GEOTECHNICAL INVESTIGATION

PROPOSED SPORTS PAVILION AND ADMINISTRATIVE BUILDING PROJECT

COLTON MIDDLE SCHOOL

670 WEST LAUREL STREET

COLTON, CALIFORNIA 92324

Prepared For **COLTON JOINT UNIFIED SCHOOL DISTRICT FACILITIES DEPARTMENT**
324 HERMOSA AVENUE, BUILDING #5
COLTON, CALIFORNIA 92324

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Project No. 038.0000020707

January 24, 2024

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Colton Joint Unified School District
350 Brookside Avenue
Beaumont, California 92223

Attention: Ms. Diane Mendez
Facilities Project Manager

Subject: Geotechnical Investigation
Proposed Sports Pavilion and Administrative Building Project
Colton Middle School
670 West Laurel Street
Colton, California 92324

In accordance with your request and authorization, Leighton Consulting, Inc. (Leighton) has conducted a geotechnical investigation for the proposed Colton Joint Unified School District's Proposed Sports Pavilion and Administrative Building project within the existing Colton Middle School campus, located at 670 West Laurel Street, in the City of Colton, California. The purpose of our study was to evaluate geologic and geotechnical conditions (including potential geologic hazards) within the area of the proposed improvements, to explore subsurface conditions, and to provide geotechnical recommendations for design and construction for the proposed improvements.

We understand based on the provided *Request for Proposals (RFP) for Geotechnical Services*, dated November 21, 2023, that the District is proposing to construct a new approximately 6,600-square-foot (SF) Sports Pavilion Building and an approximately 5,300 SF Locker Room Building. Along with the new buildings, modernization of the existing Administrative Building, a new campus entrance canopy, expansion of the existing southern parking lot, flatwork improvements, underground utilities, and a proposed infiltration facility are also proposed.

This report presents our findings and conclusions regarding this project. Based upon our study, the proposed improvements are feasible from a geotechnical viewpoint, provided our recommendations presented herein are incorporated into the design and construction of the project. The most significant geotechnical issues for this project were found to be the potential for strong seismic shaking, moderate seismic settlement, and shallow compressible soils underlying the site. These and other geotechnical issues are discussed in this report.

We appreciate the opportunity to work with Colton Joint Unified School District on this project. If you have any questions, or if we can be of further service, please call us at your convenience at (909) 484-2205.

Respectfully submitted,

LEIGHTON CONSULTING, INC.

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1.0 INTRODUCTION

1.1 Site Location and Description

The proposed Sports Pavilion and Administrative Building project is located within the northern and southeastern portions of the existing Colton Middle School campus at 670 W. Laurel Street, in the City of Colton, California. Colton Middle School is bounded to the north by Laurel Street, to the west by Valencia Drive, to the south by Oak Street, and to the east by residential homes. The approximate project site location and surrounding areas are shown on Figure 1, *Site Location Map*.

The proposed Sports Pavilion Building and adjacent Locker Room Building are to be located within the southeastern portion of the overall campus, just south of the existing lockers, and west of the existing field. The proposed Administrative Building modernization and entrance canopy addition are located within the northern portion of the school campus, just south of the northern parking lot. The proposed improvement areas are currently paved or contain existing buildings. An elevation survey map for the existing improvement area was not available at this time. Based on elevation data from published topographic maps (e.g., Figure 1), Google Earth's elevation model, and our field observations, the site is relatively flat and generally drains gently to the southeast. The ground elevation at the proposed improvement areas ranges in elevation from approximately 1,055 to 1,043 feet above mean sea level (msl).

Historic aerial photographs from 1938 to 2020 were reviewed for information regarding past site use. Based on our review, the Colton Middle School campus was constructed sometime between 1948 and 1959 and brought to its approximately current configuration sometime between 2002 and 2005.

1.2 Proposed Improvements

Based on the provided *Request for Proposal (RFP) for Geotechnical Services* dated November 21, 2023, email correspondence, and our initial site visit, we understand that the proposed project includes the demolition of an existing locker room building and existing portable building towards the southern end of the campus, just east of the basketball courts and north of the southern centrally located parking lot. The project also calls for the construction of a new approximately 6,600 square-foot (SF) Sports Pavilion Building and an approximately 5,300 SF Locker Room Building, expansion of the existing southern parking lot to accommodate approximately 30 stalls, flatwork improvements, underground utilities, and a proposed infiltration facility within the area of the proposed parking lot expansion. Also proposed is the modernization of the existing Administration Building to install a new entry portal/canopy on the eastern side of the building located at the northern end of the campus. Based on conversation with the design, team we understand at the time of this report that the proposed Pavilion Building is proposed to contain steel moment framing and the proposed Locker Room Building is proposed to be a single-story masonry building with the possibility of being changed to a light-gage-steel framed structure.

Grading plans for the associated improvements were not available at the time of this study. However, based on the relatively flat and level existing topography onsite, we anticipate the majority of grading to consist of minor cuts and fills (less than 7 feet) to achieve design grades for the proposed improvements.

This is a public-school project under the jurisdiction of the Division of the State Architect (DSA), to be designed and constructed in accordance with the 2022 California Building Code (CBC).

1.3 Previous Study

Leighton Consulting, Inc. previously performed a geotechnical investigation at Colton Middle School for construction of a proposed classroom building, locker room, and a parking lot expansion within the general area of our current study. The scope of work for the project is summarized below:

Leighton, 2004: Leighton performed a geotechnical investigation within the existing school campus for a proposed 2-story classroom building, a proposed 1-story locker building, and the expansion of the southern parking lot. The field exploration consisted of five (5) hollow-stem auger borings drilled to a maximum depth of 51 ½ feet below ground surface (bgs). The subsurface exploration encountered mostly medium dense to dense sand and gravelly/silty sand with fine contents ranging up to 20 percent. Lenses of silt and clay less than 1 foot in thickness were encountered below 25 feet bgs. Boring locations from that study (Leighton, 2004) are shown in Figure 2 – *Geotechnical Map.* Boring logs from that study are included in Appendix

A and laboratory test results from the 2004 investigation are included in Appendix B.

1.4 Purpose of Investigation

The purpose of this study has been to evaluate the geologic and geotechnical conditions and provide geotechnical recommendations for design and construction of the proposed improvements.

1.5 Scope

The scope of our geotechnical investigation has included the following tasks:

- Geologic Hazards Review – We reviewed pertinent, readily available geologic and geotechnical literature covering the site. Our review included regional geologic maps and reports available from our library and online sources. Documents reviewed are listed in the attached *References*.

- Pre-field Investigation Activities – We coordinated with District representatives and DigAlert (811) to have existing underground utilities located and marked prior to our subsurface investigation. We performed a site visit to specifically mark and review the boring locations. We also retained the services of a private utility locator to mark existing shallow buried utilities in the boring location areas.

- Field Exploration – Our field investigation included drilling, logging, and sampling of five (5) hollow-stem auger borings (LB-1 through LB-4, and LI-1) at representative locations in the area of the proposed improvements. Collectively, these borings were drilled to a maximum depth of approximately 51.5 feet below the existing ground surface (bgs).

  Encountered earth materials were logged in the field under the supervision of a State licensed Professional Engineer and described in accordance with the Unified Soil Classification System (ASTM D2488). Relatively undisturbed soil samples were obtained at selected intervals within these borings using both a ring-lined Modified California split-barrel sampler and an unlined, 2-inch outside diameter Standard Penetration Test (SPT) split-spoon sampler was also used in collecting samples. Although the SPT sampler had room for a liner, no liner was used, which is conventional in this area. Sampling resistance blow counts were obtained by dropping a 140-pound, automatic-trip hammer through a 30-inch free fall onto a sampling rod anvil. Modified California and SPT samplers were driven 18 inches, and the number of blows was recorded for each 6 inches of penetration. Both sampling methods generally followed respective ASTM D3550 and ASTM D1586 procedures. Representative bulk soil samples were also collected at shallow depths.

An infiltration test was conducted within boring LI-1, which was located in the southern side of the school campus just southwest of the existing sports field at the location requested by the design team. Testing was conducted at a depth of approximately 7 feet bgs, to estimate infiltration characteristics of the underlying soil at the location and depth requested by the design team. The infiltration test was conducted in general accordance with San Bernardino County Guidelines.

Seven (7) Cone Penetration Test (CPT) soundings were performed throughout the proposed building footprints and selected adjacent areas to a maximum depth of 50 feet bgs. Upon completion of advancement, the CPTs were backfilled with bentonite grout to the level below the surrounding asphalt and completed with asphalt cold patch to approximately match existing surface conditions.

Boring logs, CPT sounding results and infiltration measurements collected in the field are presented in Appendix A, *Geotechnical Exploration Logs*. The approximate boring and CPT locations are shown on the accompanying Figure 2, *Geotechnical Map*.

- Laboratory Tests - Laboratory tests were conducted on selected relatively undisturbed and bulk soil samples obtained during our field investigation. The laboratory testing program was designed to evaluate engineering characteristics of the onsite soil. Laboratory tests conducted include:

  - In situ moisture content and dry density
  - Sieve analysis for grain-size distribution
  - Expansion Index
  - Swell/Settlement Potential
  - Maximum dry density and optimum moisture content

- R-Value
- Corrosion Series (pH, electrical resistivity, chloride ion, sulfate ion)

Results of in situ dry density and moisture content tests are presented on the boring logs in Appendix A. Results of the remaining laboratory tests conducted for this study are provided in Appendix B.

- Engineering Analysis - Data obtained from our background review and field exploration was evaluated and analyzed to provide the geotechnical conclusions and preliminary recommendations presented in the following sections.

- Report Preparation - Results of our geotechnical investigation have been summarized in this report, presenting our findings, conclusions and preliminary recommendations for design and construction of the project.

2.0 FINDINGS

2.1 Geologic Hazards Review

We have reviewed pertinent, readily available geologic and geotechnical literature covering the site. Our review included regional geologic maps and reports available from our library and the public domain. Documents reviewed are listed in *References*. Potential geologic hazards are discussed in the following sections. Our review has considered California Geological Survey's Note 48, *Checklist of the Review of Engineering Geology and Seismology Reports for California Public Schools, Hospitals, and Essential Services Buildings*. A copy of the Note 48 checklist is included in Appendix E of this report and has been annotated indicating the applicable sections of this report that address each checklist item.

2.2 Regional Geologic Setting

The site is located in the northern Peninsular Ranges Geomorphic Province of southern California within the San Bernardino Valley. The San Bernardino Valley is underlain by a thick accumulation of alluvial sediments eroded from granitic and metamorphic rocks in the San Gabriel and San Bernardino Mountains to the northwest and northeast. Cretaceous igneous rocks of the southern California batholith underlie the hills of the Perris Block south of the site. Strike-slip faults, such as the San Jacinto Fault Zone, dominate the structure of the Peninsular Ranges. The San Andreas fault zone, 7.2 miles to the northeast, defines the valley from the southern front of the San Bernardino Mountains. The Cucamonga section of the Sierra Madre fault zone is located approximately 9.5 miles to the northwest and defines the valley from the southern front of the San Gabriel Mountains. The active sections of the San Jacinto fault zone trace about 1.1-mile to the northeast.

Based on available regional geologic maps, and as depicted on Figure 3, *Regional Geologic Map*, the site and its surroundings are underlain by early Holocene to late Pleistocene young axial-channel deposits consisting of fine to very coarse sand and pebbly sand that coarsens up-stream to poorly sorted sand and sandy pebble to small-cobble gravel (Morton and Miller, 2003). These deposits have been eroded from the San Gabriel and San Bernardino Mountains and have been transported and deposited onto the site.

Quaternary Young Axial-Channel Deposits (Map Symbol Qya): On a local site-specific scale, the site has been mapped as being underlain by Quaternary-age young axial-channel deposits consisting of fine to very coarse sand and pebbly sand that coarsens up-stream to poorly sorted sand and sandy pebble to small-cobble gravel. The regional geology of the area is depicted on Figure 3, *Regional Geology Map.*

2.3 Subsurface Soil Conditions

During our field exploration, we encountered a mantle of artificial fill (afu) underlain by native Quaternary Young Axial Channel Deposits (Qya). Artificial fill was encountered within our borings underlying existing pavement sections at the site, and typically extended to 5 feet below the existing ground surface. We have presumed that the onsite artificial fill was associated with past grading and development. Because documentation regarding the engineering and placement of artificial fill encountered was not available to us for our investigation, we have characterized it as undocumented. Undocumented artificial fill encountered generally consisted of loose to medium dense silty sands and sands with varying amounts of gravel.

Young axial-channel deposits encountered underlying undocumented artificial fill within the exploratory borings drilled onsite generally consisted of medium dense sands with silts and gravels to silty sands within 5 feet to 10 feet below ground surface (bgs). Soils below 10 feet to maximum explored depths consisted of either medium dense sands to silty sands or stiff to very stiff fine-grained soils (silts and clays). These soils were visually described as slightly moist to the maximum depths explored. The laboratory-measured in situ dry density of soil samples ranged from approximately 99 to 118 pcf and moisture contents ranged from approximately 2 and 14 percent in the upper 10 feet of alluvial soils. The laboratory maximum dry density of a near-surface soil sample obtained from boring LB-2 was 139 pcf with a 5.5 percent optimum moisture content as determined by ASTM D1557.

More detailed descriptions of the subsurface conditions are presented on the boring logs in Appendix A. Cross-sectional illustrations of encountered subsurface soil conditions are included as Figures 4A and 4B.

2.3.1 Compressible and Collapsible Soil

Soil compressibility refers to a soil's potential for settlement when subjected to increased loads, as from a new structure or fill surcharge. Based on our investigation and laboratory testing, the near-surface alluvial soils in the proposed structure locations are considered slightly compressible, becoming less compressible with depth. Partial removal and recompaction of this material will further reduce the potential for adverse total and differential settlement of the proposed improvements.

Collapse potential (moisture sensitivity, sometimes referred to as 'hydrocollapse') refers to the potential settlement of a soil under existing stresses upon being wetted. Based on laboratory testing results conducted during our previous investigation (Leighton 2004), the conditions encountered in our borings and CPT soundings, and with the implementation of our removal and recompaction recommendations during grading, soils are expected to have a low collapse potential.

2.3.2 Expansive Soils

Expansive soils contain significant amounts of clay particles that swell considerably when wetted and shrink when dried. Structures constructed on these soils are subjected to large uplifting forces caused by the swelling. Without proper measures taken, heaving and cracking of building foundations and slabs-on-grade could result.

Based on laboratory test results of the recovered near surface soils during our current and past investigations, onsite soils are expected to have a low expansion potential. Based on laboratory testing of near surface soils, soils are expected to generally have low plasticity.

2.3.3 Sulfate Content

Water-soluble sulfates in soil can react adversely with concrete. However, concrete in contact with soil containing sulfate concentrations of less than 0.1 percent by weight is considered to have negligible sulfate exposure based on the American Concrete Institute (ACI) publication 318-14, Section 19.3 (ACI, 2014), adopted by the 2022 CBC (Section 1904A.2).

A representative near-surface soil sample was tested for soluble sulfate content. The result of this test indicated a sulfate content of less than 0.1 percent by weight. As such, the soils exposed at grade are expected to pose negligible potential (Exposure Class S0) for sulfate reaction with concrete.

2.3.4 Resistivity, Chloride and pH

Soil corrosivity to ferrous metals can be estimated by the soil's electrical resistivity, chloride content and pH. In general, soil having a minimum resistivity between 2,000 and 10,000 ohm-cm is considered moderately corrosive, between 1,000 and 2,000 ohm-cm is considered corrosive, and soil having a minimum resistivity less than 1,000 ohm-cm is considered severely corrosive. Soil with a chloride content of 500 parts-per-million (ppm) or more is considered corrosive to ferrous metals.

As a screening for potentially corrosive soil, a near surface soil sample was tested during this investigation to determine their minimum resistivity, chloride content, and pH. These tests indicated a minimum resistivity of 5,000 ohm-cm, a chloride content of 20 ppm, and pH of 6.8. Based on the minimum resistivity, the onsite soil is considered moderately corrosive to ferrous metals.

2.4 Groundwater

Groundwater was not encountered in our borings drilled onsite to a maximum explored depth of 51½ feet bgs. Based on groundwater data from nearby State Well No. 01S04W17M001S, located approximately 1,300 feet north of the site with measurements dating from January 1, 1940, to June 27, 2017, and State Well No. 01S04W20K001S, located approximately 2,600 feet northeast of the site with measurements dating from January 1, 1940, to January 9, 1967, the shallowest groundwater reading identified was measured on April 11, 1945, which was at an elevation of 938 feet above mean sea level (msl). This elevation correlates to a groundwater depth of approximately 100 feet bgs based on the lowest elevation at the project site (CDWR, 2023).

Recent available groundwater data from the last five years from a nearby groundwater well managed by the San Bernardino Valley Municipal Water District for State Well No. 01S04W16P004S located approximately 1.4 miles southeast for the site indicate the shallowest groundwater elevation to be at an elevation of 863 feet above mean sea level on December 17, 2019, which correlates to a groundwater depth of approximately 180 feet bgs based on the lowest elevation onsite (CDWR, 2023). Fife, et al. (1976) indicated that the generalized depth to groundwater below the site in 1960 was at a depth between 200 and 300 feet bgs.

Based on regional groundwater level data we reviewed, we have estimated the historically highest groundwater level to be 100 feet bgs. Based on this, regional groundwater is not expected to be encountered during grading of this project. Based on these, groundwater levels at this project site are expected to be deeper than 50 feet bgs.

2.5 Faulting and Seismicity

In general, the primary seismic hazards for sites in the region include surface rupture along active faults and strong ground shaking. The potential for fault rupture and seismic shaking are discussed below.

2.5.1 Surface Faulting

One of the primary seismic hazards for this region is surface fault rupture. Our assessment of the possible presence of active faulting through the proposed improvement project site included a review of available literature, maps, and aerial photographs.

The California Geological Survey (CGS) and San Bernardino County have both mapped the site to be outside of an Earthquake Fault Zone. Additionally, published geologic mapping has not indicated any faults transecting or trending towards the site. No mapped faults or Earthquake Fault Zones transect or project through the project site.

The closest mapped active or potentially active fault traces are related to the San Jacinto fault zone (the closest mapped active trace is located approximately 1.1-mile northeast of the site, a potentially active trace is located approximately 0.5-mile southwest of the site) and the San Bernardino Mountains section of the San Andreas fault zone (located approximately 7.2 miles northeast from the site). Figure 5, *Regional Fault*

Map and Historic Seismicity Map, shows the approximate locations of known traces of significant faults relative to the location of the project.

2.5.2 Seismic Design Parameters

Based on current understanding of local faulting, the principal seismic hazard that could affect the site is ground shaking resulting from an earthquake occurring along several major active or potentially active faults in southern California. The project should be designed in accordance with applicable current building codes and standards utilizing appropriate seismic design parameters intended to reduce seismic risk as defined by California Geological Survey (CGS) Chapter 2 of Special Publication 117A (CGS, 2008). The following are seismic design parameters for new structures based on the 2022 California Building Code (CBC). The map-based seismic parameters presented were obtained from United States Geological Survey in accordance with American Society of Civil Engineers (ASCE) Publication ASCE 7-16 and the 2022 CBC, Chapter 16A.

We assume that the proposed buildings will have a period of 0.5 second or less. As such, Site Class F is not required, and Site Class may be determined in accordance with ASCE 7-16 Section 20.3. If the building period is greater than 0.5 second, site class should be reevaluated.

Based on our evaluation of subsurface data, we have selected Site Class D. A summary of Site Class evaluation is included in Appendix C.

Table 1 – 2022 CBC Seismic Design Parameters

2022 CBC Parameters (CBC or ASCE 7-16 reference)	**Value 2022 CBC**
Site Latitude and Longitude (degrees): 34.0798, -117.3321	
Site Class Definition (1613A.2.2, ASCE 7-16 Ch 20)	D**
Mapped Spectral Response Acceleration at 0.2s Period (1613A.2.1), S_s	2.277 g
Mapped Spectral Response Acceleration at 1s Period (1613A.2.1), S_1	0.910 g
Short Period Site Coefficient at 0.2s Period (T1613A.2.3(1)), F_a	*1.000*
Long Period Site Coefficient at 1s Period (T1613A.2.3(2)), F_v	*1.700**
Adjusted Spectral Response Acceleration at 0.2s Period (1613A.2.3), S_{MS}	2.277 g
Adjusted Spectral Response Acceleration at 1s Period (1613A.2.3), S_{M1}	1.547* g
Design Spectral Response Acceleration at 0.2s Period (1613A.2.4), S_{DS}	1.518 g
Design Spectral Response Acceleration at 1s Period (1613A.2.4), S_{D1}	1.031* g
Mapped MCE_G peak ground acceleration (11.8.3.2, Fig 22-9 to 13), *PGA*	0.960 g
Site Coefficient for Mapped MCE_G *PGA* (11.8.3.2), F_{PGA}	1.100
Peak Ground Acceleration, mod w/ site effects (1803A.5.12; 11.8.3.2), PGA_M	1.056 g

* See Section 11.4.8 of ASCE 7-16. A site-specific ground motion hazard analysis in accordance with Section 21.2 of ASCE 7-16 is required for this site. **Per Supplement 3 to ASCE 7-16, a site-specific ground motion hazard analysis is not required where the value of the parameters SM_1 and SD_1 in the table are increased by 50%.**

** Site Class D, and all of the resulting parameters in this table, may only be used for structures without seismic isolation or seismic damping systems.

Based on ASCE 7-16 Equation 11.8-1, the F_{PGA} is 1.1, the PGA is 0.960g, and the PGA_M is 1.056g. As an added check, PGA and hazard deaggregation were also estimated using the United States Geological Survey's (USGS) 2008 Interactive Deaggregations Utility. The results of this analysis indicate that the predominant modal earthquake has a PGA of 1.024g with a magnitude of approximately 8.1 (M_W) at a distance on the order of 2.68 kilometers for the Maximum Considered Earthquake (2% probability of exceedance in 50 years); 2/3 of this value is 0.68g. Deaggregation results are included in Appendix C.

Until reviewed and accepted by the California Geologic Survey (CGS), these parameters are subject to change. Changes may be required as part of the CGS review process.

2.5.3 Historical Seismicity

The *Regional Fault and Historical Seismicity Map* (Figure 5) shows recorded historical regional seismic events (those that have been recorded since the mid-1700s) with respect to the site. Based on this map, it appears that the site has been exposed to relatively significant seismic events; however, this site does not appear to have experienced more severe seismicity than compared to much of southern California in general. We are unaware of documentation that indicates that past earthquake damage in the site vicinity has been significantly worse than for the majority of southern California. In addition, we are unaware of damage in the site vicinity as the result of liquefaction, lateral spreading, or other related phenomena.

2.6 Secondary Seismic Hazards

In general, secondary seismic hazards for sites in the region could include soil liquefaction, earthquake-induced settlement, lateral displacement, surface manifestations of liquefaction, landslides, seiches, and tsunamis. The potential for secondary seismic hazards at the site is discussed below.

2.6.1 Liquefaction and Lateral Spreading

Liquefaction is the loss of soil strength or stiffness due to a buildup of pore-water pressure during severe ground shaking. Liquefaction is associated primarily with loose (low density), saturated, fine- to medium-grained, cohesionless soils. Effects of liquefaction can include sand boils, settlement, and bearing capacity failures below structural foundations.

The site has not been evaluated by the State of California for liquefaction hazards. San Bernardino County (2010) has mapped the site to be in an area with a low liquefaction susceptibility (see Figure 6, *Seismic Hazards Map*).

Historical groundwater levels have been estimated to have been no shallower than about 100 feet bgs based on available groundwater data from nearby water monitoring wells and published information.

Due to the lack of shallow historical groundwater levels and relatively dense nature of the underlying soils, the potential for liquefaction onsite (including effects of liquefaction, such as lateral spreading) is considered very low.

2.6.2 Seismically Induced Settlement

Seismically induced settlement consists of dry dynamic settlement (above groundwater) and liquefaction-induced settlement (below groundwater). During a strong seismic event, seismically induced settlement can occur within loose to moderately dense sandy soil due to reduction in volume during and shortly after an earthquake event. Settlement caused by ground shaking is often nonuniformly distributed, which can result in differential settlement.

We have performed analyses to estimate the potential for seismically induced settlement using the method of Tokimatsu and Seed, and based on Martin and Lew (1999), considering the maximum considered earthquake (MCE) peak ground acceleration (PGA_M). Design/historic high groundwater levels of 100 feet below ground surface were used in the analysis. Based on our analysis, a potential for approximately 4.4 inches of seismic settlement has been estimated for the site; however, based on our overexcavation recommendations presented later in this report, the maximum estimated potential seismic settlement has been reduced to approximately 3.4 inches and 2.5 inches for overexcavation depths of 7 feet and 15 feet bgs, respectively.

Seismically induced settlement analysis was also performed on CPT sounding data utilizing the computer software CLiq v.3.0.3.2 by GeoLogismiki, which considered the maximum considered earthquake (MCE) peak ground acceleration (PGA_M) and design/historic high groundwater levels of 100 feet below ground surface. Based on this analysis, the potential for approximately 5.3 inches of seismic settlement has been estimated for the site; however, based on our overexcavation recommendations presented later in this report, the maximum estimated potential seismic settlement is reduced to approximately 2.6 inches and 1.8 inches for overexcavation depths of 7 feet and 15 feet bgs, respectively. Our CPT analysis utilized the 2 times factor in the dry sand settlement to account for the possibility of multidirectional nature of earthquakes. Results of our seismic settlement analysis are presented in Appendix C.

CPT sounding data was collected continuously to explored depths, while hollow-stem SPT data was collected generally at 5-foot intervals to explored depths. In addition, the analysis procedures to estimate seismic settlement potential is different for the two types of exploration techniques. Based on this, data and analyses from one exploration method should not be compared to the other method for purposes of estimating potential seismically induced differential settlement between exploration locations.

Due to the relatively closely spaced and larger quantity of deep CPT soundings within the area the proposed building footprints, estimated potential differential settlement (angular distortion) may be taken as the differential value between adjacent CPT soundings divided by the distance between the explorations, which can be normalized to a 30-foot horizontal distance. A summary table of differential settlement calculations derived from our CPT analysis for both overexcavation cases described later in this text is located at the rear of Appendix C. Based on our analysis of the two proposed structures for this project, the steel-framed Pavilion Building and a future single-story masonry Locker Room Building, appear to be within a quarter of the tolerable differential settlement values listed in the table below from ASCE 7-16. We understand the future Locker Room Building, while currently conceptualized as masonry, has an alternative to become a single-story steel- or wood-framed structure during design. The structural engineer should determine Structure Type and Risk Category and evaluate whether the differential settlement estimates described above are tolerable. A copy of ASCE 7-16 Table 12.13-3 is provided as follows for reference.

Table 12.13-3 Differential Settlement Threshold

Structure Type	**Risk Category**		
	I or II	**III**	**IV**
Single-story structures with concrete or masonry wall systems	0.0075L	0.005L	0.002L
Other single-story structures	0.015L	0.010L	0.002L
Multistory structures with concrete or masonry wall systems	0.005L	0.003L	0.002L
Other multistory structures	0.010L	0.006L	0.002L

2.6.3 Seiches and Tsunamis

Seiches are large waves generated in enclosed bodies of water in response to ground shaking. Tsunamis are waves generated in large bodies of water by fault displacement or major ground movement. Based on the location of the site and its distance from contained water facilities, seiches and tsunamis are not a hazard to the site.

2.7 Slope Stability and Landslides

No significant slopes are present or planned near the planned improvements. As such, slope stability evaluation (including development of static and dynamic strength parameters, pseudostatic slope stability coefficients, dynamic site conditions evaluation, and slope stability mitigation) is not warranted for this project.

2.8 Flooding and Dam Breach Inundation Potential

The existing school campus is not within mapped 0.1% or a 0.2% Annual Chance Flood Hazards areas, which are also referred to as a 100 and 500-year flood hazard zones, respectively, as shown on Figure 7, *Flood Hazard Zone Map*.

Flooding can also result from the failure of dams. Based on our review of dam breach inundation data by the California Office of Emergency Services (OES), and the California Department of Water Resource's Dam Breach Inundation Map Web Publisher (CDWR, 2023b) the site is not located near dams or in an area shown as susceptible to dam breach inundation (see Figure 8, *Dam Breach Inundation Map*).

2.9 Other Potential Hazards Listed on CGS Note 48

The following naturally occurring hazards are not believed to exist at the site nor in the region: methane gas, hydrogen-sulfide gas, tar seeps, volcanic eruption, radon-22 gas, and naturally occurring asbestos in geologic formations associated with serpentine.

Subsidence refers to ground settlement due to withdrawal of liquid from the underlying earth materials (such as water or oil). The existing school campus location is within an area of land subsidence due to groundwater pumping, as identified by the U.S. Geological Survey (USGS, 2023b). This area of subsidence is related to groundwater withdrawal during the post-World War II agriculture and urbanization. The San Bernardino Valley Municipal Water District (Valley District) was formed in 1954, and as a part of their long-term integrated water resource planning, the Valley District manages groundwater levels and supply. Additionally, we are unaware of subsidence that has been documented in the area since the formation of the Valley District. As such, the potential for ground cracking or damage due to subsidence onsite is considered to be low.

2.10 Infiltration Testing

Infiltration testing was conducted within one of our borings onsite (LI-1) to estimate the infiltration characteristics of the onsite soils at the depth and location tested and requested by the design team. The infiltration testing was conducted at a bottom test zone depth of approximately 7 feet bgs.

Well permeameter tests are useful for field measurements of soil infiltration rates, and are suited for testing when the design depth of the basin or chamber is deeper than current existing grades. It should be noted that this is a clean-water, small-scale test, and that correction factors need to be applied. A test consists of excavating a boring to the depth of the test (or deeper as long as it is partially backfilled with soil and a bentonite plug with a thin soil covering is placed just below the design test elevation). A layer of clean sand or gravel is then placed in the boring bottom to temporarily support a perforated well casing pipe system. Once the well casing pipe has been installed, coarse sand or gravel is poured in the annular space outside of the well casing within the test zone to prevent the boring from caving/collapsing or spalling when water is added. Water is added into the boring to an initial water height, as water within the boring infiltrates into the soil, measurements are taken of the height of the water column within the boring at equally timed intervals (known as a falling head test). The infiltration rate as measured during intervals of the test is defined as the flow rate of water infiltrated, divided by the surface area of the infiltration interface. The test was conducted based on the USBR 7300-89 test method.

Raw Infiltration rates for the well permeameter test yielded a rate of 67.4 inches/hour within Boring LI-1; however, a confining clay layer was encountered at depths as shallow as 10 feet bgs within the immediate area. Results of infiltration testing are provided in Appendix A. Further discussion of infiltration testing and related recommendations are included in Section 3.12.

3.0 CONCLUSIONS AND RECOMMENDATIONS

3.1 General Conclusions

Based on this investigation, construction of the proposed improvements is feasible from a geotechnical standpoint, provided our recommendations presented herein are incorporated into the design and construction of the project. No severe geological or geotechnical issues were identified that would preclude construction of the proposed new campus buildings and associated improvements. The most significant geotechnical issues at the site are the potential for strong seismic shaking, moderate seismic settlement, and potentially compressible near surface soils. Recommendations for design and construction of proposed improvements are provided in the following sections.

The proposed new locker room, sports pavilion, and associated site improvements will be located within a developed site, and therefore, existing utilities may be encountered during grading. We assume these utilities will be avoided or rerouted; if so, these will then pose no special consideration, provided the excavations are properly backfilled in accordance with our recommendations below. If any existing utilities within or immediately adjacent to the proposed structures (such as within the limits of overexcavation as recommended below) are to remain, these should be further evaluated on a case-by-case basis.

3.2 Earthwork and Grading

Grading should be performed in accordance with the General Earthwork and Grading Specifications presented in Appendix D, unless specifically revised or amended below or by future recommendations based on final development plans.

3.2.1 Site Preparation

Prior to construction, the areas of the proposed improvements should be cleared of existing pavement, vegetation, trash, and debris. Any underground obstructions onsite that interfere with the proposed foundations should be removed. Trees should be removed and grubbed out. Efforts should be made to locate any existing utility lines. Those lines should be removed or rerouted if they interfere with the proposed construction, and the resulting cavities should be backfilled and compacted as recommended in Sections 3.2.4 and 3.10.

3.2.2 Overexcavation and Recompaction

To reduce the potential for adverse total and differential settlement of the proposed structures, the underlying subgrade soil should be prepared in such a manner that a uniform response to the applied loads is achieved.

Preparation of the site should include overexcavation and recompaction of existing soils to establish a layer of structural compacted fill that extends to a minimum depth of approximately 7 feet below existing grade or 4 feet below the bottom of the proposed footings, whichever is deeper. The overexcavation depths and limits will be governed by the structure type in order to reduce the seismically induced settlement to tolerable differential values as determined by the structural engineer and as explained in the following section. Undocumented fill should be completely removed during remedial grading, which was observed to be generally 5 feet thick in our exploratory borings. Thicker undocumented fills may be exposed during grading, which will require locally deeper removals. Overexcavation bottoms should be evaluated by Leighton, and localized deeper removals may be recommended during grading.

Where possible, the removal bottom should extend horizontally a minimum of 5 feet from the outside edges of the footings (including columns connected to the buildings), or a distance equal to the depth of overexcavation below the footings, whichever is farther.

Areas outside of the proposed structures planned for new asphalt or concrete pavement (such as parking areas or fire lanes), flatwork (such as sidewalks), site walls and low retaining walls (less than 4 feet tall; walls retaining 4 feet or more should be overexcavated per the recommendations for buildings), areas to receive fill, and other improvements, should be overexcavated to a minimum depth of 18 inches below existing grade or 12 inches below proposed subgrade (including the footing subgrade for walls), whichever is deeper.

After completion of the overexcavation, and prior to fill placement, the exposed surfaces should be scarified to a minimum depth of 12 inches, moisture conditioned to or slightly above optimum moisture content, and recompacted to a minimum 90 percent relative compaction, relative to the

ASTM D1557 laboratory maximum density.

3.2.3 Mitigation of Potential Seismic Settlement

The potential settlement resulting from seismic loading is considered high (up to 5.3 inches) for this site, assuming the historic high groundwater level and design level earthquake.

If seismic differential settlement (angular distortion) values exceed tolerable values for the proposed building design, we recommend that the potential for damaging seismic settlement be reduced by overexcavating the near-surface soils as described below:

Based on conversation with the design team, we understand at the time of this report, the Pavilion Building is proposed to be composed of steel framing and the proposed Locker Room Building is proposed to be a single-story masonry building with the possibility of being changed to a steel- or wood-framed structure. In order to attain differential settlement values within a quarter of the tolerable limits as identified within ASCE 7-16 Table 12.13-3 for the structure type and assumed risk category, we recommend that the Pavilion Building (steel-framed) be overexcavated a minimum of 7 feet below existing grade or 4 feet below the bottom of the proposed footings, whichever is deeper and extending a minimum of 5 from the outside edges of the footings (including columns connected to the buildings), or a distance equal to the depth of overexcavation below the footings, whichever is farther. For the future Locker Room Building, currently proposed as a single-story masonry building, we recommend the building pad be overexcavated a minimum of 15 feet below existing grade, extending a minimum horizontal distance from the outside edges of the footing equal to the depth of overexcavation below the footings (including columns connected to the buildings). Note that within our differential settlement analysis, the analysis depth of overexcavation includes an extra 1 foot more than the overexcavation depths indicated above, due to inclusion of the recommended overexcavation bottom processing and recompaction.

Overexcavation of the two buildings should be conducted simultaneously. A stepped overexcavation bottom is anticipated with the current proposed structure types.

If the proposed Locker Room Building is changed to a material that will classify it as “Other” single story structure (i.e wood or steel framing), the overexcavation limits can be reduced to that of the proposed Pavilion Building.

3.2.4 Fill Placement and Compaction

The onsite soil is suitable for use as compacted structural fill, provided it is free of debris, organic material and oversized material (greater than 8 inches in largest dimension). Any soil to be placed as fill, whether onsite or imported material, should be accepted by Leighton.

All structural fill under the buildings soil should be placed in thin, loose lifts, moisture-conditioned, as necessary, with moisture contents of at least optimum, and compacted to a minimum 95 percent relative compaction as determined by ASTM Test Method D1557. Fill soils outside of building overexcavation limits should be compacted to a minimum of 90 percent relative compaction. Aggregate base for pavements and the upper 8 inches of pavement subgrade should be compacted to a minimum of 95 percent relative compaction.

3.2.5 Import Fill Soil

If import soil is to be placed as fill, it should be geotechnically accepted by Leighton. Preferably at least 3 working days prior to proposed import to the site, the contractor should provide Leighton pertinent information of the proposed import soil, such as location of the soil, whether stockpiled or native in place, and pertinent geotechnical reports if available. We recommend that a Leighton representative visit the proposed import site to observe the soil conditions and obtain representative soil samples. Potential issues may include soil that is more expansive than onsite soil, soil that is too wet, soil that is too rocky or too dissimilar to onsite soils, oversize material, organics, debris, etc.

The owner should require proper documentation that soils imported to the project site are suitable for use at the school site from an environmental standpoint. The import soils should be evaluated and/or tested, as appropriate, for environmental suitability based on the *Information Advisory – Clean Imported Fill* (Department of Toxic Substances Control, October 2001 or more current edition). The documentation indicating the soils are suitable for use should be provided to the project construction manager prior to intended import to the site. Leighton can provide these services to the District, but the contractor must give Leighton adequate time to properly evaluate the material prior to import–a minimum of 5 working days (laboratory rush charges would apply), but preferably 7 working days or more. The contractor should provide Leighton pertinent information, such as the amount and location of the soil, whether stockpiled or native in place, soil owner contact information, and pertinent environmental reports, if available

3.2.6 Shrinkage and Subsidence

The change in volume of excavated and recompacted soil varies according to soil type and location. This volume change is represented as a percentage increase (bulking) or decrease (shrinkage) in volume of fill after removal and recompaction. Field and laboratory data used in our calculations included laboratory-measured maximum dry densities for soil types encountered at the subject site and the measured in-place densities of soils encountered. We preliminarily estimate the following earth volume changes will occur during grading. These are rough estimates:

Shrinkage (Approximate)	12% ± 5%
Subsidence (Approximate)	0.1 foot

The level of fill compaction, variations in the dry density of the existing soils and other factors influence the amount of volume change.

It should be noted that subsidence, as referred to above, is settlement of in-place earth materials due to heavy equipment processing. It does not refer to potential settlement due to placement of additional loads from new fill (i.e., rising of grades).

These shrinkage values are general guide values. Actual values will vary, due to the varying soil conditions and varying construction techniques. It is not possible to estimate exact values. Therefore, as with any grading project, some earthwork volume adjustments should be anticipated during grading.

3.2.7 Excavations in Proximity to Existing Structures

Excavations planned adjacent to existing structures should be conducted with care. Trench excavations, overexcavations, and utilities should not be allowed approximately parallel to and within close proximity to footings, as described in 2022 CBC 1809A.14 (i.e., within a 2:1 horizontal to vertical projection from 9 inches above the bottom of an existing or proposed foundation), unless such case is reviewed by the Geotechnical Engineer. In areas where an excavation is planned adjacent to other surface improvements, excavations should not come closer than a 1.5:1 projection extending from the ground surface at the location of the existing improvement, unless such case is reviewed by the Geotechnical Engineer. Temporary excavations above such projections are anticipated to be acceptable.

If a portion of an excavation is planned to extend below the projections described above, this should be reviewed on a case-by-case basis. Depending on the actual conditions (such as depth of planned excavation, horizontal distance from the structure, depth of the as-built foundation conditions, etc.), the excavation may be possible by making a series of adjacent slot cut excavations perpendicular to the buildings in a sequential ‘ABC’ method, limiting the width of excavation adjacent to existing buildings at any given time and reducing the potential for undermining the existing structure. The maximum width and depth of the slot cuts should be based on the specific conditions of the planned excavations and the soil conditions. The excavations should be no deeper than necessary and should be left open for as short a period as feasible. For slot cuts up to seven feet in depth, the maximum allowable width shall be limited to 8 feet. Cuts deeper than 7 feet should be reviewed by Leighton prior to excavations. Backfill of these slot cut excavations should be compacted to a minimum of 95 percent relative compaction as determined by ASTM Test Method D1557.

3.3 Foundations

Conventional shallow foundations may be used to support the loads of the proposed structure expansion. Overexcavation and recompaction of the footing subgrade soil should be performed as detailed in Section 3.2.2.

The following recommendations are based on the onsite soil conditions and soils with a low expansion potential.

3.3.1 Minimum Embedment and Width

Based on our investigation, conventional footings for the proposed structures should have a minimum embedment of 18 inches, with a minimum width of 24 and 15 inches for isolated and continuous footings, respectively.

3.3.2 Allowable Bearing

An allowable bearing pressure of 2,000 pounds-per-square-foot (psf) may be used, based on the minimum embedment depth and width above. This allowable bearing value may be increased by 300 psf per foot increase in depth or width to a maximum allowable bearing pressure of 4,000 psf. These allowable bearing pressures are for total dead load and sustained live loads. Footing reinforcement should be designed by the structural engineer.

3.3.3 Lateral Load Resistance

Soil resistance available to withstand lateral loads on a shallow foundation is a function of the frictional resistance along the base of the footing and the passive resistance that may develop as the face of the structure tends to move into the soil. The frictional resistance between the base of the foundation and the subgrade soil may be computed using an allowable coefficient of friction of 0.35. The passive resistance may be computed using an allowable (factor of safety of 1.5 applied) equivalent fluid pressure of 240 pounds per cubic foot (pcf), assuming there is constant contact between the footing and undisturbed soil. Friction and passive pressure may be combined without reduction, provided it is acceptable that the footings move laterally sufficiently to develop passive pressure (approximately ¼ inch); otherwise, friction alone should be assumed.

3.3.4 Increase in Bearing and Friction – Short Duration Loads

For the case of short term loading (seismic and wind loading), an increase of 1/3 would apply to the bearing pressure and friction values. The ultimate bearing pressure is assumed to be roughly three times the allowable bearing pressure. However, this ultimate pressure only considers structural failure/collapse (life safety) and not structural damage or significant cosmetic damage. Excessive settlement is anticipated to occur well before the ultimate bearing pressure is attained.

3.3.5 Settlement Estimates

The above recommended allowable bearing capacity is generally based on a total allowable, post-construction total settlement of 1 inch, for column loads and wall loads not exceeding 50 kips and 3 kips per foot, respectively, for dead plus sustained live loads. Differential settlement due to static loading is generally estimated at ½ inch over a horizontal distance of 30 feet. Once developed by the Structural Engineer, we can review total dead and sustained live loads for each column including plan location and span distance, to evaluate if differential settlements between dissimilarly loaded columns will be tolerable. Excessive differential settlement can be mitigated with the use of reduced bearing pressures, deeper footing embedment, possibly changing overexcavation schemes and using imported base material under spread footings, or possibly other methods. Assuming that all existing fill soils are completely removed and properly recompacted mitigation measures for potential seismic settlement are implemented as described previously below the proposed structures, and geotechnical recommendations presented in this report are incorporated into the design by the structural engineer, dynamic differential settlement in dense sands is expected to be within acceptable limits.

3.4 Recommendations for Slabs-On-Grade

Concrete slabs-on-grade should be designed by the structural engineer in accordance with the current CBC for a soil with a low expansion potential. Observation and possibly testing to confirm the expansion potential of the near surface soil should be conducted during site grading.

The following minimum slab recommendations should be used. More stringent requirements may be required by agencies, the structural engineer, the architect, or the CBC. Slabs-on-grade should have the following minimum recommended components:

- Subgrade Moisture Conditioning: The subgrade soil should be moisture conditioned to at least 2 percentage points above optimum moisture content to a minimum depth of 12 inches prior to placing steel or concrete.
- Concrete Thickness and Structural Design: Slabs-on-grade should be designed by the structural engineer, but should be at least 4 inches thick (this is referring to the actual minimum thickness, not the nominal thickness). Reinforcing steel should be designed by the structural engineer, but as a minimum (for conventionally reinforced slabs) should be No. 3 rebar placed at 12 inches on center, each direction, mid-depth in the slab. A modulus of subgrade reaction (k) as a linear spring constant, of 190 pounds per square inch per inch deflection (pci) can be used for design of heavily loaded slabs-on-grade, assuming a linear response up to deflections on the order of ¾ inch.

Minor cracking of the concrete as it cures, due to drying and shrinkage is normal and should be expected. However, cracking is often aggravated by a high water/cement ratio, high concrete temperature at the time of placement, small nominal aggregate size, aggregate that is not sufficiently clean, and rapid moisture loss due to hot, dry, and/or windy weather conditions during placement and curing. Cracking due to temperature and moisture fluctuations can also be expected. Low slump concrete can reduce the potential for shrinkage cracking. Additionally, reinforcement in slabs and foundations can generally reduce the potential for shrinkage cracking. The structural engineer should consider these and other pertinent concrete design and construction considerations in slab design and specifications.

3.4.1 Slab Underlayment for Moisture Vapor Retarding

Because moisture vapor from the underlying soils will be transmitted through slabs-on-grade without preventive measures, slab underlayment for moisture vapor retarding should be designed by qualified professionals (such as the structural engineer and/or architect) where control of moisture vapor transmission through slabs is considered important to this project (such as where moisture-sensitive floor coverings or equipment are planned). Slab underlayment typically includes a moisture vapor retarder membrane (such as 15-mil thick or greater), and provisions for protection of the vapor retarder during construction. The structural engineer and/or architect should specify pertinent slab and concrete design parameters, such as whether a sand blotter layer should be placed over the vapor retarder.

Moisture retarders can reduce, but not eliminate moisture vapor rise from the underlying soils up through the slab. Moisture retarders should be designed and constructed in accordance with applicable American Concrete Institute, Portland Cement Association, Post-Tensioning Institute, ASTM International, and California Building Code requirements and guidelines.

Leighton does not practice in the field of moisture vapor transmission evaluation/mitigation, since this does not fall under the geotechnical discipline. Therefore, we recommend that a qualified person, such as the flooring subcontractor, structural engineer, and/or architect, be consulted to evaluate the general and specific moisture vapor transmission paths and any impact on the proposed construction. That person (or persons) should provide recommendations for mitigation of potential adverse impact of moisture vapor transmission on various components of the structures as deemed appropriate. In addition, the recommendations in this report and our services in general are not intended to address mold prevention, since we, along with geotechnical consultants in general, do not practice in the area of mold prevention. If specific recommendations are desired, a professional mold prevention consultant should be contacted.

3.5 Seismic Design Parameters

In order to reduce the effects of ground shaking produced by regional seismic events, seismic design should be performed in accordance with the current CBC. The seismic design parameters listed in Table 1 of Section 2.5.2 of this report should be considered for the seismic analysis of the subject site.

3.6 Lateral Earth Pressures

The following retaining wall recommendations are included for design consideration of walls with a height less than 12 feet. We recommend that retaining walls be backfilled with very low expansive soil and constructed with a backdrain in accordance with the recommendations provided on Figure 9, *Retaining Wall Backfill and Subdrain Detail*. Using expansive soil as retaining wall backfill will result in higher lateral earth pressures exerted on the wall and are, therefore, not recommended. Retaining wall locations and configurations are unknown at the time of this report.

Table 2 – Retaining Wall Design Parameters

Static Equivalent Fluid Pressure (pcf)	
Condition	Level Backfill
Active	38
At-Rest (drained, compacted-fill backfill)	58
Passive (allowable)	250 (Max. 3,000 psf)

The above values do not contain an appreciable factor of safety, so the structural engineer should apply the applicable factors of safety and/or load factors during design.

Cantilever walls that are designed to yield at least 0.001H, where H is equal to the wall height, may be designed using the active condition. Rigid walls and walls braced at the top should be designed using the at-rest condition.

Passive pressure is used to compute soil resistance to lateral structural movement. In addition, for sliding resistance, a frictional resistance coefficient of 0.35 may be used at the concrete and soil interface. The lateral passive resistance should be taken into account only if it is ensured that the soil providing passive resistance, embedded against the foundation elements, will remain intact with time. A soil unit weight of 120 pcf may be assumed for calculating the actual weight of the soil over the wall footing.

In addition to the above lateral forces due to retained earth, surcharge due to improvements, such as an adjacent structure or traffic loading, should be considered in the design of the retaining wall. Loads applied within a 1:1 projection from the surcharging structure on the stem of the wall should be considered in the design. A third of uniform vertical surcharge-loads should be applied at the surface as a horizontal pressure on cantilever (active) retaining walls, while half of uniform vertical surcharge-loads should be applied as a horizontal pressure on braced (at-rest) retaining walls. To account for automobile parking surcharge, we suggest that a uniform horizontal pressure of 100 psf (for restrained walls) or 70 psf (for cantilever walls) be added for design, where autos are parked within a horizontal distance behind the retaining wall less than the height of the retaining wall stem.

For walls with a retained height over 6 feet, or where otherwise required by Code or deemed appropriate by the structural engineer, we recommend that the wall designs be checked seismically using an additive seismic Equivalent Fluid Pressure (EFP) of 31pcf, which is added to the active EFP. Such walls that are to be designed in the static case assuming the at-rest condition should be checked seismically using this additive seismic EFP added to the active condition (i.e., the additive seismic EFP is not added to the at-rest EFP value shown in Table 2 above). The additive seismic EFP should be applied with a standard EFP pressure distribution (i.e., it is not an inverted triangle).

Conventional retaining wall footings should have a minimum width of 24 inches and a minimum embedment of 12 inches below the lowest adjacent grade. An allowable bearing pressure of 2,000 psf may be used for retaining wall footing design, based on the minimum footing width and depth. This bearing value may be increased by 300 psf per foot increase in width or depth to a maximum allowable bearing pressure of 4,000 psf.

3.7 Cement Type and Corrosion Protection

Based on the results of laboratory testing, concrete structures in contact with the onsite soil will have negligible exposure to water-soluble sulfates in the soil. Therefore, common Type II cement may be used for concrete construction. Concrete should be designed in accordance with ACI 318-14, Section 4.2 (ACI, 2014), adopted by the 2022 CBC (Section 1904A.2).

Based on our laboratory testing, the onsite soil is considered moderately corrosive to ferrous metals. Metallic utilities should be avoided, or typical corrosion protection of underground metallic utilities should be provided. Corrosion information presented in this report should be provided to your underground utility contractors.

3.8 Pavement Design

Based on the design procedures outlined in the 2017 Caltrans Highway Design Manual, and an R-value of 46 for compacted subgrade soils, preliminary flexible pavement sections may consist of the following for the Traffic Indices (TI) indicated.

Table 3 – Asphalt Pavement Section Thickness

Traffic Index	Asphaltic Concrete (AC) Thickness (inches)	Class 2 Aggregate Base (AB) Thickness (inches)
5 of less	3.0	4.0
6	3.5	4.0
7	4.0	5.5

If asphalt pavement is to be constructed prior to construction, the full pavement thickness should be placed to support heavy construction traffic.

In areas where rigid concrete pavement is planned and trucks may drive on this pavement, we recommend 6 inches of Portland Cement Concrete (PCC) with a 28-day compressive strength of 4,000 psi over prepared subgrade soil (see Section 3.2.2). Reinforcement should be specified by the structural engineer, but should be a minimum of #3 rebar at 18 inches on center each way. The PCC pavement sections should be provided with crack-control joints spaced no more than 12 feet on center each way. If sawcuts are used, they should have a minimum depth of ¼ of the slab thickness and made within 24 hours of concrete placement. We recommend that sections be as nearly square as possible.

PCC sidewalks should be at least 4 inches thick over prepared subgrade soil, with construction joints no more than 8 feet on center each way, with sections as nearly square as possible. Use of reinforcing will help reduce severity of cracking.

All pavement construction should be performed in accordance with the Standard Specifications for Public Works Construction. Field observations and periodic testing, as needed during placement of the base course materials, should be undertaken to ensure that the requirements of the standard specifications are fulfilled. Prior to placement of aggregate base, the subgrade soil should be processed to a minimum depth of 6 inches, moisture-conditioned, as necessary, and recompacted to a minimum of 95 percent relative compaction. Aggregate base should be moisture conditioned, as necessary, and compacted to a minimum of 95 percent relative compaction.

3.9 Temporary Excavations

All temporary excavations, including utility trenches, retaining wall excavations and other excavations should be performed in accordance with project plans, specifications and all OSHA requirements, and the current edition of the California Construction Safety Orders, latest edition.

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

Cantilever shoring should be designed based on the active fluid pressure presented in the retaining wall section. If excavations are braced at the top and at specific design intervals, the active pressure may then be approximated by a rectangular soil pressure distribution with the pressure per foot of width equal to 26H, where H (feet) is equal to the depth of the excavation being shored.

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

3.10 Trench Backfill

Utility-type trenches onsite can be backfilled with onsite material, provided it is free of debris, significant organic material and oversized material (greater than 3 inches for trench backfill within 3 feet of a pipe, and 6 inches for trench backfill above).

Prior to backfilling the trench, pipes should be bedded and shaded in a granular material that has a sand equivalent of 40 or greater and allow water to permeate sufficiently. We recommend that open-graded crushed rock or similar material not be used as bedding material, unless special provisions are implemented to limit the migration of surrounding soil into the open-graded material, including surrounding the open-graded material with filter fabric (Mirafi 140N or equivalent), or mixing sand with the open-graded material. The bedding material should extend

12 inches above the top of the pipe. The bedding/shading sand may be densified in-place by jetting or by mechanical means. Bedding sand should be placed in accordance with the Standard Specifications for Public Works Construction – Greenbook (Public Works Standard, Inc.), current edition.

The native soil fill should be placed in loose layers, moisture conditioned, as necessary, and mechanically compacted using a minimum standard of 90 percent relative compaction based on ASTM D1557. The thickness of layers should be based on the compaction equipment used in accordance with the current Greenbook.

3.11 Surface Drainage

Water should not be allowed to pond or accumulate anywhere except in approved drainage areas, which should be set back at least 15 feet from proposed structures. Pad drainage should be designed to collect and direct surface water away from structures to approved drainage facilities. Hardscape drains should be installed and drain to storm water disposal systems. Drainage patterns and drainpipes approved at the time of fine grading should be maintained throughout the life of proposed structures. Percolation or stormwater infiltration should not be allowed within at least horizontal 15 feet of the proposed building addition.

3.12 Infiltration Recommendations

Based on our onsite observations, and infiltration test results summarized in the table below, reliance of infiltration into onsite near surface native soils is considered feasible. For underlying alluvial soils that are granular with a low fines content, we recommend an unfactored (small-scale) infiltration rate of 6.7 inches per hour, for depths of 7 feet bgs with low percent fines and at the location tested.

Although infiltration testing with a bottom depth of 7 feet bgs produced moderate rates for the test itself, soils with higher percent fines and fine-grained soils (silts and clays) were generally located below at depths ranging from 10 to 15 feet, causing a confining layer within neighboring borings. It is likely that water infiltrated at depths of approximately 7 feet bgs through prolonged infiltration will tend to migrate laterally rather than vertically and produce lower infiltration values, thus we have provided a modified unfactored rate to account for this. Actual infiltration rates would be anticipated to decrease as the adjacent soils saturate. The incremental infiltration rate is defined as the incremental flow rate of water infiltrated, divided by the surface area of the infiltration interface.

Infiltration Test Rates

Boring	Soil Type	Approx. Test Zone (ft), bgs	Percent Fines (%)	Unfactored Infiltration Rate (in/hr)*
LI-1	Sand with silt (SP-SM)	2 to 7	5	6.7

*Modified Rate Due to Confining Silt Layer within Neighboring Borings

We recommend that a correction factor/safety factor be applied to the modified infiltration rate in conformance with San Bernardino County guidelines, since monitoring of actual facility performance has shown that actual infiltration rates are lower than measured in small-scale tests. Infiltration basins are subject to siltation, which can result in reduced infiltration rates. *This small-scale infiltration rate should be divided by a design factor of at least 3 for buried chambers and at least 4 for open basins; although the design/safety factor may be higher based on project-specific aspects.* It should be noted that during periods of prolonged precipitation, underlying soils tend to become saturated to greater depths/extent. Therefore, infiltration rates tend to decrease with prolonged rainfall.
Some design considerations are presented in the following paragraphs:

- **Adjacent Structure Impact**: As infiltrating water can seep within soil strata partially horizontally, it is important to consider impact that infiltration facilities can play on nearby subterranean structures, such as basement walls or open excavations, whether onsite or offsite, and whether existing or planned. Any such nearby features should be identified and evaluated as to whether infiltrating water can impact these facilities. Infiltration facilities should not be constructed adjacent to or under buildings. Setbacks should be discussed with Leighton during the planning process, but a building setback of at least 15 feet horizontally is initially suggested.

- **Infiltration Basins Type and Geometry**: Further testing may be required depending on final design of infiltration facilities. Infiltration rates are anticipated to vary based on location and depth. Infiltration concepts should be discussed with Leighton as infiltration plans are being developed. We should review all infiltration plans, including locations and depths of proposed facilities. Further testing may be required depending on infiltration facilities design details, particularly considering type, depth and location.

- **Siltation and Soil Changes**: These infiltration rates are for a clean, un-silted infiltration surface in native, sandy alluvial soil. These values may be reduced over time as silting of the basin or chamber occurs. Furthermore, if the basin or chamber bottom is allowed to be compacted by heavy equipment, this value is expected to be reduced. Infiltration of water through soil is highly dependent on such factors as grain size distribution of soil particles, gradation (uniform versus well graded), particle shape, fines content and density. Small changes in soil conditions, including density, can cause large differences in observed infiltration rates. Infiltration is not suitable in compacted fill. For open basins and swales, vegetation within the basin bottoms and sides is expected to help reduce erosion and help maintain infiltration rates.

- **De-silting Weir/Facilities**: Periodic flow of water carrying sediments into the basin or chamber, plus deposition of fine wind-blown sediments and sediments from erosion of basin side walls, will eventually cause the basin bottom or chamber to accumulate a layer of silt, which has the potential to significantly reducing the overall infiltration rate of the basin or chamber. Therefore, we recommend that significant amounts of silt/sediment not be allowed to flow into the facility within stormwater, especially during construction of the project and prior to achieving a mature landscape onsite. We recommend that an easily maintained, robust silt/sediment removal system be installed to pretreat storm water before it enters the infiltration facility. Infiltration facilities should be constructed with spillways or other appropriate means that would prevent overfilling that could damage the facility or adjacent improvements.

- **Drainage/Infiltration Time Cycle**: In general, the rate of infiltration reduces as the head of water in the infiltration facility reduces, and it also reduces with prolonged periods of infiltration. As such, water typically infiltrates much faster near the beginning of and/or immediately after storm events than at times well after a storm when the water level in the facility has receded, since the infiltration rate is then slower due to both lower head and longer overall duration of infiltration. In open basins with compacted or silty bottoms, this could be problematic, in that even if the basin had already infiltrated significant amounts of storm water, the lower several inches or feet of water could remain in the basin for an extended period of time, creating prolonged open-water safety concern (such as potential for mosquitos and waterborne diseases, algae odor, etc.). In a buried/cover infiltration chamber, these conditions would be of less concern.

- **Maintenance**: Infiltration facilities should be routinely monitored, especially before and during the rainy season, and corrective measures should be implemented if and as needed. Things to check for include removal of trash or dumping, proper infiltration, absence of accumulated silt, and that de-silting filters/features are clean and functioning. Pretreatment desilting features should be cleaned and maintained as recommended by the manufacturer or designer. Even with measures to prevent silt from flowing into the infiltration facility, accumulated silt may need to be removed.

3.13 Limitations and Additional Geotechnical Services

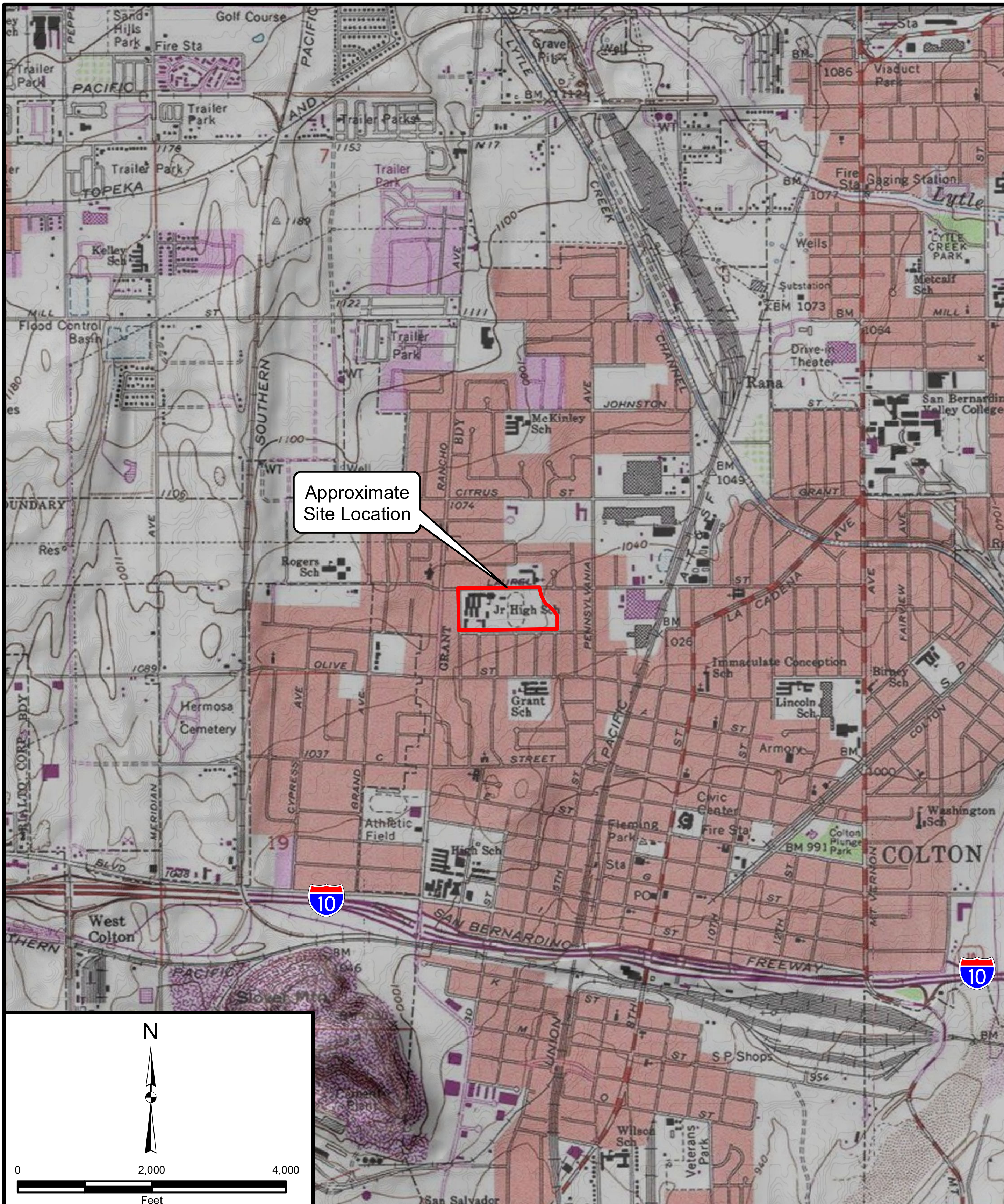
The geotechnical recommendations presented in this report are based on subsurface conditions as interpreted from limited subsurface explorations and limited laboratory testing. Our geotechnical recommendations provided in this report are based on information available at the time the report was prepared and may change as plans are developed. However, additional geotechnical study and analysis may be required based on final development plans. Leighton Consulting should review the site and grading plans when available and comment further on the geotechnical aspects of the project. Geotechnical observation and testing should be conducted during excavation and all phases of grading operations. Our conclusions and preliminary recommendations should be reviewed and verified by Leighton Consulting during construction and revised accordingly if geotechnical conditions encountered vary from our findings and interpretations. Changes in subsurface conditions can and do occur over time. Therefore, our findings, conclusions, and recommendations presented in this report are based on the assumption that Leighton Consulting will provide geotechnical observation and testing during construction. Please refer to the GBC “Important Information about This Geotechnical Engineering Report” presented at the end of this report.

Environmental services were not included as part of this study. This report was prepared for the sole use of Colton Joint Unified School District for application to the design of the proposed project in accordance with generally accepted geotechnical engineering practices at this time in California.

Geotechnical observation and testing should be provided:

- After completion of site demo/clearing.
- During overexcavation of compressible soil.
- During compaction of all fill materials.
- After excavation of all footings and prior to placement of concrete.
- During utility trench backfilling and compaction.
- During pavement subgrade and base preparation.
- When any unusual conditions are encountered.

Until reviewed and accepted by the California Geologic Survey (CGS), this report may be subject to change. Changes may be required as part of the CGS review process. Leighton Consulting, Inc. assumes no risk or liability for consequential damages that may arise due to design work progressing before this report is reviewed and accepted by CGS.



