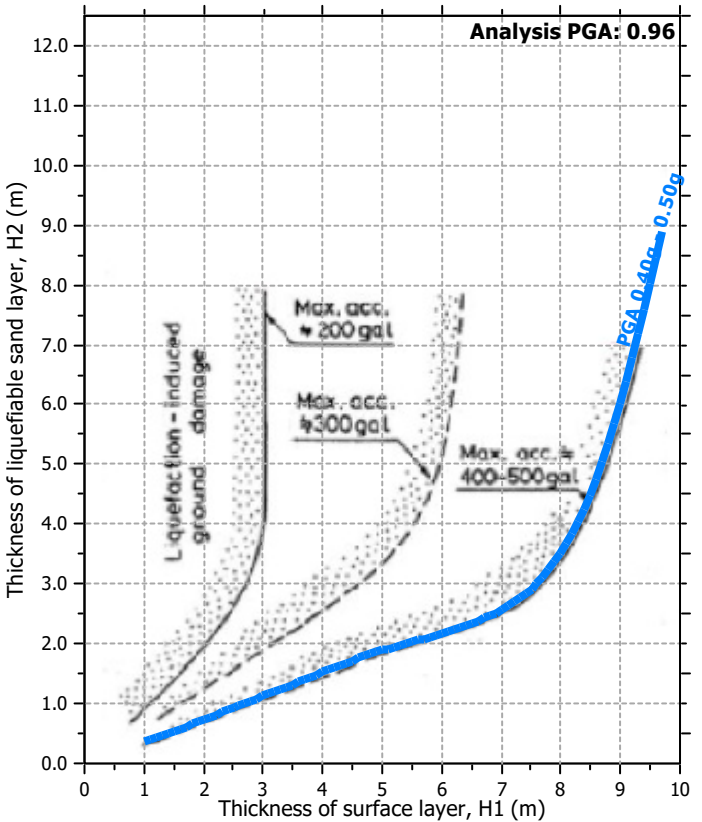
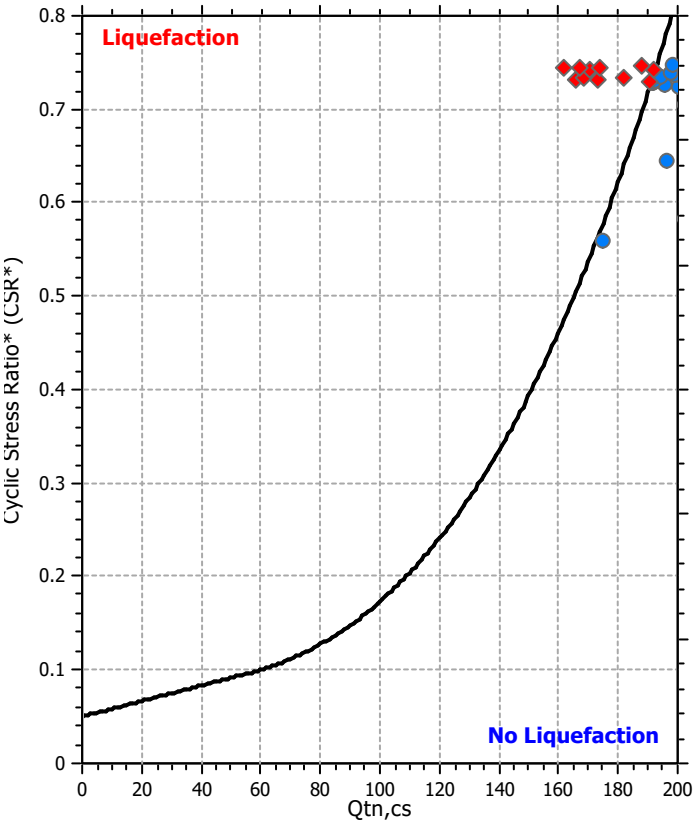
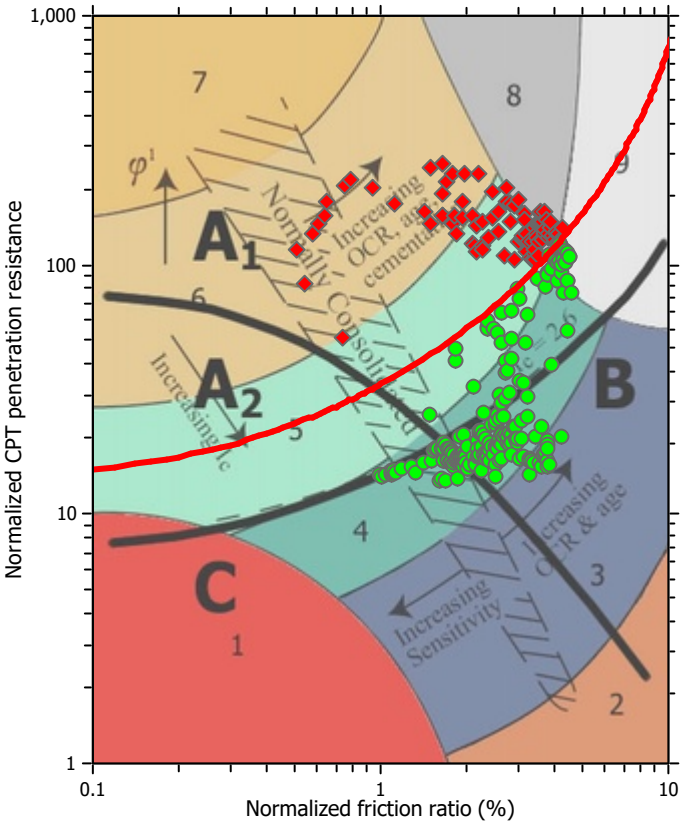
SBT legend

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





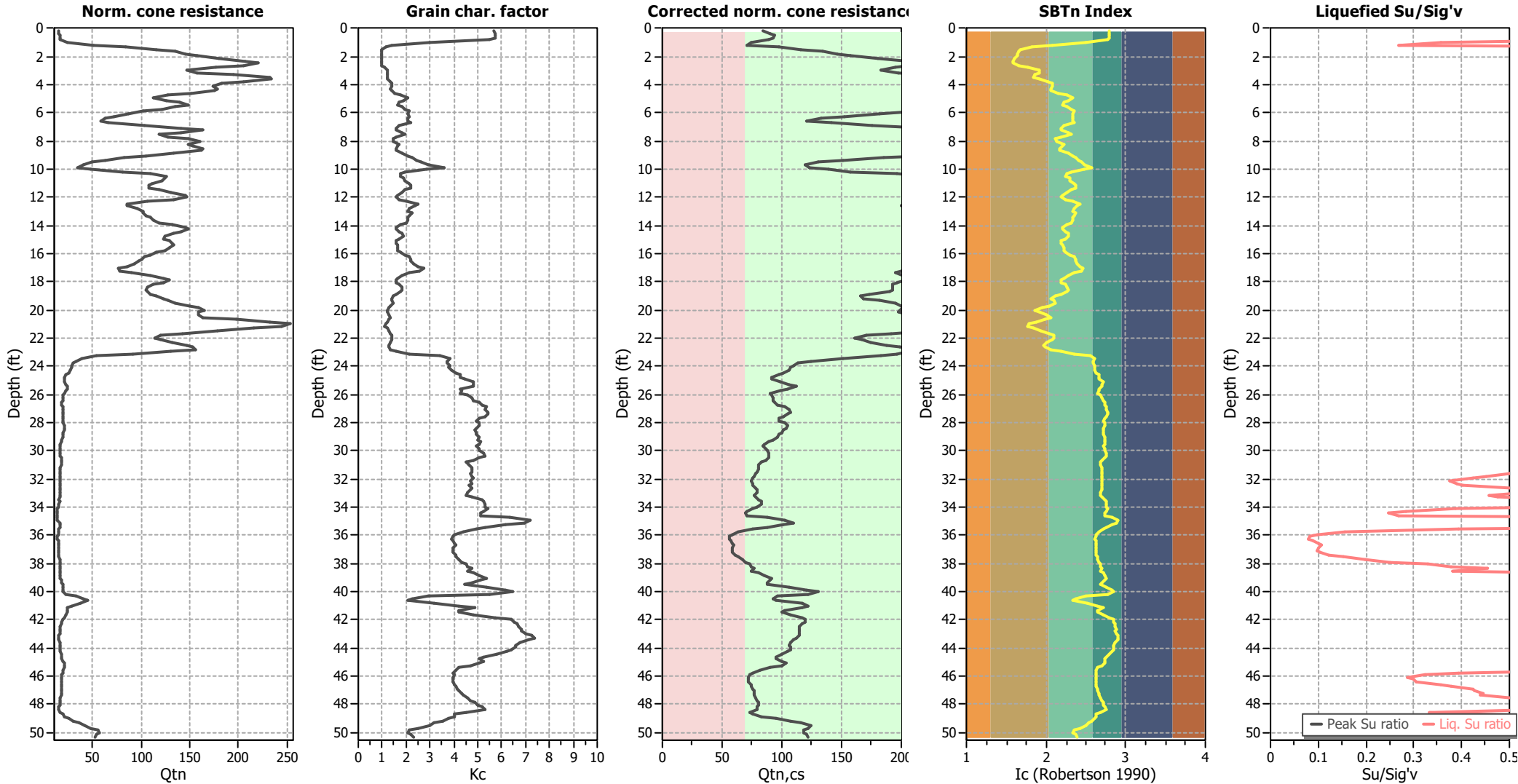
Liquefaction analysis summary plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.30	K_0 applied:	Yes
Earthquake magnitude M_w :	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.96	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	9.00 ft	Fill height:	N/A	Limit depth:	N/A

Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on I_c value	I_c cut-off value:	2.30	K_o applied:	Yes
Earthquake magnitude M_w :	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.96	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	9.00 ft	Fill height:	N/A	Limit depth:	N/A

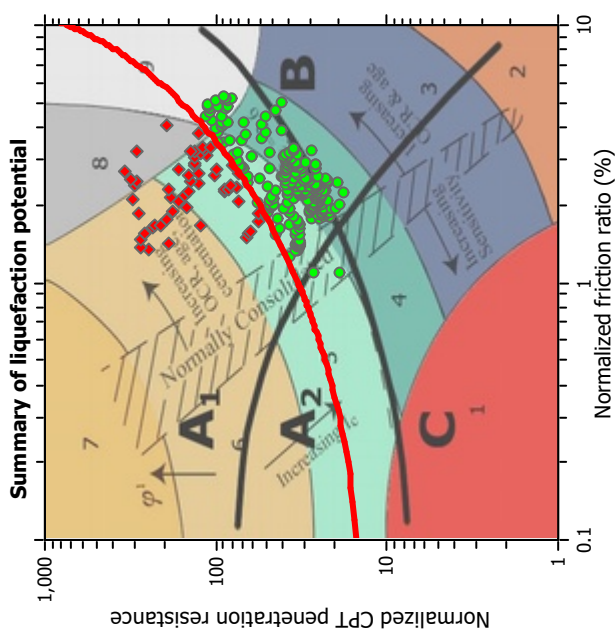
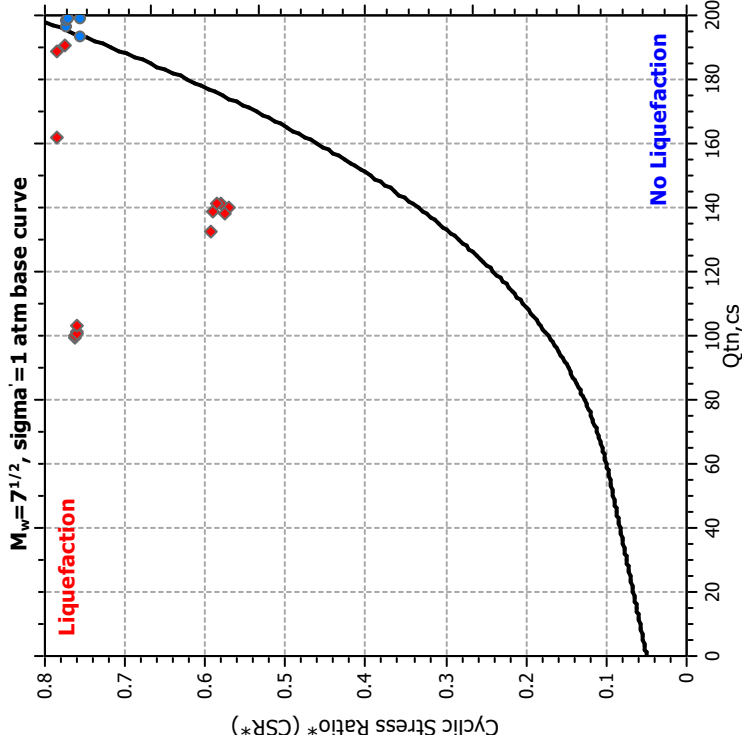
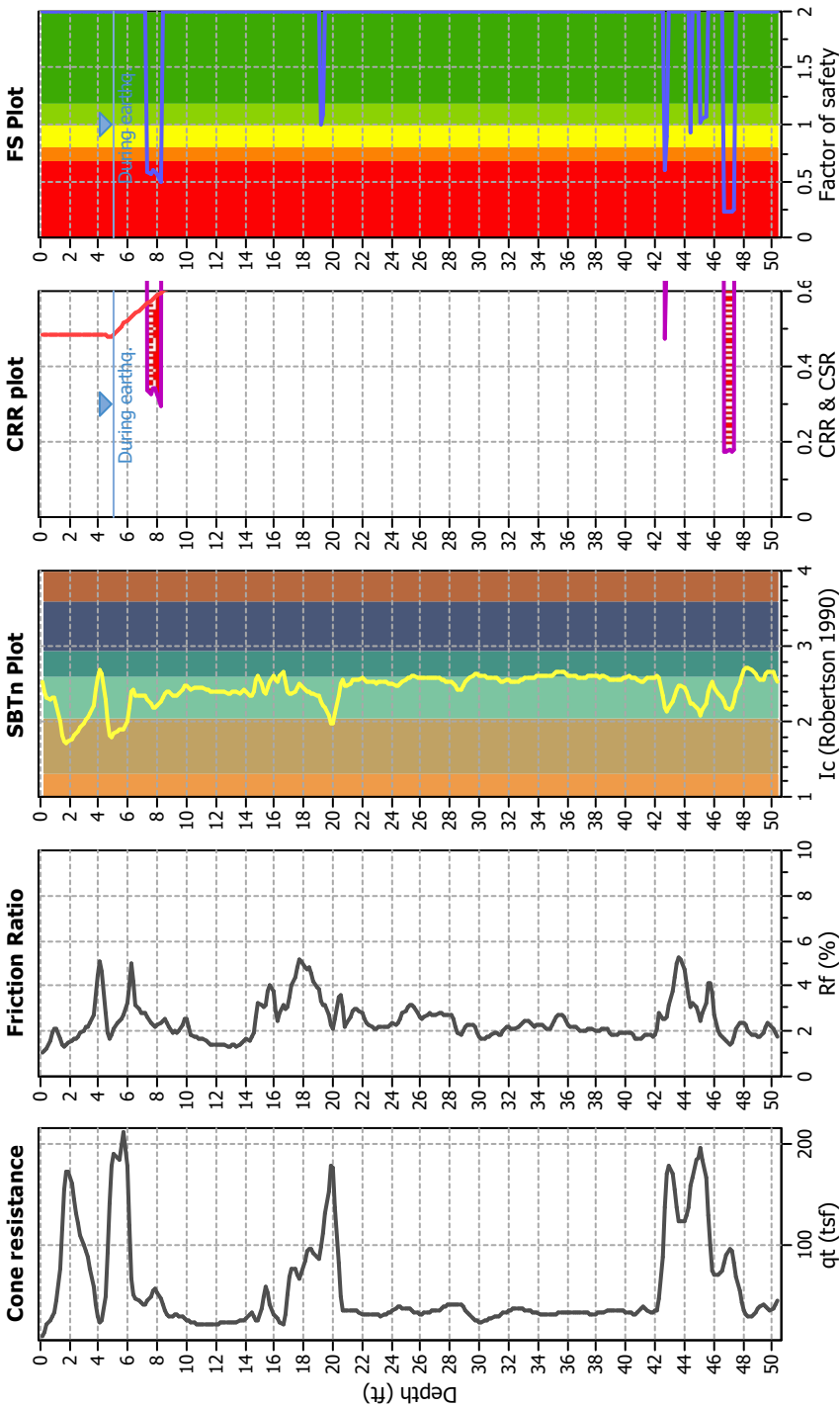
LIQUEFACTION ANALYSIS REPORT

Project title : 1030 Kaiser Road Warehouse
CPT file : SCPT-5

Location : 1030 Kaiser Road, Napa, CA

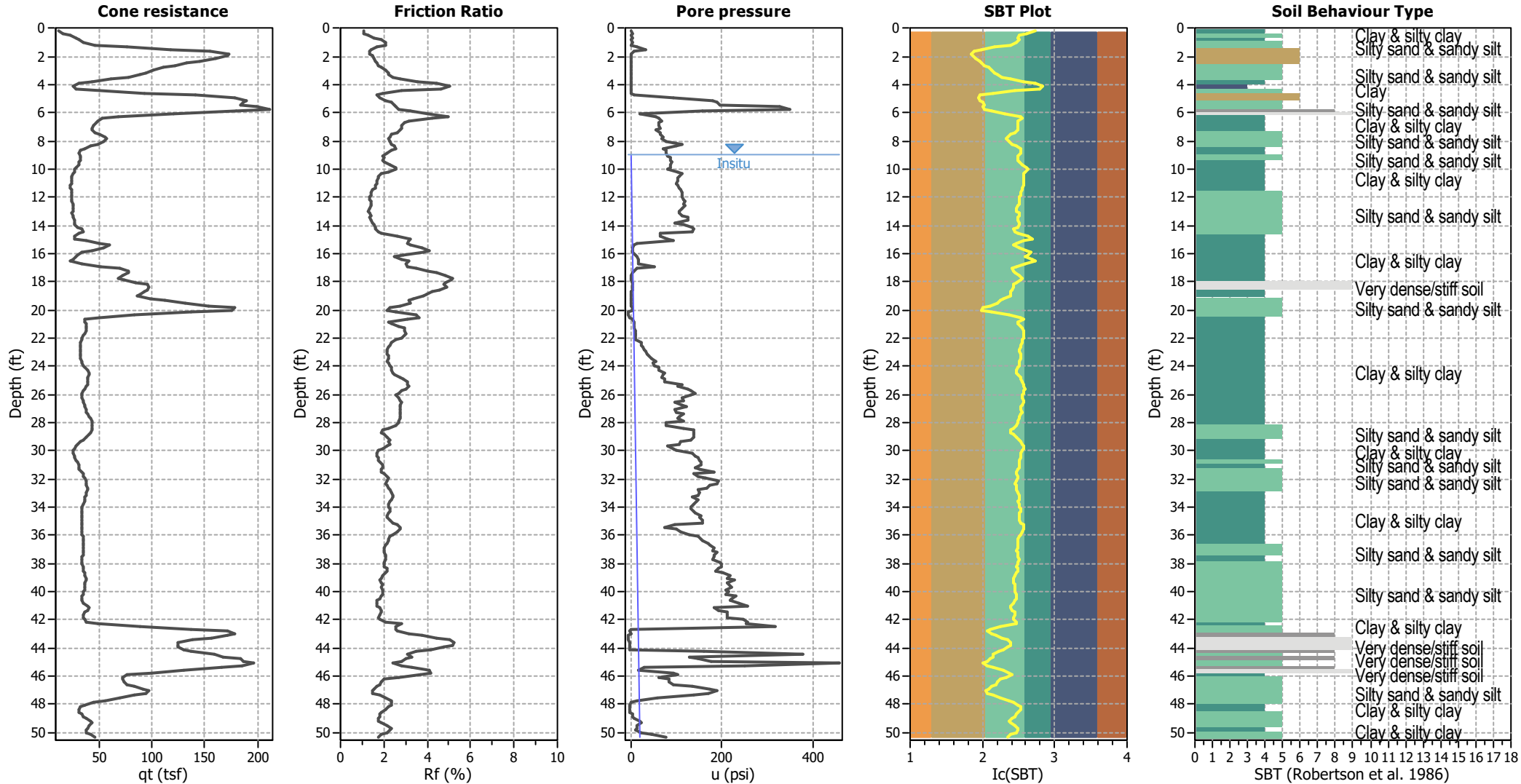
Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	9.00 ft	Use fill:	No	Clay like behavior
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	5.00 ft	Fill height:	N/A	applied:
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:
Earthquake magnitude M_w :	6.80	Ic cut-off value:	2.30	Trans. detect. applied:	No	Limit depth:
Peak ground acceleration:	0.96	Unit weight calculation:	Based on SBT	K_a applied:	Yes	MSF method:
						Method based



Zone A₁: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A₂: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots

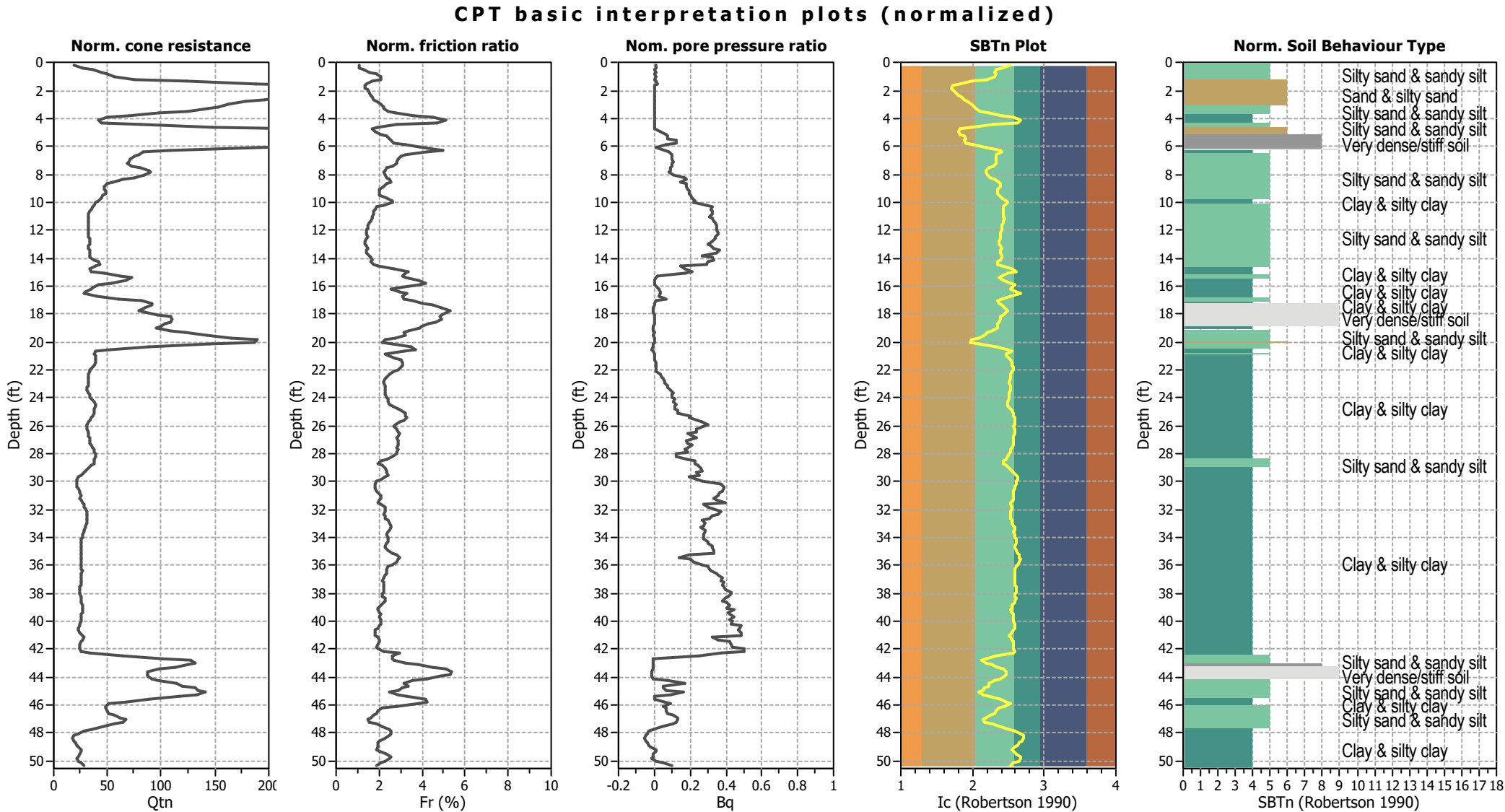


Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.30	K _o applied:	Yes
Earthquake magnitude M _w :	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.96	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	9.00 ft	Fill height:	N/A	Limit depth:	N/A

SBT legend

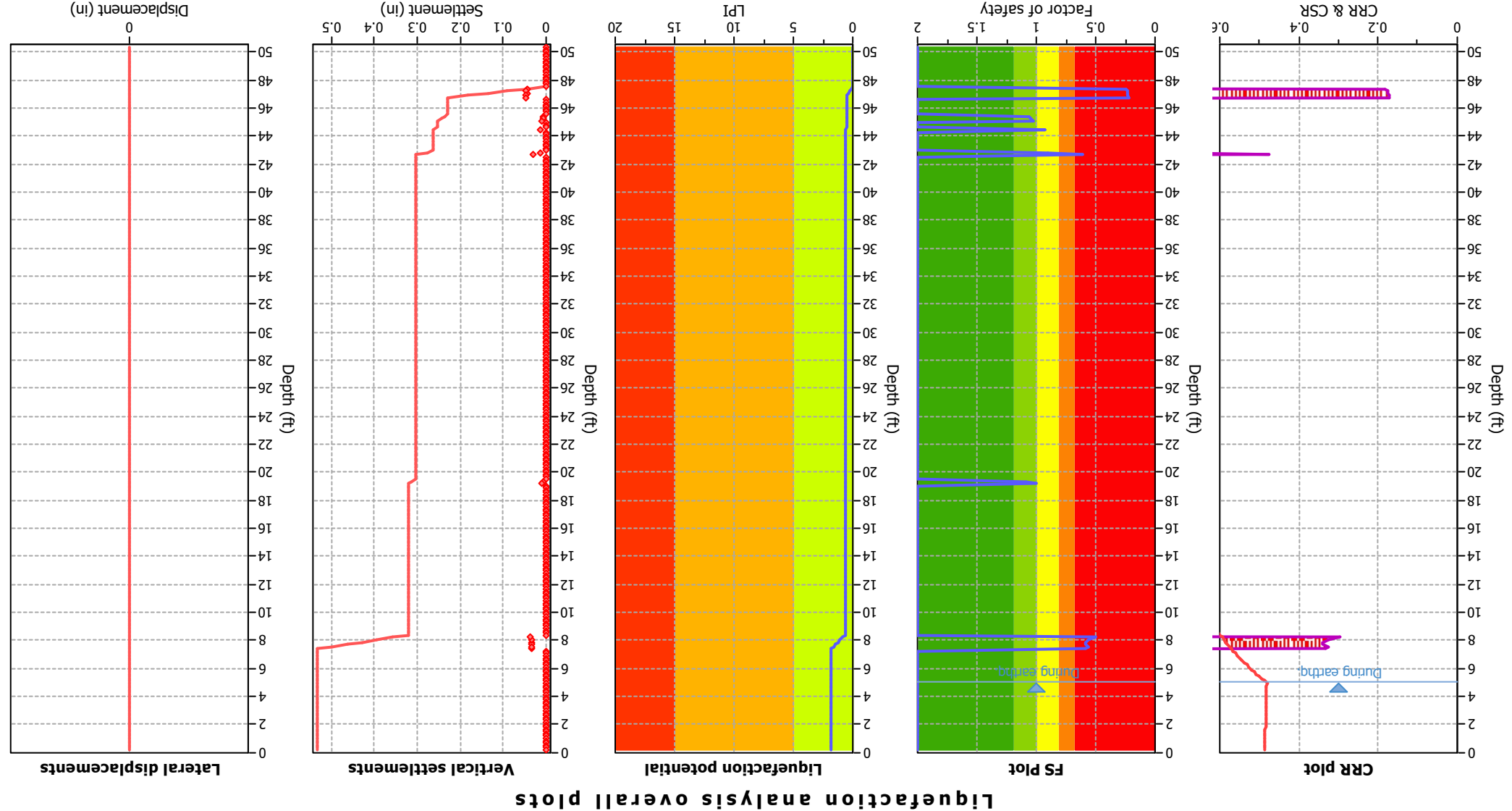
1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained



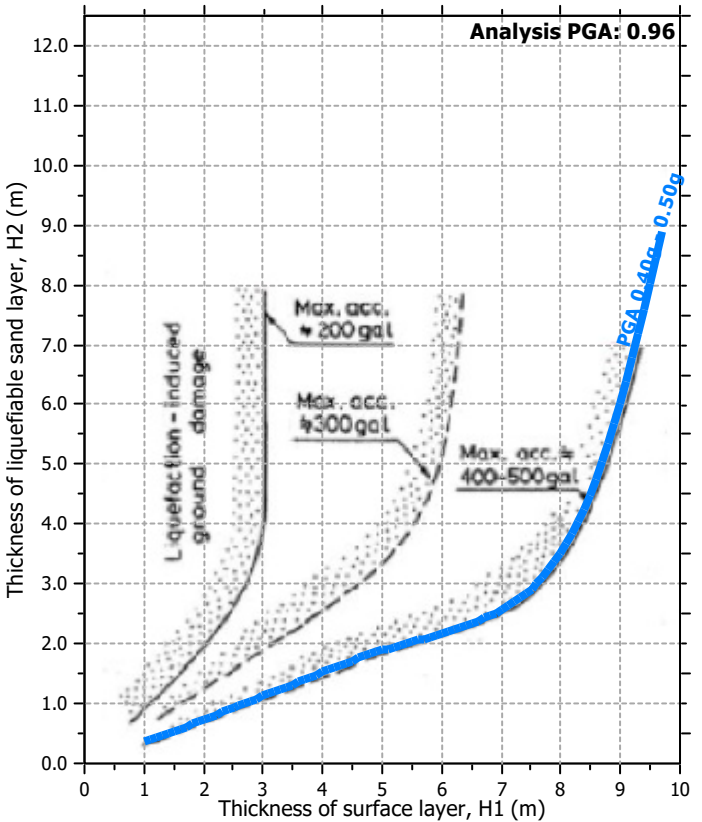
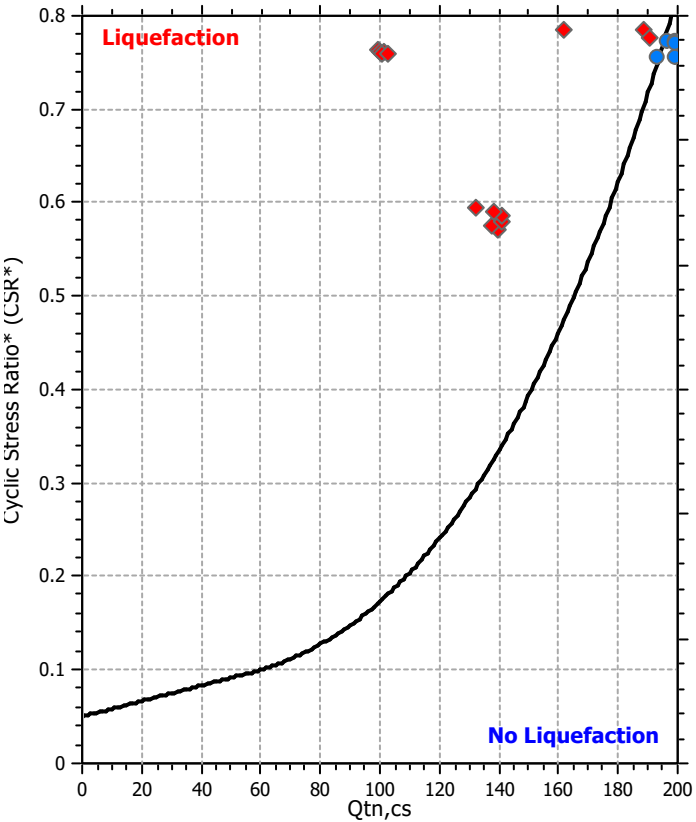
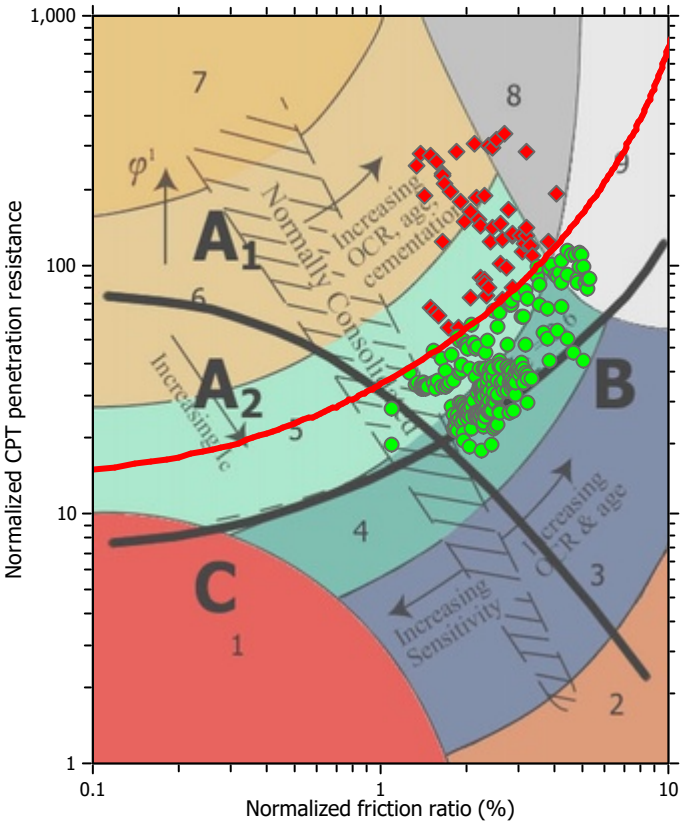
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.30	K _o applied:	Yes
Earthquake magnitude M _w :	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.96	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	9.00 ft	Fill height:	N/A	Limit depth:	N/A

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



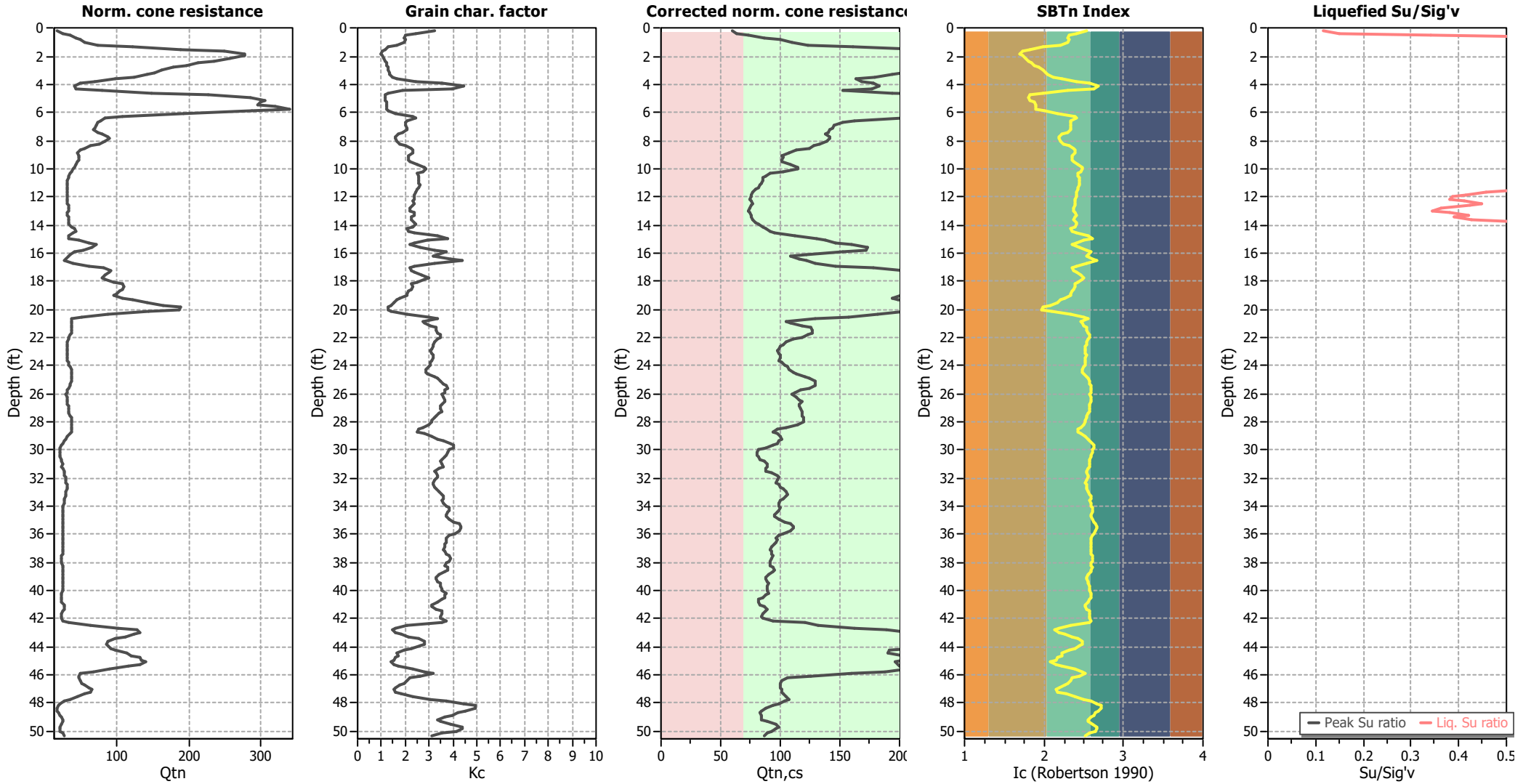
Liquefaction analysis summary plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.30	K _o applied:	Yes
Earthquake magnitude M _w :	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.96	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	9.00 ft	Fill height:	N/A	Limit depth:	N/A

Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.30	K _o applied:	Yes
Earthquake magnitude M _w :	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.96	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	9.00 ft	Fill height:	N/A	Limit depth:	N/A

LIQUEFACTION ANALYSIS REPORT

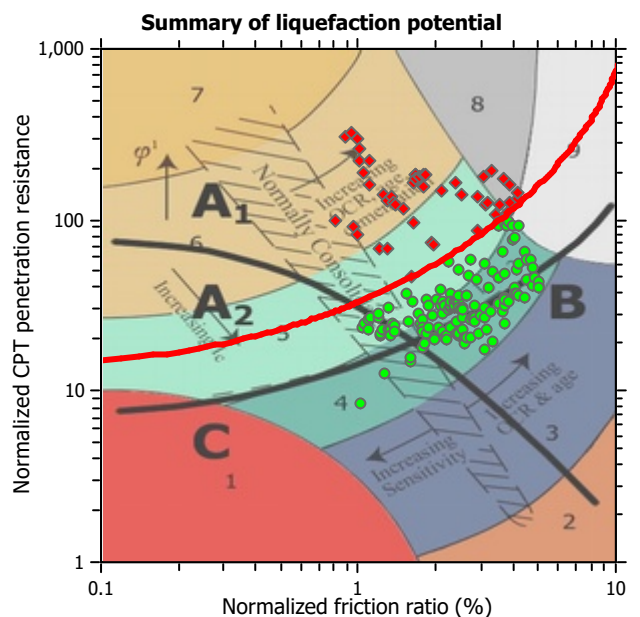
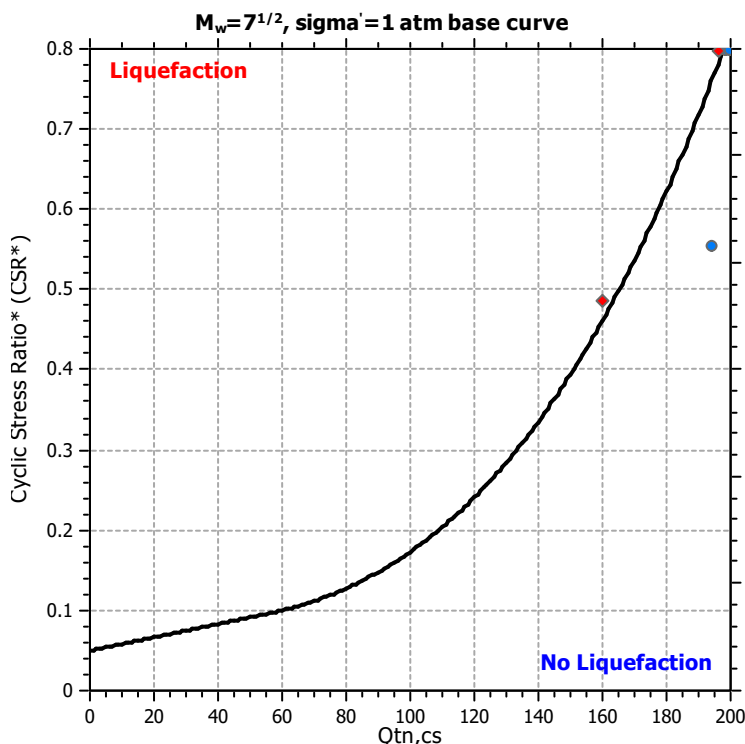
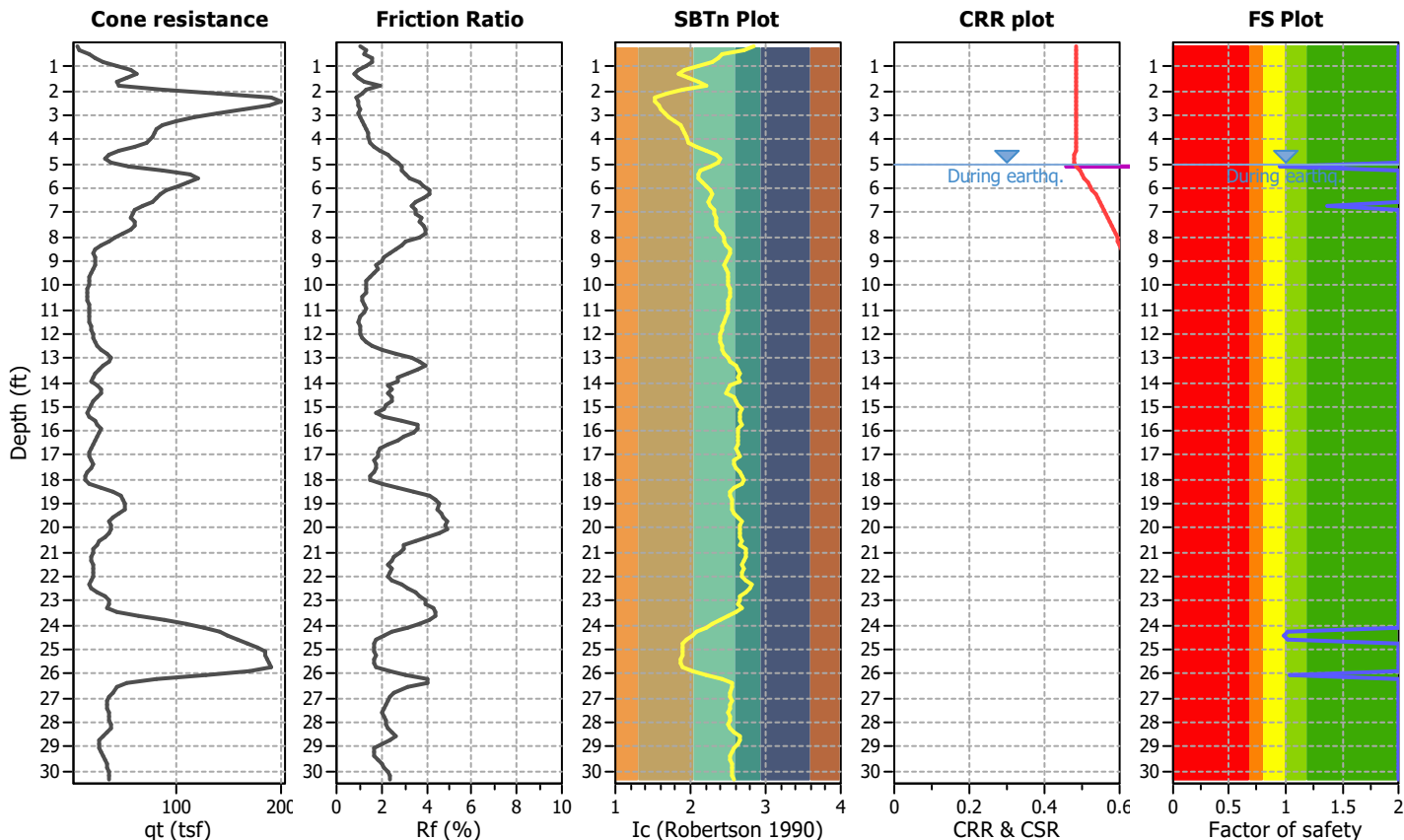
Project title : 1030 Kaiser Road Warehouse