Project: 19850	Eng/Geol: JDH/SGO
Scale: 1 " = 2,000 '	Date: January 2024

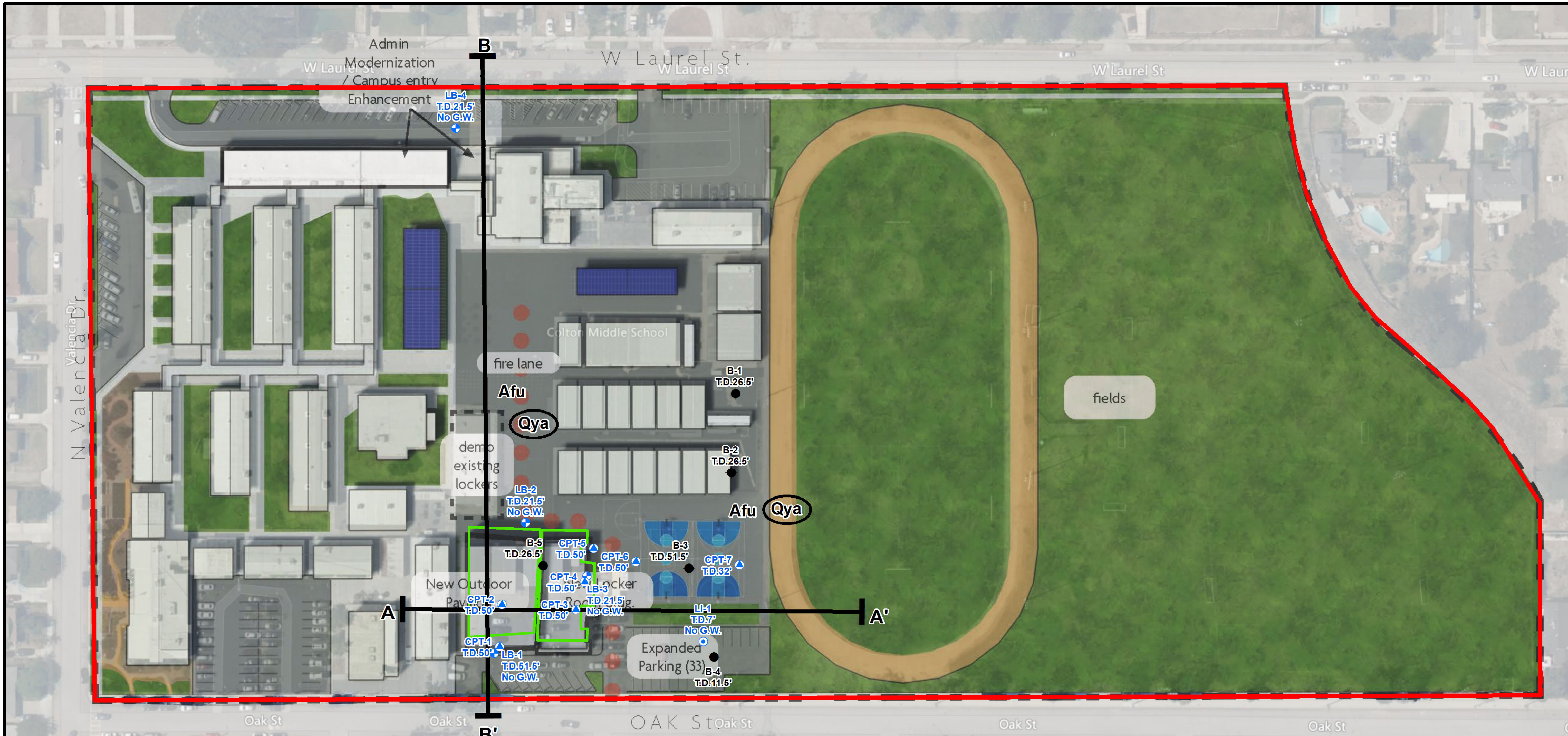
Reference: Copyright:© 2013 National Geographic Society, i-cubed

SITE LOCATION MAP

Proposed Pavilion and Administrative Building Project
Colton Middle School
670 West Laurel Street
Colton, San Bernardino County, California

FIGURE 1

Leighton



N

0 100 200

Feet

Legend

CPT-7 Approximate Location of Cone Penetration Test (CPT) Showing Total Depth (T.D.), (Leighton, 2024)

LB-4 Approximate Location of Boring Showing Total Depth (T.D.), No Groundwater in Feet Below Ground Surface. (Leighton, 2023)

LI-1 Approximate Location of Percolation Test Showing Total Depth (T.D.), No Groundwater in Feet Below Ground Surface. (Leighton, 2023)

LB-2 Approximate Location of Boring (Leighton, 2004)

Afu Artificial Fill, Undocumented

Qya Young Axial Channel deposits Circled Where Buried

A A' Geologic Cross Sections

Approximate Proposed Building Footprint

Approximate Site Boundary

Project: 20707	Eng/Geol: JDH/SGO
Scale: 1 " = 100 '	Date: January 2024

Base Map: Proposed Site Plan
Schematic Design 3 by RUHNAU CLARKE ARCHITECTS

Author: (btran)

GEOTECHNICAL MAP

Proposed Pavilion and Administrative Building Project
Colton Middle School
670 West Laurel Street, Colton, San Bernardino County, California

FIGURE 2

Leighton

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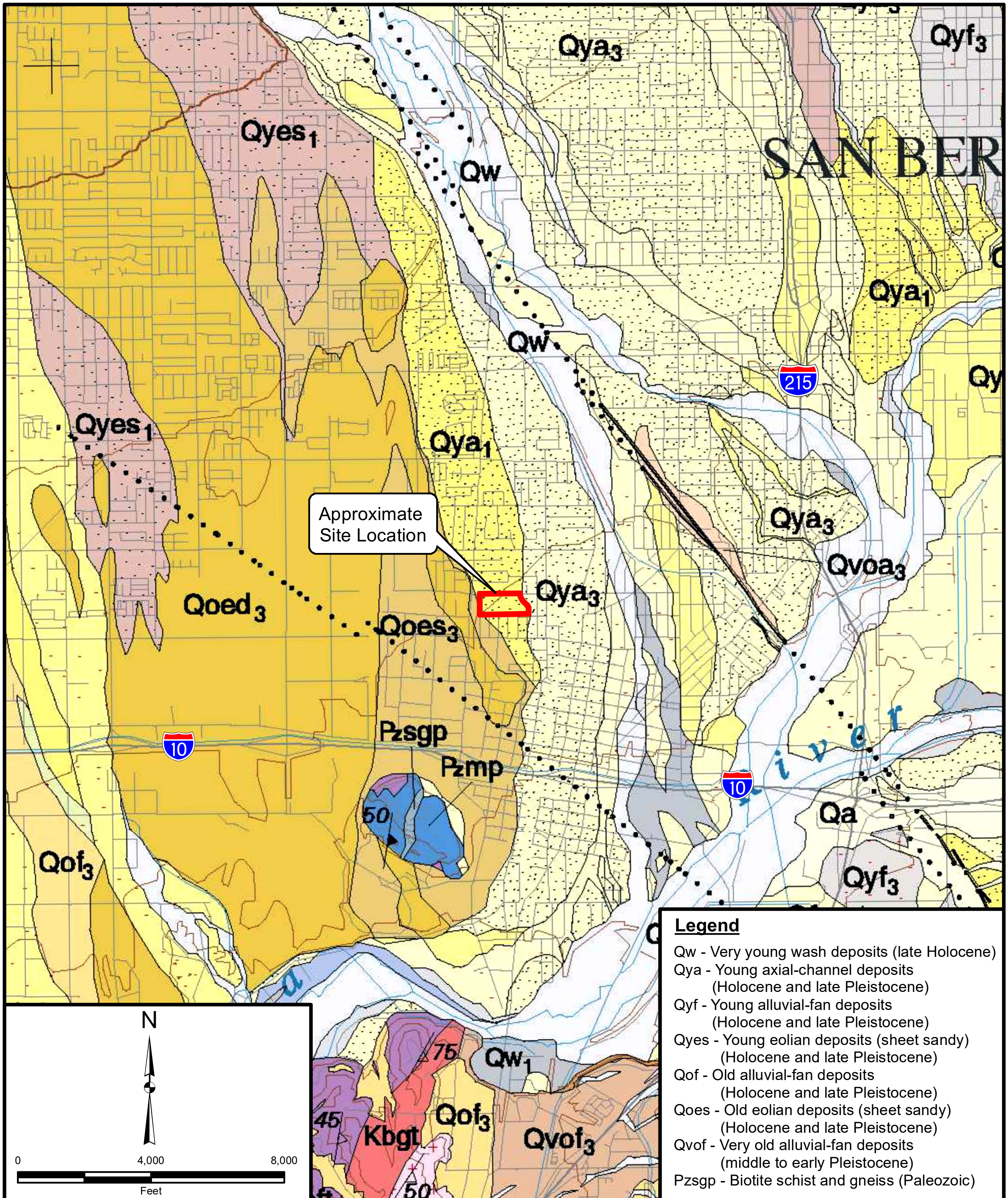


Project: 20707	Eng/Geol: JDH/SGO
Scale: 1 " = 4,000 '	Date: December 2023

Reference: Geologic Map of The San Bernardino and Santa Ana Quadrangles, California by Douglas Morton and Fred Miller, 2006

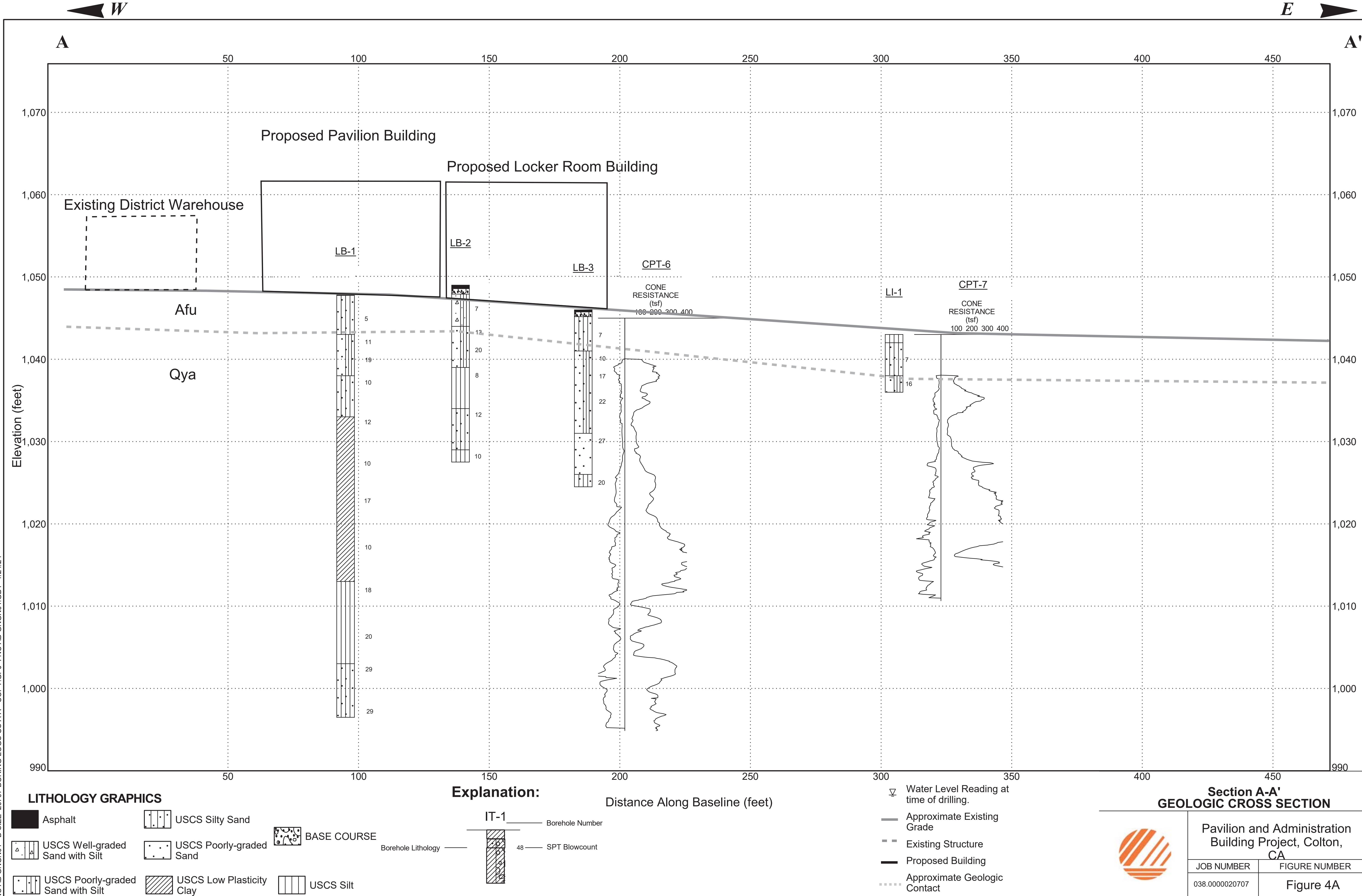
REGIONAL GEOLOGY MAP

Proposed Pavilion and Administrative Building Project
Colton Middle School
670 West Laurel Street
Colton, San Bernardino County, California

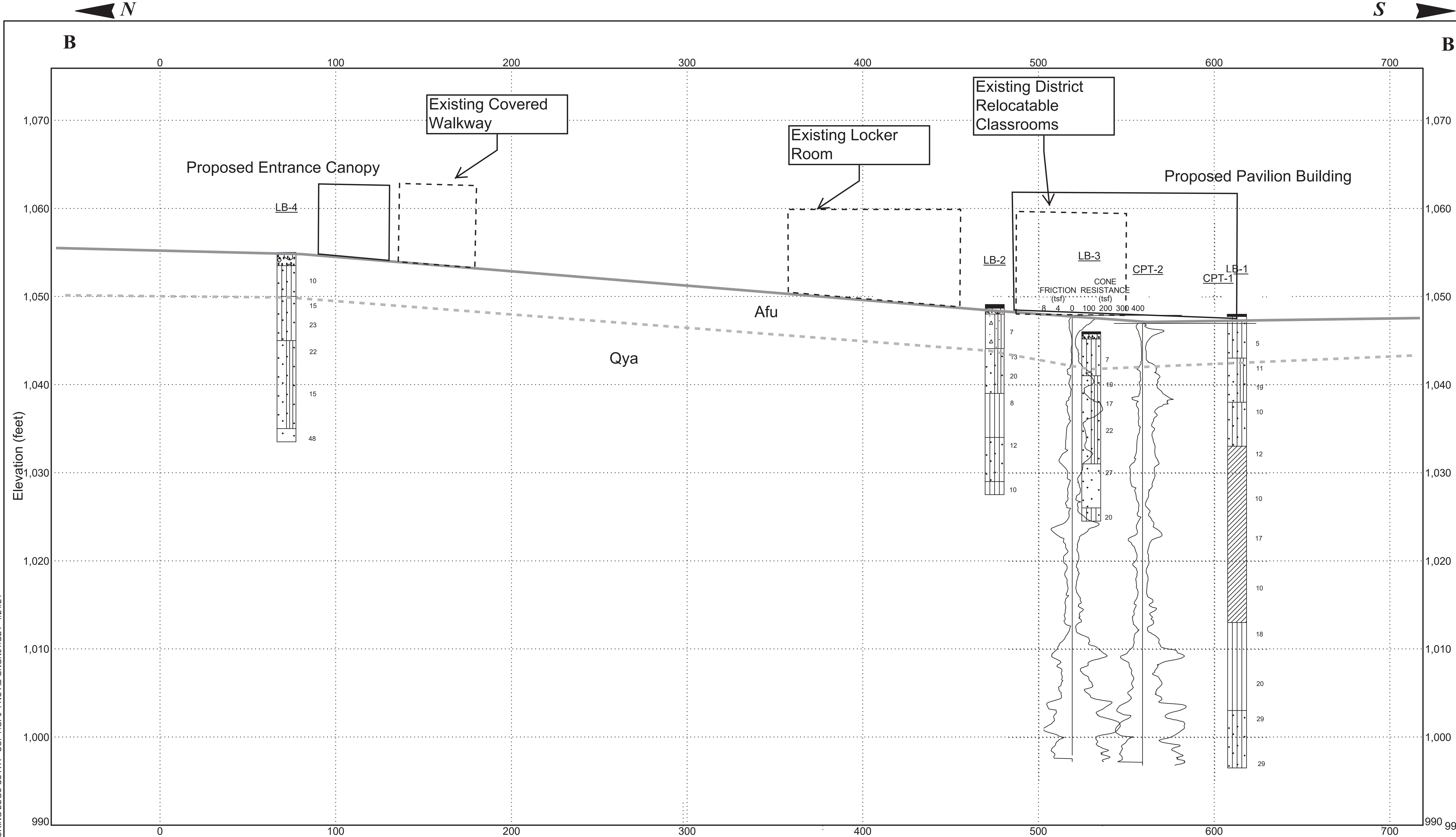
FIGURE 3

Leighton

Map Saved as Z:\Project Files\CA-DZ\ColtonJUSD\20707 - CJUSD Colton MS Pavilion-Admin GE\GIS\Maps\20707_F03_RGM_2023-12-15.mxd on 12/15/2023 1:46:25 PM (btran)



FNC AB GNGN01 - B SIZE 20707 BORING LOGS CS A-A - COPY.GPJ FNC AB GNGN01.GDT 1/24/24



FNC AB GNGN01 - B SIZE 20707 BORING LOGS CS A-A - COPY.GPJ FNC AB GNGN01.GDT 1/24/24

LITHOLOGY GRAPHICS

- Asphalt
- USCS Well-graded Sand with Silt
- USCS Poorly-graded Sand with Silt
- USCS Silty Sand
- USCS Poorly-graded Sand
- USCS Low Plasticity Clay
- BASE COURSE
- USCS Silt

Explanation:

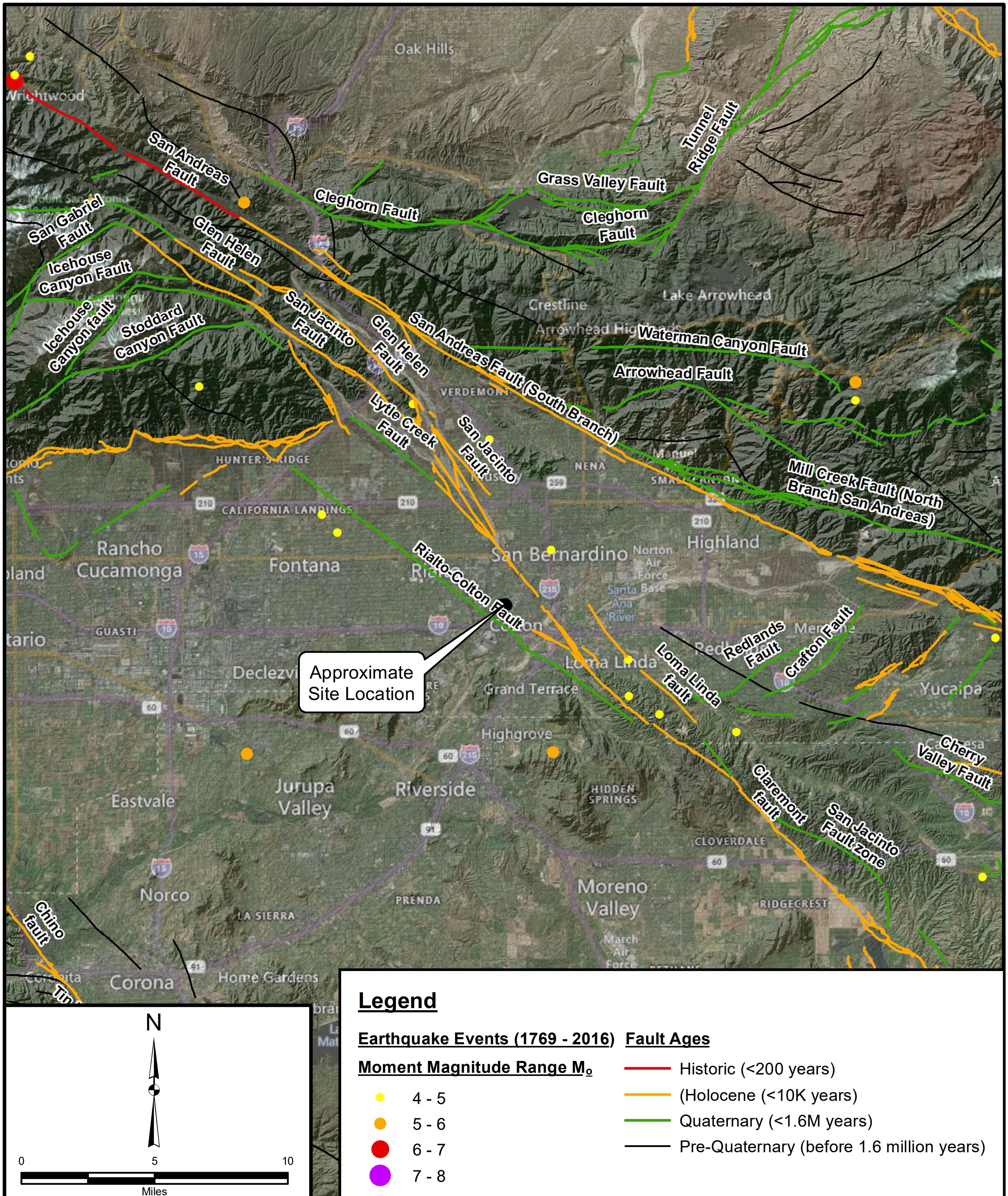
LB-1 — Borehole Number
Borehole Lithology
48 — SPT Blowcount

- Water Level Reading at time of drilling.
- Approximate Existing Grade
- Existing Structure
- Proposed Structure
- Approximate Geologic Contact

Section B-B'
GEOLOGIC CROSS SECTION

Pavilion and Administration Building Project, Colton, CA

JOB NUMBER	FIGURE NUMBER
038.0000020707	Figure 4B



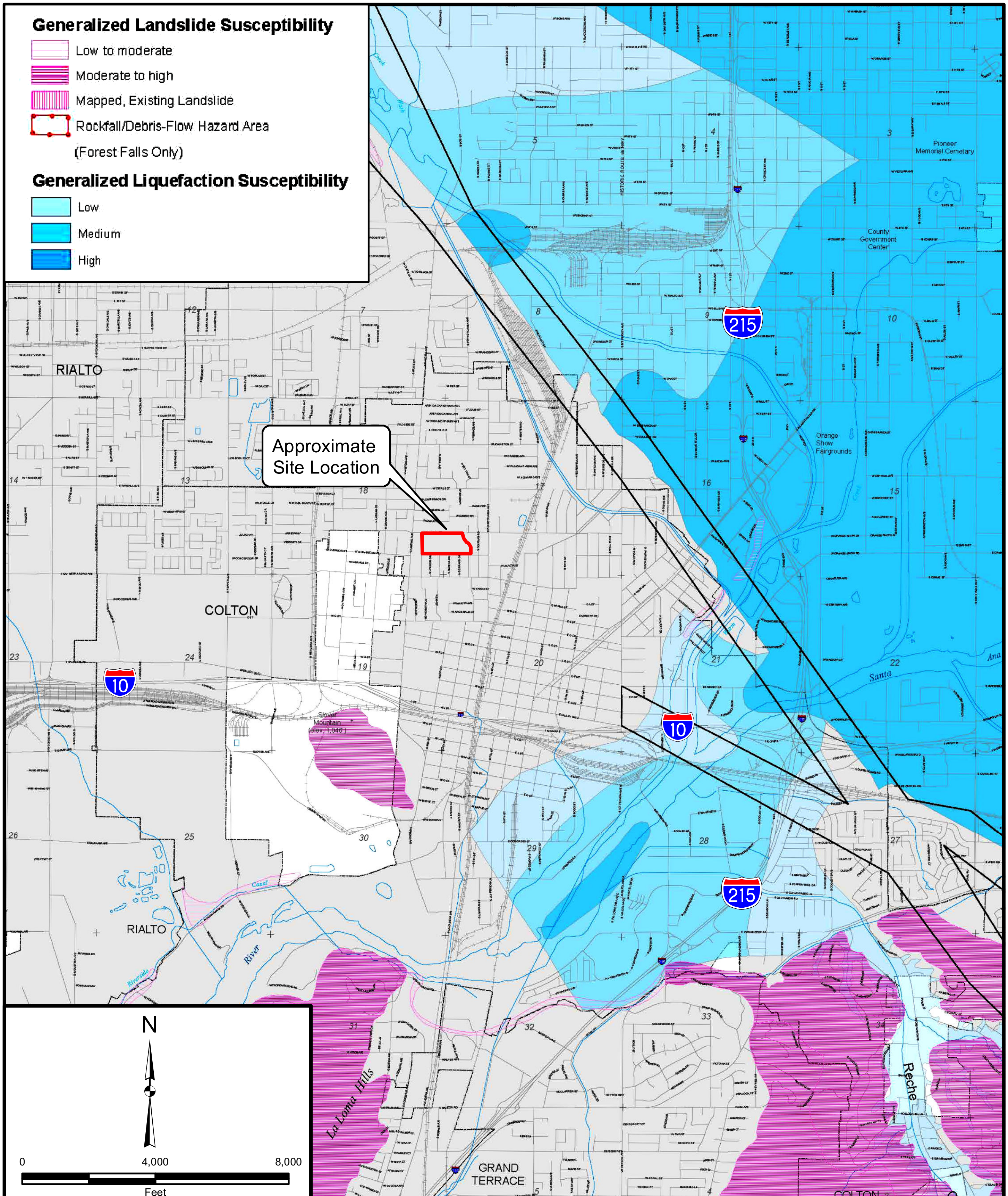
Project: 20707	Eng/Geol: JDH/SGO	**REGIONAL FAULT AND HISTORICAL SEISMICITY MAP**	**FIGURE 5**
Scale: 1 " = 5 miles	Date: December 2023		

Reference: ESRI ArcGIS Online 2023
Bryant, W. A. (compiler), 2005, Digital Database of Quaternary and Younger Faults from the Fault Activity Map of California, version 2.0: CGS, USGS, SCEC.
Author: Leighton Geomatics (btran)

Proposed Pavilion and Administrative Building Project
Colton Middle School
670 West Laurel Street
Colton, San Bernardino County, California

Leighton

Map Saved as Z:\Project Files\CA-DZ\ColtonJUSD\20707 - CJUSD Colton MS Pavilion-Admin GE\GIS\Maps\20707_F05_RF&HSM_2023-12-20.mxd on 12/15/2023 1:56:48 PM



Project: 20707	Eng/Geol: JDH/PB
Scale: 1 " = 4,000 '	Date: January 2024

Reference: San Bernardino County Land Use Plan
General Plan, Geologic Hazard Overlays
Sheet FH30 C San Bernardino S

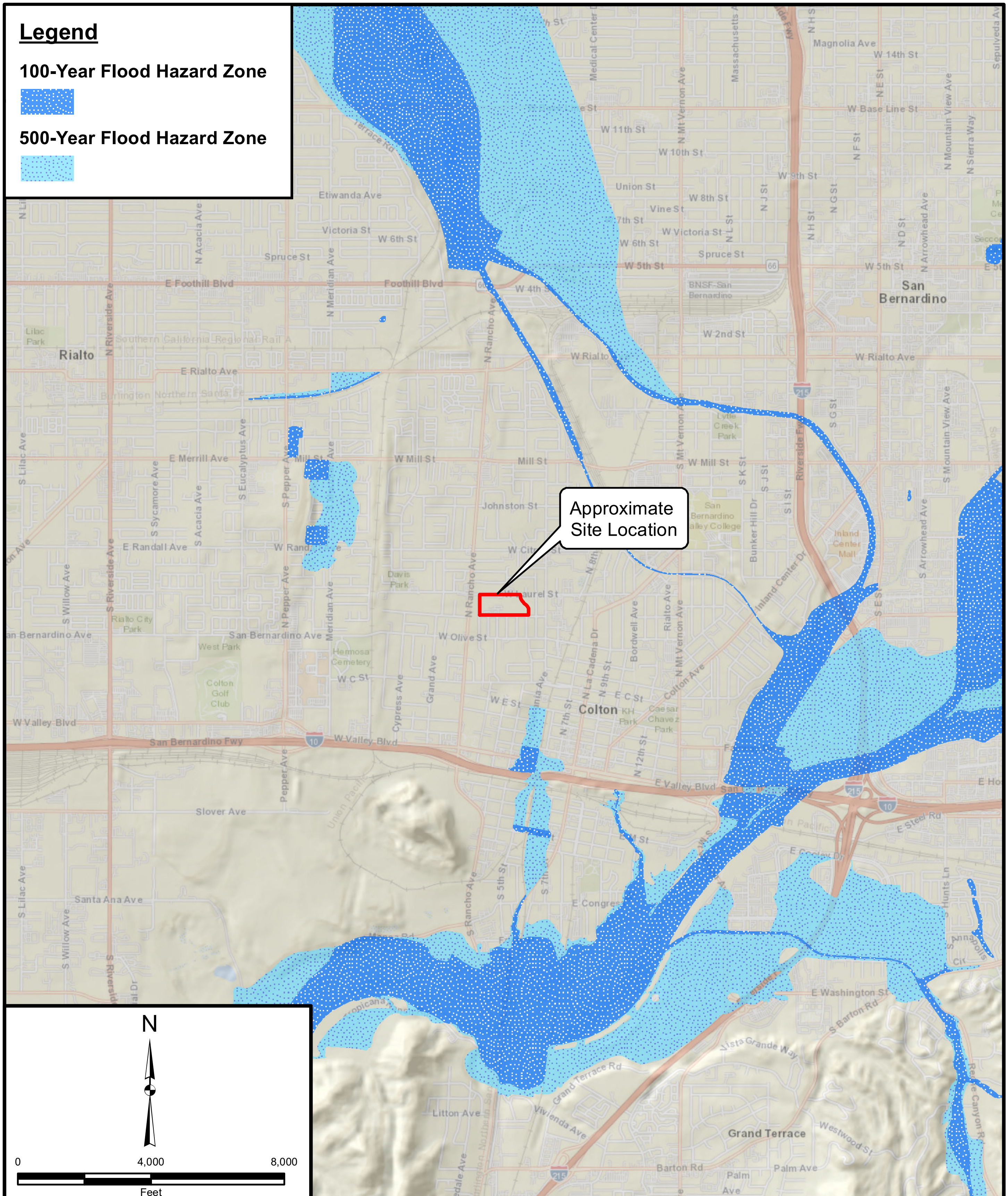
SEISMIC HAZARD MAP

Proposed Pavilion and Administrative Building Project
Colton Middle School
670 West Laurel Street
Colton, San Bernardino County, California

FIGURE 6

Leighton

Map Saved as Z:\Project Files\CA-DZ\ColtonJUSD\20707 - CJUSD Colton MS Pavilion-Admin GE\GIS\Maps\20707_F06_SHM_2024-01-24.mxd on 12/15/2023 2:09:37 PM (btran)



Project: 20707	Eng/Geol: JDH/SGO
Scale: 1 " = 4,000 '	Date: December 2023

Reference: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community
FEMA (http://www.fema.gov/index.shtm), DWR (http://www.dwr.ca.gov)

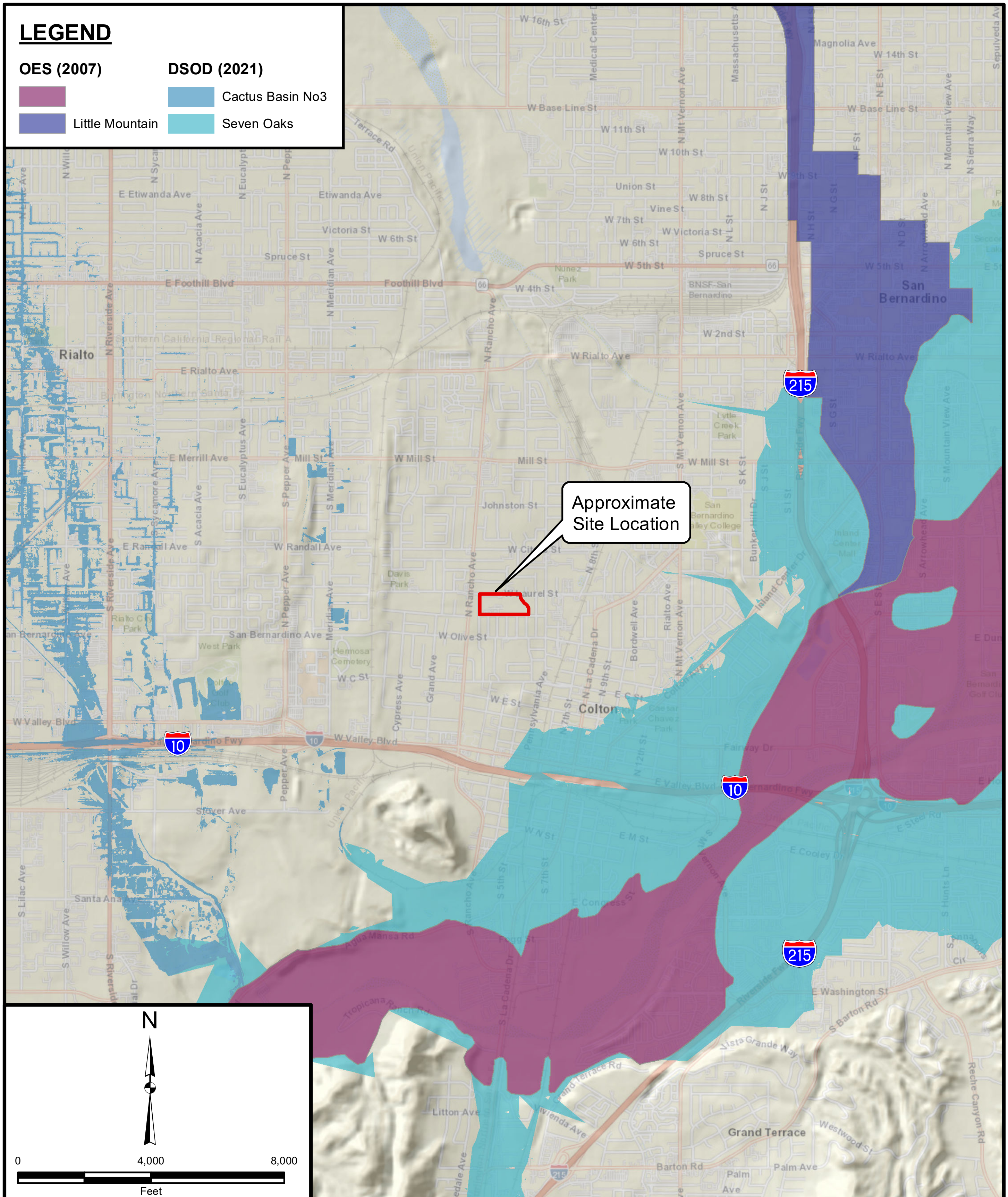
FLOOD HAZARD ZONE MAP

Proposed Pavilion and Administrative Building Project
Colton Middle School
670 West Laurel Street
Colton, San Bernardino County, California

FIGURE 7

Leighton

Map Saved as Z:\Project Files\CA-DZ\ColtonJUSD\20707 - CJUSD Colton MS Pavilion-Admin GE\GIS\Maps\20707_F07_FHM_2023-12-15.mxd on 12/15/2023 3:00:59 PM Author: KVM (btran)



Project: 20707	Eng/Geol: JDH/SGO
Scale: 1 " = 4,000 '	Date: December 2023

Base Map: ESRI ArcGIS Online 2023
Reference: Office of Emergency Services (2007),
Dept of Safety of Dams (2021)
National Inventory of Dams, Army Corps of Engrs (2021)

DAM INUNDATION MAP

Proposed Pavilion and Administrative Building Project
Colton Middle School
670 West Laurel Street
Colton, San Bernardino County, California

FIGURE 8

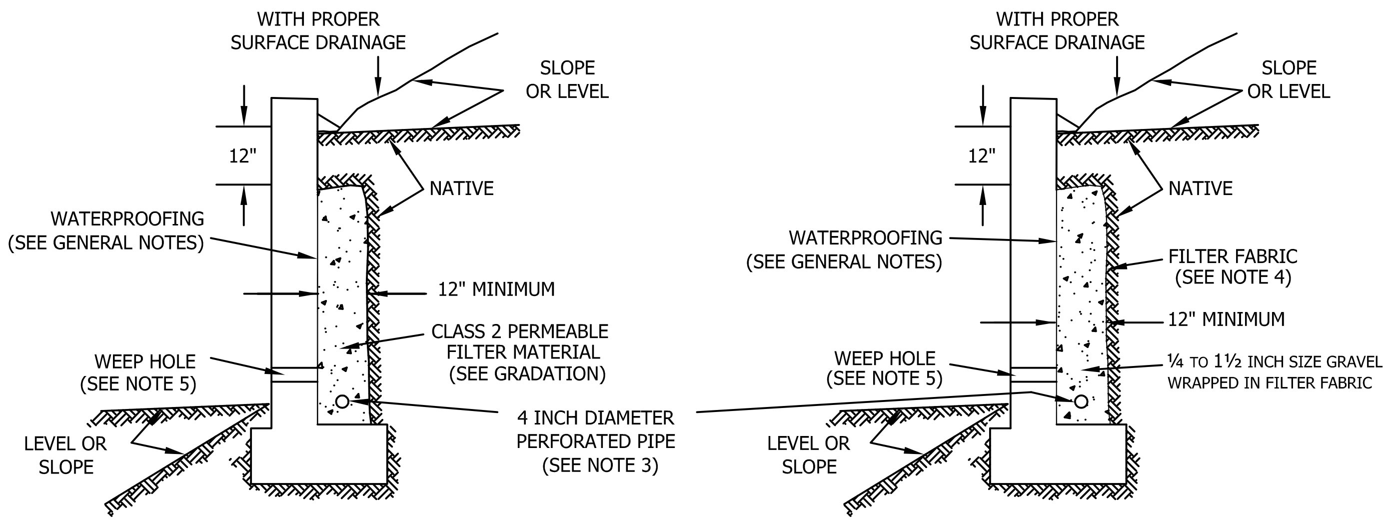
Leighton

Map Saved as Z:\Project Files\CA-DZ\ColtonJUSD\20707 - CJUSD Colton MS Pavilion-Admin GE\GIS\Maps\20707_F08_DIM_2023-12-15.mxd on 12/5/2023 4:10:17 PM Author: KVM (btran)

SUBDRAIN OPTIONS AND BACKFILL WHEN NATIVE MATERIAL HAS EXPANSION INDEX OF ≤50

OPTION 1: PIPE SURROUNDED WITH CLASS 2 PERMEABLE MATERIAL

OPTION 2: GRAVEL WRAPPED IN FILTER FABRIC



Class 2 Filter Permeable Material Gradation
Per Caltrans Specifications

Sieve Size	Percent Passing
1"	100
3/4"	90-100
3/8"	40-100
No. 4	25-40
No. 8	18-33
No. 30	5-15
No. 50	0-7
No. 200	0-3

GENERAL NOTES:

* Waterproofing should be provided where moisture nuisance problem through the wall is undesirable.
* Water proofing of the walls is not under purview of the geotechnical engineer
* All drains should have a gradient of 1 percent minimum
*Outlet portion of the subdrain should have a 4-inch diameter solid pipe discharged into a suitable disposal area designed by the project engineer. The subdrain pipe should be accessible for maintenance (rodding)
*Other subdrain backfill options are subject to the review by the geotechnical engineer and modification of design parameters.

Notes:
1) Sand should have a sand equivalent of 30 or greater and may be densified by water jetting.
2) 1 Cu. ft. per ft. of 1/4- to 1 1/2-inch size gravel wrapped in filter fabric
3) Pipe type should be ASTM D1527 Acrylonitrile Butadiene Styrene (ABS) SDR35 or ASTM D1785 Polyvinyl Chloride plastic (PVC), Schedule 40, Armco A2000 PVC, or approved equivalent. Pipe should be installed with perforations down. Perforations should be 3/8 inch in diameter placed at the ends of a 120-degree arc in two rows at 3-inch on center (staggered)
4) Filter fabric should be Mirafi 140NC or approved equivalent.
5) Weephole should be 3-inch minimum diameter and provided at 10-foot maximum intervals. If exposure is permitted, weepholes should be located 12 inches above finished grade. If exposure is not permitted such as for a wall adjacent to a sidewalk/curb, a pipe under the sidewalk to be discharged through the curb face or equivalent should be provided. For a basement-type wall, a proper subdrain outlet system should be provided.
6) Retaining wall plans should be reviewed and approved by the geotechnical engineer.
7) Walls over six feet in height are subject to a special review by the geotechnical engineer and modifications to the above requirements.

RETAINING WALL BACKFILL AND SUBDRAIN DETAIL FOR WALLS 6 FEET OR LESS IN HEIGHT

WHEN NATIVE MATERIAL HAS EXPANSION INDEX OF ≤50

Leighton

Figure 9

P:Drafting\templates\details\retain-wall-backfill-and subdrain.dwg (7/00)

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APPENDIX A

GEOTECHNICAL EXPLORATION LOGS

APPENDIX A

GEOTECHNICAL BORING LOGS

The field investigation consisted of a surface reconnaissance and a subsurface exploration program. Encountered soils were continuously logged in the field by our representative and described in accordance with the Unified Soil Classification System (ASTM D2488). Logs of these subsurface explorations are included as part of this appendix.

Borings were drilled with a truck-mounted hollow-stem drill rig. Relatively undisturbed soil samples were obtained at selected intervals within the borings using a California Ring Sampler and a Standard Penetration Test (SPT) split-spoon sampler. Bulk samples of representative soil types were also obtained from the borings. These samples were transported to our geotechnical laboratory for evaluation and appropriate testing. Borings were backfilled with the excavated earth materials after logging and sampling was completed.

The attached subsurface exploration logs and related information depict subsurface conditions only at the locations indicated and at the particular date designated on the logs. Subsurface conditions at other locations may differ from conditions occurring at these locations. The passage of time may result in altered subsurface conditions due to environmental changes. In addition, any stratification lines on the logs represent the approximate boundary between soil types and the transition may be gradual.

GEOTECHNICAL BORING LOG LB-1

Project No.	038.0000020707	**Date Drilled**	12-13-23
Project	Colton MS Pavilion and Admin Bldg GE	**Logged By**	AA
Drilling Co.	2R Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - Autohammer	**Ground Elevation**	1048'
Location	See Figure 2 - Exploration Location Map	**Sampled By**	AA

SOIL DESCRIPTION

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

Elevation Feet	Depth Feet	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	Soil Description	Type of Tests
	0		B-1					@Surface: 3 inches of ASPHALT **UNDOCUMENTED ARTIFICIAL FILL (Afu)**	CR, RV
1045			R-1	3 4 5	120	7	SM	@2.5': SILTY SAND (SM), loose, brown, slightly moist, fine to coarse sand, 45% low plasticity fines (field estimate)	
	5		R-2	3 5 14	116	3	SP-SM	**YOUNG AXIAL CHANNEL DEPOSITS (Qya)** @5': Poorly Graded SAND with SILT and GRAVEL (SP-SM), medium dense, light brown, slightly moist, coarse sand, 15% gravel, 10% fines (field estimate)	
1040			R-3	7 16 16	112	2	SP-SM	@7.5': Poorly Graded SAND with SILT and GRAVEL (SP-SM), medium dense, light brown, slightly moist, fine to medium sand, 15% gravel, 10% fines (field estimate)	
	10		R-4	4 8 9	99	5	SM	@10': SILTY SAND (SM), medium dense, tan, slightly moist, very fine sand, 29% fines (lab)	-200
1035									
	15		S-1	3 5 7			CL	@15': CLAY (CL), stiff, brown, slightly moist, low toughness, 63% low plasticity fines (lab)	-200, AL
1030									
	20		R-5	4 6 10			CL	@20': CLAY (CL), stiff, brown, slightly moist, low toughness, 65% low plasticity fines (field estimate)	
1025									
	25		S-2	4 7 10			CL	@25': LEAN CLAY (CL), very stiff, dark brown, slightly moist, medium toughness, high dry strength, 80% medium plasticity fines (field estimate)	
1020									
	30								

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

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

Leighton

GEOTECHNICAL BORING LOG LB-1

Project No.	038.0000020707	**Date Drilled**	12-13-23
Project	Colton MS Pavilion and Admin Bldg GE	**Logged By**	AA
Drilling Co.	2R Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - Autohammer	**Ground Elevation**	1048'
Location	See Figure 2 - Exploration Location Map	**Sampled By**	AA

Elevation Feet	Depth Feet	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
								This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.	
	30		R-6	2 4 12	101	18	CL	@30': LEAN CLAY (CL), stiff, brown, slightly moist, medium toughness, high dry strength, 76% medium to high plasticity fines (lab)	-200, AL
1015									
	35		S-3	2 8 10			ML	@35': SANDY SILT (ML), very stiff, tannish brown, slightly moist, fine sand, 65% low plasticity fines (field estimate)	
1010									
	40		R-7	10 20 14	115	9	ML	@40': SILT with SAND (ML), very stiff, tan, slightly moist, fine sand, 63% low plasticity fines (lab)	-200, AL
1005									
	45		S-4	5 14 15			SM	@45': SILTY SAND (SM), medium dense, tannish borwn, slightly moist, fine to medium sand, 35% fines (field estimate)	
1000									
	50		R-8	10 20 28			SM	@50': SILTY SAND (SM), medium dense, tannish borwn, slightly moist, very fine sand, micaceous, 40% fines (field estimate)	
995								**TOTAL DEPTH = 51.5 FEET** **NO GROUNDWATER ENCOUNTERED** **BACKFILLED TO SURFACE WITH SOIL CUTTINGS and ASPHALT COLD PATCH**	
	55								
990									
	60								

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

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

Leighton

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

GEOTECHNICAL BORING LOG LB-2

Project No.	038.0000020707	**Date Drilled**	12-13-23
Project	Colton MS Pavilion and Admin Bldg GE	**Logged By**	AA
Drilling Co.	2R Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - Autohammer	**Ground Elevation**	1049'
Location	See Figure 2 - Exploration Location Map	**Sampled By**	AA

SOIL DESCRIPTION

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

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	0								@Surface: 5 inches of ASPHALT over 8 inches of BASE	
				B-1					**UNDOCUMENTED ARTIFICIAL FILL (Afu)**	MD, SA
				R-1	3 5 7	114	6	SW-SM	@2.5': Well graded sand with SILT and GRAVEL (SW-SM), loose, brown, slightly moist, medium to coarse sand, 6% fines (lab)	
1045	5			R-2	5 7 14	118	3	SP-SM	**YOUNG AXIAL CHANNEL DEPOSITS (Qya)** @5': Poorly Graded SAND with SILT and GRAVEL (SP-SM), medium dense, light brown, slightly moist, medium to coarse sand, 15% gravel, 10% fines (field estimate)	
				R-3	11 16 18	117	2	SP-SM	@7.5': Poorly Graded SAND with SILT and GRAVEL (SP-SM), medium dense, grayish brown, slightly moist, coarse sand, 20% gravel, 5% fines (field estimate)	
1040	10			R-4	6 6 8	105	14	ML	@10': SILT with SAND (ML), stiff, brown, slightly moist, fine sand, 85% low plasticity fines (field estimate)	
1035	15			S-1	3 5 7		6	SM	@15': SILTY SAND (SM), medium dense, brown, slightly moist, fine sand, 23% low plasticity fines (lab)	-200, AL
1030	20			R-5	4 8 9			CL	@20': SANDY SILT (ML), stiff, brown, slightly moist, medium toughness, 50% medium plasticity fines (lab)	-200, AL
1025	25								**TOTAL DEPTH = 21.5 FEET** **NO GROUNDWATER ENCOUNTERED** **BACKFILLED TO SURFACE WITH SOIL CUTTINGS and ASPHALT COLD PATCH**	
1020	30									

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

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

Leighton

GEOTECHNICAL BORING LOG LB-3

Project No.	038.0000020707	**Date Drilled**	12-13-23
Project	Colton MS Pavilion and Admin Bldg GE	**Logged By**	AA
Drilling Co.	2R Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - Autohammer	**Ground Elevation**	1046'
Location	See Figure 2 - Exploration Location Map	**Sampled By**	AA

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

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	0								@Surface: 5 inches of ASPHALT over 8 inches of BASE	
1045								SM	**UNDOCUMENTED ARTIFICIAL FILL (Afu)** @10": SILTY SAND (SM), brown, slightly moist, fine to coarse sand, 20% fines (field estimate)	
				R-1	3 4 7	118	6	SM	@2.5': SILTY SAND (SM), loose, brown, slightly moist, medium to coarse sand, trace of gravel, 15% fines (field estimate)	
1040	5			R-2	5 7 10	108	3	SP-SM	**YOUNG AXIAL CHANNEL DEPOSITS (Qya)** @5': Poorly Graded SAND with SILT (SP-SM), medium dense, brown, slightly moist, coarse sand, trace of gravel, 10% fines (field estimate)	
				R-3	7 13 16	114	2	SP-SM	@7.5': Poorly Graded SAND with SILT (SP-SM), medium dense, light brown, slightly moist, medium to coarse sand, trace of gravel, 10% fines (field estimate)	
1035	10			R-4	9 17 20	108	3	SP-SM	@10': Poorly Graded SAND with SILT (SP-SM), medium dense, light brown, moist, coarse sand, 10% fines (field estimate)	
1030	15			S-1	5 12 15			SP	@15': Poorly Graded SAND (SP), medium dense, grayish brown, slightly moist, fine to coarse sand, 5% fines (field estimate)	
1025	20			R-5	8 9 24			SM	@20': SILTY SAND (SM), medium dense, tan, slightly moist, fine sand, 25% fines (field estimate)	
1020	25								**TOTAL DEPTH = 21.5 FEET** **NO GROUNDWATER ENCOUNTERED** **BACKFILLED TO SURFACE WITH SOIL CUTTINGS and ASPHALT COLD PATCH**	
	30									

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

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

Leighton

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

GEOTECHNICAL BORING LOG LB-4

Project No.	038.0000020707	**Date Drilled**	12-13-23
Project	Colton MS Pavilion and Admin Bldg GE	**Logged By**	AA
Drilling Co.	2R Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - Autohammer	**Ground Elevation**	1055'
Location	See Figure 2 - Exploration Location Map	**Sampled By**	AA

SOIL DESCRIPTION

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

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
1055	0								@Surface: 5 inches of ASPHALT over 13 inches of BASE	
				B-1					**UNDOCUMENTED ARTIFICIAL FILL (Afu)**	
				R-1	6 8 9	118	7	SM	@2.5': SILTY SAND (SM), medium dense, brown, moist, medium to coarse sand, 30% fines (field estimate)	
1050	5			R-2	6 10 15	118	3	SM	**YOUNG AXIAL CHANNEL DEPOSITS (Qya)** @5': SILTY SAND (SM), medium dense, brown, slightly moist, medium to coarse sand, trace of gravel, 15% fines (field estimate)	
				R-3	10 17 22	118	2	SM	@7.5': SILTY SAND with GRAVEL (SM), medium dense, grayish brown, slightly moist, medium to coarse sand, 20% gravel, 15% fines (field estimate)	
1045	10			R-4	8 16 21			SP-SM	@10': Poorly Graded SAND with SILT (SP-SM), medium dense, light brown, slightly moist, fine to medium sand, 10% fines (field estimate)	
1040	15			S-1	4 7 8			SP-SM	@15': Poorly Graded SAND with SILT (SP-SM), medium dense, light brown, slightly moist, fine to medium sand, trace of gravel, 5% fines (lab)	-200
1035	20			R-5	20 32 48			SP	@20': Poorly Graded SAND with GRAVEL (SP), dense, brown, slightly moist, coarse sand, 15% gravel, 5% fines (field estimate)	
									TOTAL DEPTH = 21.5 FEET **NO GROUNDWATER ENCOUNTERED** **BACKFILLED TO SURFACE WITH SOIL CUTTINGS and ASPHALT COLD PATCH**	
1030	25									
1025	30									

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

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

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GEOTECHNICAL BORING LOG LI-1

Project No.	038.0000020707	**Date Drilled**	12-13-23
Project	Colton MS Pavilion and Admin Bldg GE	**Logged By**	AA
Drilling Co.	2R Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - Autohammer	**Ground Elevation**	1043'
Location	See Figure 2 - Exploration Location Map	**Sampled By**	AA

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	0			B-1				ML	@Surface: GRASS over SANDY SILT **UNDOCUMENTED ARTIFICIAL FILL (Afu)** SANDY SILT (ML): dark brown, moist, fine sand, 75% low plasticity fines (field estimate)	
1040				S-1	1 2 5			SM	@2.5': SILTY SAND (SM), loose, light brown, slightly moist, medium to coarse sand, 20% fines (field estimate)	
	5			S-2	5 9 7			SP-SM	**YOUNG AXIAL CHANNEL DEPOSITS (Qya)** @5.5': Poorly Graded SAND with SILT (SP-SM), medium dense, grayish brown, slightly moist, medium to coarse sand, 5% fines (lab)	-200
1035									**TOTAL DEPTH = 7 FEET** **NO GROUNDWATER ENCOUNTERED** **INFILTRATION TEST PERFORMED AT 2 TO 7 FEET** **BACKFILLED TO SURFACE WITH SOIL CUTTINGS**	
	10									
1030										
	15									
1025										
	20									
1020										
	25									
1015										
	30									

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

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

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
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- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

Leighton

Results of Well Permeameter, from USBR 7300-89 Method

Project: 20707
Exploration #/Location: LI-1
Depth Boring drilled, bgs (ft): 7
Tested by: AA
USCS Soil Type in test zone: SP-SM
Weather (start to finish): Sunny
Water Source/pH: Tap Water
Measured boring diameter: 8 in. 4 in. Well Radius
Depth to GW or aquitard, bgs: 100 ft
Well Prep: Drilled to 7 feet, 2" diameter screened pipe full depth, #3 sand around anulus

Initial estimated Depth to Water Surface (in.): 69
Average depth of water in well, "h" (in.): 17
approx. h/r: 4.3
Tu (Fig. 8) (ft): 94.3
Tu>3h?: yes, OK

Cross-sectional area for flow calcs based on Δh
Well pack sand porosity 0.3
Casing outer diameter, in. 2.3
Casing inner diameter, in. 2.1
Cross-sectional area, in.^2 17.3

	ft	in.	Total (in.)
Depth to bottom of well measured from top of auger (or ground surfa	7. ft	2. in.	86
Casing stickup measured above top of auger (or ground surface) (+ i	0. ft	0. in.	0
Depth to top of sand from top of casing	2. ft	0. in.	

Depth of well bottom below top of casing (in): 86

Use of Barrels: No
Use of Flow Meter: Yes
Test Type: Constant Head

Flow Meter ID: 2499 Meter Units: Gallons 0.05 gallons/pulse
Data logger ID:

Field Data **Calculations**

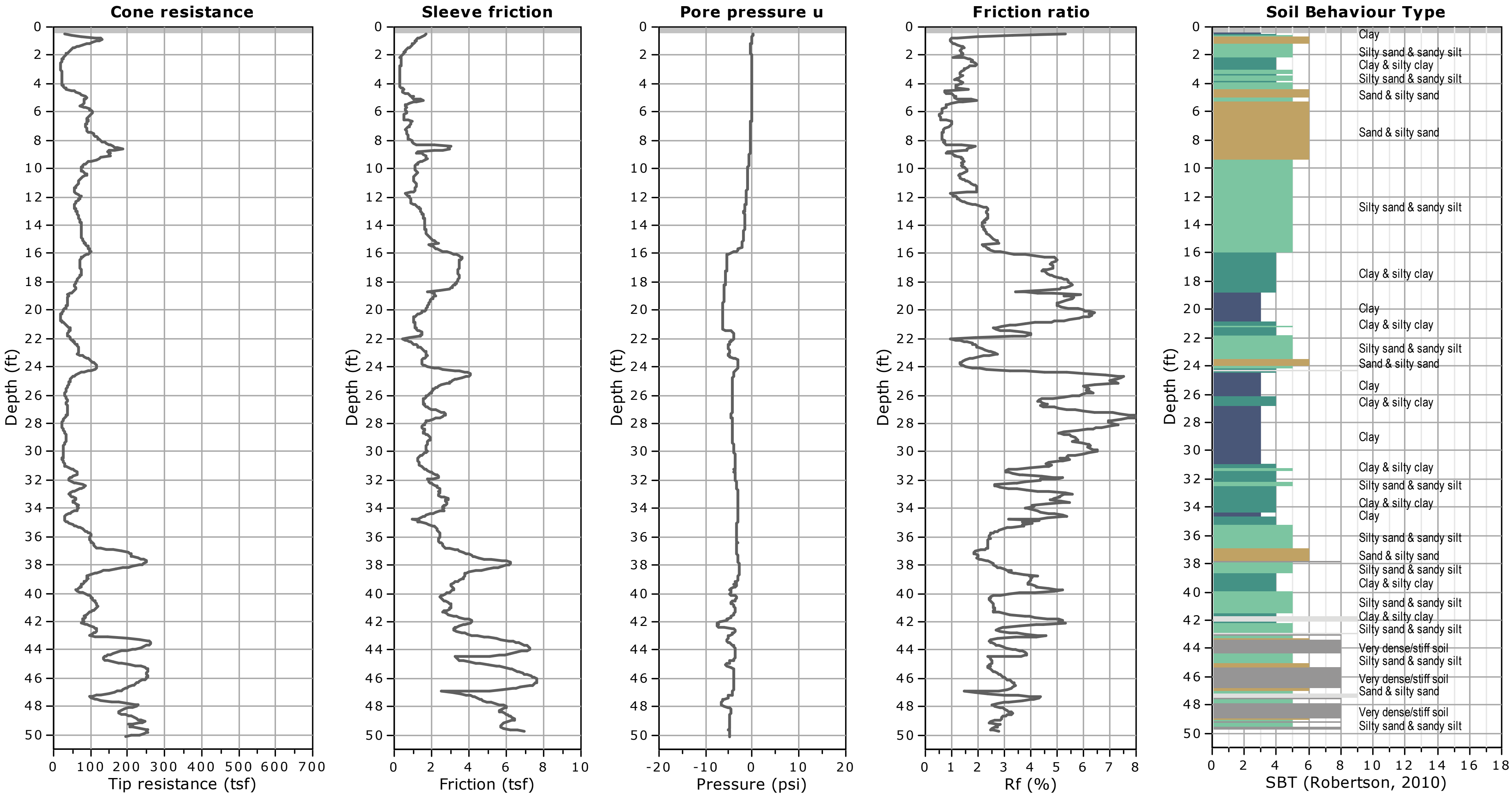
Date	Time	Data from Flow Meter: Reading (gallons)	Interval Pulse Count	Depth to WL in Boring (measured from top of casing) ft	in.	Water Temp (deg F)	Refilled? (or Comments)	Δt (min)	Total Elapsed Time (min)	Depth to WL in well (in.)	h, Height of Water in Well (in.)	Δh (in.)	Avg. h	Vol Change (in.^3) from supply	from Δh	Total	Flow (in^3/ min)	q, Flow (in^3/ hr)	Average Infiltration Surface Area, (in^2)	V (Fig 9)	K20, Coef. Of Perme-ability at 20 deg C (in./hr)	Infiltration Rate [flow/surf area] (in./hr) (FS=1)
Start Date	Start time:	Gallons		ft	in.																	
12/15/2023	10:00																					
12/15/23	10:03	524.75		5.83					3	70.0	16.0											
12/15/23	10:05	530.17		5.83				2	5	70.0	16.0	0	16	1252	0	1252	626	37561		0.9	28.19	76.37
12/15/23	10:10	543.76		5.82				5	10	69.8	16.2	0.12	16	3139	-2	3137	627	37647		0.9	27.89	76.29
12/15/23	10:15	557.34		5.83				5	15	70.0	16.0	-0.12	16	3137	2	3139	628	37669		0.9	28.33	76.34
12/15/23	10:20	570.92		5.83				5	20	70.0	16.0	0	16	3137	0	3137	627	37644		0.9	28.25	76.54
12/15/23	10:25	584.5		5.83				5	25	70.0	16.0	0	16	3137	0	3137	627	37644		0.9	28.25	76.54
12/15/23	10:30	598.07		5.83				5	30	70.0	16.0	0	16	3135	0	3135	627	37616		0.9	28.23	76.48
12/15/23	10:35	611.65		5.8				5	35	69.6	16.4	0.36	16	3137	-6	3131	626	37569		0.9	27.15	75.63
12/15/23	10:40	625.27		5.8				5	40	69.6	16.4	0	16	3146	0	3146	629	37755		0.9	27.46	75.26
12/15/23	10:45	638.86		5.79				5	45	69.5	16.5	0.12	16	3139	-2	3137	627	37647		0.9	27.04	74.80
12/15/23	10:50	652.5		5.79				5	50	69.5	16.5	0	17	3151	0	3151	630	37810		0.9	27.22	74.89
12/15/23	10:55	666.13		5.78				5	55	69.4	16.6	0.12	17	3149	-2	3146	629	37757		0.9	26.85	74.54
12/15/23	11:00	679.8		5.76				5	60	69.1	16.9	0.24	17	3158	-4	3154	631	37843		0.9	26.31	73.99
12/15/23	11:10	707.18		5.75				10	70	69.0	17.0	0.12	17	6325	-2	6323	632	37936		0.9	26.17	73.47
12/15/23	11:15	720.87		5.74				5	75	68.9	17.1	0.12	17	3162	-2	3160	632	37924		0.9	25.90	72.98
12/15/23	11:20	734.55		5.73				5	80	68.8	17.2	0.12	17	3160	-2	3158	632	37896		0.9	25.63	72.47
12/15/23	11:25	748.23		5.73				5	85	68.8	17.2	0	17	3160	0	3160	632	37921		0.9	25.70	72.29
12/15/23	11:30	761.89		5.72				5	90	68.6	17.4	0.12	17	3155	-2	3153	631	37841		0.9	25.34	71.92
12/15/23	11:35	775.55		5.7				5	95	68.4	17.6	0.24	17	3155	-4	3151	630	37816		0.9	24.78	71.21
12/15/23																						
12/15/23	11:40	789.03		5.62					100	67.4	18.6											
12/15/23	11:45	803.69		5.61				5	105	67.3	18.7	0.12	19	3386	-2	3384	677	40613		0.9	24.50	72.24
12/15/23	11:50	818.33		5.6				5	110	67.2	18.8	0.12	19	3382	-2	3380	676	40557		0.9	24.24	71.73
12/15/23	11:55	833.98		5.59				5	115	67.1	18.9	0.12	19	3615	-2	3613	723	43357		0.9	25.68	76.24
12/15/23	12:00	847.62		5.58				5	120	67.0	19.0	0.12	19	3151	-2	3149	630	37785		0.9	22.17	66.06
12/15/23	12:05	862.21		5.56				5	125	66.7	19.3	0.24	19	3370	-4	3366	673	40394		0.9	23.24	70.02
12/15/23	12:10	876.88		5.55				5	130	66.6	19.4	0.12	19	3389	-2	3387	677	40640		0.9	23.21	69.85
12/15/23	12:15	891.48		5.55				5	135	66.6	19.4	0	19	3373	0	3373	675	40471		0.9	23.16	69.37
12/15/23	12:20	906.09		5.54				5	140	66.5	19.5	0.12	19	3375	-2	3373	675	40474		0.9	22.91	69.18
12/15/23	12:25	920.69		5.53				5	145	66.4	19.6	0.12	20	3373	-2	3371	674	40446		0.9	22.70	68.75
12/15/23	12:30	935.27		5.53				5	150	66.4	19.6	0	20	3368	0	3368	674	40416		0.9	22.72	68.50
12/15/23																						
12/15/23	12:35	947.37		5.82					155	69.8	16.2											
12/15/23	12:41	961.16		5.83				6	161	70.0	16.0	-0.12	16	3185	2	3188	531	31876		0.9	23.97	64.60
12/15/23	12:46	972.67		5.83				5	166	70.0	16.0	0	16	2659	0	2659	532	31906		0.9	23.94	64.87
12/15/23	12:51	984.16		5.83				5	171	70.0	16.0	0	16	2654	0	2654	531	31850		0.9	23.90	64.76
12/15/23	12:56	995.65		5.82				5	176	69.8	16.2	0.12	16	2654	-2	2652	530	31825		0.9	23.58	64.49
12/15/23	13:01	1007.14		5.82				5	181	69.8	16.2	0	16	2654	0	2654	531	31850		0.9	23.65	64.33

Minimum Rate: 64.33
Raw Rate for design, prior to application of adjustment factors: **67.40**

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

Project: **Leighton Consulting / Colton MS Pavillion and Administration Building** **CPT-1**

Location: **670 W. Laurel St, Colton, CA** Total depth: 50.15 ft, Date: 1/17/2024



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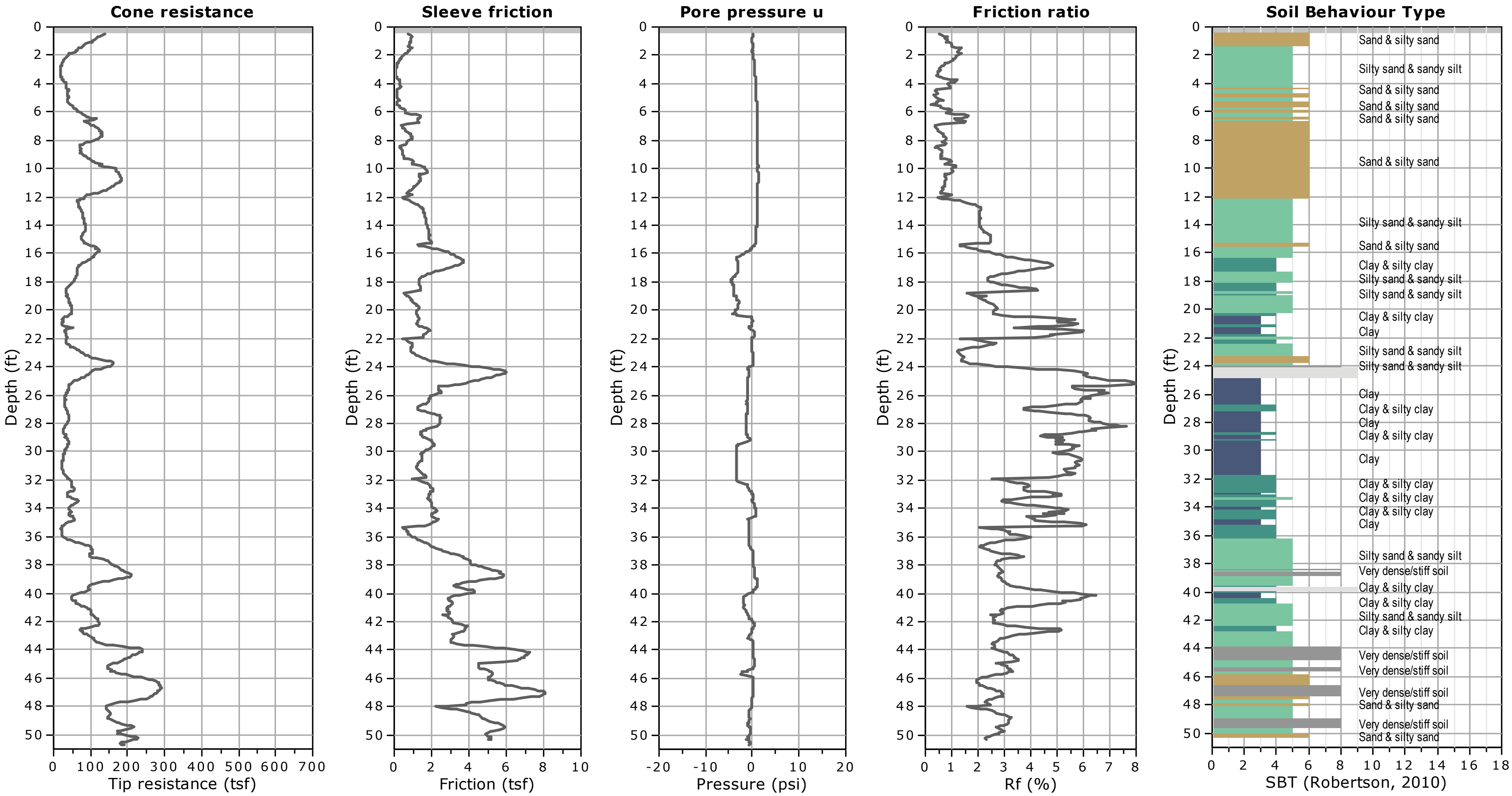
Project: Leighton Consulting / Colton MS Pavillion and Administration Building **CPT-2**

Location: 670 W. Laurel St, Colton, CA Total depth: 50.73 ft, Date: 1/17/2024



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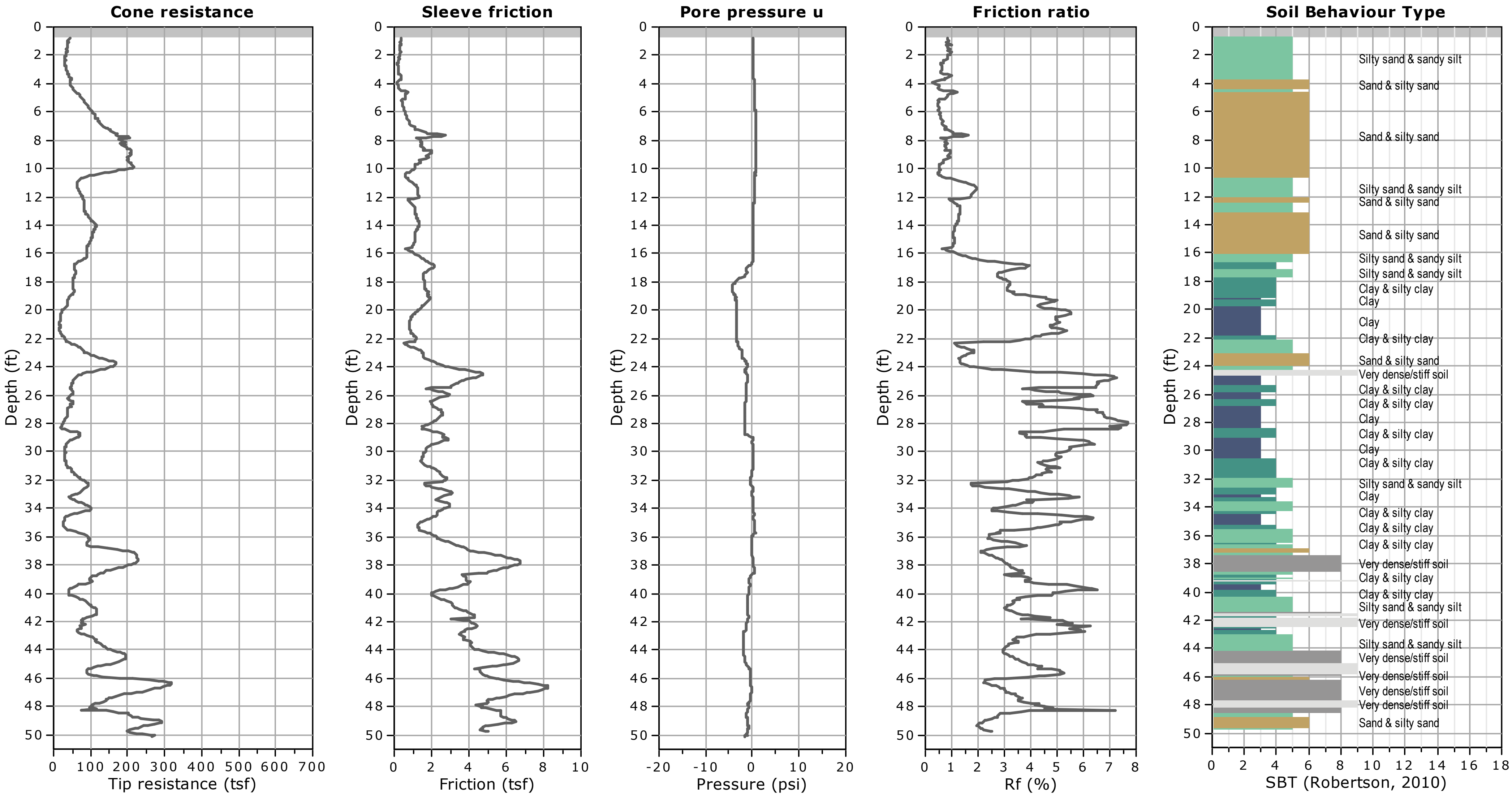
Project: Leighton Consulting / Colton MS Pavillion and Administration Building

Location: 670 W. Laurel St, Colton, CA

CPT-3

Total depth: 50.14 ft, Date: 1/17/2024



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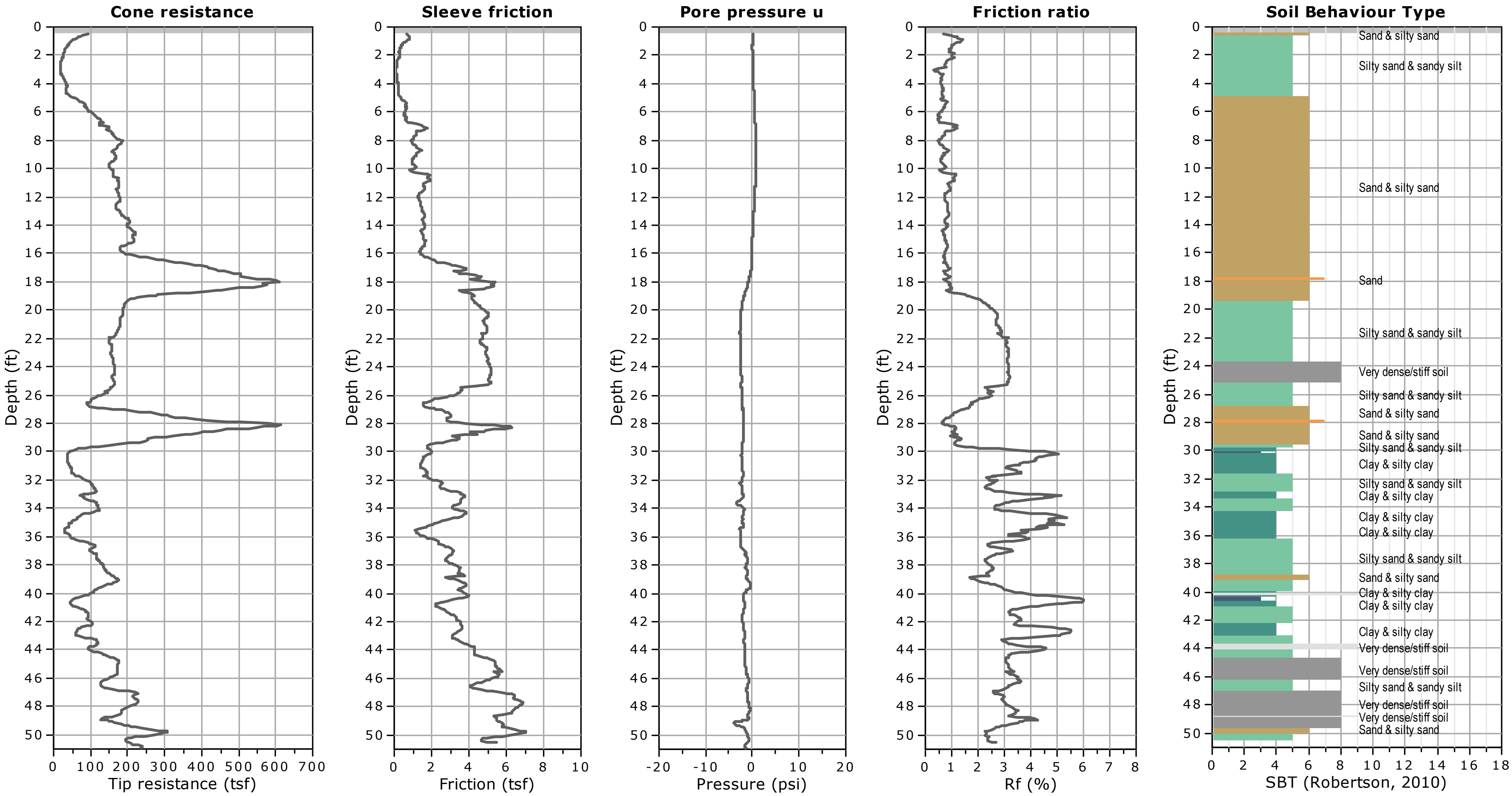
Project: Leighton Consulting / Colton MS Pavillion and Administration Building

Location: 670 W. Laurel St, Colton, CA

CPT-4

Total depth: 50.92 ft, Date: 1/17/2024



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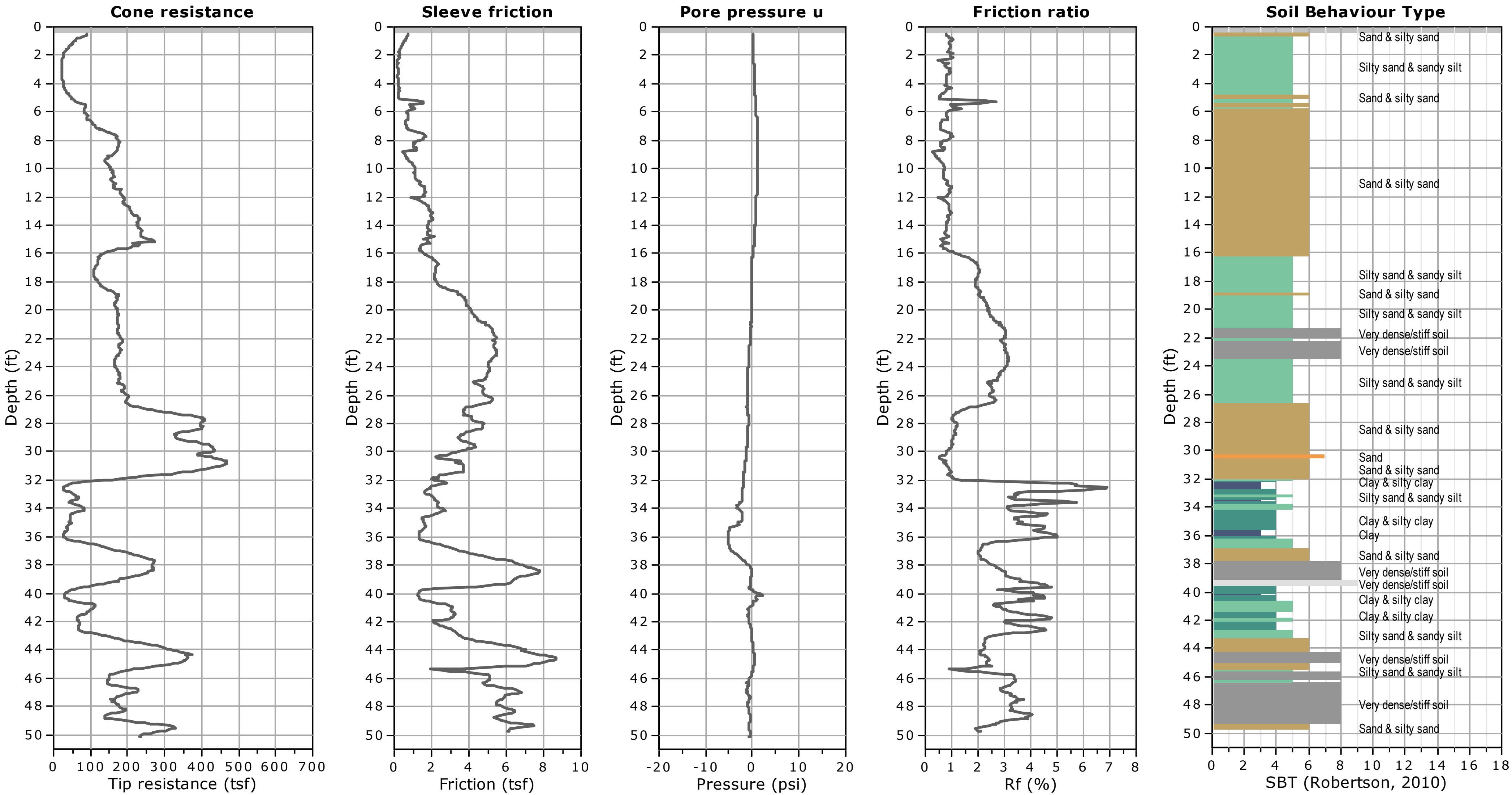
Project: **Leighton Consulting / Colton MS Pavillion and Administration Building** **CPT-5**

Location: **670 W. Laurel St, Colton, CA** Total depth: 50.13 ft, Date: 1/17/2024



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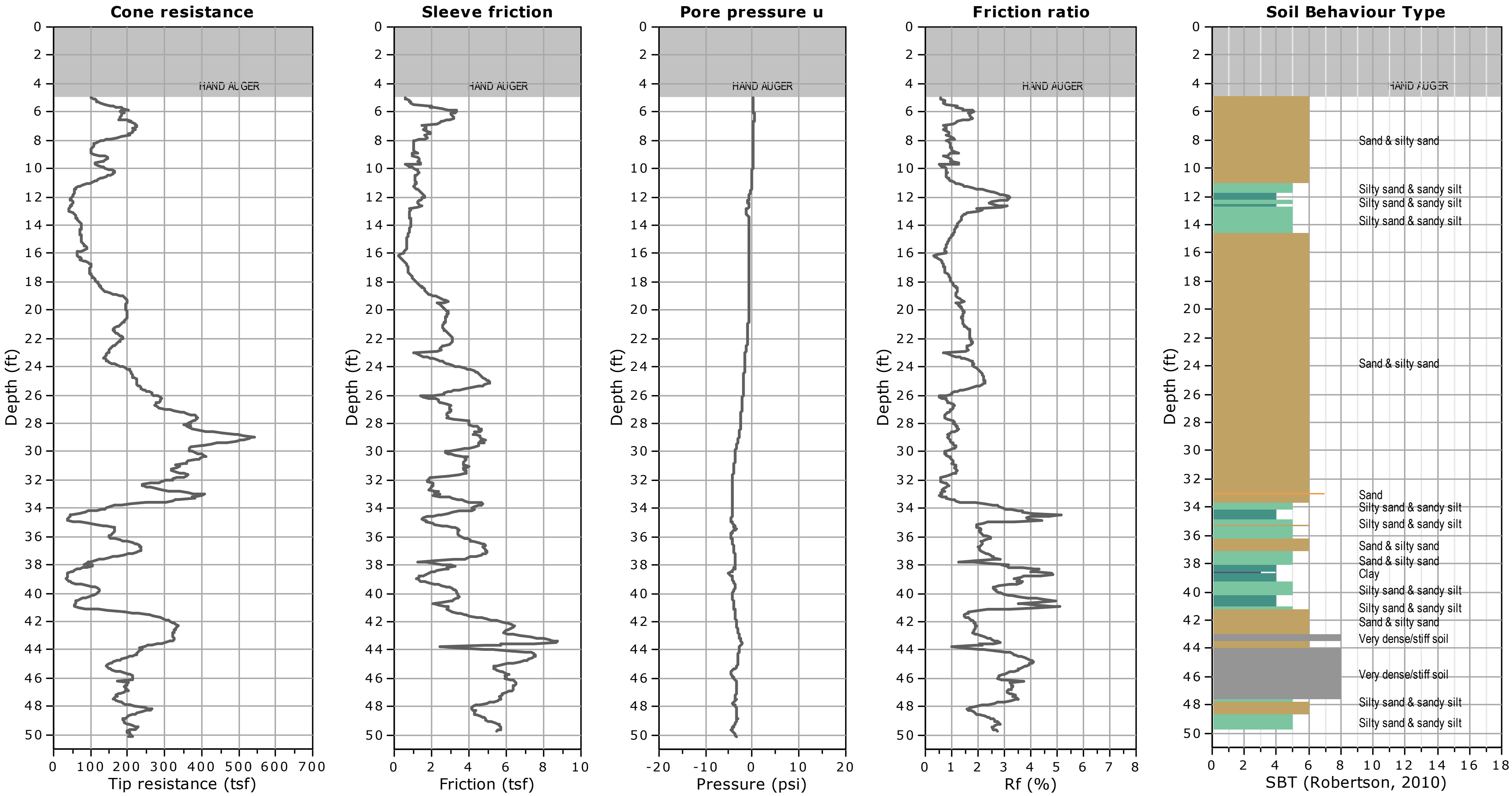
Project: **Leighton Consulting / Colton MS Pavillion and Administration Building**

Location: **670 W. Laurel St, Colton, CA**

CPT-6

Total depth: 50.14 ft, Date: 1/17/2024



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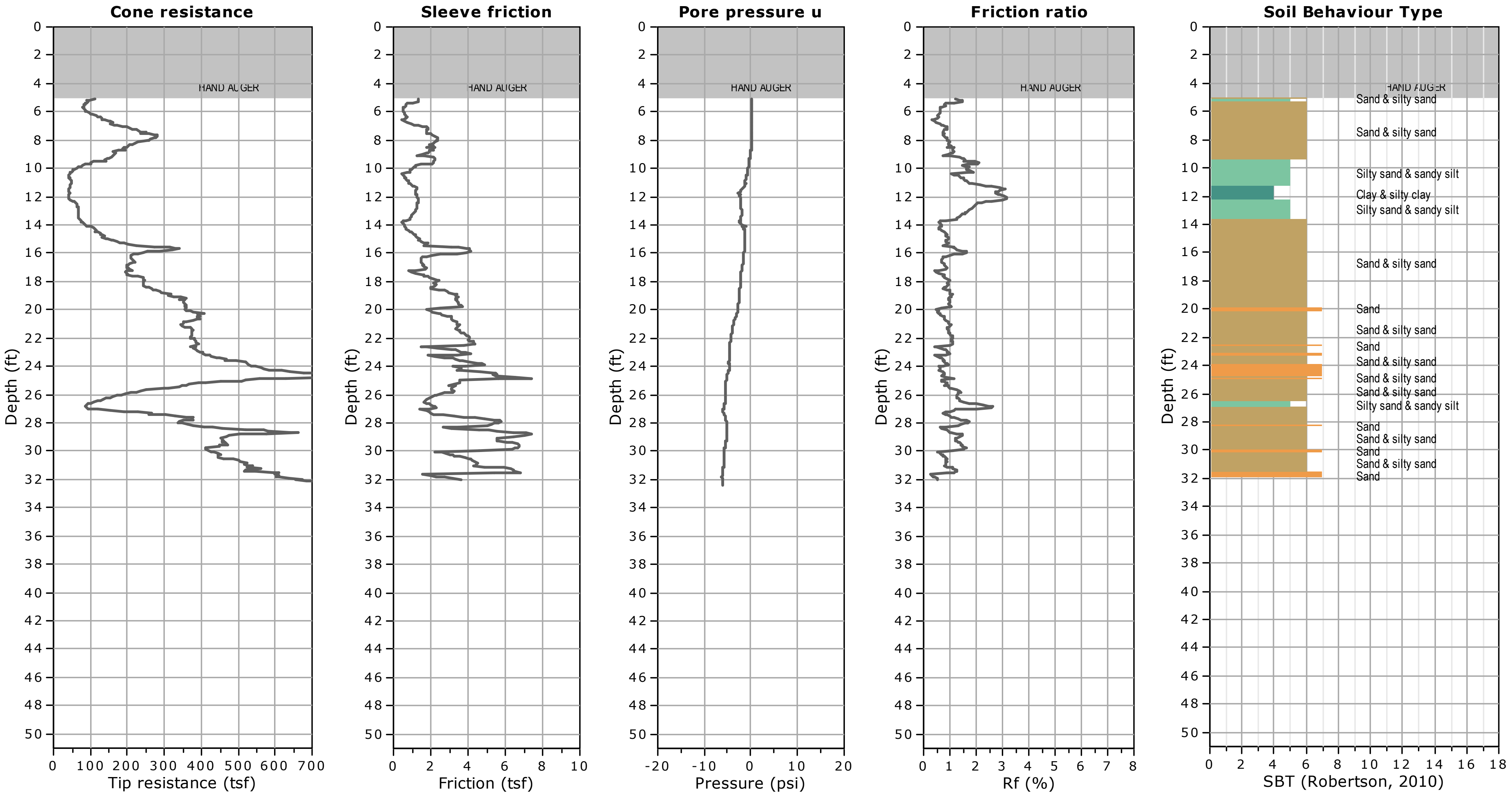
Project: **Leighton Consulting / Colton MS Pavillion and Administration Building** **CPT-7**

Location: **670 W. Laurel St, Colton, CA** Total depth: 32.36 ft, Date: 1/17/2024



GEOTECHNICAL EXPLORATION LOGS
(LEIGHTON 2004)

Leighton
a verdantas company

GEOTECHNICAL BORING LOG B-1

Date 8-24-04 **Sheet** 1 **of** 1

Project Colton Joint Unified School District/Colton Middle School **Project No.** 600615-001

Drilling Co. 2-R Drilling **Type of Rig** CME 75

Hole Diameter 8" **Drive Weight** 140 lb Automatic Hammer **Drop** 30"

Elevation Top of Hole 1044' **Location** See Geotechnical Map

Logged By DAG

Sampled By DAG

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Six Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
	0			B-1					@ 0' ASPHALT, 2" asphalt over 3" base @ 5" Gravelly/Silty SAND, moderate brown, moist, fine- to medium-grained, subangular gravel to 3"	MD
				R-1	3 4 5	118.4	5.0	SM	@ 2.5' Gravelly/Silty SAND, moderate brown, moist, fine- to medium-grained, loose, subrounded gravel to 1", low to non-plastic silt	SA
1040	5			R-2	4 6 8			SW	@ 5' Gravelly SAND, moderate brown, moist, fine- to coarse-grained, medium dense, subrounded to subangular gravel to 1", trace non-plastic silt	
1035	10			R-3	7 8 9	117.1	10.7	SM	@ 10' Silty SAND, moderate yellow brown, moist, very fine-grained, medium dense, non-plastic silt, grades to Sandy SILT	Collapse
1030	15			S-1	3 5 9			SM	@ 15' Silty SAND, moderate yellow brown, moist, very fine- to fine-grained, medium dense, non-plastic silt, trace caliche, grades to Sandy SILT	
1025	20			S-2	4 4 4			SM	@ 20' Silty SAND, moderate yellowish brown, moist, very fine-grained, medium dense, low plasticity silt, grades to Sandy SILT	
1020	25			S-3	5 10 15			CL/SM	@ 25' Sandy CLAY, moderate yellowish brown, moist, low plasticity, very stiff, fine-grained sand, caliche, iron staining @ 25.5' Silty SAND, moderate yellowish brown, moist, fine-grained, dense, low plasticity silt, grades to Clayey SAND	
1015	30								Total depth 26.5 feet No groundwater Boring backfilled with soil cuttings and patched with cold asphalt	

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

TYPE OF TESTS:
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- CR CORROSION
- SA SIEVE ANALYSIS
- AL ATTERBERG LIMITS
- EI EXPANSION INDEX
- RV R-VALUE

LEIGHTON CONSULTING, INC.

GEOTECHNICAL BORING LOG B-2

Date 8-24-04 **Sheet** 1 **of** 1
Project Colton Joint Unified School District/Colton Middle School **Project No.** 600615-001
Drilling Co. 2-R Drilling **Type of Rig** CME 75
Hole Diameter 8" **Drive Weight** 140 lb Automatic Hammer **Drop** 30"
Elevation Top of Hole 1043' **Location** See Geotechnical Map

Logged By DAG
Sampled By DAG

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Six Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
	0								@ 0' ASPHALT, 2.5" asphalt over 2" base @ 5" Gravelly/Silty SAND, moderate brown, moist, fine- to medium-grained, subangular gravel to 2", low-plasticity silt	
1040				R-1	3 3 7			SM	@ 2.5' Gravelly/Silty SAND, moderate brown, moist, fine- to medium-grained, loose, subangular gravel to 2", low-plasticity silt	
	5			R-2	5 8 11	115.8	2.8	SW	@ 5' Gravelly SAND, moderate yellowish brown, moist, fine- to coarse-grained, medium dense, subangular gravel to 2"	
1035										
	10			R-3	6 8 10	104.3	9.9	SM	@ 10' Silty SAND, moderate yellowish brown, moist, very fine- to fine-grained, medium dense, non-plastic silt	Collapse
1030										
	15			R-4	13 29 39			SP	@ 15' Gravelly SAND, moderate brown, moist, fine- to medium-grained, very dense, contains some low-plasticity silt and clay, subrounded gravel to 3"	
1025										
	20			R-5	19 28 40			SP	@ 20' SAND, moderate yellowish brown, moist, fine- to medium-grained, very dense, some fine gravel present	
1020										
	25			R-6	33 46 50/5"			SP	@ 25' SAND, moderate yellowish brown, moist, medium- to coarse-grained, very dense, some fine gravel present	
1015									Total depth 26.5 feet No groundwater Boring backfilled with soil cuttings and patched with cold asphalt	
	30									

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

TYPE OF TESTS:
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- CR CORROSION
- SA SIEVE ANALYSIS
- AL ATTERBERG LIMITS
- EI EXPANSION INDEX
- RV R-VALUE

LEIGHTON CONSULTING, INC.

GEOTECHNICAL BORING LOG B-5

Date 8-24-04 **Sheet** 1 **of** 1
Project Colton Joint Unified School District/Colton Middle School **Project No.** 600615-001
Drilling Co. 2-R Drilling **Type of Rig** CME 75
Hole Diameter 8" **Drive Weight** 140 lb Automatic Hammer **Drop** 30"
Elevation Top of Hole 1042' **Location** See Geotechnical Map

Logged By DAG
Sampled By DAG

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Six Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
	0								@ 0' ASPHALT, 4" asphalt over 2" base @ 6" Silty/Gravelly SAND, moderate brown, moist, fine- to medium-grained, gravel to 2"	
1040				B-1						
				R-1	4 5 6	119.3	4.9	SM	@ 2.5' Silty/Gravelly SAND, moderate brown, moist, fine- to medium-grained, loose, gravel to 2", micaceous	
	5			R-2	6 9 14	117.3	1.8	SW	@ 5' Gravelly SAND, moderate brown, moist, fine- to coarse-grained, medium dense, subrounded gravel to 1", slightly micaceous, trace fines	
1035										
	10			R-3	11 21 21	117.9	2.5	SP	@ 10' SAND, pale brown, moist, fine- to medium-grained, dense, slightly micaceous, trace fine gravel	
1030										
	15			S-1	7 10 12			SP	@ 15' SAND, pale brown, moist, fine- to medium-grained, dense, slightly micaceous, trace fine gravel	
1025										
	20			S-2	5 6 9			SP	@ 20' SAND, moderate yellowish brown, moist, very fine- to fine-grained, medium dense, micaceous, some non-plastic silt present, grades to Silty SAND	
1020										
	25			S-3	7 12 14			SP	@ 25' SAND, moderate yellowish brown, moist, fine-grained, dense, slightly micaceous	
1015									Total depth 26.5 feet No groundwater Boring backfilled with soil cuttings and patched with cold asphalt	
	30									

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

TYPE OF TESTS:
DS DIRECT SHEAR
MD MAXIMUM DENSITY
CN CONSOLIDATION
CR CORROSION
SA SIEVE ANALYSIS
AL ATTERBERG LIMITS
EI EXPANSION INDEX
RV R-VALUE

LEIGHTON CONSULTING, INC.

GEOTECHNICAL BORING LOG B-3

Date 8-24-04 **Sheet** 1 of 2
Project Colton Joint Unified School District/Colton Middle School **Project No.** 600615-001
Drilling Co. 2-R Drilling **Type of Rig** CME 75
Hole Diameter 8" **Drive Weight** 140 lb Automatic Hammer **Drop** 30"
Elevation Top of Hole 1042' **Location** See Geotechnical Map

Logged By DAG
Sampled By DAG

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Six Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
	0								@ 0' ASPHALT, 2.5" asphalt over 2" base @ 5" Silty/Gravelly SAND, moderate brown, moist, fine-grained, gravel to 1", low plasticity silt	
1040				R-1	3 6 6	119.8	6.0	SM	@ 2.5' Silty/Gravelly SAND, moderate brown, moist, fine-grained, loose, rounded to subrounded gravel to 1", low plasticity silt and clay	
	5			R-2	5 8 8	113.2	1.9	SP	@ 5' Gravelly SAND, moderate yellowish brown, moist, medium-grained, medium dense, subrounded to subangular gravel to 2", trace fines	
1035				R-3	8 13 13	113.9	2.2	SP	@ 7.5' Gravelly SAND, moderate yellowish brown, moist, medium- to coarse-grained, medium dense, subangular gravel to 2"	
	10			R-4	7 14 20	102.5	1.8	SP	@ 10' SAND, pale brown, moist, fine-grained, medium dense	
1030									@ 11.5' Silty SAND, moderate brown, moist, fine-grained, medium dense, low plasticity silt and clay	
	15			R-5	15 20 29			SP	@ 15' SAND, moderate brown, moist, fine- to medium-grained, dense, some rounded gravel to 1", low plasticity silt, grades to Silty SAND	
1025										
	20			R-6	21 30 35			SP	@ 20' Gravelly SAND, moderate yellowish brown, moist, medium- to coarse-grained, dense, rounded to subrounded gravel to 1"	
1020										
	25			S-1	5 9 15			SP	@ 25' SAND, moderate yellowish brown, moist, fine-grained, dense, some fractured gravels present, portions grade to Silty SAND, gravel present near tip of sampler	
1015										
	30									

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

TYPE OF TESTS:
DS DIRECT SHEAR
MD MAXIMUM DENSITY
CN CONSOLIDATION
CR CORROSION
SA SIEVE ANALYSIS
AL ATTERBERG LIMITS
EI EXPANSION INDEX
RV R-VALUE

LEIGHTON CONSULTING, INC.

GEOTECHNICAL BORING LOG B-3

Date 8-24-04 | Sheet 2 of 2
Project Colton Joint Unified School District/Colton Middle School | Project No. 600615-001
Drilling Co. 2-R Drilling | Type of Rig CME 75
Hole Diameter 8" | Drive Weight 140 lb Automatic Hammer | Drop 30"
Elevation Top of Hole 1042' | Location See Geotechnical Map

Logged By DAG
Sampled By DAG

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Six Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
	30			S-2	22 23 18			SP	@ 30' Gravelly SAND, pale brown, moist, medium-grained, very dense, subangular gravel to 1.5", some coarse sand present, trace fines	
1010										
	35			S-3	2 5 19				@ 35' Silty/Sandy CLAY, moderate brown, moist, low plasticity, stiff, fine-grained sand, mottled, grades to Sandy SILT @ 35.5' Silty SAND, moderate brown, moist, very fine- to fine-grained, dense, low to non-plastic silt @ 36' SAND, pale brown, moist, fine-grained, dense, trace non-plastic silt	
1005										
	40			S-4	5 3 5				@ 40' Clayey SILT, moderate brown, moist, low to non-plastic, stiff, slightly micaceous @ 40.4' Silty CLAY, moderate brown, moist, low plasticity, stiff @ 41' Silty SAND, moderate brown, moist, very fine- to fine-grained, medium dense, low plasticity silt, trace pebbles	
1000										
	45			S-5	5 8 13			SP/ML	@ 45' SILT, moderate yellowish brown, moist, low plasticity, very stiff, slightly micaceous @ 45.5' SAND, pale brown, moist, fine-grained, dense, several interbedded silty layers <1", micaceous	
995										
	50			S-6	10 13 13				@ 50' Interbedded SILT and SAND, pale to moderate brown, moist, fine-grained sand, low to non-plastic silt, dense, micaceous	
990									Total depth 51.5 feet No groundwater Boring backfilled with soil cuttings and patched with cold asphalt	
	55									
985										
	60									

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

TYPE OF TESTS:
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- CR CORROSION
- SA SIEVE ANALYSIS
- AL ATTERBERG LIMITS
- EI EXPANSION INDEX
- RV R-VALUE

LEIGHTON CONSULTING, INC.

GEOTECHNICAL BORING LOG B-4

Date 8-24-04 **Sheet** 1 of 1
Project Colton Joint Unified School District/Colton Middle School **Project No.** 600615-001
Drilling Co. 2-R Drilling **Type of Rig** CME 75
Hole Diameter 8" **Drive Weight** 140 lb Automatic Hammer **Drop** 30"
Elevation Top of Hole 1041' **Location** See Geotechnical Map

Logged By DAG
Sampled By DAG

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Six Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
1040	0			B-1					Surface: 3" grass and topsoil @ 0' Silty/Gravelly SAND, moderate yellowish brown, slightly moist, fine-grained, gravel to 3", non-plastic silt, about 3" grass and topsoil	EI,CR
				R-1	8 8 8			SM	@ 2.5' Silty/Gravelly SAND, moderate yellowish brown, slightly moist, fine- to medium-grained, medium dense, gravel to 3", non-plastic silt, gravel to 1"	
1035	5			R-2	12 15 17			SP	@ 5' Gravelly SAND, moderate yellowish brown, moist, fine- to medium-grained, medium dense, subrounded to subangluar gravel to 2", trace silt	
1030	10			R-3	12 14 15	107.4	2.0	SP	@ 10' Gravelly SAND, moderate yellowish brown, moist, fine- to medium-grained, medium dense, subrounded to subangluar gravel to 2", trace silt	Collapse
									@ 11' SAND, pale brown, moist, fine-grained, medium dense, micaceous, trace fines, some subrounded gravel to 1/2" present	
									Total depth 11.5 feet No groundwater Boring backfilled with soil cuttings	
1025	15									
1020	20									
1015	25									
	30									

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

TYPE OF TESTS:
DS DIRECT SHEAR
MD MAXIMUM DENSITY
CN CONSOLIDATION
CR CORROSION
SA SIEVE ANALYSIS
AL ATTERBERG LIMITS
EI EXPANSION INDEX
RV R-VALUE

LEIGHTON CONSULTING, INC.

APPENDIX B

GEOTECHNICAL LABORATORY TEST RESULTS

MODIFIED PROCTOR COMPACTION TEST
ASTM D 1557

Project Name:	Colton MS Pavillion & Admin Bldg	Tested By:	G. Stearns	Date:	12/22/23
Project No.:	038.0000020707	Input By:	M. Vinet	Date:	01/04/24
Boring No.:	LB-2	Depth (ft.):	0 - 5.0		
Sample No.:	B-1				
Soil Identification:	Well-Graded Sand with Silt and Gravel (SW-SM)g, Light Brown.				

Note: Corrected dry density calculation assumes specific gravity of 2.70 and moisture content of 1.0% for oversize particles

Preparation Method:	X	Moist
		Dry
Compaction Method	X	Mechanical Ram
		Manual Ram

Scalp Fraction (%)	
#3/4	
#3/8	12.6
#4	

Rammer Weight (lb.) = 10.0
Height of Drop (in.) = 18.0
Mold Volume (ft³) 0.03340

TEST NO.	1	2	3	4	5	6
Wt. Compacted Soil + Mold (g)	5587	5695	5663	5621		
Weight of Mold (g)	3513	3513	3513	3513		
Net Weight of Soil (g)	2074	2182	2150	2108		
Wet Weight of Soil + Cont. (g)	1162.6	1234.9	969.2	1039.0		
Dry Weight of Soil + Cont. (g)	1129.2	1186.9	917.6	972.2		
Weight of Container (g)	328.4	415.2	328.0	330.0		
Moisture Content (%)	4.2	6.2	8.8	10.4		
Wet Density (pcf)	136.9	144.0	141.9	139.1		
Dry Density (pcf)	131.4	135.6	130.5	126.0		

Maximum Dry Density (pcf) 135.6
Optimum Moisture Content (%) 6.2
Corrected Dry Density (pcf) 139.0
Corrected Moisture Content (%) 5.5

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

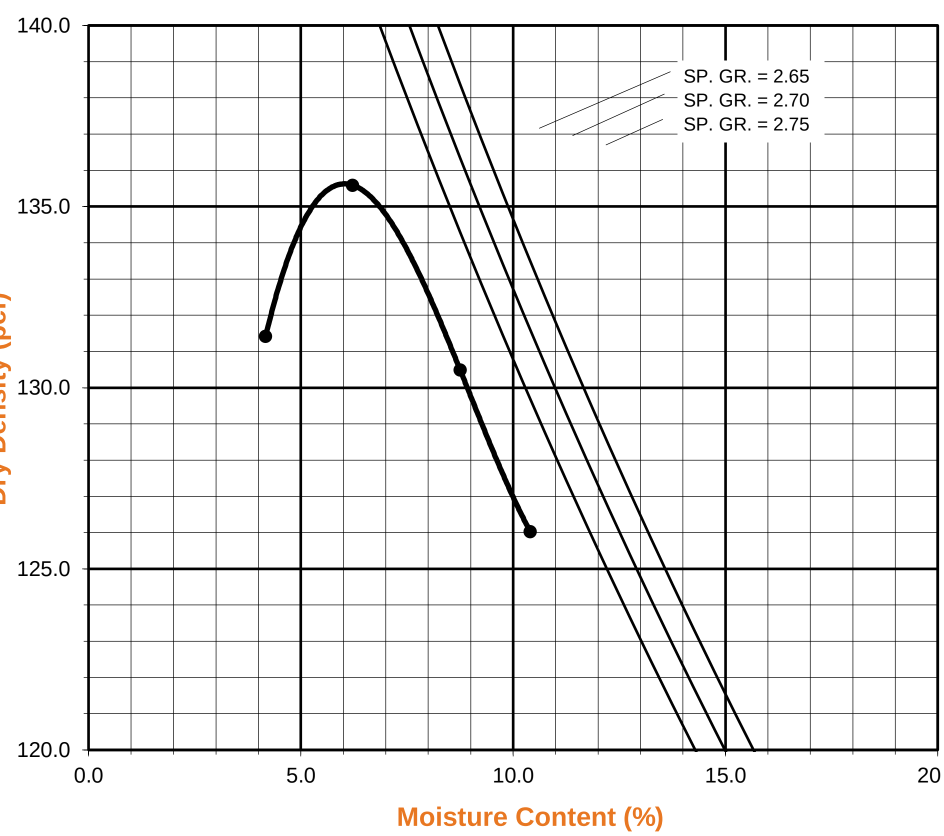
☒ **Procedure B**
Soil Passing 3/8 in. (9.5 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
Use if +#4 is >20% and +3/8 in. is 20% or less

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

Particle-Size Distribution:
20:74:6
GR:SA:FI

Atterberg Limits:

LL,PL,PI



PARTICLE-SIZE DISTRIBUTION (GRADATION) of SOILS USING SIEVE ANALYSIS

ASTM D 6913

Leighton

Project Name:	Colton MS Pavillion & Admin Bldg	Tested By:	CM	Date:	12/22/23
Project No.:	038.0000020707	Checked By:	MRV	Date:	01/04/24
Boring No.:	LB-2	Depth (feet):	0 - 5.0		
Sample No.:	B-1				
Soil Identification:	Well-Graded Sand with Silt and Gravel (SW-SM)g, Light Brown.				

		Moisture Content of Total Air - Dry Soil	
Container No.:	M	Wt. of Air-Dry Soil + Cont. (g)	2564.8
Wt. of Air-Dried Soil + Cont.(g)	2564.8	Wt. of Dry Soil + Cont. (g)	2423.1
Wt. of Container (g)	279.1	Wt. of Container No.______ (g)	279.1
Dry Wt. of Soil (g)	2144.0	Moisture Content (%)	6.6

After Wet Sieve	Container No.	M
	Wt. of Dry Soil + Container (g)	2305.4
	Wt. of Container (g)	279.1
	Dry Wt. of Soil Retained on # 200 Sieve (g)	2026.3

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (g)	Percent Passing (%)
3"	75.000	0.0	100.0
1"	25.000	33.7	98.4
3/4"	19.000	101.3	95.3
1/2"	12.500	222.6	89.6
3/8"	9.500	270.7	87.4
#4	4.750	419.0	80.5
#8	2.360	578.3	73.0
#16	1.180	839.0	60.9
#30	0.600	1257.3	41.4
#50	0.300	1667.3	22.2
#100	0.150	1913.0	10.8
#200	0.075	2026.3	5.5
PAN			

GRAVEL: **20 %**

SAND: **74 %**

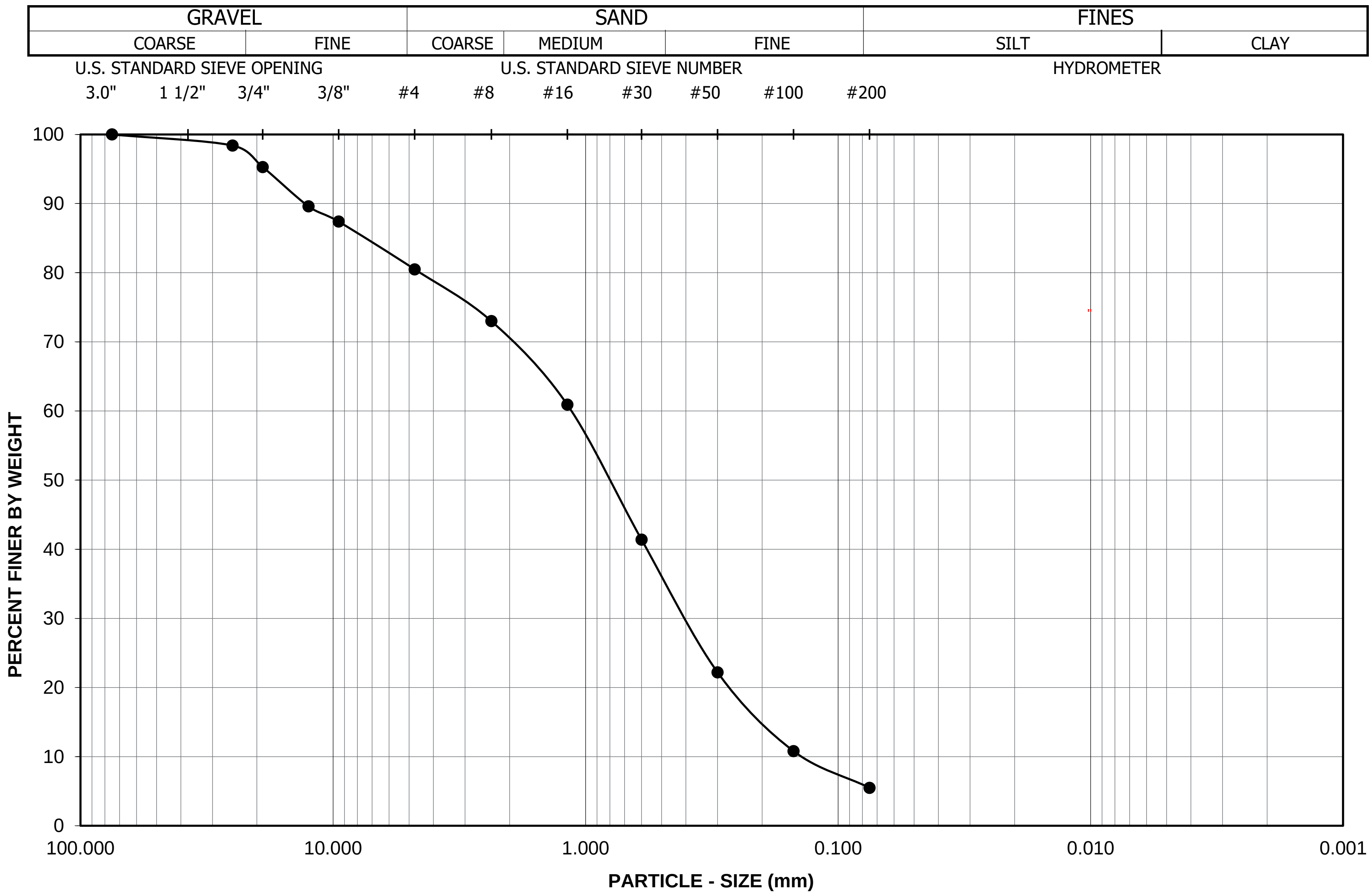
FINES: **6 %**

GROUP SYMBOL: **(SW-SM)g**

$Cu = D60/D10 =$ 8.21

$Cc = (D30)^2/(D60*D10) =$ 1.04

Remarks:



Project Name: Colton MS Pavillion & Admin Bldg

Project No.: 038.0000020707

Boring No.: LB-2 | Sample No.: B-1

Depth (feet): 0 - 5.0 | Soil Type : (SW-SM)g

Soil Identification: Well-Graded Sand with Silt and Gravel (SW-SM)g, Light Brown.

GR:SA:FI : (%) **20 : 74 : 6**

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 6913

Jan-24

Sieve; LB-2, B-1 (12-13-23)

Boring No.	LB-1	LB-1	LB-1	LB-2	LI-1	LB-4		
Sample No.	R-4	R-6	R-7	S-1	S-2	S-1		
Depth (ft.)	10.0	30.0	40.0	15.0	5.5	15.0		
Sample Type	RING	RING	RING	SPT	SPT	SPT		
Soil Classification	SM	(CL)s	s(ML)	SM	SP-SM	SP-SM		
Soak Time (min)	10	10	10	10	10	10		
Moisture Correction								
Wet Weight of Soil + Container (gm.)	662.3	765.5	706.0	729.7	711.9	722.2		
Dry Weight of Soil + Container (gm.)	630.7	689.6	669.3	702.6	697.1	709.0		
Weight of Container (gm)	276.1	277.3	278.5	278.1	278.0	278.8		
Moisture Content (%)	8.9	18.4	9.4	6.4	3.5	3.1		
Container No.:	W	X	B	BA	86	M		
Sample Dry Weight Determination								
Weight of Sample + Container (gm.)	630.7	689.6	669.3	702.6	697.1	709.0		
Weight of Container (gm.)	276.1	277.3	278.5	278.1	278.0	278.8		
Weight of Dry Sample (gm.)	354.6	412.3	390.8	424.5	419.1	430.2		
Container No.:	W	X	B	BA	86	M		
After Wash								
Dry Weight of Sample + Container (gm)	529.2	374.5	424.0	604.5	677.4	686.2		
Weight of Container (gm)	276.1	277.3	278.5	278.1	278.0	278.8		
Dry Weight of Sample (gm)	253.1	97.2	145.5	326.4	399.4	407.4		
% Passing No. 200 Sieve	**29**	**76**	**63**	**23**	**5**	**5**		
% Retained No. 200 Sieve	71	24	37	77	95	95		

Leighton

PERCENT PASSING
No. 200 SIEVE
ASTM D 1140

Project Name: Colton MS Pavillion & Admin Bldg
Project No.: 038.0000020707
Client Name: Colton Joint Unified School District
Tested By: C. McCoy Date: 12/22/23

Boring No.	LB-1	LB-2						
Sample No.	S-1	R-5						
Depth (ft.)	15.0	20.0						
Sample Type	SPT	RING						
Soil Classification	s(CL)	s(ML)						
Soak Time (min)	10	10						
Moisture Correction								
Wet Weight of Soil + Container (gm.)	623.1	680.9						
Dry Weight of Soil + Container (gm.)	583.5	631.4						
Weight of Container (gm)	278.5	277.4						
Moisture Content (%)	13.0	14.0						
Container No.:	AB	XY						
Sample Dry Weight Determination								
Weight of Sample + Container (gm.)	583.5	631.4						
Weight of Container (gm.)	278.5	277.4						
Weight of Dry Sample (gm.)	305.0	354.0						
Container No.:	AB	XY						
After Wash								
Dry Weight of Sample + Container (gm)	390.5	453.5						
Weight of Container (gm)	278.5	277.4						
Dry Weight of Sample (gm)	112.0	176.1						
% Passing No. 200 Sieve	**63**	**50**						
% Retained No. 200 Sieve	37	50						

Leighton

PERCENT PASSING
No. 200 SIEVE
ASTM D 1140

Project Name: Colton MS Pavillion & Admin Bldg
Project No.: 038.0000020707
Client Name: Colton Joint Unified School District
Tested By: M. Vinet Date: 01/08/24

ATTERBERG LIMITS

ASTM D 4318

Project Name:	Colton MS Pavillion & Admin Bldg	Tested By:	M. Vinet	Date:	01/05/24
Project No. :	038.0000020707	Input By:	M. Vinet	Date:	01/05/24
Boring No.:	LB-1	Checked By:	M. Vinet		
Sample No.:	R-6	Depth (ft.)	30.0		
Soil Identification:	Lean Clay (CL)s, Dark Yellowish Brown.				

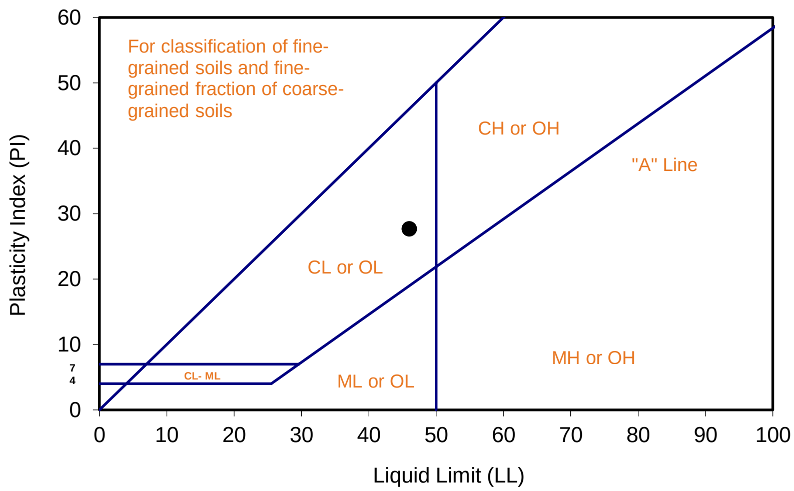
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			15	27	35	
Wet Wt. of Soil + Cont. (g)	19.59	21.35	21.90	24.42	23.36	
Dry Wt. of Soil + Cont. (g)	18.67	20.20	19.18	21.13	20.46	
Wt. of Container (g)	13.56	14.02	13.75	13.88	13.78	
Moisture Content (%) [Wn]	18.00	18.61	50.09	45.38	43.41	

Liquid Limit	**46**
Plastic Limit	**18**
Plasticity Index	**28**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) | 18.98

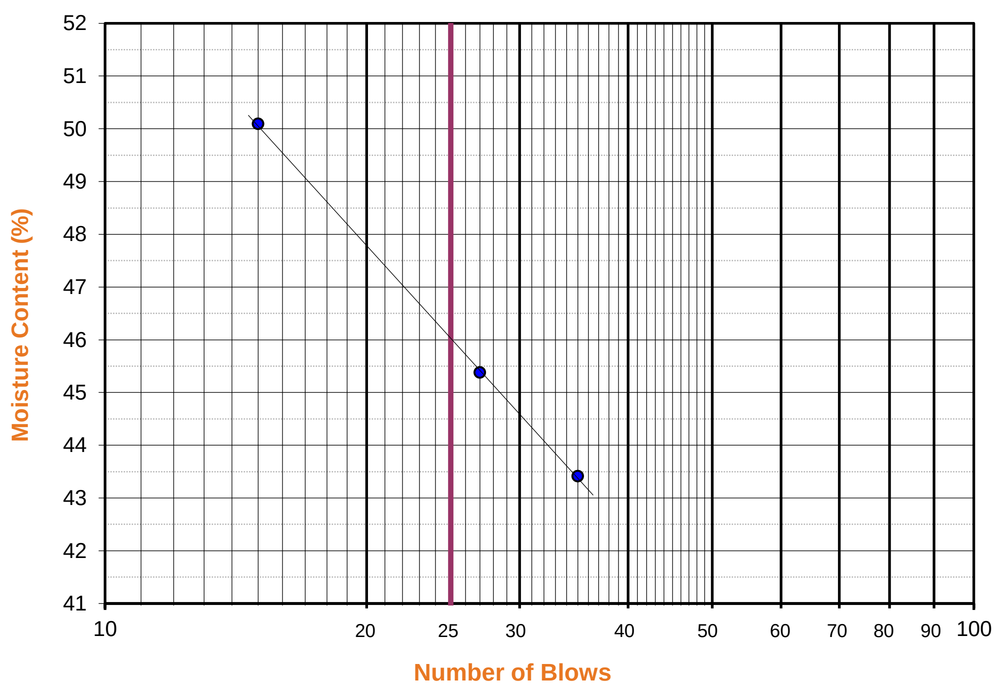
One - Point Liquid Limit Calculation

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



PROCEDURES USED

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



ATTERBERG LIMITS

ASTM D 4318

Project Name:	Colton MS Pavillion & Admin Bldg	Tested By:	F. Mina	Date:	01/03/24
Project No. :	038.0000020707	Input By:	M. Vinet	Date:	01/04/24
Boring No.:	LB-1	Checked By:	M. Vinet		
Sample No.:	R-7	Depth (ft.)	40.0		
Soil Identification:	Sandy Silt s(ML), Dark Yellowish Brown.				

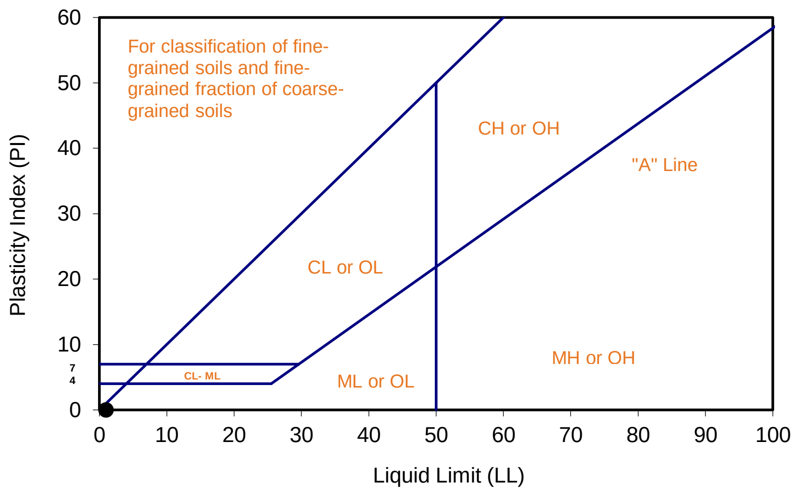
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]						
Wet Wt. of Soil + Cont. (g)	Non-Plastic (NP)		Non-Plastic (NP)			
Dry Wt. of Soil + Cont. (g)						
Wt. of Container (g)						
Moisture Content (%) [Wn]						

Liquid Limit	**NP**
Plastic Limit	**NP**
Plasticity Index	**NP**
Classification	**s(ML)**

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

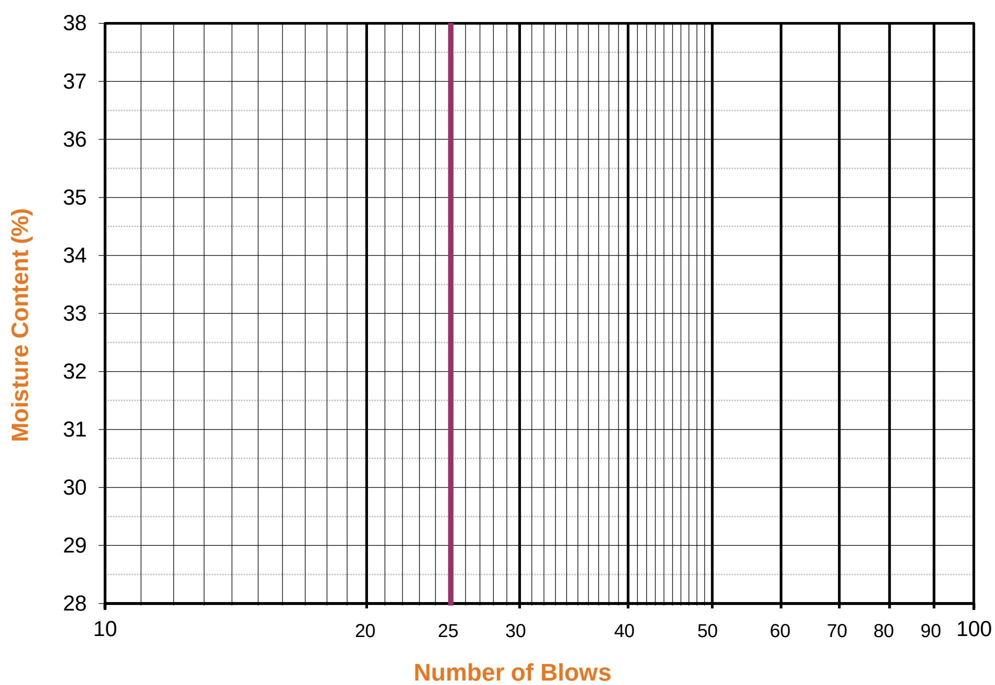
One - Point Liquid Limit Calculation

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



PROCEDURES USED

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



ATTERBERG LIMITS
ASTM D 4318

Project Name:	Colton MS Pavillion & Admin Bldg	Tested By:	F. Mina	Date:	01/03/24
Project No. :	038.0000020707	Input By:	M. Vinet	Date:	01/04/24
Boring No.:	LB-2	Checked By:	M. Vinet		
Sample No.:	S-1	Depth (ft.)	15.0		
Soil Identification:	Silty Sand (SM), Dark Yellowish Brown.				

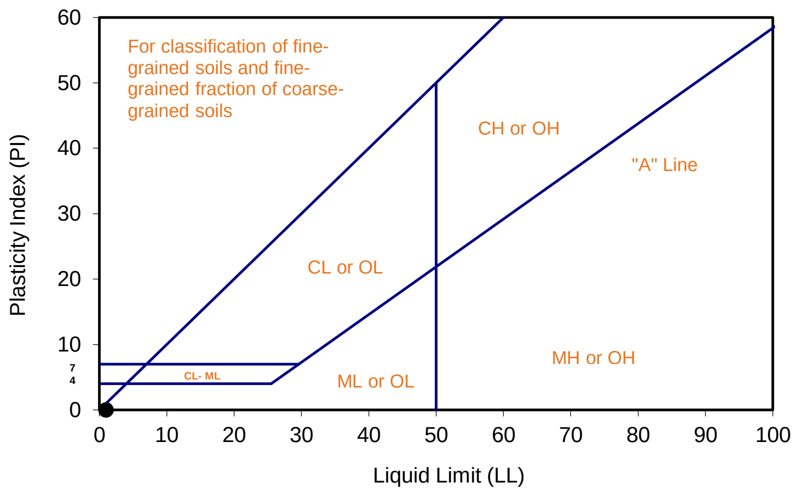
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]						
Wet Wt. of Soil + Cont. (g)	Non-Plastic (NP)		Non-Plastic (NP)			
Dry Wt. of Soil + Cont. (g)						
Wt. of Container (g)						
Moisture Content (%) [Wn]						

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

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

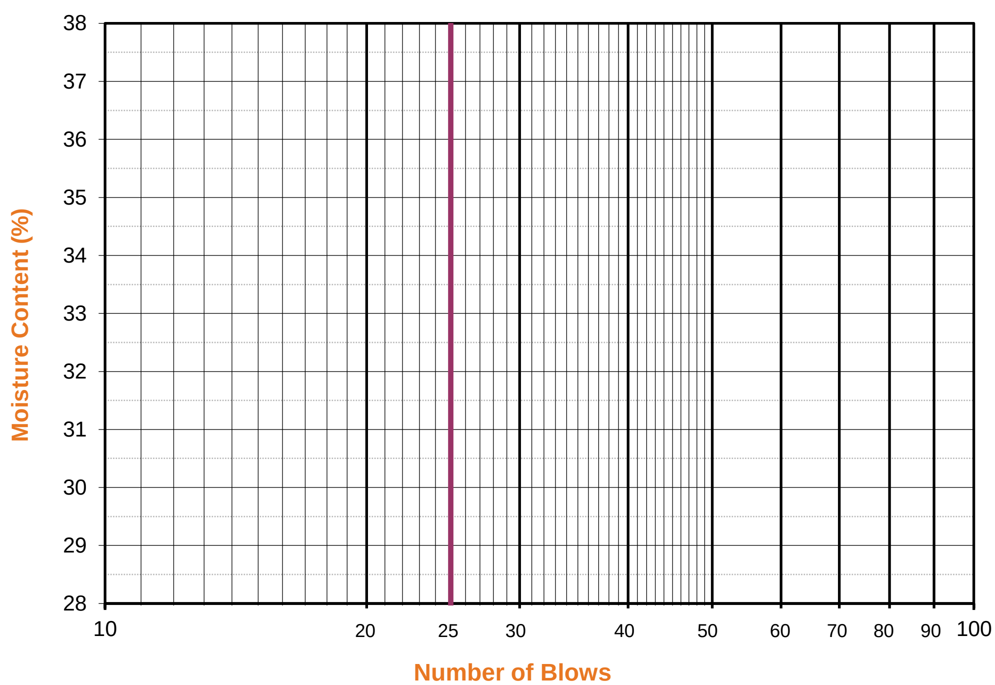
One - Point Liquid Limit Calculation

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



PROCEDURES USED

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



ATTERBERG LIMITS
ASTM D 4318

Project Name:	Colton MS Pavillion & Admin Bldg	Tested By:	M. Vinet	Date:	01/09/24
Project No. :	038.0000020707	Input By:	M. Vinet	Date:	01/10/24
Boring No.:	LB-1	Checked By:	M. Vinet		
Sample No.:	S-1	Depth (ft.)	15.0		
Soil Identification:	Sandy Lean Clay s(CL), Dark Yellowish Brown.				

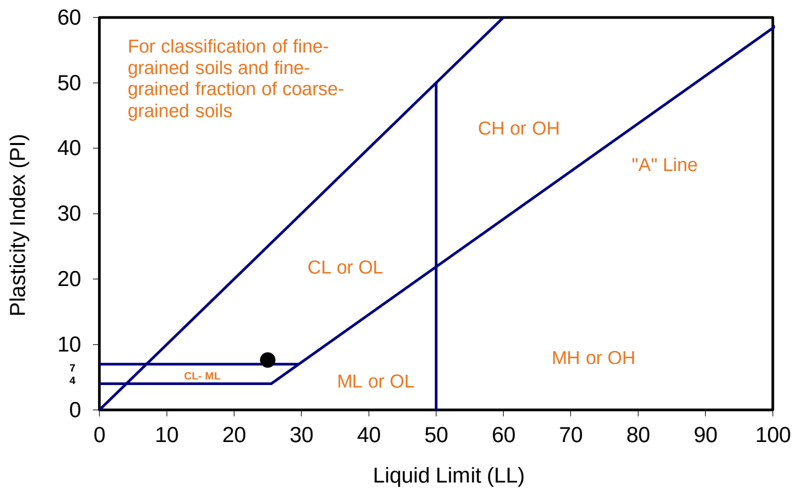
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			15	25	33	
Wet Wt. of Soil + Cont. (g)	23.13	21.82	25.21	24.18	26.17	
Dry Wt. of Soil + Cont. (g)	21.75	20.63	22.81	22.11	23.78	
Wt. of Container (g)	13.86	13.73	13.67	13.71	13.67	
Moisture Content (%) [Wn]	17.49	17.25	26.26	24.64	23.64	

Liquid Limit	**25**
Plastic Limit	**17**
Plasticity Index	**8**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) | 3.65

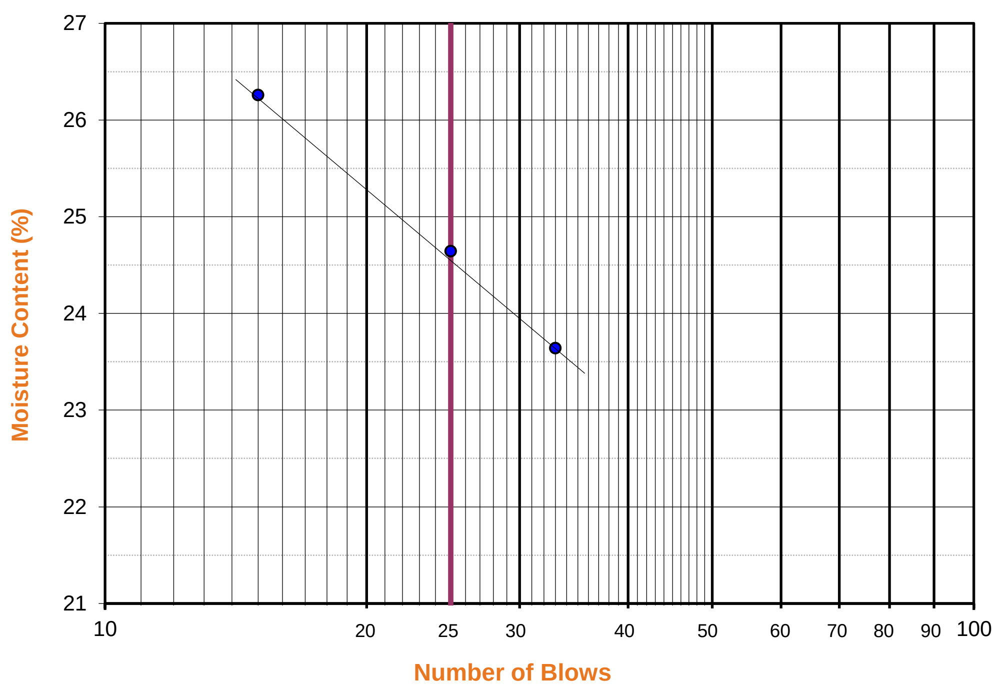
One - Point Liquid Limit Calculation

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



PROCEDURES USED

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



ATTERBERG LIMITS

ASTM D 4318

Project Name:	Colton MS Pavillion & Admin Bldg	Tested By:	M. Vinet	Date:	01/09/24
Project No. :	038.0000020707	Input By:	M. Vinet	Date:	01/10/24
Boring No.:	LB-2	Checked By:	M. Vinet		
Sample No.:	R-5	Depth (ft.)	20.0		
Soil Identification:	Sandy Silt s(ML), Grayish Brown.				

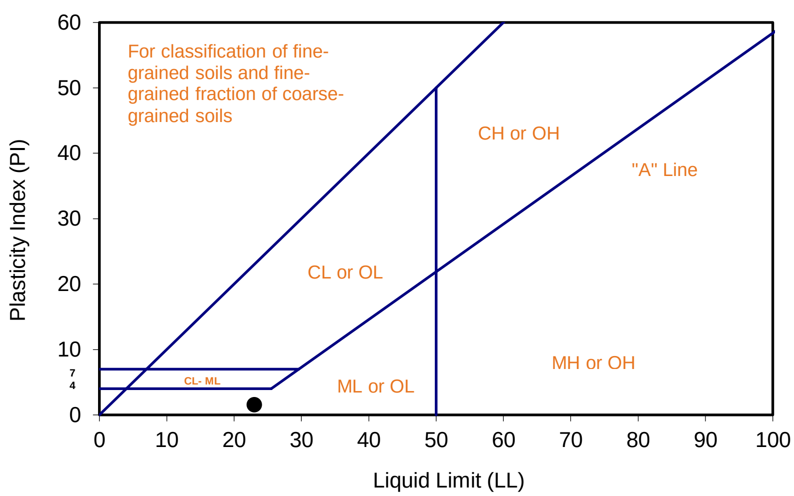
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			15	23	30	
Wet Wt. of Soil + Cont. (g)	22.18	22.35	23.65	26.19	25.15	
Dry Wt. of Soil + Cont. (g)	20.68	20.85	21.71	23.81	23.00	
Wt. of Container (g)	13.74	13.80	13.69	13.71	13.68	
Moisture Content (%) [Wn]	21.61	21.28	24.19	23.56	23.07	

Liquid Limit	**23**
Plastic Limit	**21**
Plasticity Index	**2**
Classification	**ML**

PI at "A" - Line = 0.73(LL-20) | 2.19

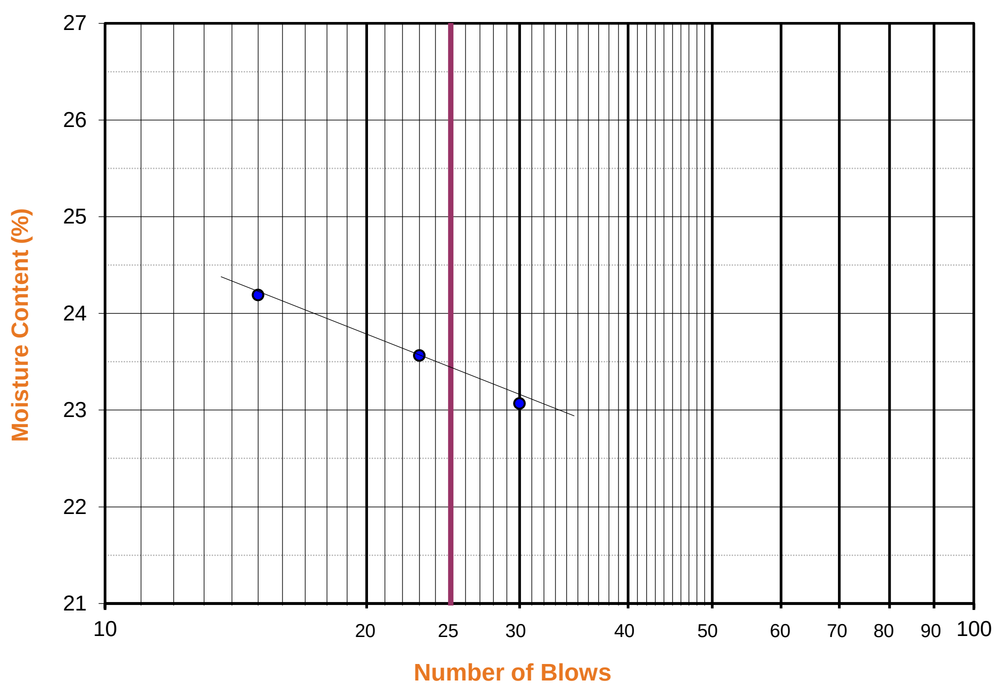
One - Point Liquid Limit Calculation

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



PROCEDURES USED

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



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EXPANSION INDEX of SOILS

ASTM D 4829

Project Name:	CJUSD Colton MS Pavillion & Admin Bldg	Tested By:	F. Mina	Date:	1/4/24
Project No. :	038.0000020707	Checked By:	M. Vinet	Date:	1/5/24
Boring No.:	LB-1	Depth:	0 - 5.0		
Sample No. :	B-1	Location:	N/A		
Sample Description:	Silty Sand (SM), Dark Yellowish Brown.				

Dry Wt. of Soil + Cont. (gm.)	4259.3
Wt. of Container No. (gm.)	0.0
Dry Wt. of Soil (gm.)	4259.3
Weight Soil Retained on #4 Sieve	616.3
Percent Passing # 4	85.5

MOLDED SPECIMEN	Before Test	After Test
Specimen Diameter (in.)	4.01	4.01
Specimen Height (in.)	1.0000	1.0022
Wt. Comp. Soil + Mold (gm.)	605.3	629.5
Wt. of Mold (gm.)	177.7	177.7
Specific Gravity (Assumed)	2.70	2.70
Container No.	7	7
Wet Wt. of Soil + Cont. (gm.)	579.8	629.5
Dry Wt. of Soil + Cont. (gm.)	558.9	397.8
Wt. of Container (gm.)	279.8	177.7
Moisture Content (%)	7.5	13.6
Wet Density (pcf)	129.0	136.0
Dry Density (pcf)	120.0	119.7
Void Ratio	0.405	0.408
Total Porosity	0.288	0.290
Pore Volume (cc)	59.7	60.1
Degree of Saturation (%) [S meas]	**50.0**	**89.9**

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

Date	Time	Pressure (psi)	Elapsed Time (min.)	Dial Readings (in.)
1/4/24	7:30	1.0	0	0.5000
1/4/24	7:40	1.0	10	0.5000
	Add Distilled Water to the Specimen			
1/5/24	5:00	1.0	1280	0.5022
1/5/24	6:00	1.0	1340	0.5022

Expansion Index (EI meas) =	((Final Rdg - Initial Rdg) / Initial Thick.) x 1000	2.2
Expansion Index (Report) =	Nearest Whole Number or Zero (0) if Initial Height is > than Final Heigh	**2**

Rev. 03-08

TESTS for SULFATE CONTENT
CHLORIDE CONTENT and pH of SOILS

Project Name: CJUSD Colton MS Pavillion & Admin Bldg | Tested By : F. Mina | Date: 01/03/24

Project No. : 038.0000020707 | Data Input By: M. Vinet | Date: 01/04/24

Boring No.	LB-1			
Sample No.	B-1			
Sample Depth (ft)	0 - 5.0			
Soil Identification:	Silty Sand (SM)			
Wet Weight of Soil + Container (g)	100.0			
Dry Weight of Soil + Container (g)	100.0			
Weight of Container (g)	0.0			
Moisture Content (%)	0.0			
Weight of Soaked Soil (g)	100.0			

SULFATE CONTENT, Hach Kit Method

Dilution : 1	3			
Water Fraction (ml)	25			
Tube Reading	50			
PPM Sulfate	**150**			
% Sulfate	0.0150			

CHLORIDE CONTENT, DOT California Test 422

ml of Extract For Titration (B)	30			
ml of AgNO3 Soln. Used in Titration (C)	0.4			
PPM of Chloride (C -0.2) * 100 * 30 / B	20			
PPM of Chloride, Dry Wt. Basis	**20**			

pH TEST, DOT California Test 643

pH Value	**6.80**			
Temperature °C	21.0			

SOIL RESISTIVITY TEST
DOT CA TEST 643

Leighton

Project Name:	CJUSD Colton MS Pavillion & Admin Bldg	Tested By :	F. Mina	Date:	01/03/24
Project No. :	038.0000020707	Data Input By:	M. Vinet	Date:	01/04/24
Boring No.:	LB-1	Depth (ft.) :	0 - 5.0		
Sample No. :	B-1				

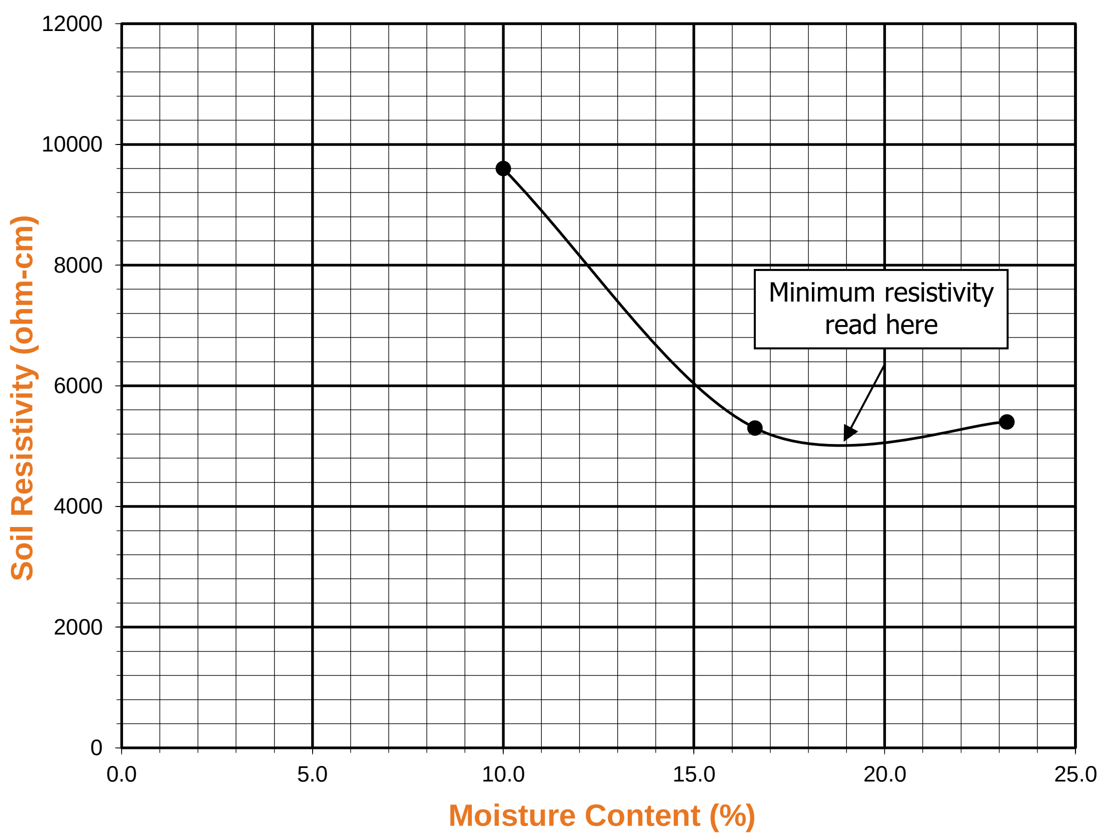
Soil Identification:* Silty Sand (SM)

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

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	50	10.00	9600	9600
2	83	16.60	5300	5300
3	116	23.20	5400	5400
4				
5				

Moisture Content (%) (MCi)	0.00
Wet Wt. of Soil + Cont. (g)	100.00
Dry Wt. of Soil + Cont. (g)	100.00
Wt. of Container (g)	0.00
Container No.	A
Initial Soil Wt. (g) (Wt)	500.00
Box Constant	1.000
MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100	

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH: pH	Soil pH: Temp. (°C)
DOT CA Test 643		Hach Kit	DOT CA Test 422	DOT CA Test 643	
5000	**19.0**	**150**	**20**	**6.80**	**21.0**



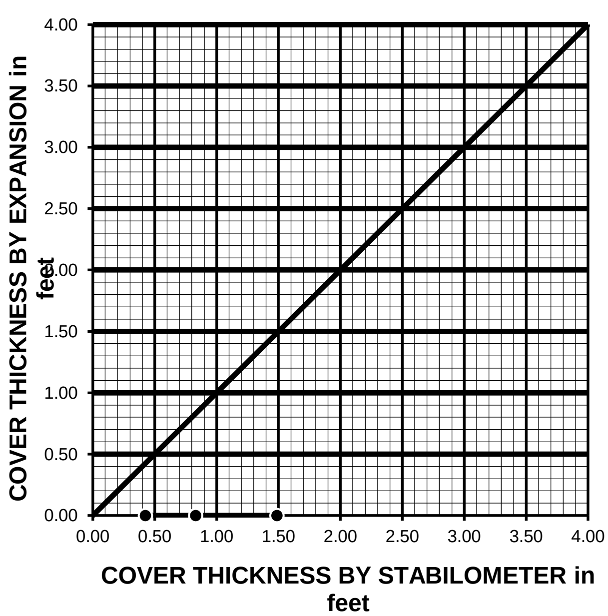
R-VALUE TEST RESULTS
ASTM D 2844

Project Name:	CJUSD Colton MS Pavillion & Admin Bldg	Date:	1/3/24
Project Number:	038.0000020707	Technician:	F. Mina
Boring Number:	LB-1	Depth (ft.):	0 - 5.0
Sample Number:	B-1		
Sample Description:	Silty Sand (SM), Dark Yellowish Brown.	Sample Location:	N/A

TEST SPECIMEN	**A**	**B**	**C**
MOISTURE AT COMPACTION %	9.4	10.5	12.7
HEIGHT OF SAMPLE, Inches	2.45	2.55	2.55
DRY DENSITY, pcf	120.3	119.3	117.5
COMPACTOR AIR PRESSURE, psi	140	115	85
EXUDATION PRESSURE, psi	762	322	104
EXPANSION, Inches x 10exp-4	0	0	0
STABILITY Ph 2,000 lbs (160 psi)	27	58	139
TURNS DISPLACEMENT	4.45	4.75	5.02
R-VALUE UNCORRECTED	73	48	7
R-VALUE CORRECTED	73	48	7

DESIGN CALCULATION DATA	**a**	**b**	**c**
GRAVEL EQUIVALENT FACTOR	1.0	1.0	1.0
TRAFFIC INDEX	5.0	5.0	5.0
STABILOMETER THICKNESS, ft.	0.42	0.83	1.49
EXPANSION PRESSURE THICKNESS, ft.	0.00	0.00	0.00

EXPANSION PRESSURE CHART



EXUDATION PRESSURE CHART

R-VALUE BY EXPANSION:	N/A
R-VALUE BY EXUDATION:	46
EQUILIBRIUM R-VALUE:	46

GEOTECHNICAL LABORATORY TEST RESULTS
(Leighton 2004)

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MODIFIED PROCTOR COMPACTION TEST

ASTM D 1557

Leighton

Project Name:	CUSD / Colton M. S.	Tested By :	GBE	Date:	09/10/04
Project No.:	600593-002	Input By :	LF	Date:	09/13/04
Boring No.:	B-1	Depth (ft.)	1-5		
Sample No. :	B-1				
Soil Identification:	Brown silty sand (SM)				

Preparation Method: [X] Moist [ ] Dry   [X] Mechanical Ram [ ] Manual Ram

Mold Volume (ft³) 0.03328   *Ram Weight = 10 lb.; Drop = 18 in.*

TEST NO.	1	2	3	4	5	6
Wt. Compacted Soil + Mold (g)	3754.1	3840.9	3886.7	3821.3		
Weight of Mold (g)	1701.0	1701.0	1701.0	1701.0		
Net Weight of Soil (g)	2053.1	2139.9	2185.7	2120.3		
Wet Weight of Soil + Cont. (g)	556.60	515.00	468.00	499.00		
Dry Weight of Soil + Cont. (g)	542.50	491.80	438.20	459.00		
Weight of Container (g)	49.30	48.40	49.80	54.00		
Moisture Content (%)	2.86	5.23	7.67	9.88		
Wet Density (pcf)	136.0	141.8	144.8	140.5		
Dry Density (pcf)	132.2	134.7	134.5	127.8		

Maximum Dry Density (pcf) 135.5   **Optimum Moisture Content (%)** 6.5

PROCEDURE USED

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

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

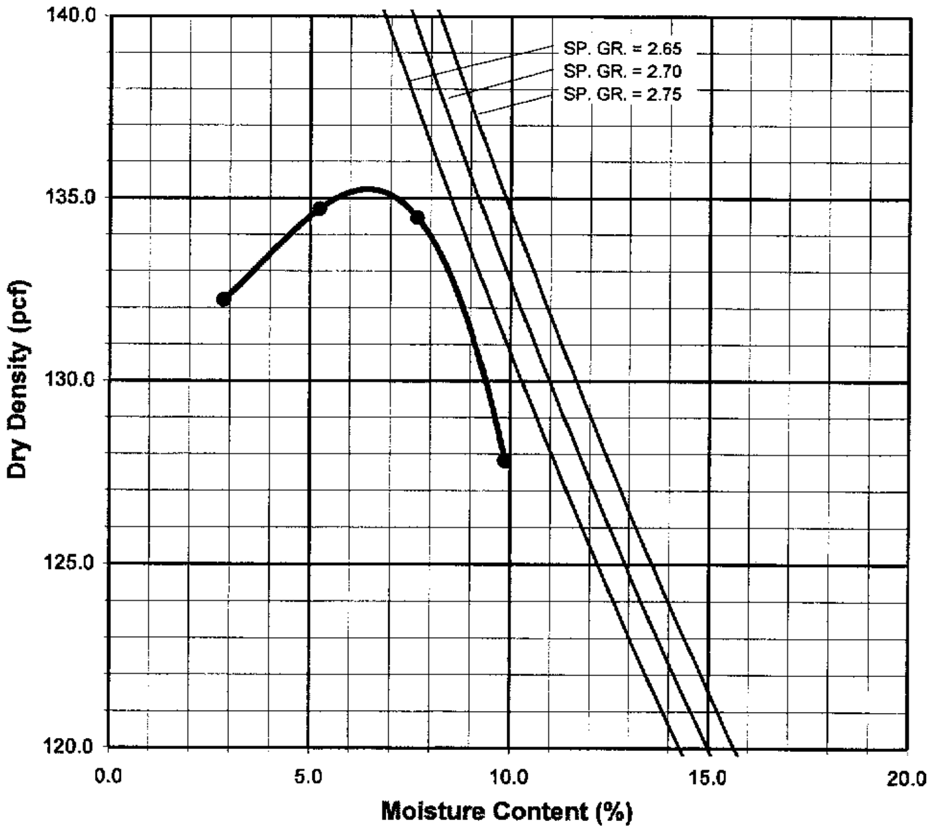
[ ] **Procedure C**
Soil Passing 3/4 in. (19.0 mm) Sieve
Mold : 6 in. (152.4 mm) diameter
Layers : 5 (Five)
Blows per layer : 56 (fifty-six)
Use if +3/8 in. is >20% and +¾ in. is <30%

Particle-Size Distribution:

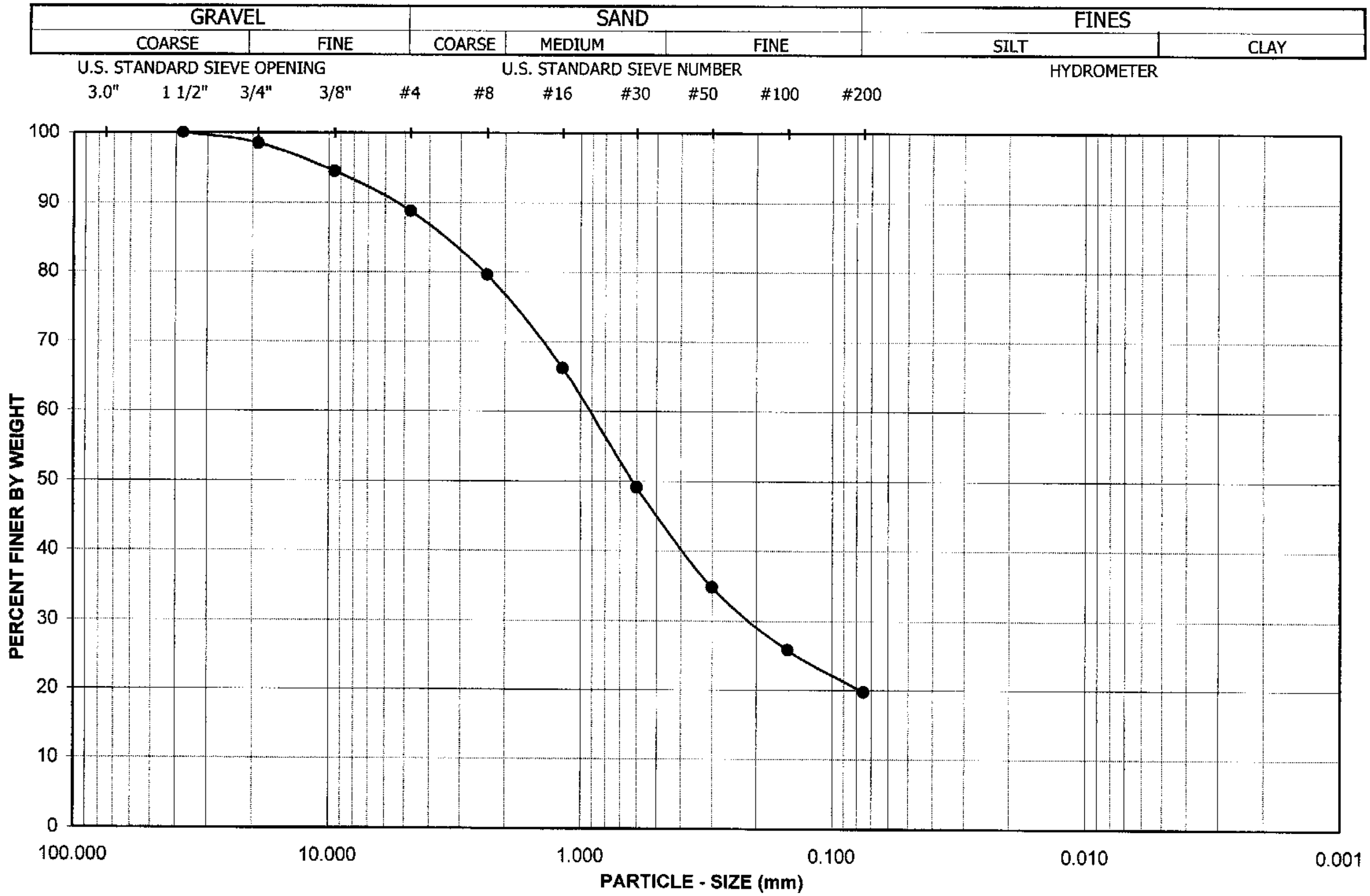
GR:SA:FI

Atterberg Limits:

LL,PL,PI



MX B-1 B-1 @ 1-5



Project Name: CUSD / Colton M. S.