Location : 1030 Kaiser Road, Napa, CA

CPT file : CPT-6

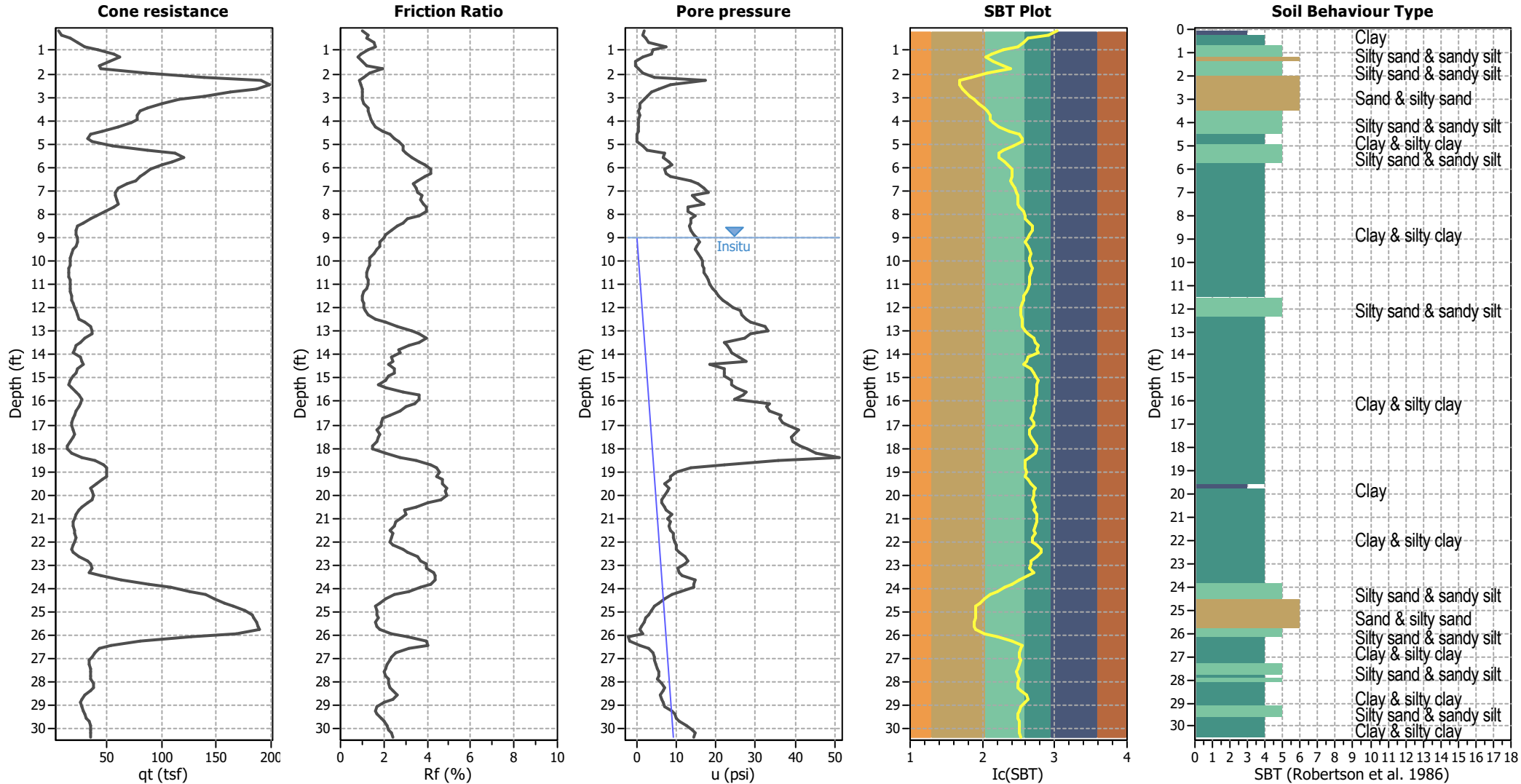
Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	9.00 ft	Use fill:	No	Clay like behavior	
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	5.00 ft	Fill height:	N/A	applied:	Sands only
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	No
Earthquake magnitude M_w :	6.80	Ic cut-off value:	2.30	Trans. detect. applied:	No	Limit depth:	N/A
Peak ground acceleration:	0.96	Unit weight calculation:	Based on SBT	K_o applied:	Yes	MSF method:	Method based



Zone A1: Cyclic liquefaction likely depending on size and duration of cyclic loading
 Zone A2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
 Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
 Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



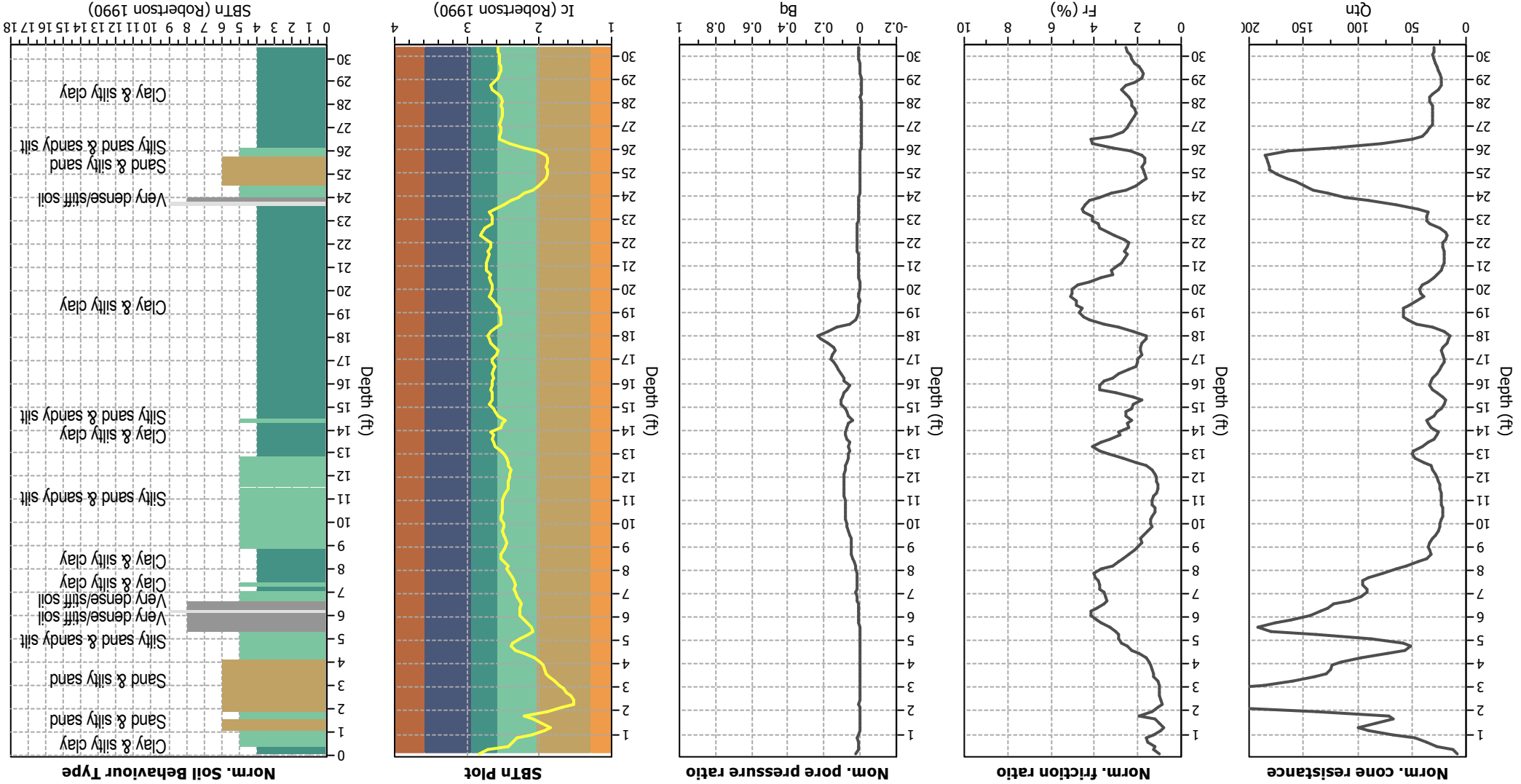
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.30	K _o applied:	Yes
Earthquake magnitude M _w :	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.96	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	9.00 ft	Fill height:	N/A	Limit depth:	N/A

SBT legend

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

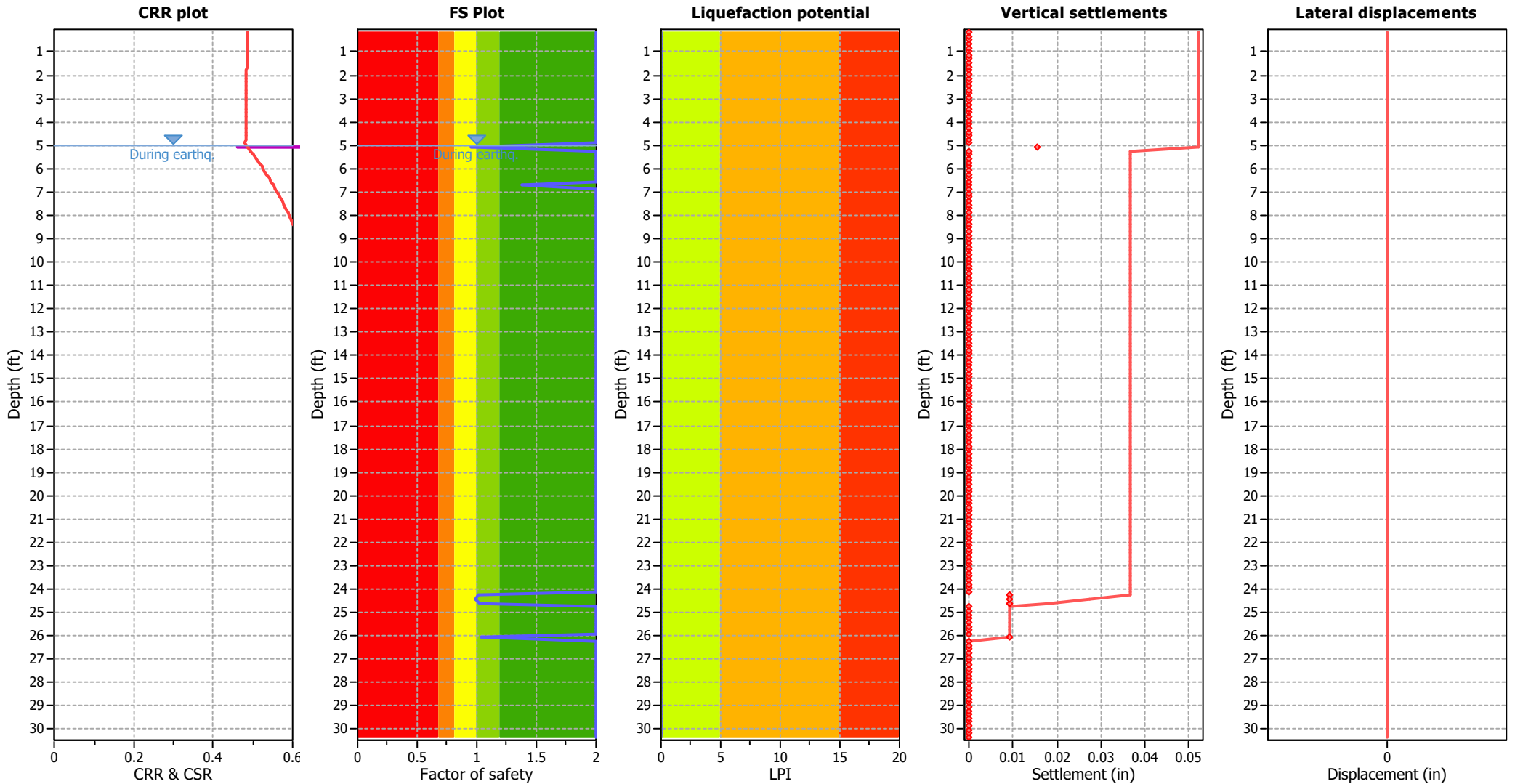
CPT basic interpretation plots (normalized)



Input parameters and analysis data

Analysis method:	NCEER (1998)
Fines correction method:	NCEER (1998)
Points to test:	Based on Ic value
Earthquake magnitude M_w :	6.80
Peak ground acceleration:	0.96
Depth to water table (instn):	9.00 ft
Fill weight:	5.00 ft
Unit weight calculation:	Based on SBT
Limit depth applied:	No
Limit depth:	N/A
Clay like behavior applied:	No
K_0 applied:	Yes
Transition detect. applied:	No
Fill weight:	N/A

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (earthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.30	K _o applied:	Yes
Earthquake magnitude M _w :	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.96	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	9.00 ft	Fill height:	N/A	Limit depth:	N/A

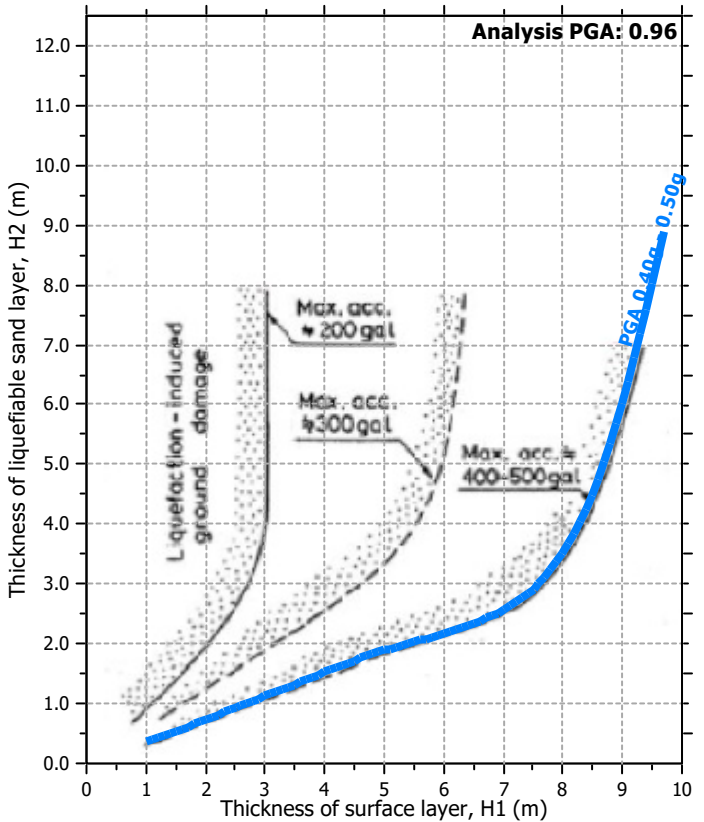
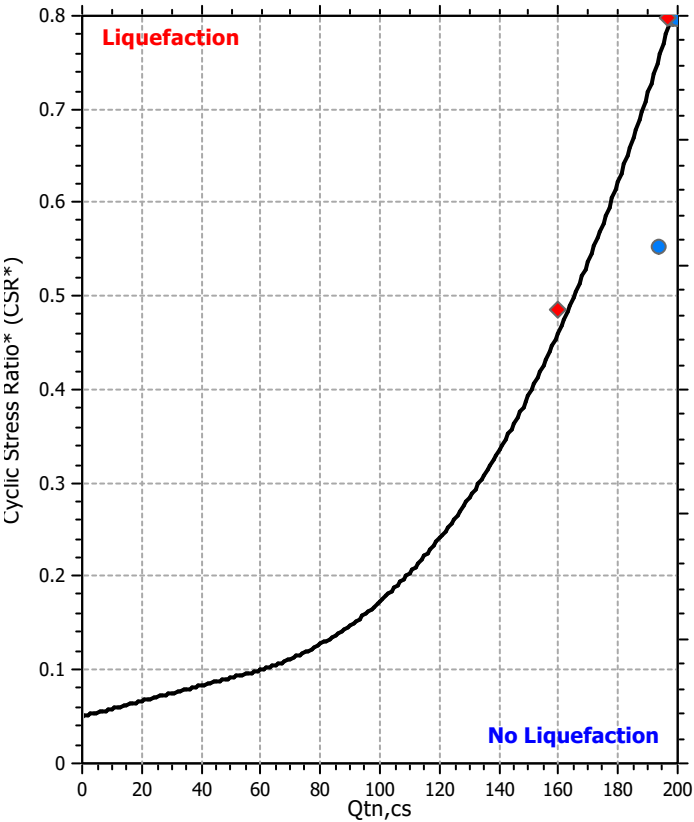
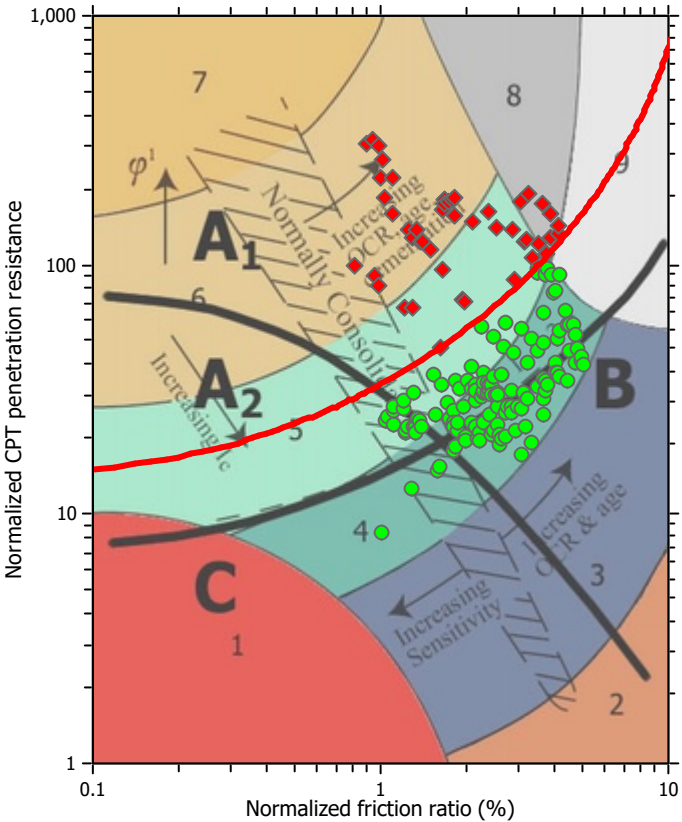
F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

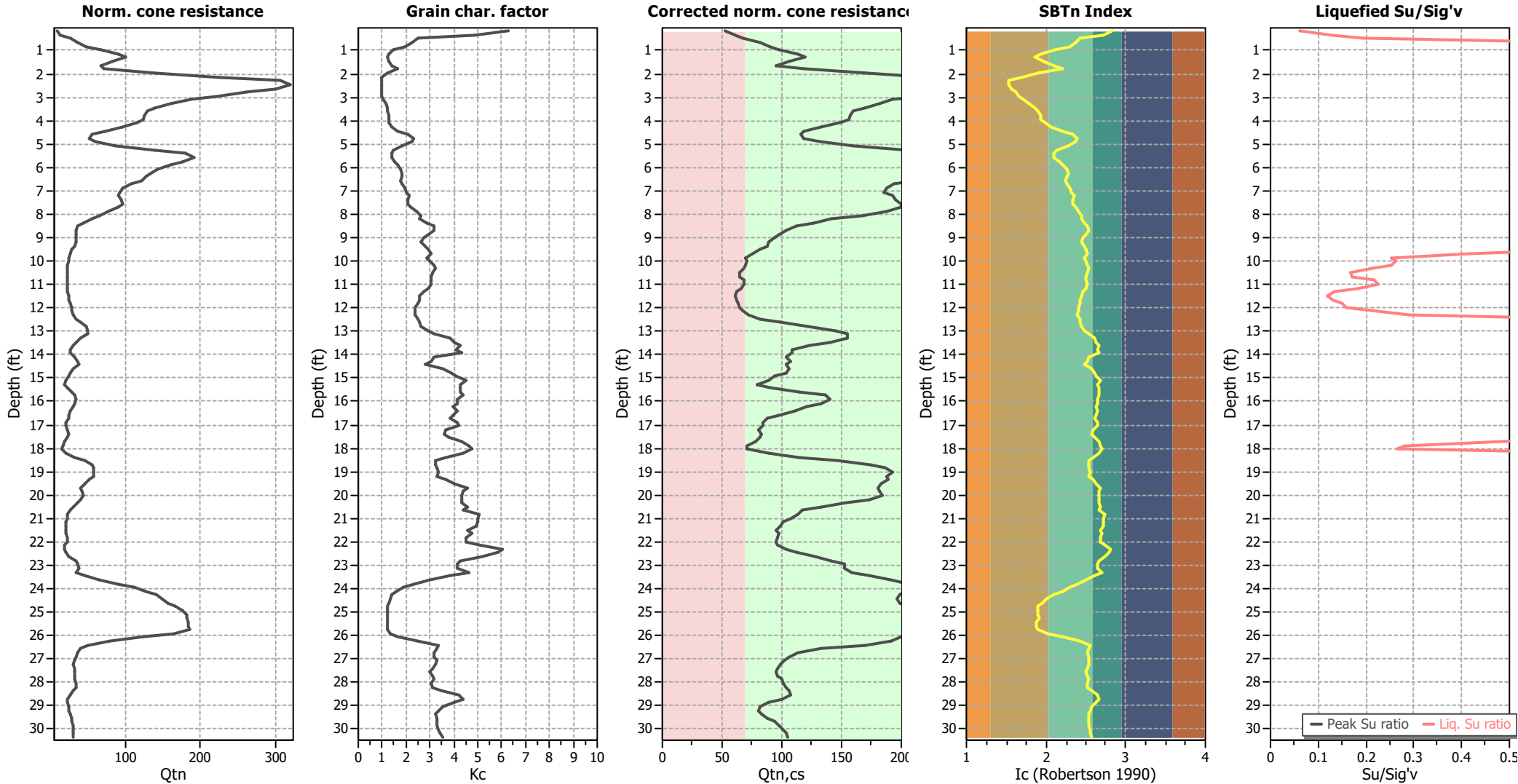
Liquefaction analysis summary plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.30	K_0 applied:	Yes
Earthquake magnitude M_w :	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.96	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	9.00 ft	Fill height:	N/A	Limit depth:	N/A

Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.30	K _o applied:	Yes
Earthquake magnitude M _w :	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.96	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	9.00 ft	Fill height:	N/A	Limit depth:	N/A

LIQUEFACTION ANALYSIS REPORT

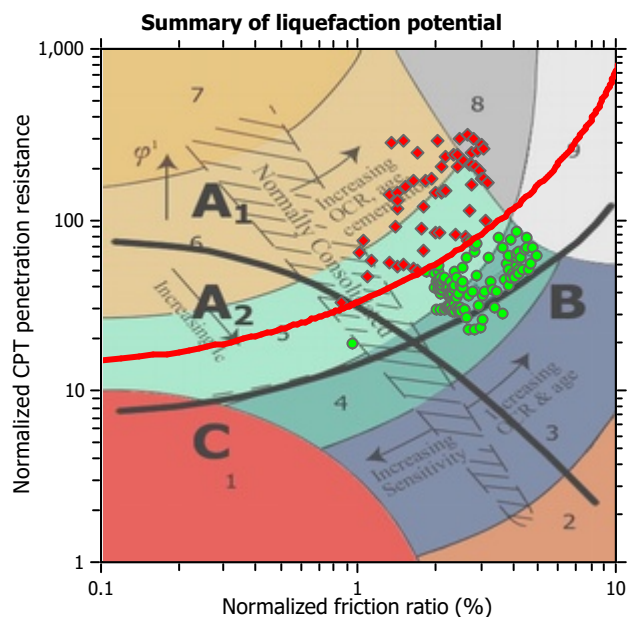
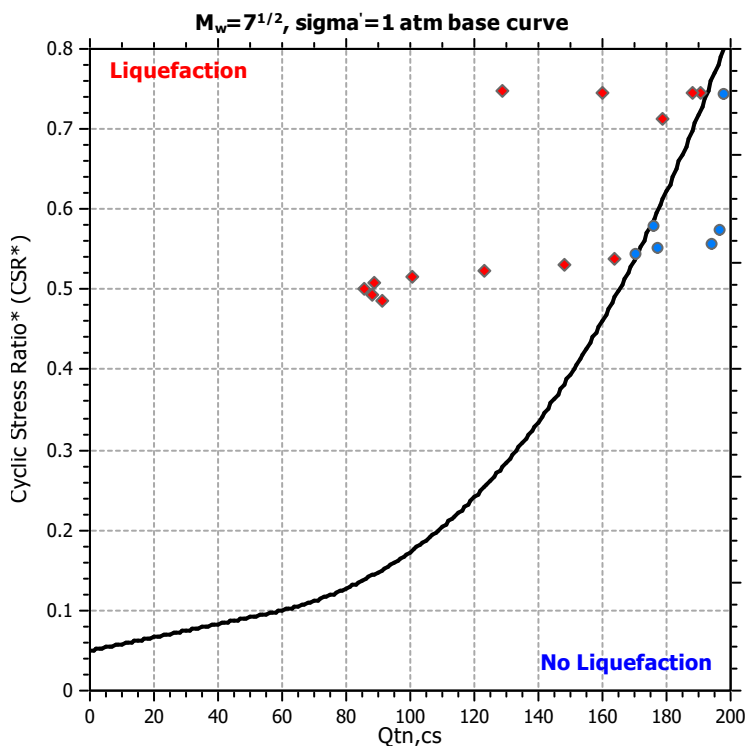
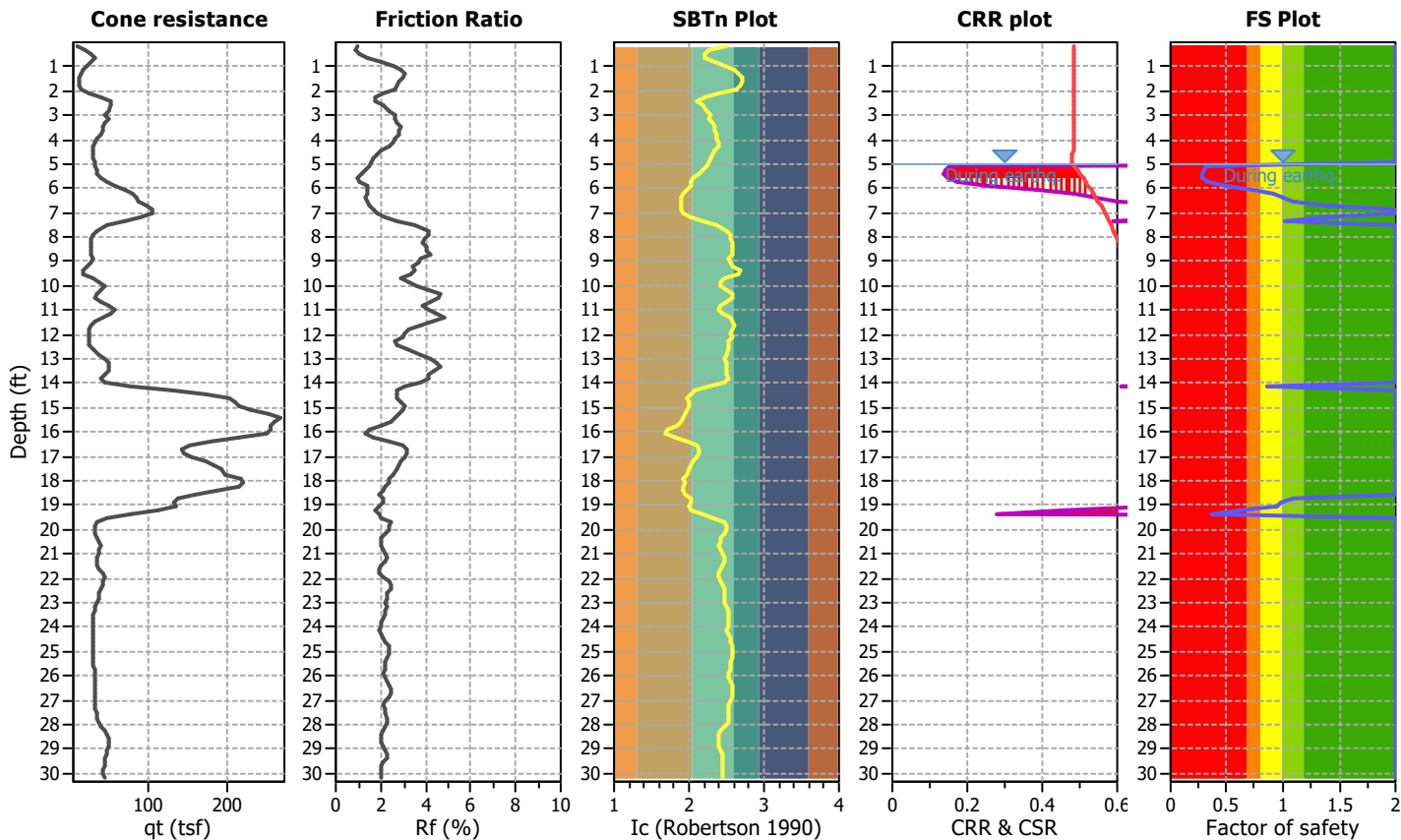
Project title : 1030 Kaiser Road Warehouse

Location : 1030 Kaiser Road, Napa, CA

CPT file : CPT-7

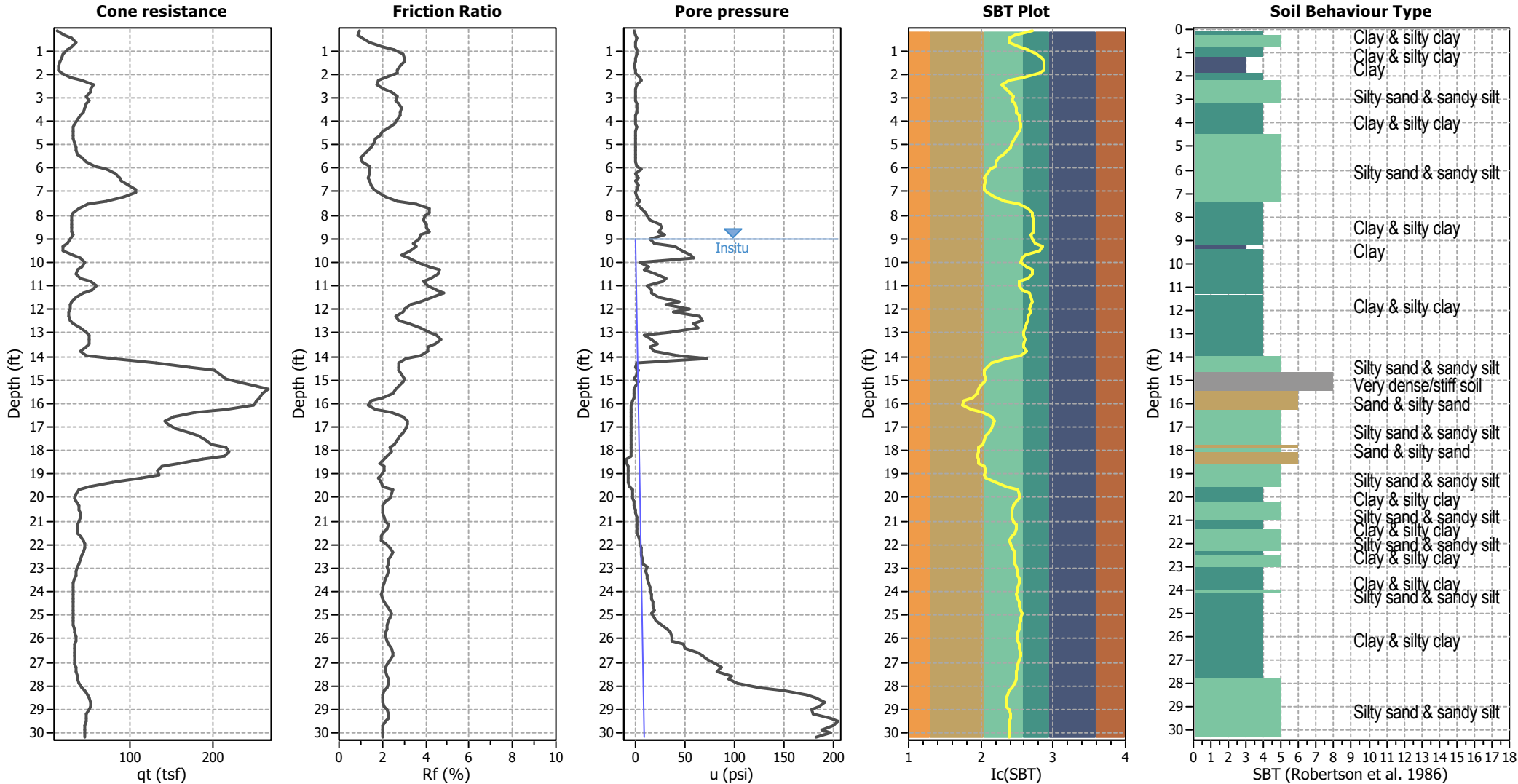
Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	9.00 ft	Use fill:	No	Clay like behavior	
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	5.00 ft	Fill height:	N/A	applied:	Sands only
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	No
Earthquake magnitude M_w :	6.80	Ic cut-off value:	2.30	Trans. detect. applied:	No	Limit depth:	N/A
Peak ground acceleration:	0.96	Unit weight calculation:	Based on SBT	K_o applied:	Yes	MSF method:	Method based



Zone A₁: Cyclic liquefaction likely depending on size and duration of cyclic loading
 Zone A₂: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
 Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
 Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots

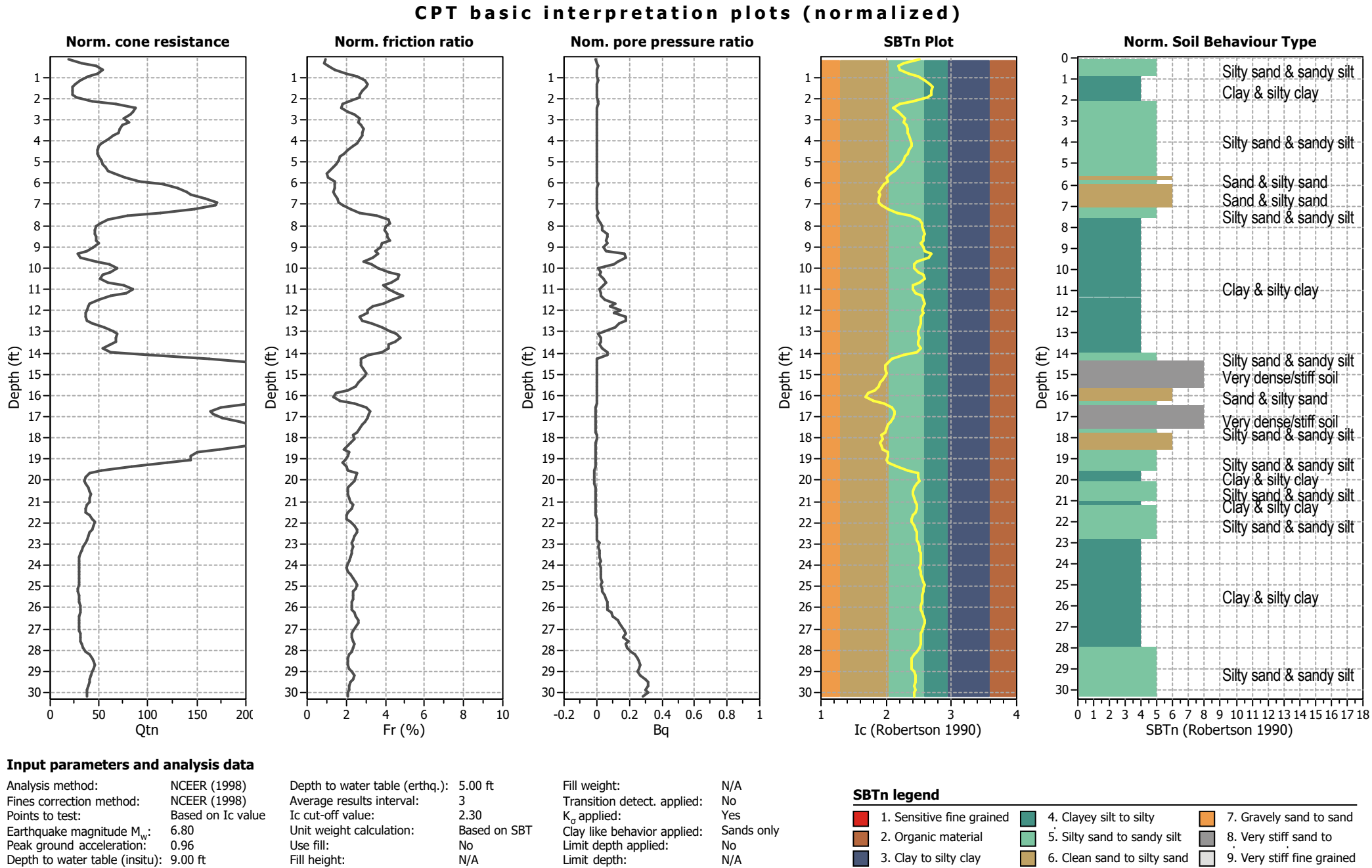


Input parameters and analysis data

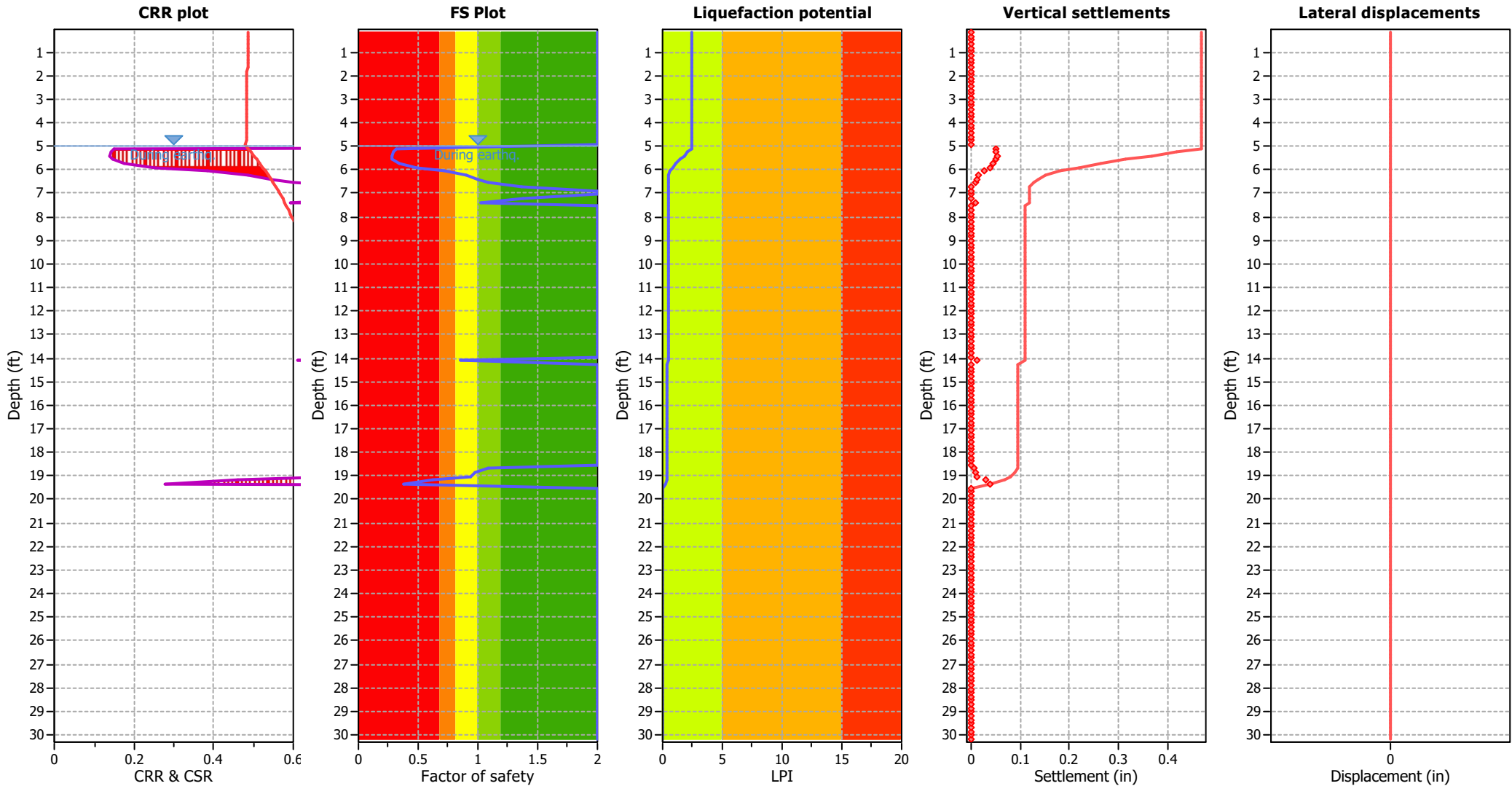
Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.30	K _o applied:	Yes
Earthquake magnitude M _w :	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.96	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	9.00 ft	Fill height:	N/A	Limit depth:	N/A

SBT legend

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



Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.30	K ₀ applied:	Yes
Earthquake magnitude M _w :	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.96	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	9.00 ft	Fill height:	N/A	Limit depth:	N/A

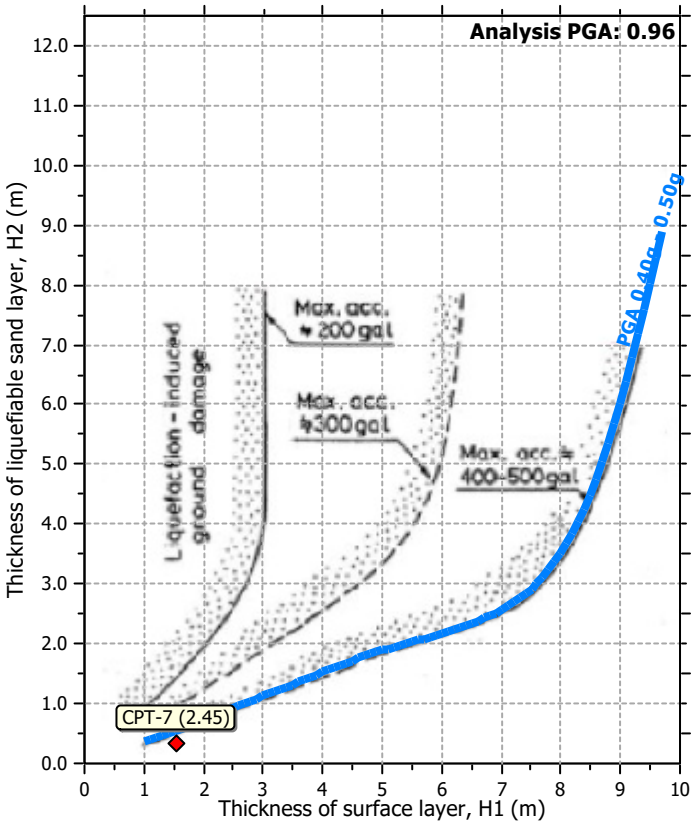
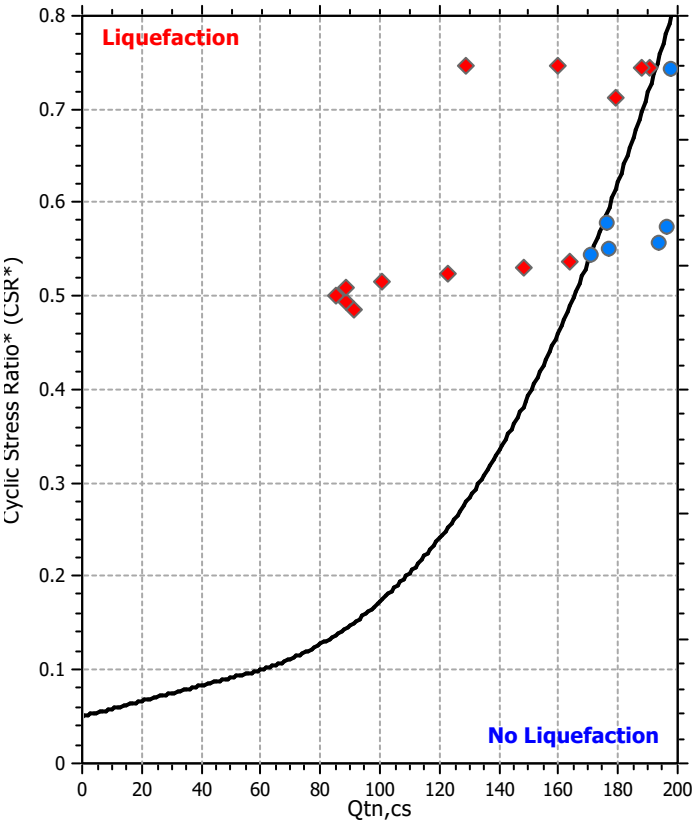
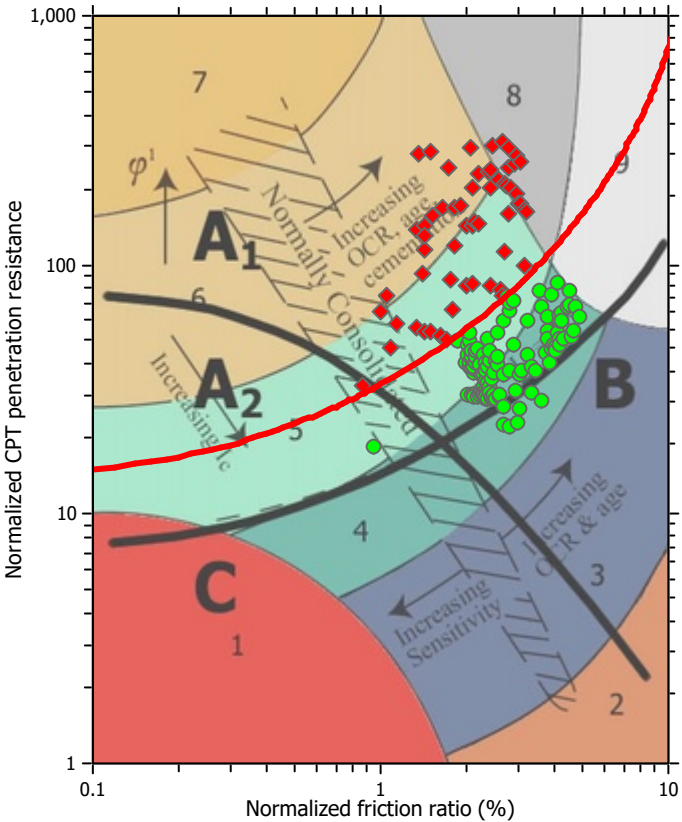
F.S. color scheme

Red	Almost certain it will liquefy
Orange	Very likely to liquefy
Yellow	Liquefaction and no liq. are equally likely
Light Green	Unlike to liquefy
Dark Green	Almost certain it will not liquefy