Project No.: 600593-002

Exploration No.: B-1 Sample No.: R-1

Depth (feet): 2.5 Soil Type : SM

Soil Identification: Brown silty sand (SM)

GR:SA:FI : (%) 11 : 69 : 20

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PARTICLE - SIZE DISTRIBUTION ASTM D 422

Sep-04

SA B-1 R-1 @ 2.5

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One-Dimensional Swell or Settlement Potential of Cohesive Soils
(ASTM D 4546)

Project Name:	CUSD / Colton M. S.	Tested By:	FT, ESS	Date:	09/02/04
Project No.:	600593-002	Checked By:	LF	Date:	09/11/04
Boring No.:	B-1	Sample Type:	Drive		
Sample No.:	R-3	Depth (ft.)	10.0		

Sample Description: Brown fine sandy silt / silty fine sand (s(ML)/SM)

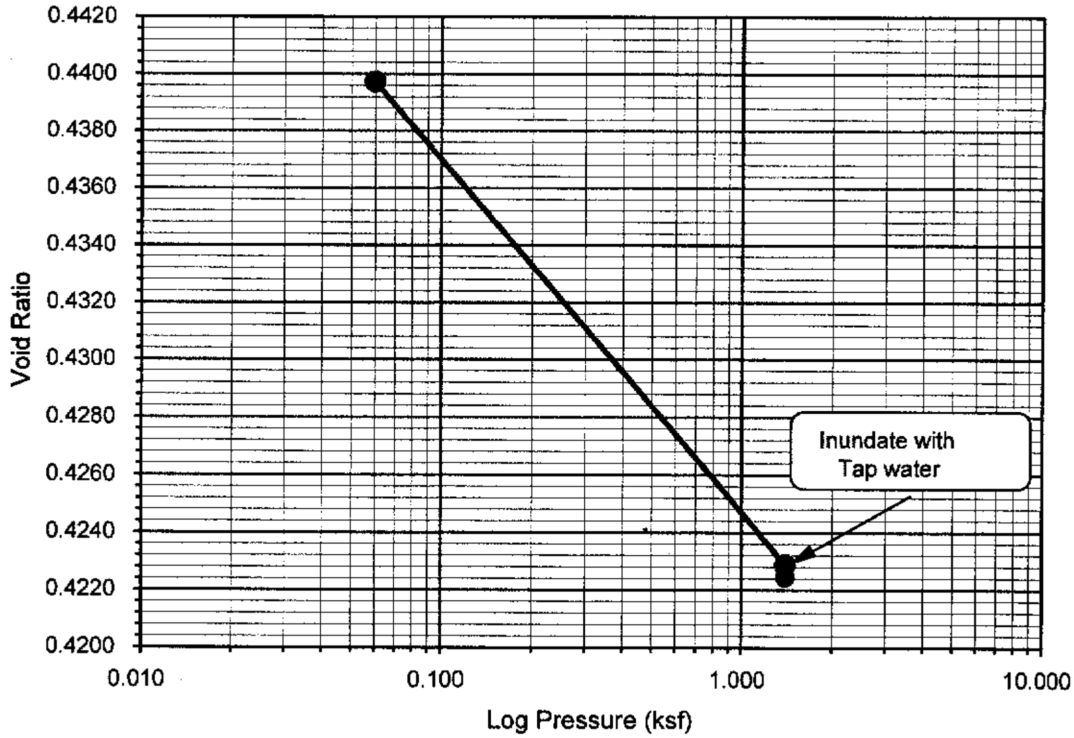
Initial Dry Density (pcf):	117.1
Initial Moisture (%):	10.69
Initial Length (in.):	1.0000
Initial Dial Reading:	0.1428
Diameter(in):	2.416

Final Dry Density (pcf):	117.7
Final Moisture (%) :	16.3
Initial Void ratio:	0.4397
Specific Gravity(assumed):	2.70
Initial Saturation (%)	65.7

Pressure (p) (ksf)	Final Reading (in)	Apparent Thickness (in)	Load Compliance (%)	Swell (+) Settlement (-) % of Sample Thickness	Void Ratio	Corrected Deformation (%)
0.060	0.1428	1.0000	0.00	0.00	0.4397	0.00
1.400	0.1545	0.9883	0.00	-1.17	0.4229	-1.17
H2O	0.1548	0.9880	0.00	-1.20	0.4225	-1.20

Percent Swell (+) / Settlement (-) After Inundation = -0.03

Void Ratio - Log Pressure Curve



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One-Dimensional Swell or Settlement Potential of Cohesive Soils
(ASTM D 4546)

Project Name:	CUSD / Colton M. S.	Tested By:	FT, ESS Date: 09/02/04
Project No.:	600593-002	Checked By:	LF Date: 09/11/04
Boring No.:	B-2	Sample Type:	Drive
Sample No.:	R-3	Depth (ft.)	10.0

Sample Description: Brown fine sandy silt / silty fine sand (s(ML)/SM)

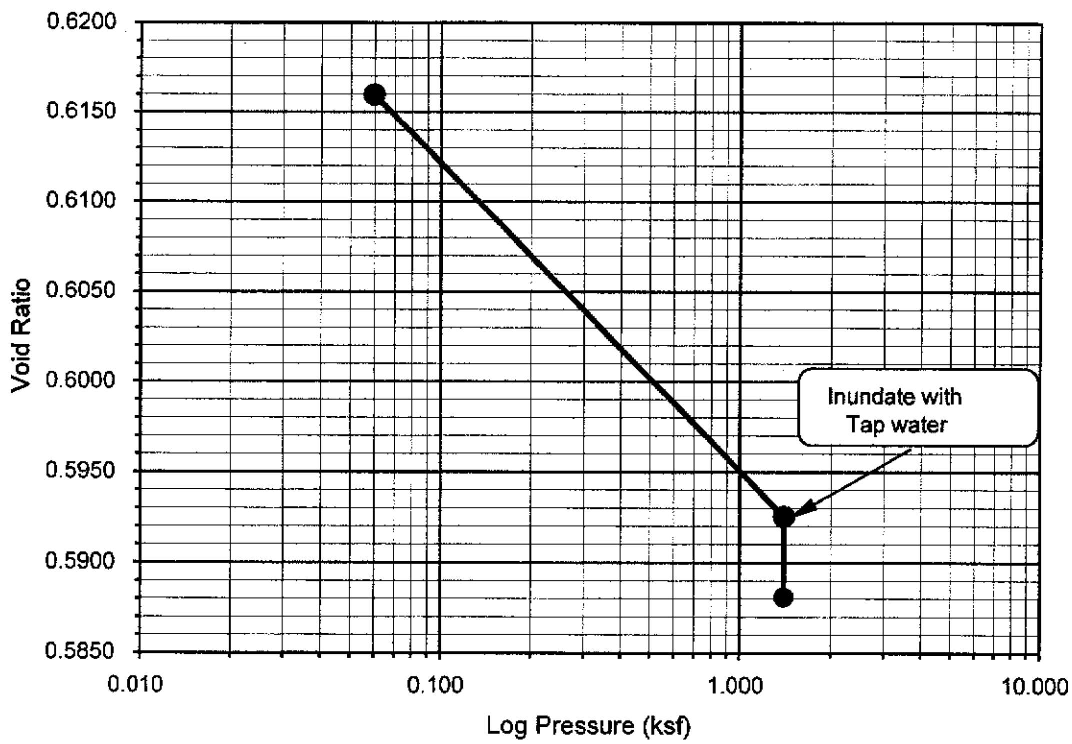
Initial Dry Density (pcf):	104.3
Initial Moisture (%):	9.89
Initial Length (in.):	1.0000
Initial Dial Reading:	0.1648
Diameter(in):	2.416

Final Dry Density (pcf):	102.9
Final Moisture (%) :	22.6
Initial Void ratio:	0.6160
Specific Gravity(assumed):	2.70
Initial Saturation (%)	43.3

Pressure (p) (ksf)	Final Reading (in)	Apparent Thickness (in)	Load Compliance (%)	Swell (+) Settlement (-) % of Sample Thickness	Void Ratio	Corrected Deformation (%)
0.060	0.1648	1.0000	0.00	0.00	0.6160	0.00
1.400	0.1793	0.9855	0.00	-1.45	0.5925	-1.45
H2O	0.1821	0.9828	0.00	-1.73	0.5881	-1.73

Percent Swell (+) / Settlement (-) After Inundation = -0.28

Void Ratio - Log Pressure Curve



One-Dimensional Swell or Settlement Potential of Cohesive Soils
(ASTM D 4546)

Leighton

Project Name:	CUSD / Colton M. S.	Tested By:	FT, ESS Date: 09/02/04
Project No.:	600593-002	Checked By:	LF Date: 09/11/04
Boring No.:	B-4	Sample Type:	Drive
Sample No.:	R-3	Depth (ft.)	10.0
Sample Description:	Brown silty sand (SM)		

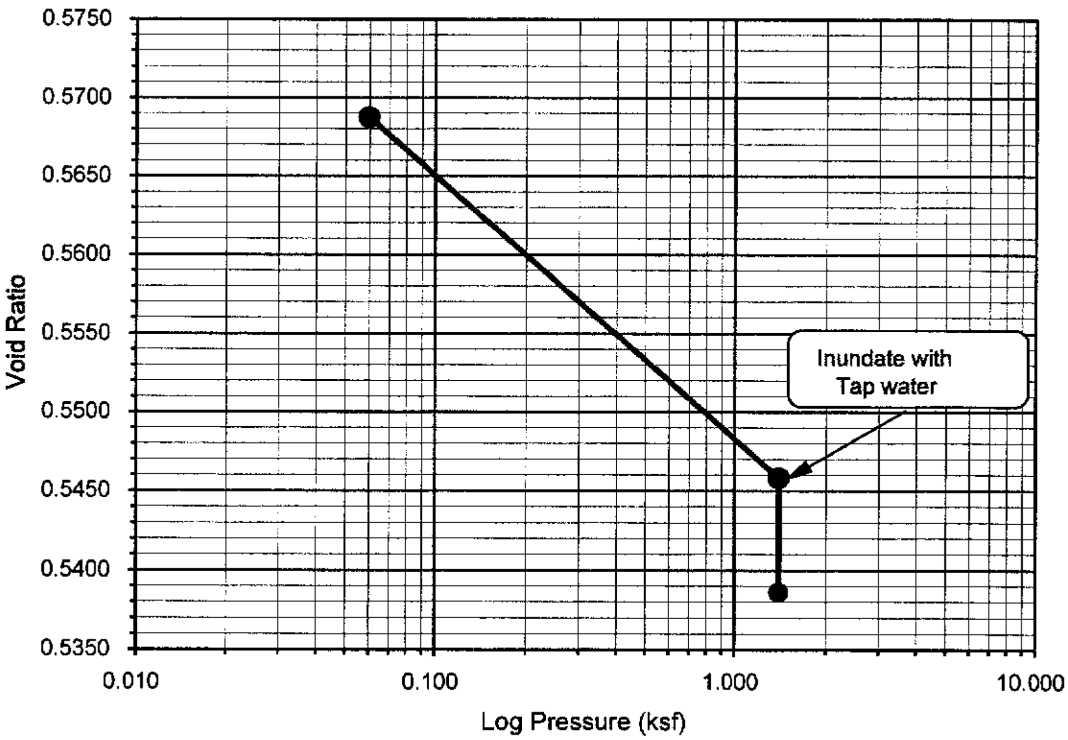
Initial Dry Density (pcf):	107.4
Initial Moisture (%):	2.02
Initial Length (in.):	1.0000
Initial Dial Reading:	0.1251
Diameter(in):	2.416

Final Dry Density (pcf):	107.2
Final Moisture (%) :	19.5
Initial Void ratio:	0.5689
Specific Gravity(assumed):	2.70
Initial Saturation (%)	9.6

Pressure (p) (ksf)	Final Reading (in)	Apparent Thickness (in)	Load Compliance (%)	Swell (+) Settlement (-) % of Sample Thickness	Void Ratio	Corrected Deformation (%)
0.060	0.1252	0.9999	0.00	-0.01	0.5687	-0.01
1.400	0.1398	0.9853	0.00	-1.47	0.5458	-1.47
H2O	0.1444	0.9807	0.00	-1.93	0.5386	-1.93

Percent Swell (+) / Settlement (-) After Inundation = -0.47

Void Ratio - Log Pressure Curve



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EXPANSION INDEX of SOILS

ASTM D 4829

Project Name:	CUSD / Colton M. S.	Tested By:	JHW	Date:	09/13/04
Project No. :	600593-002	Checked By:	LF	Date:	09/15/04
Boring No.:	B-4	Depth (ft.)	0-5		
Sample No. :	B-1				
Soil Identification:	Dark brown silty sand (SM)				

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

MOLDED SPECIMEN		Before Test	After Test
Specimen Diameter	(in.)	4.01	4.01
Specimen Height	(in.)	1.0000	1.0015
Wt. Comp. Soil + Mold	(g)	614.40	443.90
Wt. of Mold	(g)	185.00	0.00
Specific Gravity (Assumed)		2.70	2.70
Container No.		O	O
Wet Wt. of Soil + Cont.	(g)	831.10	628.90
Dry Wt. of Soil + Cont.	(g)	766.00	580.80
Wt. of Container	(g)	0.00	185.00
Moisture Content	(%)	8.50	12.15
Wet Density	(pcf)	129.5	133.7
Dry Density	(pcf)	119.4	119.2
Void Ratio		0.412	0.414
Total Porosity		0.292	0.293
Pore Volume	(cc)	60.4	60.7
Degree of Saturation (%) [S_{meas}]		**55.7**	79.2

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

Date	Time	Pressure (psi)	Elapsed Time (min.)	Dial Readings (in.)
09/13/04	14:39	1.0	0	0.1055
09/13/04	14:49	1.0	10	0.1052
Add Distilled Water to the Specimen				
09/13/04	15:14	1.0	25	0.1063
09/14/04	7:02	1.0	973	0.1070
09/14/04	9:03	1.0	1094	0.1070

Expansion Index (EI_{meas})	= ((Final Rdg - Initial Rdg) / Initial Thick.) x 1000	1.8
Expansion Index (EI)$_{50}$	= EI_{meas} - (50 - S_{meas})x((65+EI_{meas}) / (220-S_{meas}))	**4**

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SOIL RESISTIVITY TEST

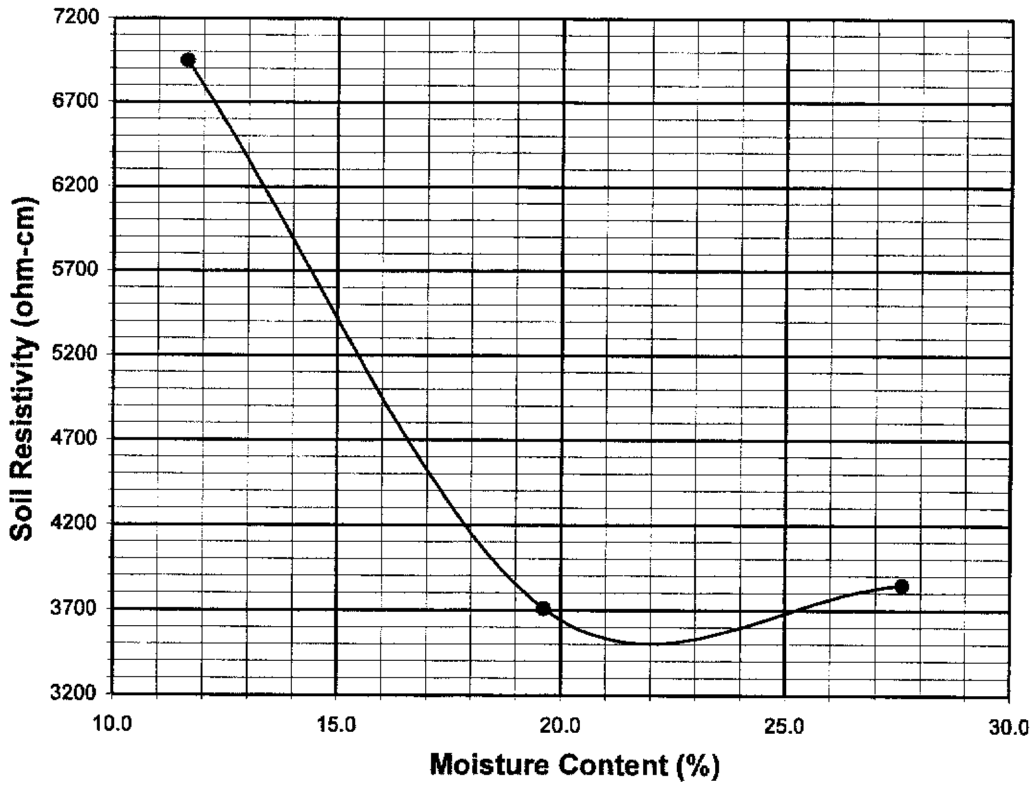
DOT CA TEST 532 / 643

Project Name: CUSD / Colton M. S.
Tested By : GB
Date: 09/08/04
Project No. : 600593-002
Data Input By: LF
Date: 09/11/04
Boring No.: B-4
Depth (ft.) : 0-5
Sample No. : B-1
Soil Identification: SM

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	100	11.65	1030	6948
2	200	19.62	550	3710
3	300	27.60	570	3845
4				
5				

Moisture Content (%) (MCi)	3.67
Wet Wt. of Soil + Cont. (g)	216.75
Dry Wt. of Soil + Cont. (g)	211.10
Wt. of Container (g)	57.30
Container No.	
Initial Soil Wt. (g) (Wt)	1300.00
Box Constant	6.746
MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100	

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 532 / 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 532 / 643	
3500	**22.0**	**77**	**218**	**7.22**	**21.7**



APPENDIX C

SUMMARY OF SEISMIC ANALYSIS

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Determination of Site Class and Estimation of Shear Wave Velocity

Project: 20707 Colton MS Pavilion and Admin Bldg GE

Depth (ft)	di, Layer Thick (ft)	Field Blow Counts, Ni Corrected for Cs and sampler type Blows per foot (bpf) LB-1	LB-2	LB-3	LB-4		Average Ni (bpf)	Ni Hammer Corr: 1.3	di / Ni
5	7.5	11	13	10	15		12	16	0.47
10	5	10	8	22	22		16	20	0.24
15	5	12	12	27	17		17	22	0.23
20	5	10	10	20	48		22	28	0.18
25	5	17					17	22	0.23
30	5	10					10	12	0.40
35	5	18					18	23	0.21
40	5	20					20	27	0.19
45	5	29					29	38	0.13
50	7.5	29					29	37	0.20
60	10	29	*Assumed based on blowcount at 50'				29	38	0.27
70	10	29					29	38	0.27
80	10	29					29	38	0.27
90	10	29					29	38	0.27
100	5	29					29	38	0.13
Summatior	100								3.67
						Navg = Sum(di) / Sum(di / Ni) =			**27**

Extract of ASCE 7-16 Table 20.3-1 Site Classification (2019 CBC 1613A.2.2):

Site Class	Soil Profile Name	Avg. N upper 100' from	to	Vs30 (ft/sec) from	to	Vs30 (m/s) from	to	Site Avg N	Interpolated vs30 (ft/s)
A	Hard Rock	-		5000	10000	1524	3048		
B	Rock	-		2500	5000	762	1524		
C	VD soil & soft rock	50.001	100	1200	2500	366	762		
D	Stiff Soil	**15**	**50**	600	1200	183	366	27	810
E	Soft Soil	0	14.999	0	600	0	183		
F		-	-			0	0		

SITE CLASS, Table 20.3-1: **D**

Estimation of Average Shear Wave Velocity in upper 100 ft (Vs30):

	ft/s	m/s
Approx. Vs30 (interpolation of Table 20.3-1) =	810	247
Approx. Vs30 sands (Imai and Tonouchi, 1982) =	988	301
Approx. Vs30 sands (Sykora and Stokoe, 1983) =	854	260
Approx. Vs30 (Maheswari, Boominathan, Dodagoudar, 2009) =	813	248

Liquefaction Susceptibility Analysis: SPT Method

Leighton

Youd and Idriss (2001), Martin and Lew (1999)

Description: Colton MS Pavilion and Admin Bldg GE; Case 1; PGAm 1.056; design GW 100; No overex 0

Project No.: 38.00000207

Jan 2024

General Boring Information:

Boring No.	Existing GW Depth (ft)	Design GW Depth (ft)	Design Fill Height (ft)	Overex. depth bgs (ft)	Ground Surface Elev (ft)	design gw elve
LB-1	200	100		0	1048	948
LB-2	200	100		0	1049	949
LB-3	200	100		0	1046	946
LB-4	200	100		0	1055	955
						0
						0
						0
						0
						0
						0
						0
						0
						0
						0
						0
						0
						0

Boring Location Coordinates X (ft)	Y (ft)
405.21	47.602
437	181.01
500.01	127.45
366.09	581.33

General Parameters:	
a_{max} =	1.06g
M_W =	8.1
MSF eq:	1
MSF =	0.82
Hammer Efficiency =	83
C_E =	1.38
C_B =	1
C_S for SPT?	TRUE
Unlined, but room for liner	
Rod Stickup (feet) =	3
Ring sample correction =	0.65

Summary of Liquefaction Susceptibility Analysis: SPT Method

Liquefaction Method: Youd and Idriss (2001). Seismic Settlement Method: Tokimatsu and Seed (1987) and Martin and Lew (1999).

Project: Colton MS Pavilion and Admin Bldg GE; Case 1; PGAm 1.056; design GW 100; No overex 0

Project No.: 38.00000207

Boring No.	Approx. Layer Depth (ft)	SPT Depth (ft)	Approx Layer Thick-ness (ft)	Plasticity ("n"=non susc. to liq.)	Estimated Fines Cont (%)	γ_t (pcf)	N_m or B (blows/ft)	Sampler Type (enter 2 if mod CA Ring)	Cs	N_m (corrected for Cs and ring->SPT) (blows/ft)	Exist σ_{vo}' (psf)	$(N_1)_{60}$	$(N_1)_{60CS}$	**$CRR_{7.5}$**	Design σ_{vo}' (psf)	$CSR_{7.5}$	CSR_M	**Liquefaction Factor of Safety**	$(N_1)_{60CS}$ (for Settle-ment) (blows/ft)	Dry Sand Strain (%) (Tok/ Seed 87) (%)	Sat Sand Strain (%) (Tok/ Seed 87) (%)	Seismic Sett. of Layer (in.)	**Cummulative Seismic Settlement** (in.)
LB-1	0 to 3.8	2.5	3.8		45	120	9	2	1	5.9	300	10.3	17.4	0.185	300	0.68	0.83	**NonLiq**	17.4	1.36		0.61	4.4
LB-1	3.8 to 6.3	5	2.5		10	120	19	2	1	12.4	600	21.8	23.1	0.259	600	0.68	0.83	**NonLiq**	23.1	1.14		0.34	3.8
LB-1	6.3 to 8.8	7.5	2.5		10	120	32	2	1	20.8	900	35.1	36.7	>Range	900	0.67	0.82	**NonLiq**	36.7	0.39		0.12	3.4
LB-1	8.8 to 12.5	10	3.8		**29**	120	17	2	1	11.1	1200	17.1	24.3	0.278	1200	0.67	0.82	**NonLiq**	24.3	1.17		0.53	3.3
LB-1	12.5 to 17.5	15	5.0		**63**	120	12	1	1.18	14.1	1800	17.9	26.5	0.325	1800	0.66	0.81	**NonLiq**	26.5	1.04		0.62	2.8
LB-1	17.5 to 22.5	20	5.0		65	120	16	2	1	10.4	2400	12.7	20.3	0.219	2400	0.65	0.80	**NonLiq**	20.3	1.17		0.70	2.2
LB-1	22.5 to 27.5	25	5.0	N	80	120	17	1	1.23	20.9	3000	22.9	32.5	>Range	3000	0.65	0.79	**NonLiq**	32.5	0.00		0.00	1.5
LB-1	27.5 to 32.5	30	5.0	N	**76**	120	16	2	1	10.4	3600	11.0	18.1	>Range	3600	0.64	0.78	**NonLiq**	18.1	0.00		0.00	1.5
LB-1	32.5 to 37.5	35	5.0		65	120	18	1	1.21	21.8	4200	21.3	30.5	>Range	4200	0.61	0.74	**NonLiq**	30.5	0.61		0.37	1.5
LB-1	37.5 to 42.5	40	5.0		**63**	120	34	2	1	22.1	4800	20.2	29.2	0.420	4800	0.58	0.71	**NonLiq**	29.2	1.10		0.66	1.1
LB-1	42.5 to 47.5	45	5.0		35	120	29	1	1.3	37.7	5400	32.4	43.9	>Range	5400	0.55	0.68	**NonLiq**	43.9	0.18		0.11	0.4
LB-1	47.5 to 52.0	50	4.5		40	120	48	2	1	31.2	6000	25.5	35.6	>Range	6000	0.53	0.64	**NonLiq**	35.6	0.61		0.33	0.3
LB-2	0 to 3.8	2.5	3.8		**6**	120	12	2	1	7.8	300	13.8	**13.9**	0.149	300	0.68	0.83	**NonLiq**	13.9	2.28		1.03	3.3
LB-2	3.8 to 6.3	5	2.5		10	120	21	2	1	13.7	600	24.1	25.5	0.301	600	0.68	0.83	**NonLiq**	25.5	1.13		0.34	2.2
LB-2	6.3 to 8.8	7.5	2.5		10	120	34	2	1	22.1	900	37.3	38.9	>Range	900	0.67	0.82	**NonLiq**	38.9	0.37		0.11	1.9
LB-2	8.8 to 12.5	10	3.8		85	120	14	2	1	9.1	1200	14.1	21.9	0.241	1200	0.67	0.82	**NonLiq**	21.9	1.17		0.53	1.8
LB-2	12.5 to 17.5	15	5.0		**23**	120	12	1	1.18	14.1	1800	17.9	23.8	0.269	1800	0.66	0.81	**NonLiq**	23.8	1.06		0.64	1.3
LB-2	17.5 to 22.0	20	4.5		**50**	120	17	2	1	11.1	2400	13.5	21.3	0.232	2400	0.65	0.80	**NonLiq**	21.3	1.17		0.63	0.6
LB-3	0 to 3.8	2.5	3.8		15	120	11	2	1	7.2	300	12.6	15.7	0.167	300	0.68	0.83	**NonLiq**	15.7	1.45		0.65	1.8
LB-3	3.8 to 6.3	5	2.5		10	120	17	2	1	11.1	600	19.5	20.8	0.225	600	0.68	0.83	**NonLiq**	20.8	1.16		0.35	1.1
LB-3	6.3 to 8.8	7.5	2.5		10	120	29	2	1	18.9	900	31.8	33.3	>Range	900	0.67	0.82	**NonLiq**	33.3	0.43		0.13	0.8
LB-3	8.8 to 12.5	10	3.8		10	120	37	2	1	24.1	1200	37.3	39.0	>Range	1200	0.67	0.82	**NonLiq**	39.0	0.58		0.26	0.7
LB-3	12.5 to 17.5	15	5.0		5	120	27	1	1.3	35.1	1800	44.5	44.5	>Range	1800	0.66	0.81	**NonLiq**	44.5	0.13		0.08	0.4
LB-3	17.5 to 22.0	20	4.5		25	120	33	2	1	21.5	2400	26.3	33.6	>Range	2400	0.65	0.80	**NonLiq**	33.6	0.61		0.33	0.3
LB-4	0 to 3.8	2.5	3.8		30	120	17	2	1	11.1	300	19.5	27.2	0.344	300	0.68	0.83	**NonLiq**	27.2	0.60		0.27	1.5
LB-4	3.8 to 6.3	5	2.5		15	120	25	2	1	16.3	600	28.7	32.5	>Range	600	0.68	0.83	**NonLiq**	32.5	0.63		0.19	1.2
LB-4	6.3 to 8.8	7.5	2.5		15	120	39	2	1	25.4	900	42.7	47.3	>Range	900	0.67	0.82	**NonLiq**	47.3	0.11		0.03	1.0
LB-4	8.8 to 12.5	10	3.8		10	120	37	2	1	24.1	1200	37.3	39.0	>Range	1200	0.67	0.82	**NonLiq**	39.0	0.58		0.26	1.0
LB-4	12.5 to 17.5	15	5.0		**5**	120	15	1	1.23	18.5	1800	23.4	23.4	0.264	1800	0.66	0.81	**NonLiq**	23.4	1.07		0.64	0.7
LB-4	17.5 to 22.0	20	4.5		5	120	80	2	1	52.0	2400	63.7	63.7	>Range	2400	0.65	0.80	**NonLiq**	63.7	0.14		0.07	0.1

Liquefaction Susceptibility Analysis: SPT Method

Leighton

Youd and Idriss (2001), Martin and Lew (1999)

Description: Colton MS Pavilion and Admin Bldg GE; Case 3; PGAm 1.056; design GW 100; Overex./scarify 7
Project No.: 38.00000207
Jan 2024

General Boring Information:

Boring No.	Existing GW Depth (ft)	Design GW Depth (ft)	Design Fill Height (ft)	Overex. depth bgs (ft)	Ground Surface Elev (ft)	design gw elve
LB-1	200	100		7	1048	948
LB-2	200	100		7	1049	949
LB-3	200	100		7	1046	946
LB-4	200	100		7	1055	955
						0
						0
						0
						0
						0
						0
						0
						0
						0
						0
						0
						0
						0

Boring Location Coordinates X (ft)	Y (ft)
405.21	47.602
437	181.01
500.01	127.45
366.09	581.33

General Parameters:

a_{max} = 1.06g
M_W = 8.1
MSF eq: 1
MSF = 0.82
Hammer Efficiency = 83
C_E = 1.38
C_B = 1
C_S for SPT? TRUE
Unlined, but room for liner
Rod Stickup (feet) = 3
Ring sample correction = 0.65

Summary of Liquefaction Susceptibility Analysis: SPT Method

Leighton

Liquefaction Method: Youd and Idriss (2001). Seismic Settlement Method: Tokimatsu and Seed (1987) and Martin and Lew (1999).

Project: Colton MS Pavilion and Admin Bldg GE; Case 3; PGAm 1.056; design GW 100; Overex./scarify 7

Project No.: 38.00000207

Boring No.	Approx. Layer Depth (ft)	SPT Depth (ft)	Approx Layer Thick-ness (ft)	Plasticity ("n"=non susc. to liq.)	Estimated Fines Cont (%)	γ_t (pcf)	N_m or B (blows/ft)	Sampler Type (enter 2 if mod CA Ring)	Cs	N_m (corrected for Cs and ring->SPT) (blows/ft)	Exist σ_{vo}' (psf)	$(N_1)_{60}$	$(N_1)_{60CS}$	**$CRR_{7.5}$**	Design σ_{vo}' (psf)	$CSR_{7.5}$	CSR_M	**Liquefaction Factor of Safety**	$(N_1)_{60CS}$ (for Settle-ment) (blows/ft)	Dry Sand Strain (%) (Tok/ Seed 87) (%)	Sat Sand Strain (%) (Tok/ Seed 87) (%)	Seismic Sett. of Layer (in.)	**Cummulative Seismic Settlement** (in.)
LB-1	0 to 3.8	2.5	3.8	OX	45	120	50	1	1.3	65.0	300	114.6	142.6	>Range	300	0.68	0.83	**NonLiq**	142.6	0.00		0.00	3.4
LB-1	3.8 to 6.3	5	2.5	OX	10	120	50	1	1.3	65.0	600	114.6	118.0	>Range	600	0.68	0.83	**NonLiq**	118.0	0.00		0.00	3.4
LB-1	6.3 to 7.0	7.5	0.8	OX	10	120	50	1	1.3	65.0	900	109.6	112.8	>Range	900	0.67	0.82	**NonLiq**	112.8	0.00		0.00	3.4
LB-1	7.0 to 8.8	7.5	1.8		10	120	32	2	1	20.8	900	35.1	36.7	>Range	900	0.67	0.82	**NonLiq**	36.7	0.39		0.08	3.4
LB-1	8.8 to 12.5	10	3.8		**29**	120	17	2	1	11.1	1200	17.1	24.3	0.278	1200	0.67	0.82	**NonLiq**	24.3	1.17		0.53	3.3
LB-1	12.5 to 17.5	15	5.0		**63**	120	12	1	1.18	14.1	1800	17.9	26.5	0.325	1800	0.66	0.81	**NonLiq**	26.5	1.04		0.62	2.8
LB-1	17.5 to 22.5	20	5.0		65	120	16	2	1	10.4	2400	12.7	20.3	0.219	2400	0.65	0.80	**NonLiq**	20.3	1.17		0.70	2.2
LB-1	22.5 to 27.5	25	5.0	N	80	120	17	1	1.23	20.9	3000	22.9	32.5	>Range	3000	0.65	0.79	**NonLiq**	32.5	0.00		0.00	1.5
LB-1	27.5 to 32.5	30	5.0	N	**76**	120	16	2	1	10.4	3600	11.0	18.1	>Range	3600	0.64	0.78	**NonLiq**	18.1	0.00		0.00	1.5
LB-1	32.5 to 37.5	35	5.0		65	120	18	1	1.21	21.8	4200	21.3	30.5	>Range	4200	0.61	0.74	**NonLiq**	30.5	0.61		0.37	1.5
LB-1	37.5 to 42.5	40	5.0		**63**	120	34	2	1	22.1	4800	20.2	29.2	0.420	4800	0.58	0.71	**NonLiq**	29.2	1.10		0.66	1.1
LB-1	42.5 to 47.5	45	5.0		35	120	29	1	1.3	37.7	5400	32.4	43.9	>Range	5400	0.55	0.68	**NonLiq**	43.9	0.18		0.11	0.4
LB-1	47.5 to 52.0	50	4.5		40	120	48	2	1	31.2	6000	25.5	35.6	>Range	6000	0.53	0.64	**NonLiq**	35.6	0.61		0.33	0.3
LB-2	0 to 3.8	2.5	3.8	OX	**6**	120	50	1	1.3	65.0	300	114.6	115.2	>Range	300	0.68	0.83	**NonLiq**	115.2	0.00		0.00	1.9
LB-2	3.8 to 6.3	5	2.5	OX	10	120	50	1	1.3	65.0	600	114.6	118.0	>Range	600	0.68	0.83	**NonLiq**	118.0	0.00		0.00	1.9
LB-2	6.3 to 7.0	7.5	0.8	OX	10	120	50	1	1.3	65.0	900	109.6	112.8	>Range	900	0.67	0.82	**NonLiq**	112.8	0.00		0.00	1.9
LB-2	7.0 to 8.8	7.5	1.8		10	120	34	2	1	22.1	900	37.3	38.9	>Range	900	0.67	0.82	**NonLiq**	38.9	0.37		0.08	1.9
LB-2	8.8 to 12.5	10	3.8		85	120	14	2	1	9.1	1200	14.1	21.9	0.241	1200	0.67	0.82	**NonLiq**	21.9	1.17		0.53	1.8
LB-2	12.5 to 17.5	15	5.0		**23**	120	12	1	1.18	14.1	1800	17.9	23.8	0.269	1800	0.66	0.81	**NonLiq**	23.8	1.06		0.64	1.3
LB-2	17.5 to 22.0	20	4.5		**50**	120	17	2	1	11.1	2400	13.5	21.3	0.232	2400	0.65	0.80	**NonLiq**	21.3	1.17		0.63	0.6
LB-3	0 to 3.8	2.5	3.8	OX	15	120	50	1	1.3	65.0	300	114.6	122.7	>Range	300	0.68	0.83	**NonLiq**	122.7	0.00		0.00	0.8
LB-3	3.8 to 6.3	5	2.5	OX	10	120	50	1	1.3	65.0	600	114.6	118.0	>Range	600	0.68	0.83	**NonLiq**	118.0	0.00		0.00	0.8
LB-3	6.3 to 7.0	7.5	0.8	OX	10	120	50	1	1.3	65.0	900	109.6	112.8	>Range	900	0.67	0.82	**NonLiq**	112.8	0.00		0.00	0.8
LB-3	7.0 to 8.8	7.5	1.8		10	120	29	2	1	18.9	900	31.8	33.3	>Range	900	0.67	0.82	**NonLiq**	33.3	0.43		0.09	0.8
LB-3	8.8 to 12.5	10	3.8		10	120	37	2	1	24.1	1200	37.3	39.0	>Range	1200	0.67	0.82	**NonLiq**	39.0	0.58		0.26	0.7
LB-3	12.5 to 17.5	15	5.0		5	120	27	1	1.3	35.1	1800	44.5	44.5	>Range	1800	0.66	0.81	**NonLiq**	44.5	0.13		0.08	0.4
LB-3	17.5 to 22.0	20	4.5		25	120	33	2	1	21.5	2400	26.3	33.6	>Range	2400	0.65	0.80	**NonLiq**	33.6	0.61		0.33	0.3
LB-4	0 to 3.8	2.5	3.8	OX	30	120	50	1	1.3	65.0	300	114.6	137.0	>Range	300	0.68	0.83	**NonLiq**	137.0	0.00		0.00	1.0
LB-4	3.8 to 6.3	5	2.5	OX	15	120	50	1	1.3	65.0	600	114.6	122.7	>Range	600	0.68	0.83	**NonLiq**	122.7	0.00		0.00	1.0
LB-4	6.3 to 7.0	7.5	0.8	OX	15	120	50	1	1.3	65.0	900	109.6	117.3	>Range	900	0.67	0.82	**NonLiq**	117.3	0.00		0.00	1.0
LB-4	7.0 to 8.8	7.5	1.8		15	120	39	2	1	25.4	900	42.7	47.3	>Range	900	0.67	0.82	**NonLiq**	47.3	0.11		0.02	1.0
LB-4	8.8 to 12.5	10	3.8		10	120	37	2	1	24.1	1200	37.3	39.0	>Range	1200	0.67	0.82	**NonLiq**	39.0	0.58		0.26	1.0
LB-4	12.5 to 17.5	15	5.0		**5**	120	15	1	1.23	18.5	1800	23.4	23.4	0.264	1800	0.66	0.81	**NonLiq**	23.4	1.07		0.64	0.7
LB-4	17.5 to 22.0	20	4.5		5	120	80	2	1	52.0	2400	63.7	63.7	>Range	2400	0.65	0.80	**NonLiq**	63.7	0.14		0.07	0.1

Liquefaction Susceptibility Analysis: SPT Method

Leighton

Youd and Idriss (2001), Martin and Lew (1999)

Description: Colton MS Pavilion and Admin Bldg GE; Case 4; PGAm 1.056; design GW 100; Overex. 15
Project No.: 38.00000207
Jan 2024

General Boring Information:

Boring No.	Existing GW Depth (ft)	Design GW Depth (ft)	Design Fill Height (ft)	Overex. depth bgs (ft)	Ground Surface Elev (ft)	design gw elve
LB-1	200	100		15	1048	948
LB-2	200	100		15	1049	949
LB-3	200	100		15	1046	946
LB-4	200	100		15	1055	955
						0
						0
						0
						0
						0
						0
						0
						0
						0
						0
						0
						0
						0

Boring Location Coordinates X (ft)	Y (ft)
405.21	47.602
437	181.01
500.01	127.45
366.09	581.33

General Parameters:	
a_{max} =	1.06g
M_W =	8.1
MSF eq:	1
MSF =	0.82
Hammer Efficiency =	83
C_E =	1.38
C_B =	1
C_S for SPT?	TRUE
Unlined, but room for liner	
Rod Stickup (feet) =	3
Ring sample correction =	0.65

Summary of Liquefaction Susceptibility Analysis: SPT Method

Leighton

Liquefaction Method: Youd and Idriss (2001). Seismic Settlement Method: Tokimatsu and Seed (1987) and Martin and Lew (1999).

Project: Colton MS Pavilion and Admin Bldg GE; Case 4; PGAm 1.056; design GW 100; Overex. 15

Project No.: 38.00000207

Boring No.	Approx. Layer Depth (ft)	SPT Depth (ft)	Approx Layer Thick-ness (ft)	Plasticity ("n"=non susc. to liq.)	Estimated Fines Cont (%)	γ_t (pcf)	N_m or B (blows/ft)	Sampler Type (enter 2 if mod CA Ring)	Cs	N_m (corrected for Cs and ring->SPT) (blows/ft)	Exist σ_{vo}' (psf)	$(N_1)_{60}$	$(N_1)_{60CS}$	**$CRR_{7.5}$**	Design σ_{vo}' (psf)	$CSR_{7.5}$	CSR_M	**Liquefaction Factor of Safety**	$(N_1)_{60CS}$ (for Settle-ment) (blows/ft)	Dry Sand Strain (%) (Tok/ Seed 87) (%)	Sat Sand Strain (%) (Tok/ Seed 87) (%)	Seismic Sett. of Layer (in.)	**Cummulative Seismic Settlement** (in.)
LB-1	0 to 3.8	2.5	3.8	OX	45	120	50	1	1.3	65.0	300	114.6	142.6	>Range	300	0.68	0.83	**NonLiq**	142.6	0.00		0.00	2.5
LB-1	3.8 to 6.3	5	2.5	OX	10	120	50	1	1.3	65.0	600	114.6	118.0	>Range	600	0.68	0.83	**NonLiq**	118.0	0.00		0.00	2.5
LB-1	6.3 to 8.8	7.5	2.5	OX	10	120	50	1	1.3	65.0	900	109.6	112.8	>Range	900	0.67	0.82	**NonLiq**	112.8	0.00		0.00	2.5
LB-1	8.8 to 12.5	10	3.8	OX	**29**	120	50	1	1.3	65.0	1200	100.8	120.2	>Range	1200	0.67	0.82	**NonLiq**	120.2	0.00		0.00	2.5
LB-1	12.5 to 15.0	15	2.5	OX	**63**	120	50	1	1.3	65.0	1800	82.3	103.8	>Range	1800	0.66	0.81	**NonLiq**	103.8	0.00		0.00	2.5
LB-1	15.0 to 17.5	15	2.5		**63**	120	12	1	1.18	14.1	1800	17.9	26.5	0.325	1800	0.66	0.81	**NonLiq**	26.5	1.04		0.31	2.5
LB-1	17.5 to 22.5	20	5.0		65	120	16	2	1	10.4	2400	12.7	20.3	0.219	2400	0.65	0.80	**NonLiq**	20.3	1.17		0.70	2.2
LB-1	22.5 to 27.5	25	5.0	N	80	120	17	1	1.23	20.9	3000	22.9	32.5	>Range	3000	0.65	0.79	**NonLiq**	32.5	0.00		0.00	1.5
LB-1	27.5 to 32.5	30	5.0	N	**76**	120	16	2	1	10.4	3600	11.0	18.1	>Range	3600	0.64	0.78	**NonLiq**	18.1	0.00		0.00	1.5
LB-1	32.5 to 37.5	35	5.0		65	120	18	1	1.21	21.8	4200	21.3	30.5	>Range	4200	0.61	0.74	**NonLiq**	30.5	0.61		0.37	1.5
LB-1	37.5 to 42.5	40	5.0		**63**	120	34	2	1	22.1	4800	20.2	29.2	0.420	4800	0.58	0.71	**NonLiq**	29.2	1.10		0.66	1.1
LB-1	42.5 to 47.5	45	5.0		35	120	29	1	1.3	37.7	5400	32.4	43.9	>Range	5400	0.55	0.68	**NonLiq**	43.9	0.18		0.11	0.4
LB-1	47.5 to 52.0	50	4.5		40	120	48	2	1	31.2	6000	25.5	35.6	>Range	6000	0.53	0.64	**NonLiq**	35.6	0.61		0.33	0.3
LB-2	0 to 3.8	2.5	3.8	OX	**6**	120	50	1	1.3	65.0	300	114.6	115.2	>Range	300	0.68	0.83	**NonLiq**	115.2	0.00		0.00	1.0
LB-2	3.8 to 6.3	5	2.5	OX	10	120	50	1	1.3	65.0	600	114.6	118.0	>Range	600	0.68	0.83	**NonLiq**	118.0	0.00		0.00	1.0
LB-2	6.3 to 8.8	7.5	2.5	OX	10	120	50	1	1.3	65.0	900	109.6	112.8	>Range	900	0.67	0.82	**NonLiq**	112.8	0.00		0.00	1.0
LB-2	8.8 to 12.5	10	3.8	OX	85	120	50	1	1.3	65.0	1200	100.8	126.0	>Range	1200	0.67	0.82	**NonLiq**	126.0	0.00		0.00	1.0
LB-2	12.5 to 15.0	15	2.5	OX	**23**	120	50	1	1.3	65.0	1800	82.3	94.6	>Range	1800	0.66	0.81	**NonLiq**	94.6	0.00		0.00	1.0
LB-2	15.0 to 17.5	15	2.5		**23**	120	12	1	1.18	14.1	1800	17.9	23.8	0.269	1800	0.66	0.81	**NonLiq**	23.8	1.06		0.32	1.0
LB-2	17.5 to 22.0	20	4.5		**50**	120	17	2	1	11.1	2400	13.5	21.3	0.232	2400	0.65	0.80	**NonLiq**	21.3	1.17		0.63	0.6
LB-3	0 to 3.8	2.5	3.8	OX	15	120	50	1	1.3	65.0	300	114.6	122.7	>Range	300	0.68	0.83	**NonLiq**	122.7	0.00		0.00	0.4
LB-3	3.8 to 6.3	5	2.5	OX	10	120	50	1	1.3	65.0	600	114.6	118.0	>Range	600	0.68	0.83	**NonLiq**	118.0	0.00		0.00	0.4
LB-3	6.3 to 8.8	7.5	2.5	OX	10	120	50	1	1.3	65.0	900	109.6	112.8	>Range	900	0.67	0.82	**NonLiq**	112.8	0.00		0.00	0.4
LB-3	8.8 to 12.5	10	3.8	OX	10	120	50	1	1.3	65.0	1200	100.8	103.9	>Range	1200	0.67	0.82	**NonLiq**	103.9	0.00		0.00	0.4
LB-3	12.5 to 15.0	15	2.5	OX	5	120	50	1	1.3	65.0	1800	82.3	82.3	>Range	1800	0.66	0.81	**NonLiq**	82.3	0.00		0.00	0.4
LB-3	15.0 to 17.5	15	2.5		5	120	27	1	1.3	35.1	1800	44.5	44.5	>Range	1800	0.66	0.81	**NonLiq**	44.5	0.13		0.04	0.4
LB-3	17.5 to 22.0	20	4.5		25	120	33	2	1	21.5	2400	26.3	33.6	>Range	2400	0.65	0.80	**NonLiq**	33.6	0.61		0.33	0.3
LB-4	0 to 3.8	2.5	3.8	OX	30	120	50	1	1.3	65.0	300	114.6	137.0	>Range	300	0.68	0.83	**NonLiq**	137.0	0.00		0.00	0.4
LB-4	3.8 to 6.3	5	2.5	OX	15	120	50	1	1.3	65.0	600	114.6	122.7	>Range	600	0.68	0.83	**NonLiq**	122.7	0.00		0.00	0.4
LB-4	6.3 to 8.8	7.5	2.5	OX	15	120	50	1	1.3	65.0	900	109.6	117.3	>Range	900	0.67	0.82	**NonLiq**	117.3	0.00		0.00	0.4
LB-4	8.8 to 12.5	10	3.8	OX	10	120	50	1	1.3	65.0	1200	100.8	103.9	>Range	1200	0.67	0.82	**NonLiq**	103.9	0.00		0.00	0.4
LB-4	12.5 to 15.0	15	2.5	OX	**5**	120	50	1	1.3	65.0	1800	82.3	82.3	>Range	1800	0.66	0.81	**NonLiq**	82.3	0.00		0.00	0.4
LB-4	15.0 to 17.5	15	2.5		**5**	120	15	1	1.23	18.5	1800	23.4	23.4	0.264	1800	0.66	0.81	**NonLiq**	23.4	1.07		0.32	0.4
LB-4	17.5 to 22.0	20	4.5		5	120	80	2	1	52.0	2400	63.7	63.7	>Range	2400	0.65	0.80	**NonLiq**	63.7	0.14		0.07	0.1

Unified Hazard Tool

Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the U.S. Seismic Design Maps web tools (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

Please also see the new USGS Earthquake Hazard Toolbox for access to the most recent NSHMs for the conterminous U.S. and Hawaii.

Input

Edition

Dynamic: Conterminous U.S. 2014 (u…

Spectral Period

Peak Ground Acceleration

Latitude

Decimal degrees

34.07980749

Time Horizon

Return period in years

2475

Longitude

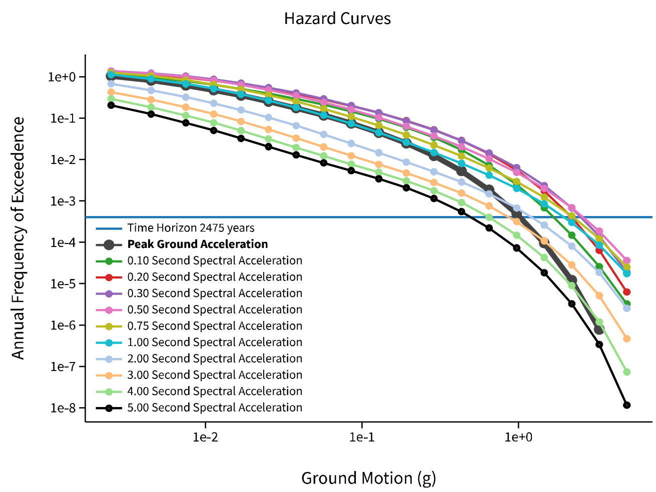
Decimal degrees, negative values for western longitudes

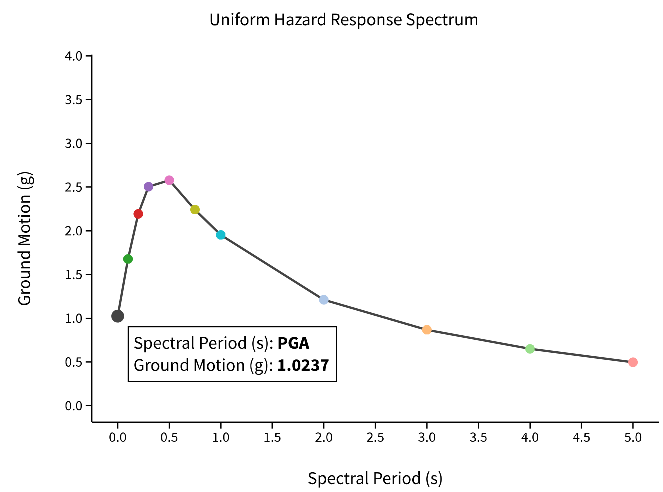
-117.33211652

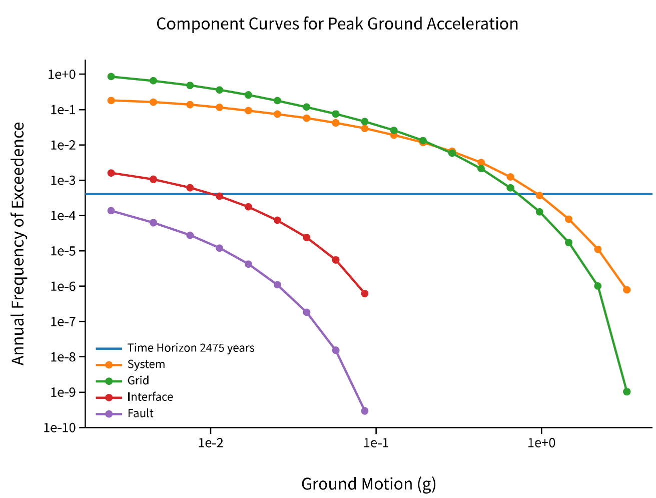
Site Class

259 m/s (Site class D)

Hazard Curve





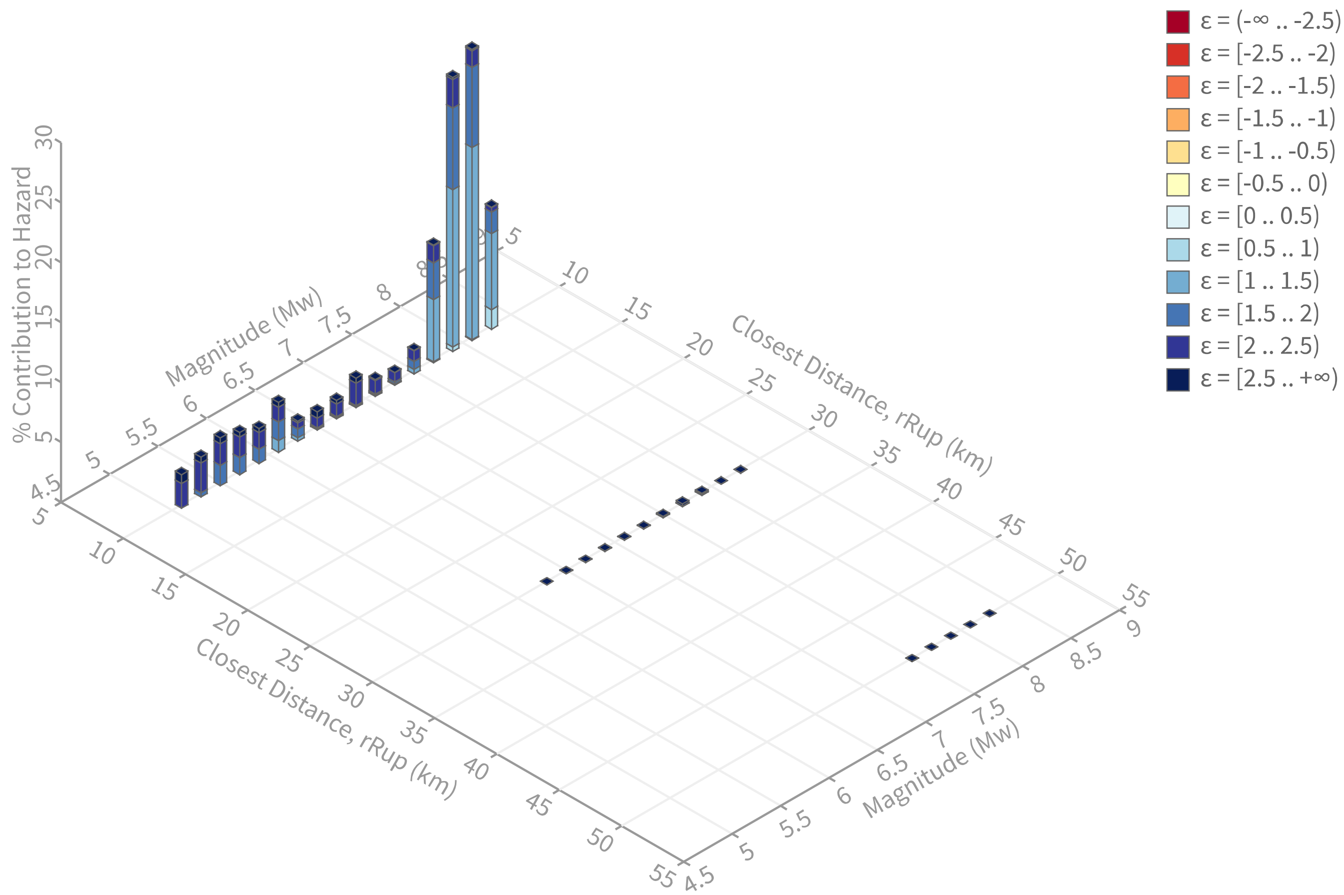


[View Raw Data]

^ Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 2475 yrs
Exceedance rate: 0.0004040404 yr^{-1}
PGA ground motion: 1.0236607 g

Recovered targets

Return period: 3251.8316 yrs
Exceedance rate: 0.000307519 yr^{-1}

Totals

Binned: 100 %
Residual: 0 %
Trace: 0.03 %

Mean (over all sources)

m: 7.38
r: 6.29 km
ε_0: 1.62 σ

Mode (largest m-r bin)

m: 8.1
r: 4.62 km
ε_0: 1.32 σ
Contribution: 24.29 %

Mode (largest m-r-ε_0 bin)

m: 8.1
r: 2.68 km
ε_0: 1.1 σ
Contribution: 16.03 %

Discretization

r: min = 0.0, max = 1000.0, Δ = 20.0 km
m: min = 4.4, max = 9.4, Δ = 0.2
ε: min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

ε0: [-∞ .. -2.5)
ε1: [-2.5 .. -2.0)
ε2: [-2.0 .. -1.5)
ε3: [-1.5 .. -1.0)
ε4: [-1.0 .. -0.5)
ε5: [-0.5 .. 0.0)
ε6: [0.0 .. 0.5)
ε7: [0.5 .. 1.0)
ε8: [1.0 .. 1.5)
ε9: [1.5 .. 2.0)
ε10: [2.0 .. 2.5)
ε11: [2.5 .. +∞]

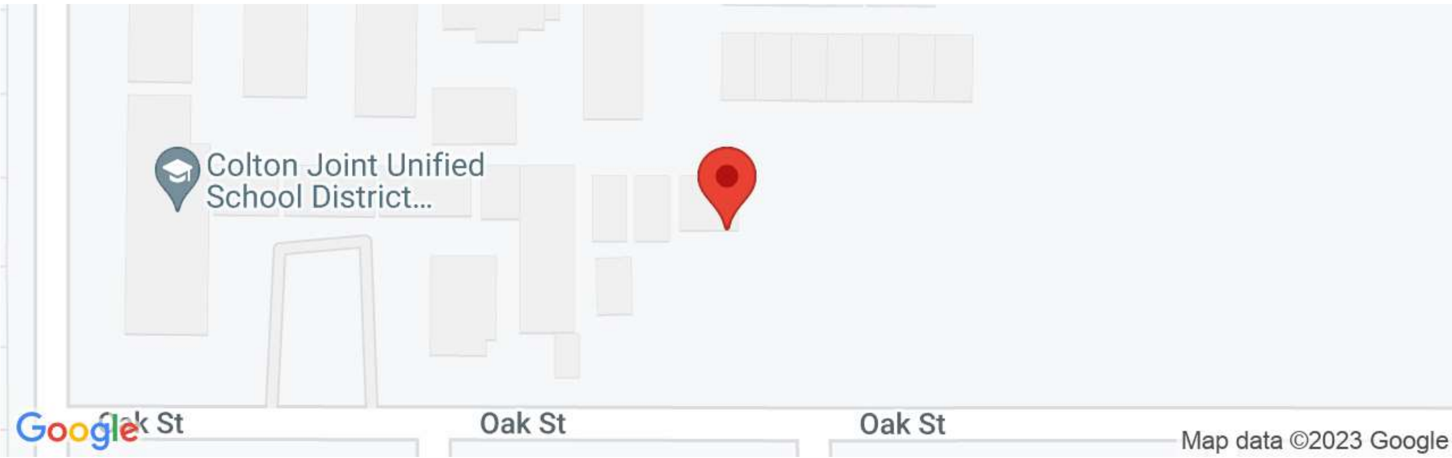
Deaggregation Contributors

Source Set ↳ Source	Type	r	m	ε_0	lon	lat	az	%
UC33brAvg_FM32	System							38.58
San Jacinto (San Bernardino) [3]		2.23	8.00	1.18	117.316°W	34.092°N	46.85	24.04
San Andreas (San Bernardino N) [5]		11.67	7.79	1.92	117.269°W	34.171°N	29.81	8.31
San Andreas (North Branch Mill Creek) [0]		11.36	7.99	1.63	117.270°W	34.171°N	29.15	2.04
San Andreas (San Bernardino S) [0]		12.86	7.00	2.33	117.222°W	34.150°N	52.36	1.34
UC33brAvg_FM31	System							38.58
San Jacinto (San Bernardino) [3]		2.23	8.01	1.18	117.316°W	34.092°N	46.85	24.08
San Andreas (San Bernardino N) [5]		11.67	7.78	1.92	117.269°W	34.171°N	29.81	8.26
San Andreas (North Branch Mill Creek) [0]		11.36	7.98	1.64	117.270°W	34.171°N	29.15	1.97
San Andreas (San Bernardino S) [0]		12.86	6.99	2.33	117.222°W	34.150°N	52.36	1.32
UC33brAvg_FM31 (opt)	Grid							11.42
PointSourceFinite: -117.332, 34.111		6.28	5.59	1.97	117.332°W	34.111°N	0.00	3.47
PointSourceFinite: -117.332, 34.111		6.28	5.59	1.97	117.332°W	34.111°N	0.00	3.47
PointSourceFinite: -117.332, 34.138		8.07	5.70	2.21	117.332°W	34.138°N	0.00	1.16
PointSourceFinite: -117.332, 34.138		8.07	5.70	2.21	117.332°W	34.138°N	0.00	1.16
UC33brAvg_FM32 (opt)	Grid							11.42
PointSourceFinite: -117.332, 34.111		6.28	5.59	1.97	117.332°W	34.111°N	0.00	3.47
PointSourceFinite: -117.332, 34.111		6.28	5.59	1.97	117.332°W	34.111°N	0.00	3.47
PointSourceFinite: -117.332, 34.138		8.07	5.70	2.21	117.332°W	34.138°N	0.00	1.16
PointSourceFinite: -117.332, 34.138		8.07	5.70	2.21	117.332°W	34.138°N	0.00	1.16

USGS web services were down for some period of time and as a result this tool wasn't operational, resulting in *timeout* error.
USGS web services are now operational so this tool should work as expected.

OSHPD

Latitude, Longitude: 34.07980749, -117.33211652



Date	12/14/2023, 12:20:09 PM
Design Code Reference Document	ASCE7-16
Risk Category	II
Site Class	D - Stiff Soil

Type	Value	Description
S_S	2.277	MCE_R ground motion. (for 0.2 second period)
S_1	0.91	MCE_R ground motion. (for 1.0s period)
S_{MS}	2.277	Site-modified spectral acceleration value
S_{M1}	null -See Section 11.4.8	Site-modified spectral acceleration value
S_{DS}	1.518	Numeric seismic design value at 0.2 second SA
S_{D1}	null -See Section 11.4.8	Numeric seismic design value at 1.0 second SA

Type	Value	Description
SDC	null -See Section 11.4.8	Seismic design category
F_a	1	Site amplification factor at 0.2 second
F_v	null -See Section 11.4.8	Site amplification factor at 1.0 second
PGA	0.96	MCE_G peak ground acceleration
F_{PGA}	1.1	Site amplification factor at PGA
PGA_M	1.056	Site modified peak ground acceleration
T_L	8	Long-period transition period in seconds
SsRT	2.389	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	2.609	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	2.277	Factored deterministic acceleration value. (0.2 second)
S1RT	0.953	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	1.069	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	0.91	Factored deterministic acceleration value. (1.0 second)
PGAd	0.96	Factored deterministic acceleration value. (Peak Ground Acceleration)
PGA_{UH}	1.041	Uniform-hazard (2% probability of exceedance in 50 years) Peak Ground Acceleration
C_{RS}	0.916	Mapped value of the risk coefficient at short periods

Type	Value	Description
C_{R1}	0.891	Mapped value of the risk coefficient at a period of 1 s
C_V	1.5	Vertical coefficient

DISCLAIMER

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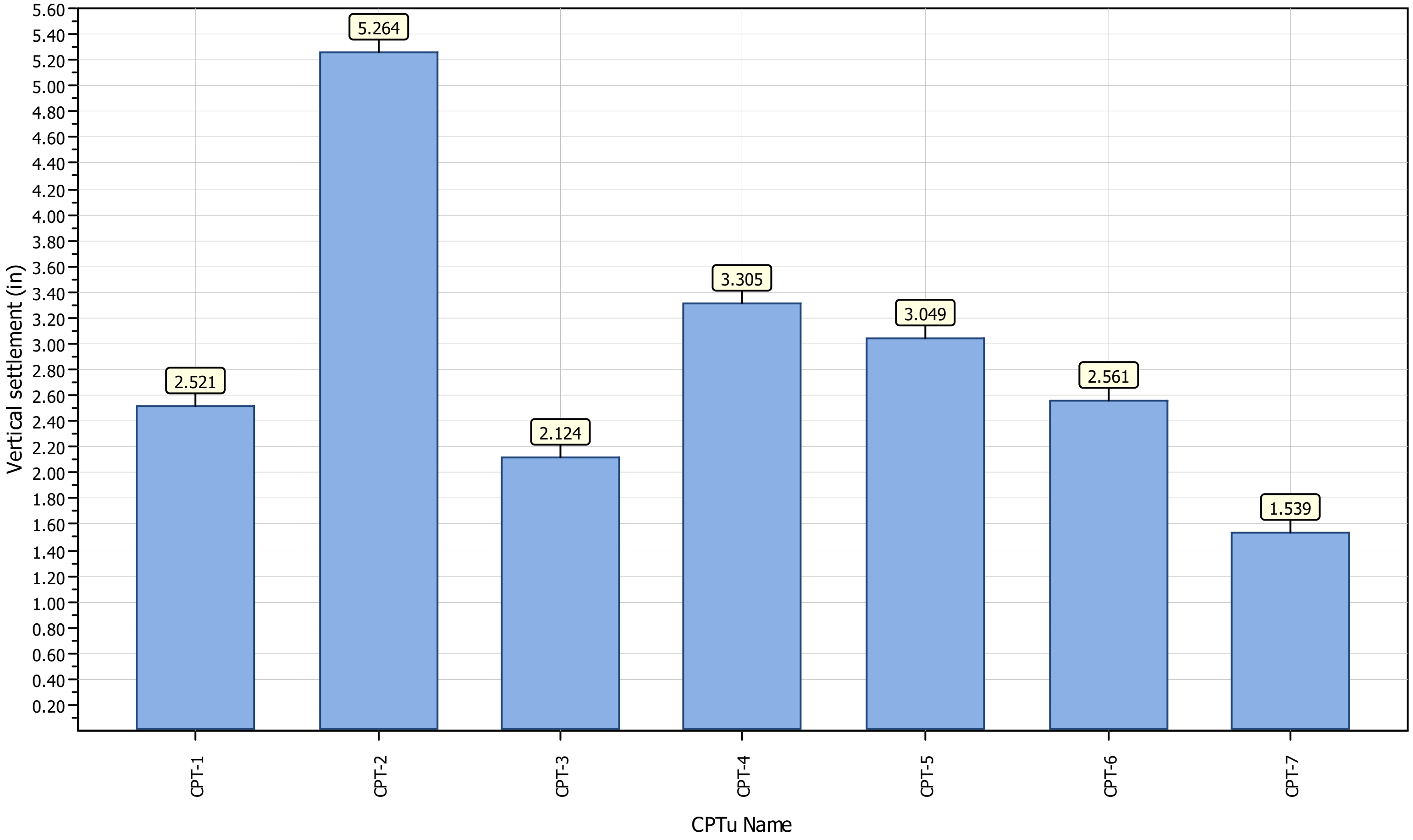
Project title : Colton Middle School Pavilion and Admin Building

Location : Colton California

Overall vertical settlements report



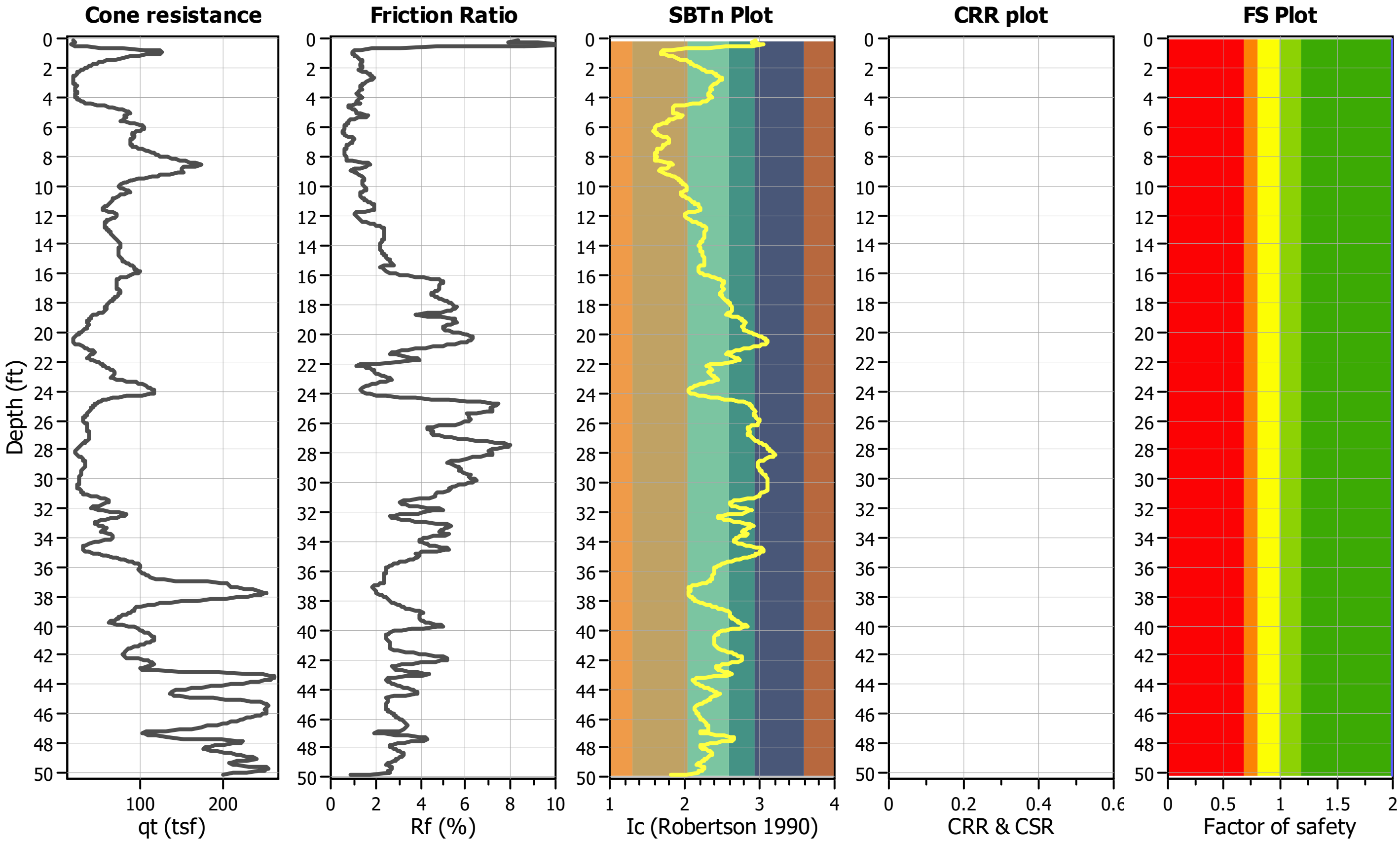
LIQUEFACTION ANALYSIS REPORT

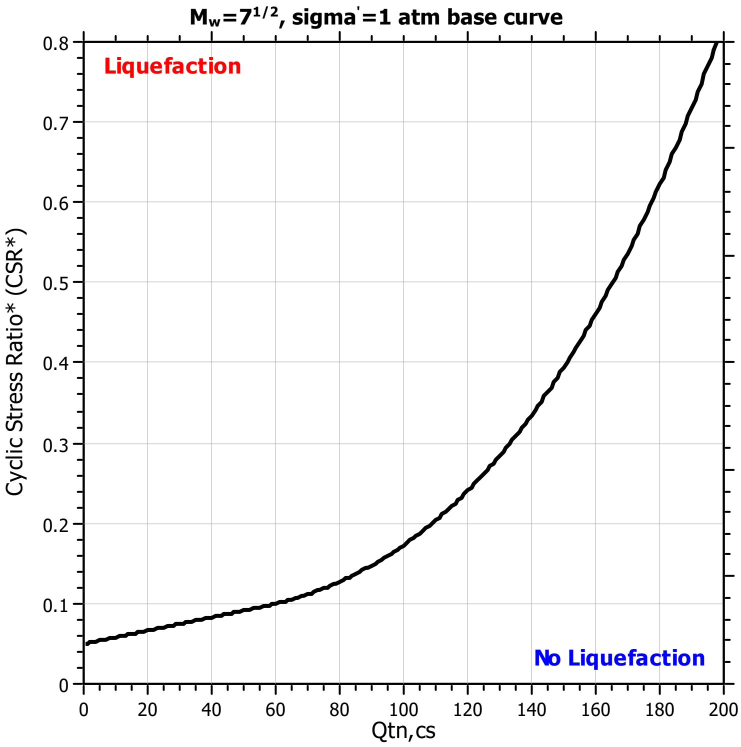
Project title : Colton Middle School Pavilion and Admin **Location : Colton California**

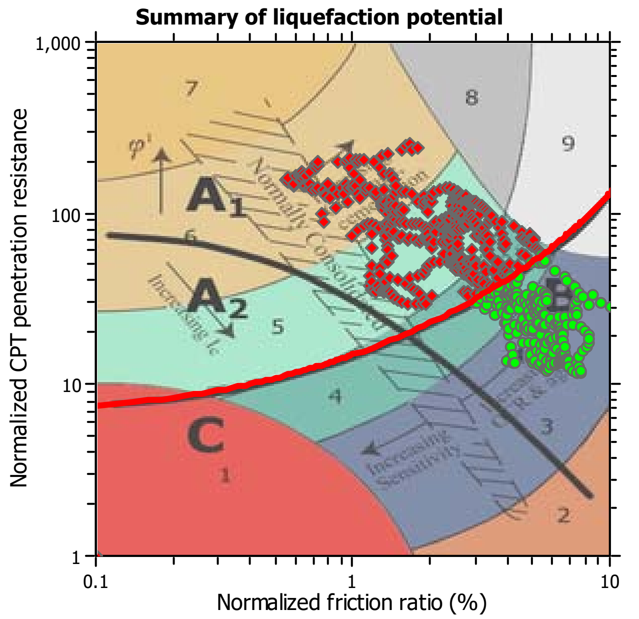
CPT file : CPT-1

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	200.00 ft	Use fill:	No	Clay like behavior	
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	100.00 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:	Yes
Earthquake magnitude M_w:	8.10	Ic cut-off value:	2.60	Trans. detect. applied:	No	Limit depth:	50.00 ft
Peak ground acceleration:	1.06	Unit weight calculation:	Based on SBT	K_σ applied:	Yes	MSF method:	Method based

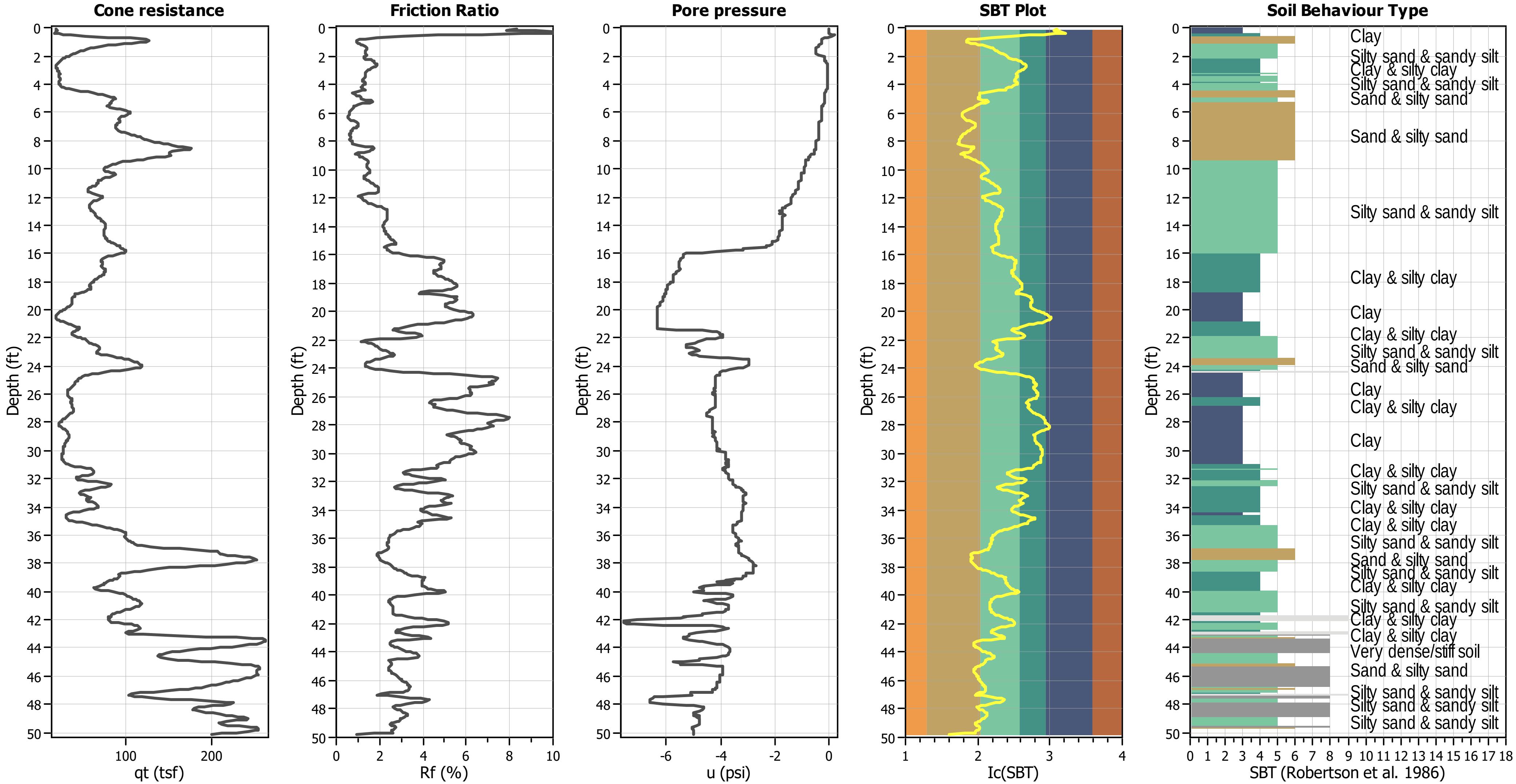






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



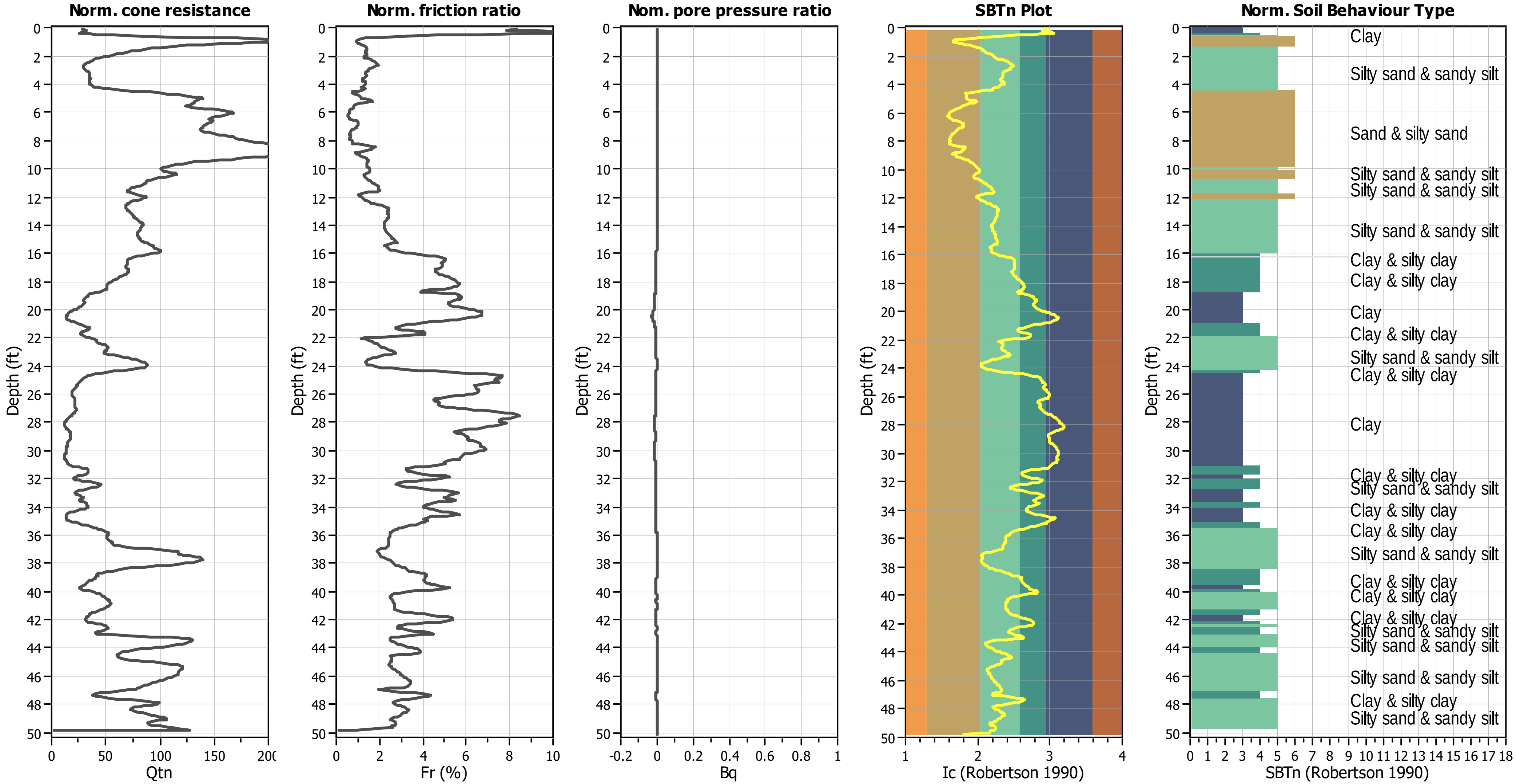
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	100.00 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:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	8.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	1.06	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	200.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

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)



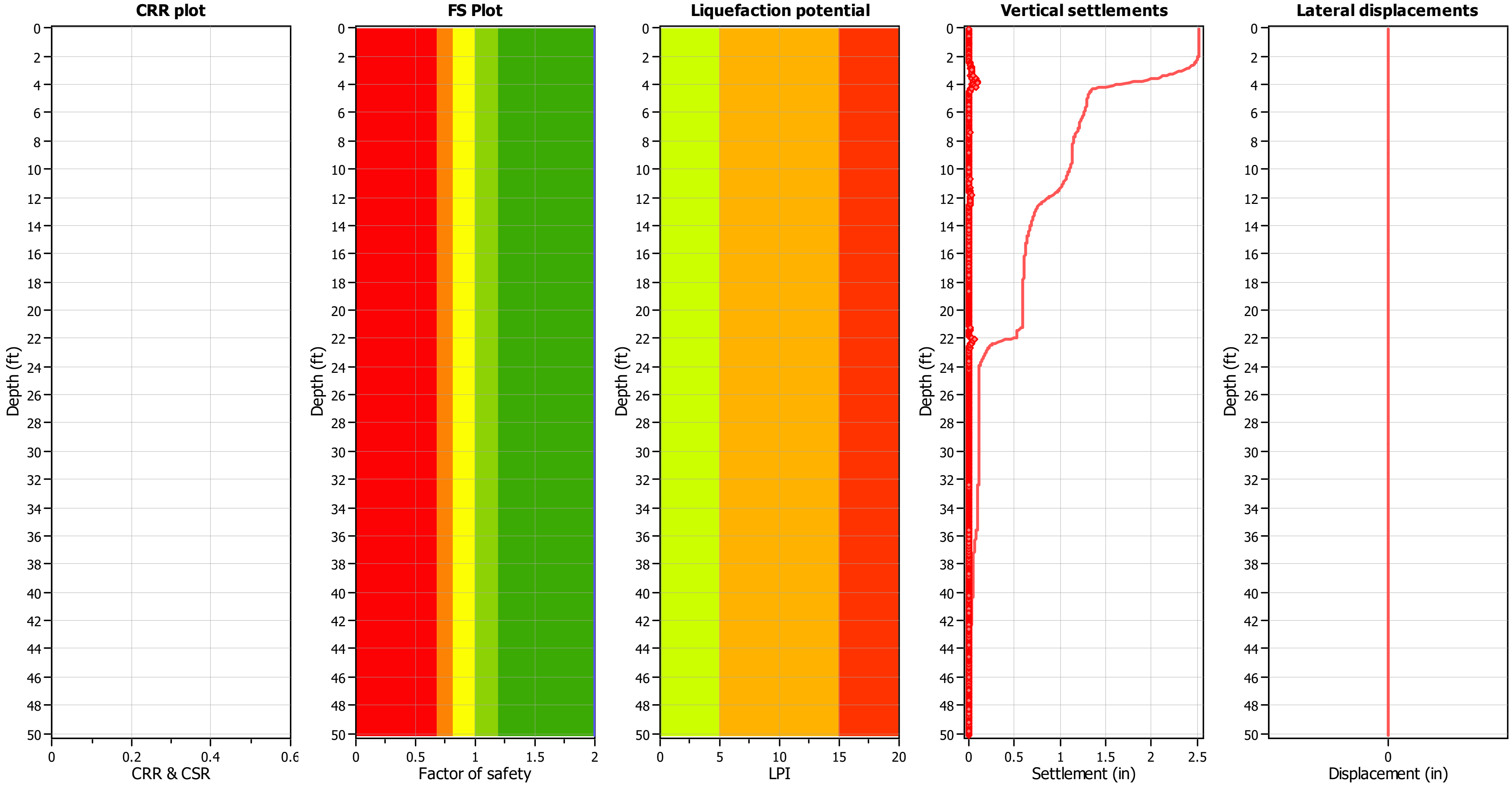
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	100.00 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:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	8.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	1.06	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	200.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

SBTn legend

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	100.00 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:	2.60	K_{σ} applied:	Yes
Earthquake magnitude M_w:	8.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	1.06	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	200.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

Leighton
038.0000020707

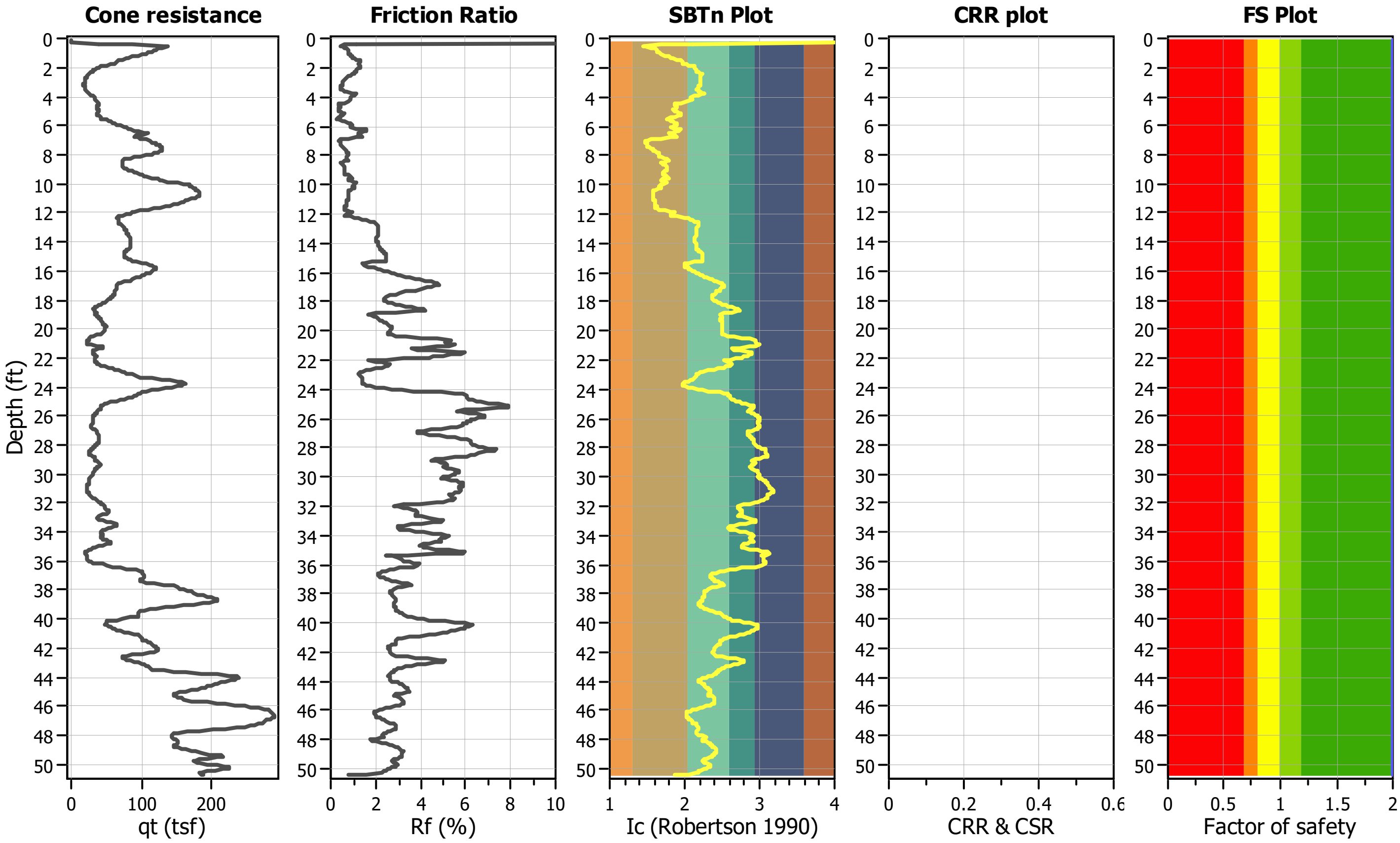
LIQUEFACTION ANALYSIS REPORT

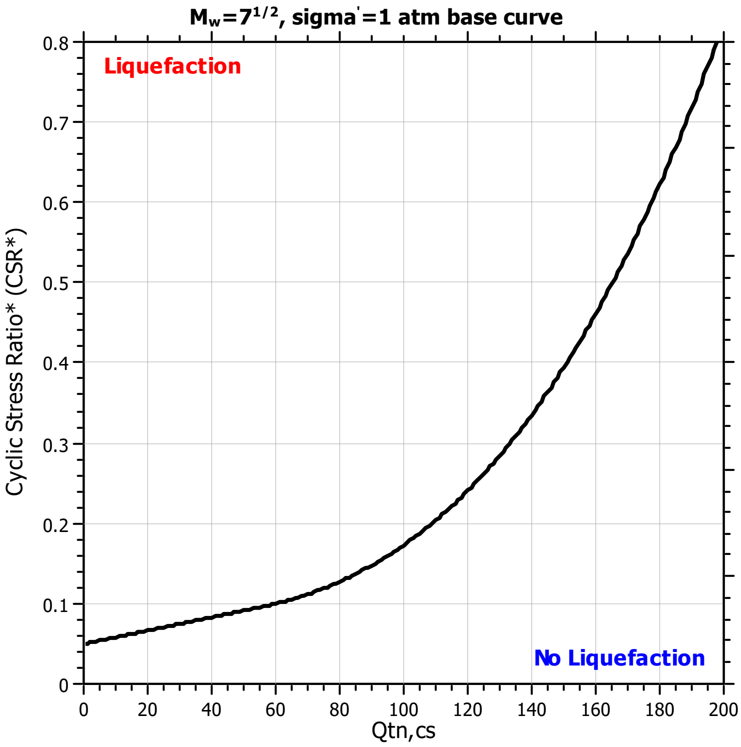
Project title : Colton Middle School Pavilion and Admin **Location : Colton California**

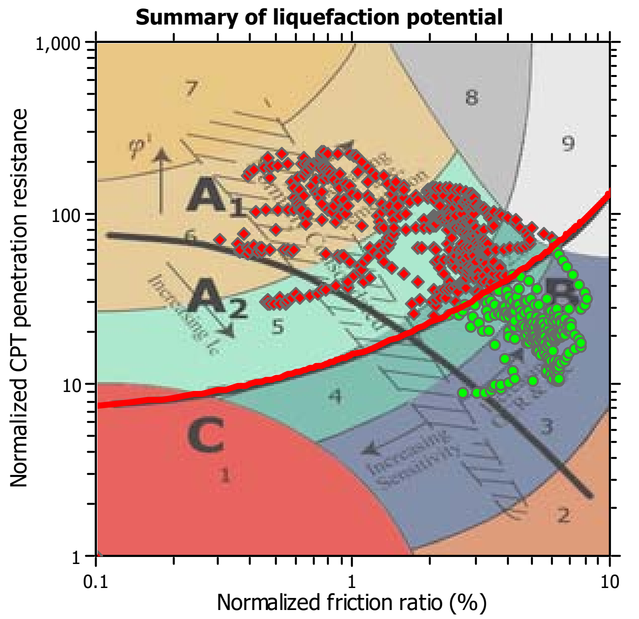
CPT file : CPT-2

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	200.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	100.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	50.00 ft
Earthquake magnitude M_w:	8.10	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	1.06	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

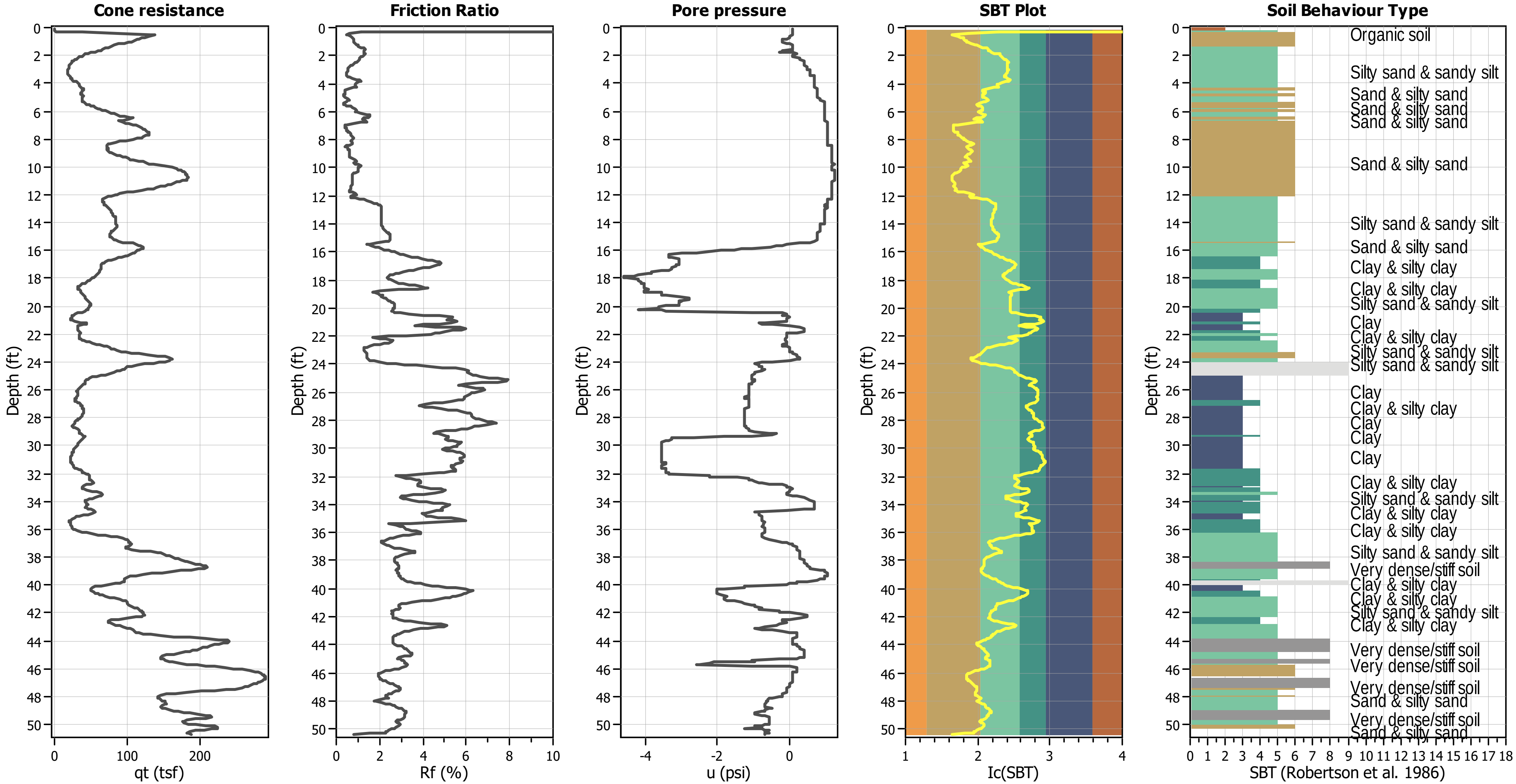






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



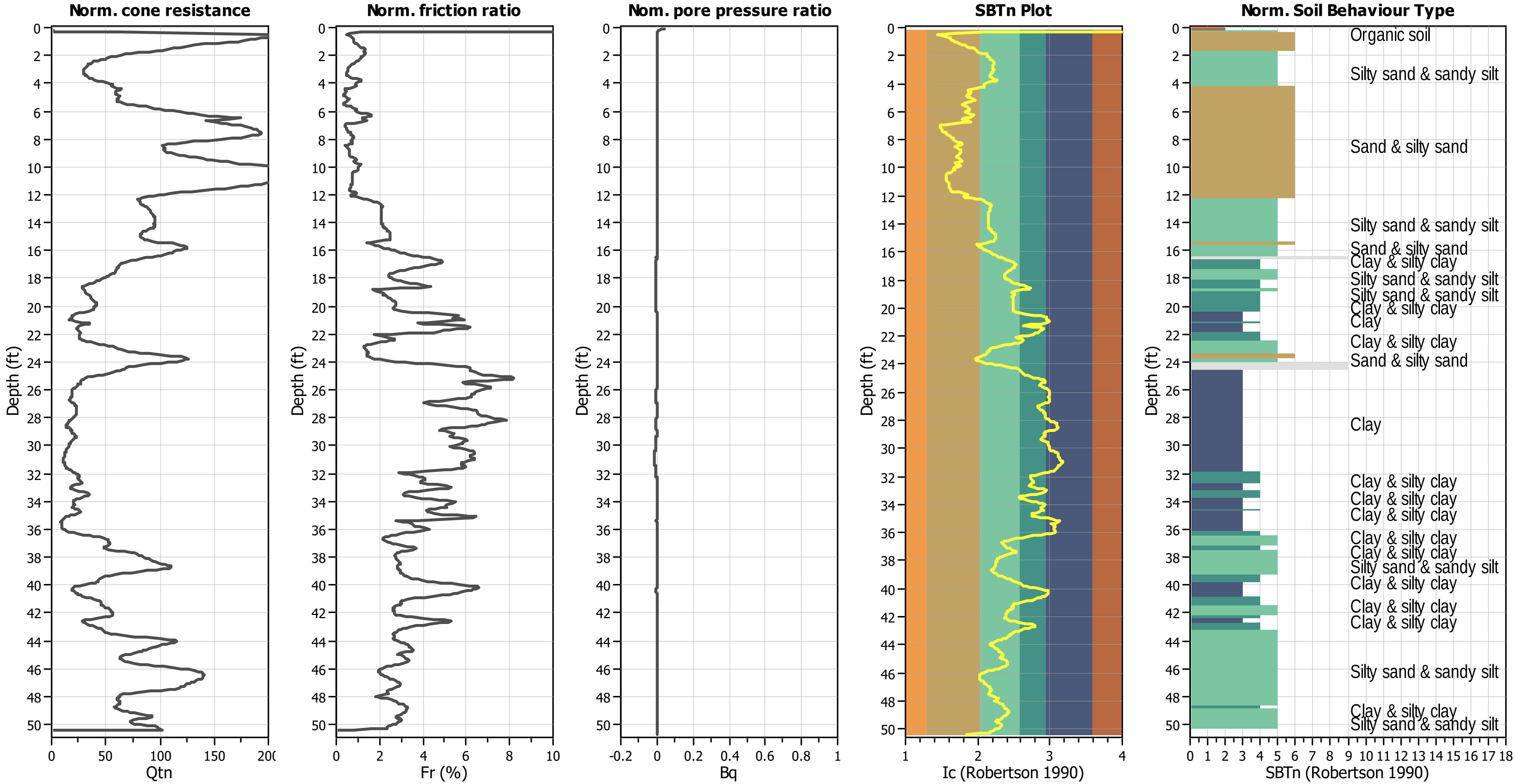
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	100.00 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:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	8.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	1.06	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	200.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

SBT legend

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

CPT basic interpretation plots (normalized)



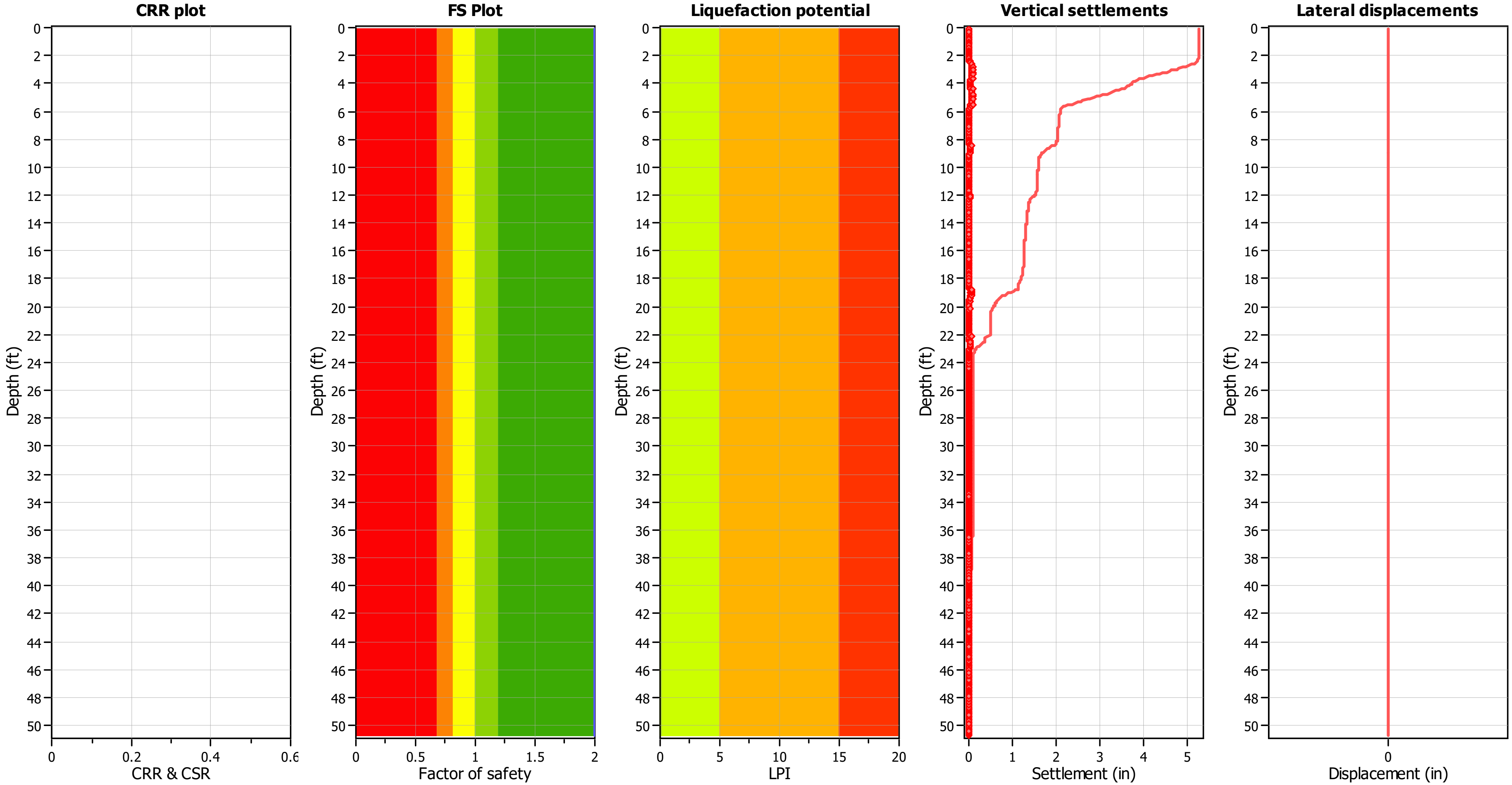
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	100.00 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:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	8.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	1.06	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	200.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

SBTn legend

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	100.00 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:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	8.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	1.06	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	200.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

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

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

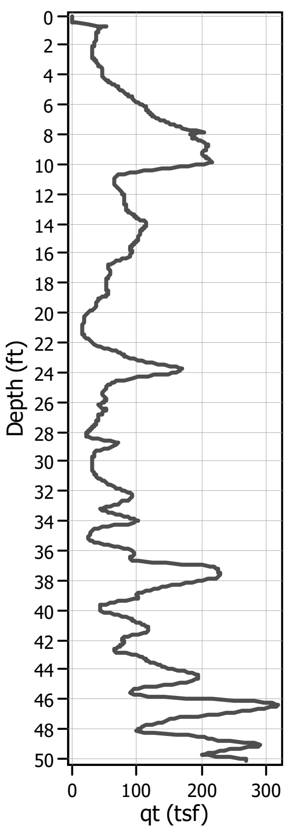
LIQUEFACTION ANALYSIS REPORT

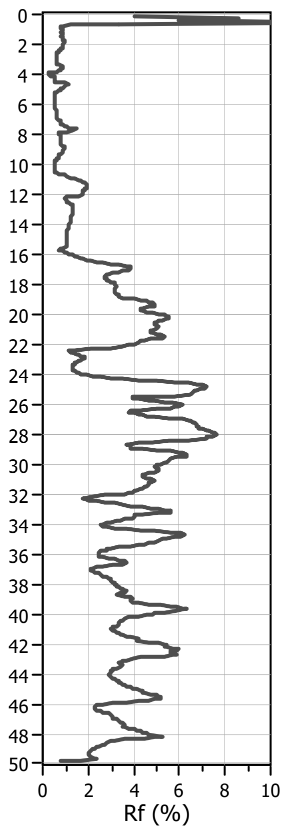
Project title : Colton Middle School Pavilion and Admin **Location : Colton California**

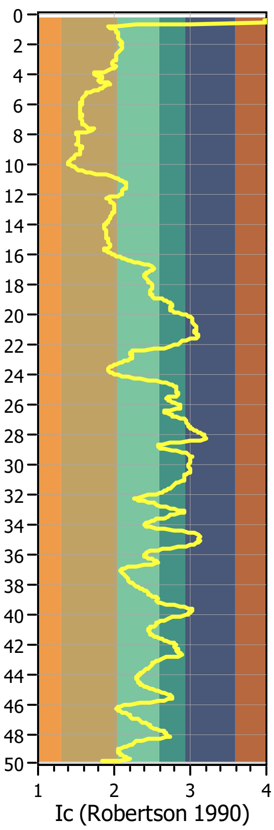
CPT file : CPT-3

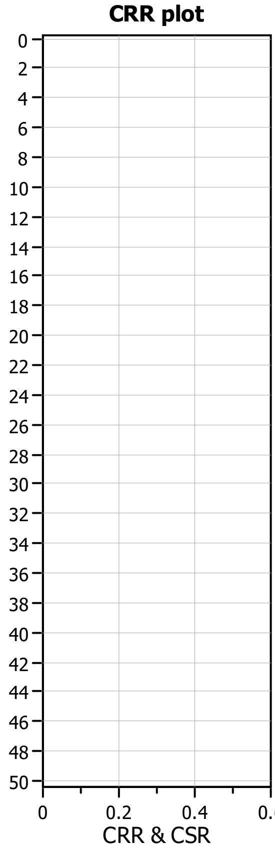
Input parameters and analysis data

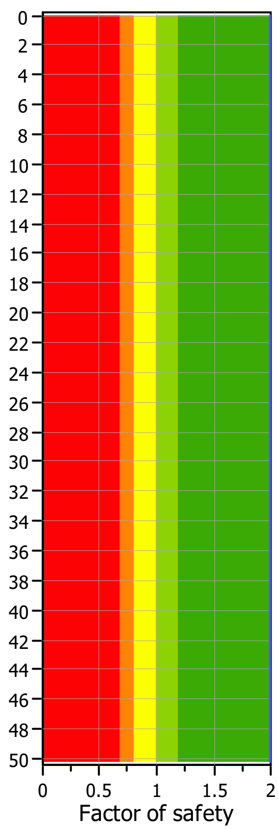
Analysis method:	NCEER (1998)	G.W.T. (in-situ):	200.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	100.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	50.00 ft
Earthquake magnitude M_w:	8.10	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	1.06	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

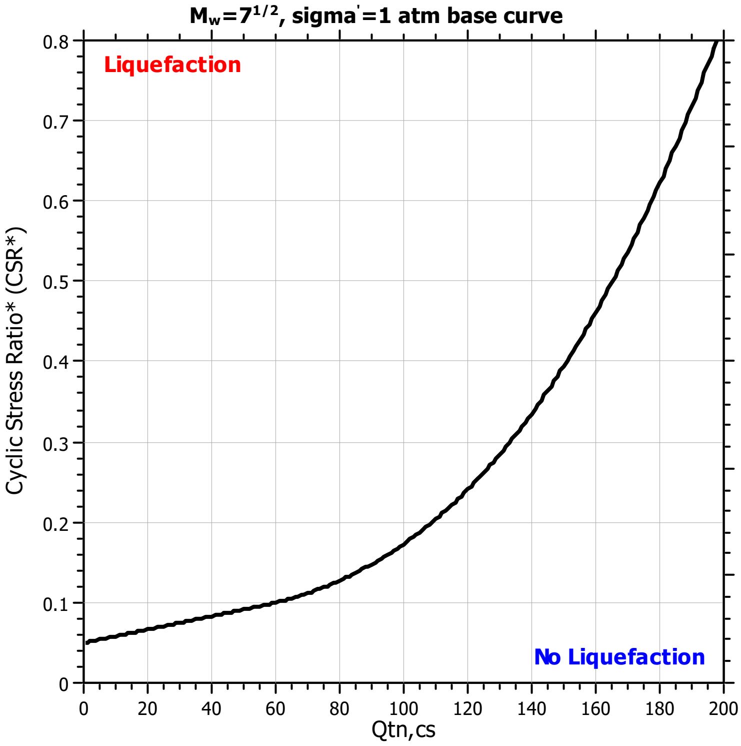


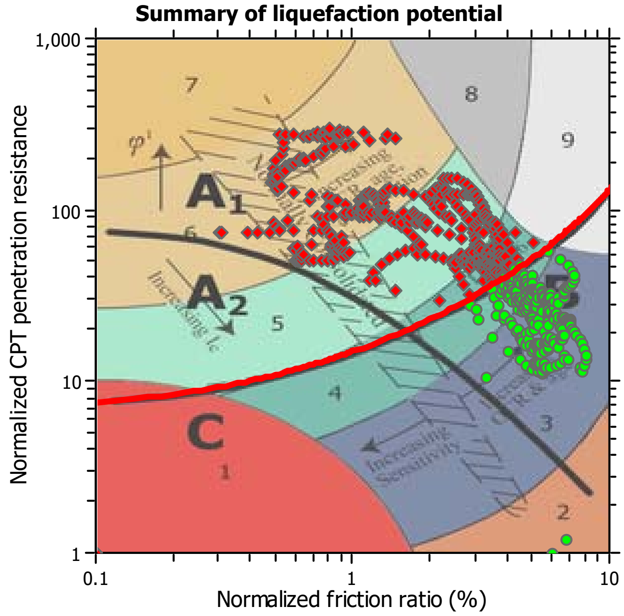






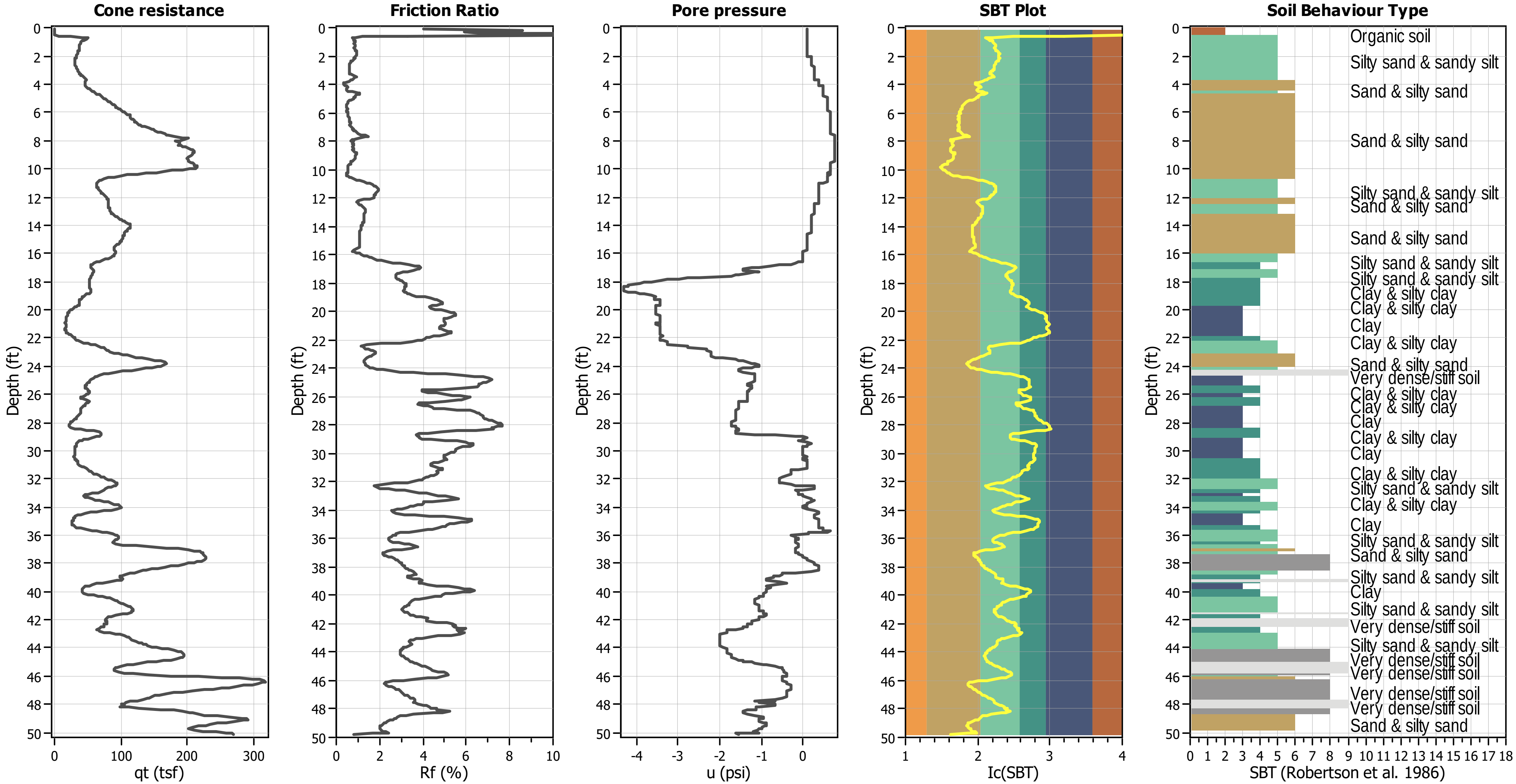






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



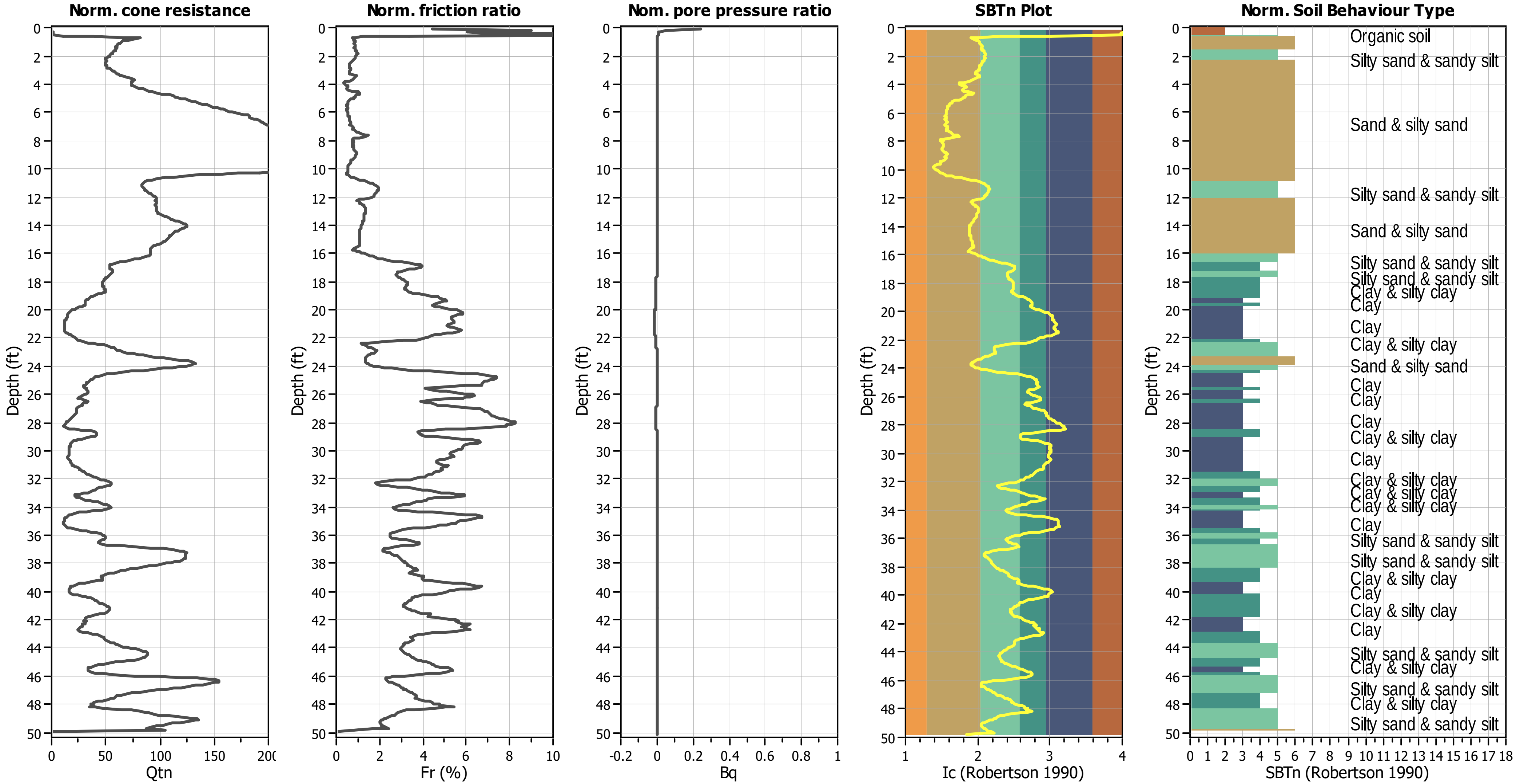
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	100.00 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:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	8.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	1.06	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	200.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

SBT legend

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

CPT basic interpretation plots (normalized)



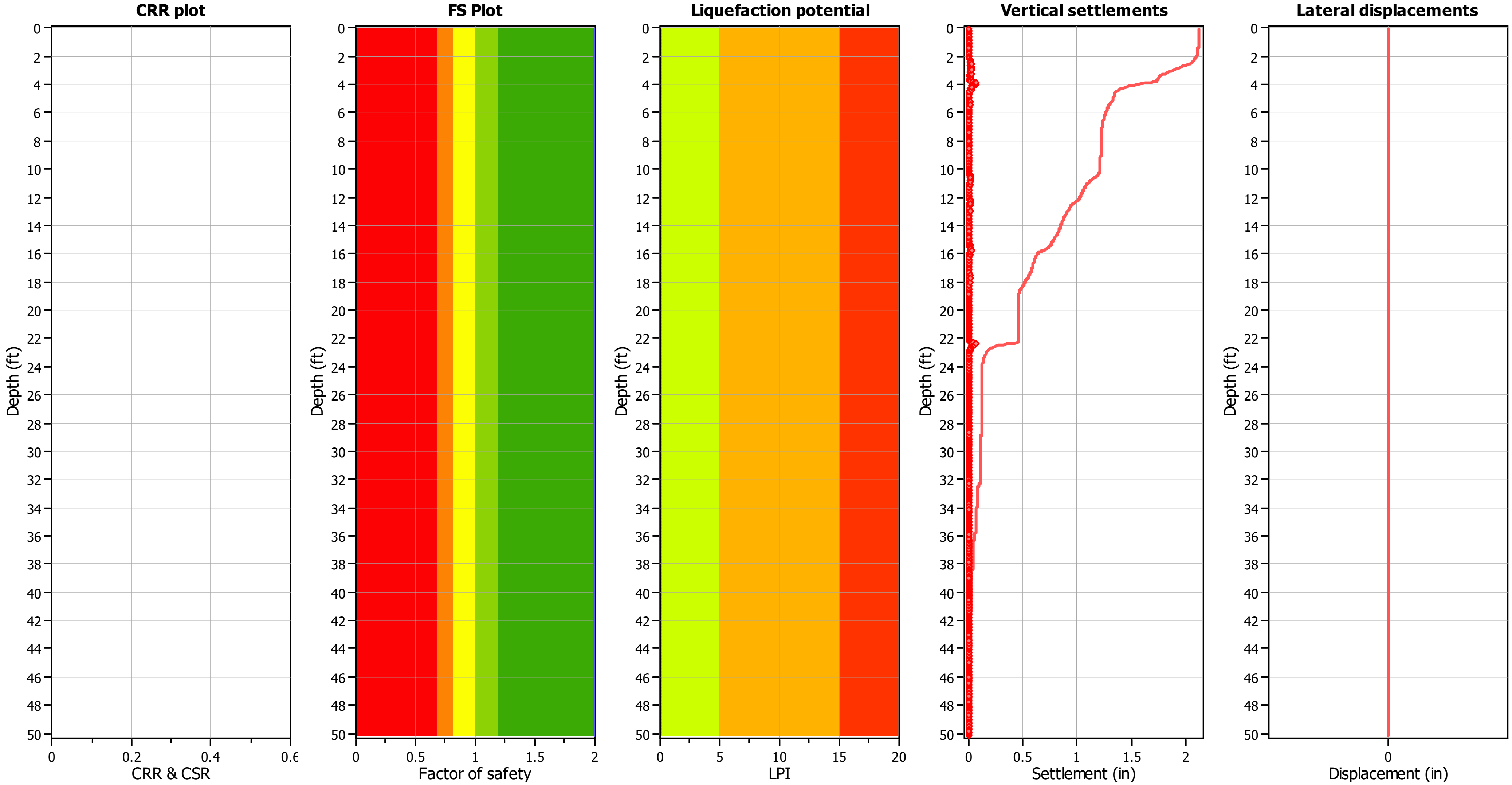
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	100.00 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:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	8.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	1.06	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	200.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

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 (erthq.):	100.00 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:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	8.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	1.06	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	200.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

Leighton
038.0000020707

LIQUEFACTION ANALYSIS REPORT

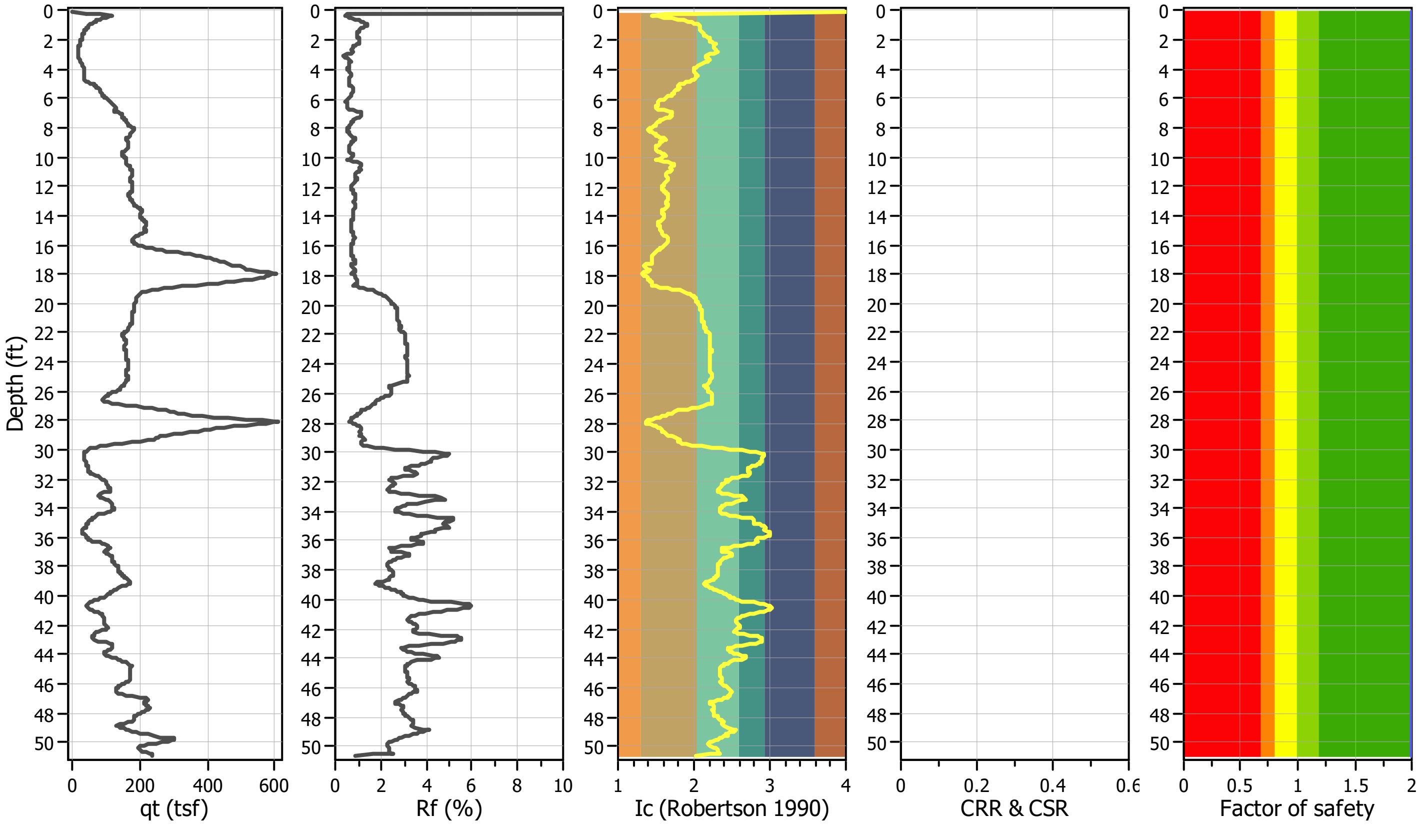
Project title : Colton Middle School Pavilion and Admin **Location : Colton California**

CPT file : CPT-4

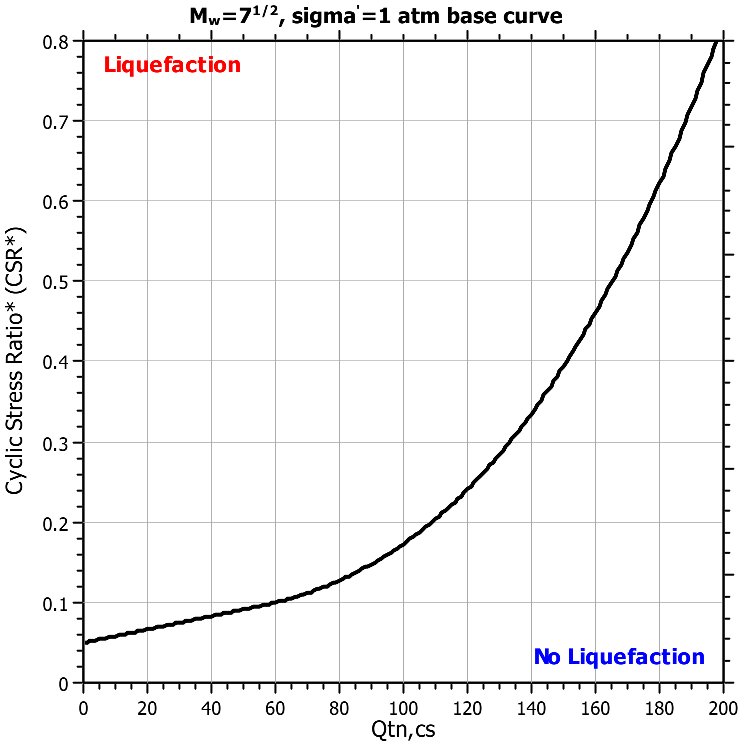
Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	200.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	100.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	50.00 ft
Earthquake magnitude M_w:	8.10	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	1.06	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

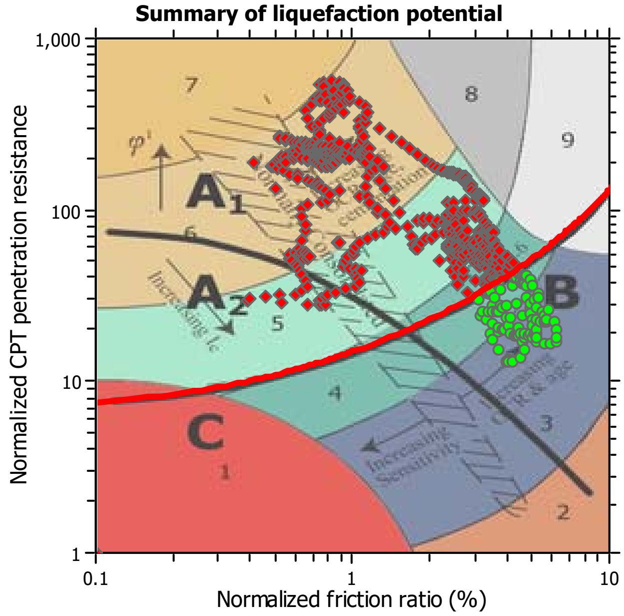
Cone resistance **Friction Ratio** **SBTn Plot** **CRR plot** **FS Plot**



M_w=7$^{1/2}$, sigma'=1 atm base curve

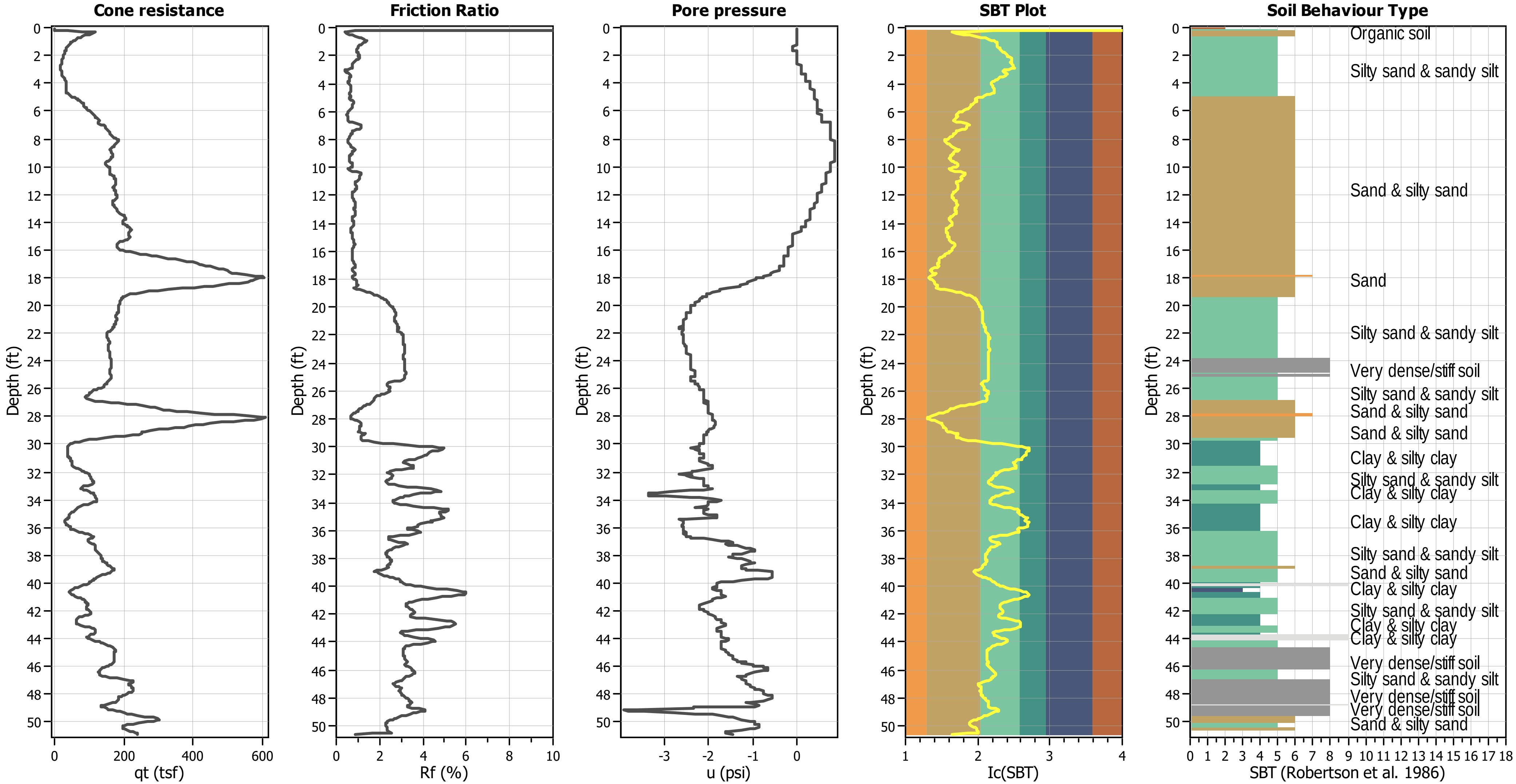


Summary of liquefaction potential



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

CPT basic interpretation plots



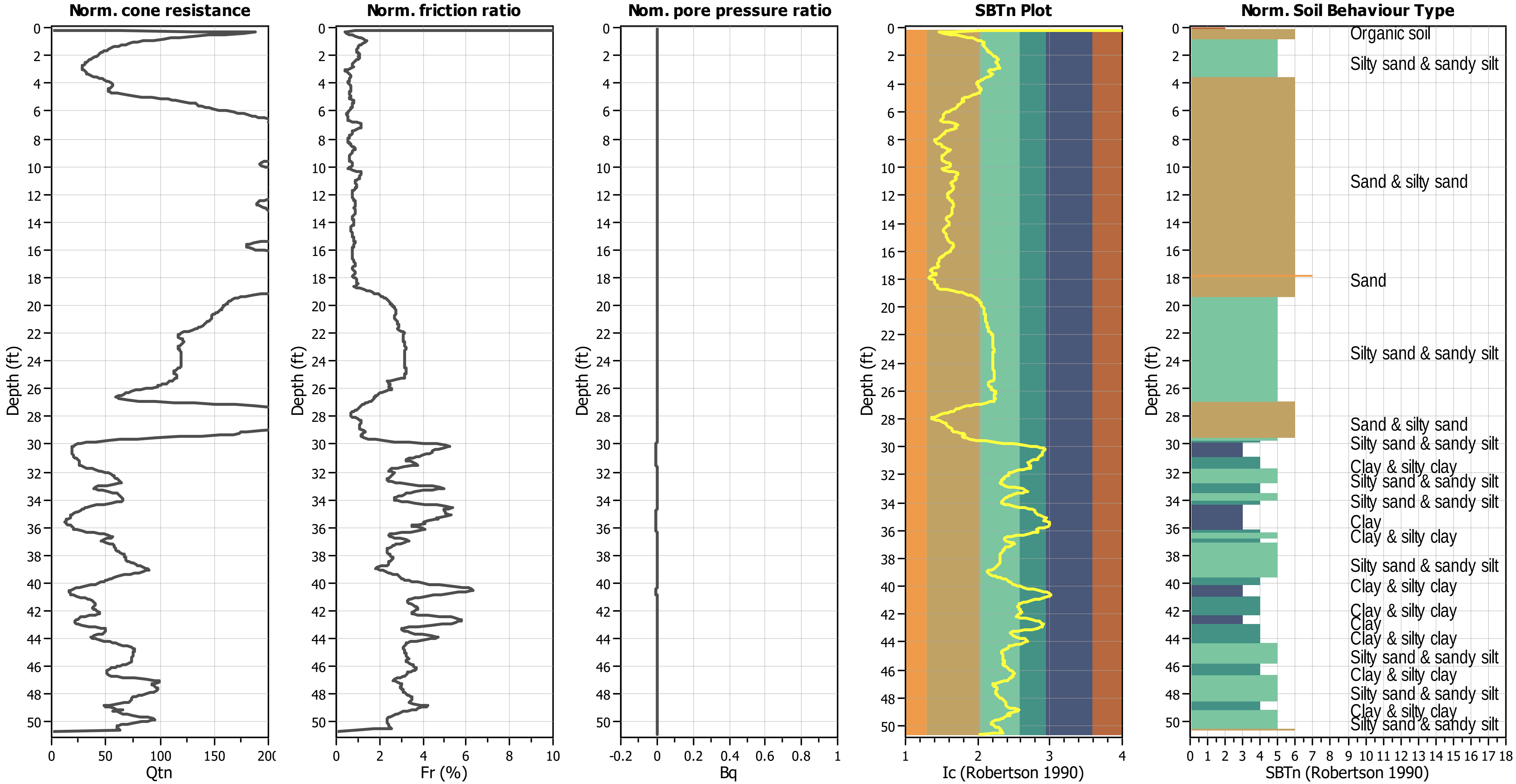
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	100.00 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:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	8.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	1.06	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	200.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