LPI color scheme

Red	Very high risk
Orange	High risk
Yellow	Low risk

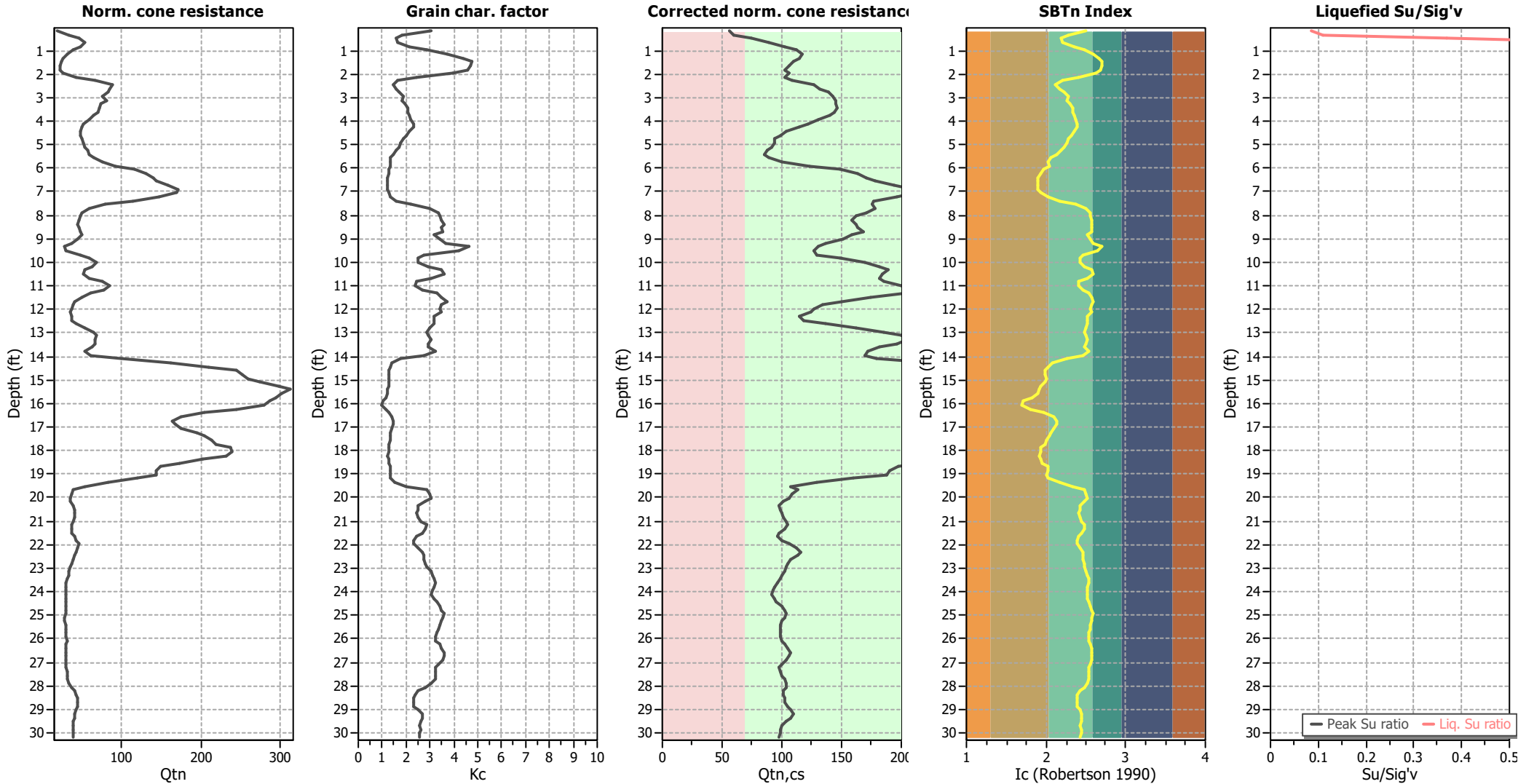
Liquefaction analysis summary plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.30	K_0 applied:	Yes
Earthquake magnitude M_w :	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.96	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	9.00 ft	Fill height:	N/A	Limit depth:	N/A

Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on I _c value	I _c cut-off value:	2.30	K _o applied:	Yes
Earthquake magnitude M _w :	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.96	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	9.00 ft	Fill height:	N/A	Limit depth:	N/A

LIQUEFACTION ANALYSIS REPORT

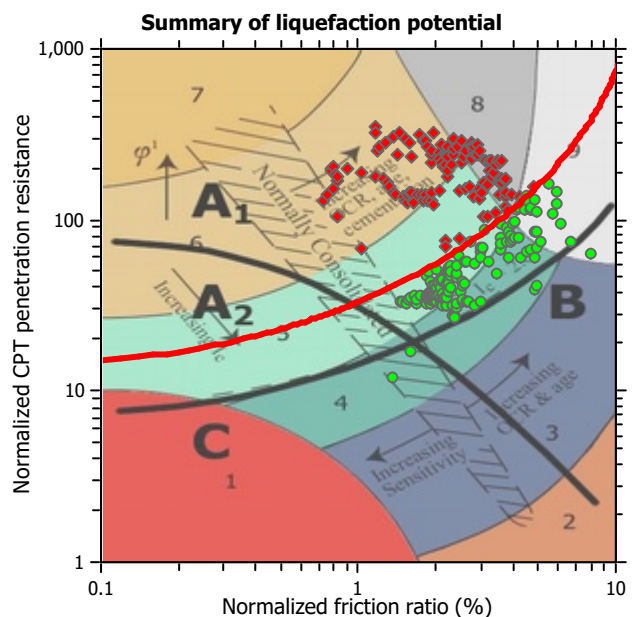
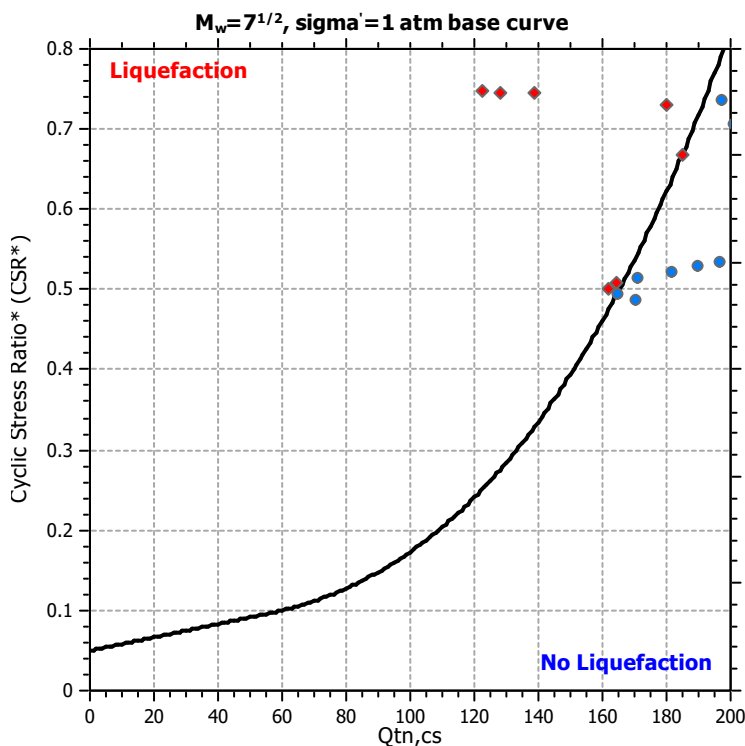
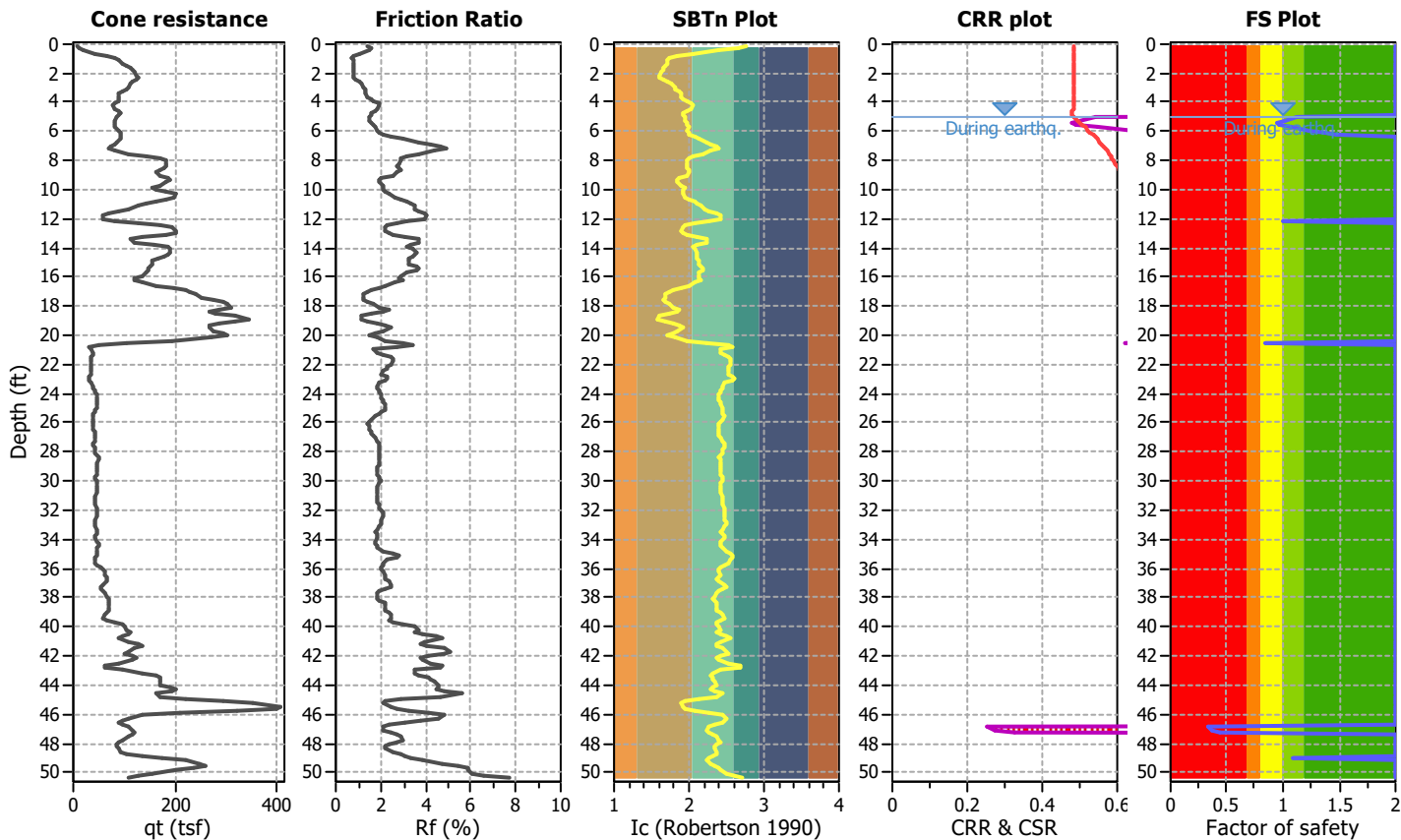
Project title : 1030 Kaiser Road Warehouse

Location : 1030 Kaiser Road, Napa, CA

CPT file : SCPT-8

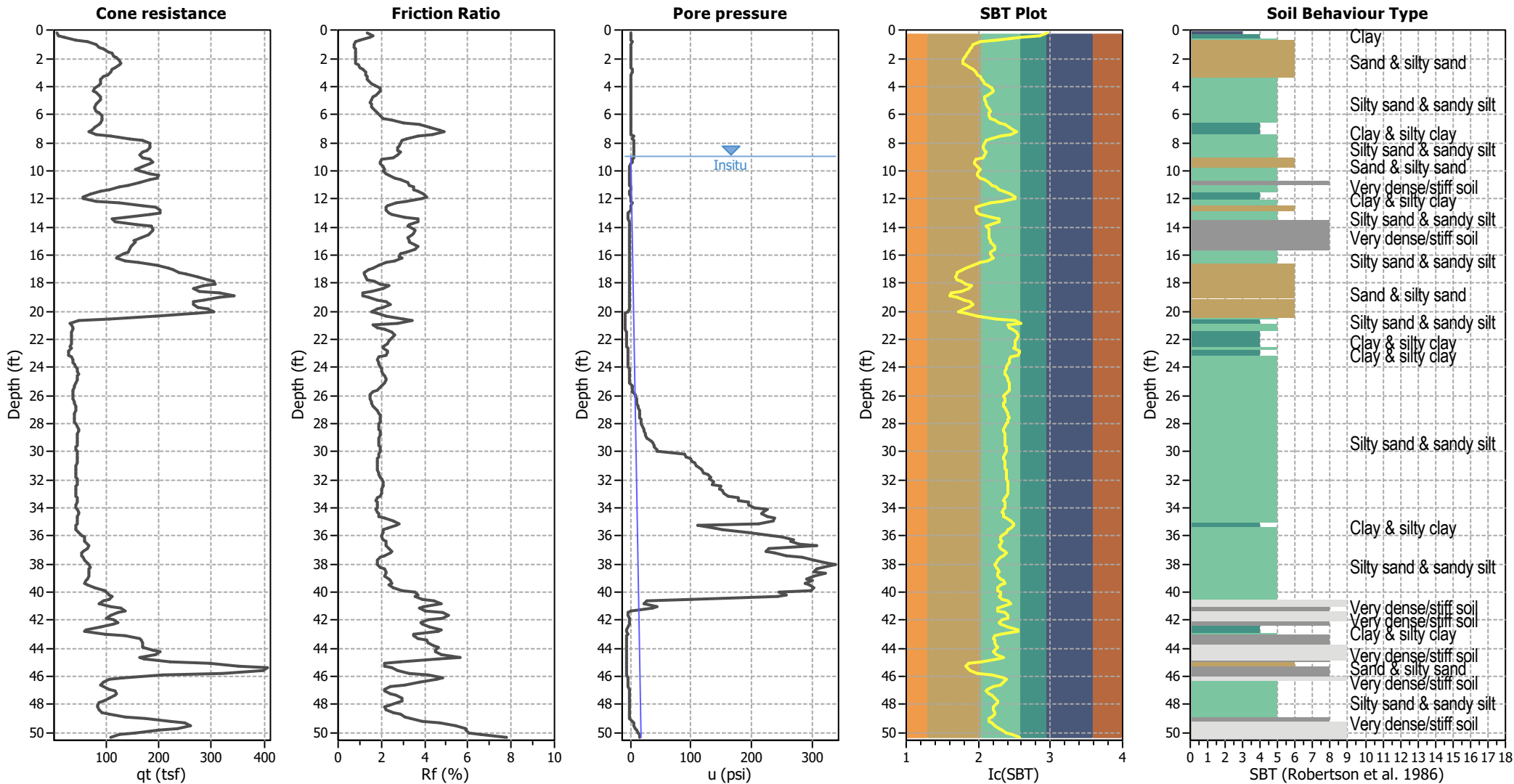
Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	9.00 ft	Use fill:	No	Clay like behavior	
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	5.00 ft	Fill height:	N/A	applied:	Sands only
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	No
Earthquake magnitude M_w :	6.80	Ic cut-off value:	2.30	Trans. detect. applied:	No	Limit depth:	N/A
Peak ground acceleration:	0.96	Unit weight calculation:	Based on SBT	K_o applied:	Yes	MSF method:	Method based



Zone A₁: Cyclic liquefaction likely depending on size and duration of cyclic loading
 Zone A₂: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
 Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
 Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots

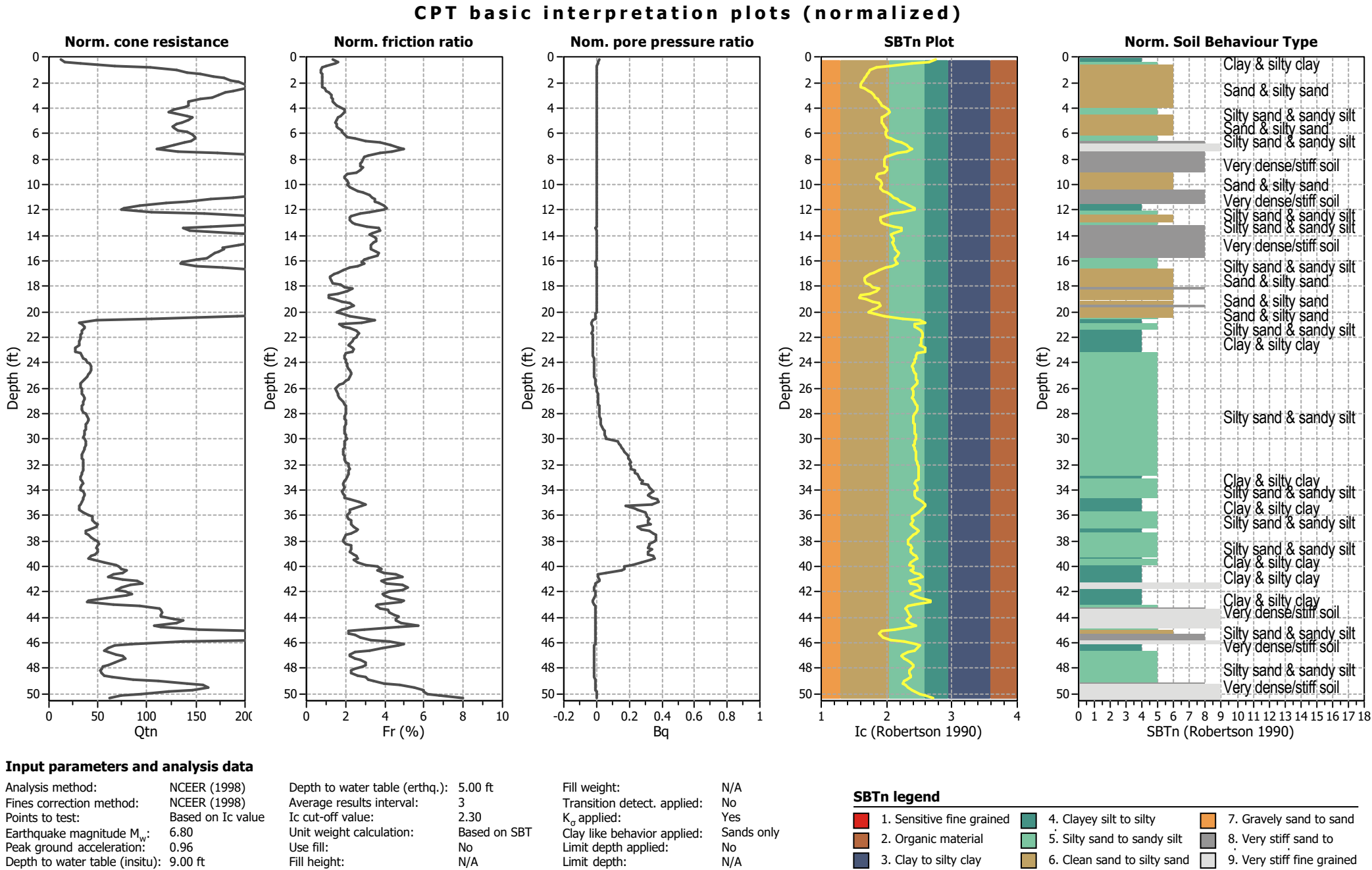


Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.30	K ₀ applied:	Yes
Earthquake magnitude M _w :	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.96	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	9.00 ft	Fill height:	N/A	Limit depth:	N/A

SBT legend

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



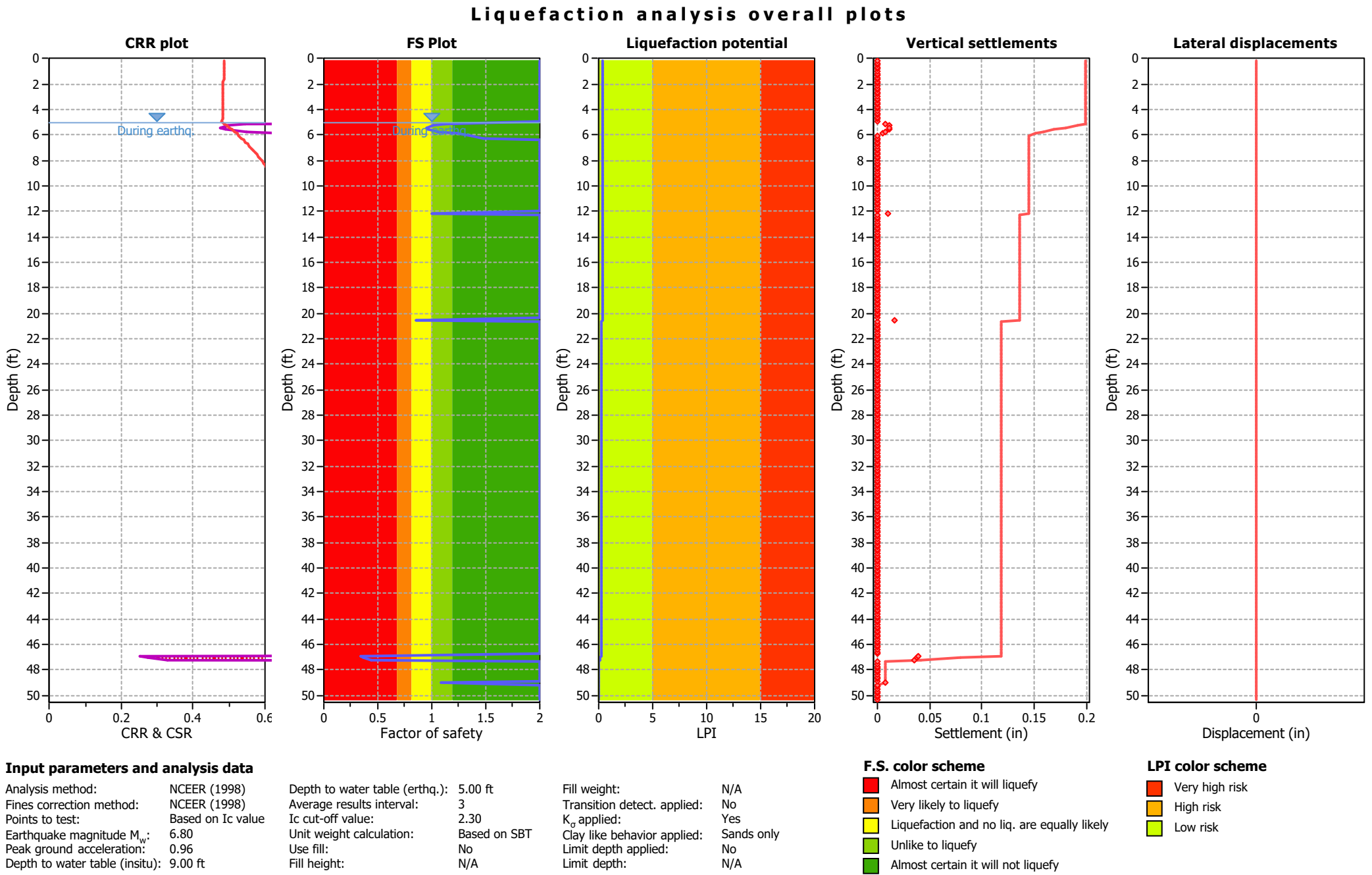
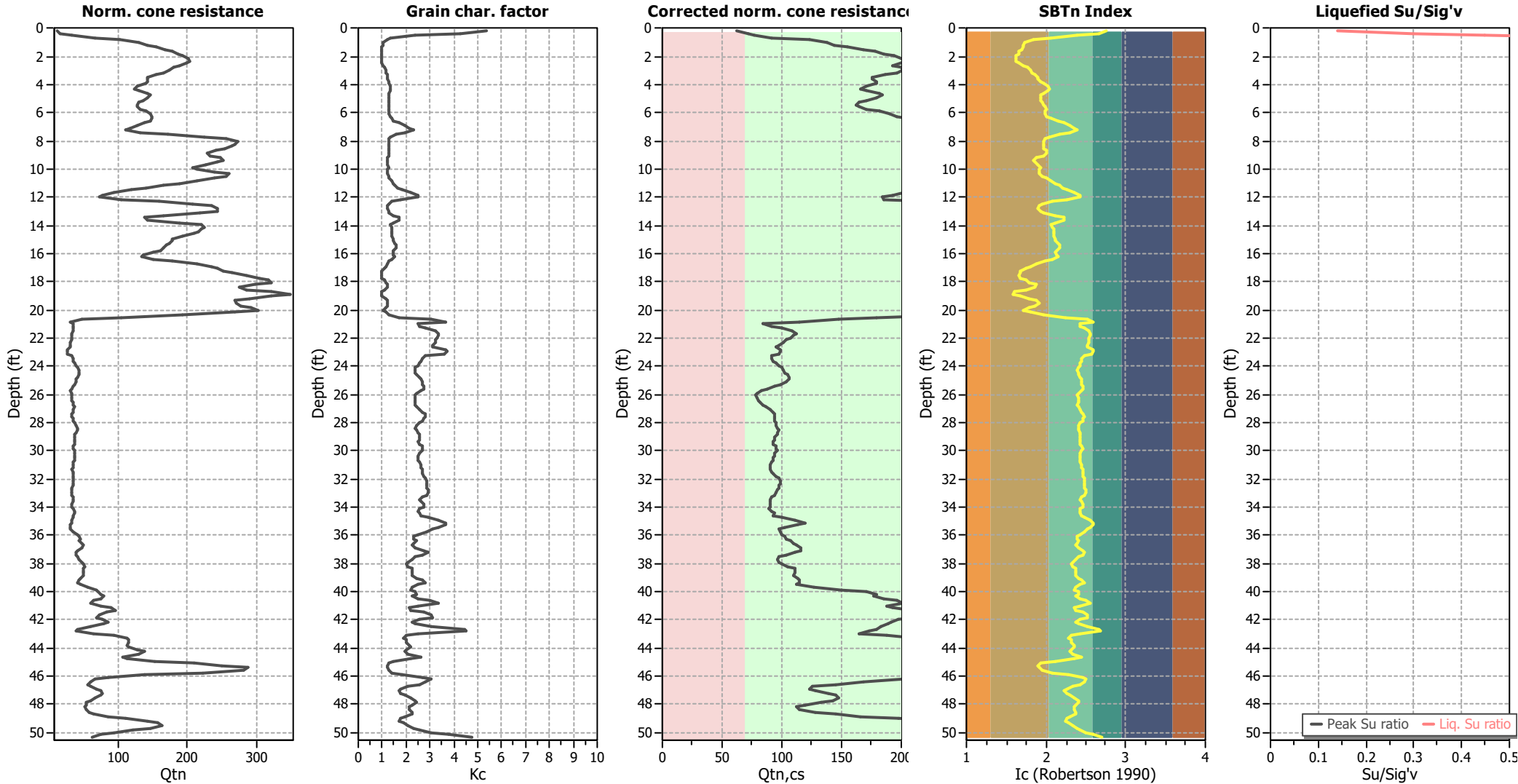


Figure 10 consists of three plots related to soil liquefaction analysis.

- Left Plot:** A log-log plot of Normalized CPT penetration resistance (y-axis, 1 to 1,000) versus Normalized friction ratio (%) (x-axis, 0.1 to 10). The plot is divided into several regions labeled A₁, A₂, B, and C. Region A₁ is labeled "Normally Consolidated" and "Increasing Sensitivity". Region A₂ is labeled "Increasing ϕ' ". Region B is labeled "Increasing CPT & age". Region C is labeled "Increasing Sensitivity". Data points are shown as red diamonds and green circles. A red curve separates the regions.
- Middle Plot:** A log-log plot of Cyclic Stress Ratio* (CSR*) (y-axis, 0 to 0.8) versus $Q_{tn,cs}$ (x-axis, 0 to 200). The plot shows a black curve representing the boundary between "Liquefaction" (above) and "No Liquefaction" (below). Data points are shown as red diamonds and blue circles.
- Right Plot:** A log-log plot of Thickness of liquefiable sand layer, H₂ (m) (y-axis, 0.0 to 12.0) versus Thickness of surface layer, H₁ (m) (x-axis, 0 to 10). The plot shows a blue curve representing the boundary between "Liquefaction-induced ground damage" (above) and "No Liquefaction" (below). Data points are shown as red diamonds and blue circles. The plot is labeled "Analysis PGA: 0.96".

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.30	K _o applied:	Yes
Earthquake magnitude M _w :	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.96	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	9.00 ft	Fill height:	N/A	Limit depth:	N/A

Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on I_c value	I_c cut-off value:	2.30	K_o applied:	Yes
Earthquake magnitude M_w :	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.96	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	9.00 ft	Fill height:	N/A	Limit depth:	N/A

LIQUEFACTION ANALYSIS REPORT

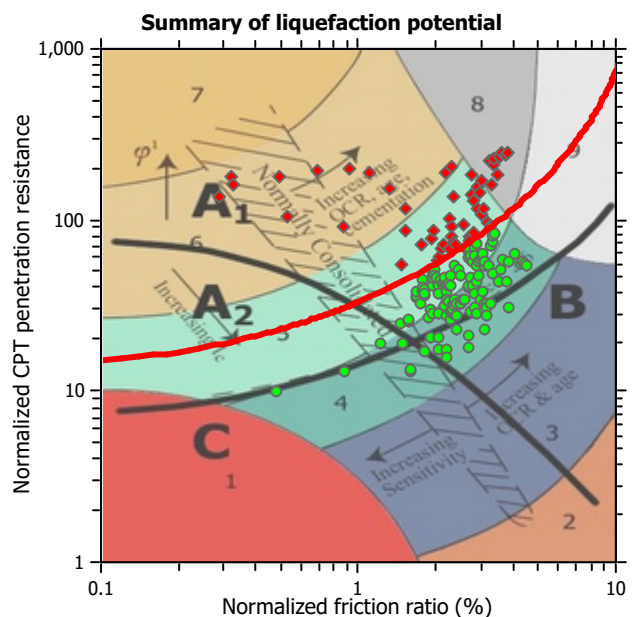
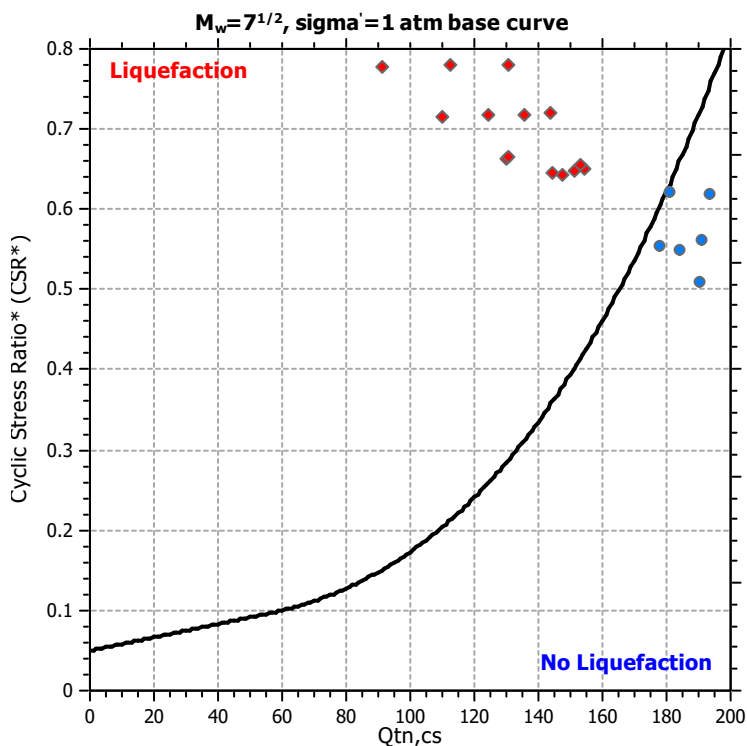
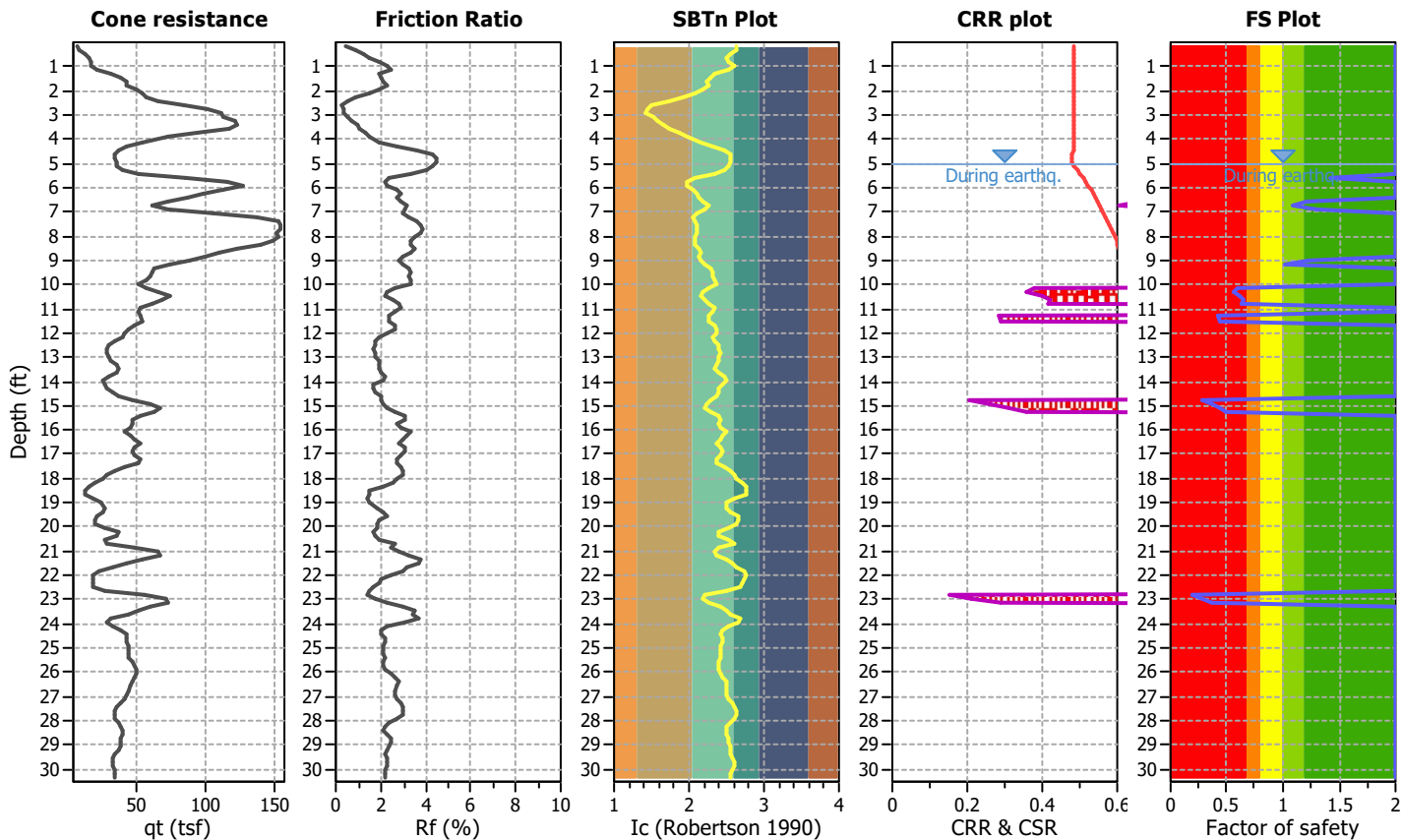
Project title : 1030 Kaiser Road Warehouse

Location : 1030 Kaiser Road, Napa, CA

CPT file : CPT-9

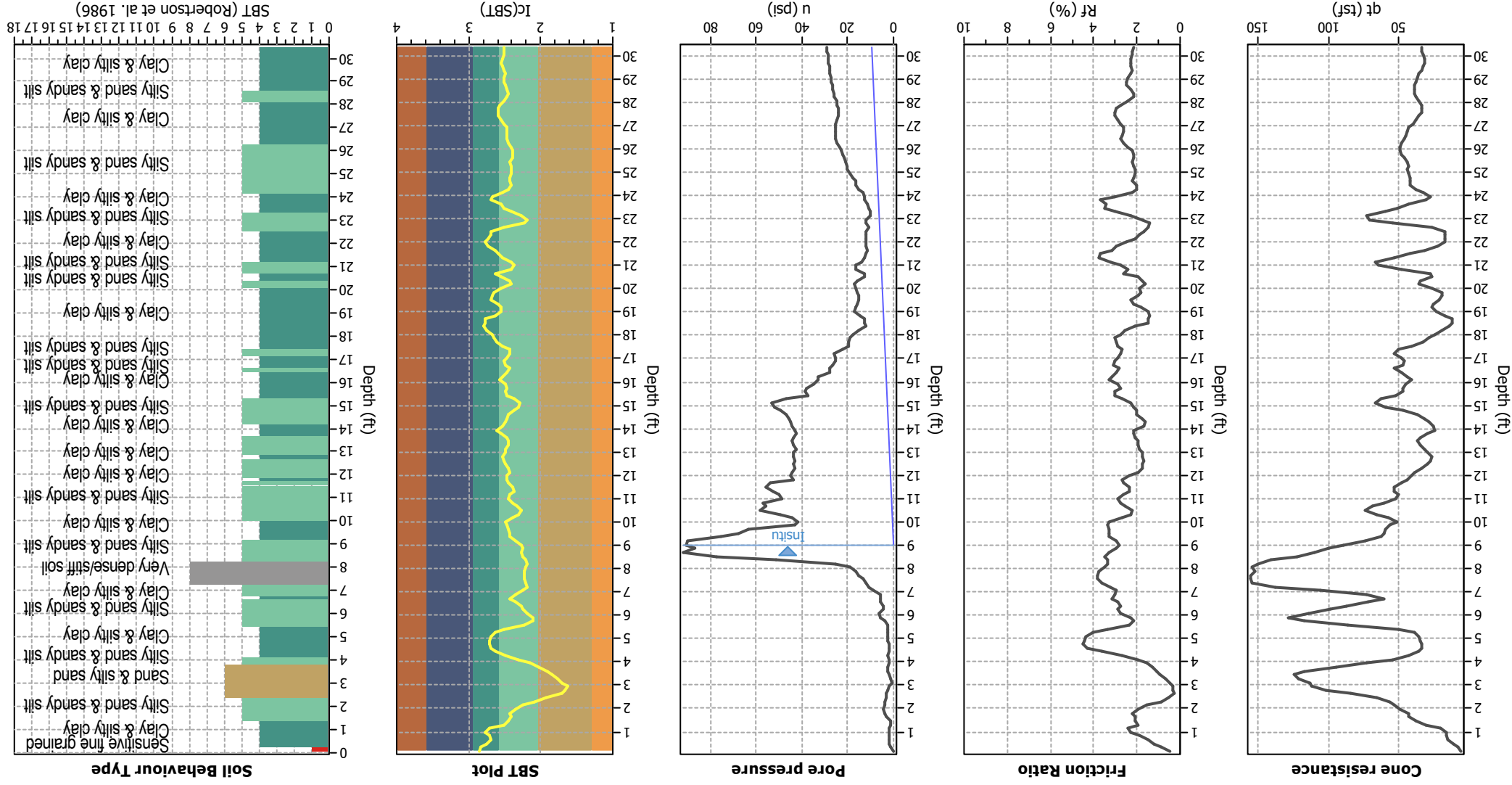
Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	9.00 ft	Use fill:	No	Clay like behavior	
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	5.00 ft	Fill height:	N/A	applied:	Sands only
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	No
Earthquake magnitude M_w :	6.80	Ic cut-off value:	2.30	Trans. detect. applied:	No	Limit depth:	N/A
Peak ground acceleration:	0.96	Unit weight calculation:	Based on SBT	K_o applied:	Yes	MSF method:	Method based



Zone A₁: Cyclic liquefaction likely depending on size and duration of cyclic loading
 Zone A₂: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
 Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
 Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



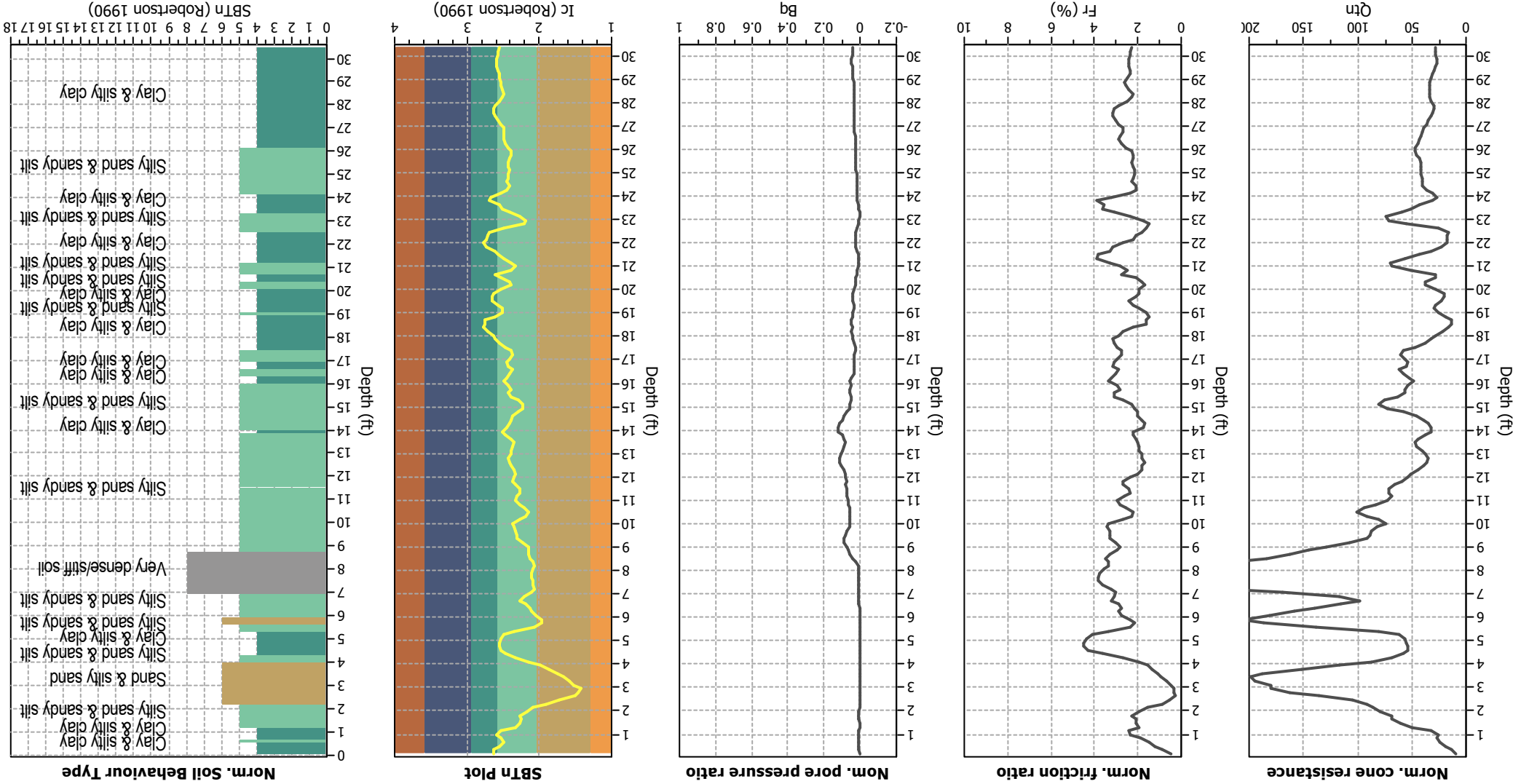
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (ethq.):	5.00 ft	Fill weight:	N/A
Finest correction method:	NCEER (1998)	Average residual interval:	3	k_v applied:	No
Points to test:	Based on I_c value	I_c cut-off value:	2.30	Clay like behavior applied:	Sands only
Earthquake magnitude M_w :	6.80	Unit weight calculation:	Based on SBT	Limit depth applied:	No
Peak ground acceleration:	0.96	Fill fill:	No	Limit depth:	N/A
Depth to water table (inst):	9.00 ft	Fill height:	N/A		

SPT legend

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

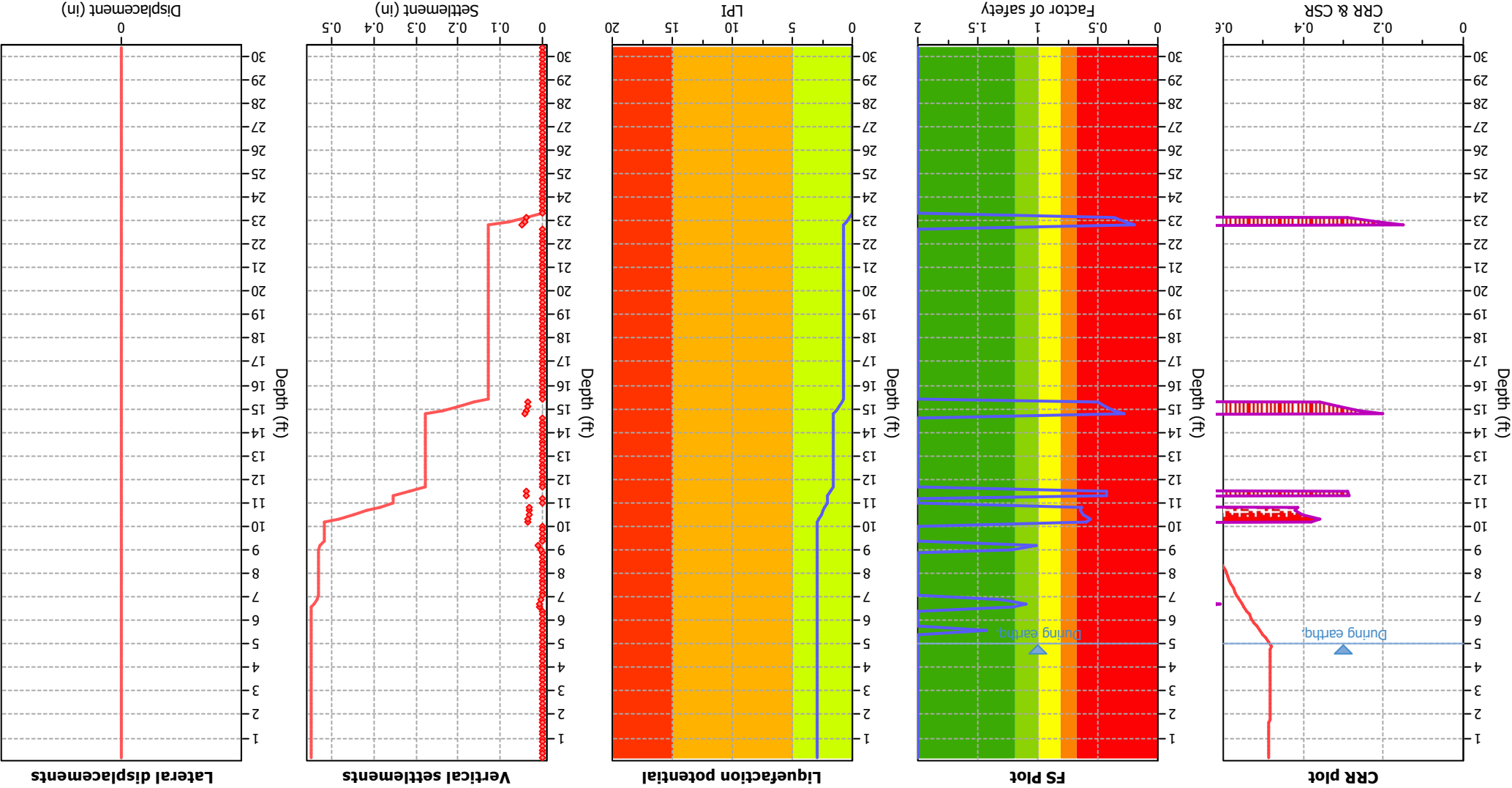
CPT basic interpretation plots (normalized)