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)



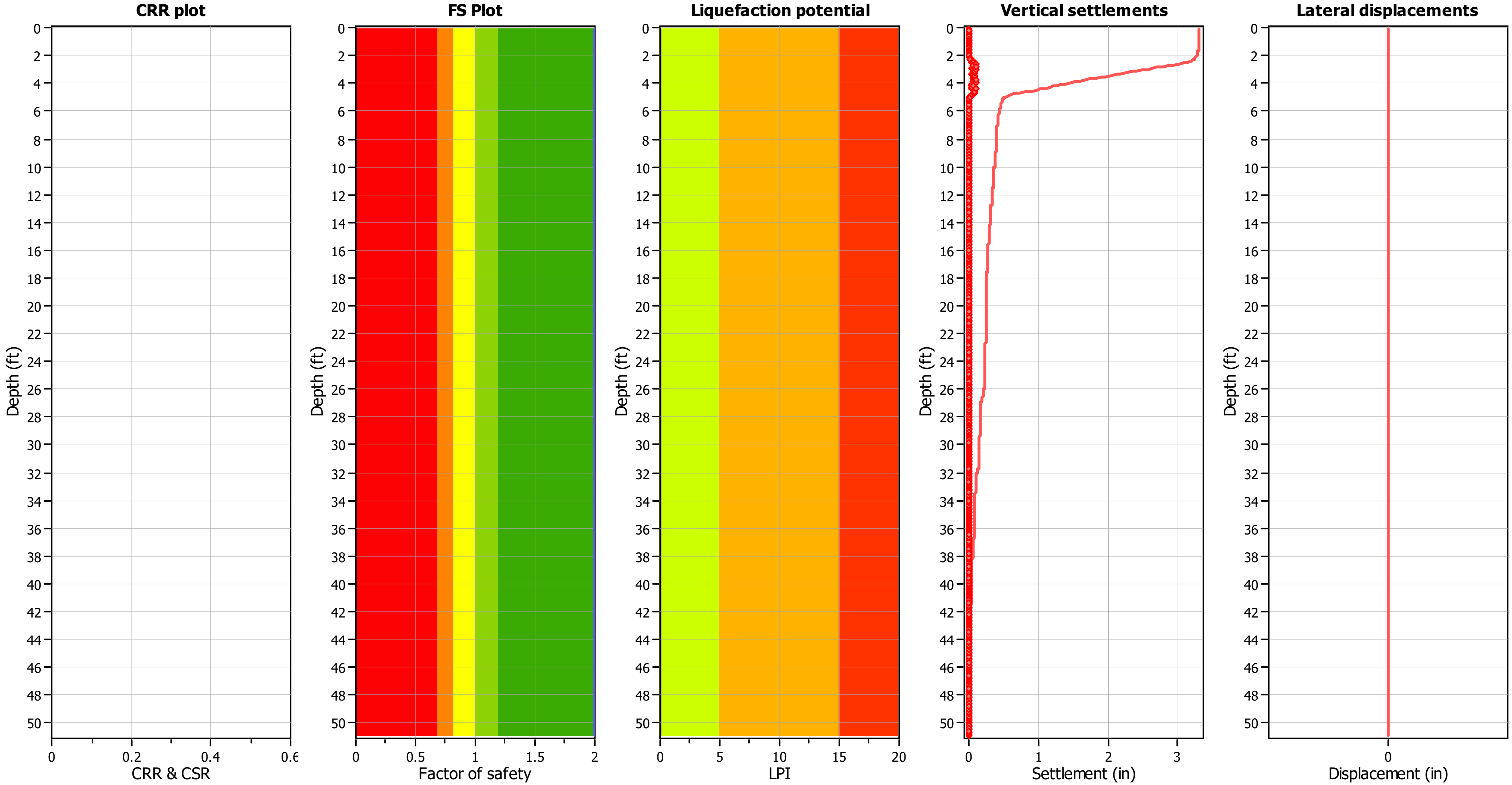
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	100.00 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:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	8.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	1.06	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	200.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

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 (erthq.):	100.00 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:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	8.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	1.06	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	200.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

Leighton
038.0000020707

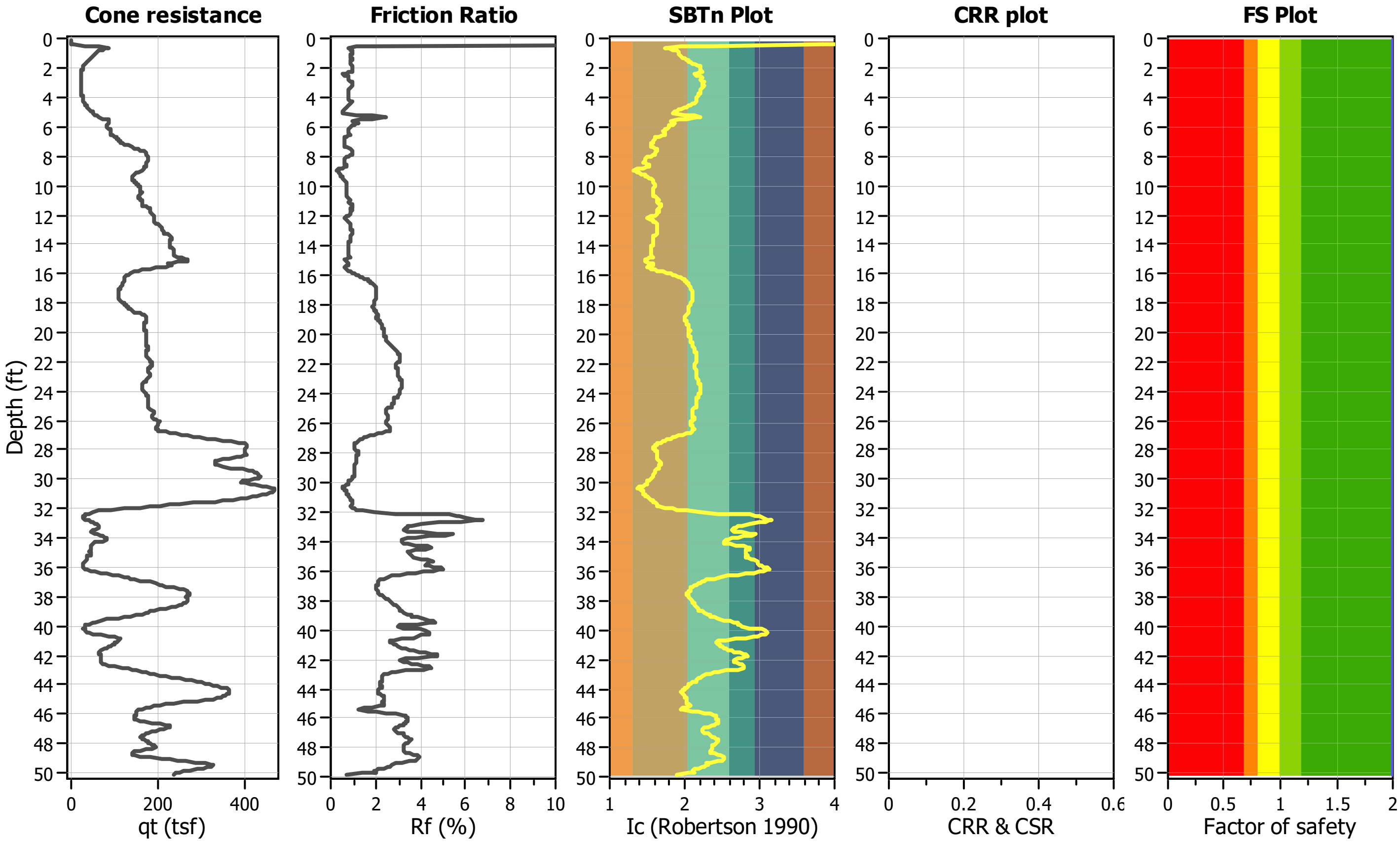
LIQUEFACTION ANALYSIS REPORT

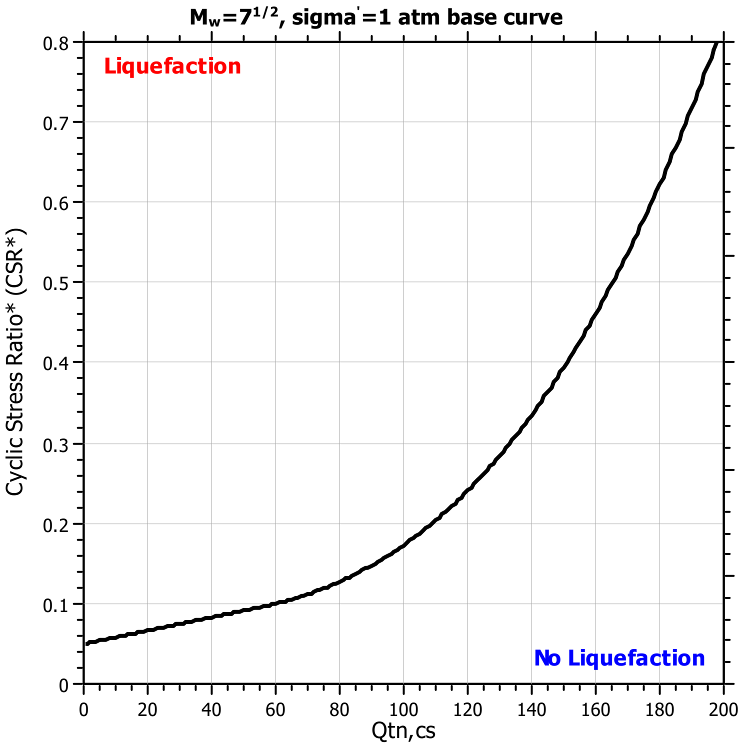
Project title : Colton Middle School Pavilion and Admin **Location : Colton California**

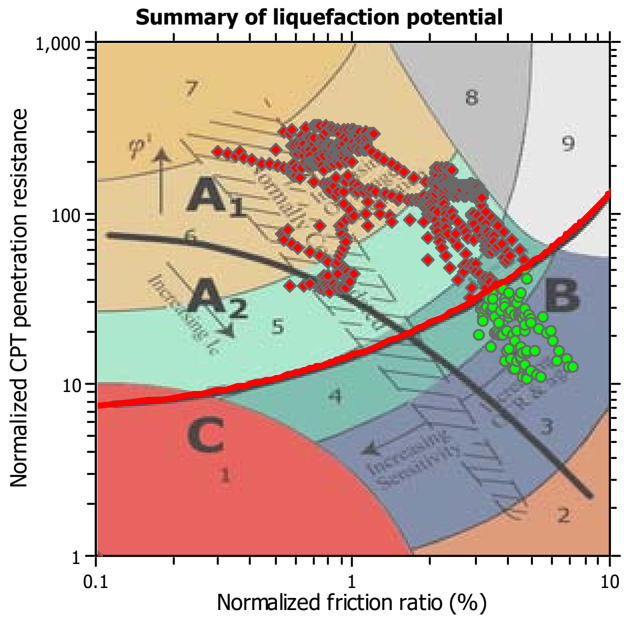
CPT file : CPT-5

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	200.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	100.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	50.00 ft
Earthquake magnitude M_w:	8.10	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	1.06	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

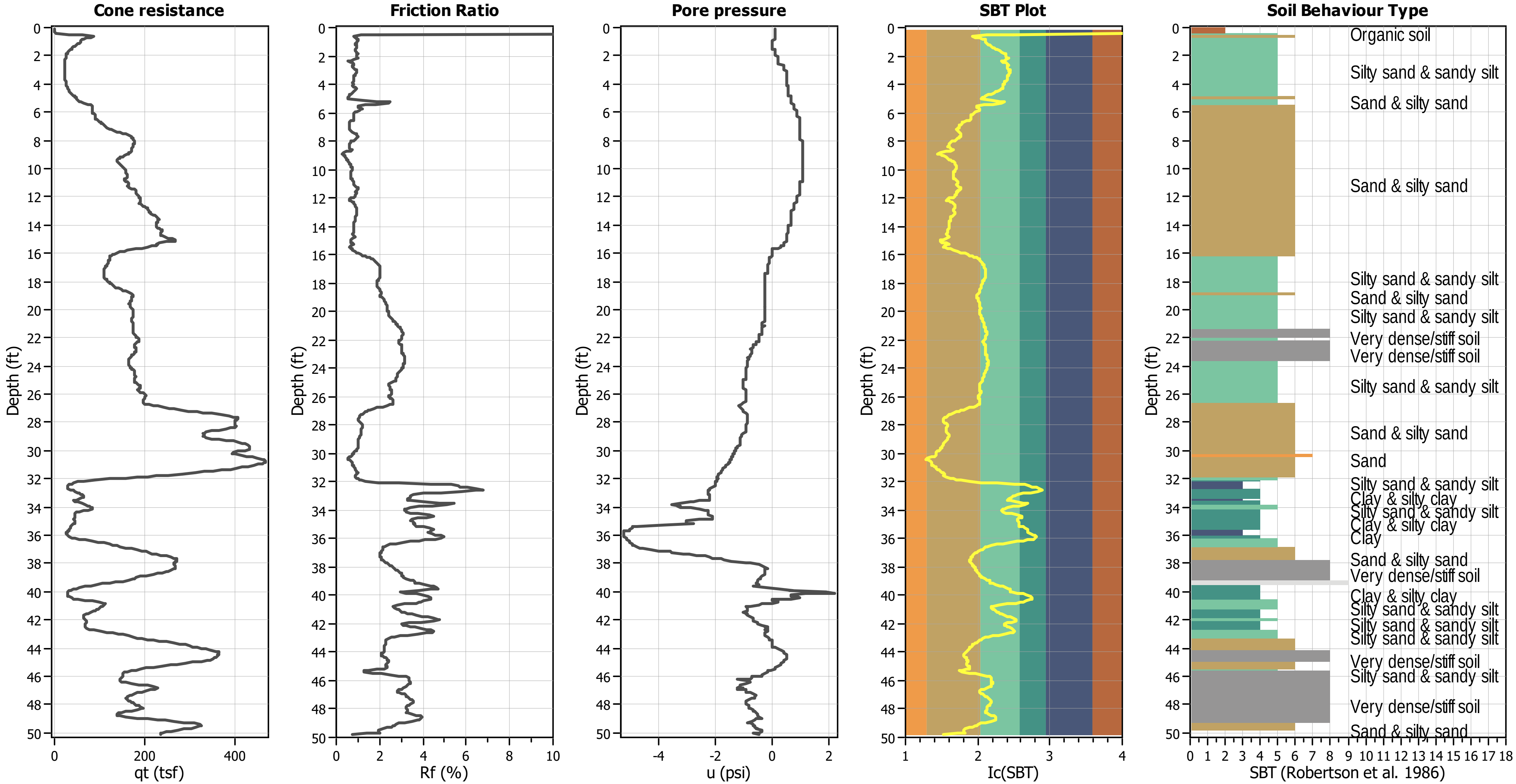






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



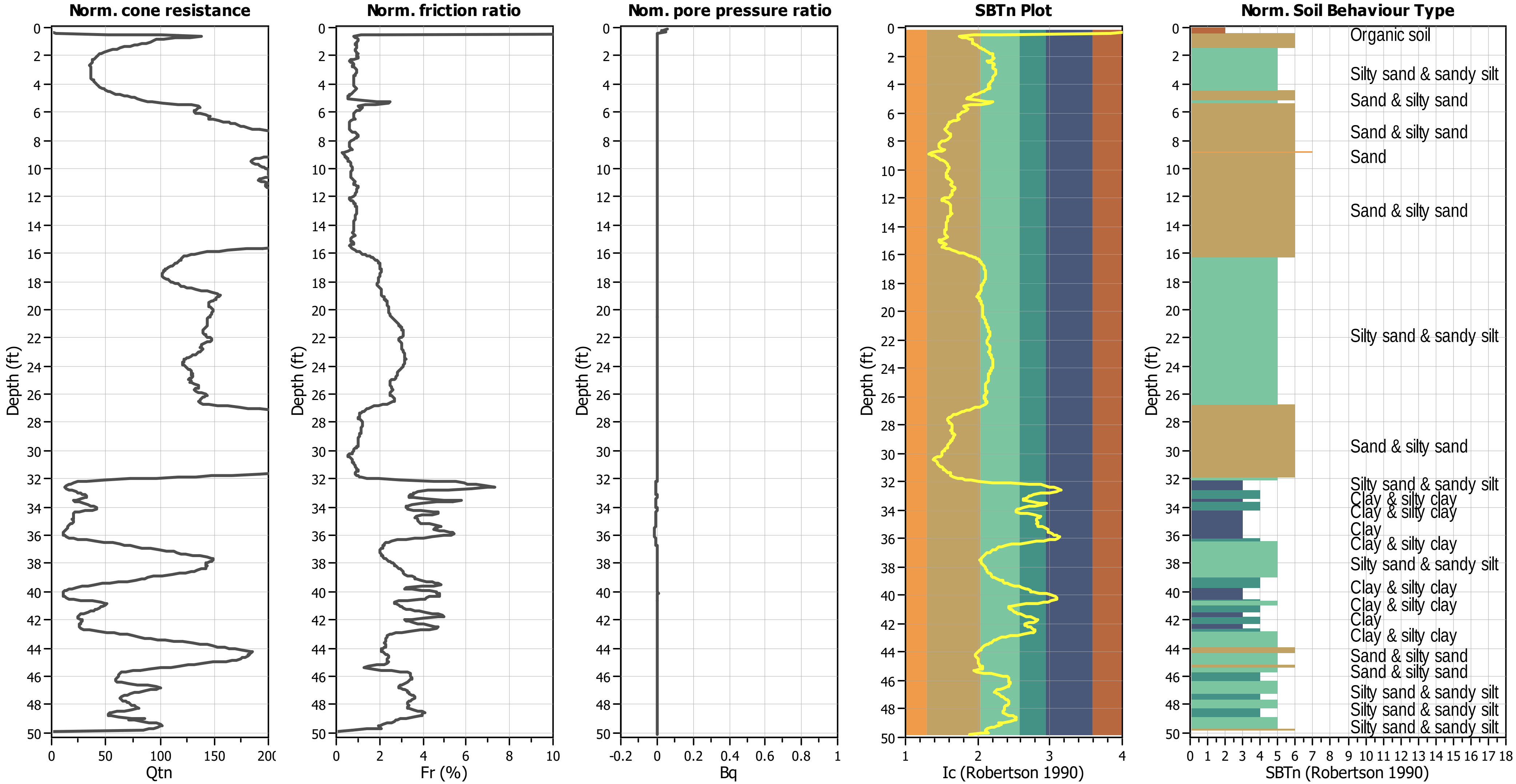
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	100.00 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:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	8.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	1.06	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	200.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

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)



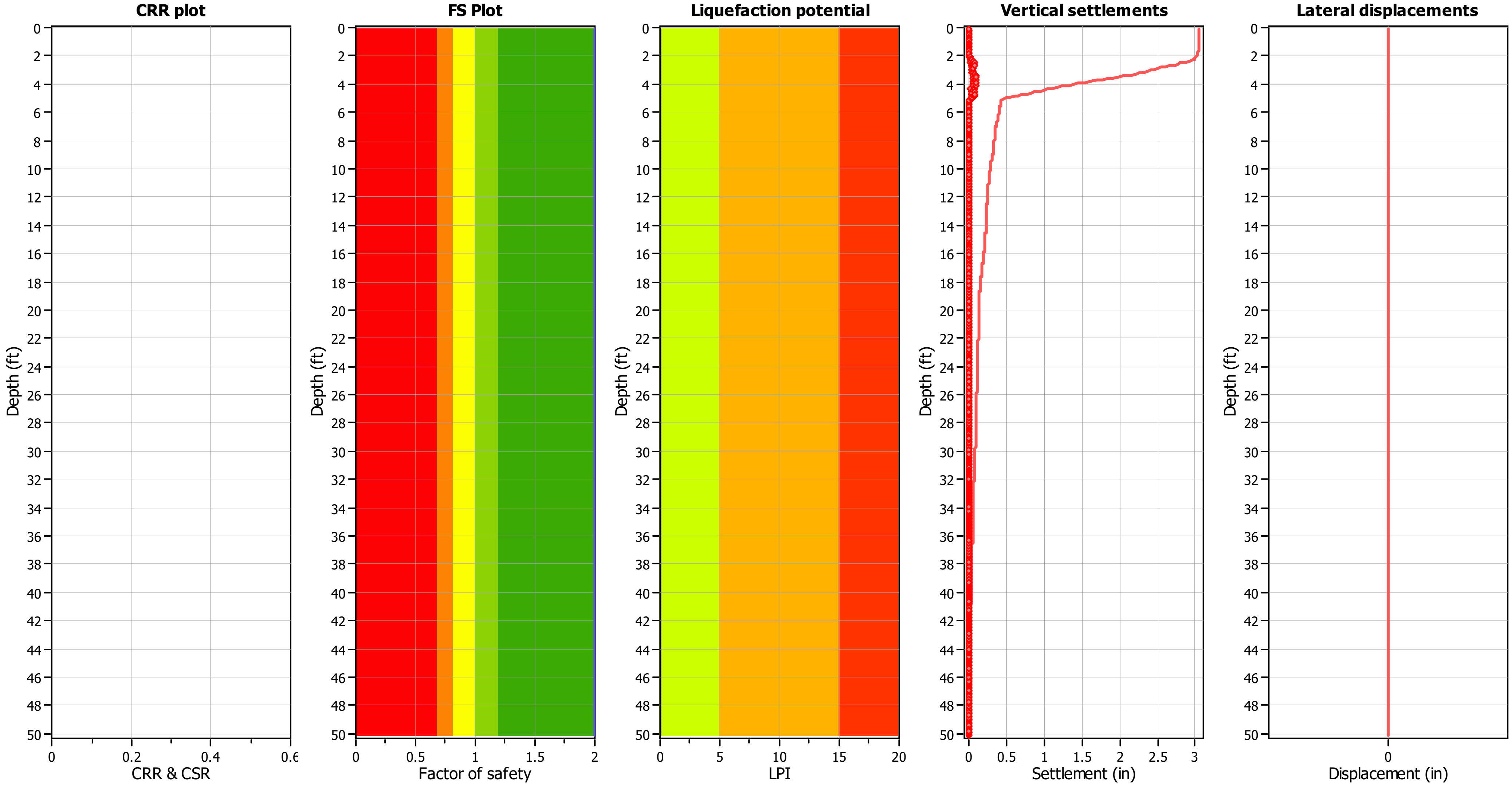
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	100.00 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:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	8.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	1.06	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	200.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

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 (erthq.):	100.00 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:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	8.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	1.06	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	200.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

Leighton
038.0000020707

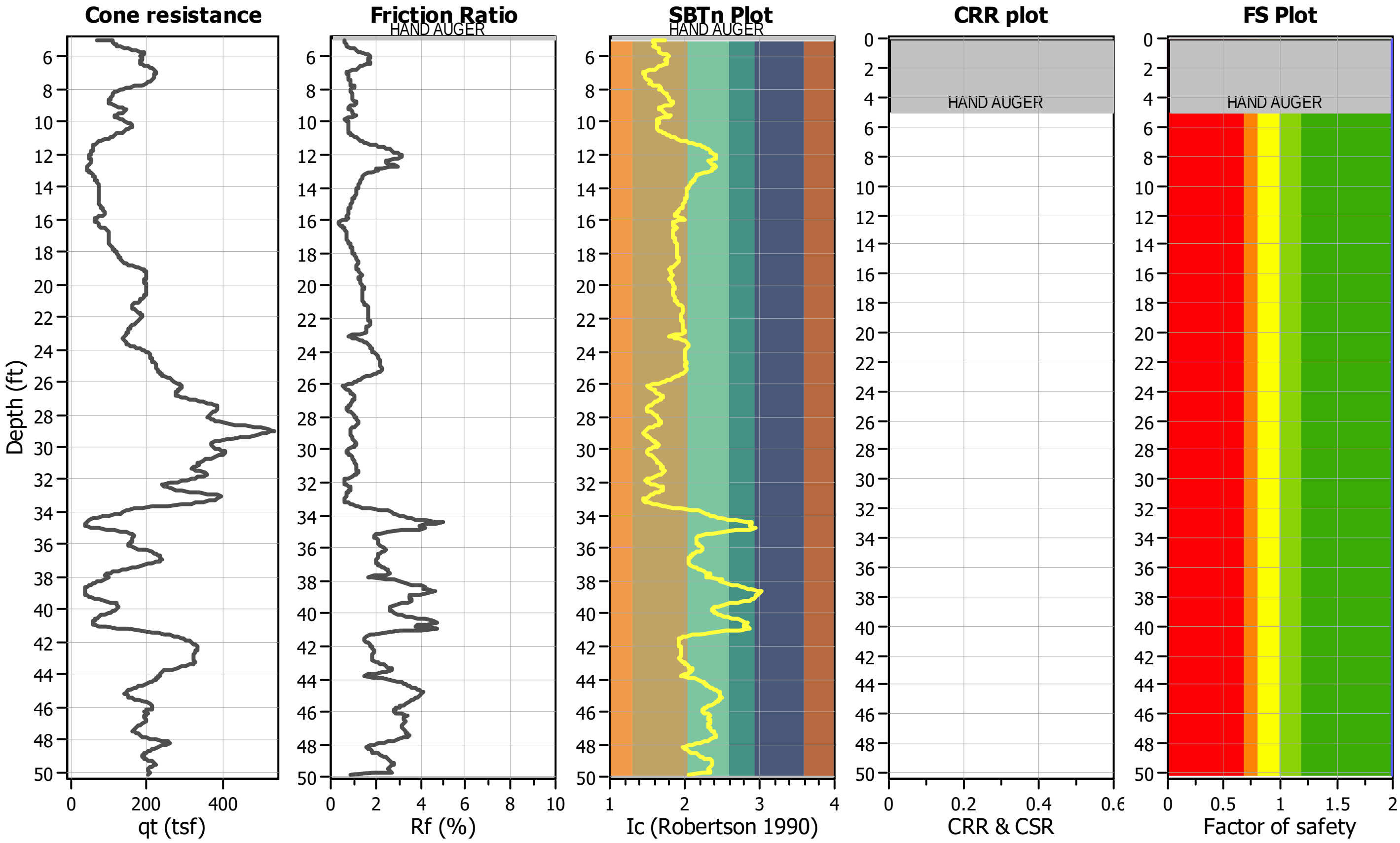
LIQUEFACTION ANALYSIS REPORT

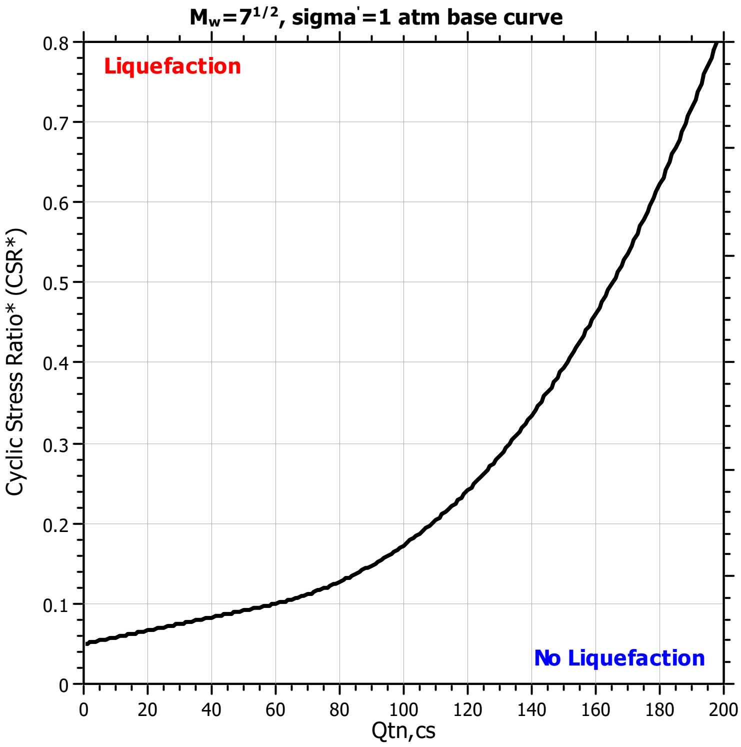
Project title : Colton Middle School Pavilion and Admin **Location : Colton California**

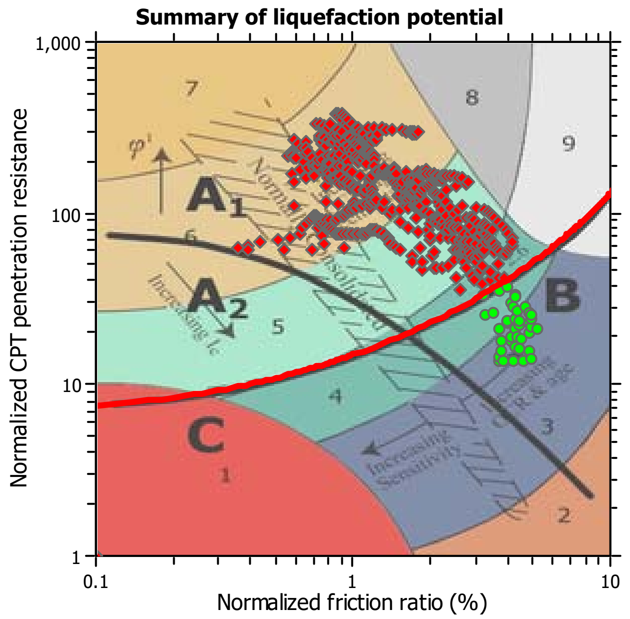
CPT file : CPT-6

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	200.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	100.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	50.00 ft
Earthquake magnitude M_w:	8.10	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	1.06	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

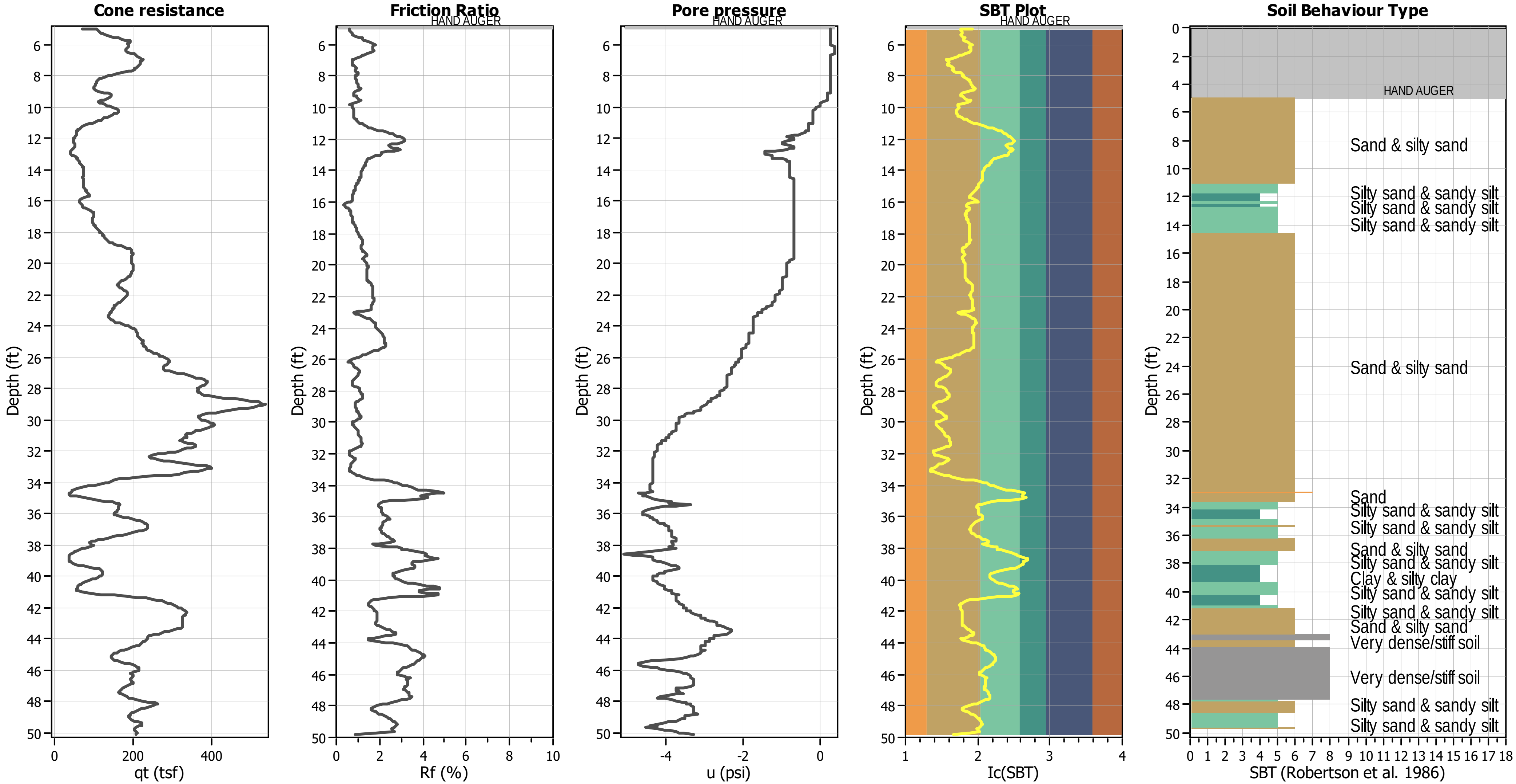






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



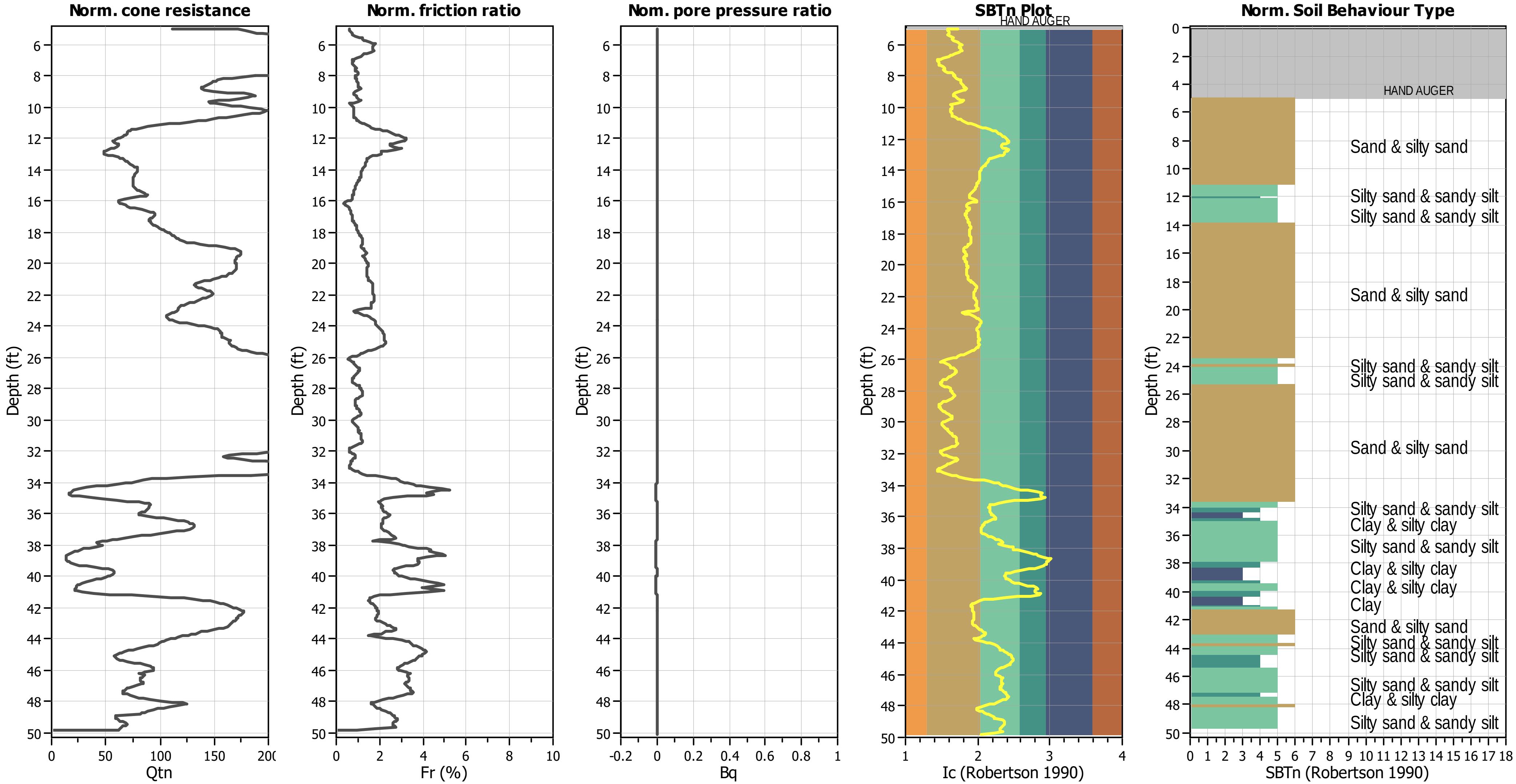
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	100.00 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:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	8.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	1.06	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	200.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

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)



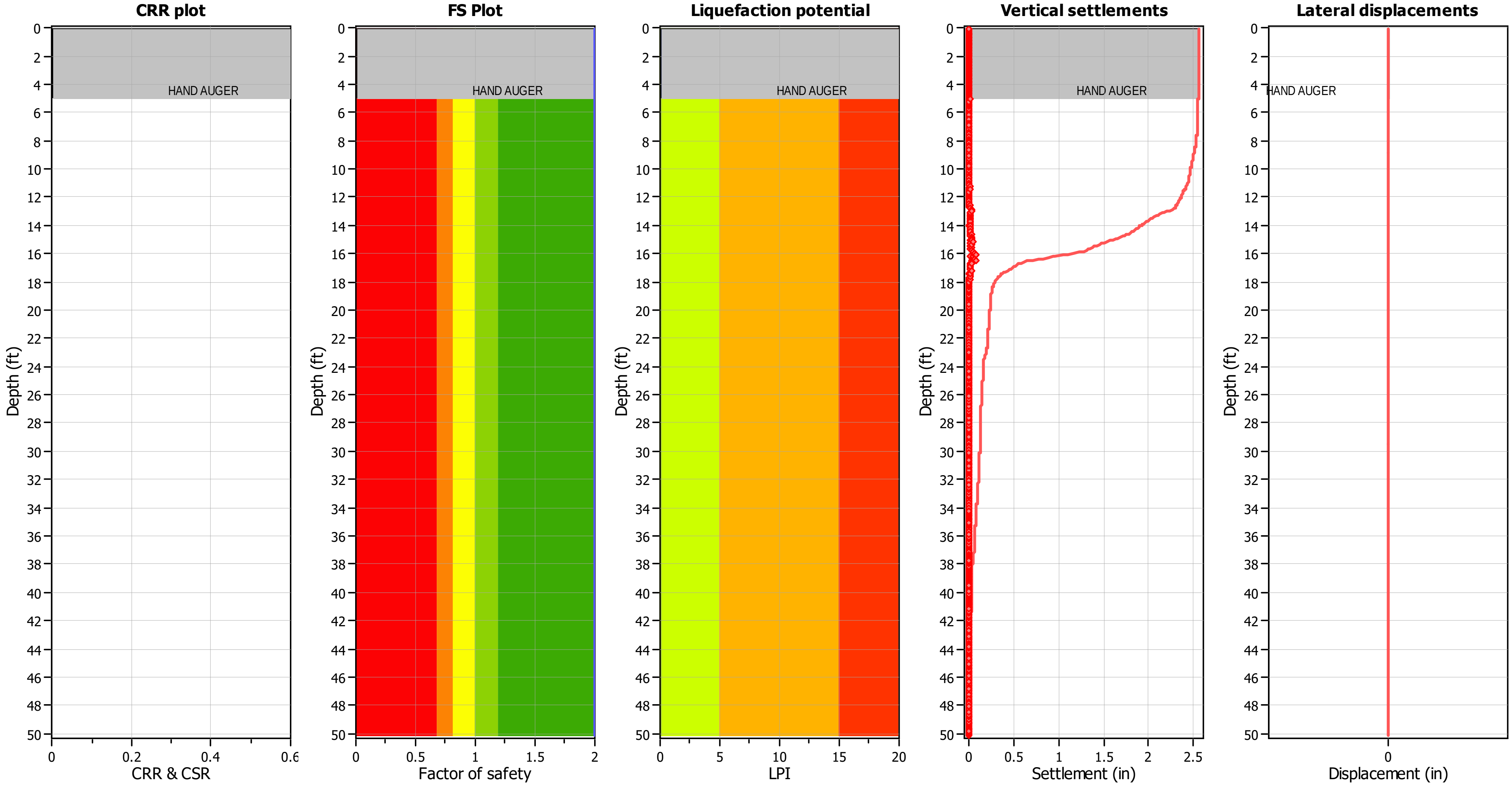
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	100.00 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:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	8.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	1.06	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	200.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

SBTn legend

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	100.00 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:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	8.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	1.06	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	200.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

Leighton
038.0000020707

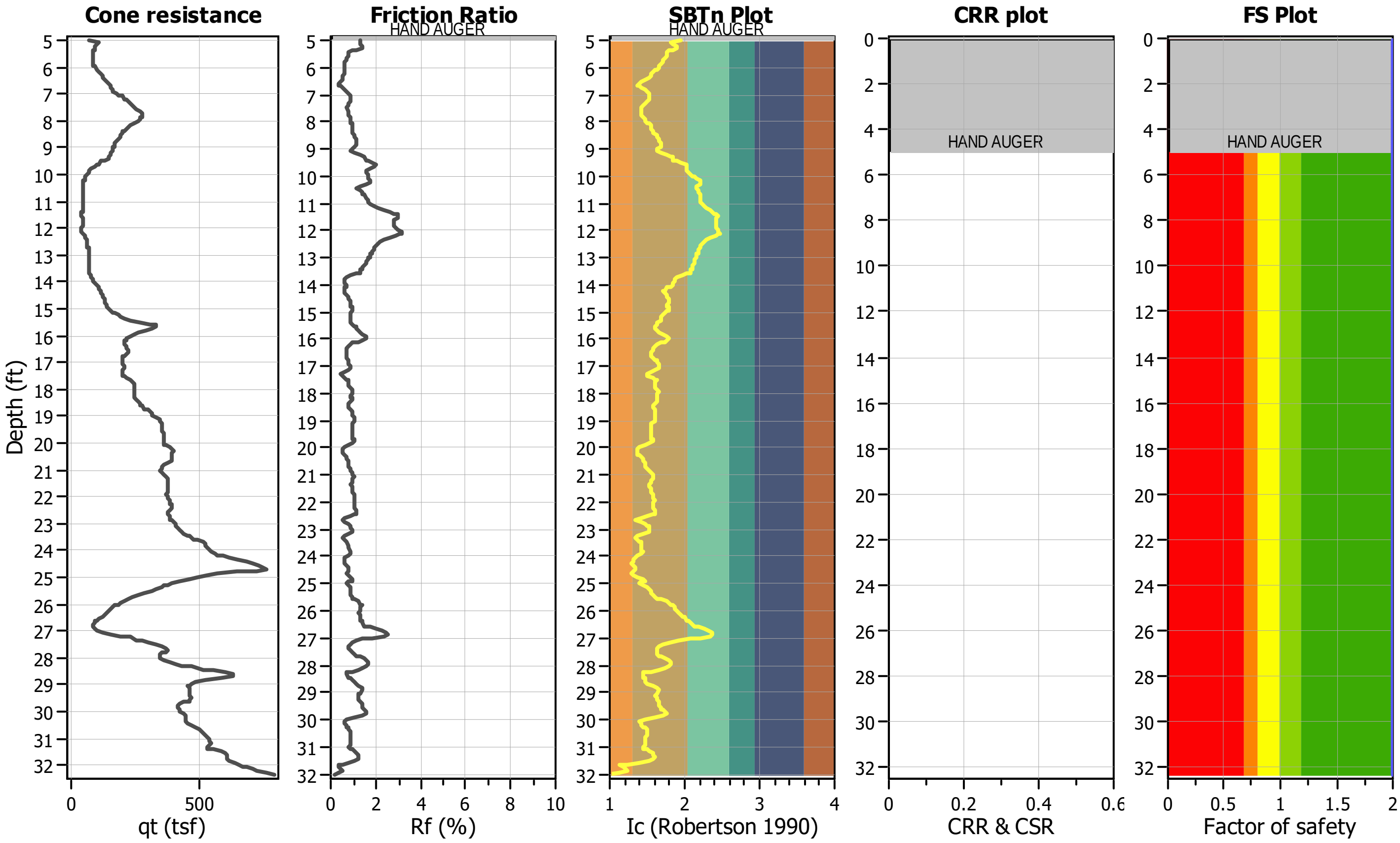
LIQUEFACTION ANALYSIS REPORT

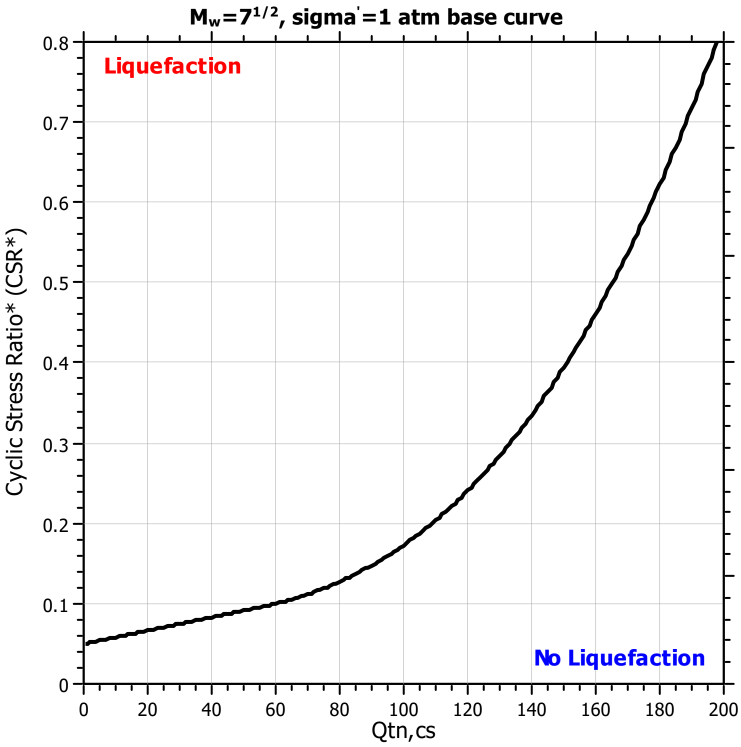
Project title : Colton Middle School Pavilion and Admin Building **Location : Colton California**

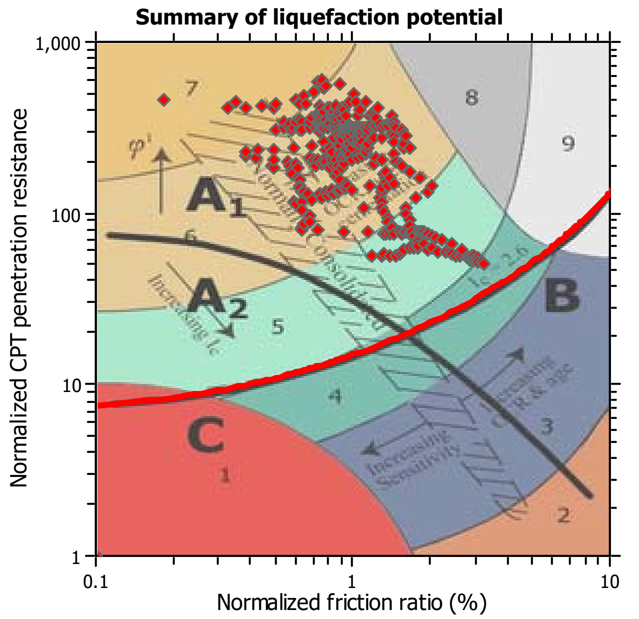
CPT file : CPT-7

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	200.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	100.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	50.00 ft
Earthquake magnitude M_w:	8.10	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	1.06	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

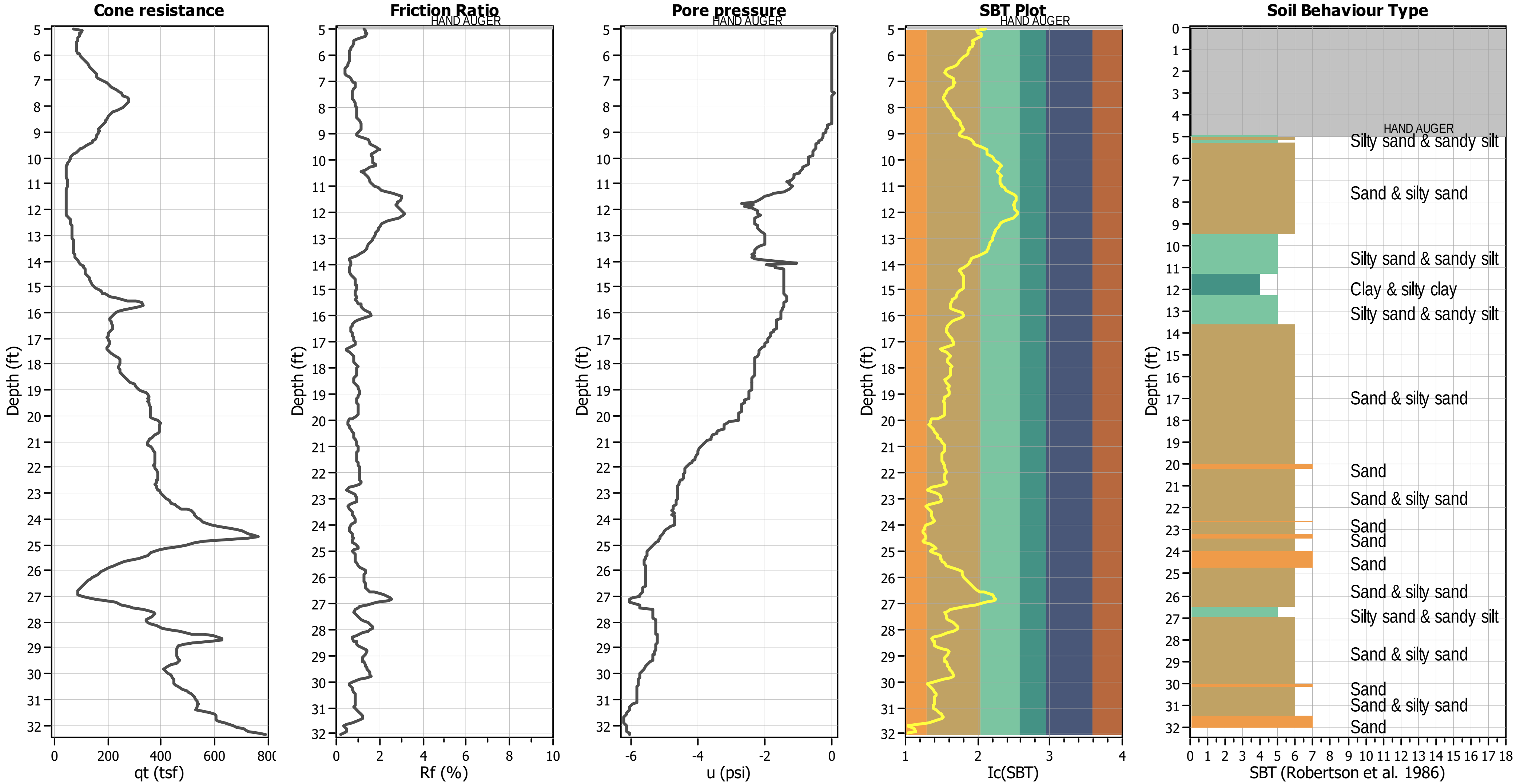






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



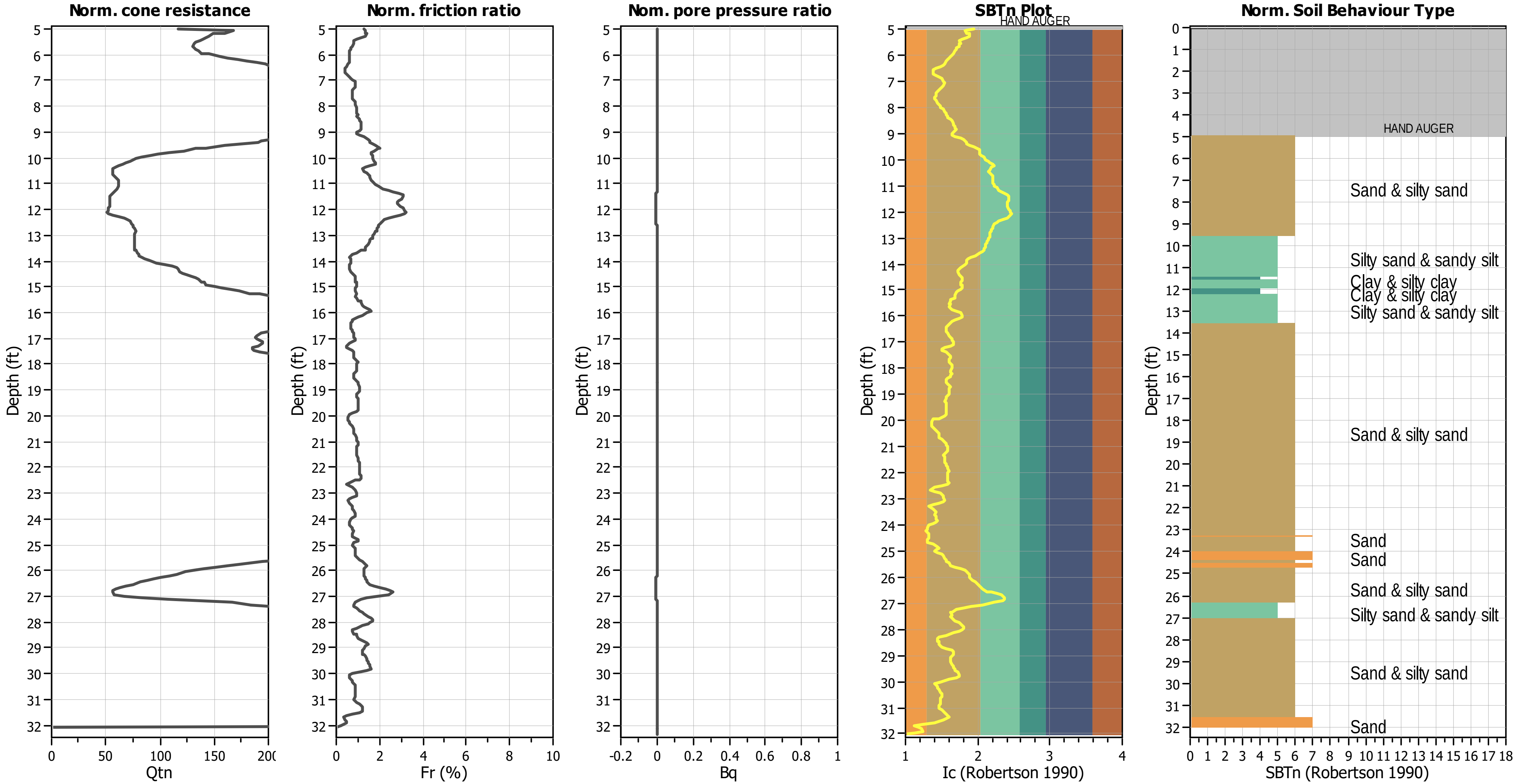
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	100.00 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:	2.60	K_{σ} applied:	Yes
Earthquake magnitude M_w:	8.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	1.06	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	200.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

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)



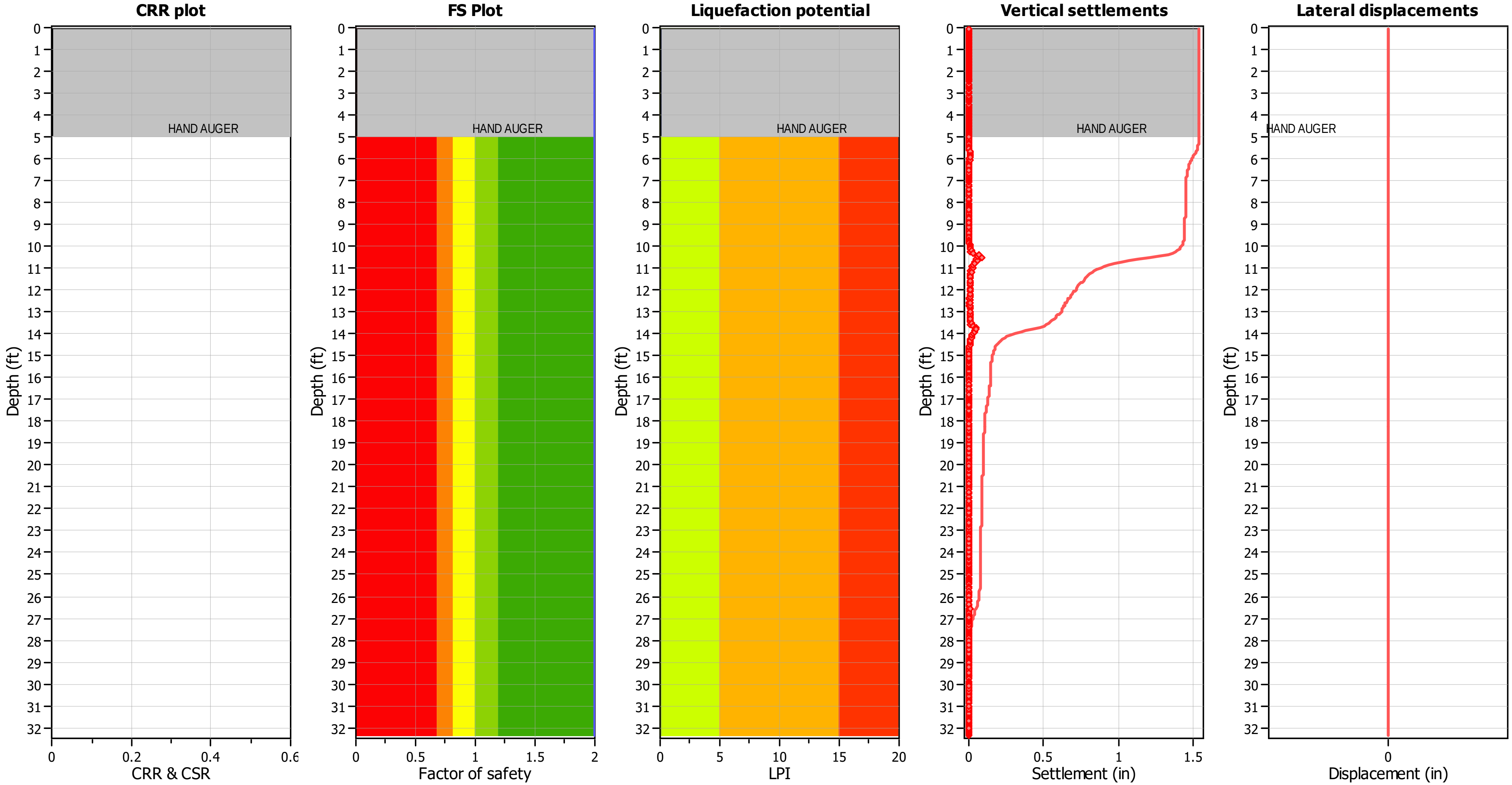
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	100.00 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:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	8.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	1.06	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	200.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

SBTn legend

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	100.00 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:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	8.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	1.06	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	200.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

F.S. color scheme

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

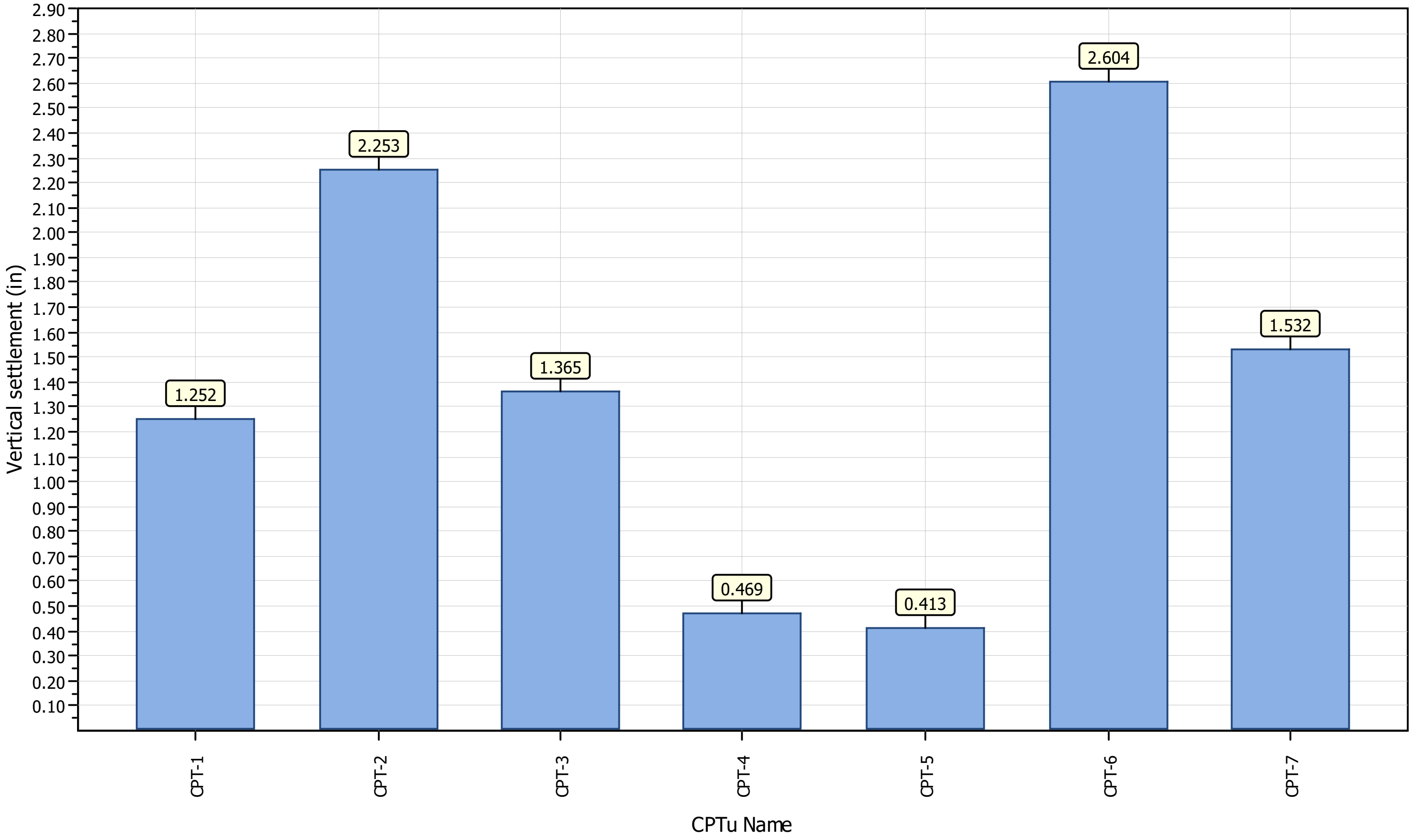
LPI color scheme

- Very high risk
- High risk
- Low risk

Project title : Colton Middle School Pavilion and Admin Building

Location : Colton California

Overall vertical settlements report



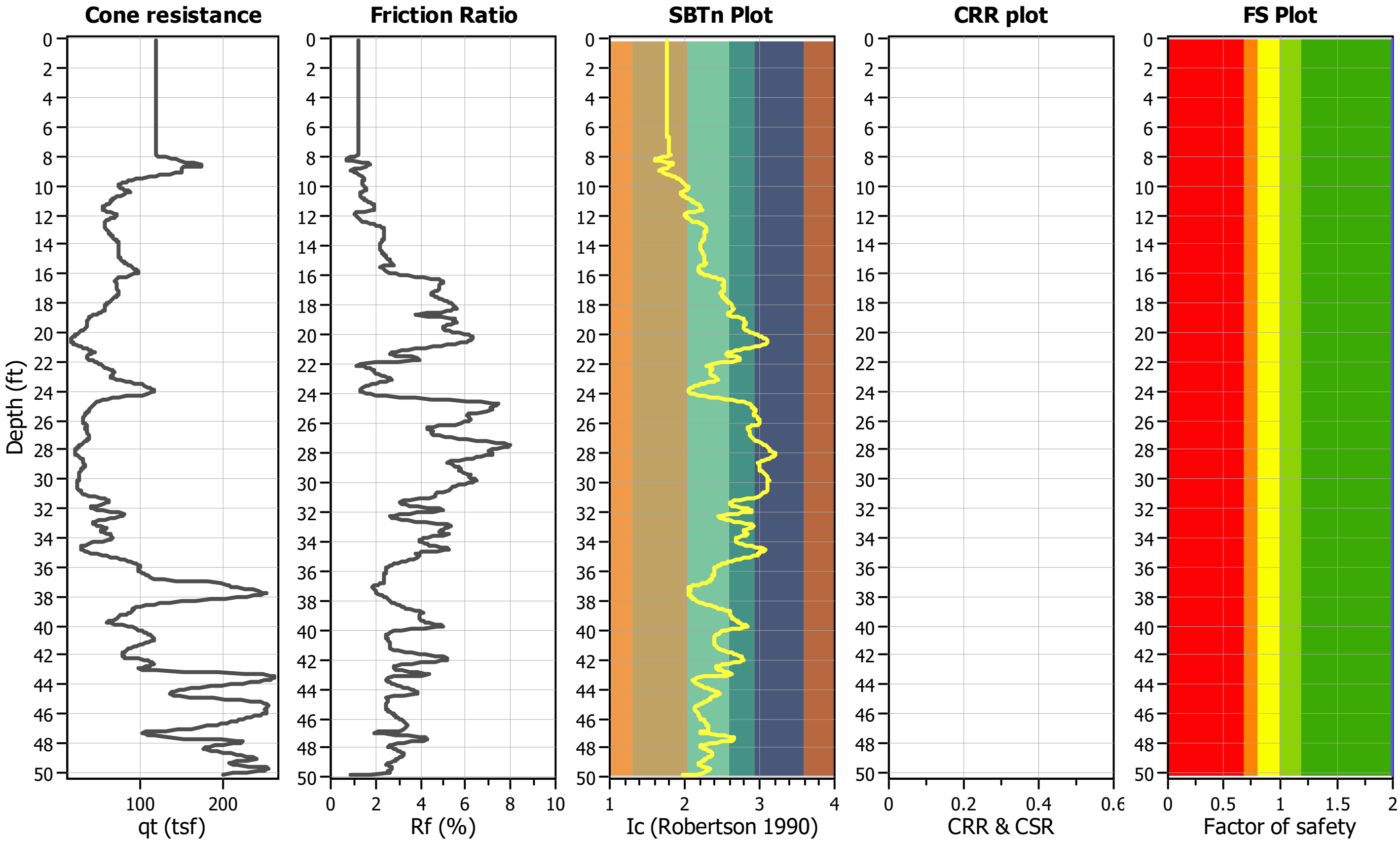
LIQUEFACTION ANALYSIS REPORT

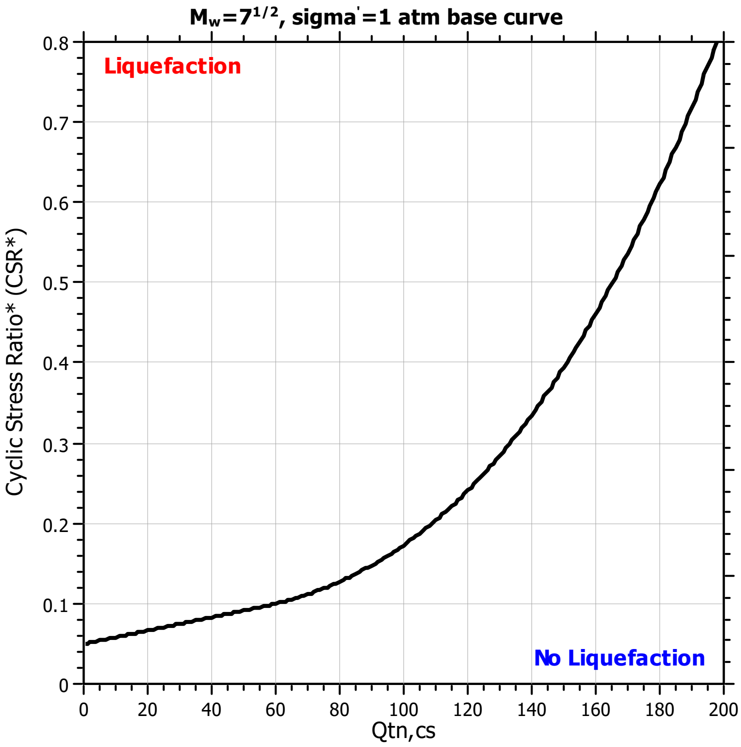
Project title : Colton Middle School Pavilion and Admin **Location : Colton California**