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (earthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.30	K _g applied:	Yes
Earthquake magnitude M _w :	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.96	Use fill:	No	Limit depth applied:	No
Depth to water table (instn):	9.00 ft	Fill height:	N/A	Limit depth:	N/A

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method: NCEER (1998)
Fines correction method: NCEER (1998)
Points to test: Based on I_c value
Earthquake magnitude M_w : 6.80
Peak ground acceleration: 0.96
Depth to water table (instn): 9.00 ft

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

Fill weight: N/A
Transition detect. applied: No
 K_0 applied: Yes
Clay like behavior applied: Sands only
Limit depth applied: No
Limit depth: N/A

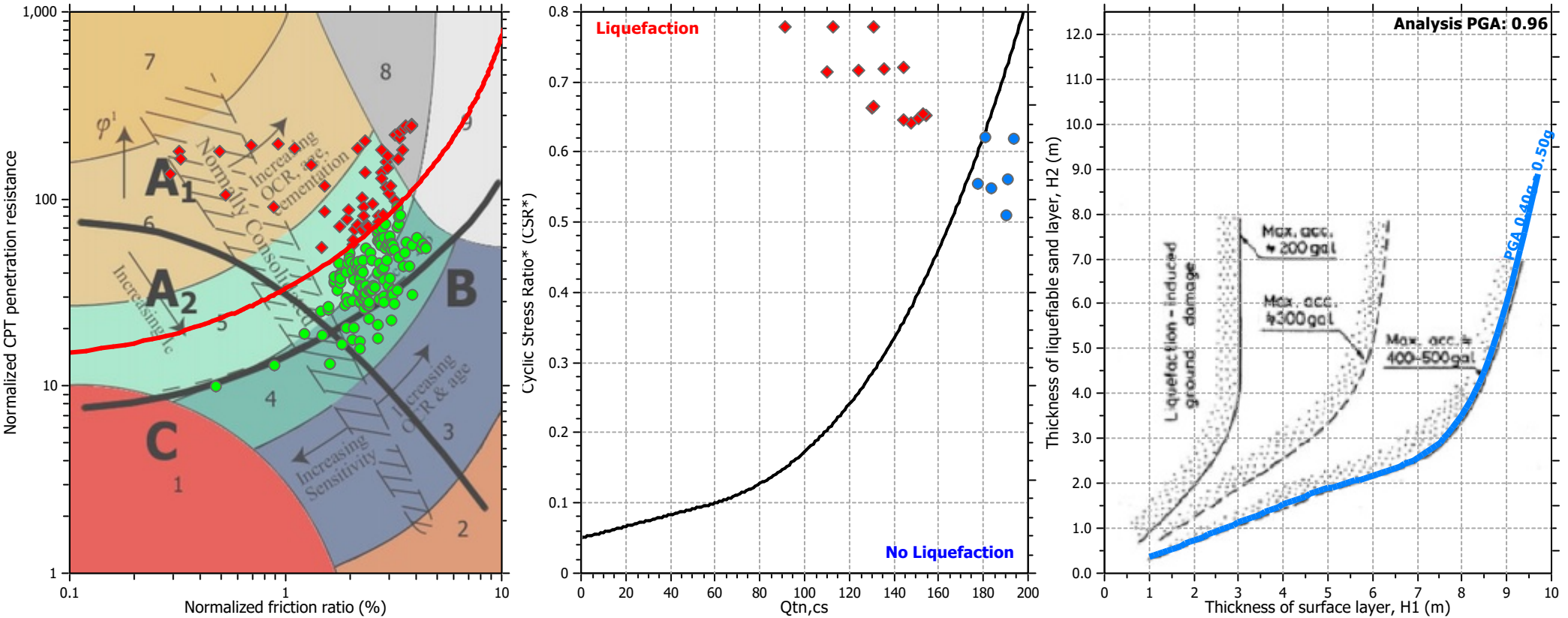
F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

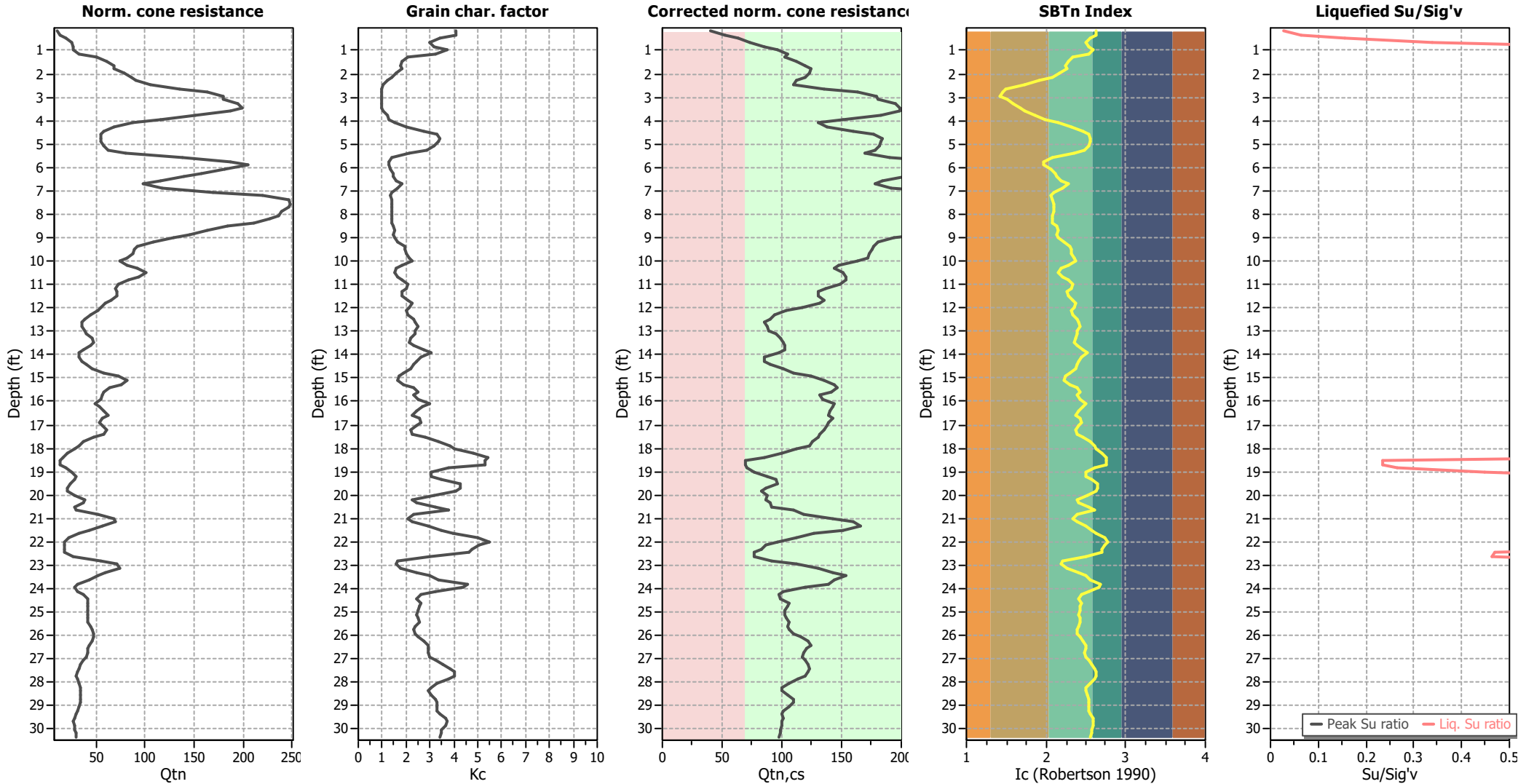
Liquefaction analysis summary plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.30	K_0 applied:	Yes
Earthquake magnitude M_w :	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.96	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	9.00 ft	Fill height:	N/A	Limit depth:	N/A

Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.30	K _o applied:	Yes
Earthquake magnitude M _w :	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.96	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	9.00 ft	Fill height:	N/A	Limit depth:	N/A

LIQUEFACTION ANALYSIS REPORT

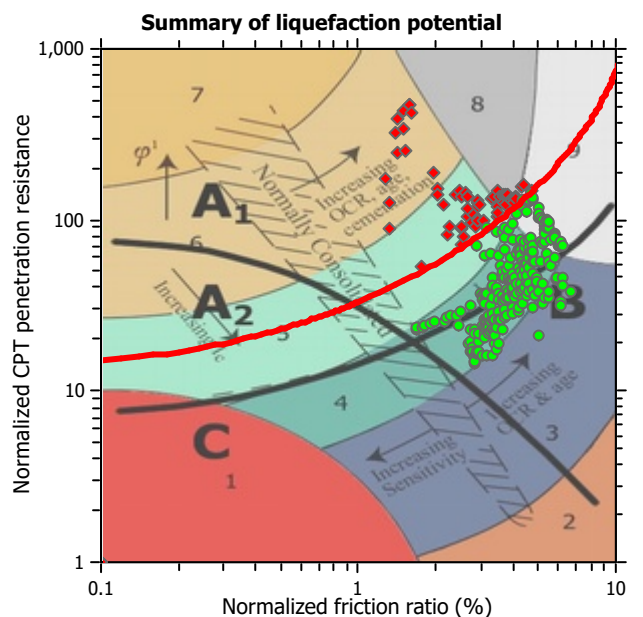
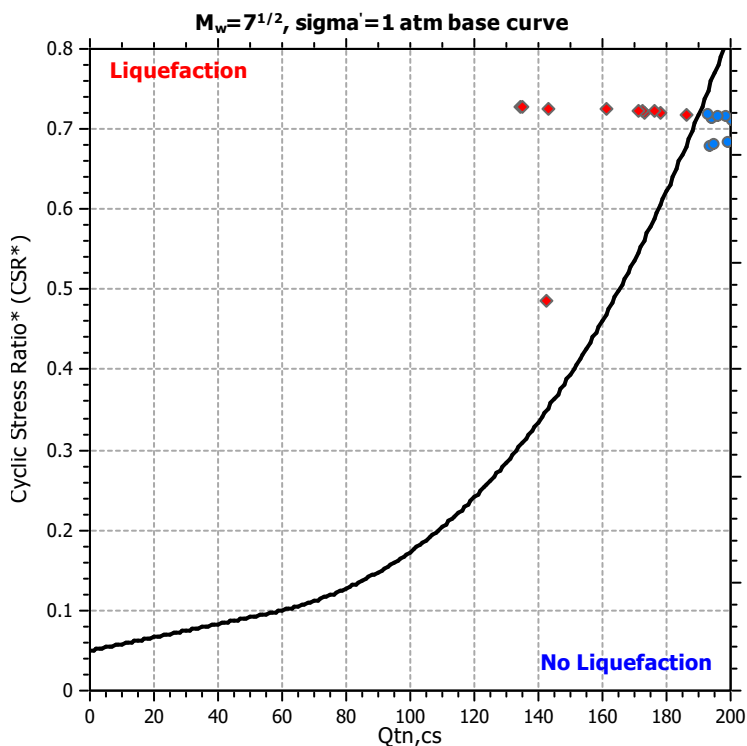
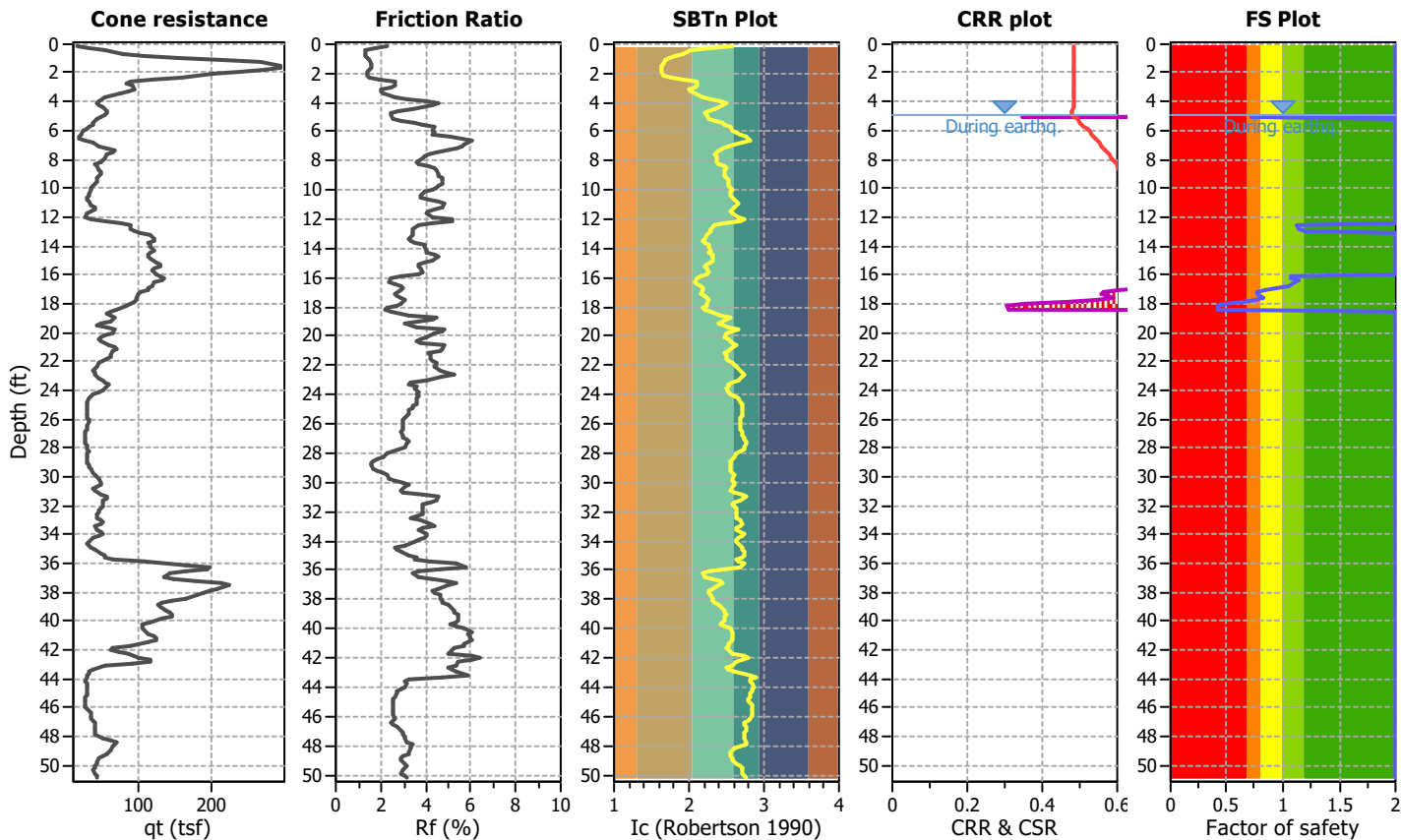
Project title : 1030 Kaiser Road Warehouse

Location : 1030 Kaiser Road, Napa, CA

CPT file : CPT-01

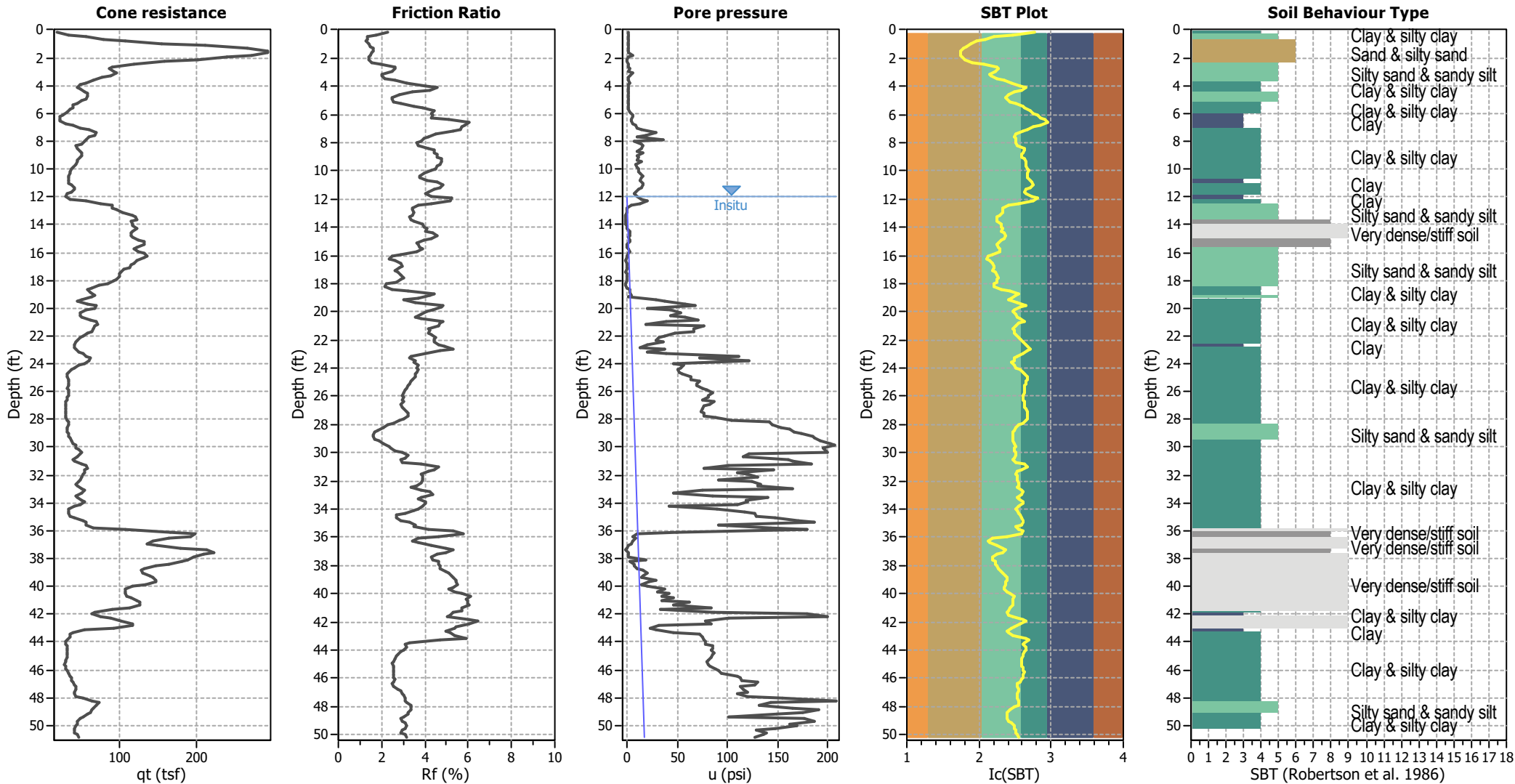
Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	12.00 ft	Use fill:	No	Clay like behavior	
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	5.00 ft	Fill height:	N/A	applied:	Sands only
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	No
Earthquake magnitude M_w :	6.80	Ic cut-off value:	2.30	Trans. detect. applied:	No	Limit depth:	N/A
Peak ground acceleration:	0.96	Unit weight calculation:	Based on SBT	K_o applied:	Yes	MSF method:	Method based



Zone A₁: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A₂: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots

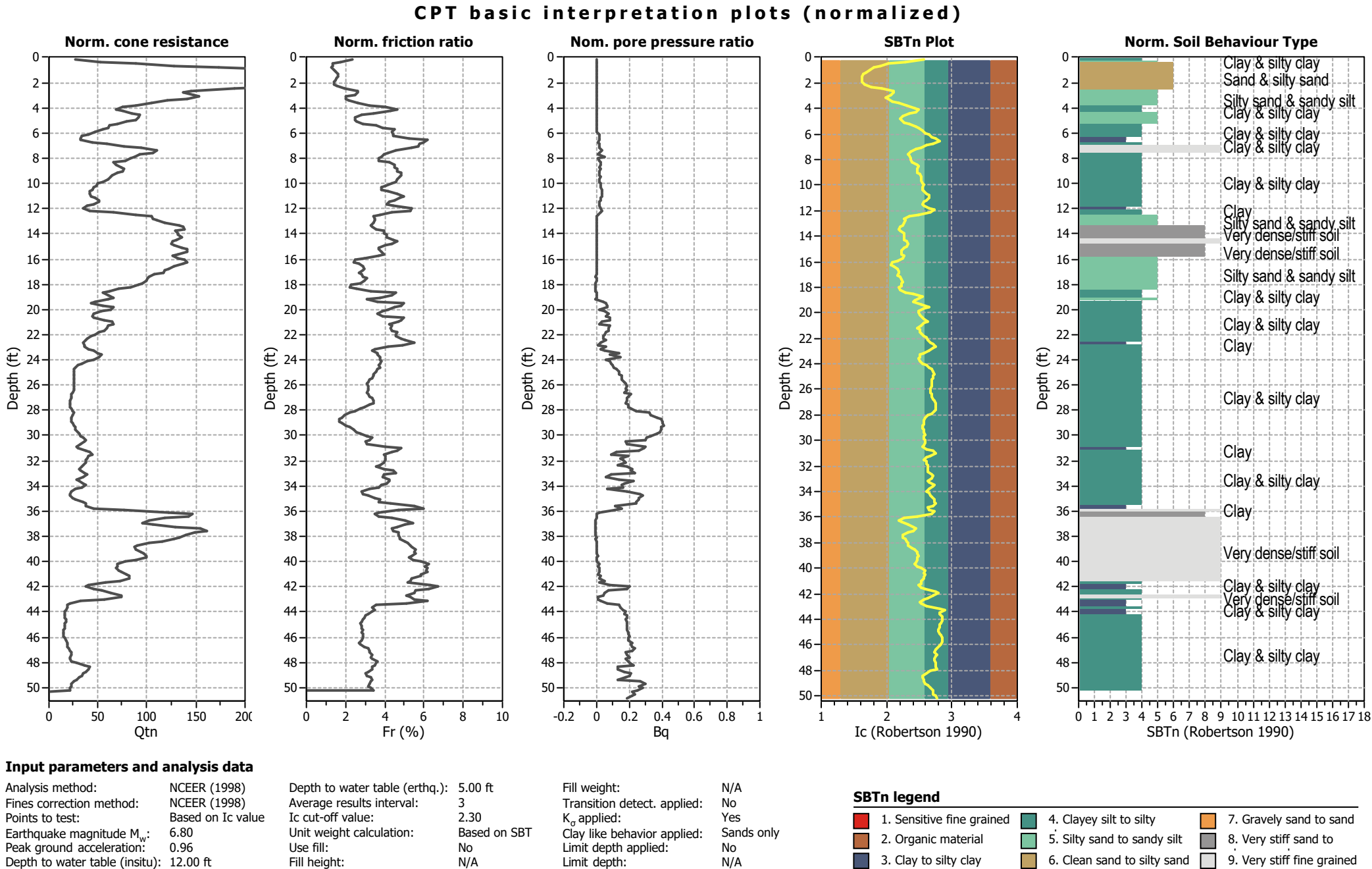


Input parameters and analysis data

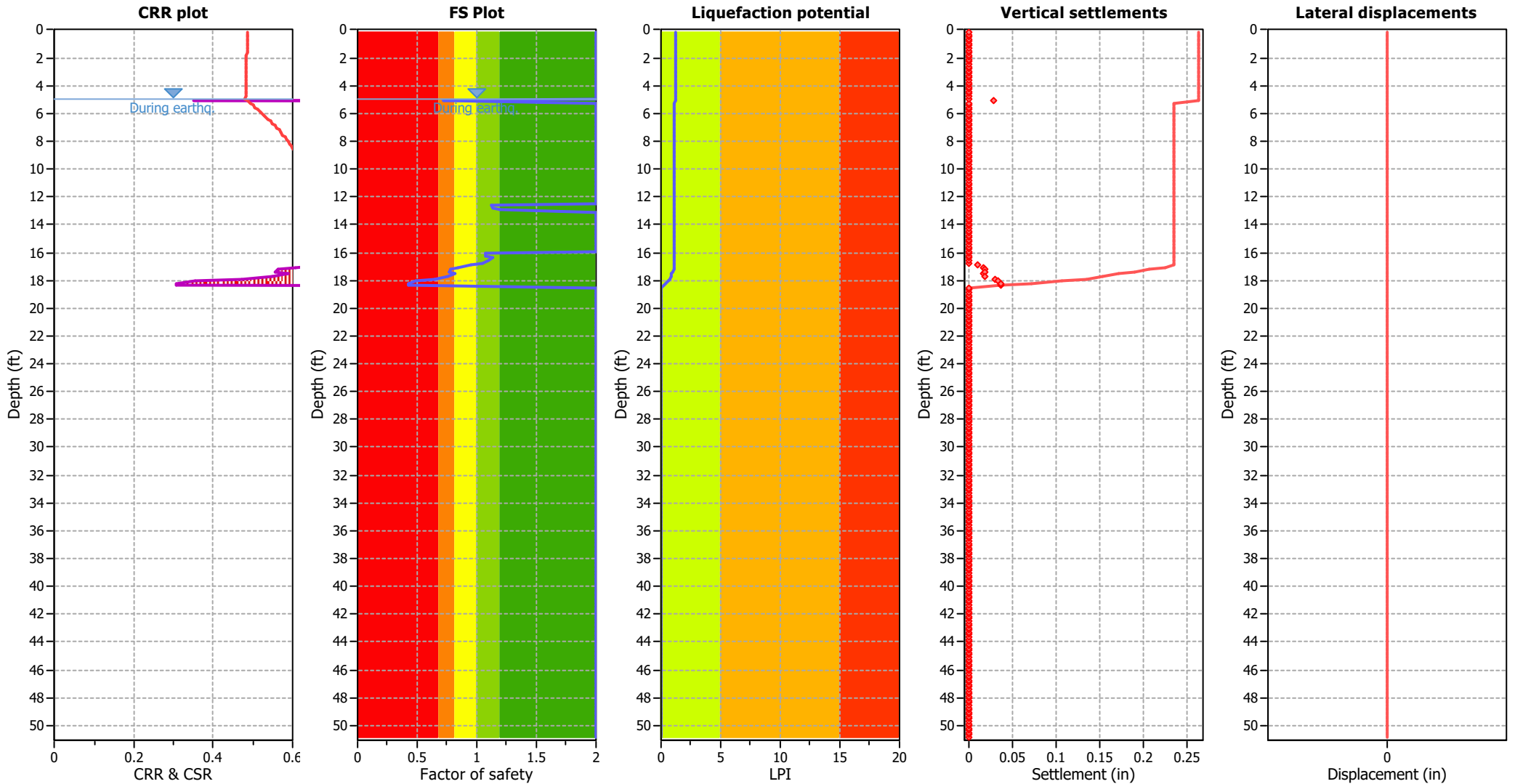
Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on I_c value	I_c cut-off value:	2.30	K_o applied:	Yes
Earthquake magnitude M_w :	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.96	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	12.00 ft	Fill height:	N/A	Limit depth:	N/A

SBT legend

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



Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (earthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.30	K _o applied:	Yes
Earthquake magnitude M _w :	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.96	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	12.00 ft	Fill height:	N/A	Limit depth:	N/A

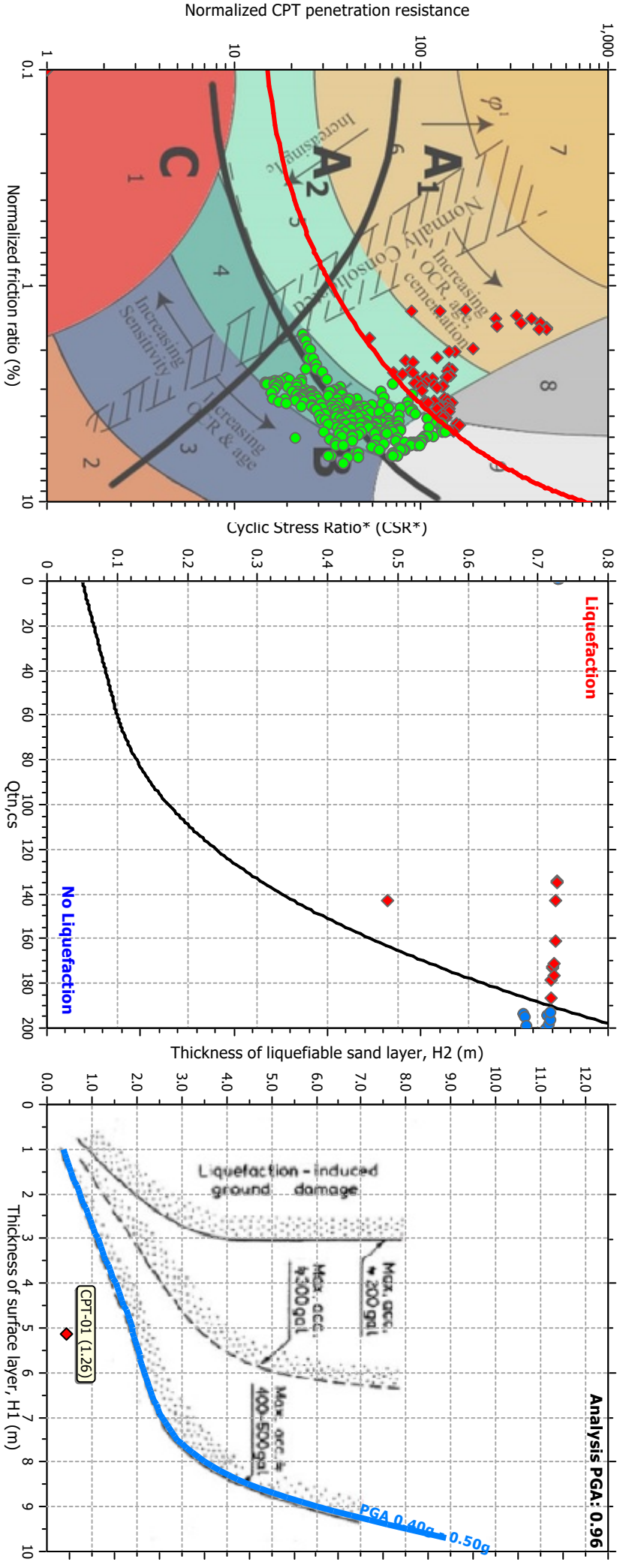
F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

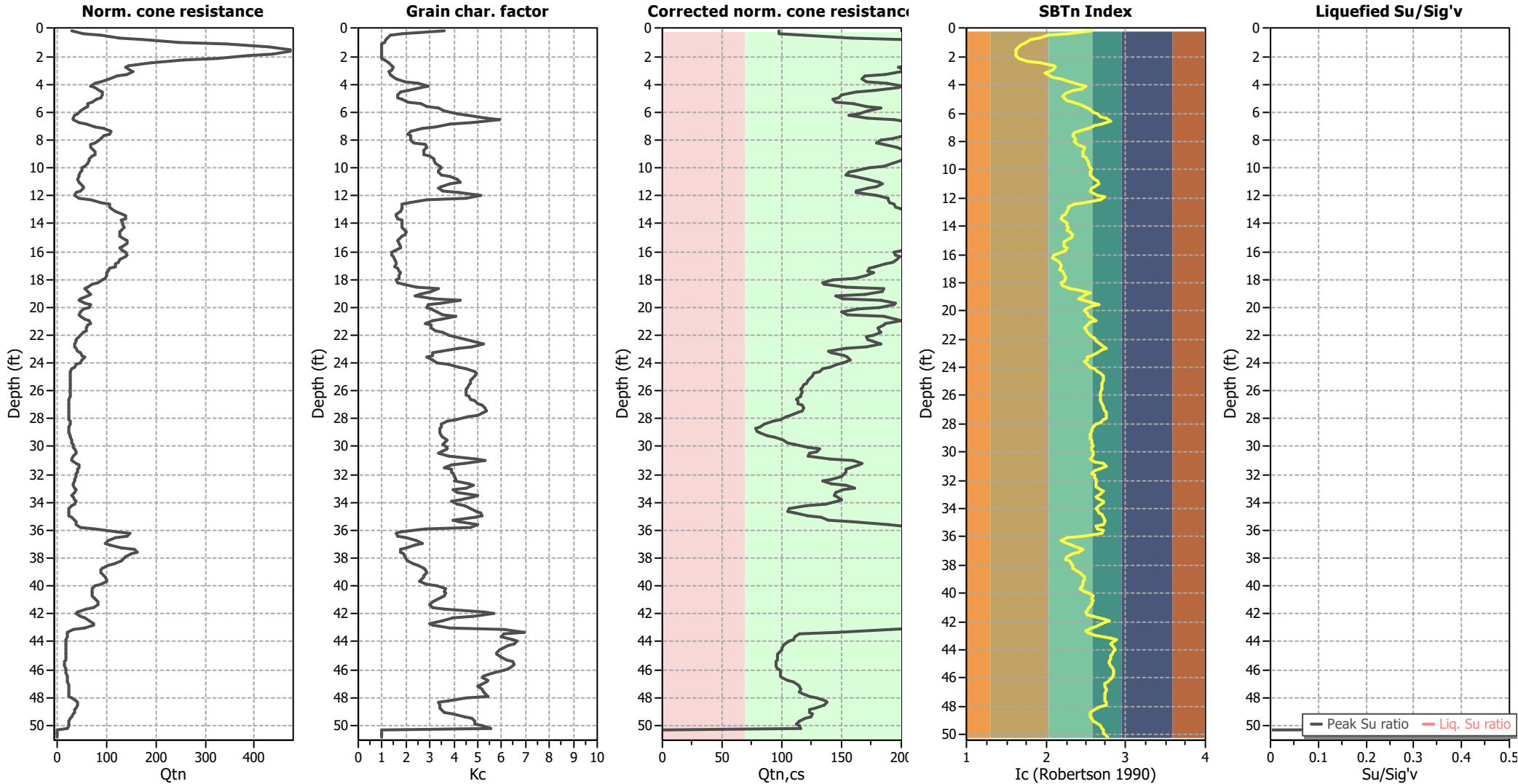
Liquefaction analysis summary plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (ethq):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.30	K _s applied:	Yes
Earthquake magnitude M _w :	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.96	Use fill:	No	Limit depth applied:	No
Depth to water table (instu):	12.00 ft	Fill height:	N/A	Limit depth:	N/A

Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.30	K _o applied:	Yes
Earthquake magnitude M _w :	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.96	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	12.00 ft	Fill height:	N/A	Limit depth:	N/A

LIQUEFACTION ANALYSIS REPORT

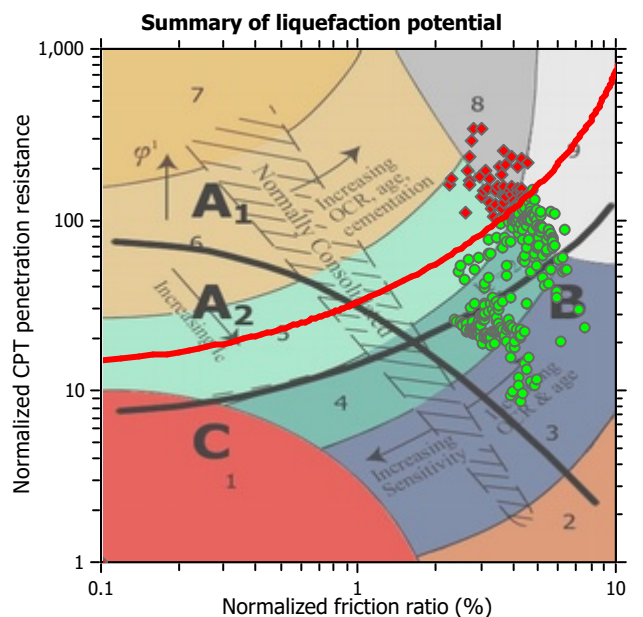
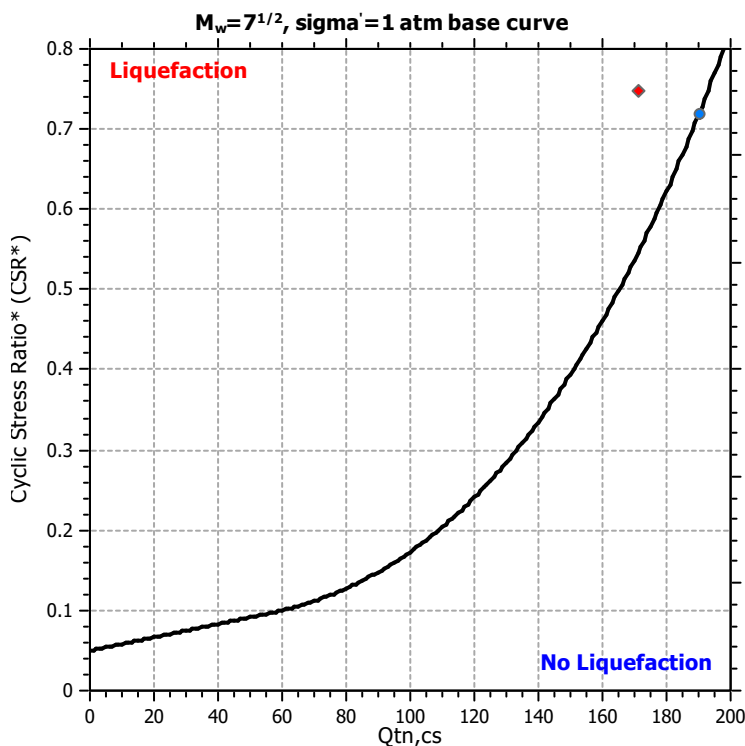
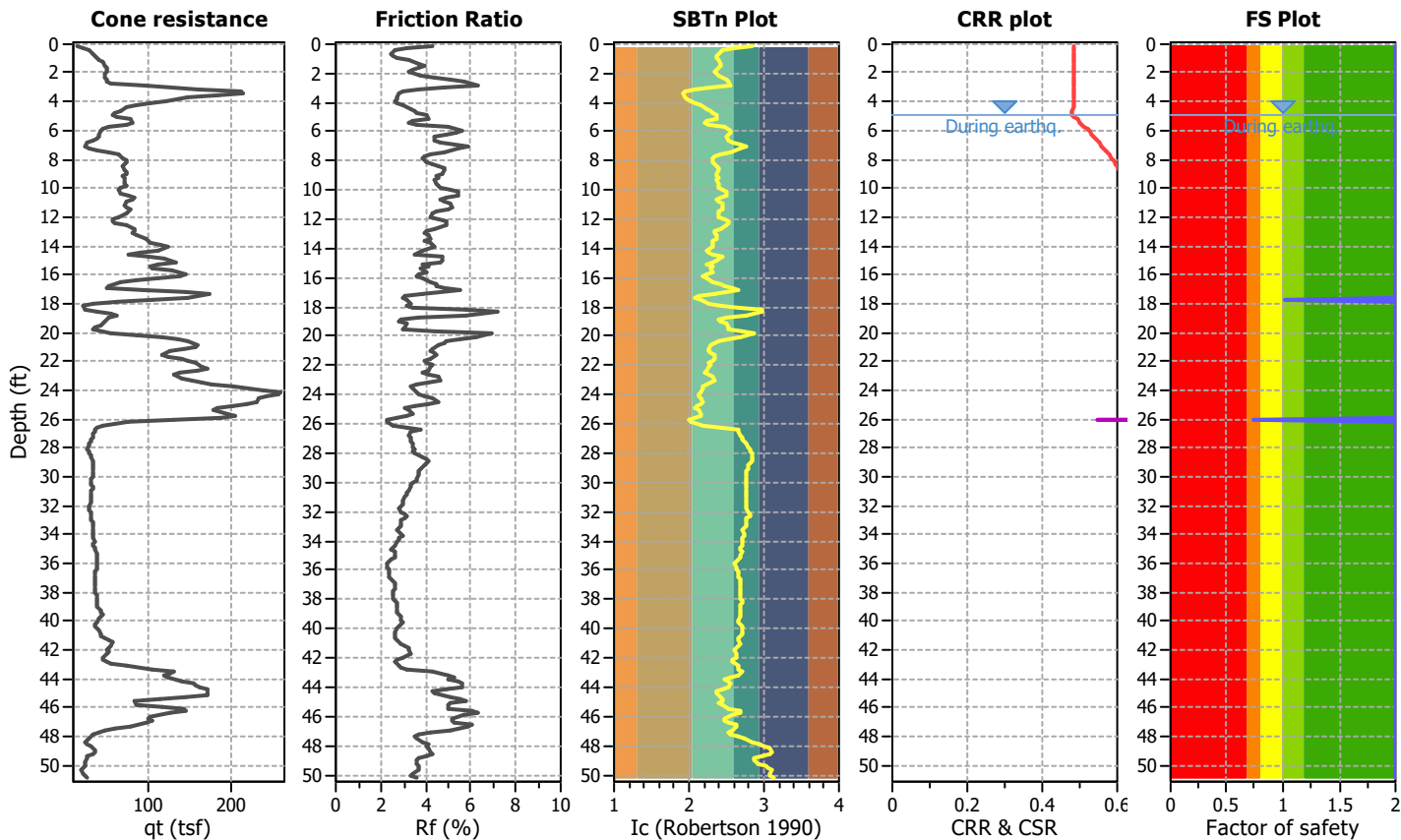
Project title : 1030 Kaiser Road Warehouse

Location : 1030 Kaiser Road, Napa, CA

CPT file : CPT-02

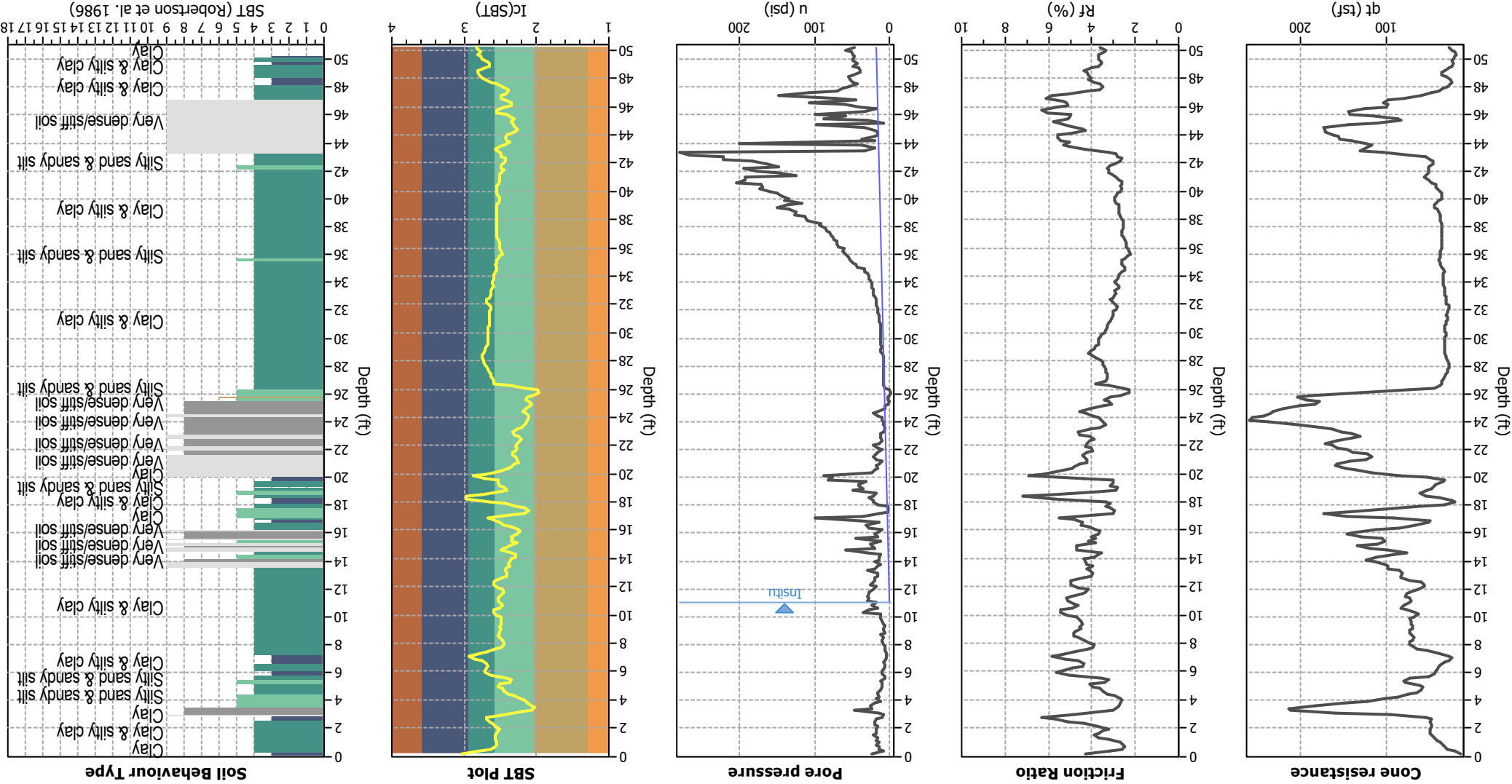
Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	11.00 ft	Use fill:	No	Clay like behavior	
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	5.00 ft	Fill height:	N/A	applied:	Sands only
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	No
Earthquake magnitude M_w :	6.80	Ic cut-off value:	2.30	Trans. detect. applied:	No	Limit depth:	N/A
Peak ground acceleration:	0.96	Unit weight calculation:	Based on SBT	K_o applied:	Yes	MSF method:	Method based

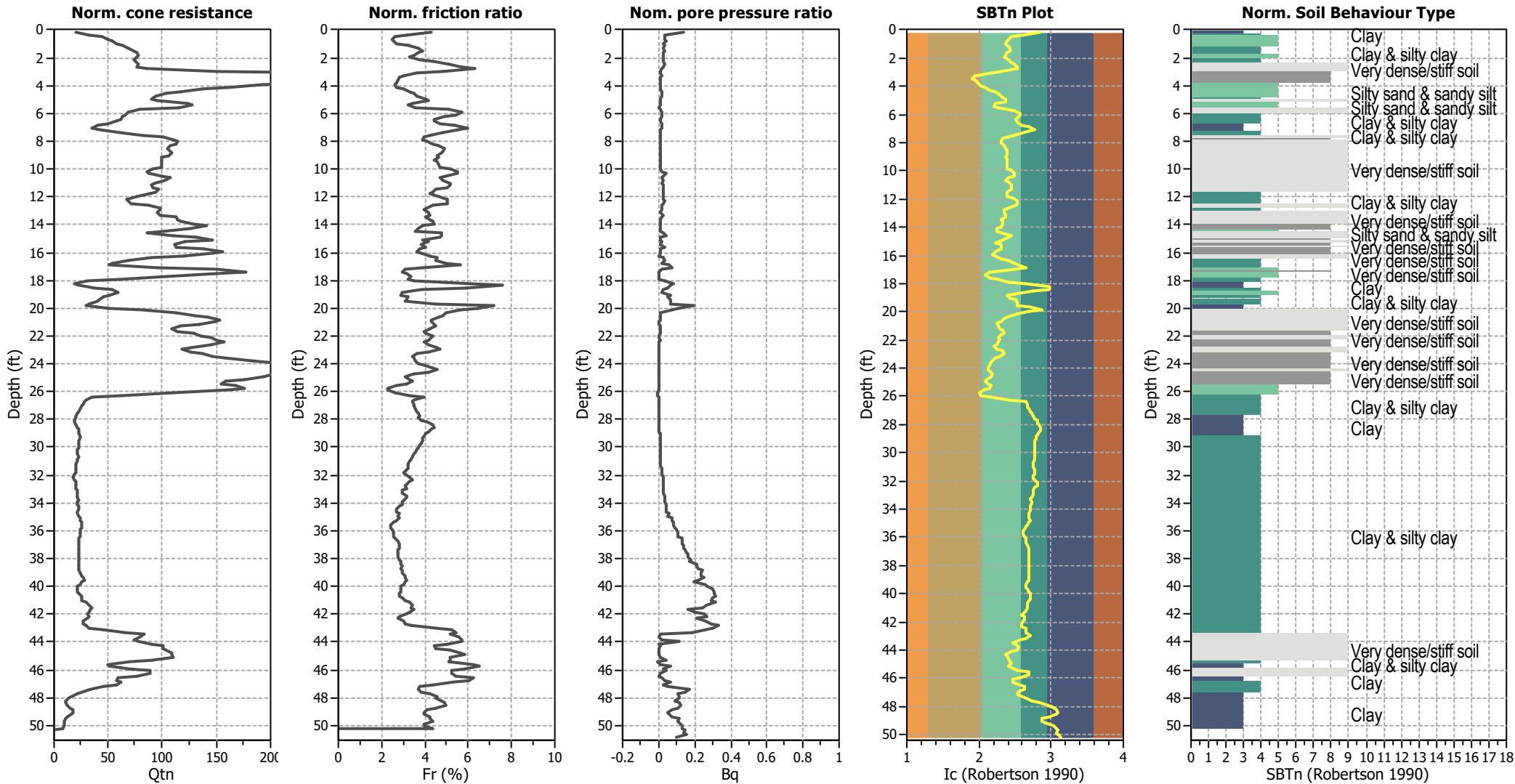


Zone A₁: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A₂: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



CPT basic interpretation plots (normalized)

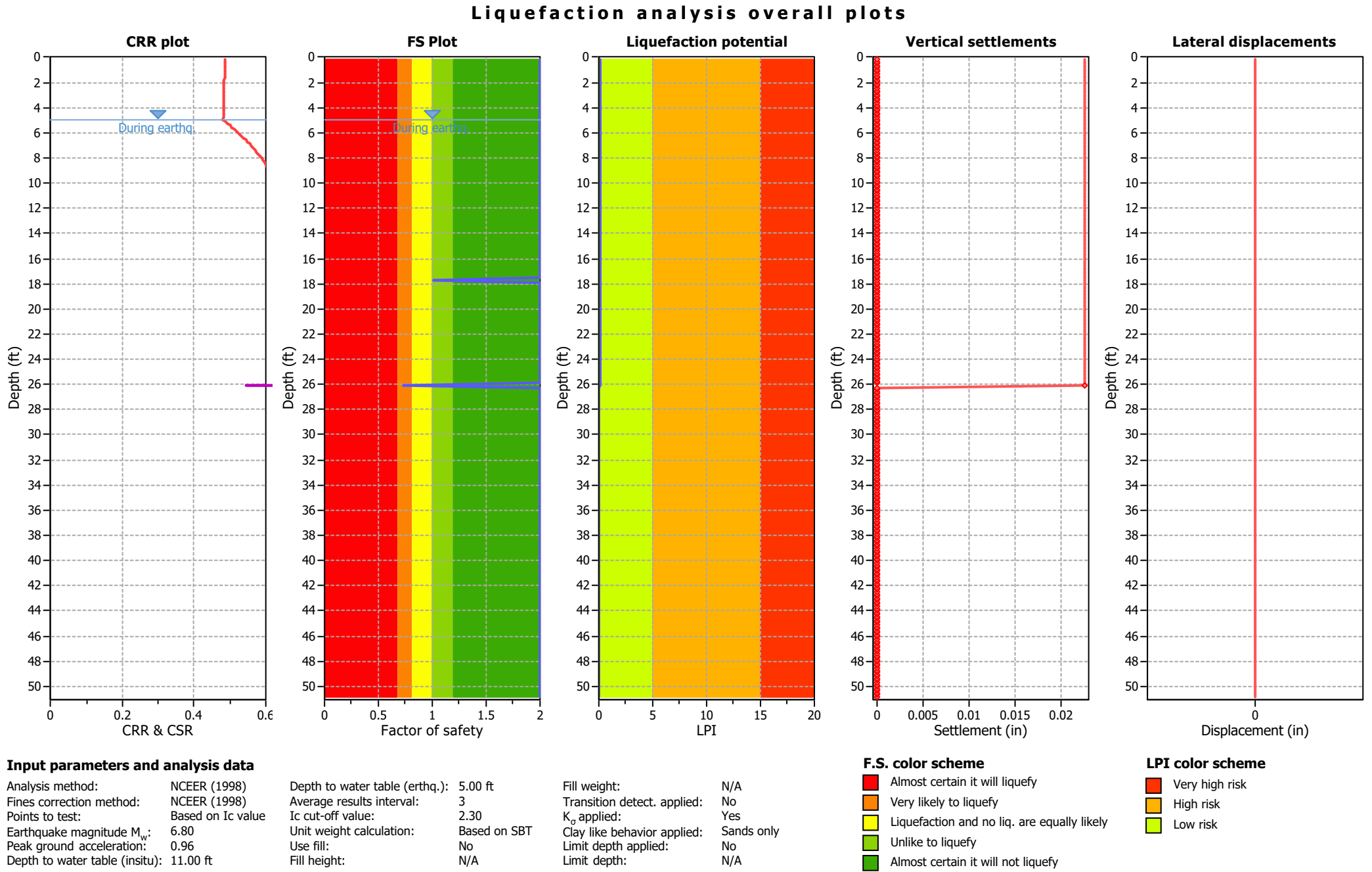


Input parameters and analysis data

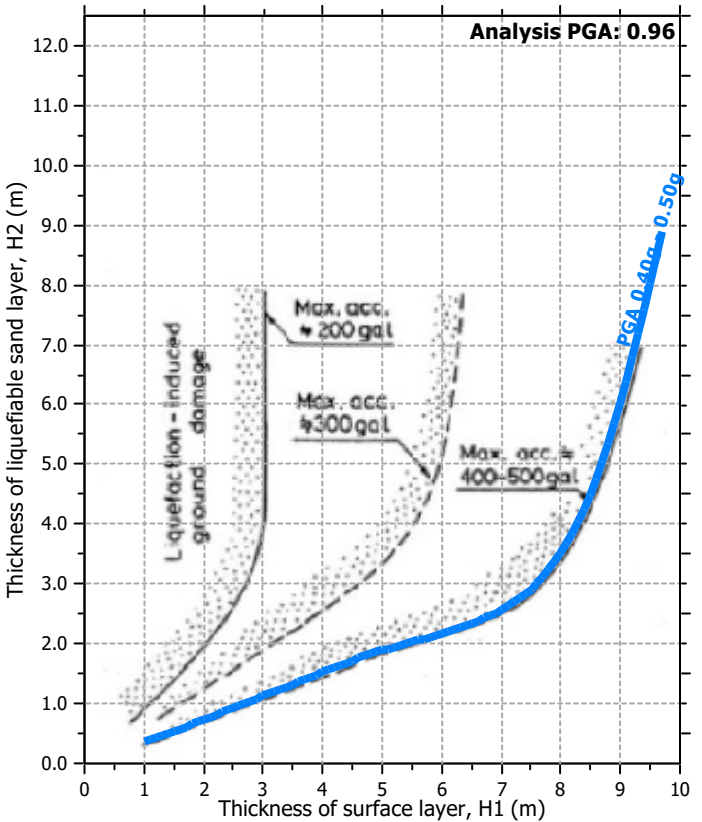
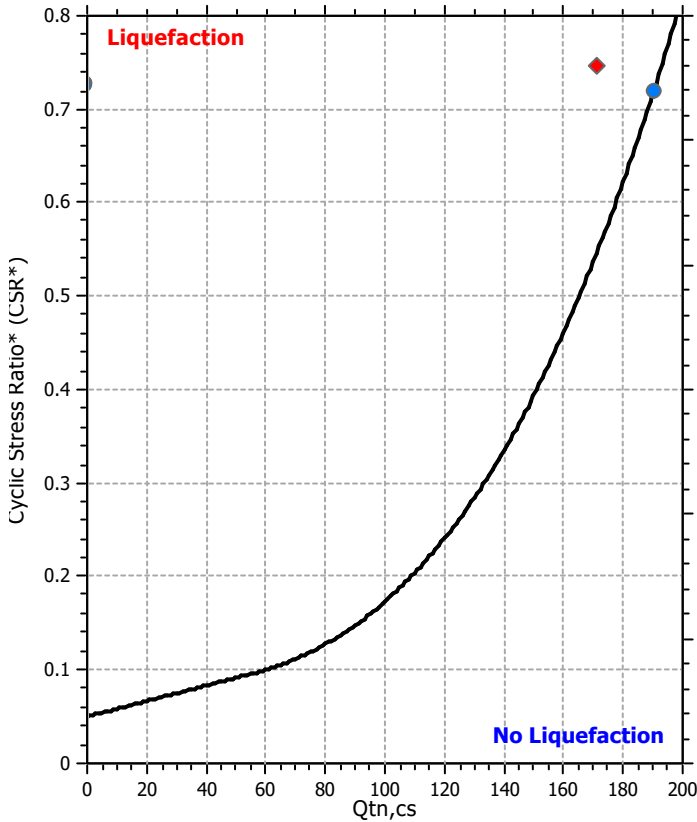
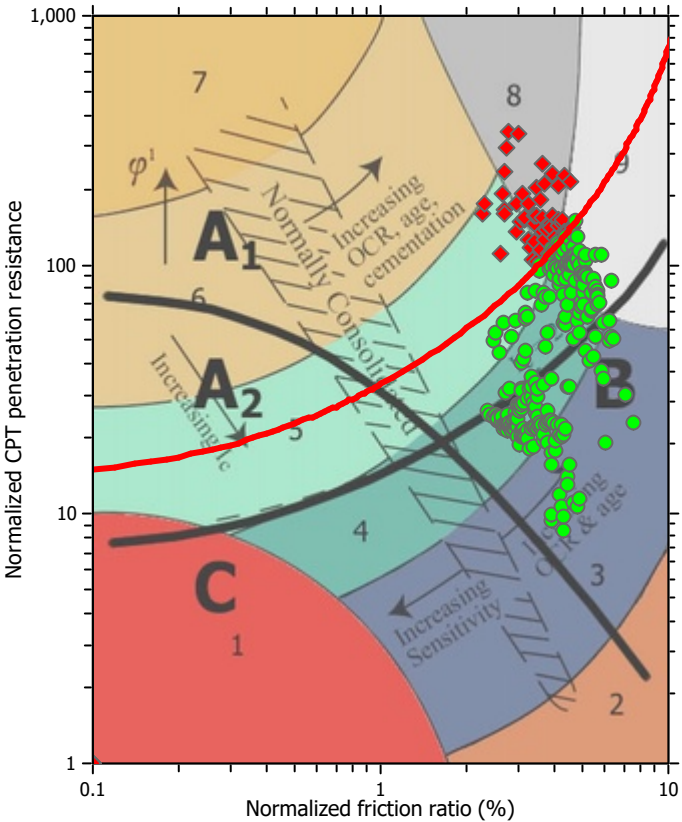
Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.30	K _o applied:	Yes
Earthquake magnitude M _w :	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.96	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	11.00 ft	Fill height:	N/A	Limit depth:	N/A

SBTn legend

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



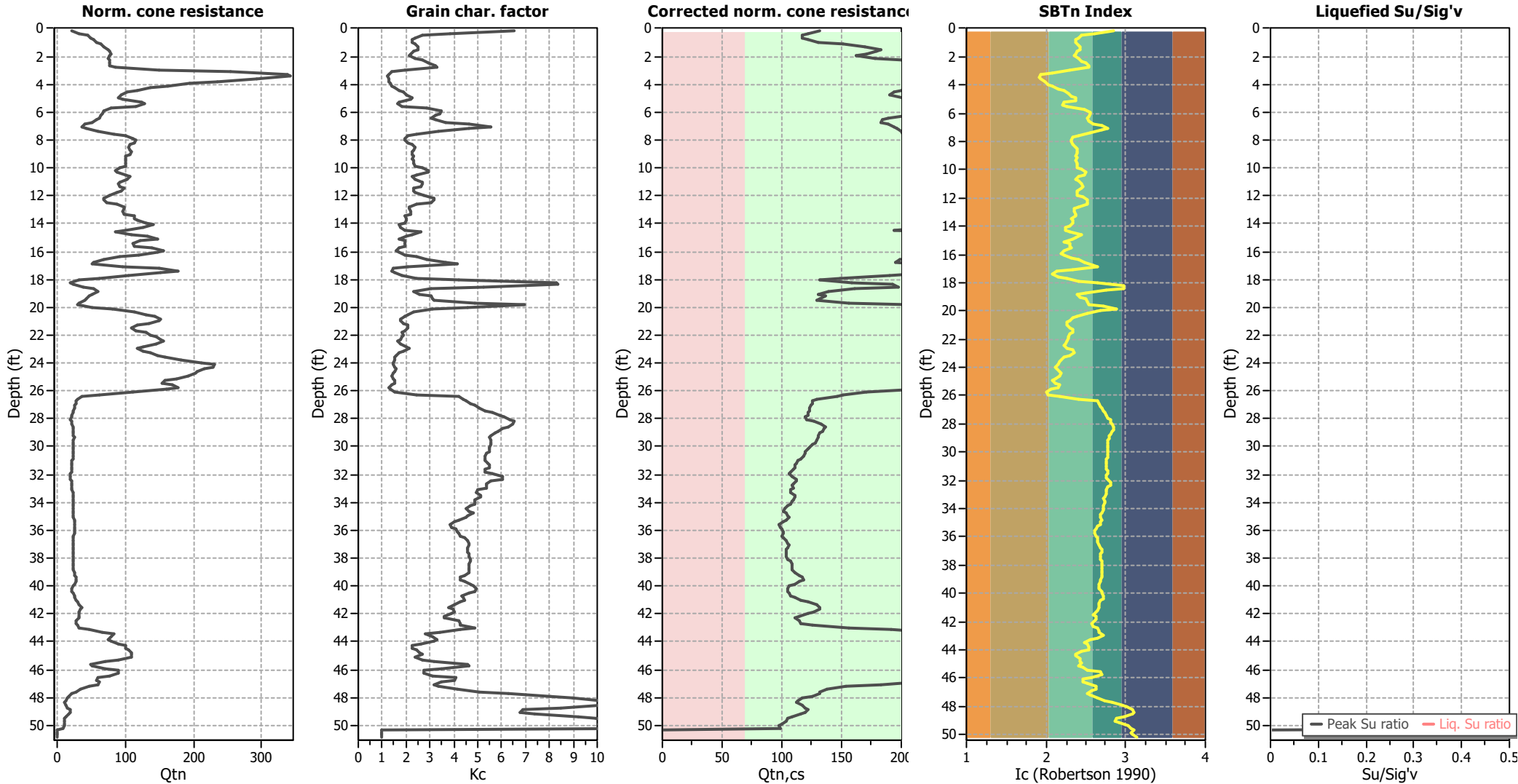
Liquefaction analysis summary plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.30	K_0 applied:	Yes
Earthquake magnitude M_w :	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.96	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	11.00 ft	Fill height:	N/A	Limit depth:	N/A

Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.30	K _o applied:	Yes
Earthquake magnitude M _w :	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.96	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	11.00 ft	Fill height:	N/A	Limit depth:	N/A

LIQUEFACTION ANALYSIS REPORT

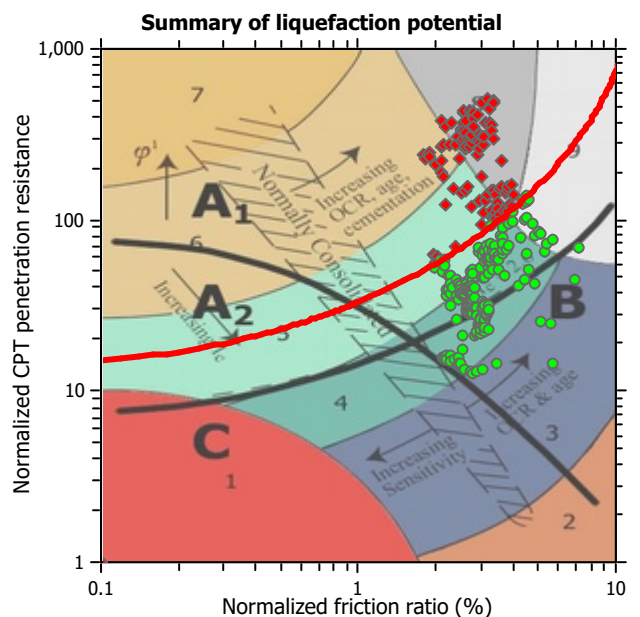
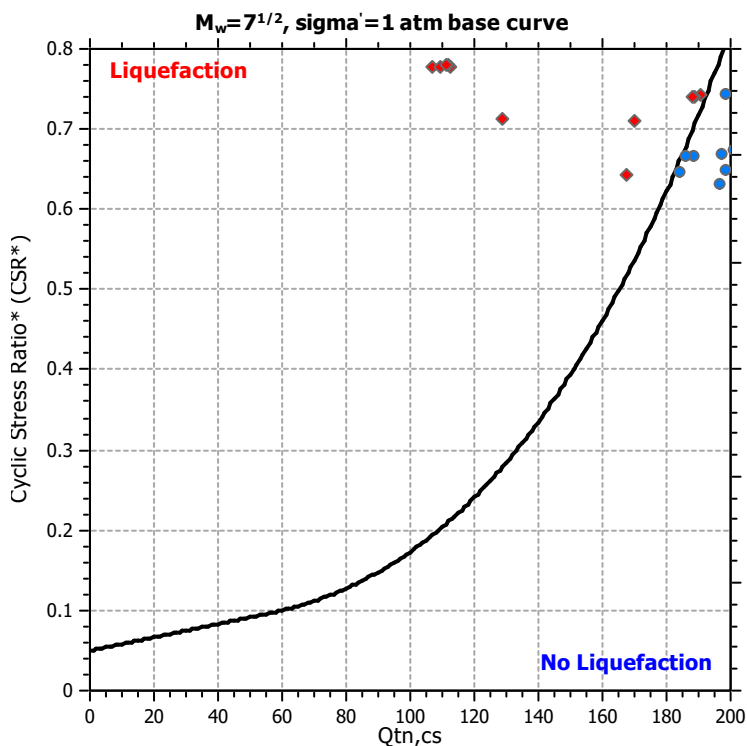
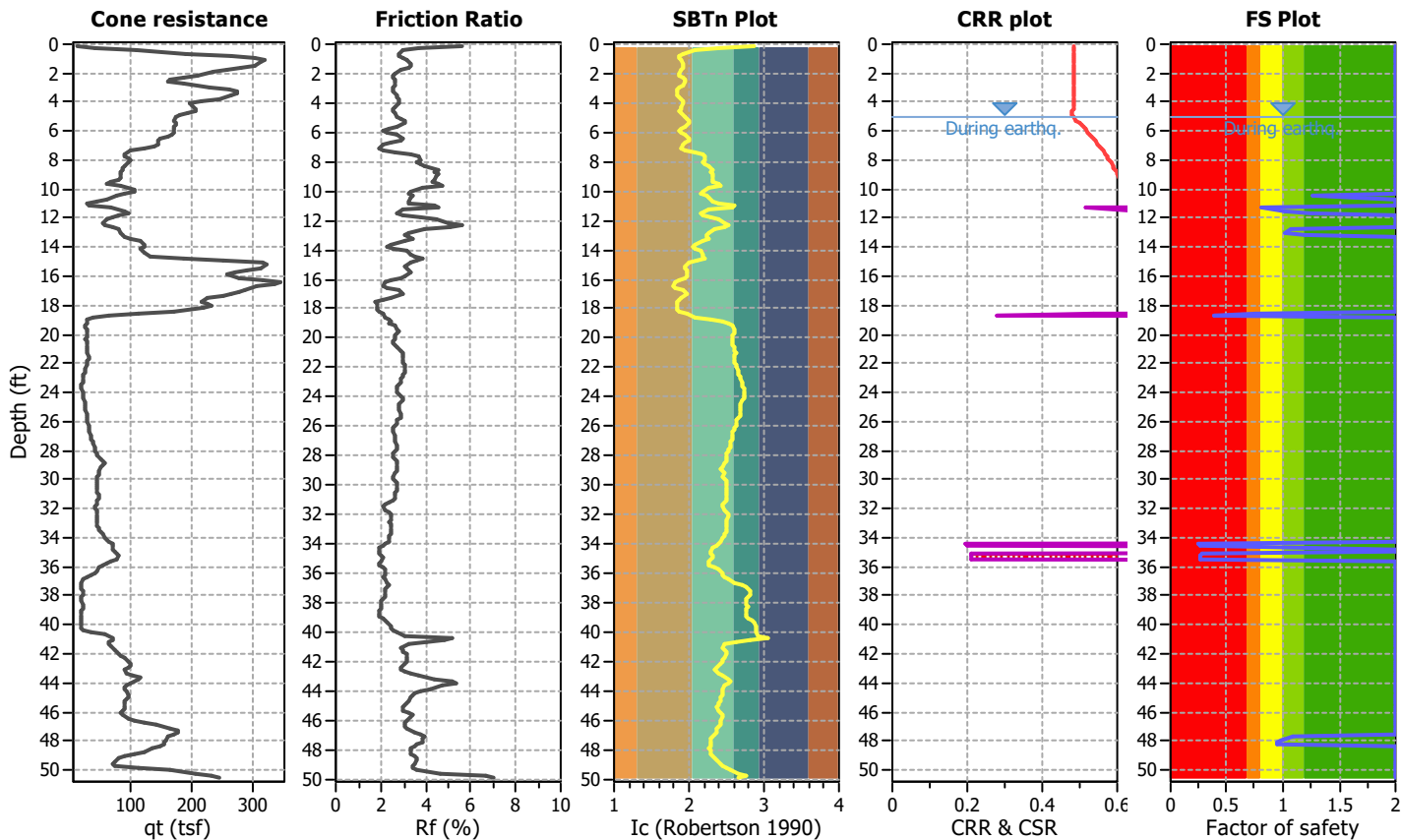
Project title : 1030 Kaiser Road Warehouse

Location : 1030 Kaiser Road, Napa, CA

CPT file : CPT-03

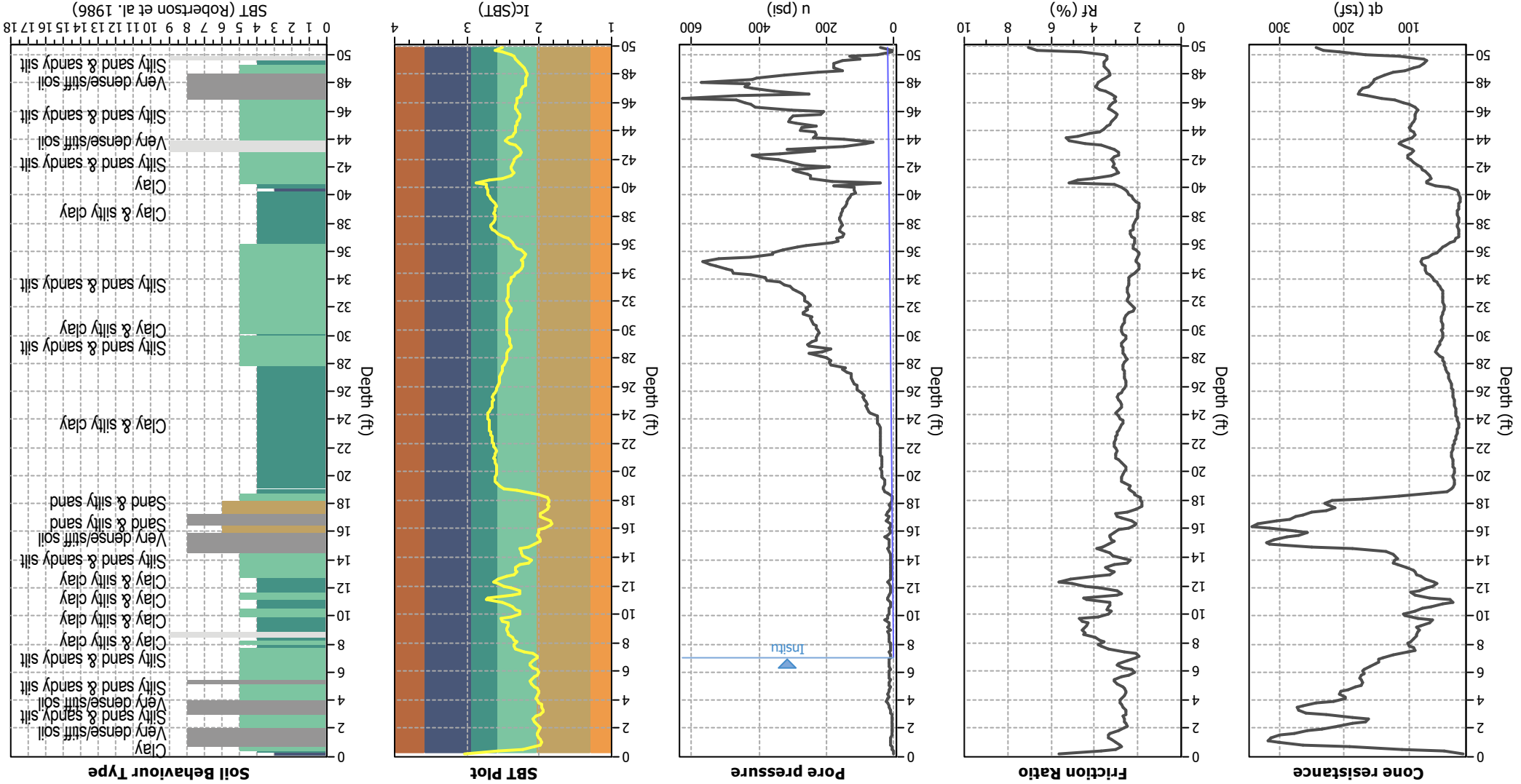
Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	7.00 ft	Use fill:	No	Clay like behavior	
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	5.00 ft	Fill height:	N/A	applied:	Sands only
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	No
Earthquake magnitude M_w :	6.80	Ic cut-off value:	2.30	Trans. detect. applied:	No	Limit depth:	N/A
Peak ground acceleration:	0.96	Unit weight calculation:	Based on SBT	K_o applied:	Yes	MSF method:	Method based



Zone A₁: Cyclic liquefaction likely depending on size and duration of cyclic loading
 Zone A₂: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
 Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
 Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots

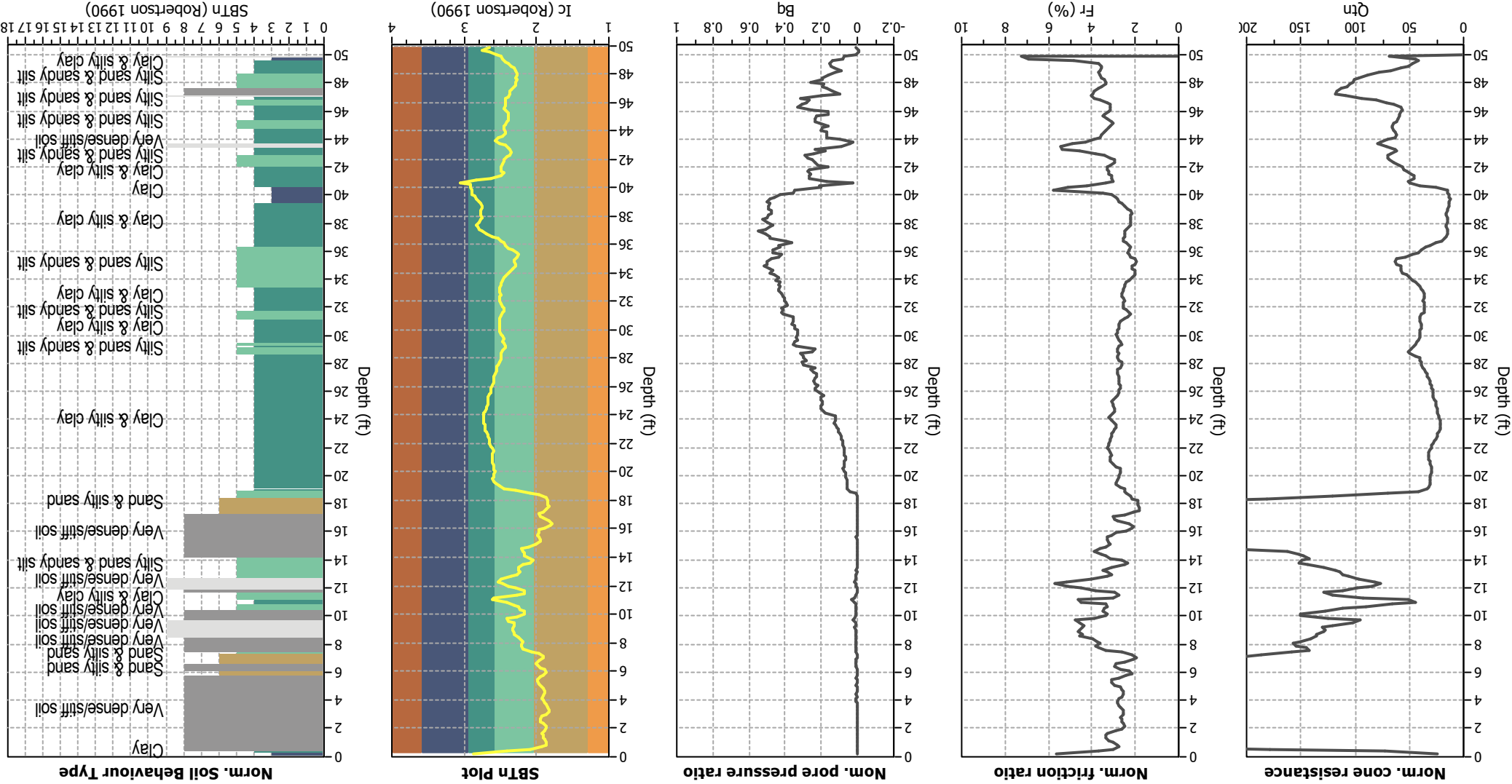


Input parameters and analysis data

Analysis method:	NCEER (1998)
Fines correction method:	NCEER (1998)
Points to test:	Based on Ic value
Earthquake magnitude M_w :	6.80
Peak ground acceleration:	0.96
Depth to water table (institu):	7.00 ft
Depth to water table (earthq.):	5.00 ft
Average results interval:	3
Unit weight calculation:	Based on SBT
Use fill:	No
Fill height:	N/A
Limit depth applied:	No
Limit depth:	N/A
Clay like behavior applied:	Sands only
K_0 applied:	Yes
Transition detect. applied:	No
Fill weight:	N/A

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)

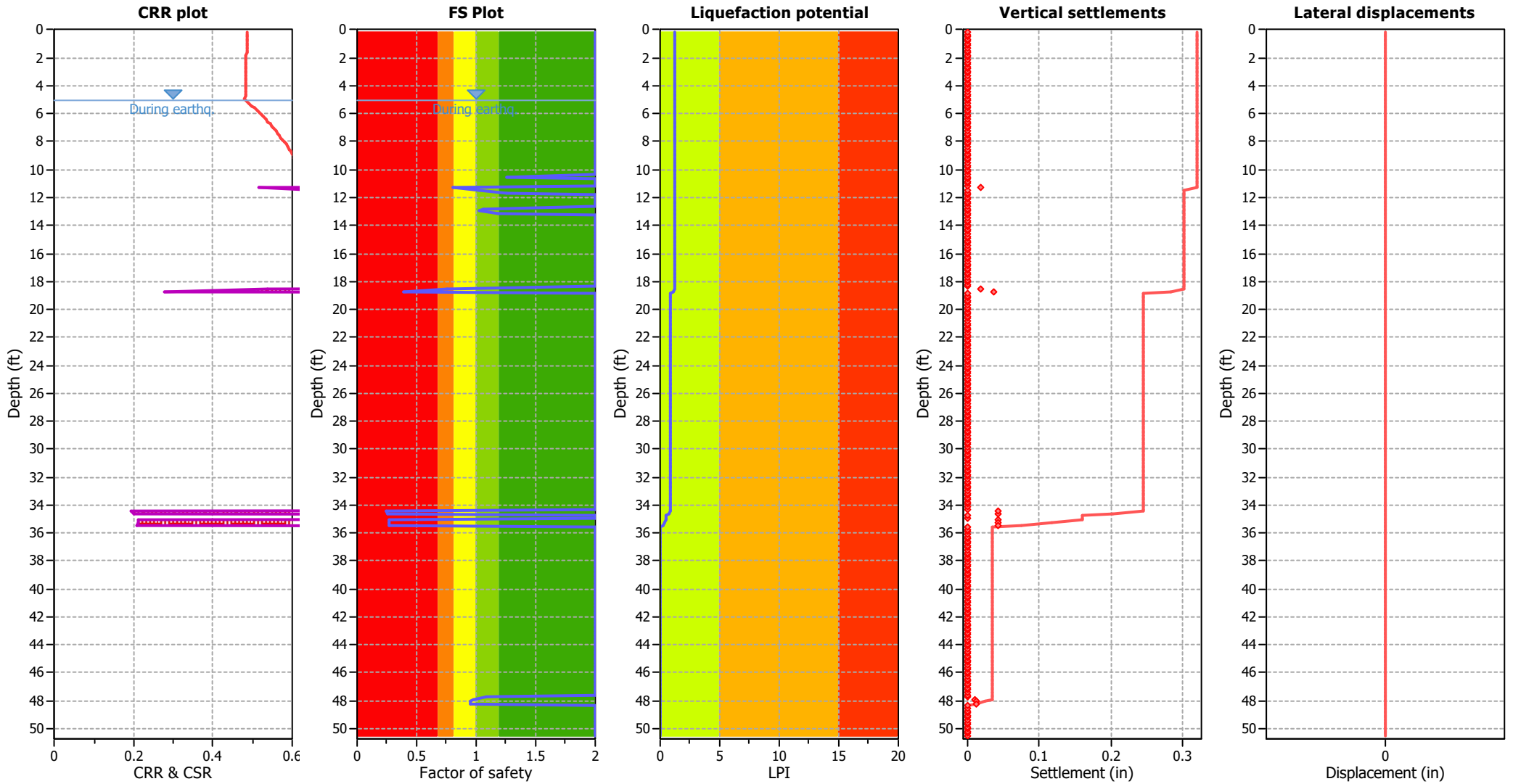


Input parameters and analysis data

Analysis method:	NCEER (1998)
Fines correction method:	NCEER (1998)
Points to test:	Based on I_c value
Earthquake magnitude M_w :	6.80
Peak ground acceleration:	0.96
Depth to water table (instn):	7.00 ft
Fill height:	N/A
Use fill:	No
Unit weight calculation:	Based on SBT
K_0 applied:	2.30
Clay like behavior applied:	No
Limit depth:	N/A
Fill weight:	N/A
Transition detect. applied:	No
Sands only:	Yes
Limit depth:	N/A

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



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (earthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.30	K _o applied:	Yes
Earthquake magnitude M _w :	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.96	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	7.00 ft	Fill height:	N/A	Limit depth:	N/A

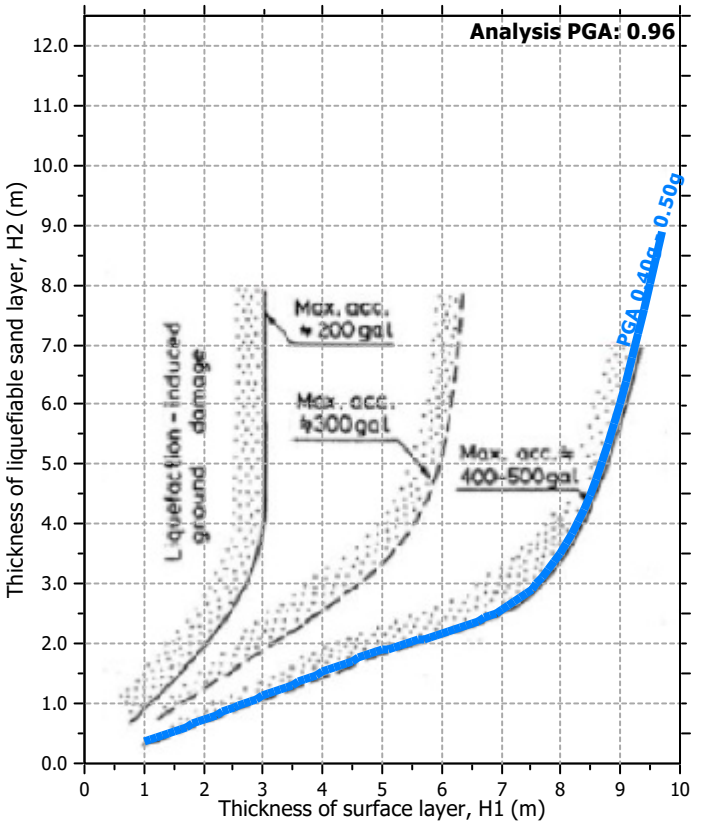
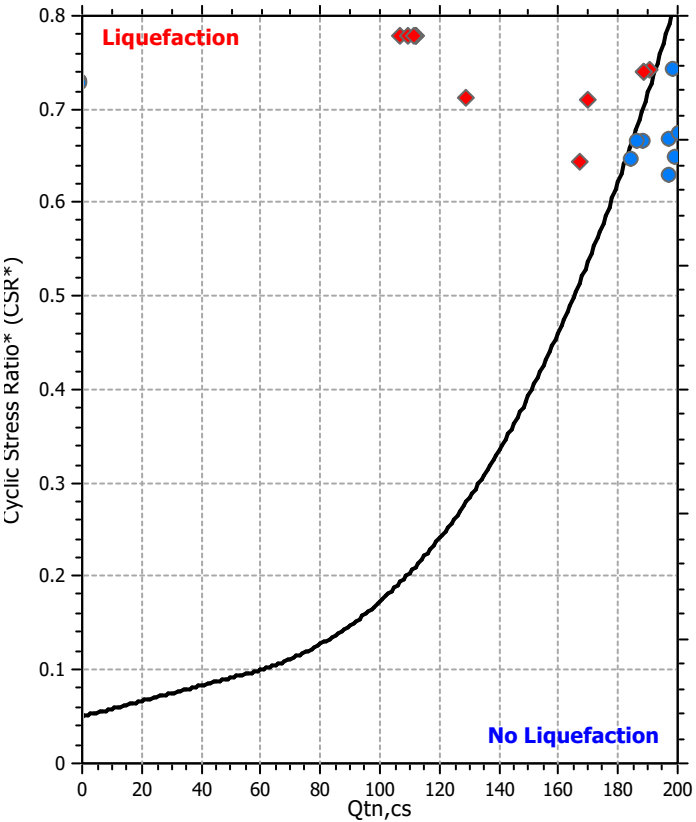
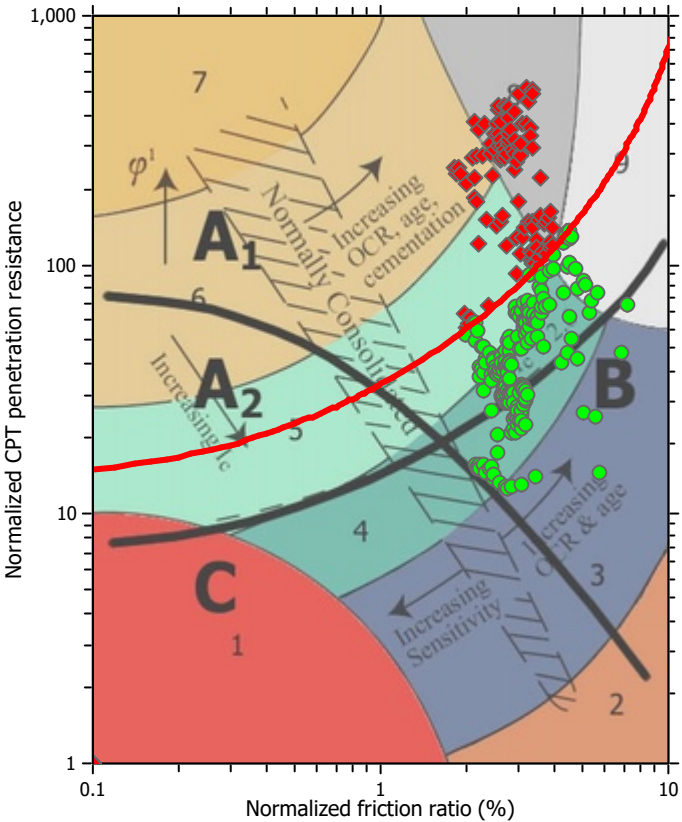
F.S. color scheme

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

LPI color scheme

Very high risk
High risk
Low risk

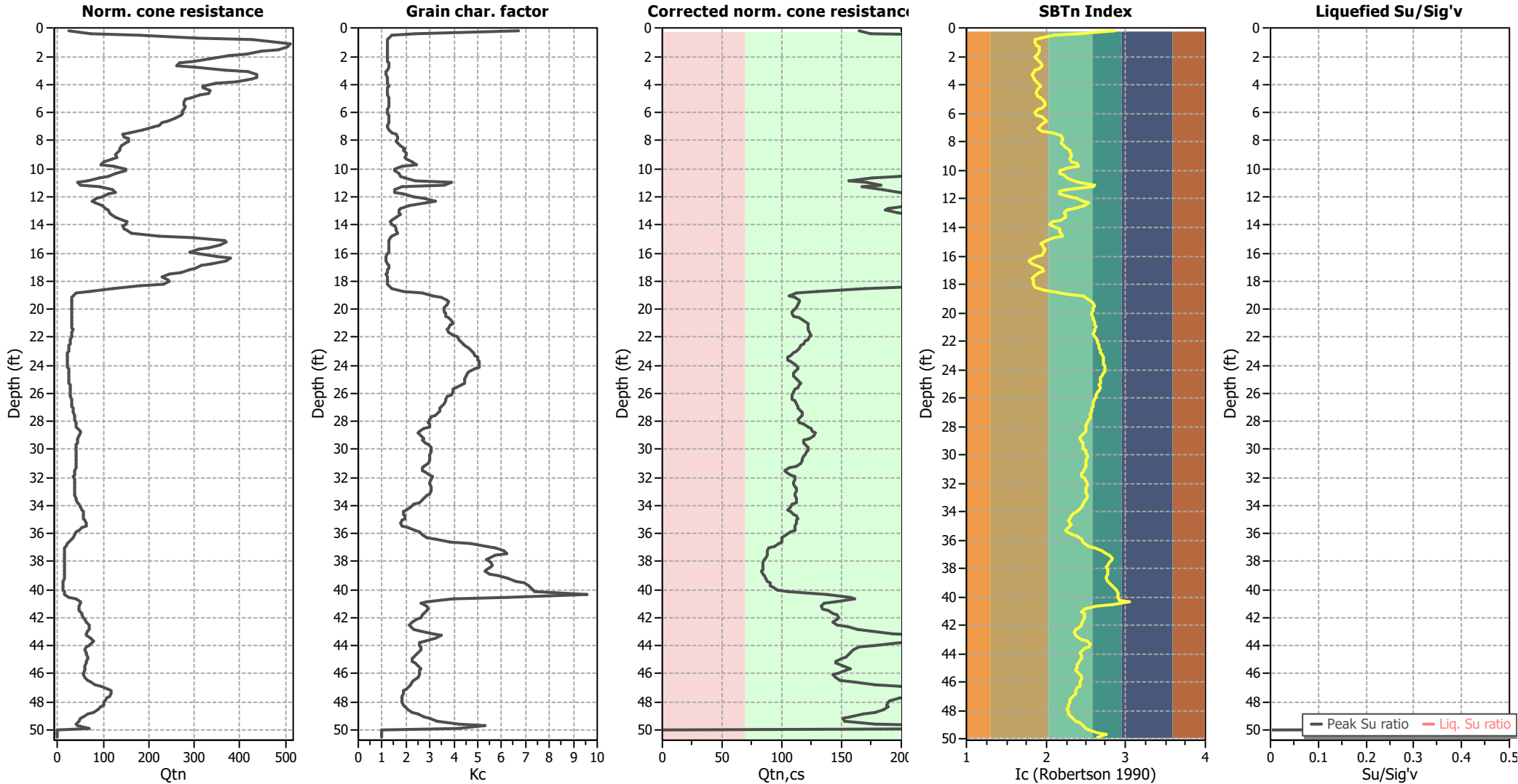
Liquefaction analysis summary plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.30	K _o applied:	Yes
Earthquake magnitude M _w :	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.96	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	7.00 ft	Fill height:	N/A	Limit depth:	N/A

Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.30	K _o applied:	Yes
Earthquake magnitude M _w :	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.96	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	7.00 ft	Fill height:	N/A	Limit depth:	N/A

LIQUEFACTION ANALYSIS REPORT

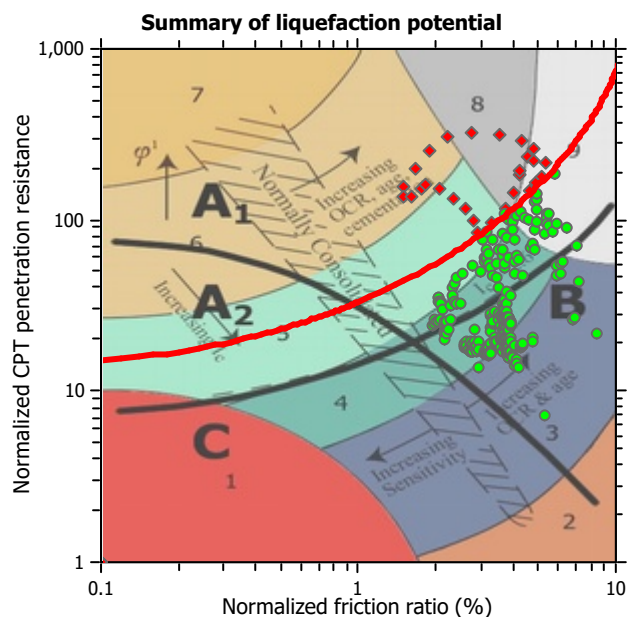
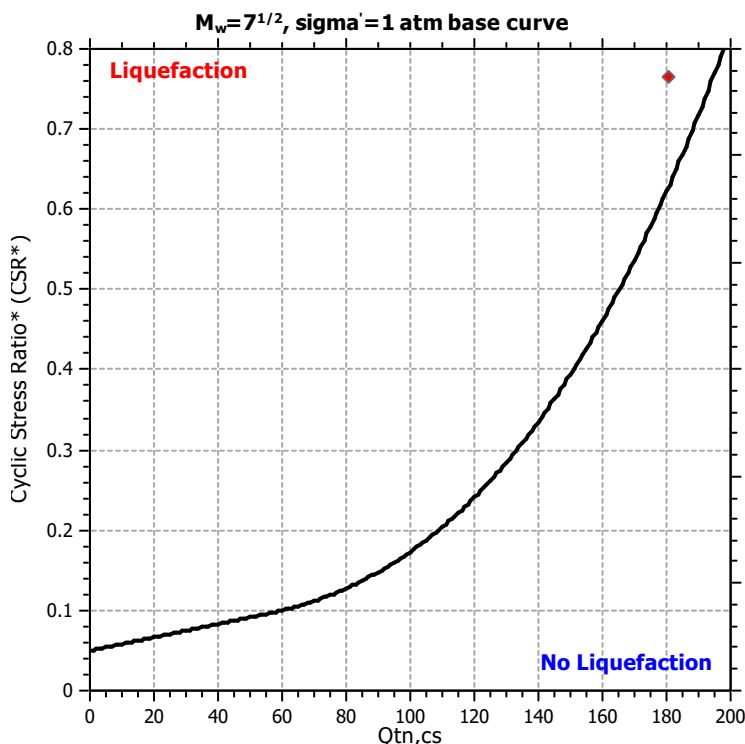
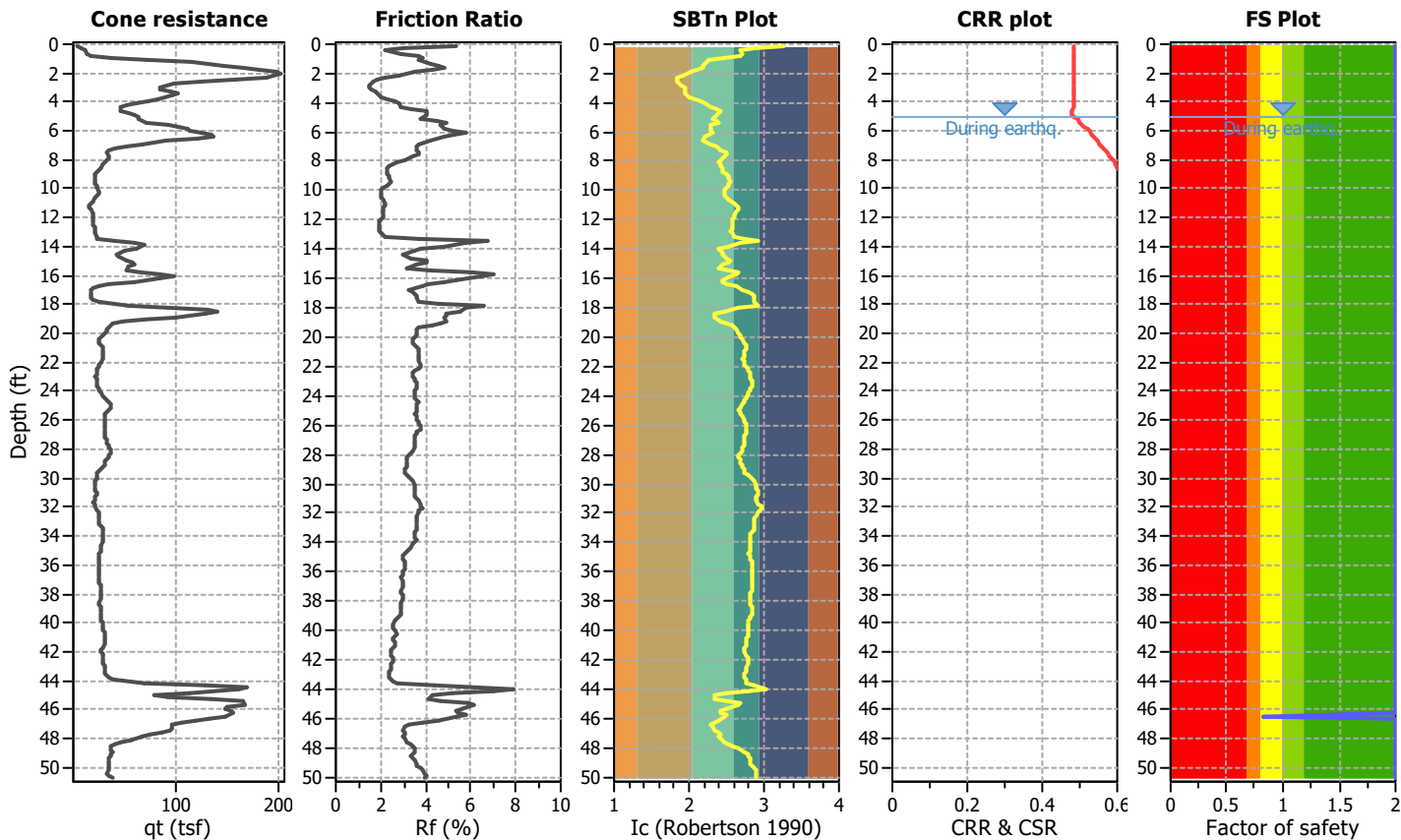
Project title : 1030 Kaiser Road Warehouse

Location : 1030 Kaiser Road, Napa, CA

CPT file : CPT-04

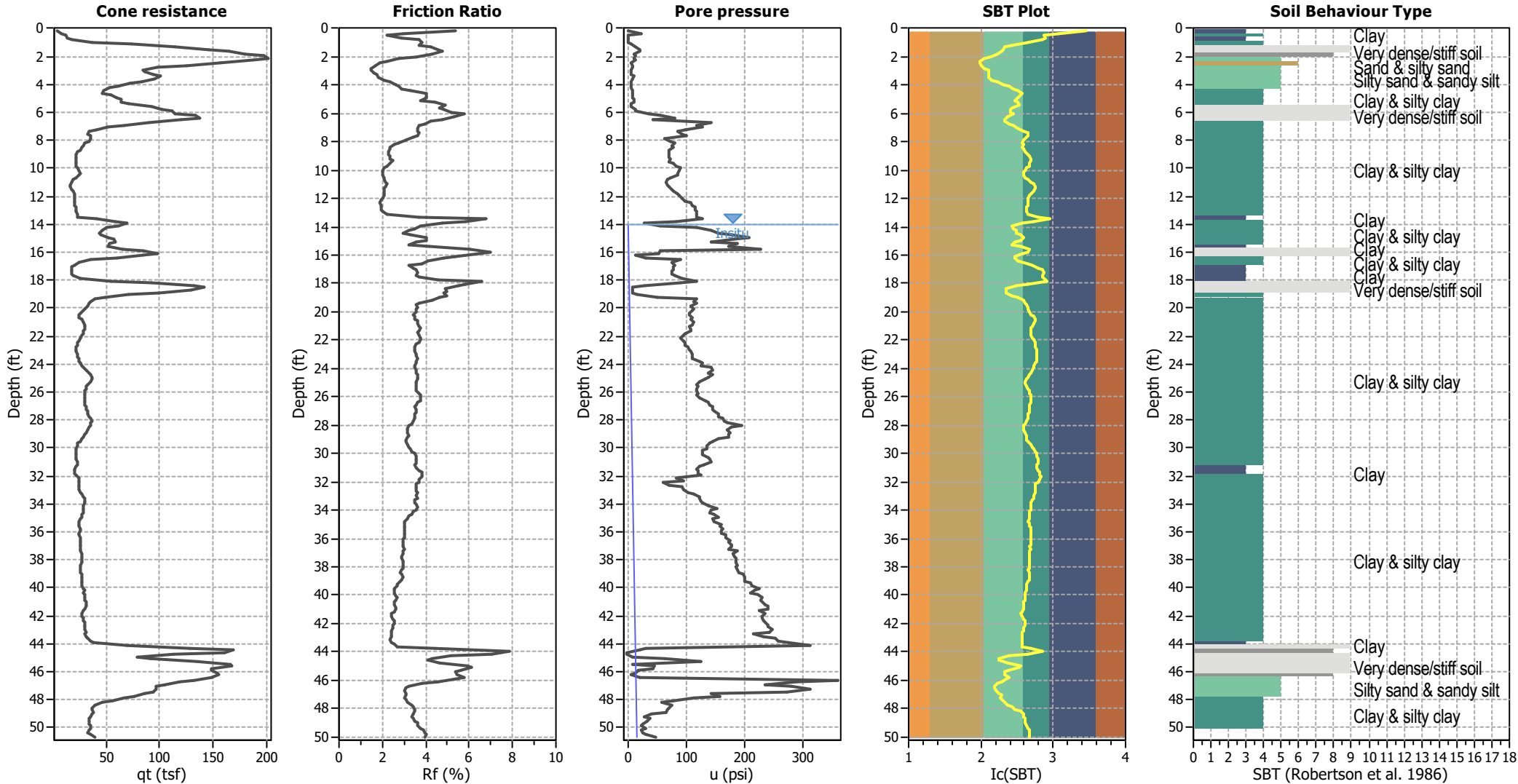
Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	14.00 ft	Use fill:	No	Clay like behavior	
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	5.00 ft	Fill height:	N/A	applied:	Sands only
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	No
Earthquake magnitude M_w :	6.80	Ic cut-off value:	2.30	Trans. detect. applied:	No	Limit depth:	N/A
Peak ground acceleration:	0.96	Unit weight calculation:	Based on SBT	K_o applied:	Yes	MSF method:	Method based



Zone A₁: Cyclic liquefaction likely depending on size and duration of cyclic loading
 Zone A₂: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
 Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
 Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots

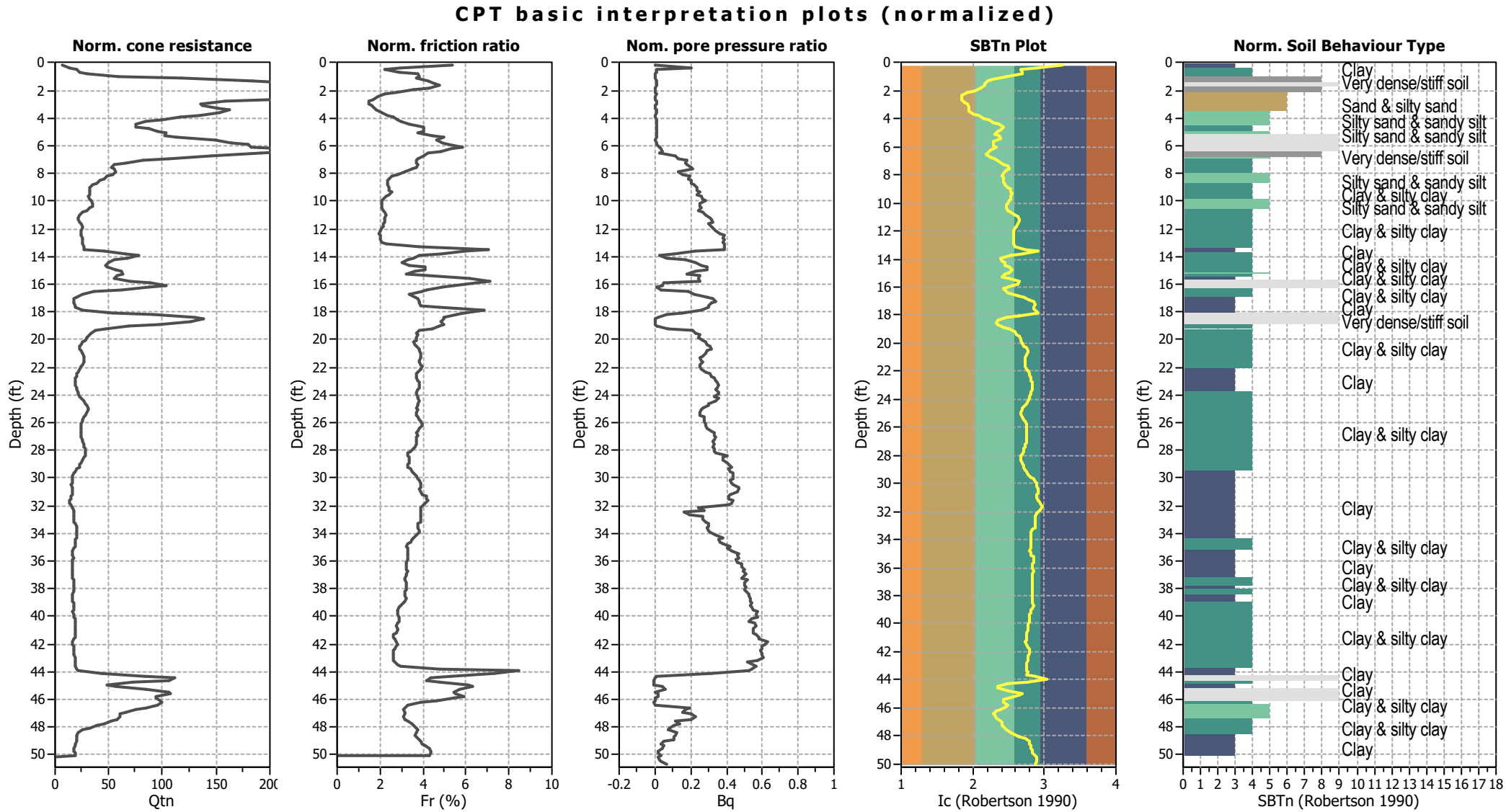


Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.30	K ₀ applied:	Yes
Earthquake magnitude M _w :	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.96	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	14.00 ft	Fill height:	N/A	Limit depth:	N/A

SBT legend

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

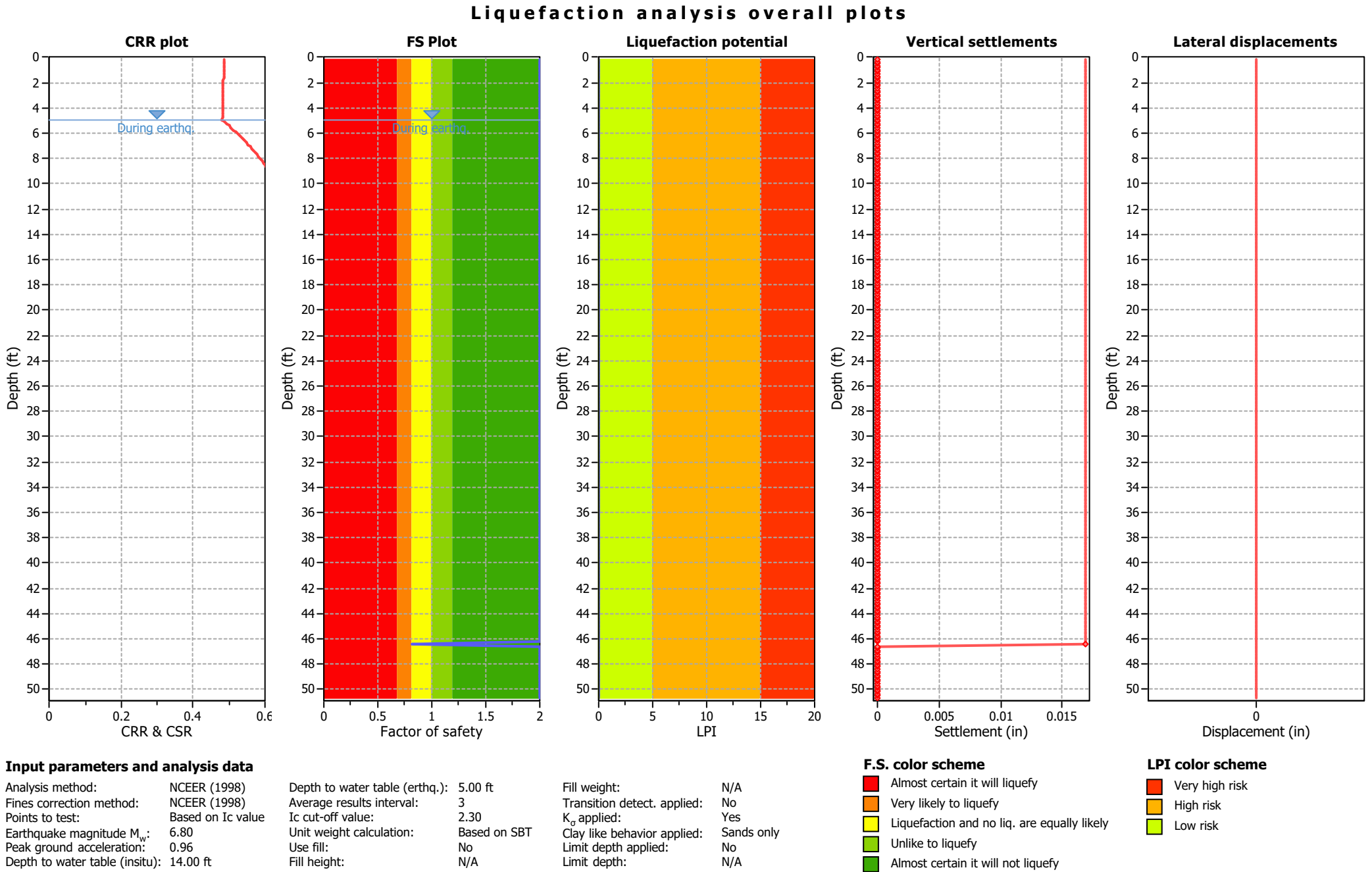


Input parameters and analysis data

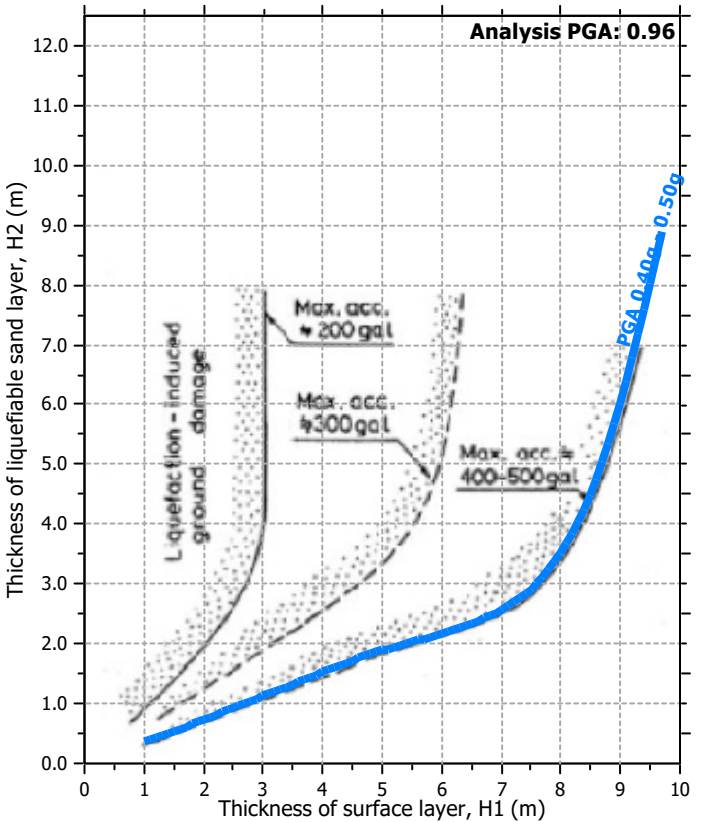
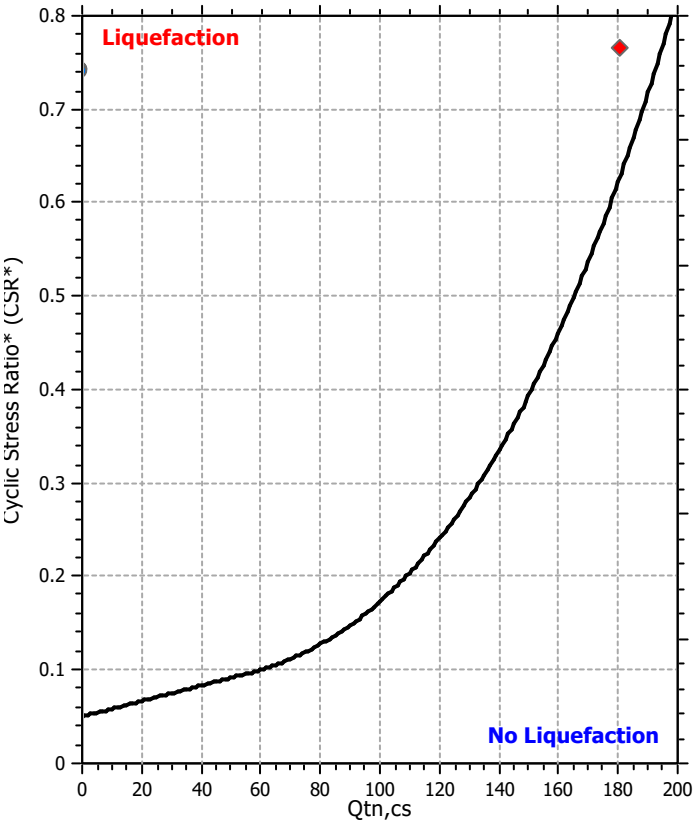
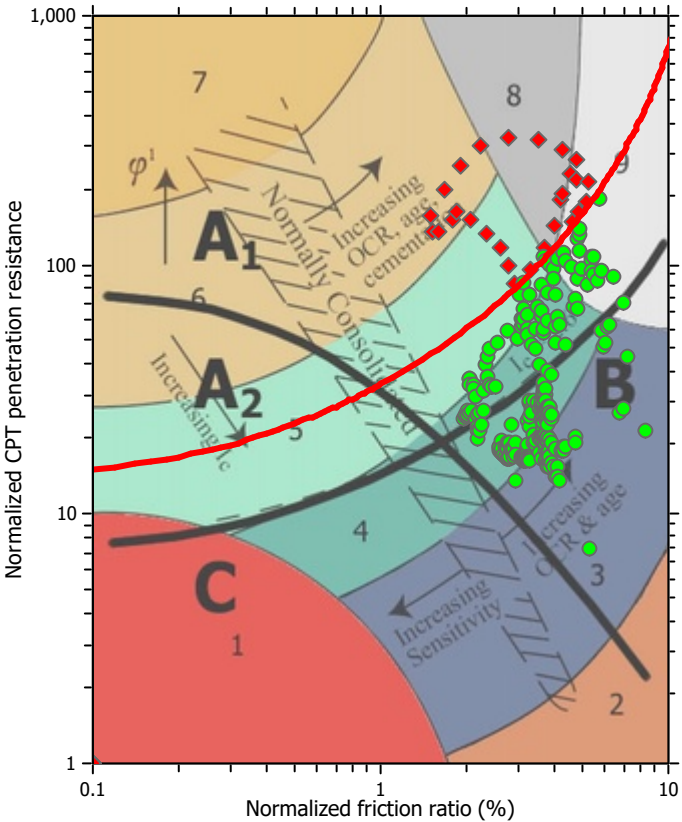
Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.30	K _o applied:	Yes
Earthquake magnitude M _w :	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.96	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	14.00 ft	Fill height:	N/A	Limit depth:	N/A

SBTn legend

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



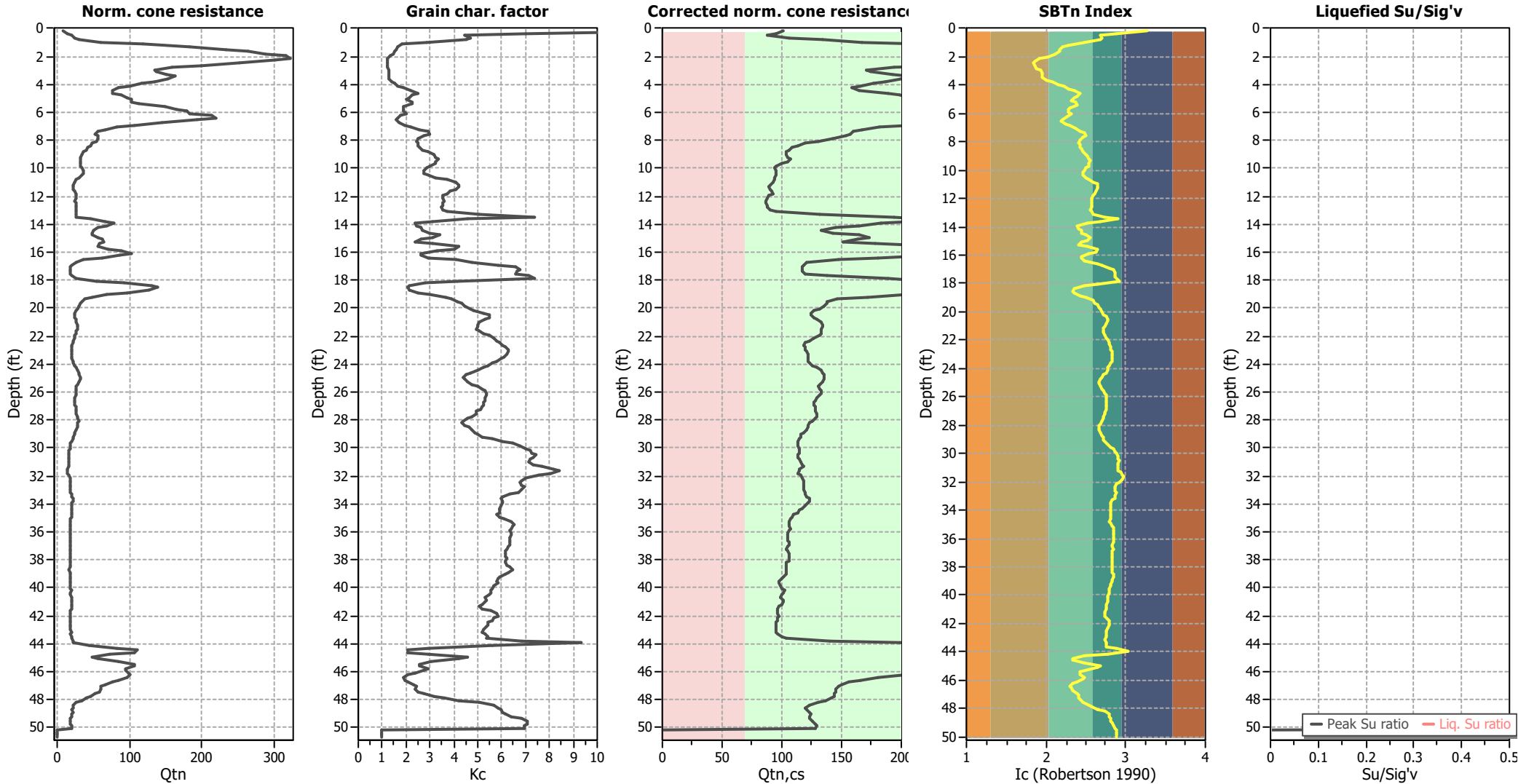
Liquefaction analysis summary plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.30	K_0 applied:	Yes
Earthquake magnitude M_w :	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.96	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	14.00 ft	Fill height:	N/A	Limit depth:	N/A

Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on I_c value	I_c cut-off value:	2.30	K_o applied:	Yes
Earthquake magnitude M_w :	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.96	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	14.00 ft	Fill height:	N/A	Limit depth:	N/A

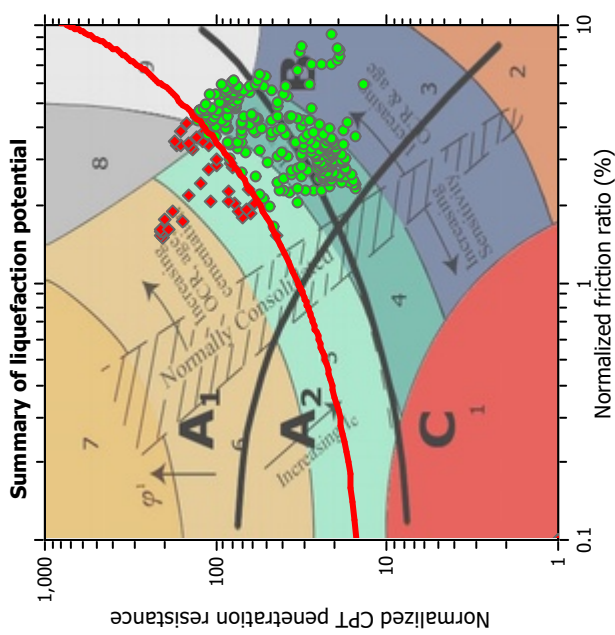
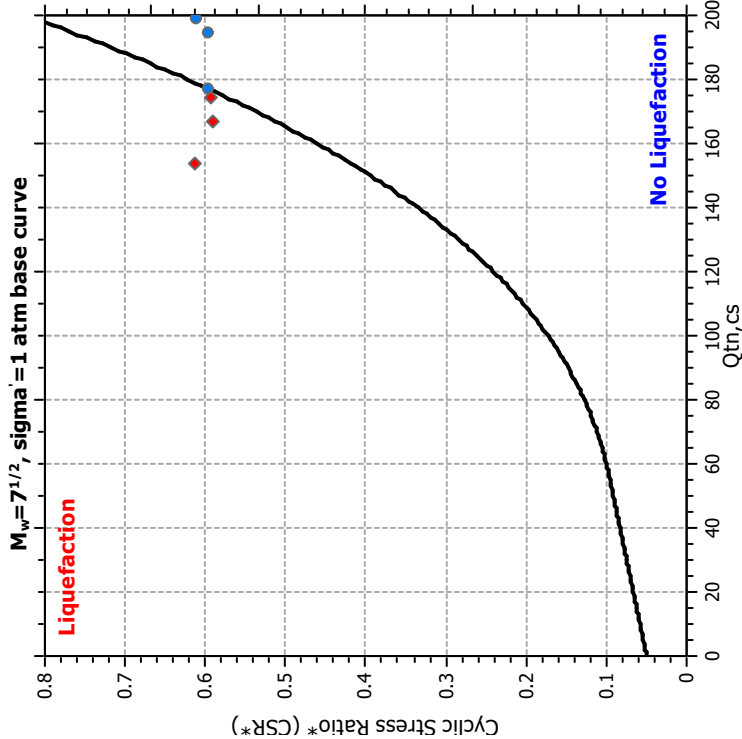
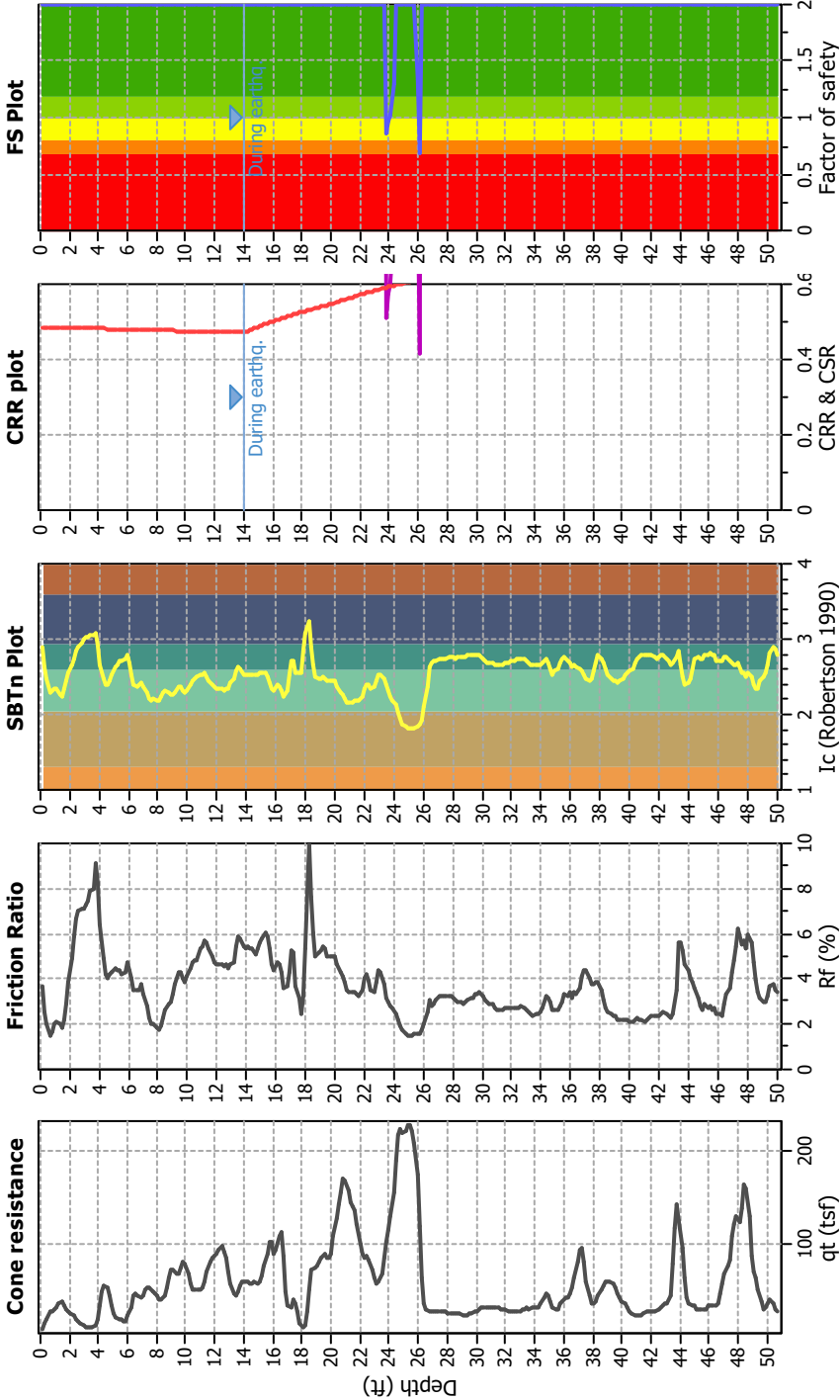
LIQUEFACTION ANALYSIS REPORT

Project title : 1030 Kaiser Road Warehouse
CPT file : CPT-05

Location : 1030 Kaiser Road, Napa, CA

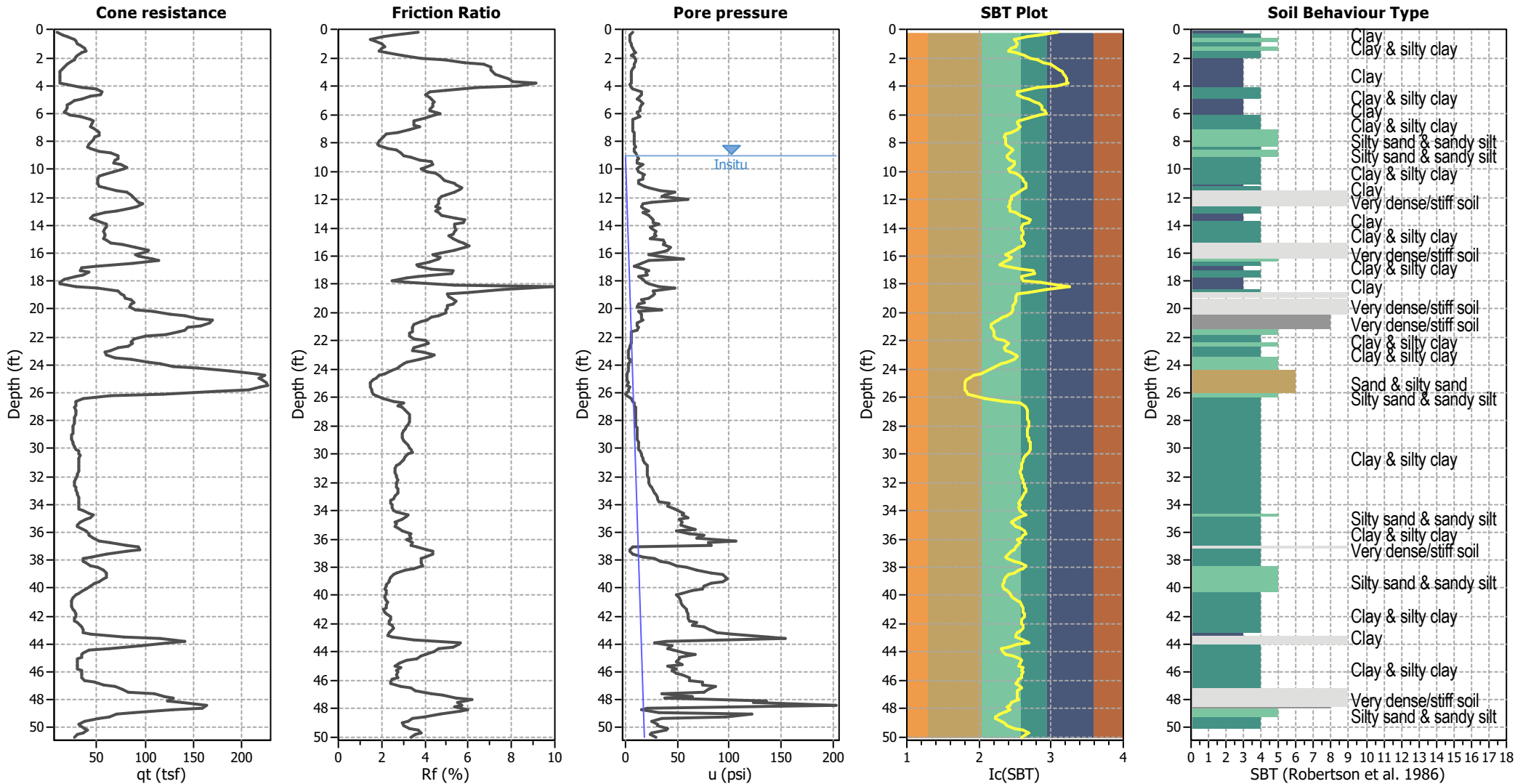
Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	9.00 ft	Use fill:	No	Clay like behavior	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	14.00 ft	Fill height:	N/A	applied:	
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	No
Earthquake magnitude M_w :	6.80	Ic cut-off value:	2.30	Trans. detect. applied:	No	Limit depth:	N/A
Peak ground acceleration:	0.96	Unit weight calculation:	Based on SBT	K_a applied:	Yes	MSF method:	Method based



Zone A1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



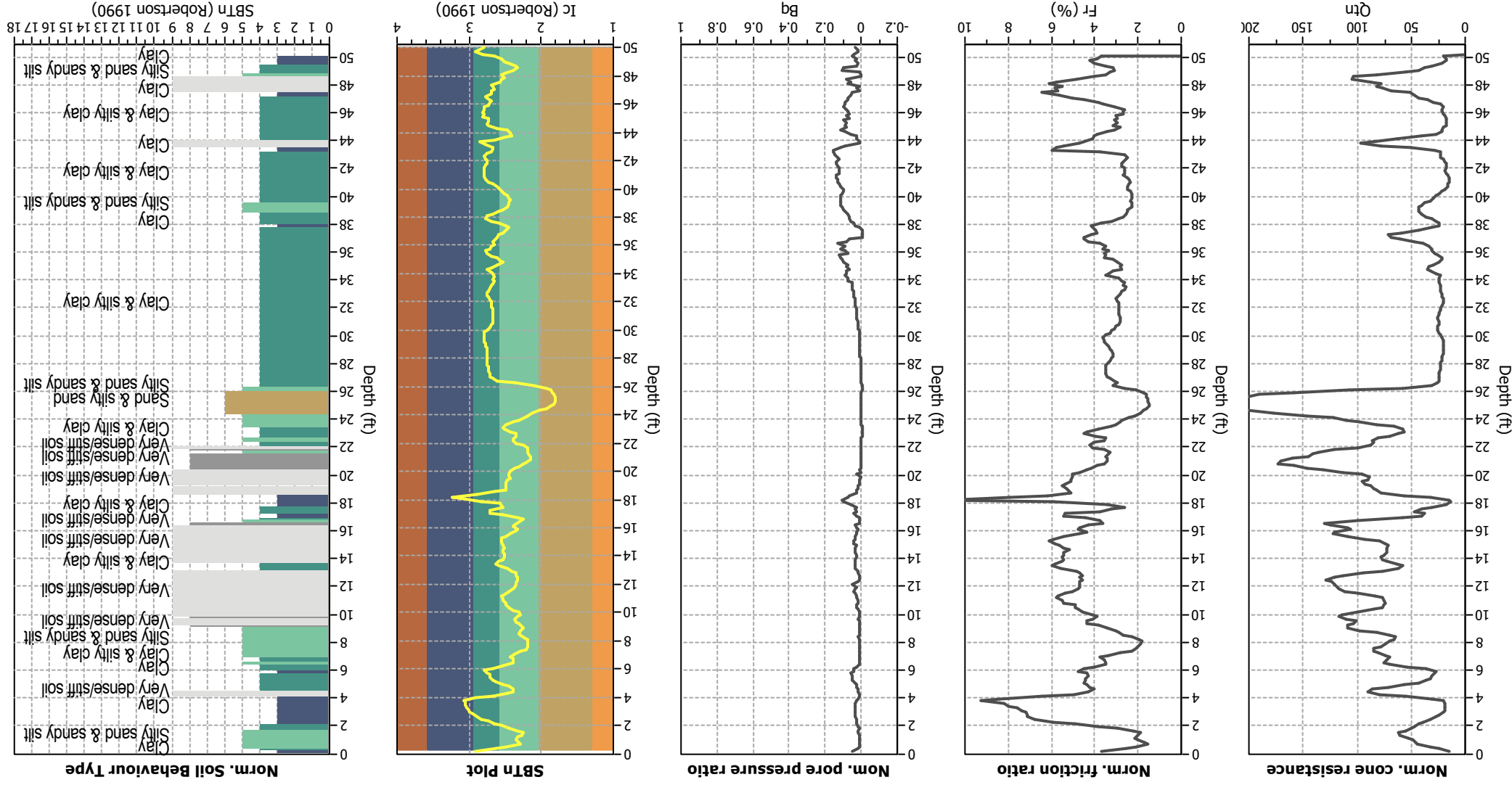
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	14.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.30	K ₀ applied:	Yes
Earthquake magnitude M _w :	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.96	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	9.00 ft	Fill height:	N/A	Limit depth:	N/A

SBT legend

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

CPT basic interpretation plots (normalized)