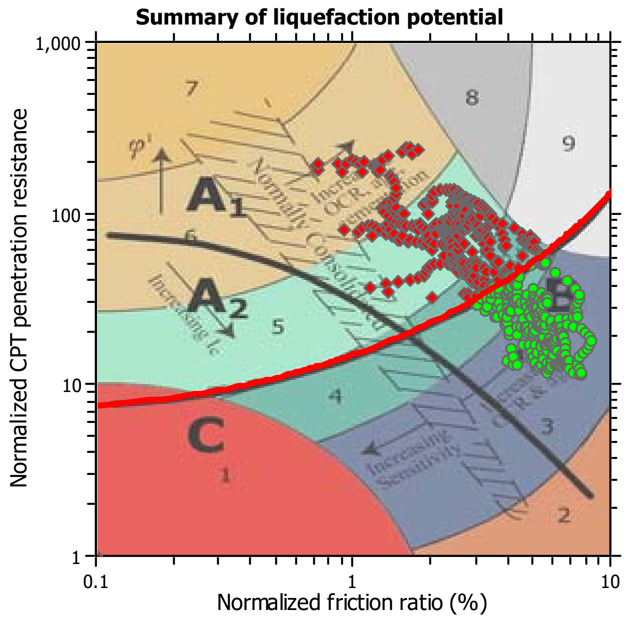
CPT file : CPT-1

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	200.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	100.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	50.00 ft
Earthquake magnitude M_w:	8.10	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	1.06	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

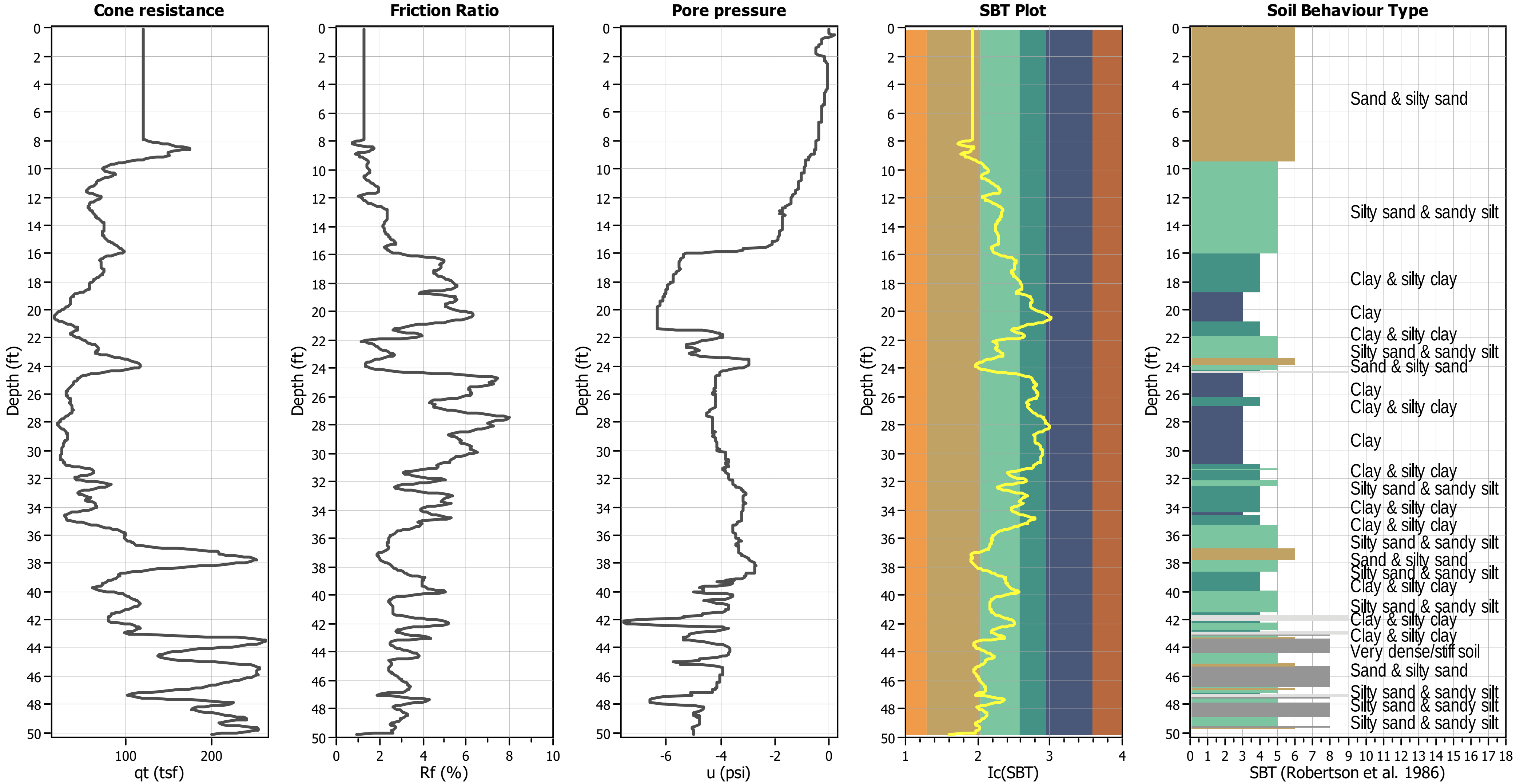






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



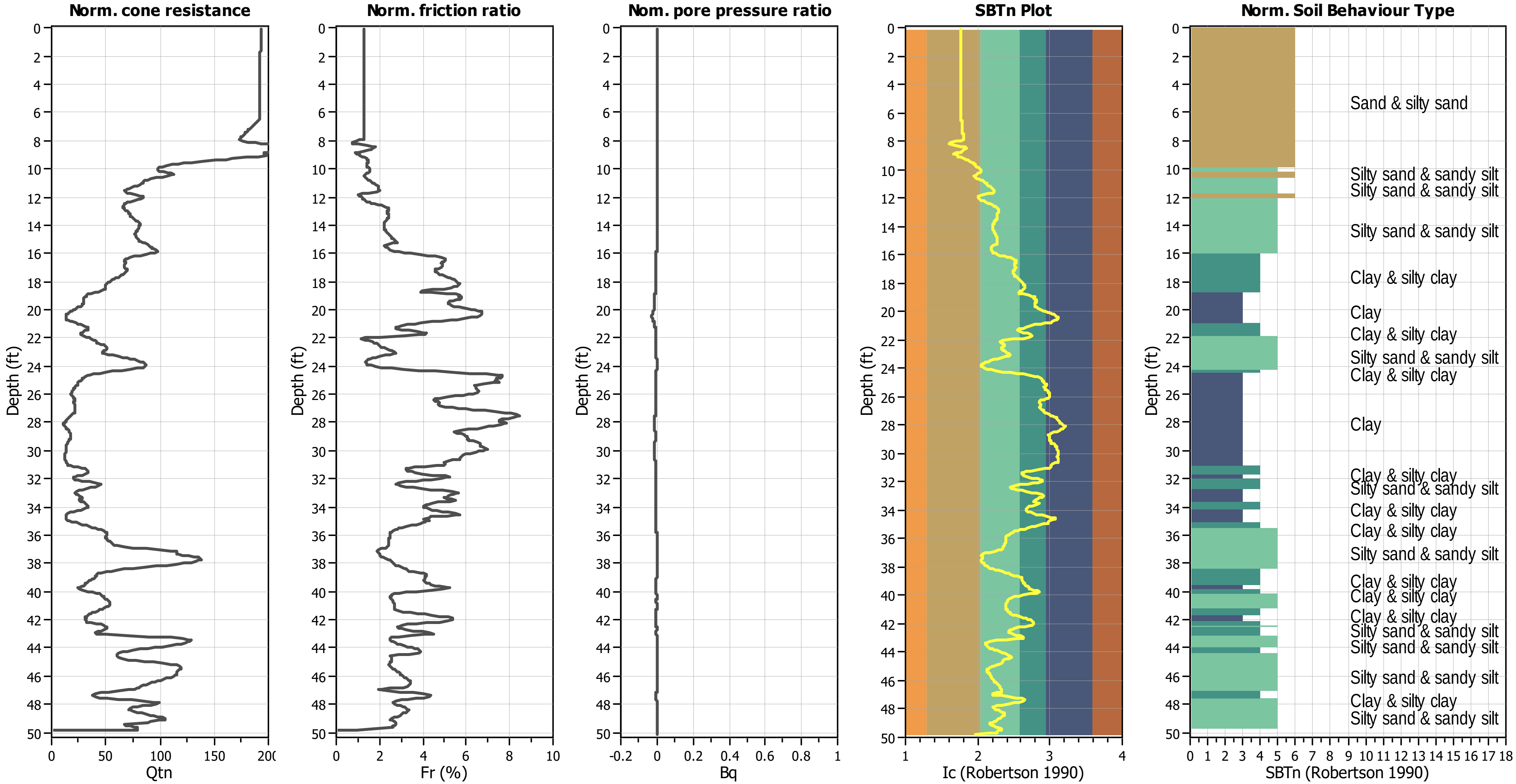
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	100.00 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:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	8.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	1.06	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	200.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

SBT legend

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

CPT basic interpretation plots (normalized)



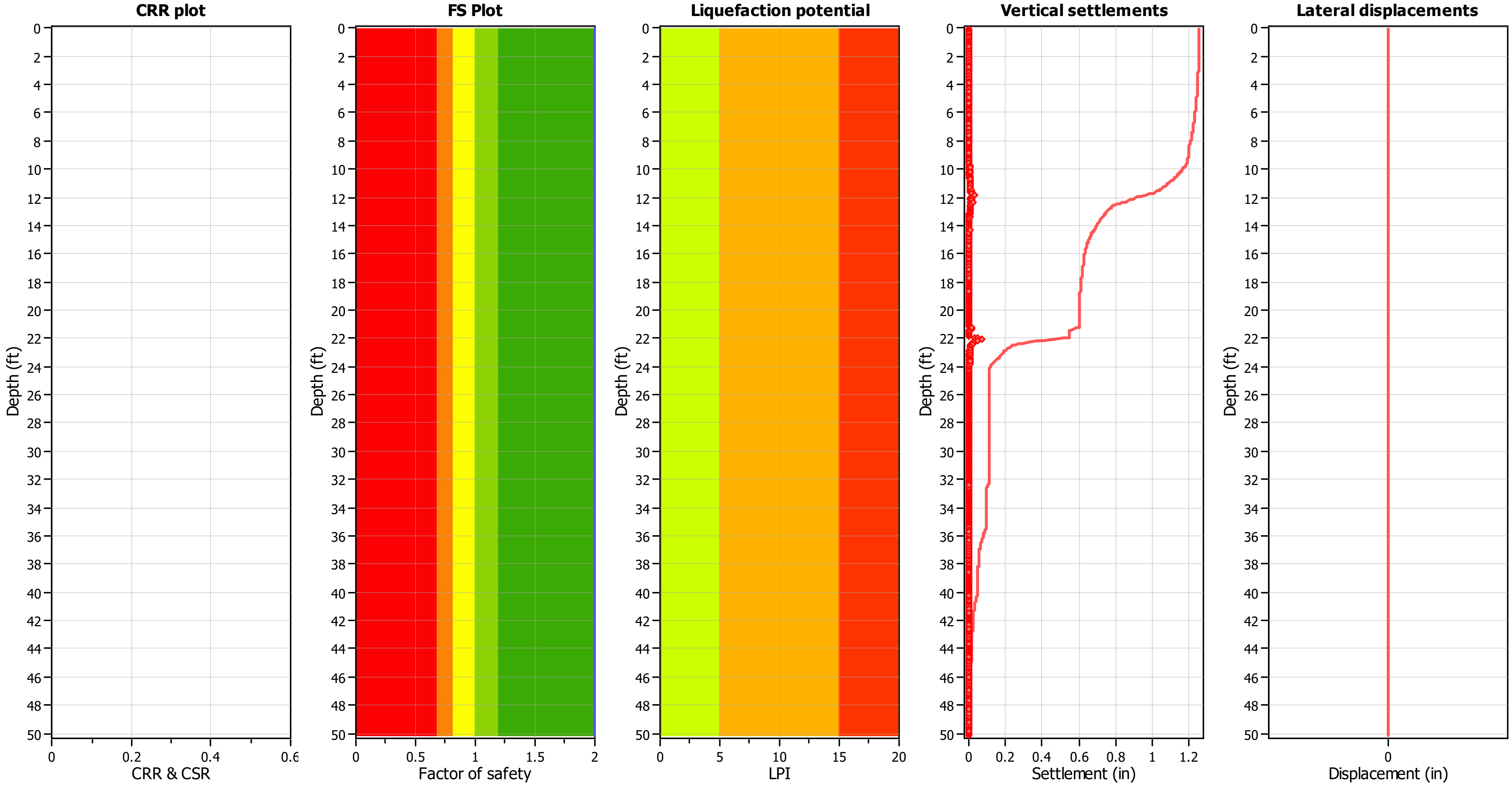
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	100.00 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:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	8.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	1.06	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	200.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

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 (erthq.):	100.00 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:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	8.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	1.06	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	200.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

Leighton
038.0000020707

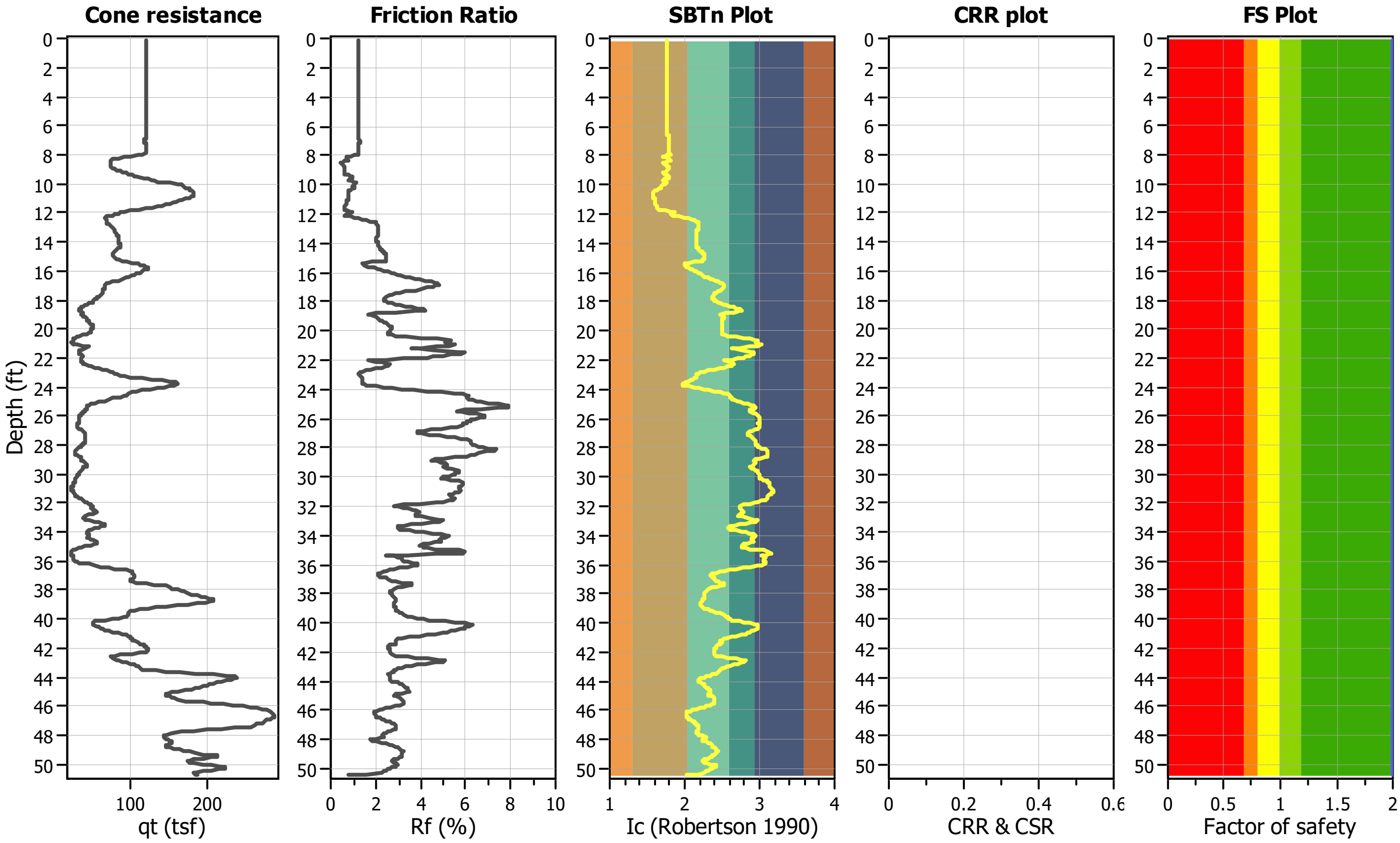
LIQUEFACTION ANALYSIS REPORT

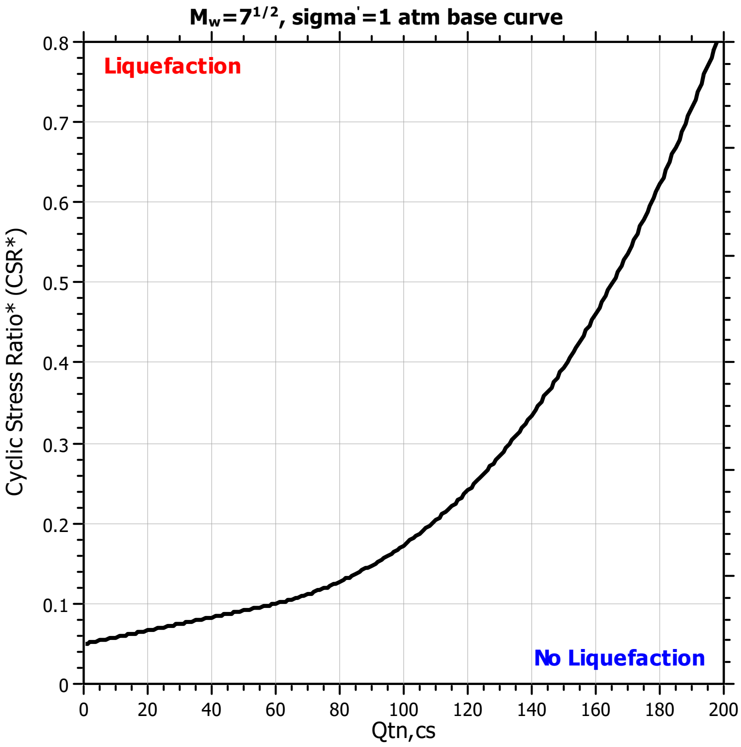
Project title : Colton Middle School Pavilion and Admin **Location : Colton California**

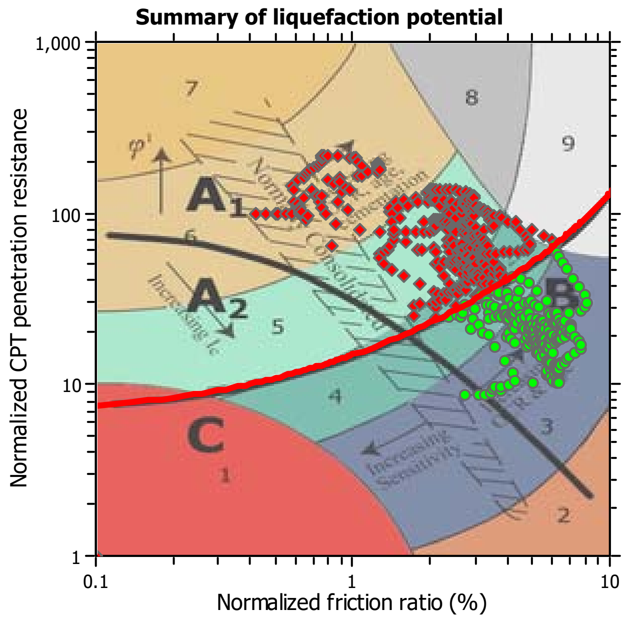
CPT file : CPT-2

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	200.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	100.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	50.00 ft
Earthquake magnitude M_w:	8.10	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	1.06	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

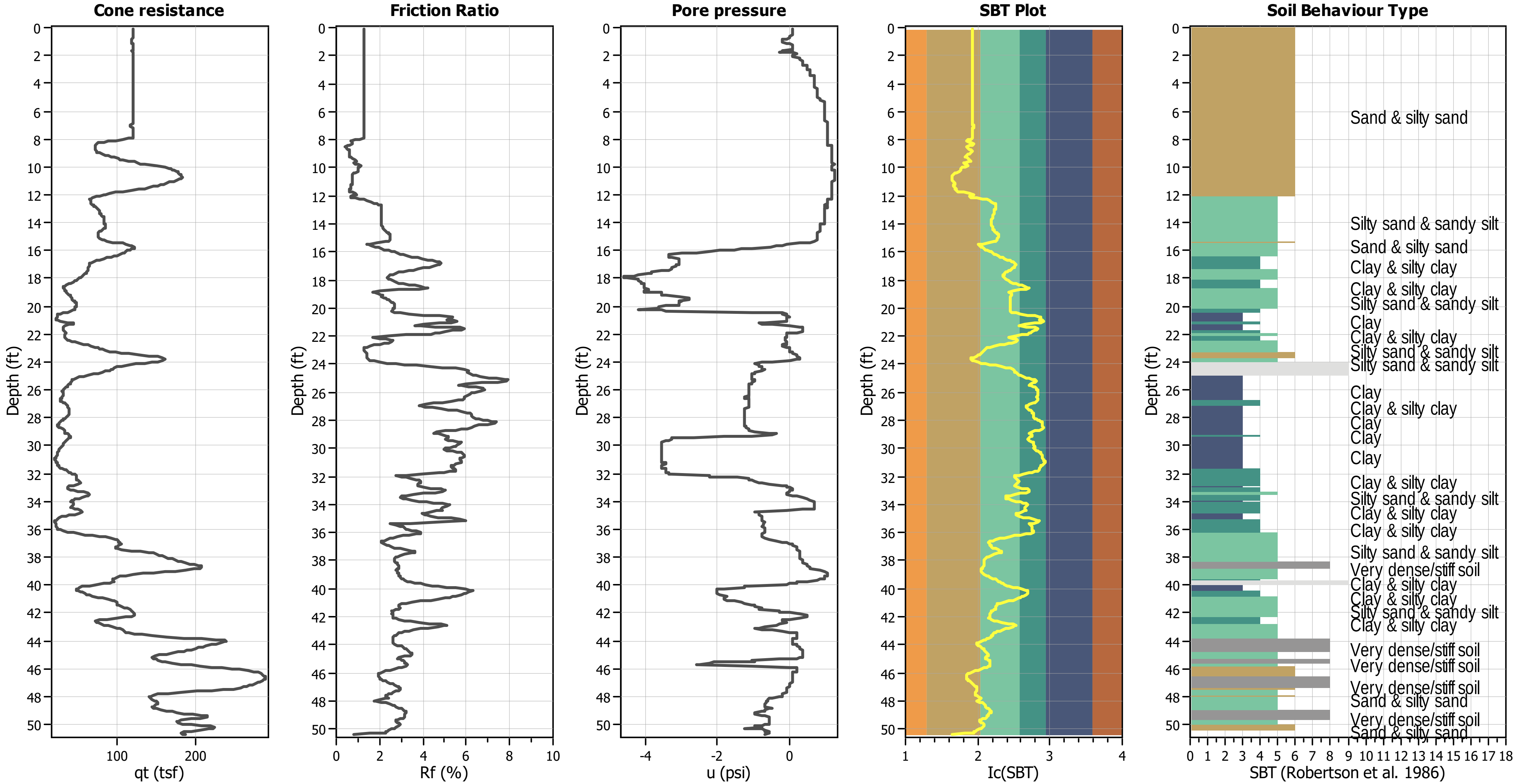






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



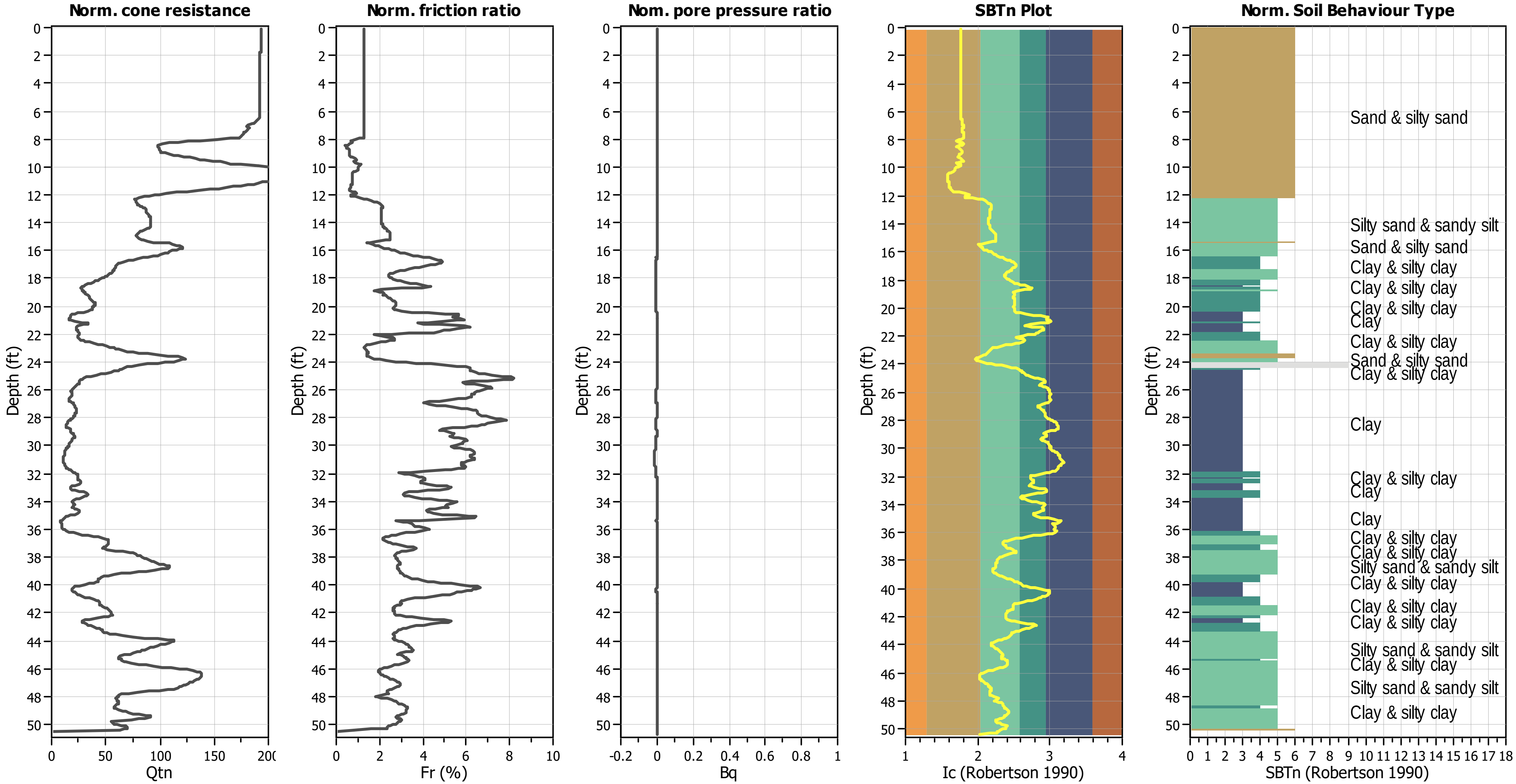
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	100.00 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:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	8.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	1.06	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	200.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

SBT legend

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

CPT basic interpretation plots (normalized)



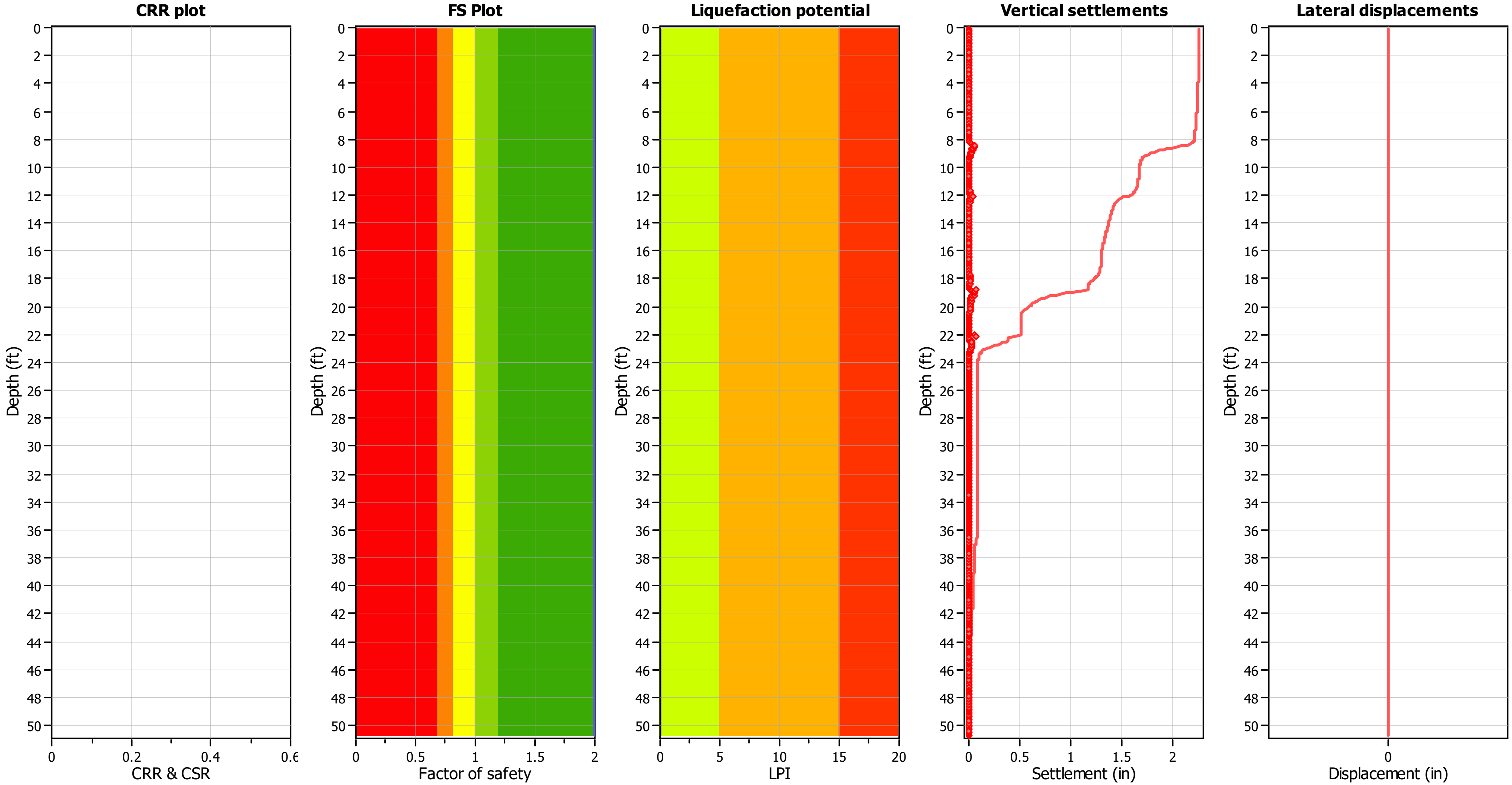
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	100.00 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:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	8.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	1.06	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	200.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

SBTn legend

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	100.00 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:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	8.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	1.06	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	200.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

Leighton
038.0000020707

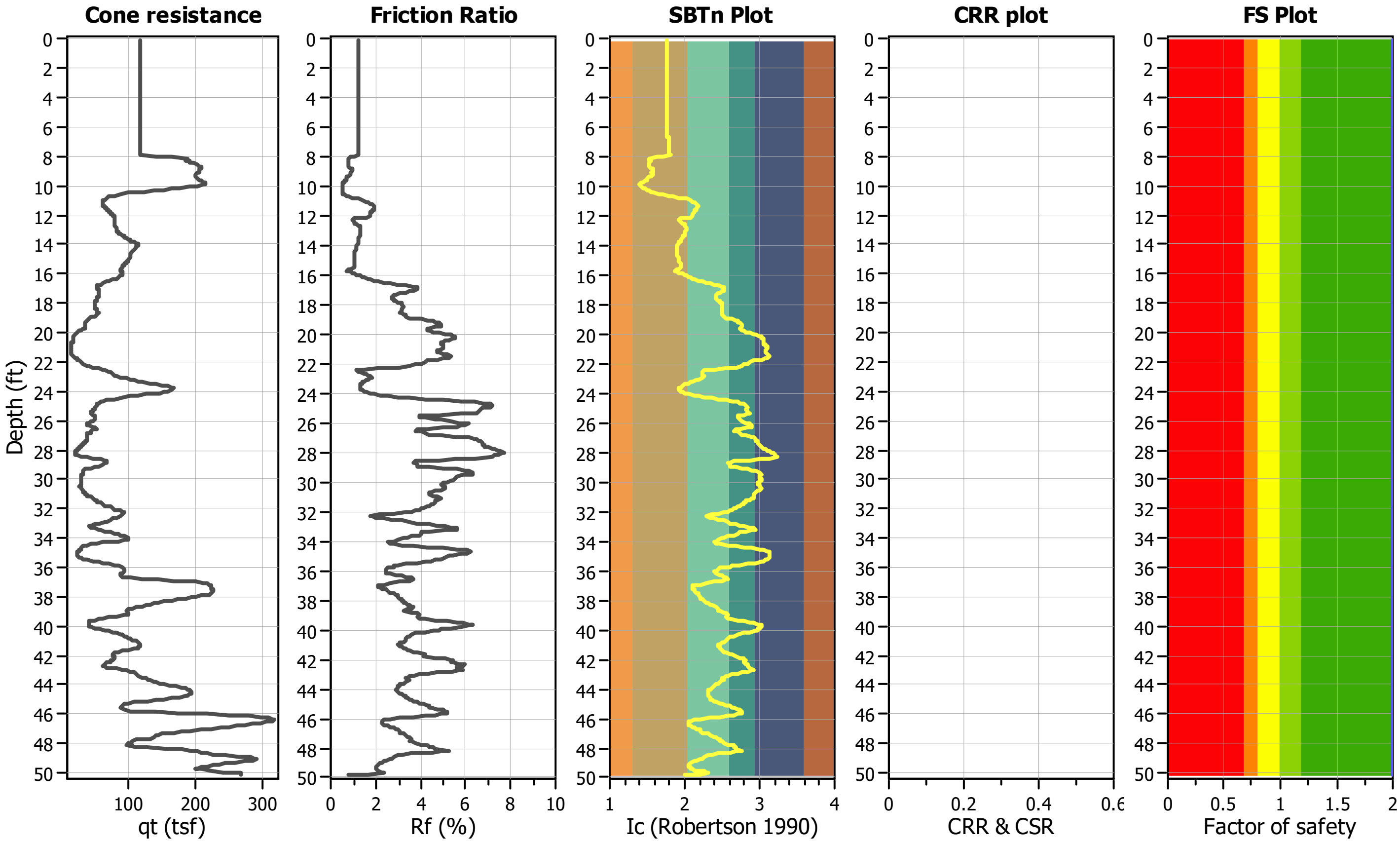
LIQUEFACTION ANALYSIS REPORT

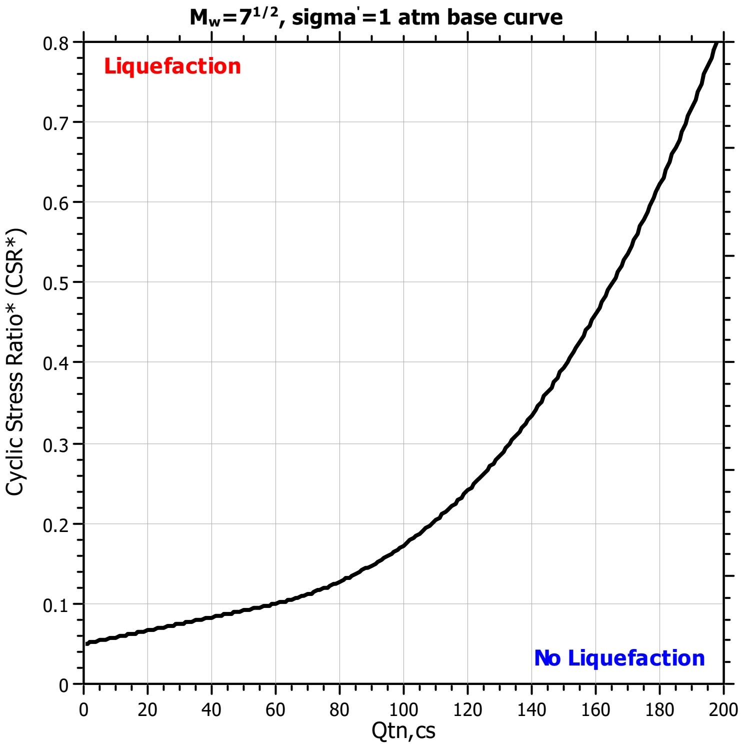
Project title : Colton Middle School Pavilion and Admin **Location : Colton California**

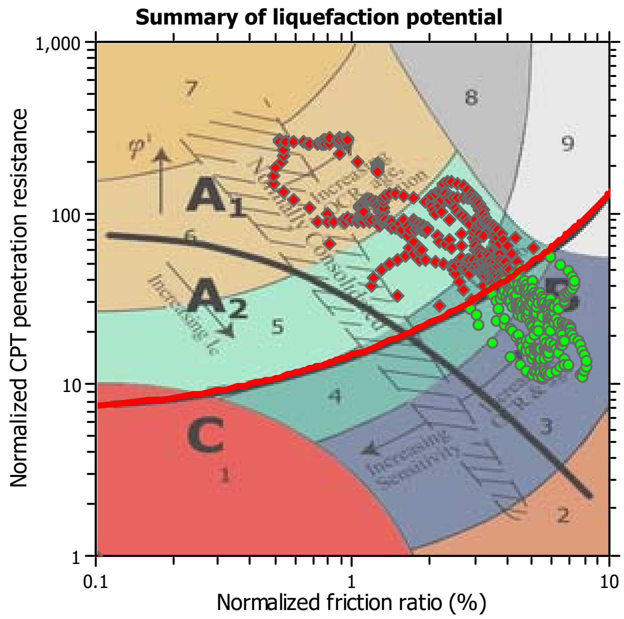
CPT file : CPT-3

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	200.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	100.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	50.00 ft
Earthquake magnitude M_w:	8.10	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	1.06	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

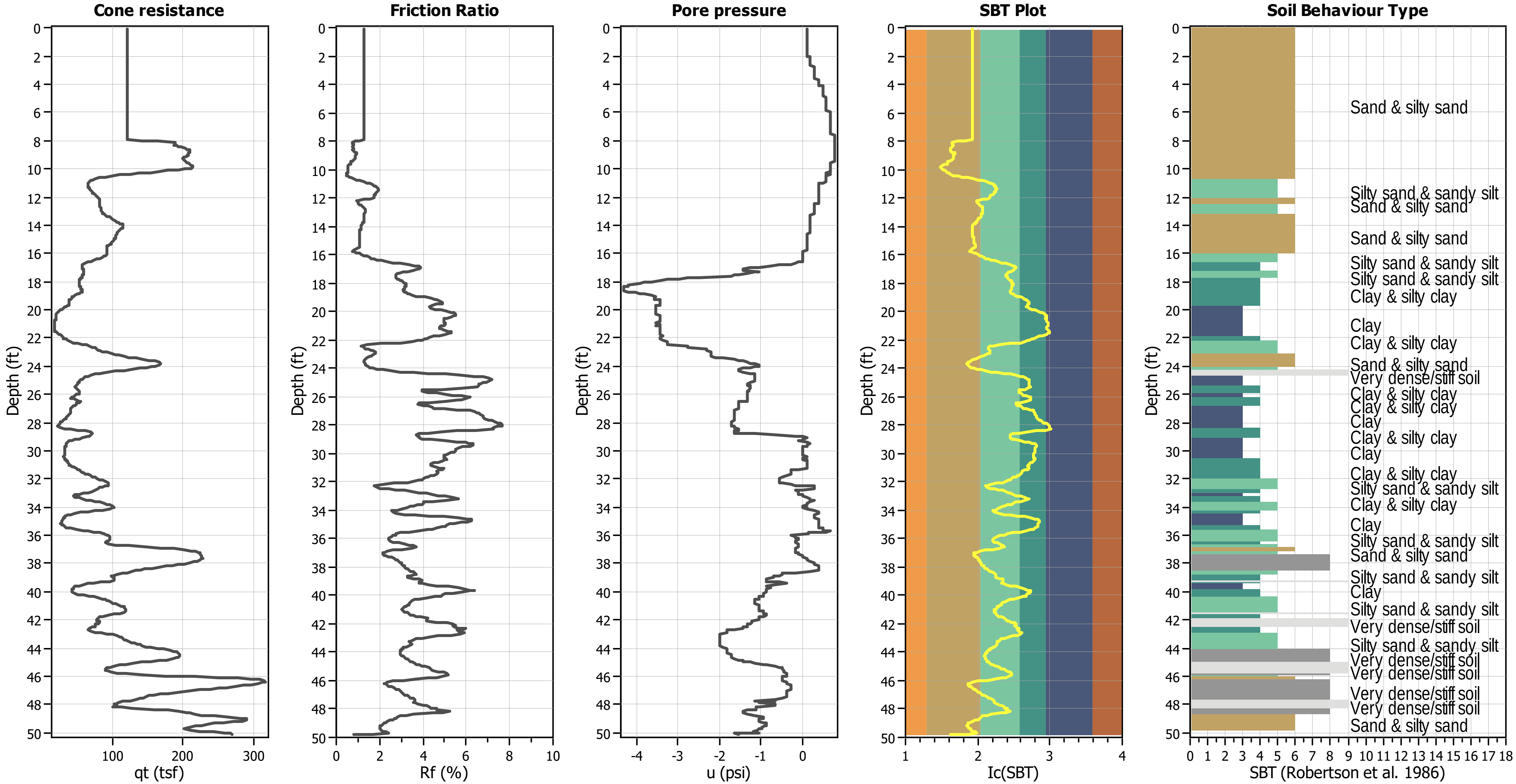






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



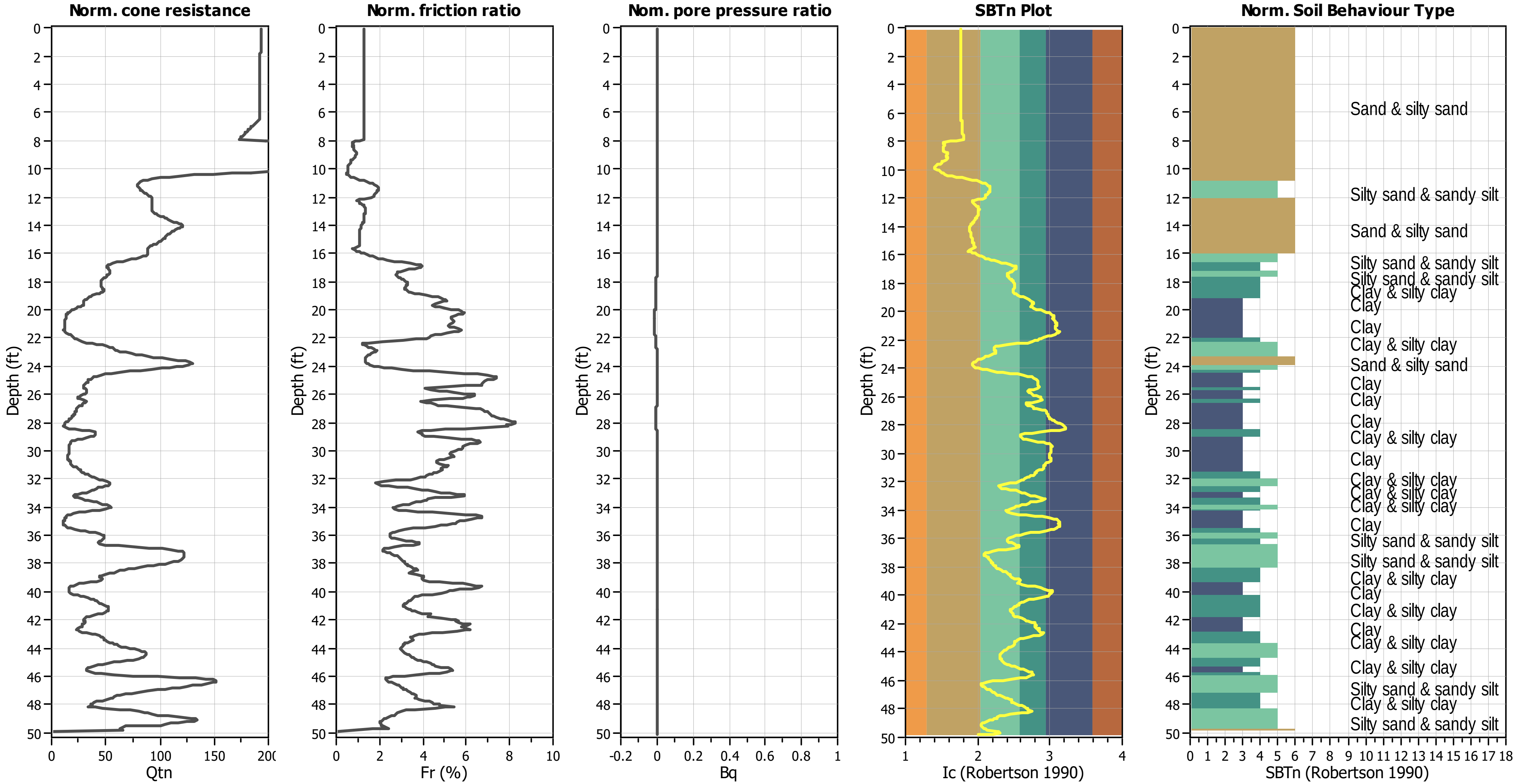
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	100.00 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:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	8.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	1.06	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	200.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

SBT legend

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

CPT basic interpretation plots (normalized)



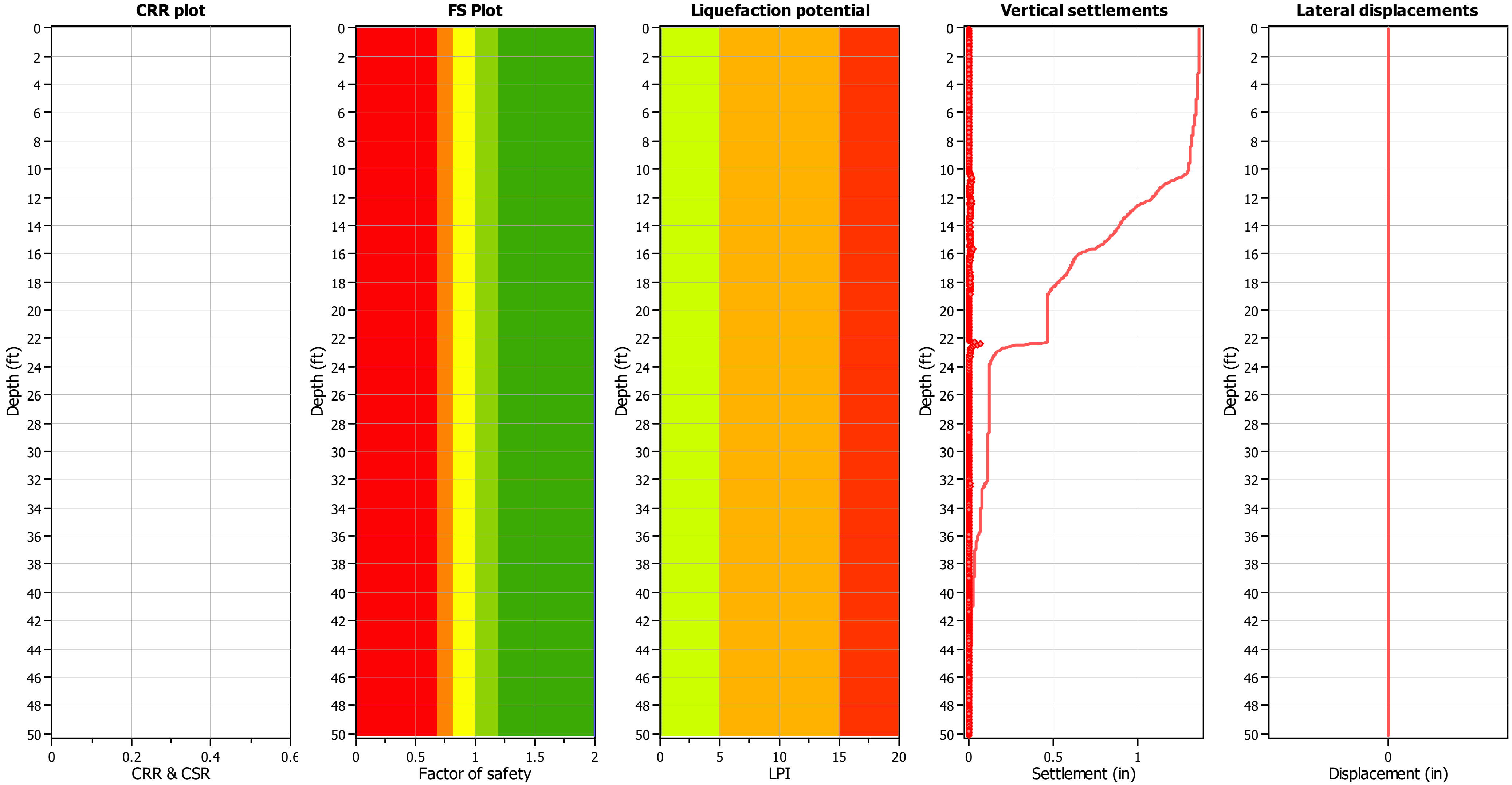
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	100.00 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:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	8.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	1.06	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	200.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

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 (erthq.):	100.00 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:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	8.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	1.06	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	200.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

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

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

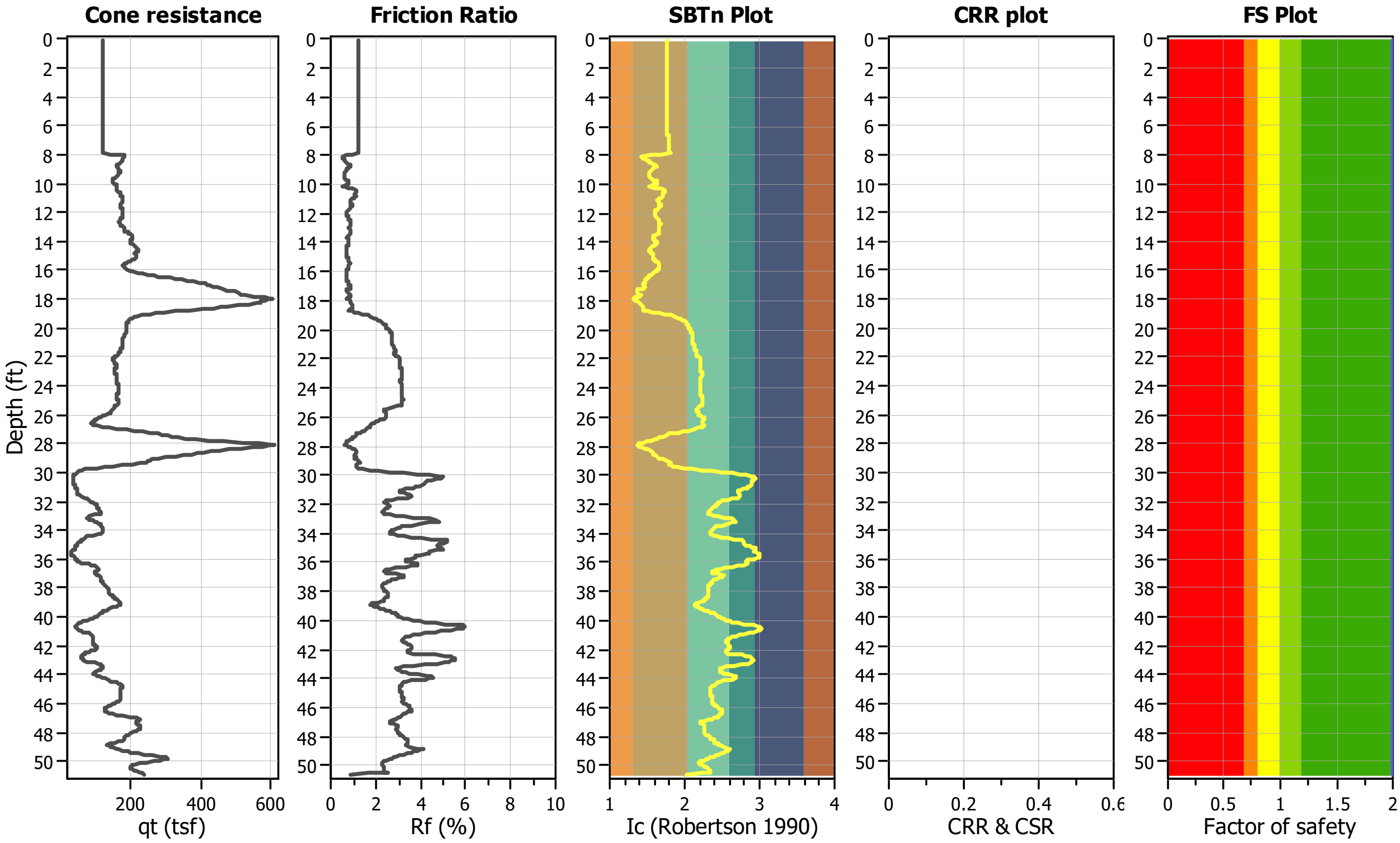
LIQUEFACTION ANALYSIS REPORT

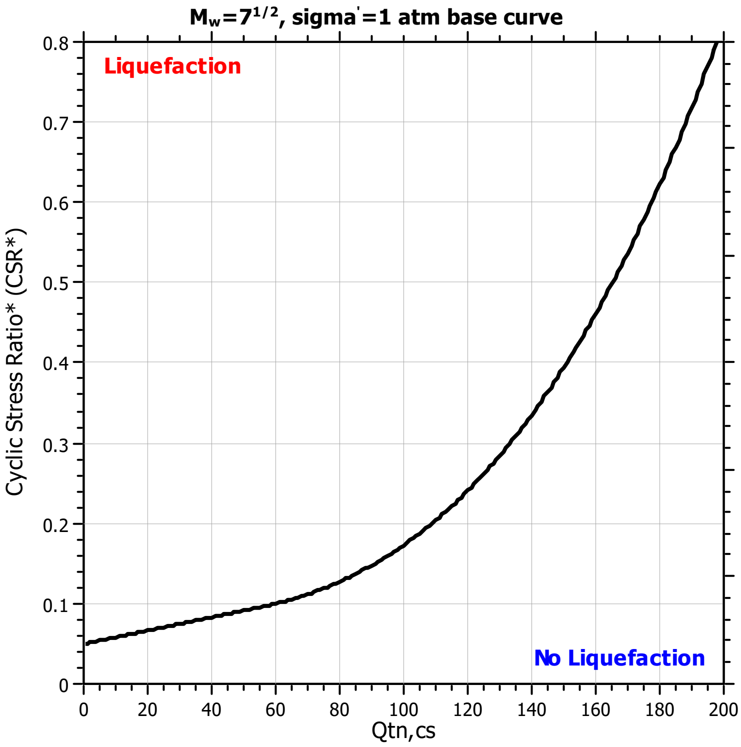
Project title : Colton Middle School Pavilion and Admin Building **Location : Colton California**

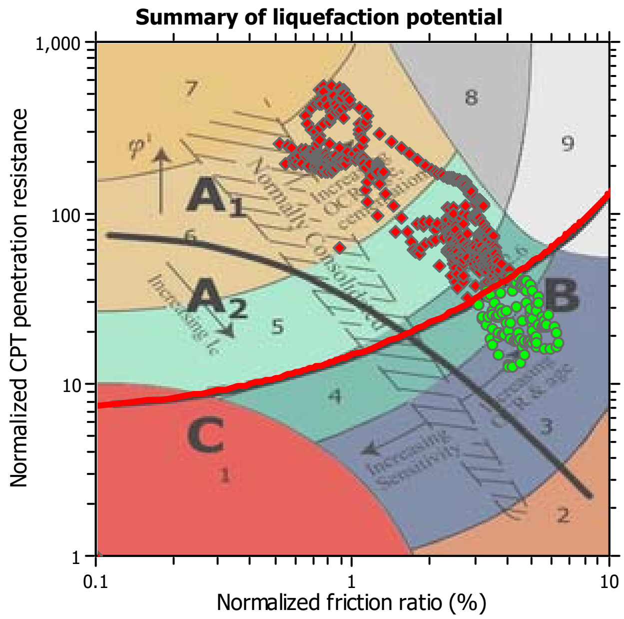
CPT file : CPT-4

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	200.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	100.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	50.00 ft
Earthquake magnitude M_w:	8.10	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	1.06	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

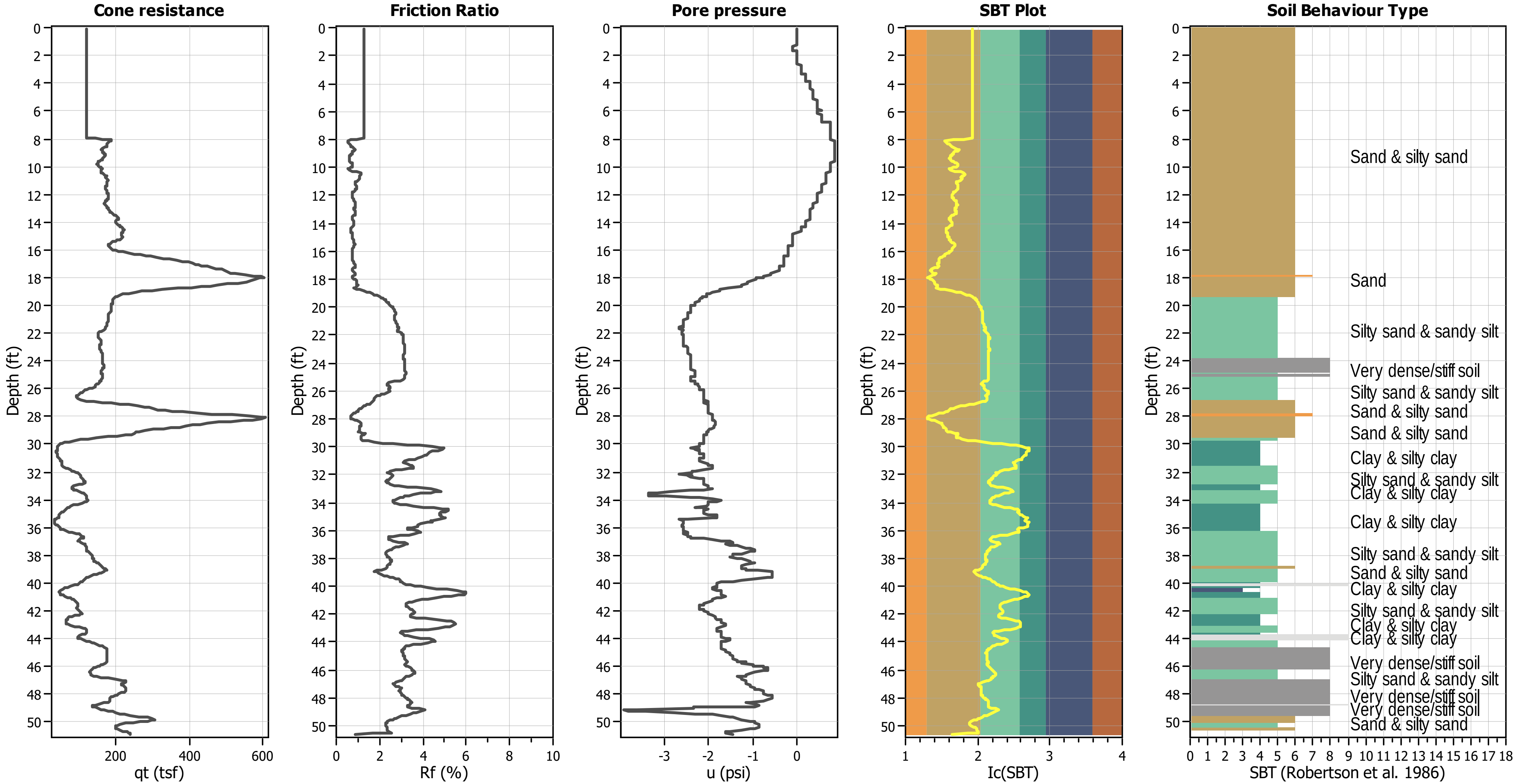






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



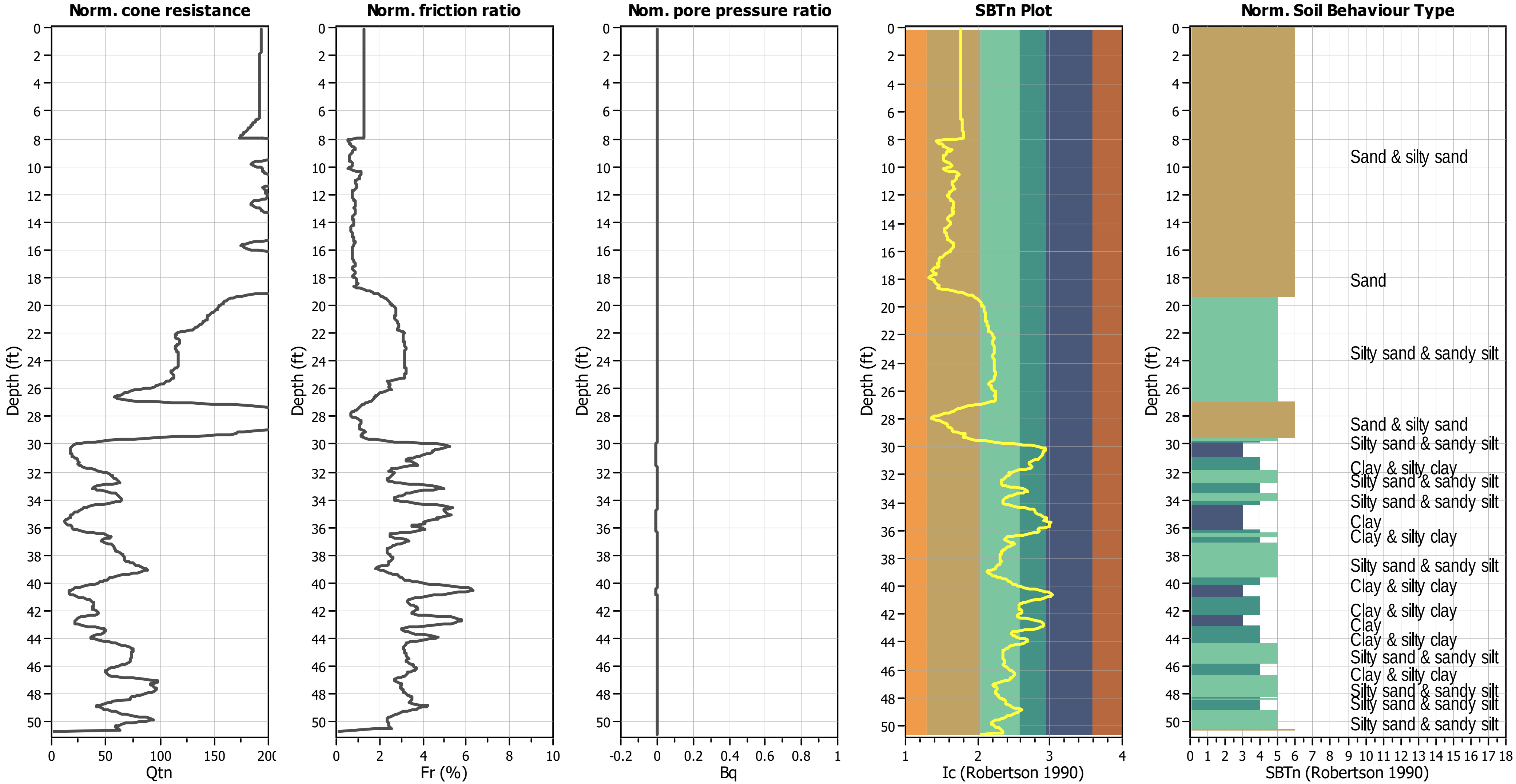
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	100.00 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:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	8.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	1.06	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	200.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

SBT legend

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

CPT basic interpretation plots (normalized)



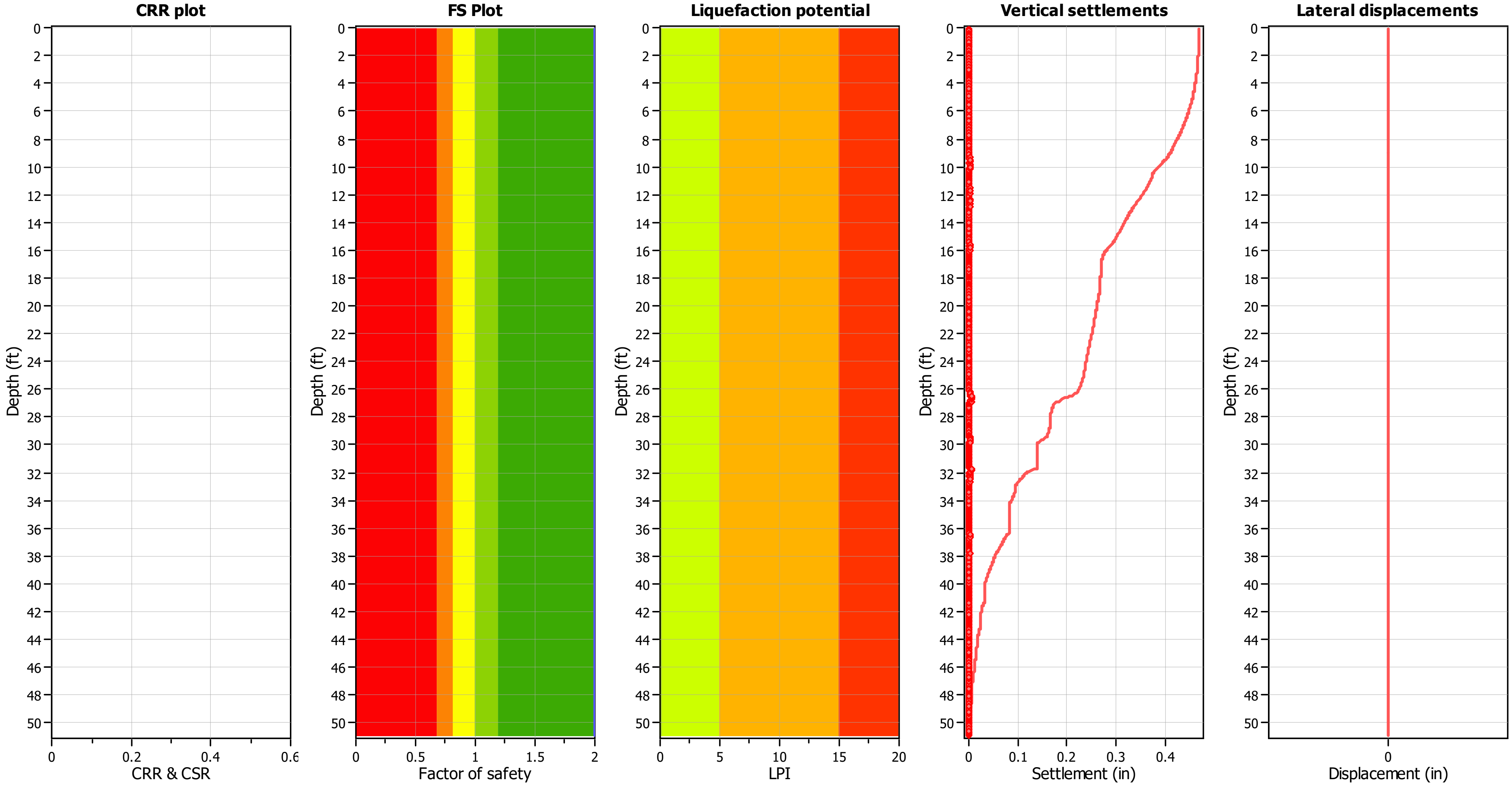
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	100.00 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:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	8.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	1.06	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	200.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

SBTn legend

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	100.00 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:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	8.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	1.06	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	200.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

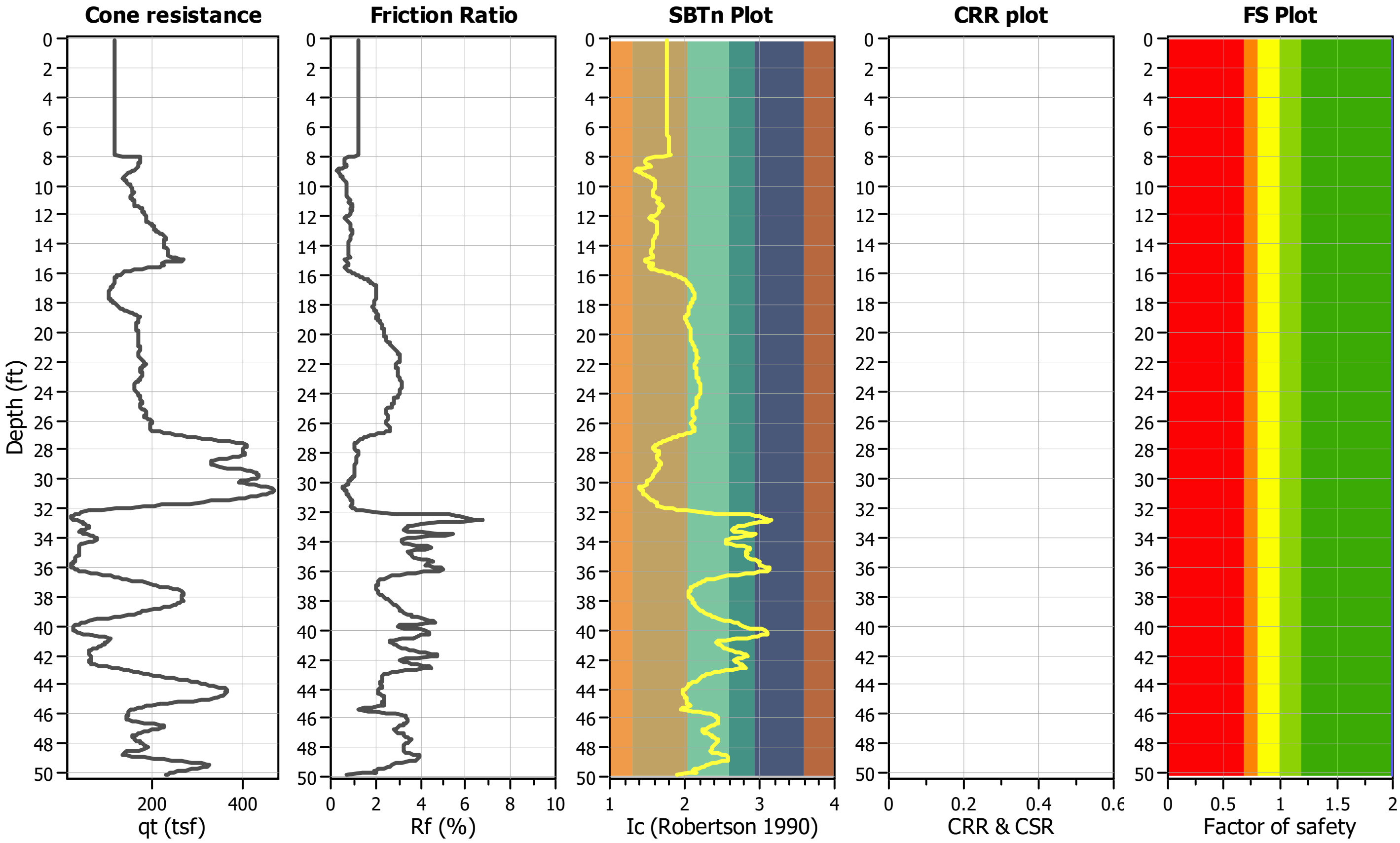
LIQUEFACTION ANALYSIS REPORT

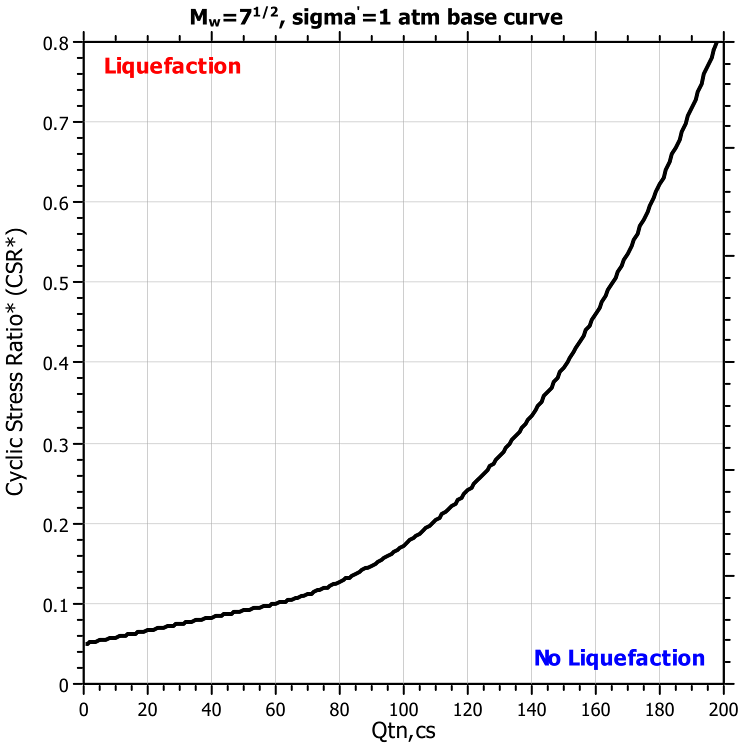
Project title : Colton Middle School Pavilion and Admin **Location : Colton California**