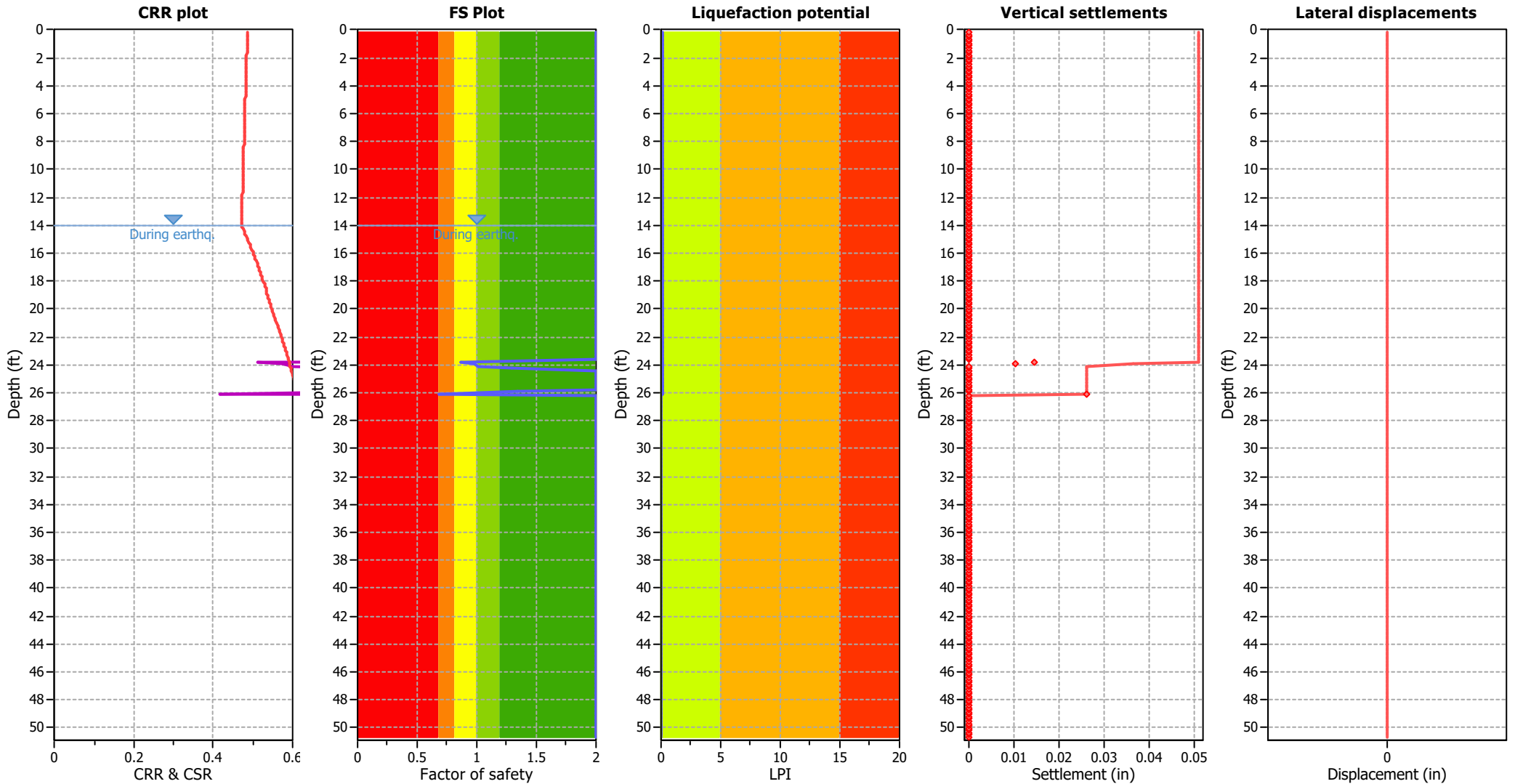
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (earthq.):	14.00 ft	Fill weight:	N/A
Finest correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.30	k_p applied:	Yes
Earthquake magnitude M_w :	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.96	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	9.00 ft	Fill height:	N/A	Limit depth:	N/A

SRTn legend

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (earthq.):	14.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.30	K _o applied:	Yes
Earthquake magnitude M _w :	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.96	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	9.00 ft	Fill height:	N/A	Limit depth:	N/A

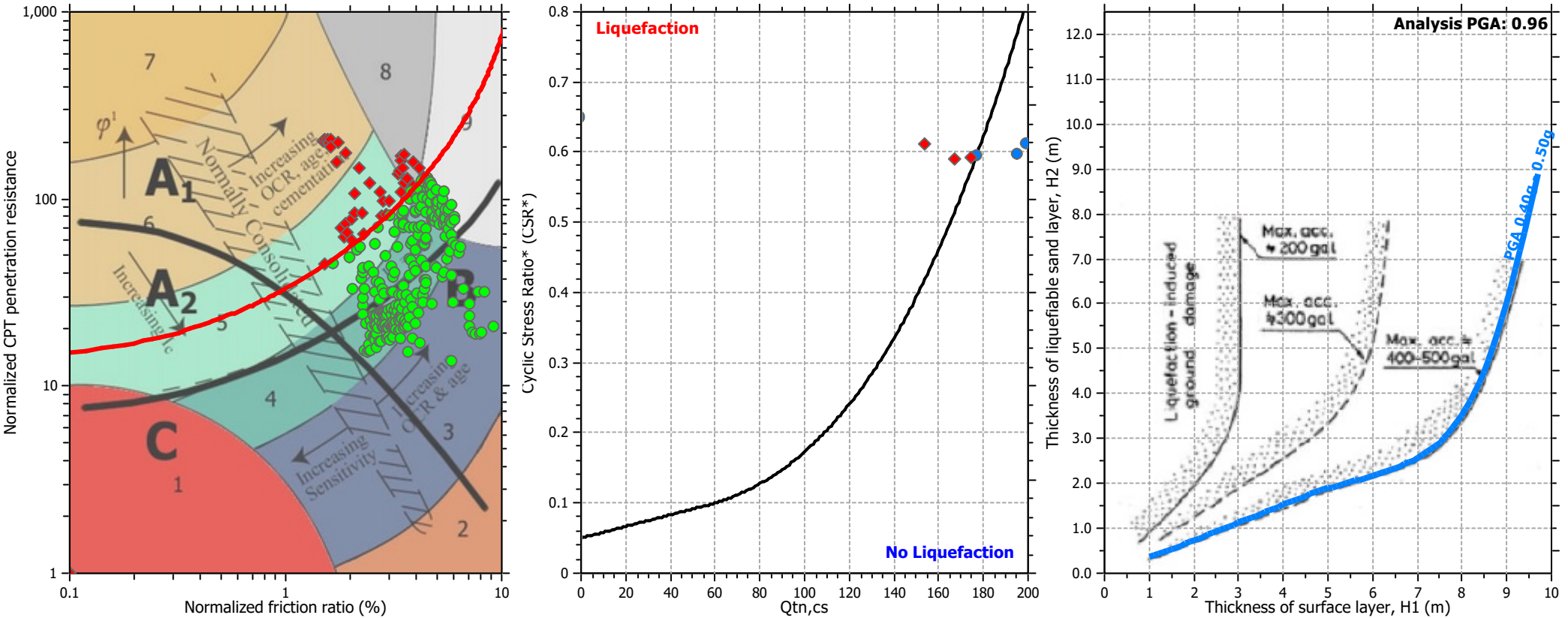
F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

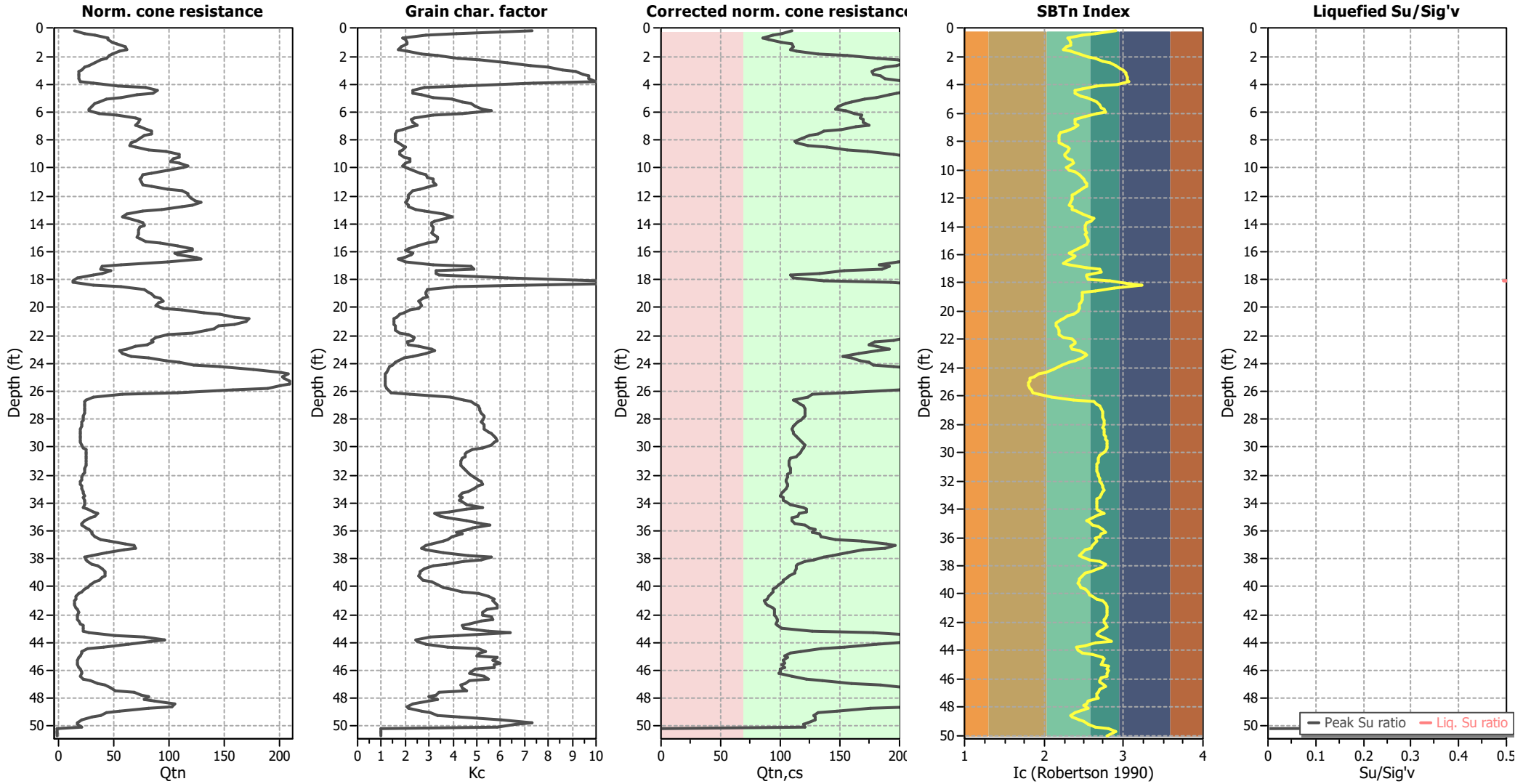
Liquefaction analysis summary plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	14.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.30	K_0 applied:	Yes
Earthquake magnitude M_w :	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.96	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	9.00 ft	Fill height:	N/A	Limit depth:	N/A

Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	14.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.30	K _o applied:	Yes
Earthquake magnitude M _w :	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.96	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	9.00 ft	Fill height:	N/A	Limit depth:	N/A

LIQUEFACTION ANALYSIS REPORT

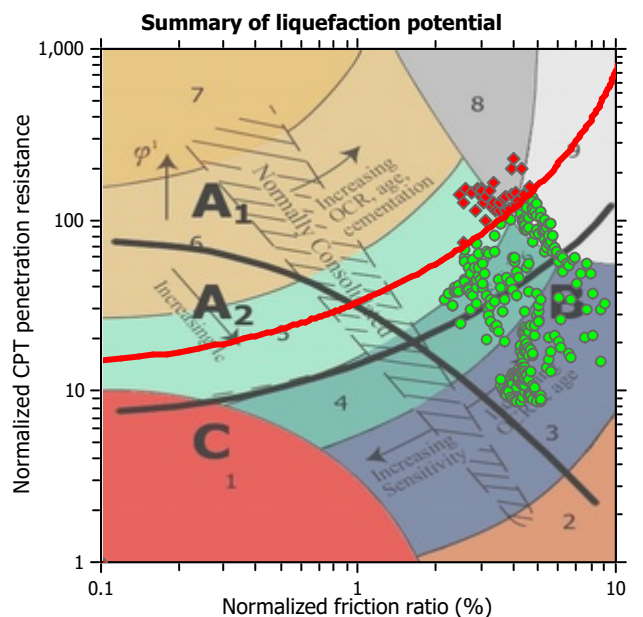
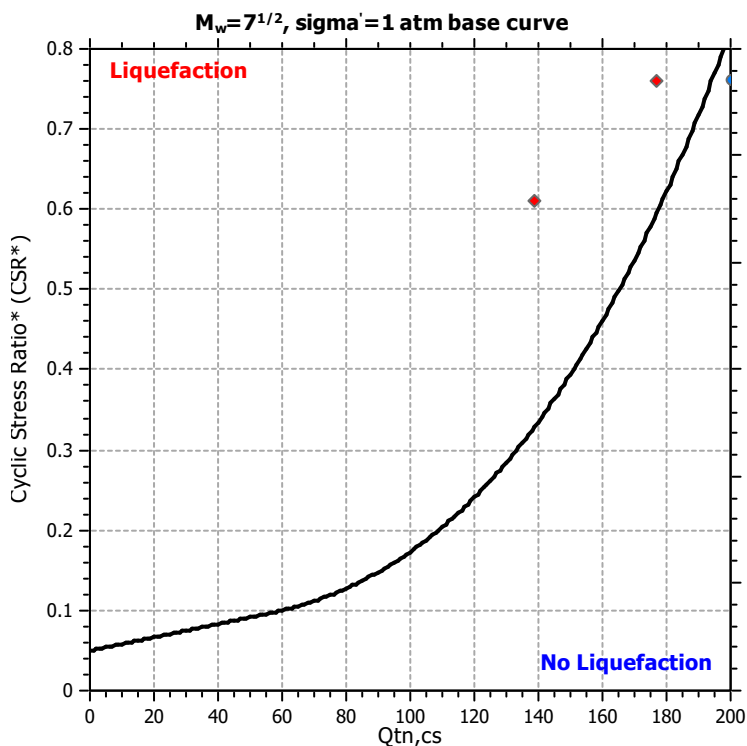
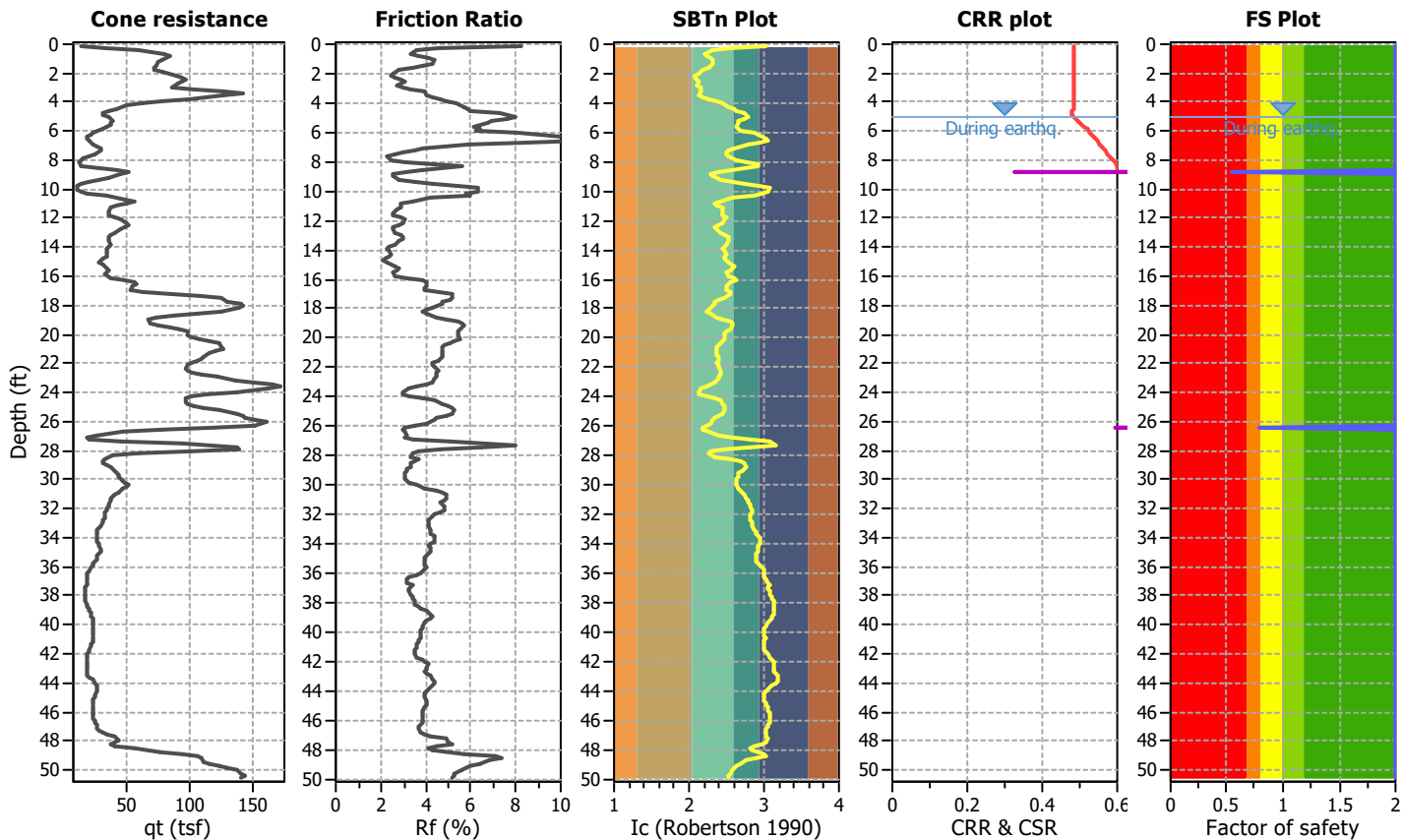
Project title : 1030 Kaiser Road Warehouse

Location : 1030 Kaiser Road, Napa, CA

CPT file : CPT-06

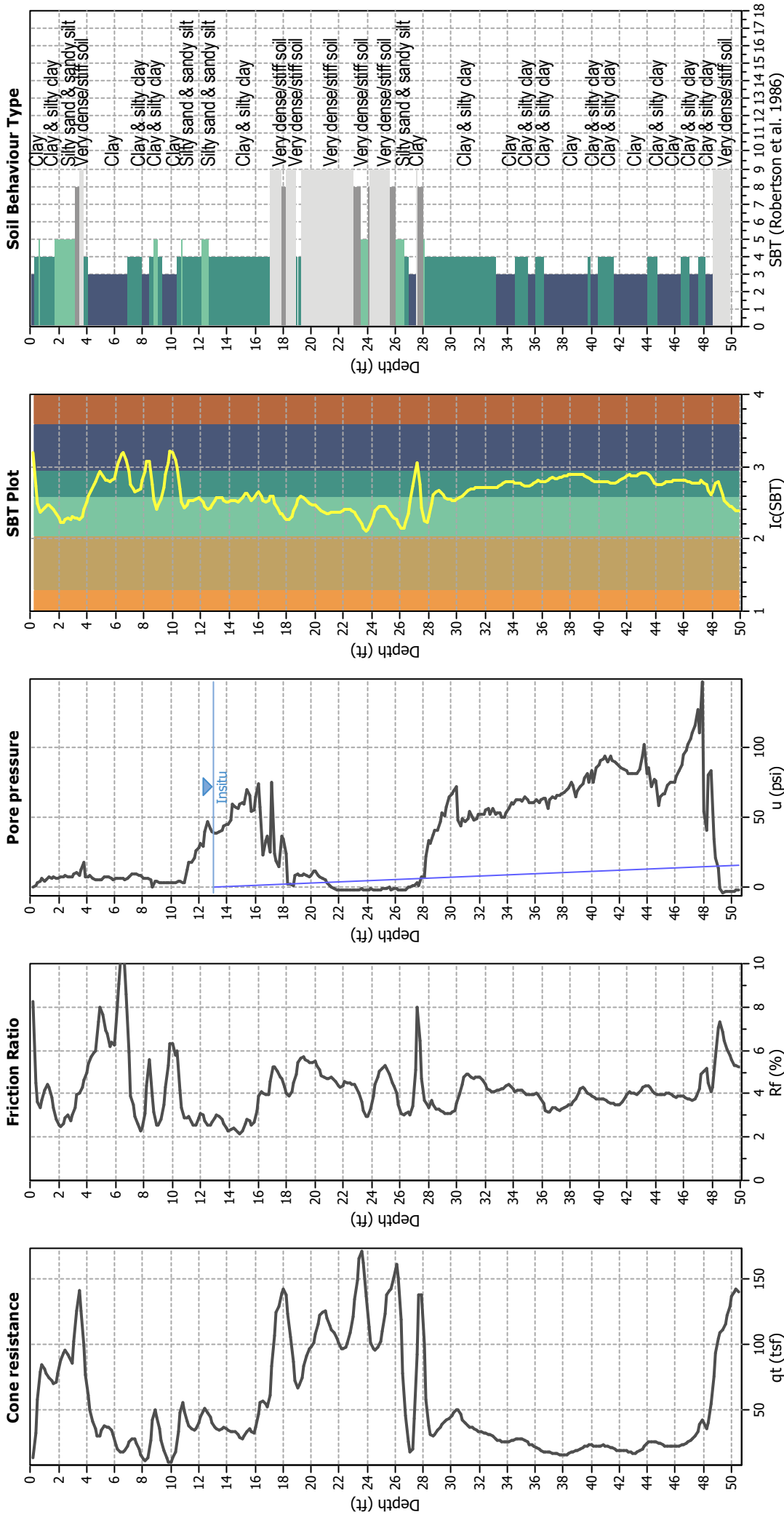
Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	13.00 ft	Use fill:	No	Clay like behavior	
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	5.00 ft	Fill height:	N/A	applied:	Sands only
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	No
Earthquake magnitude M_w :	6.80	Ic cut-off value:	2.30	Trans. detect. applied:	No	Limit depth:	N/A
Peak ground acceleration:	0.96	Unit weight calculation:	Based on SBT	K_o applied:	Yes	MSF method:	Method based

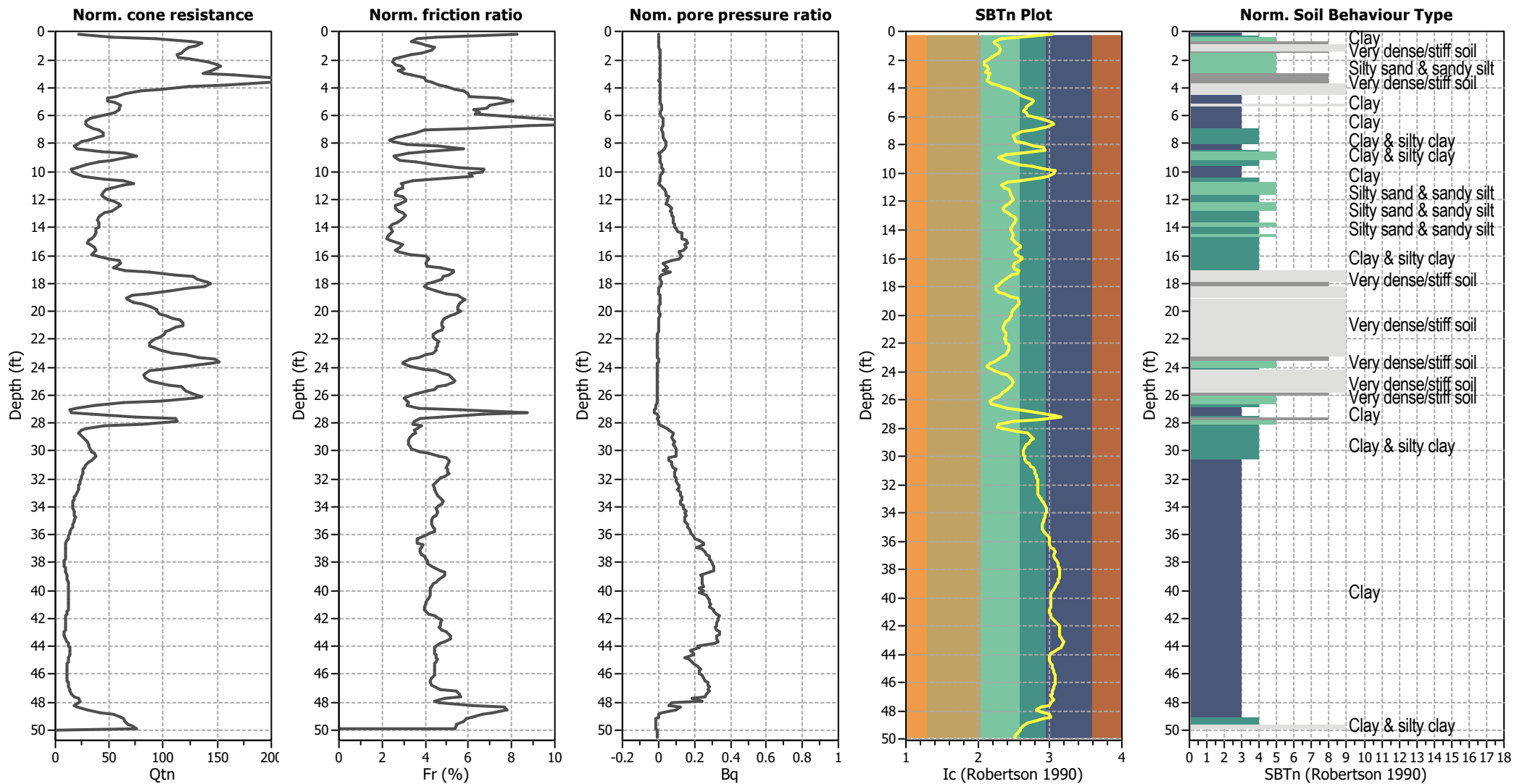


Zone A₁: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A₂: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



CPT basic interpretation plots (normalized)



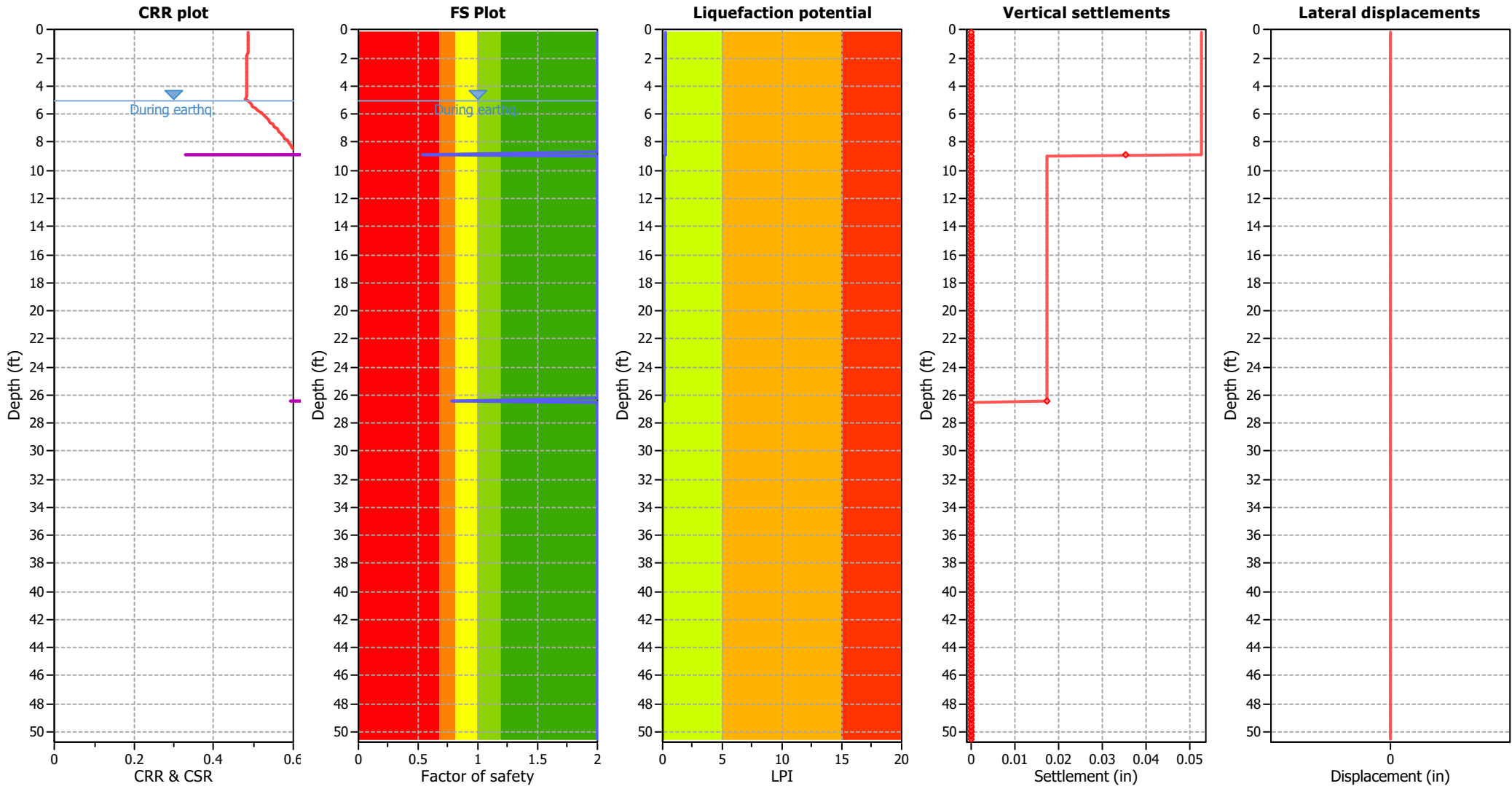
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.30	K _o applied:	Yes
Earthquake magnitude M _w :	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.96	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	13.00 ft	Fill height:	N/A	Limit depth:	N/A

SBTn legend

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (earthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.30	K _o applied:	Yes
Earthquake magnitude M _w :	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.96	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	13.00 ft	Fill height:	N/A	Limit depth:	N/A

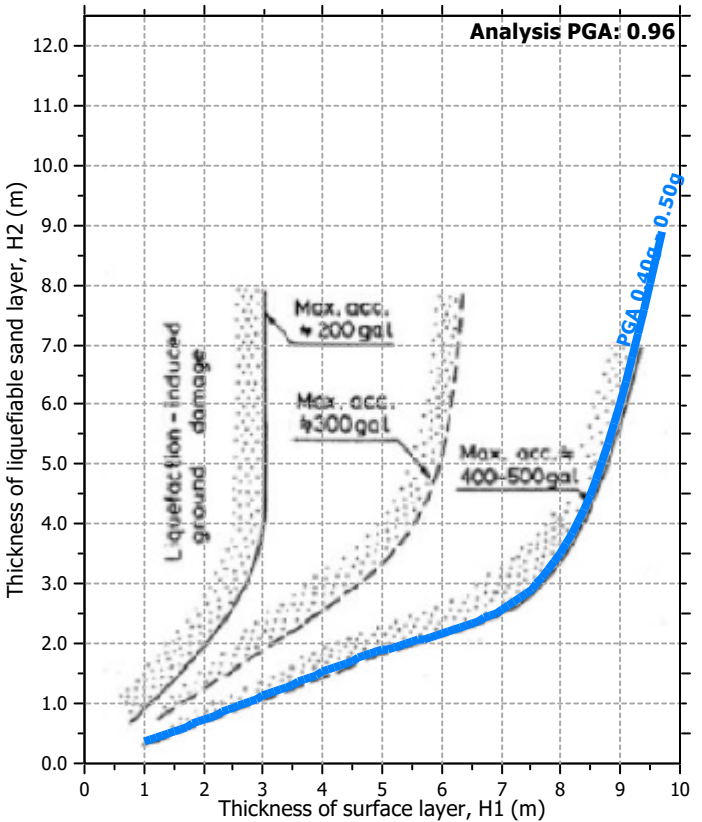
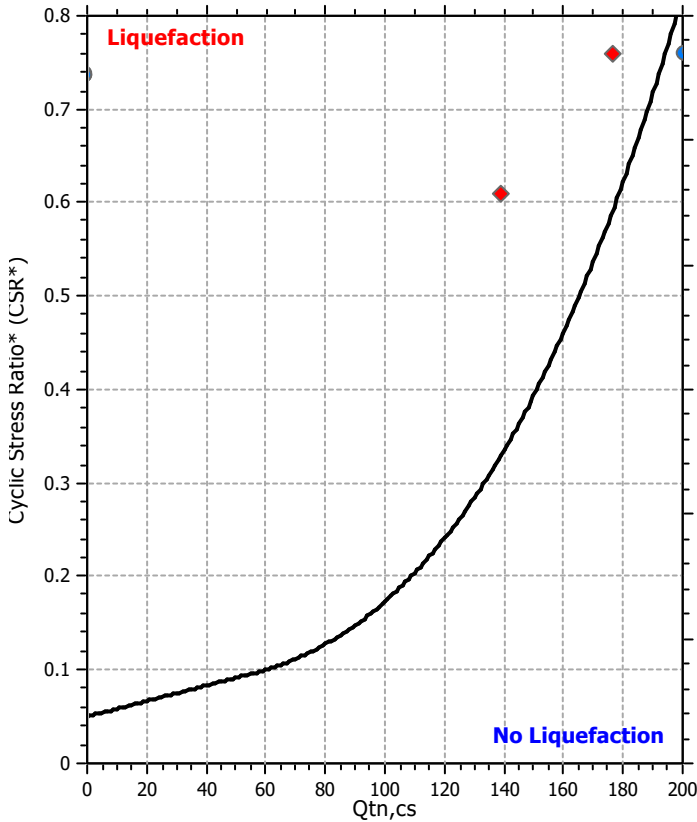
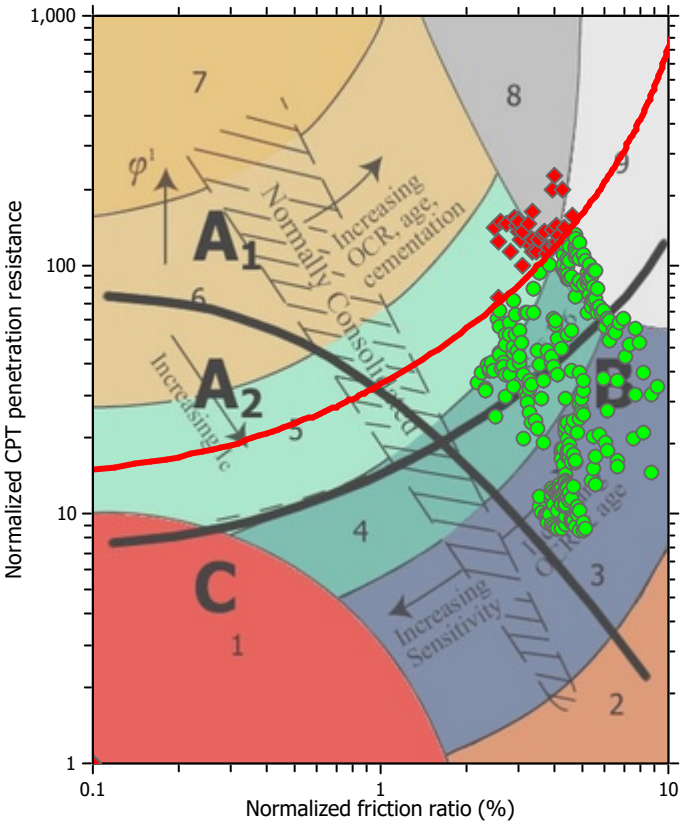
F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

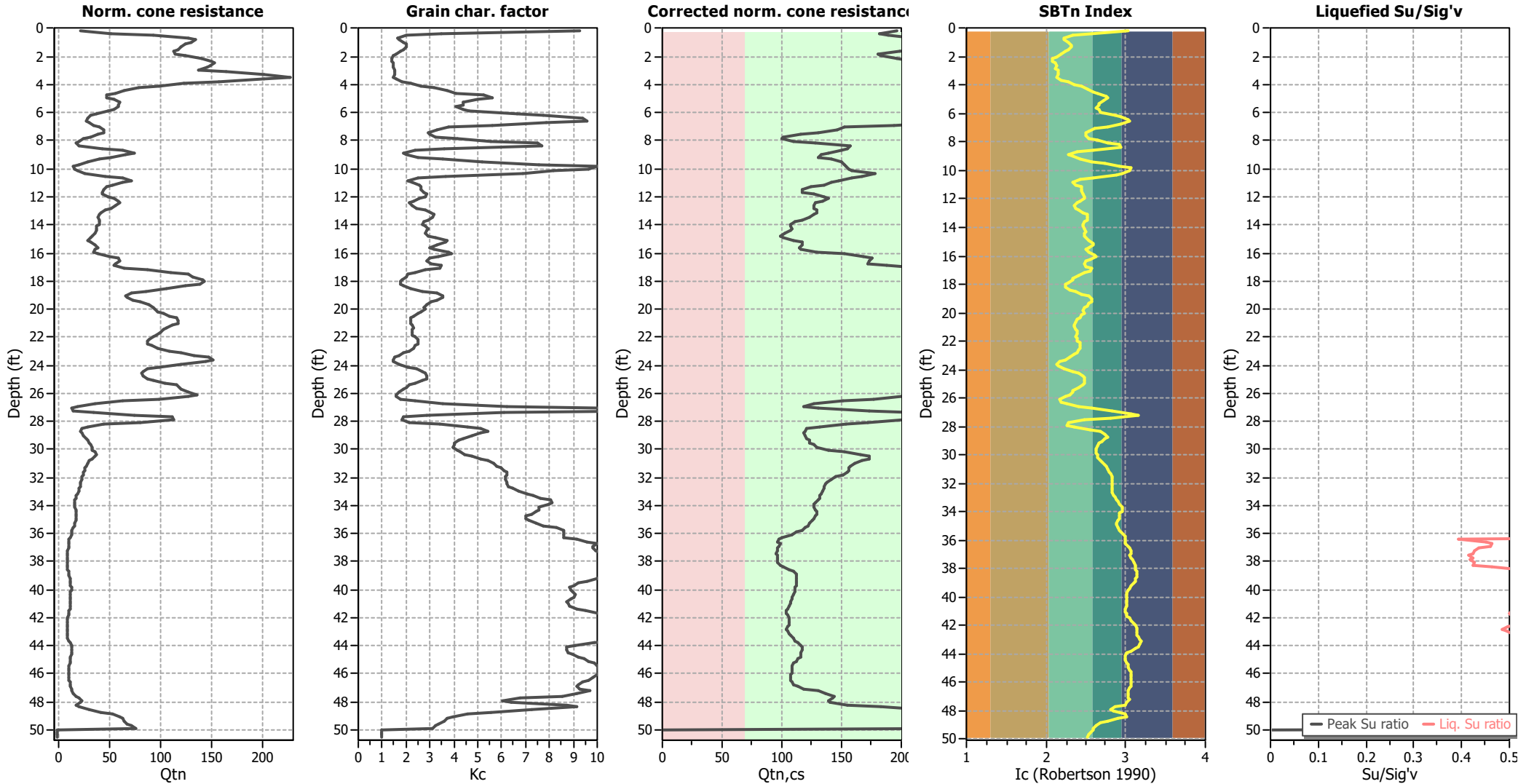
Liquefaction analysis summary plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.30	K_0 applied:	Yes
Earthquake magnitude M_w :	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.96	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	13.00 ft	Fill height:	N/A	Limit depth:	N/A

Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.30	K _o applied:	Yes
Earthquake magnitude M _w :	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.96	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	13.00 ft	Fill height:	N/A	Limit depth:	N/A

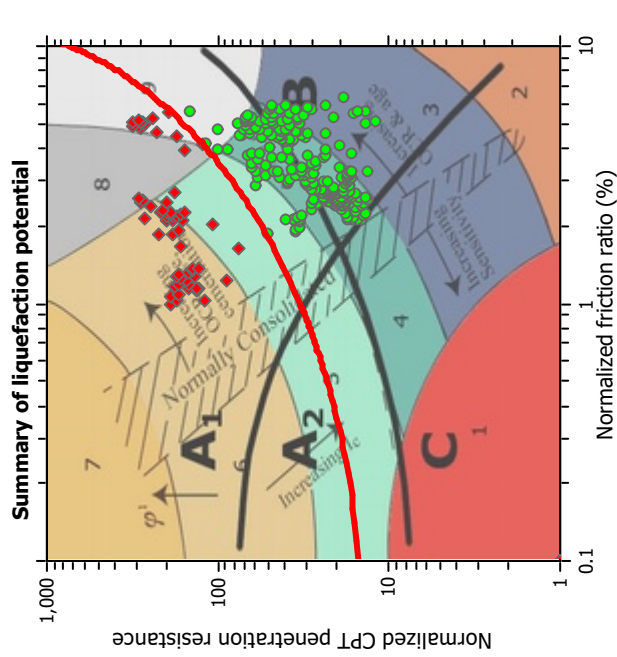
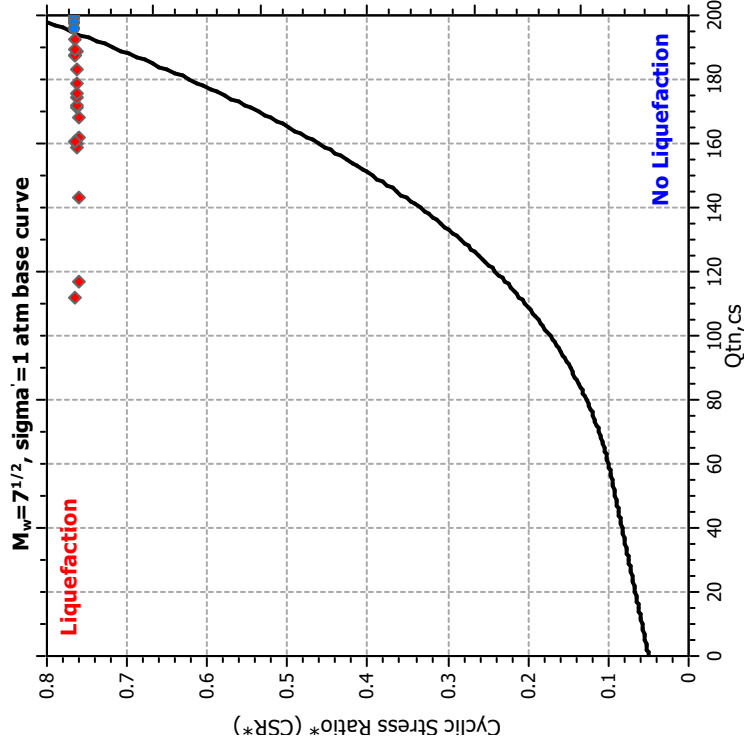
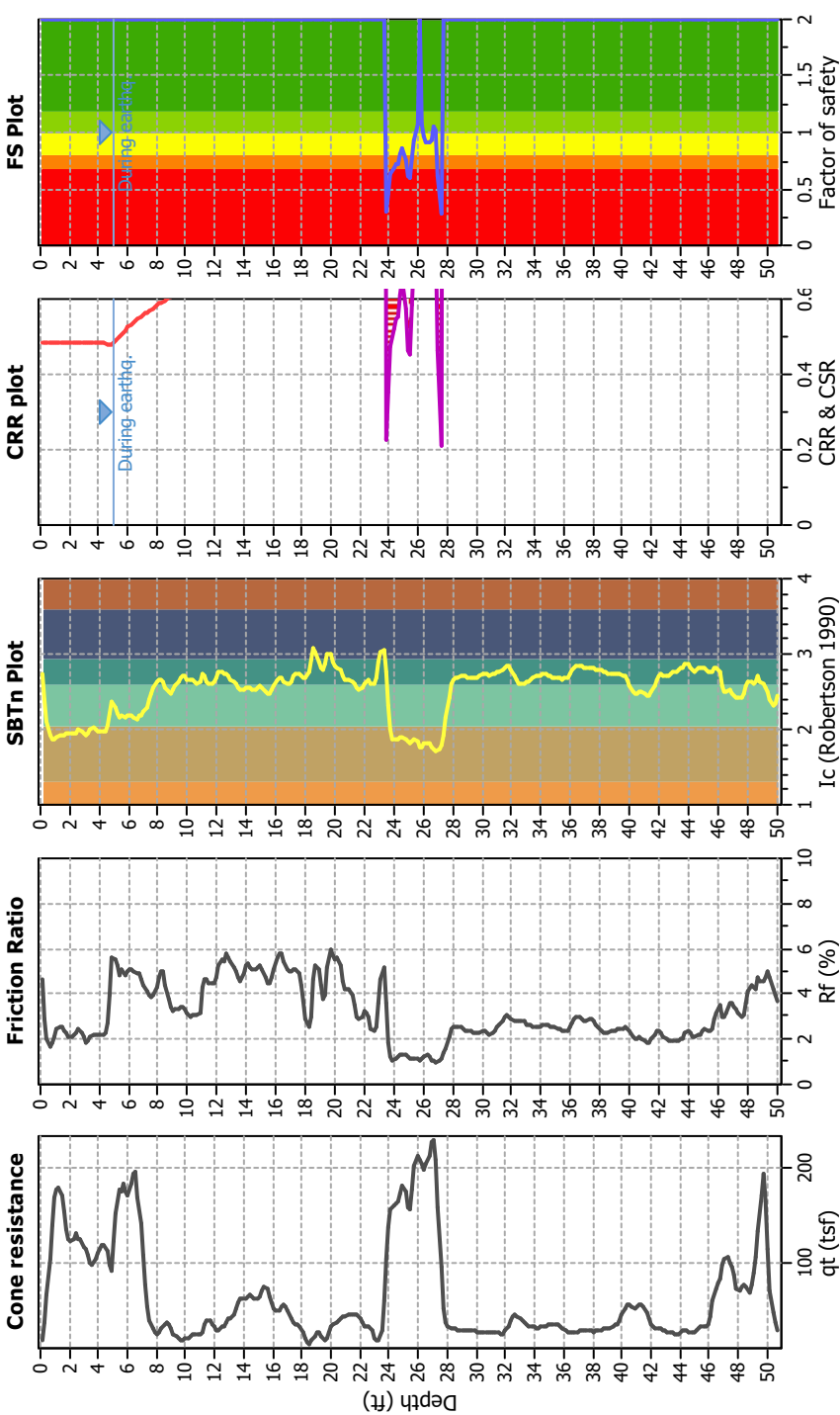
LIQUEFACTION ANALYSIS REPORT

Project title : 1030 Kaiser Road Warehouse
CPT file : CPT-07

Location : 1030 Kaiser Road, Napa, CA

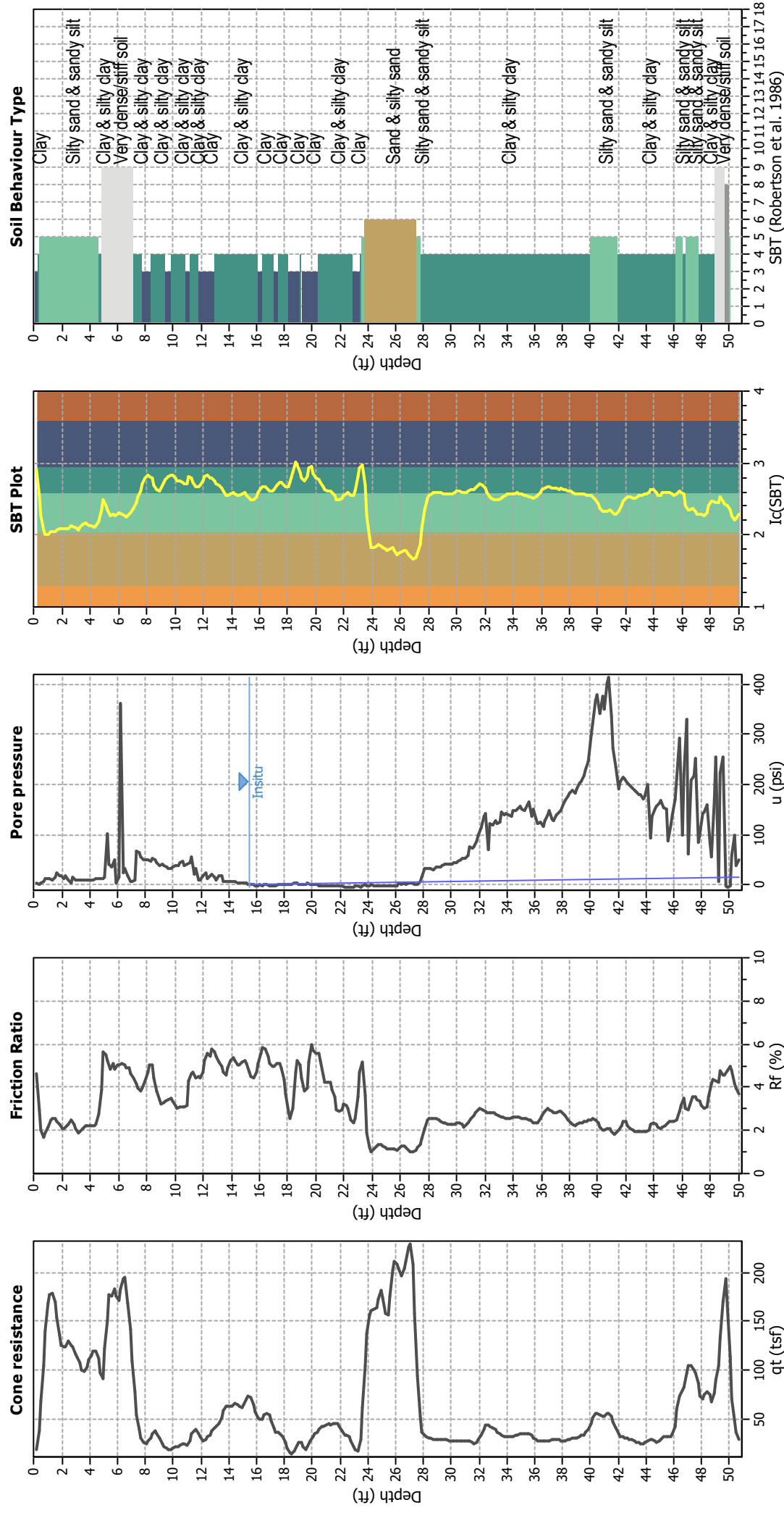
Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	15.50 ft	Use fill:	No	Clay like behavior	
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	5.00 ft	Fill height:	N/A	applied:	Sands only
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	No
Earthquake magnitude M_w :	6.80	Ic cut-off value:	2.30	Trans. detect. applied:	No	Limit depth:	N/A
Peak ground acceleration:	0.96	Unit weight calculation:	Based on SBT	K_a applied:	Yes	MSF method:	Method based



Zone A1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone A3: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone B: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

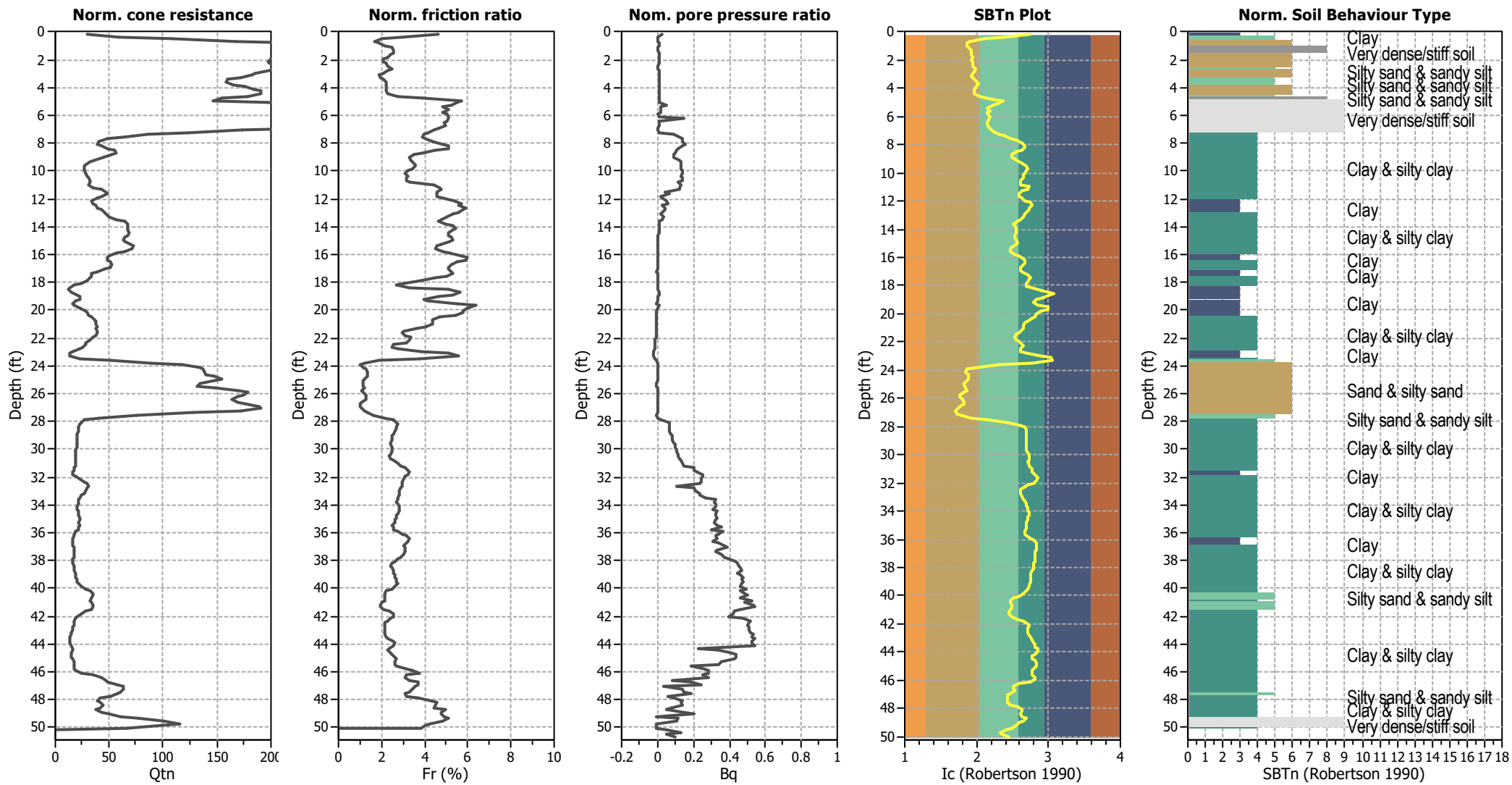
CPT basic interpretation plots



Input parameters and analysis data

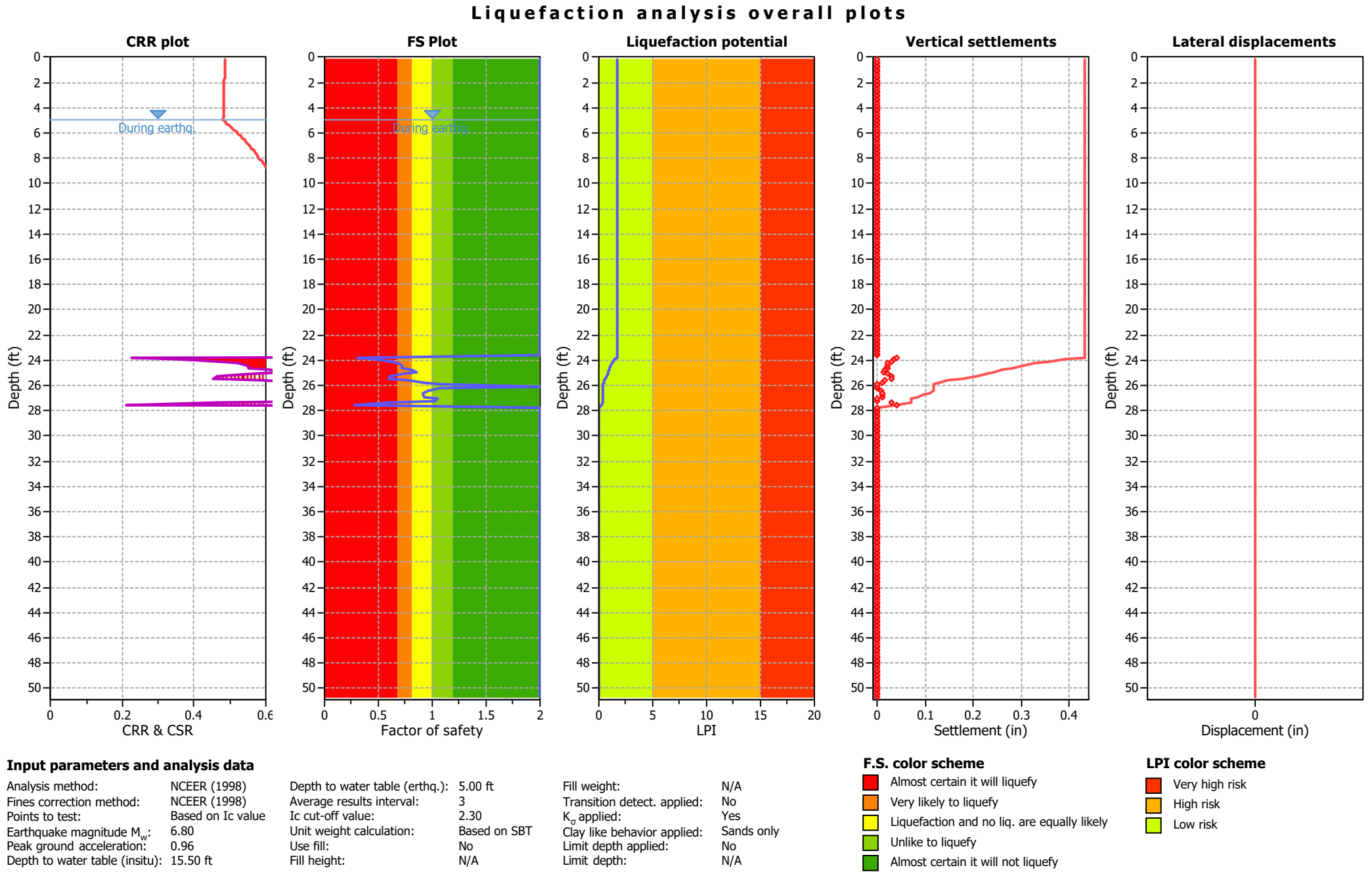
Analysis method:	NCEER (1998)	Depth to water table (earthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.30	K _o applied:	Yes
Earthquake magnitude M _w :	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.96	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	15.50 ft	Fill height:	N/A	Limit depth:	N/A

CPT basic interpretation plots (normalized)

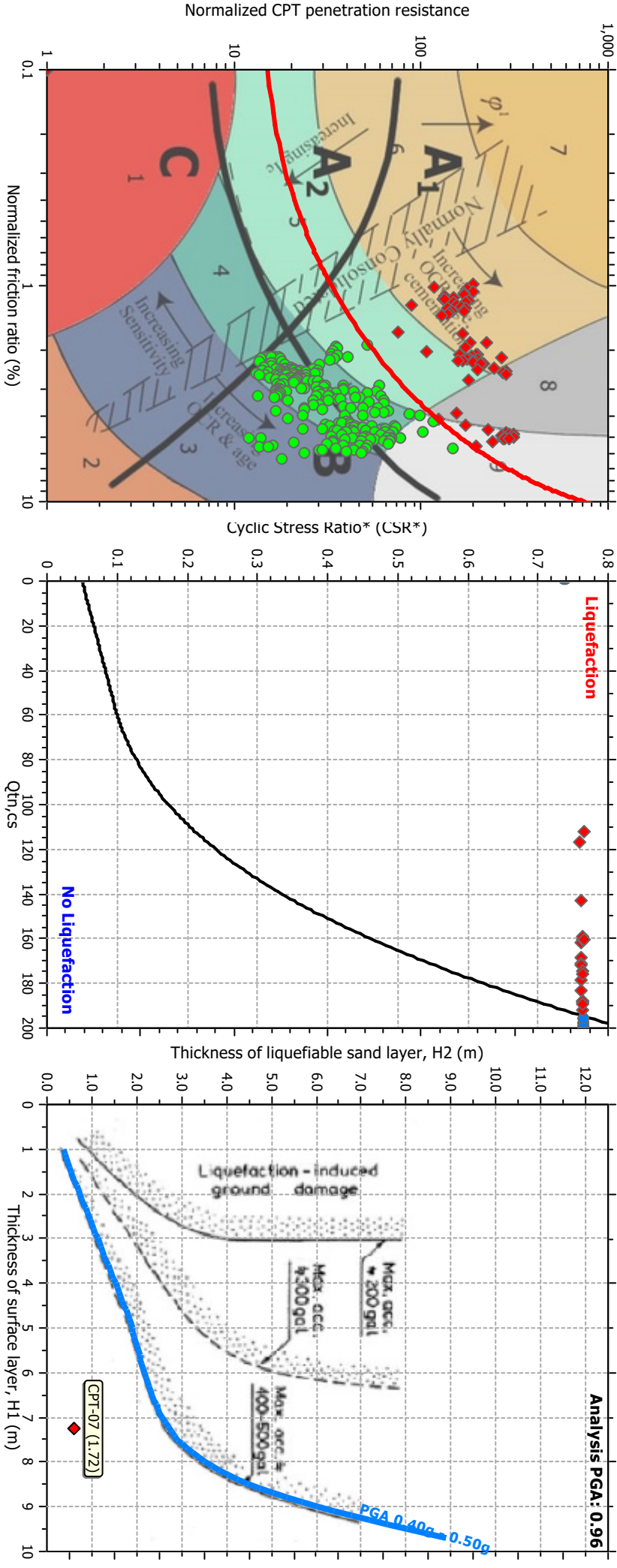


Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.30	K _o applied:	Yes
Earthquake magnitude M _w :	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.96	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	15.50 ft	Fill height:	N/A	Limit depth:	N/A



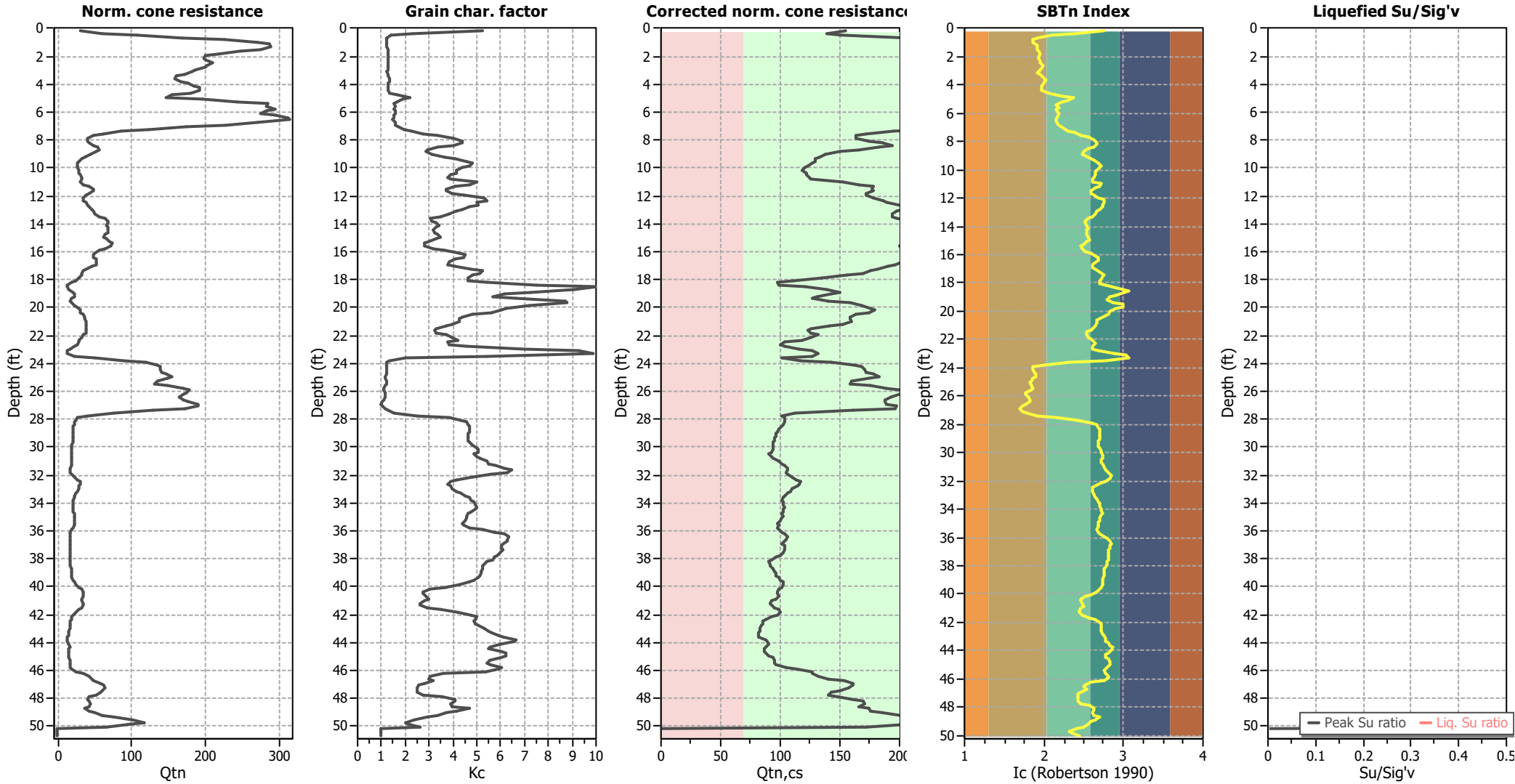
Liquefaction analysis summary plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (ethq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.30	K _u applied:	Yes
Earthquake magnitude M _w :	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.96	Use fill:	No	Limit depth applied:	No
Depth to water table (instu):	15.50 ft	Fill height:	N/A	Limit depth:	N/A

Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.30	K _o applied:	Yes
Earthquake magnitude M _w :	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.96	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	15.50 ft	Fill height:	N/A	Limit depth:	N/A

LIQUEFACTION ANALYSIS REPORT

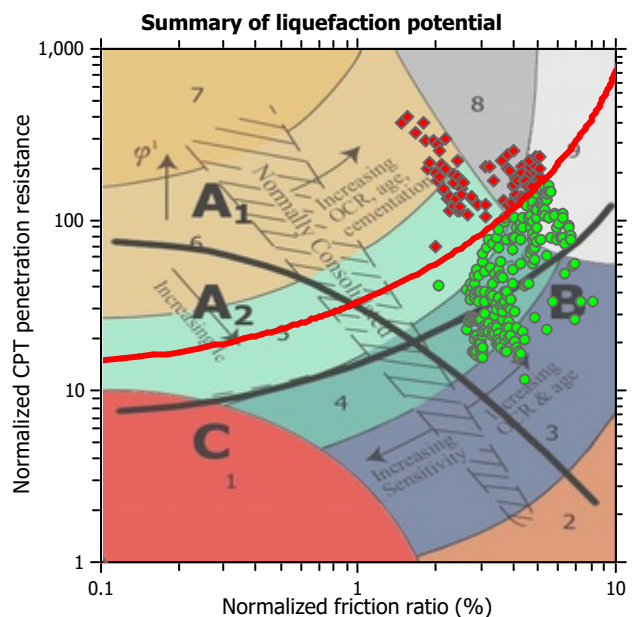
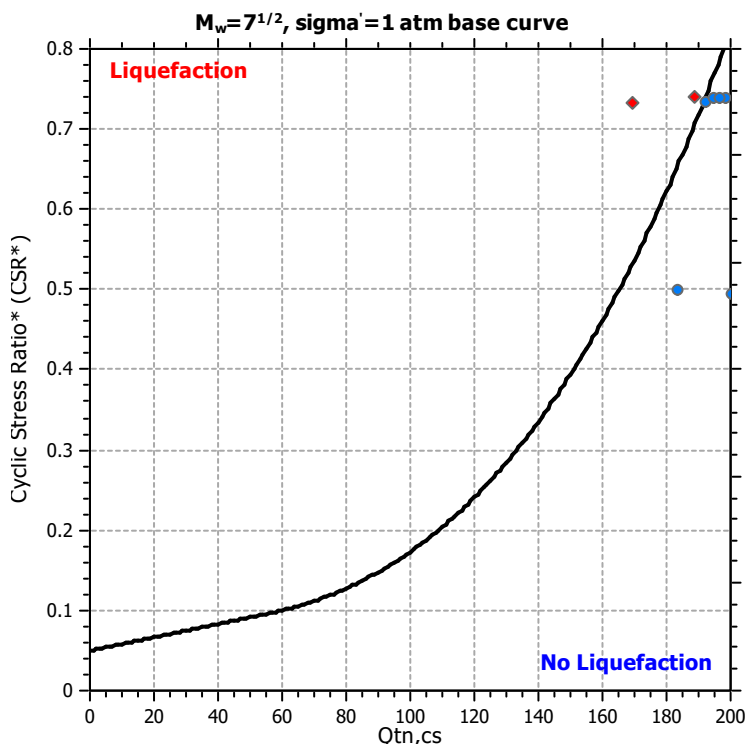
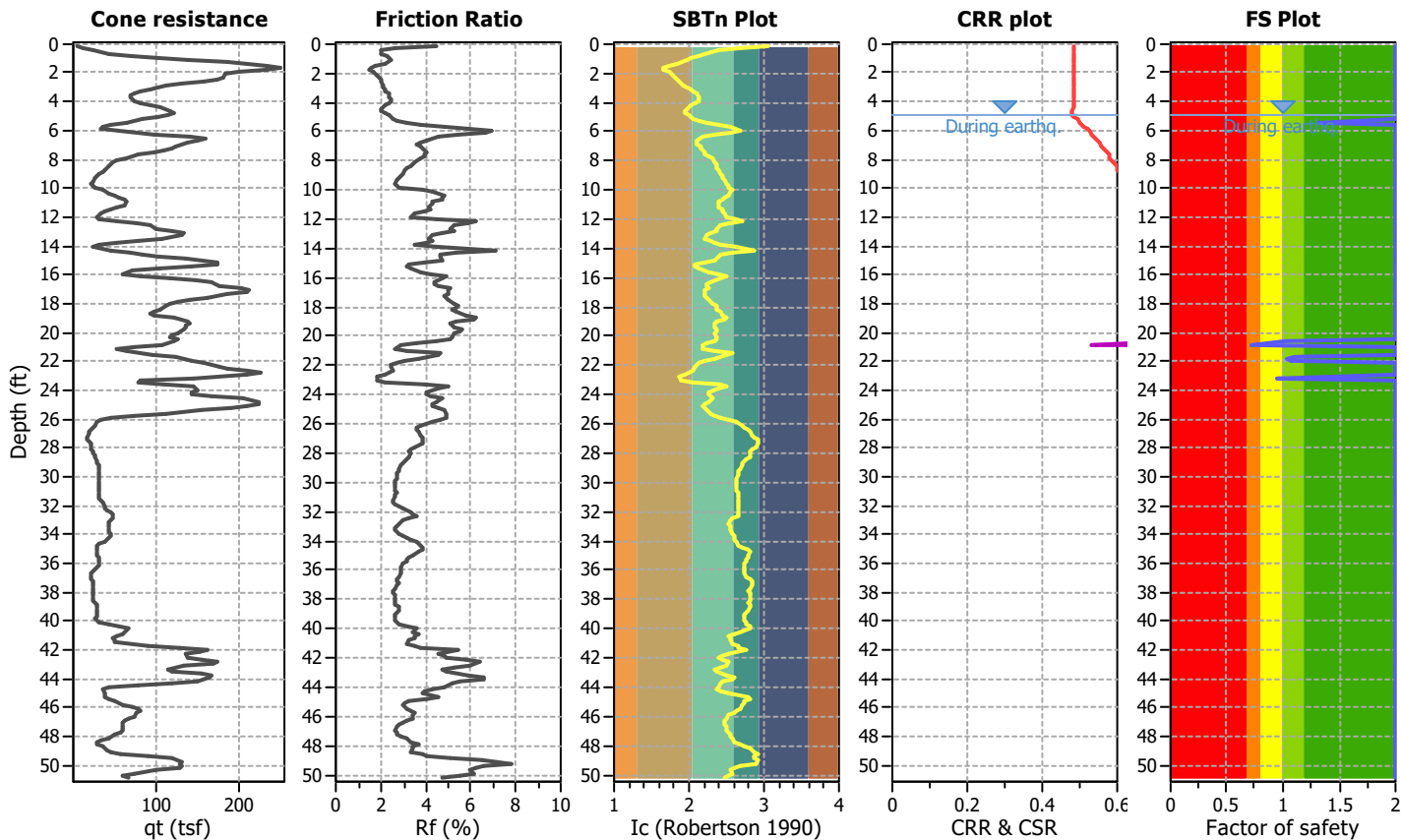
Project title : 1030 Kaiser Road Warehouse

Location : 1030 Kaiser Road, Napa, CA

CPT file : CPT-08

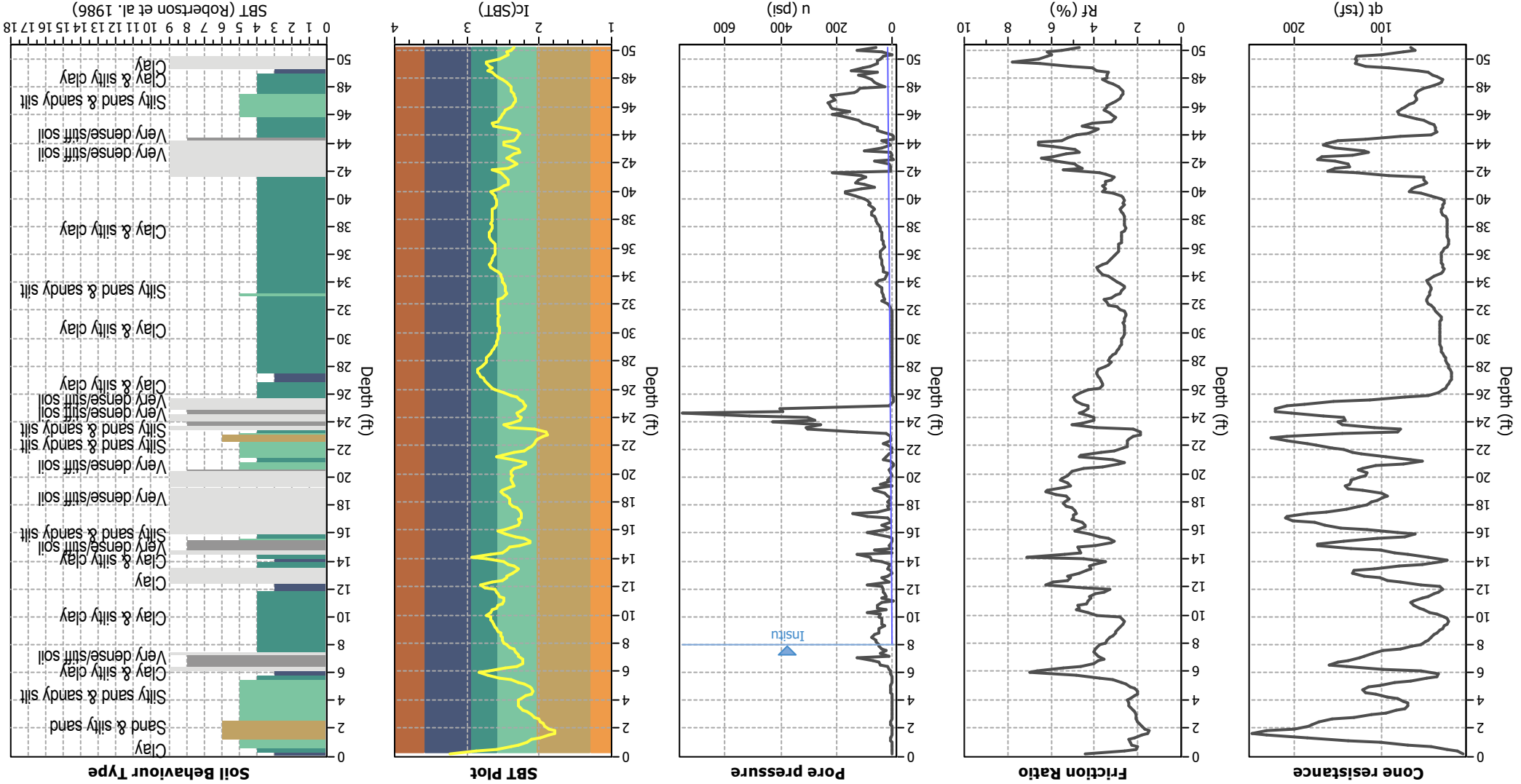
Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	8.00 ft	Use fill:	No	Clay like behavior	
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	5.00 ft	Fill height:	N/A	applied:	Sands only
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	No
Earthquake magnitude M_w :	6.80	Ic cut-off value:	2.30	Trans. detect. applied:	No	Limit depth:	N/A
Peak ground acceleration:	0.96	Unit weight calculation:	Based on SBT	K_o applied:	Yes	MSF method:	Method based



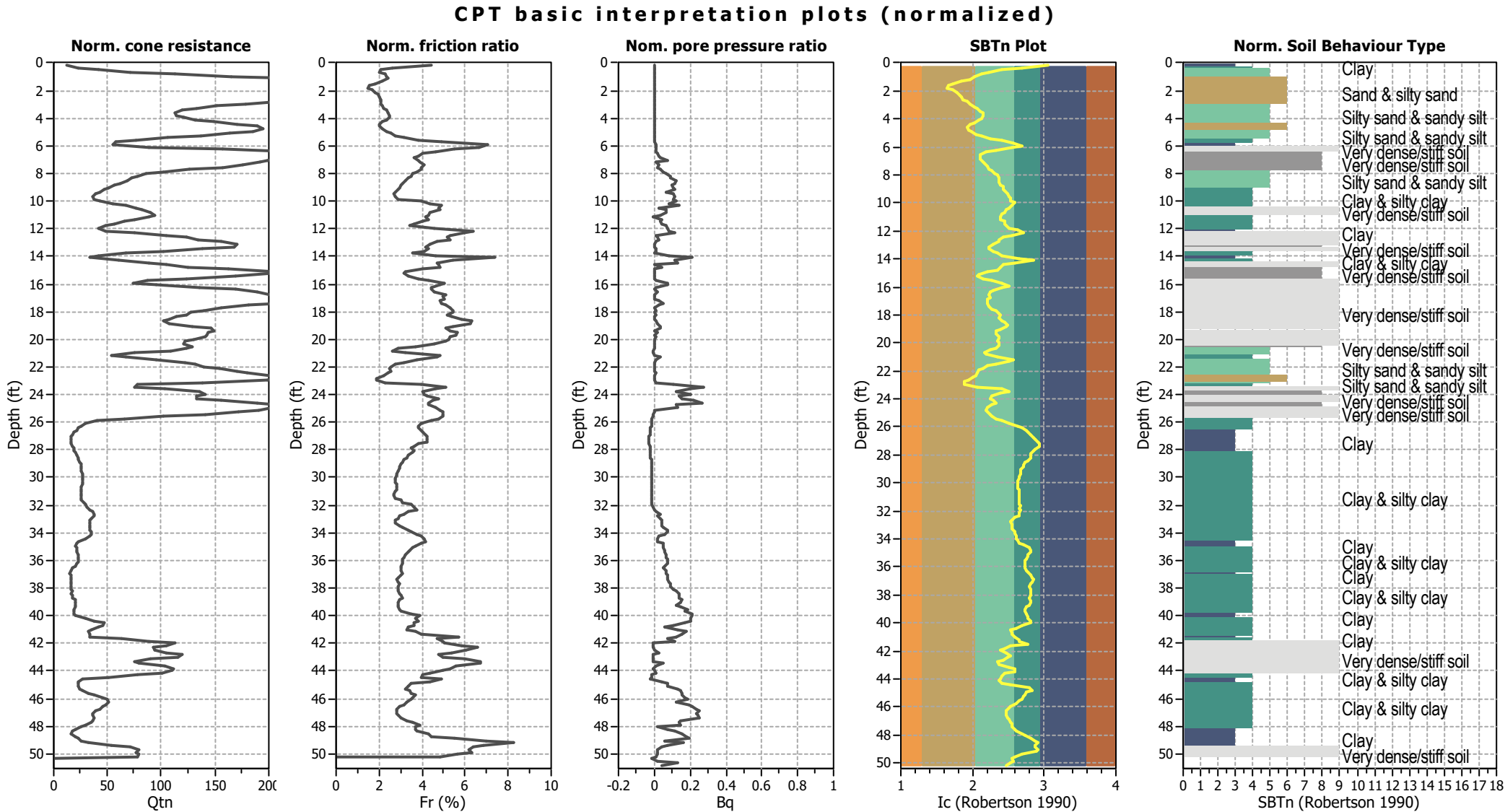
Zone A1: Cyclic liquefaction likely depending on size and duration of cyclic loading
 Zone A2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
 Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
 Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

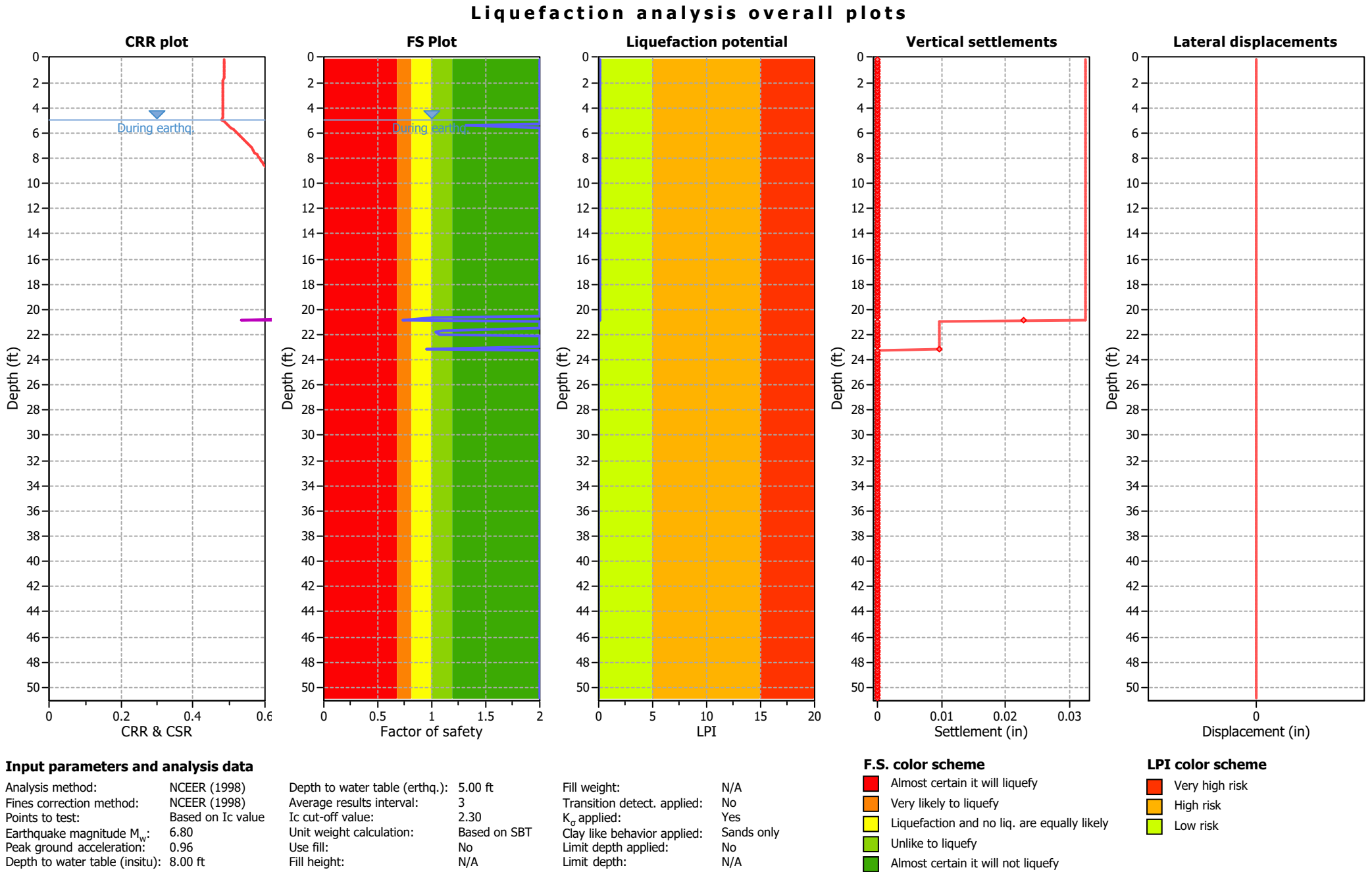
CPT basic interpretation plots



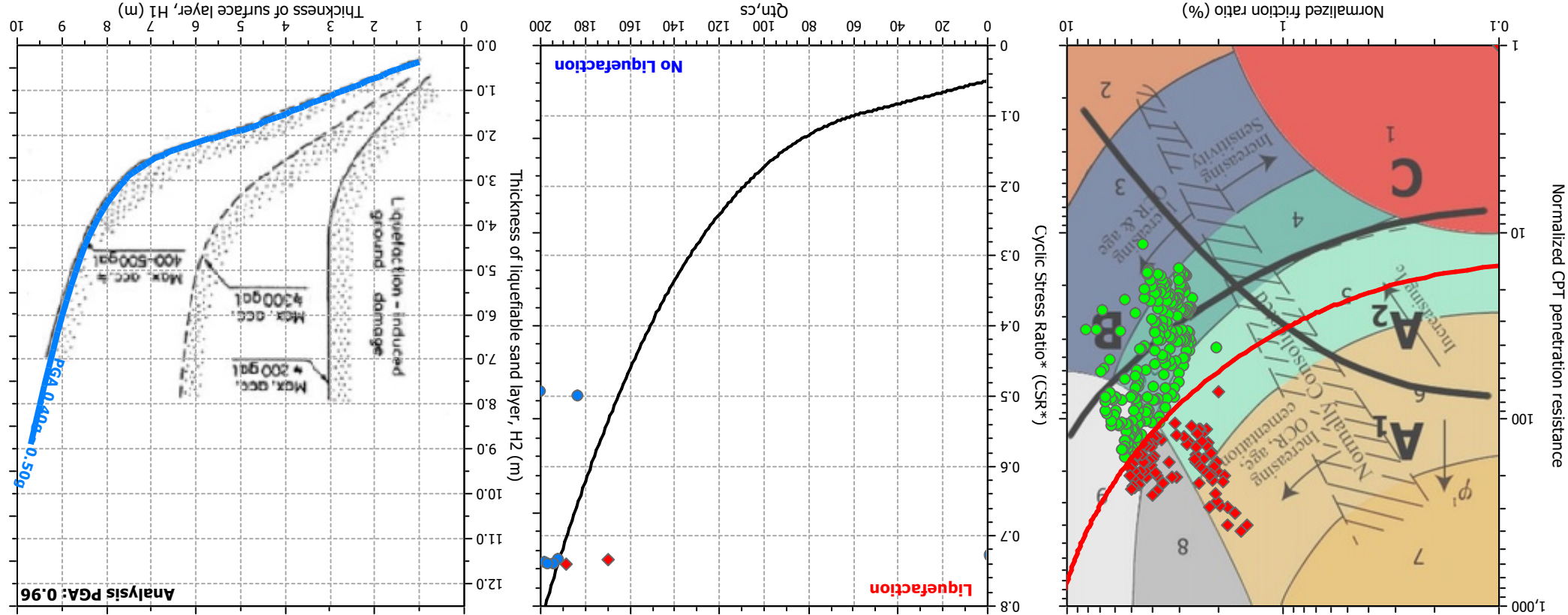
Input parameters and analysis data

Analysis method:	NCEER (1998)
Fines correction method:	NCEER (1998)
Points to test:	Based on Ic value
Earthquake magnitude M_w :	6.80
Peak ground acceleration:	0.96
Depth to water table (instu):	8.00 ft
Fill height:	
Use fill:	No
Unit weight calculation:	Based on SBT
Ic cut-off value:	2.30
Average results interval:	3
Depth to water table (earthq.):	5.00 ft
Fill weight:	N/A
Transition detect. applied:	No
K_0 applied:	Yes
Clay like behavior applied:	Sands only
Limit depth applied:	No
Limit depth:	N/A





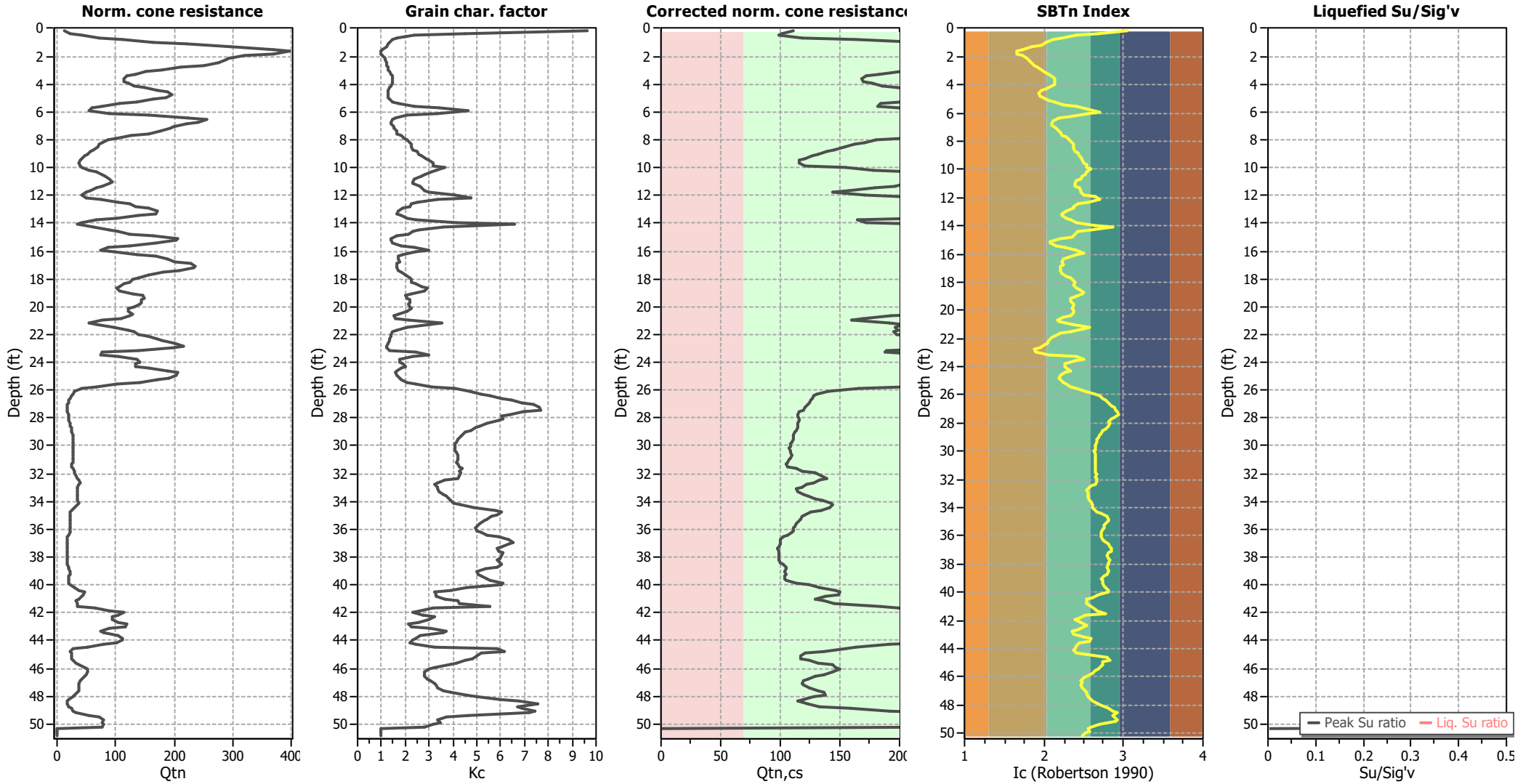
Liquefaction analysis summary plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (earthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	No
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Earthquake magnitude M _w :	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.96	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	8.00 ft	Fill height:	N/A	Limit depth:	N/A

Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
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Earthquake magnitude M _w :	6.80	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.96	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	8.00 ft	Fill height:	N/A	Limit depth:	N/A