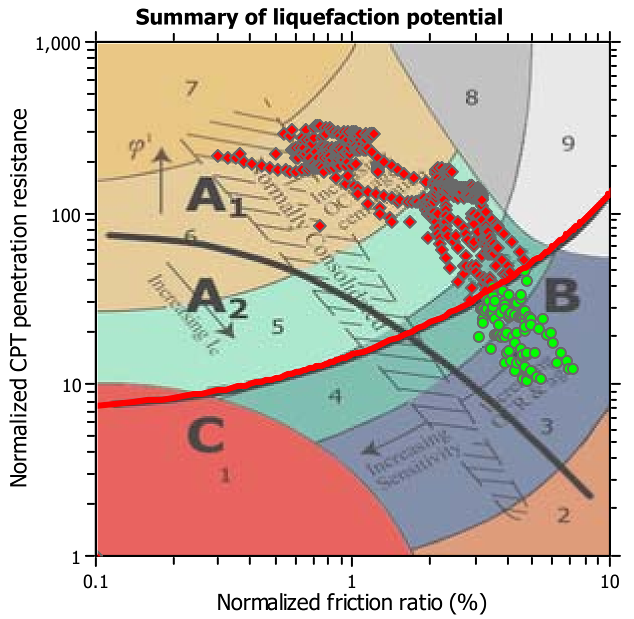
CPT file : CPT-5

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	200.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	100.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	50.00 ft
Earthquake magnitude M_w:	8.10	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	1.06	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

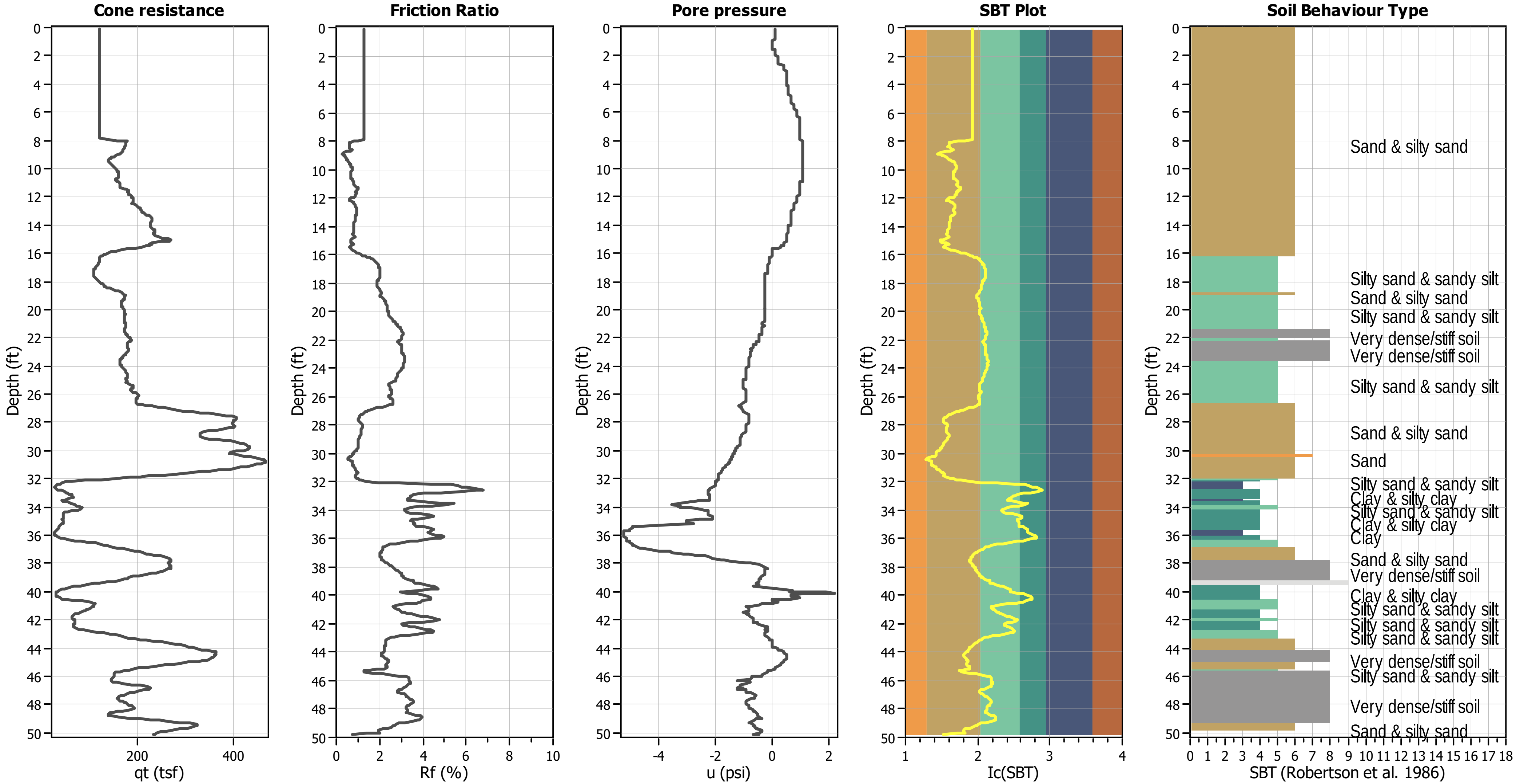






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



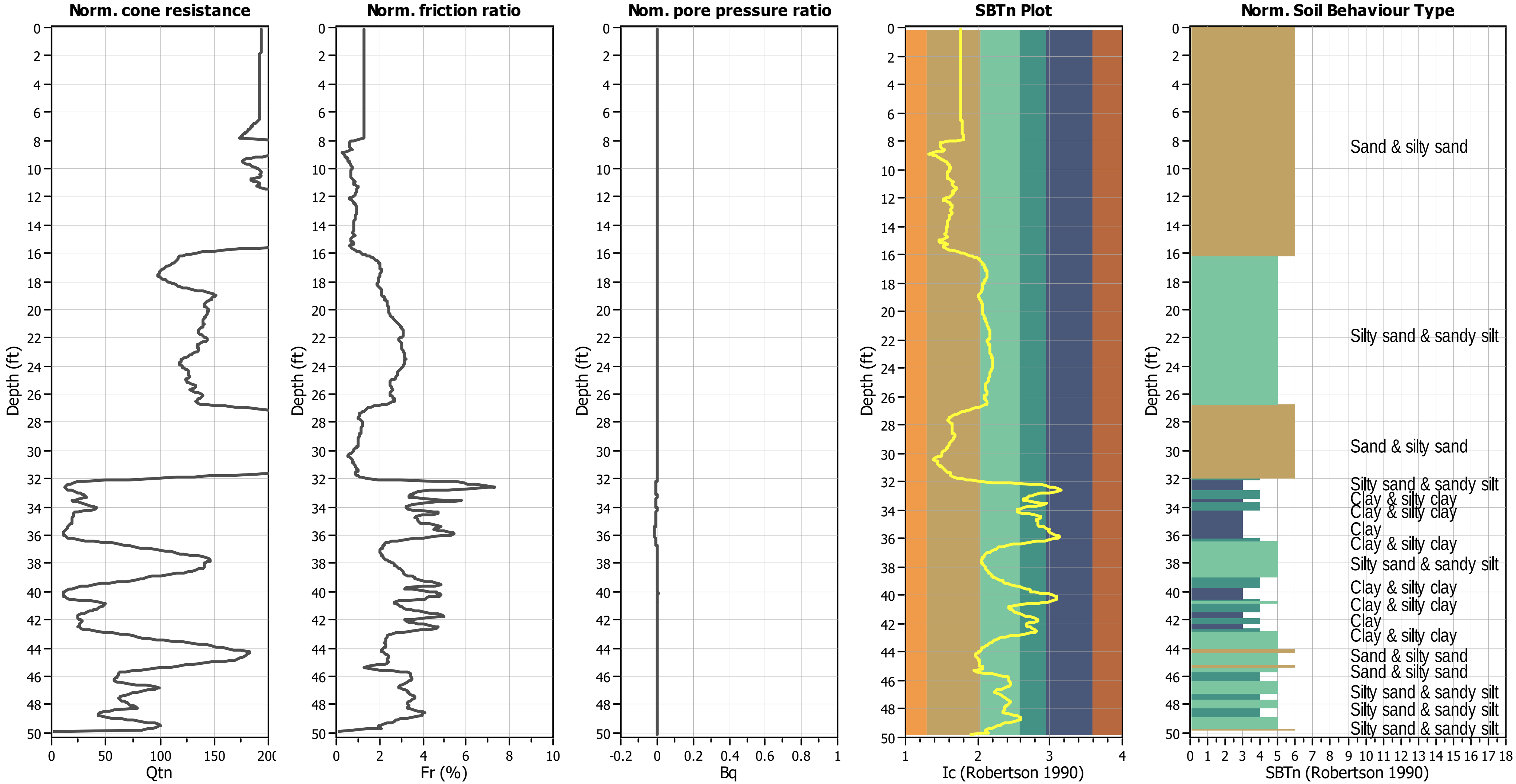
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	100.00 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:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	8.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	1.06	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	200.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

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)



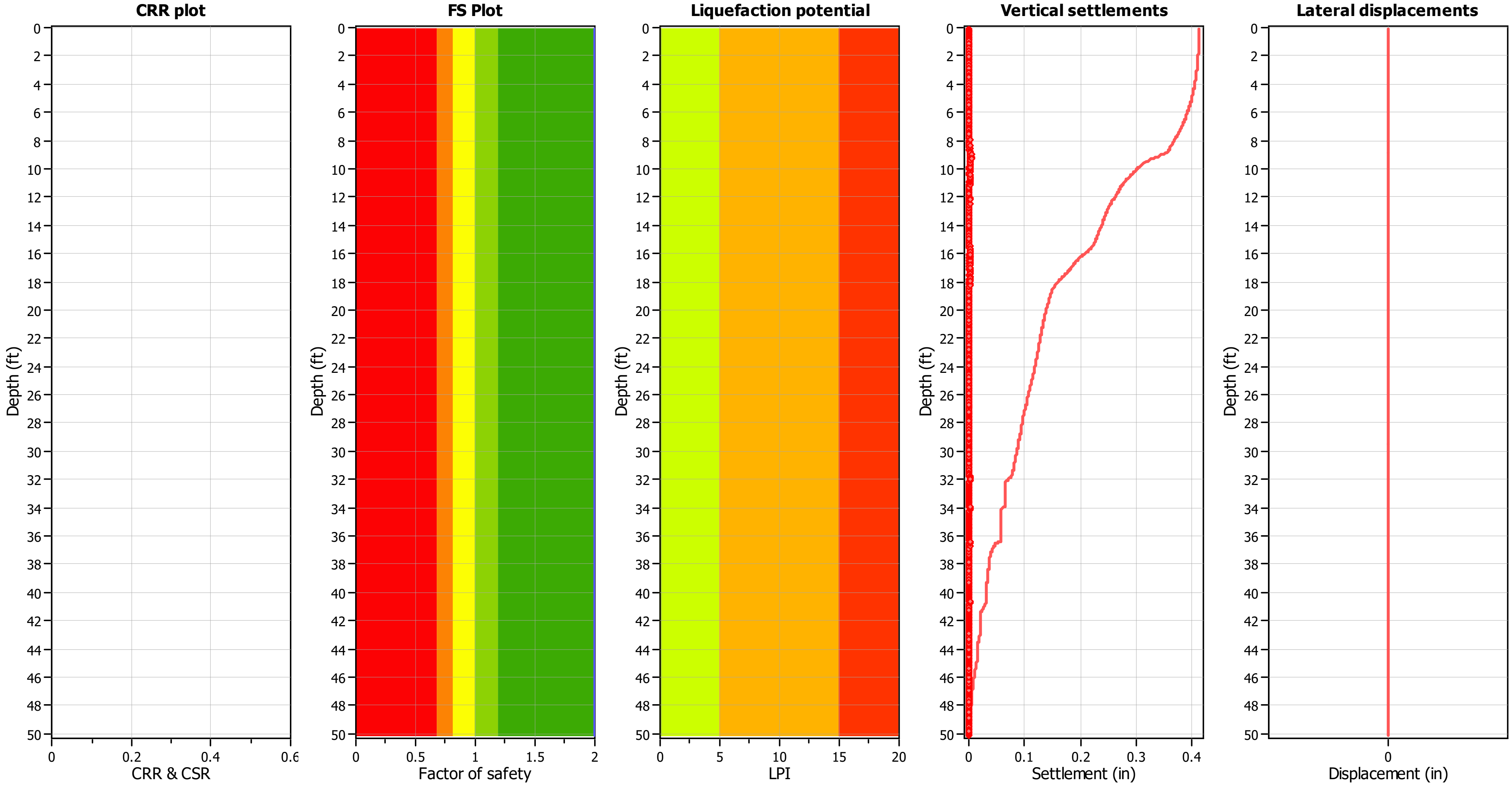
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	100.00 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:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	8.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	1.06	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	200.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

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 (erthq.):	100.00 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:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	8.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	1.06	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	200.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

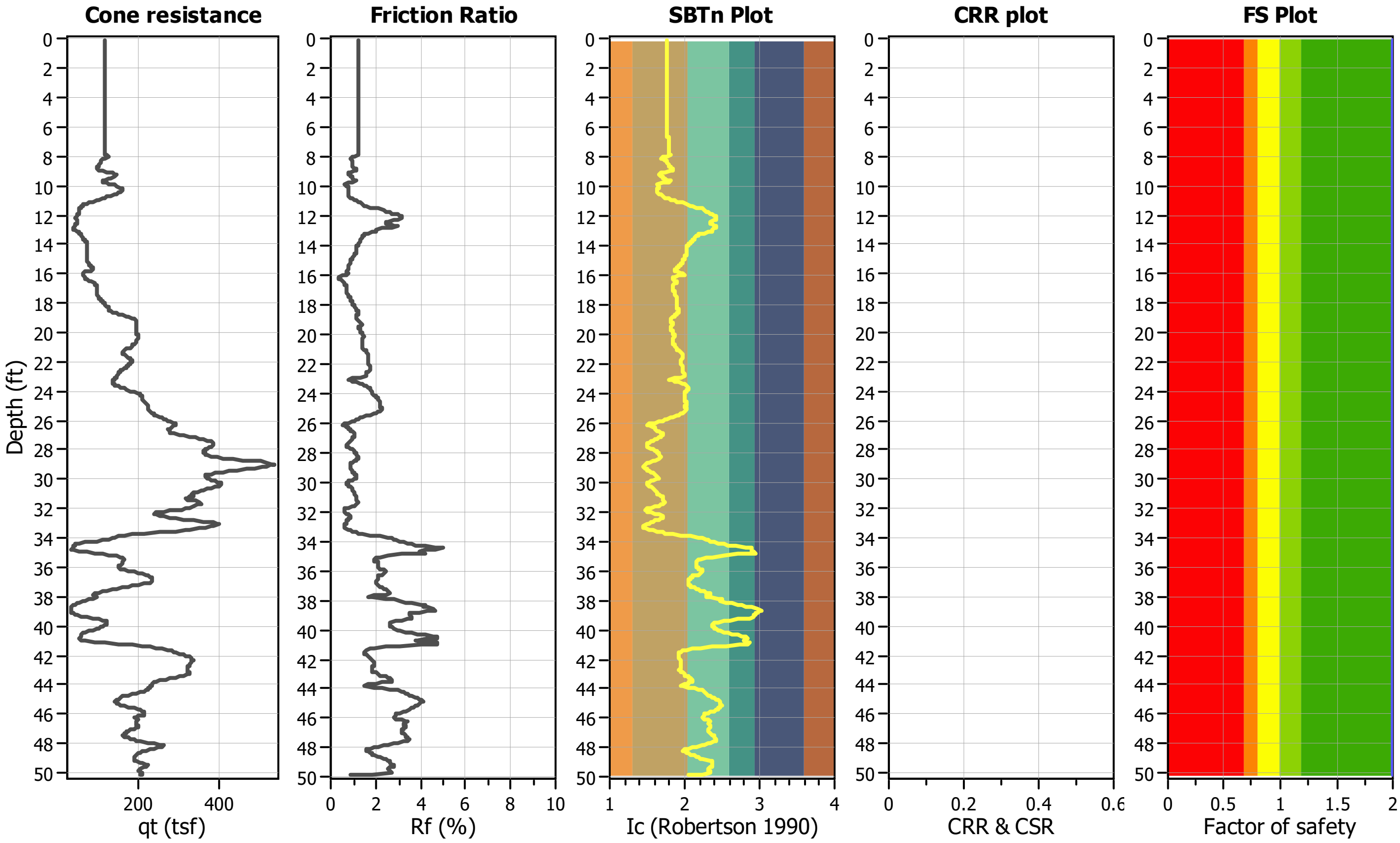
LIQUEFACTION ANALYSIS REPORT

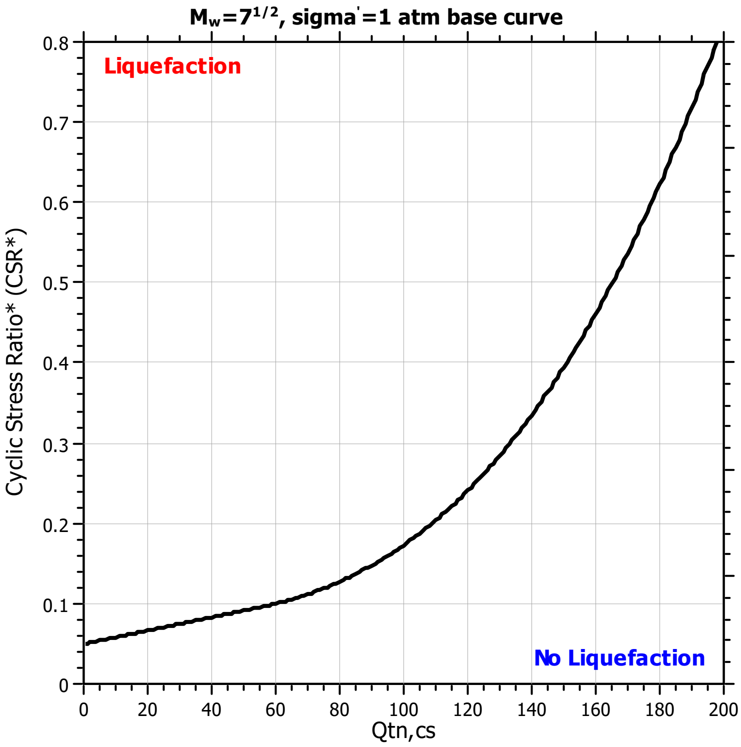
Project title : Colton Middle School Pavilion and Admin **Location : Colton California**

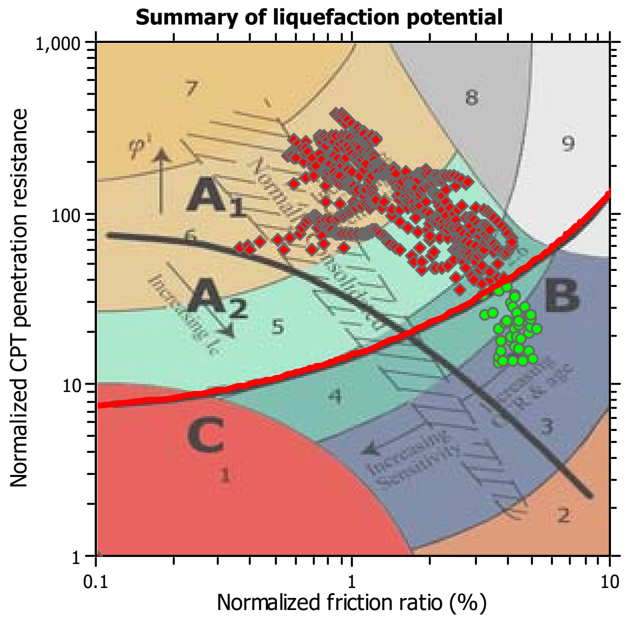
CPT file : CPT-6

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	200.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	100.00 ft	Fill height:	N/A		
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	Yes
Earthquake magnitude M_w:	8.10	Ic cut-off value:	2.60	Trans. detect. applied:	No	Limit depth:	50.00 ft
Peak ground acceleration:	1.06	Unit weight calculation:	Based on SBT	K_σ applied:	Yes	MSF method:	Method based

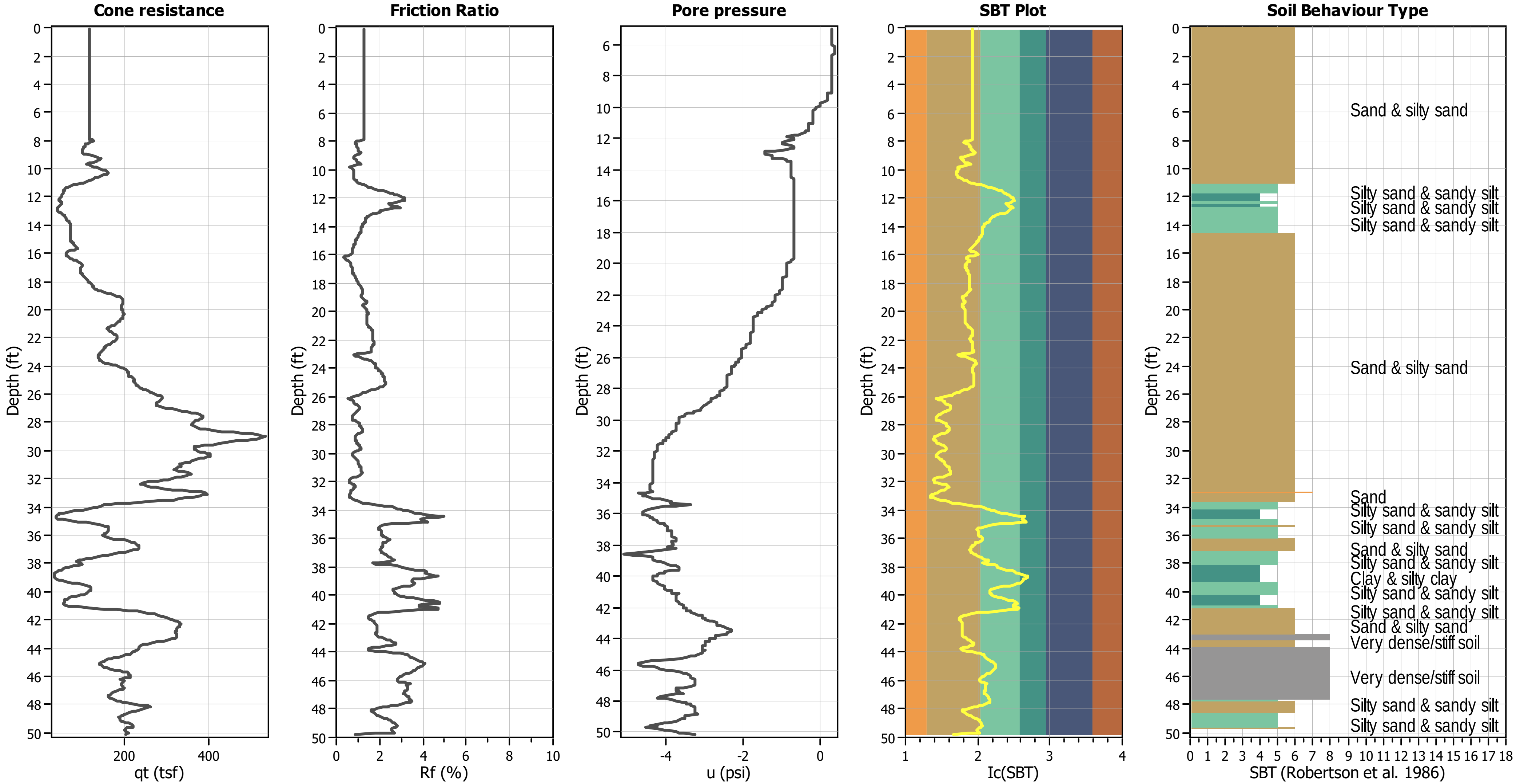






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



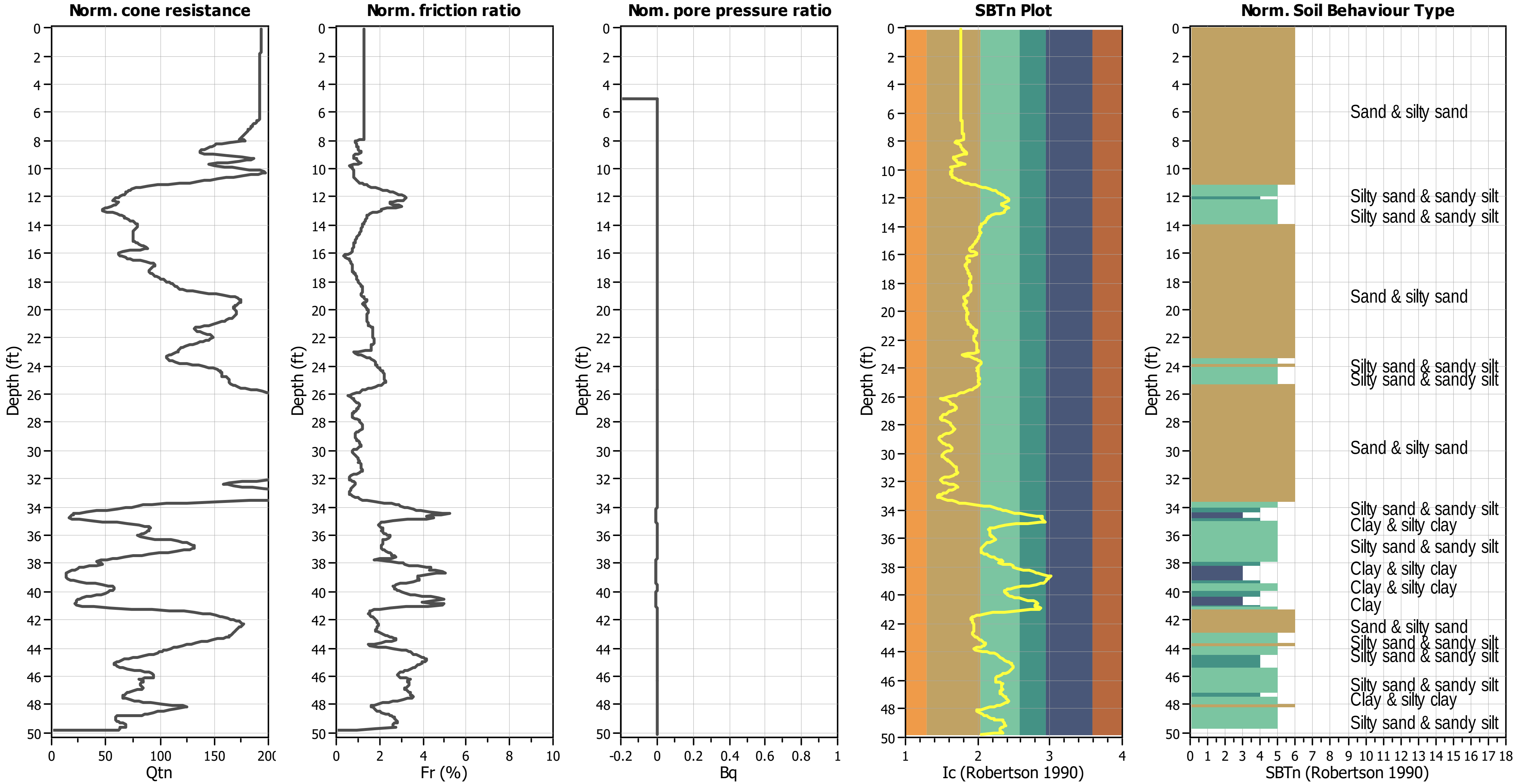
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	100.00 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:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	8.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	1.06	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	200.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

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)



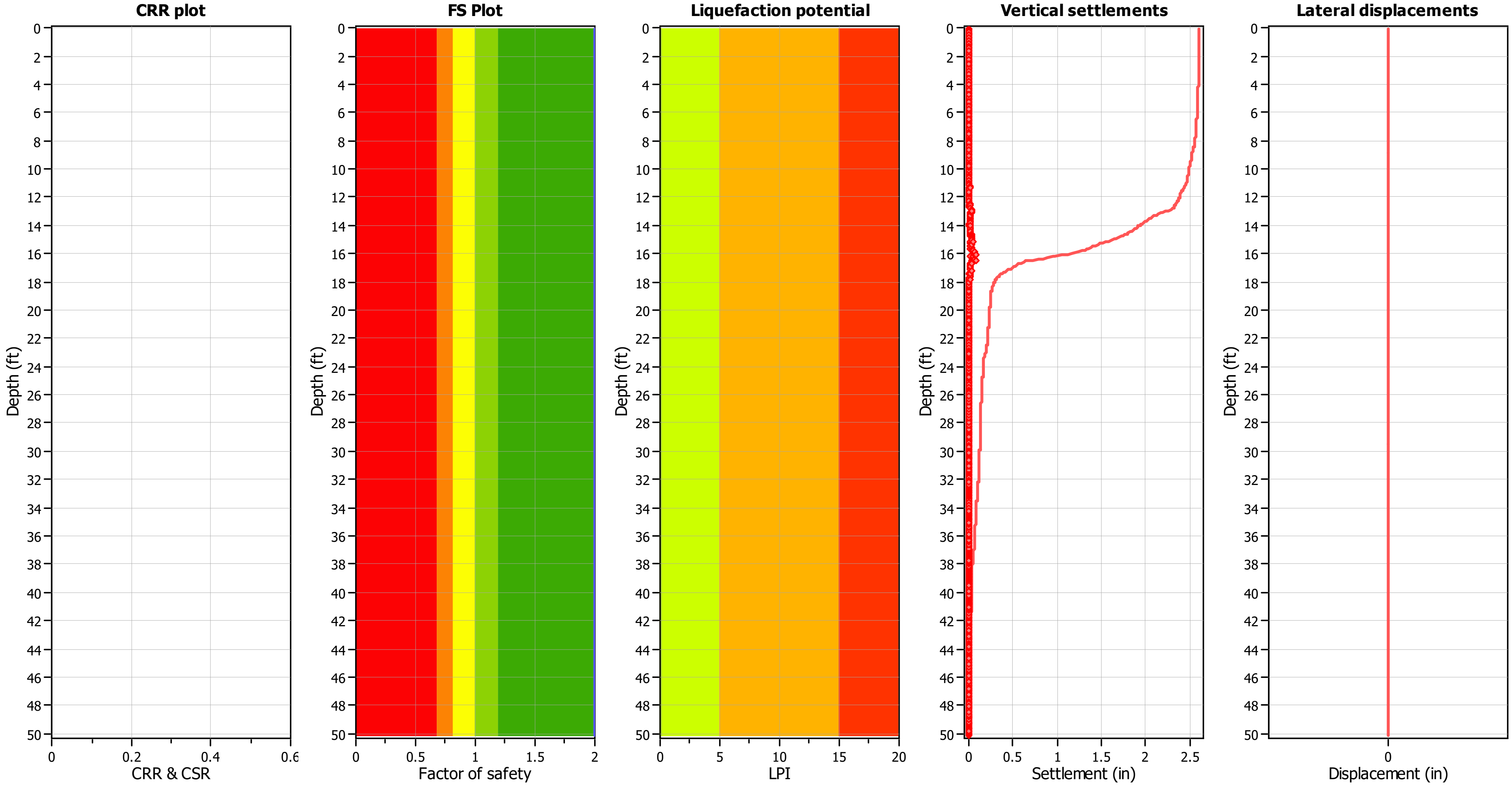
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	100.00 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:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	8.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	1.06	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	200.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

SBTn legend

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	100.00 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:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	8.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	1.06	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	200.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

Leighton
038.0000020707

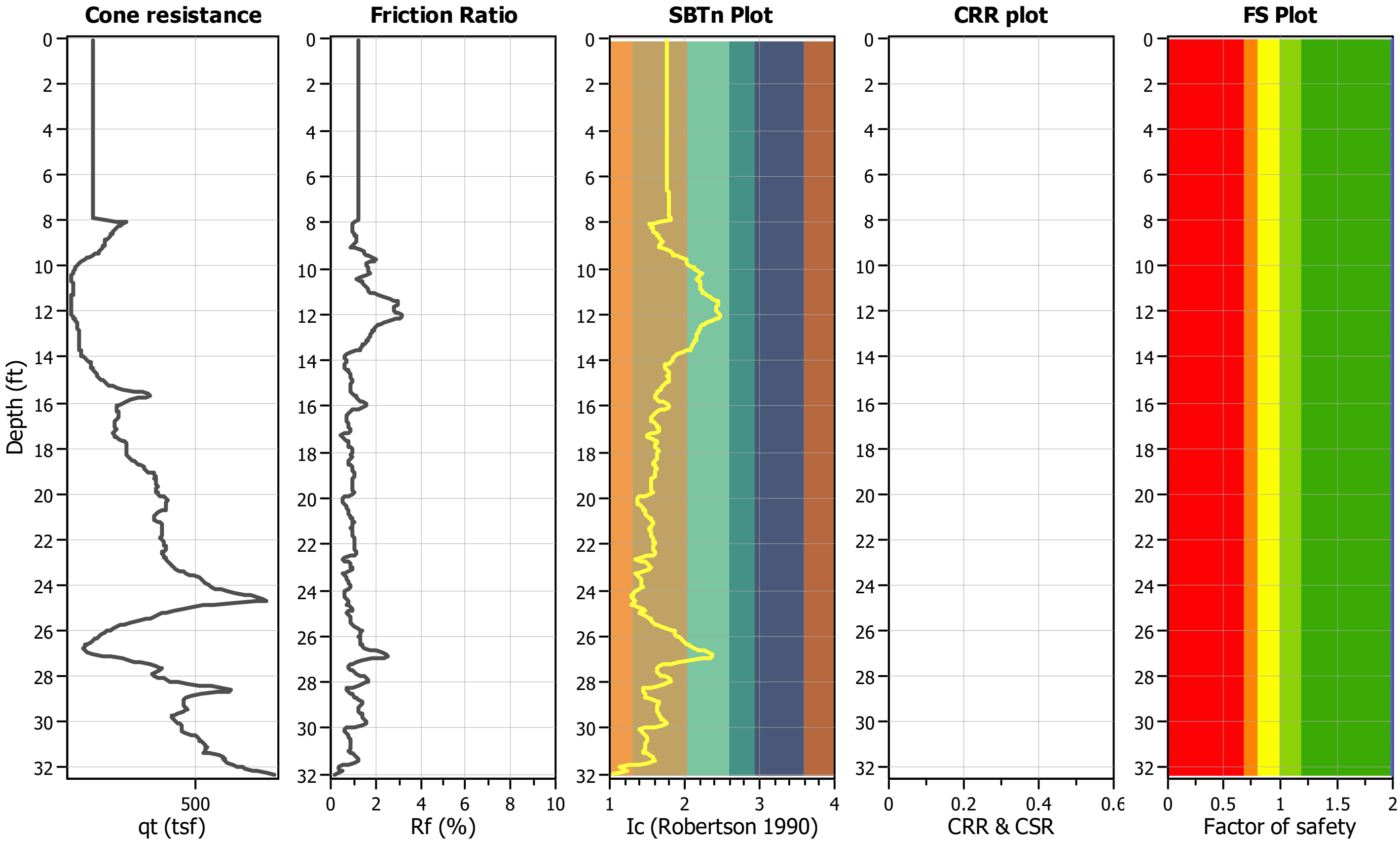
LIQUEFACTION ANALYSIS REPORT

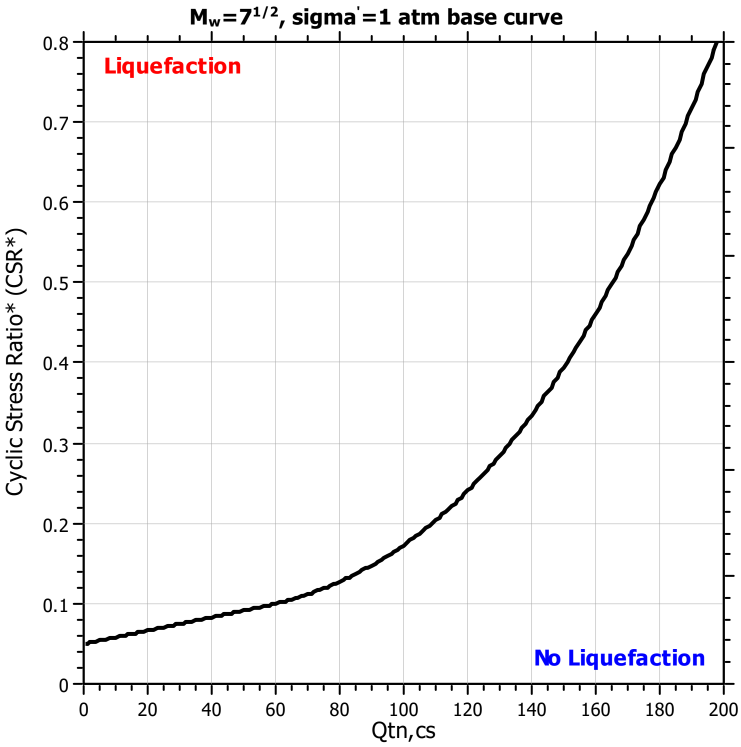
Project title : Colton Middle School Pavilion and Admin Buildi... **Location : Colton California**

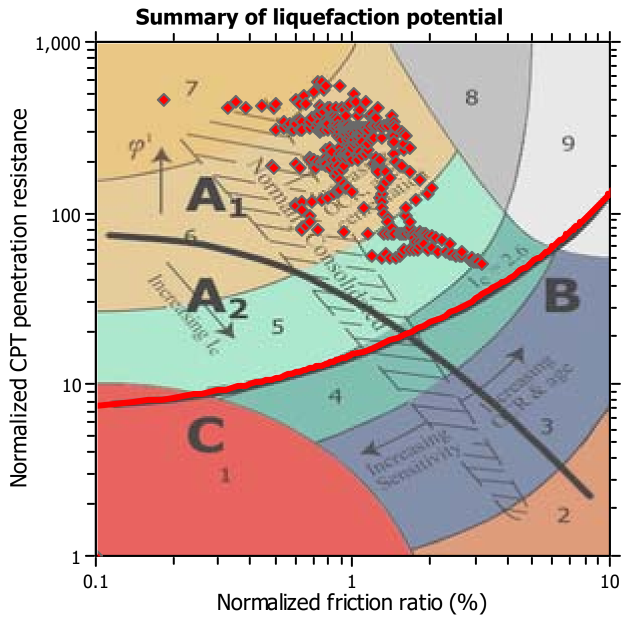
CPT file : CPT-7

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	200.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	100.00 ft	Fill height:	N/A		
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	Yes
Earthquake magnitude M_w:	8.10	Ic cut-off value:	2.60	Trans. detect. applied:	No	Limit depth:	50.00 ft
Peak ground acceleration:	1.06	Unit weight calculation:	Based on SBT	K_σ applied:	Yes	MSF method:	Method based

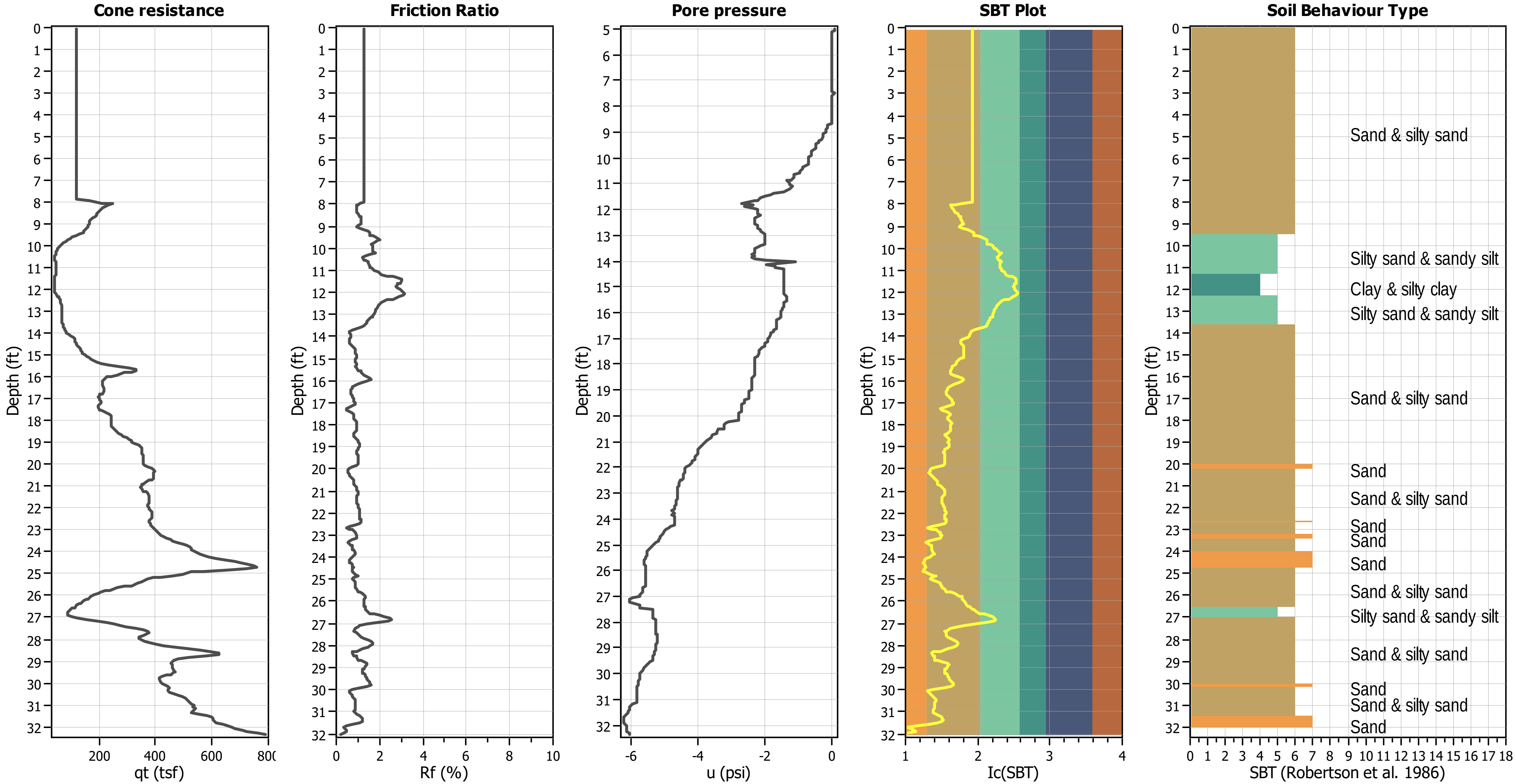






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



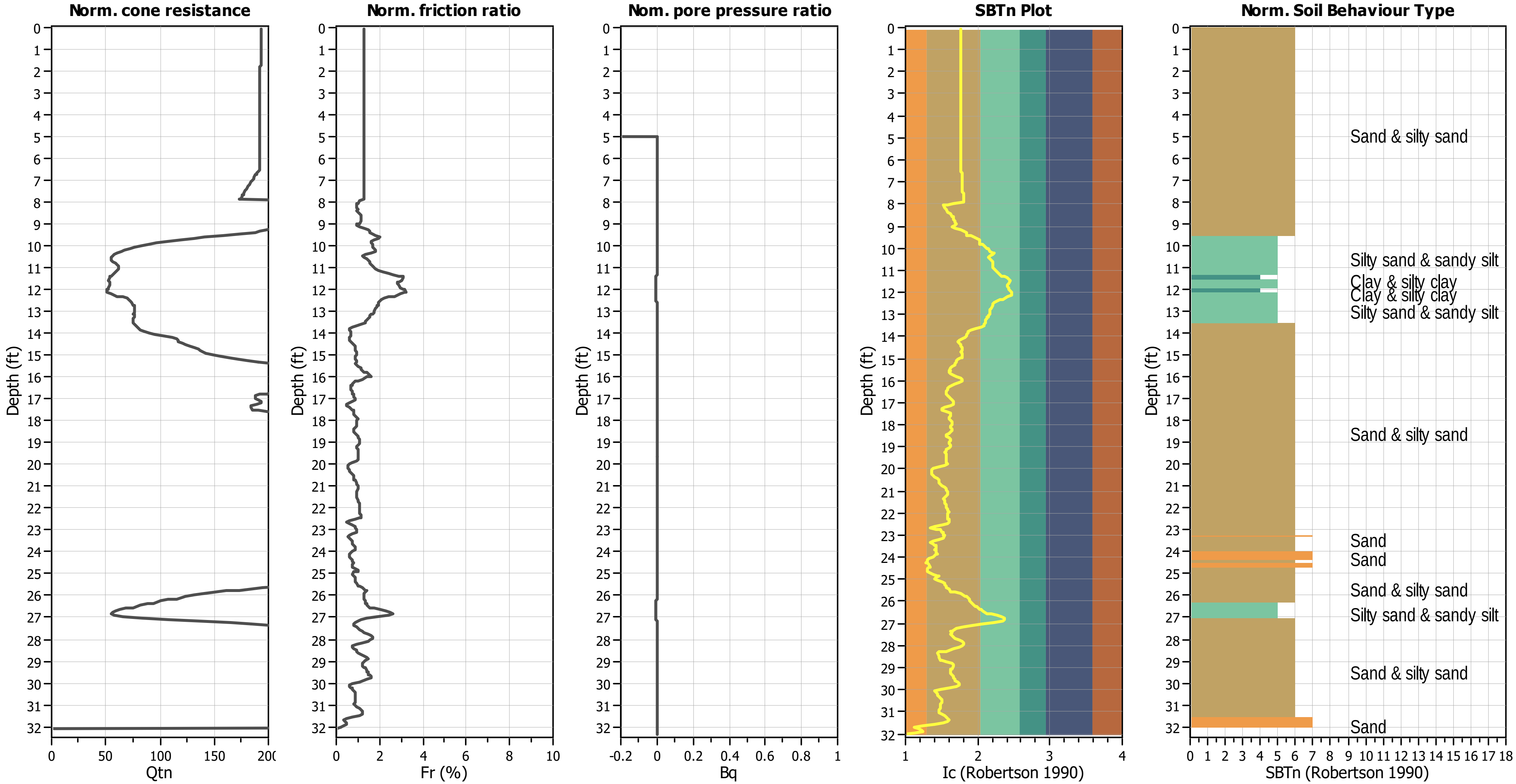
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	100.00 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:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	8.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	1.06	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	200.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

SBT legend

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

CPT basic interpretation plots (normalized)



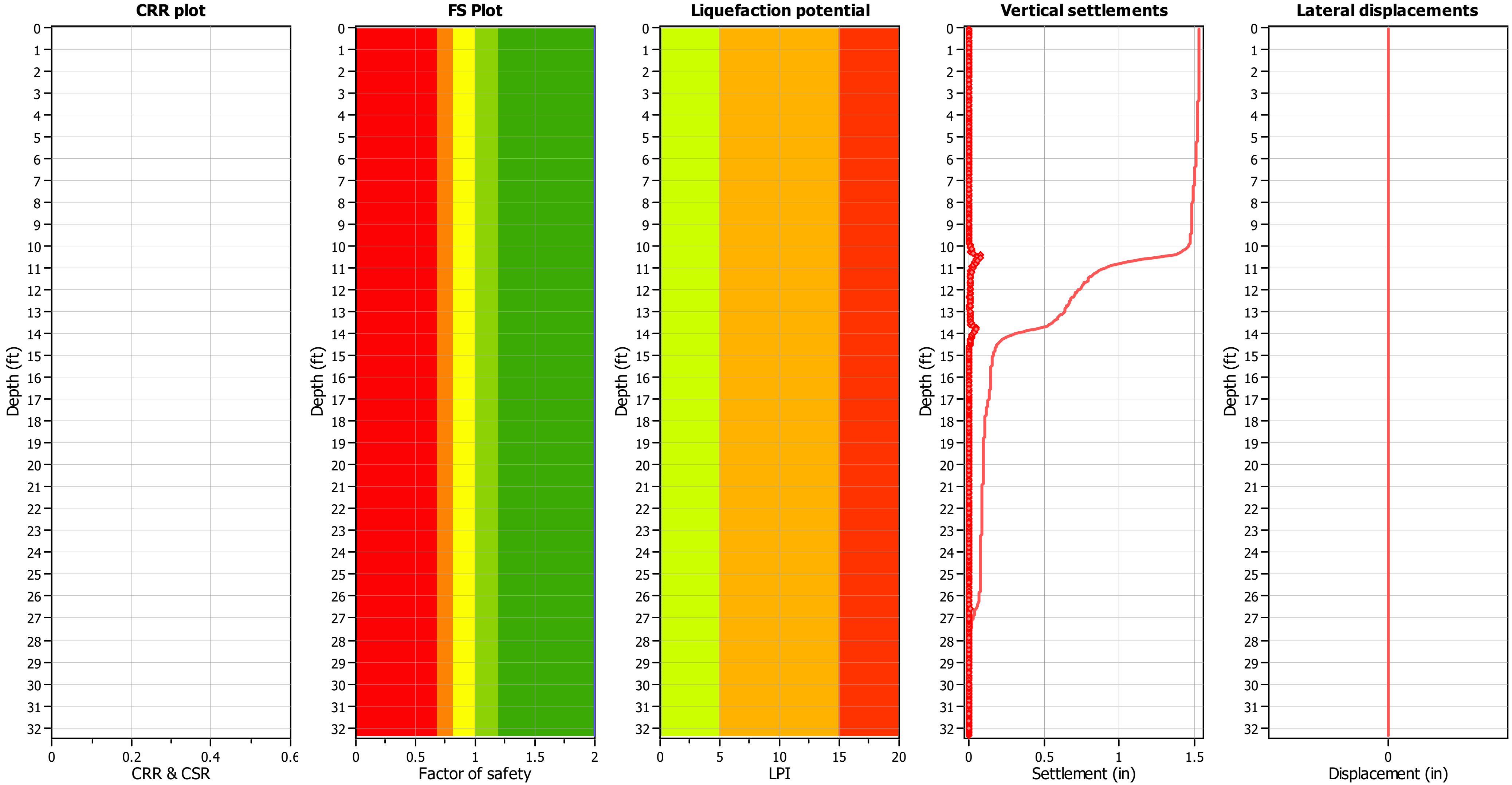
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	100.00 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:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	8.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	1.06	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	200.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

SBTn legend

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	100.00 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:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	8.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	1.06	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	200.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

F.S. color scheme

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

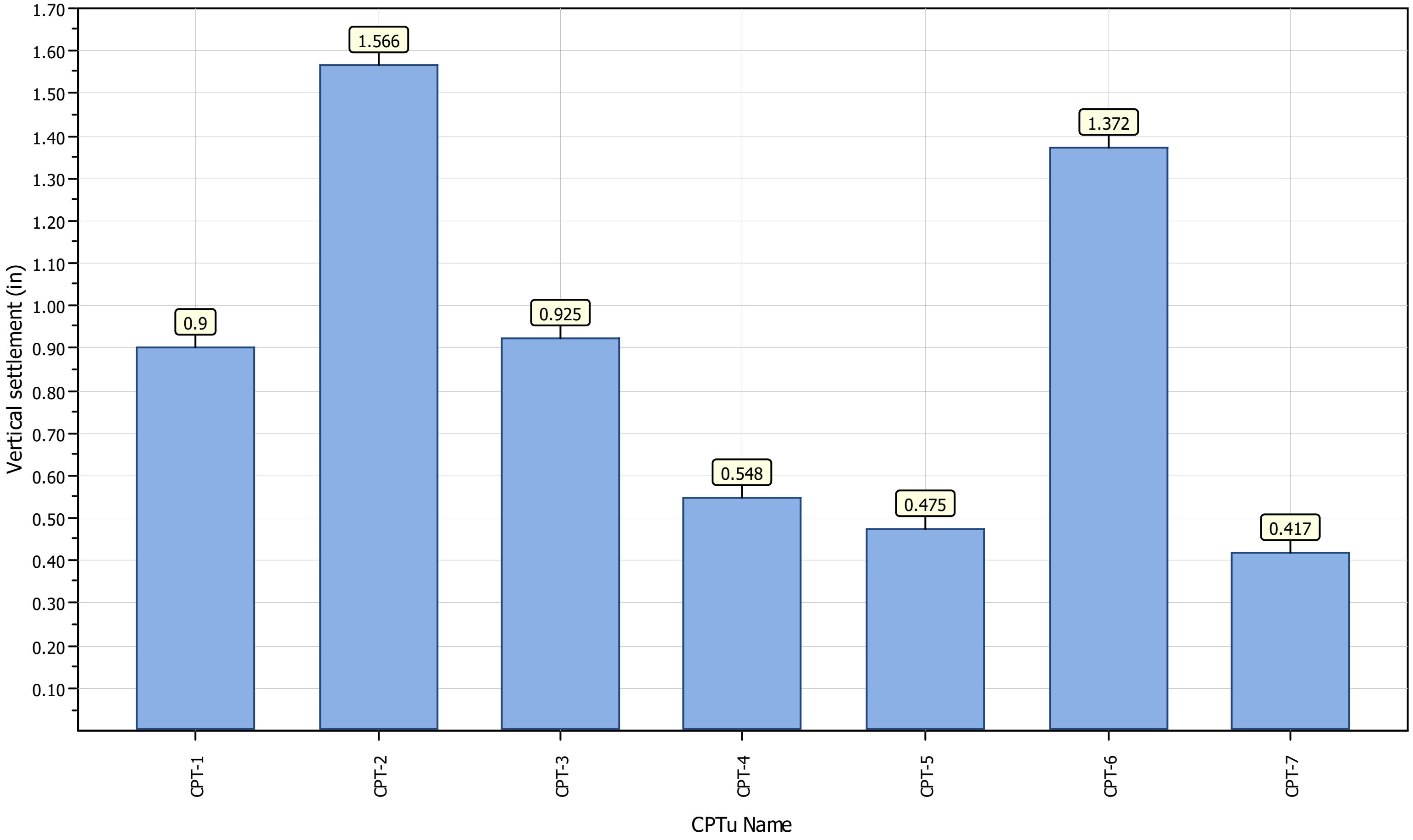
LPI color scheme

- Very high risk
- High risk
- Low risk

Project title : Colton Middle School Pavilion and Admin Building

Location : Colton California

Overall vertical settlements report



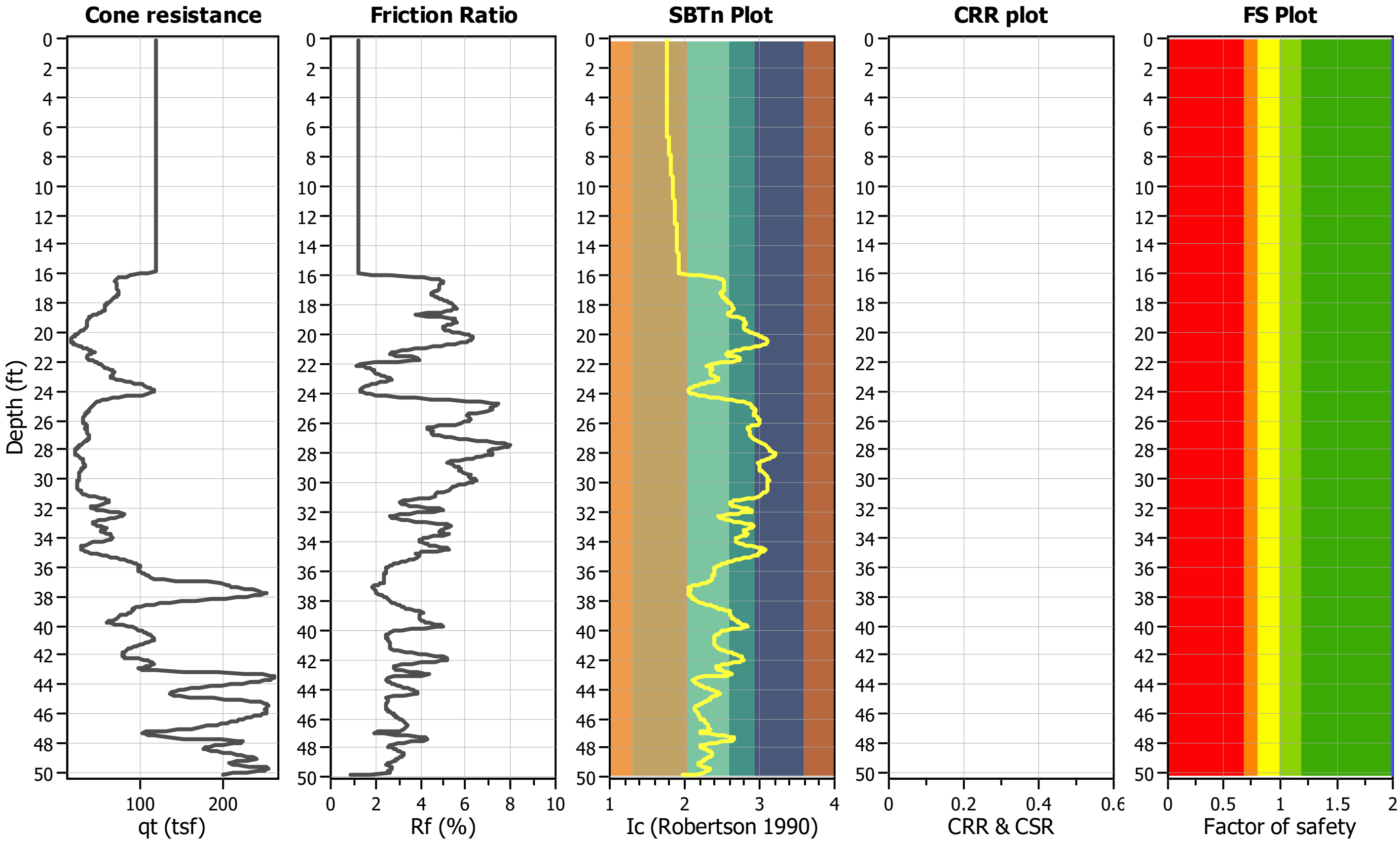
LIQUEFACTION ANALYSIS REPORT

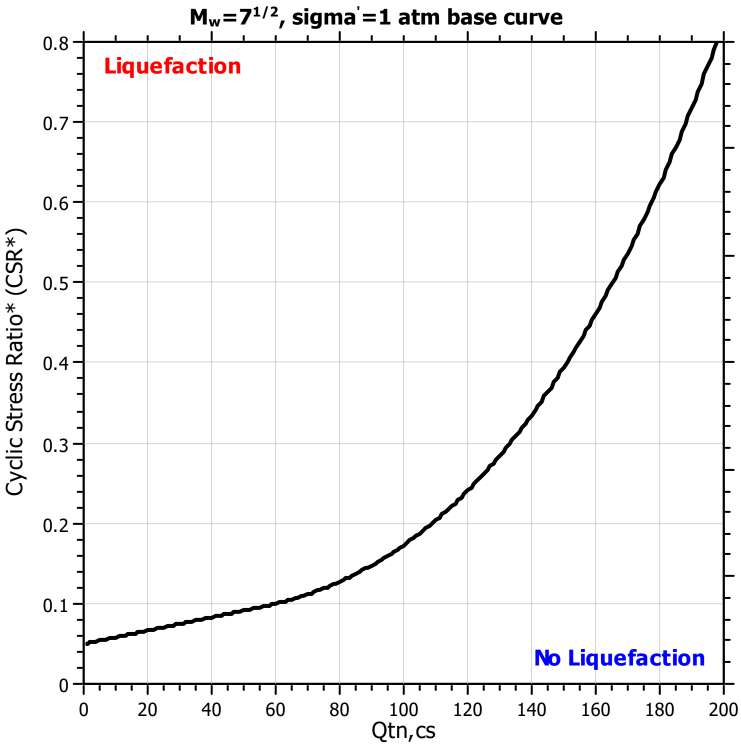
Project title : Colton Middle School Pavilion and Admin Buildi... **Location : Colton California**

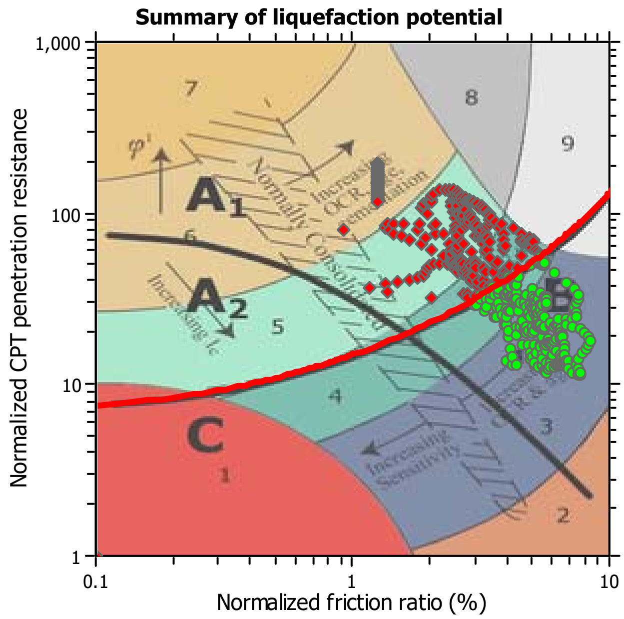
CPT file : CPT-1

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	200.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	100.00 ft	Fill height:	N/A		
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	Yes
Earthquake magnitude M_w:	8.10	Ic cut-off value:	2.60	Trans. detect. applied:	No	Limit depth:	50.00 ft
Peak ground acceleration:	1.06	Unit weight calculation:	Based on SBT	K_σ applied:	Yes	MSF method:	Method based

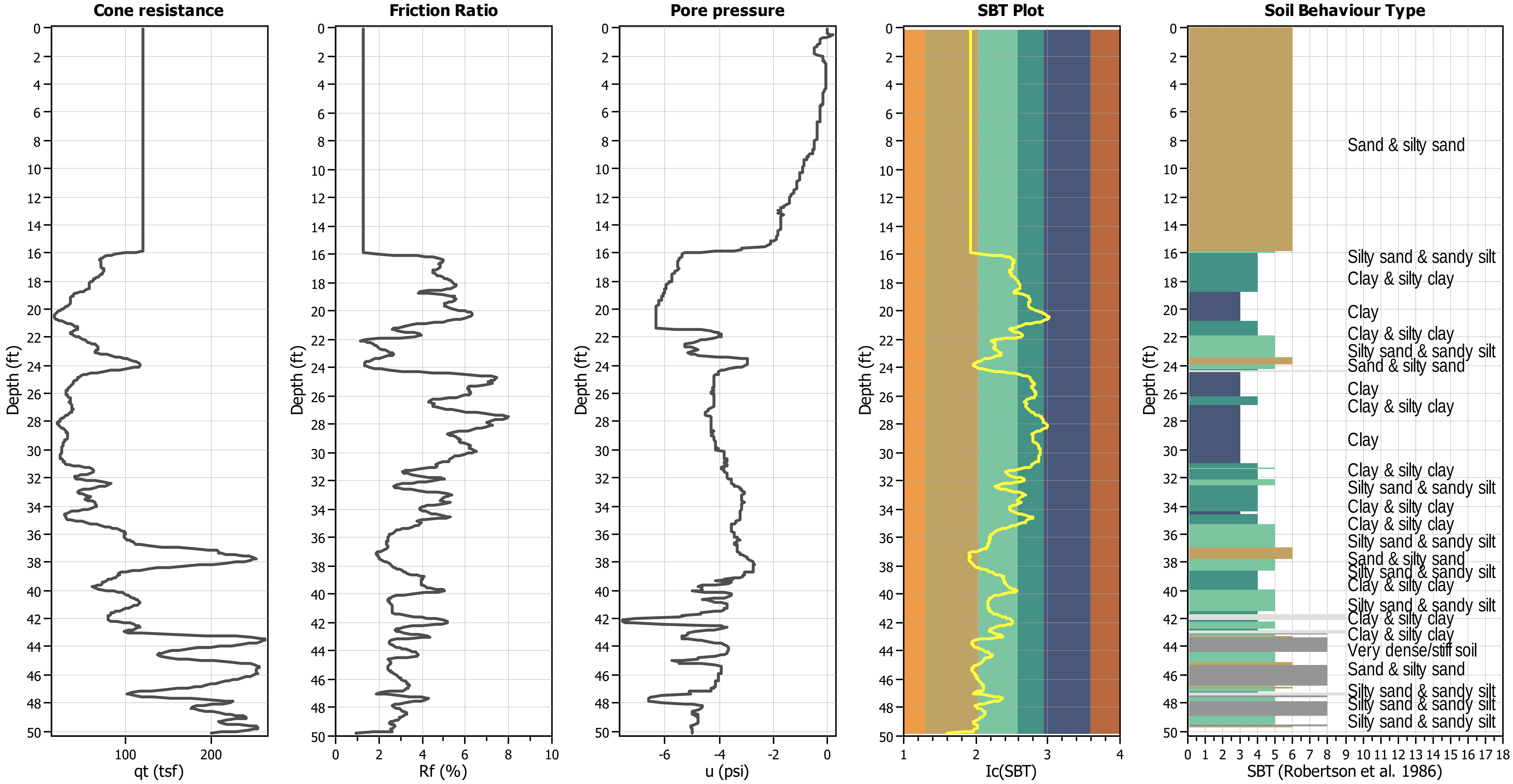






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



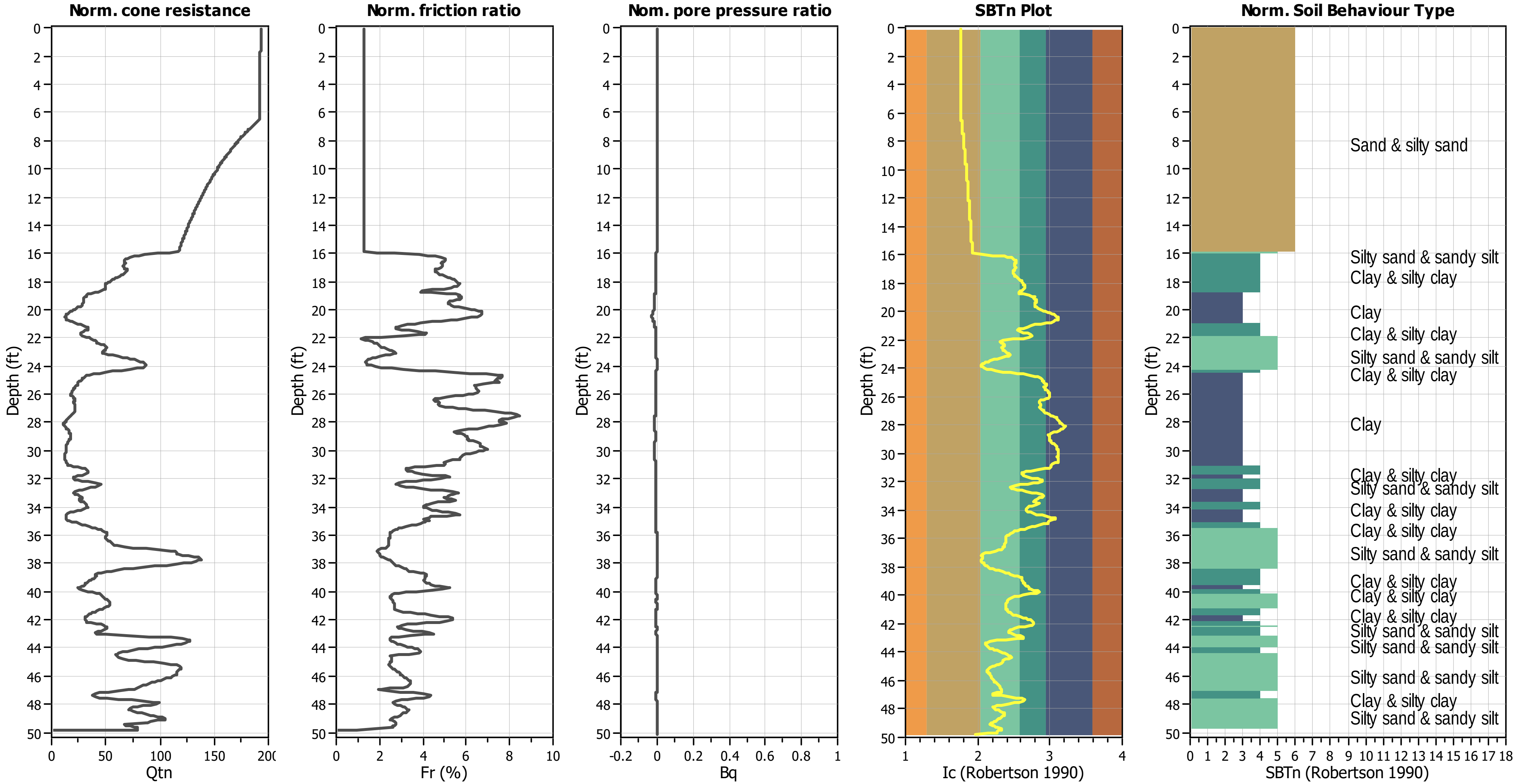
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	100.00 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:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	8.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	1.06	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	200.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

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)



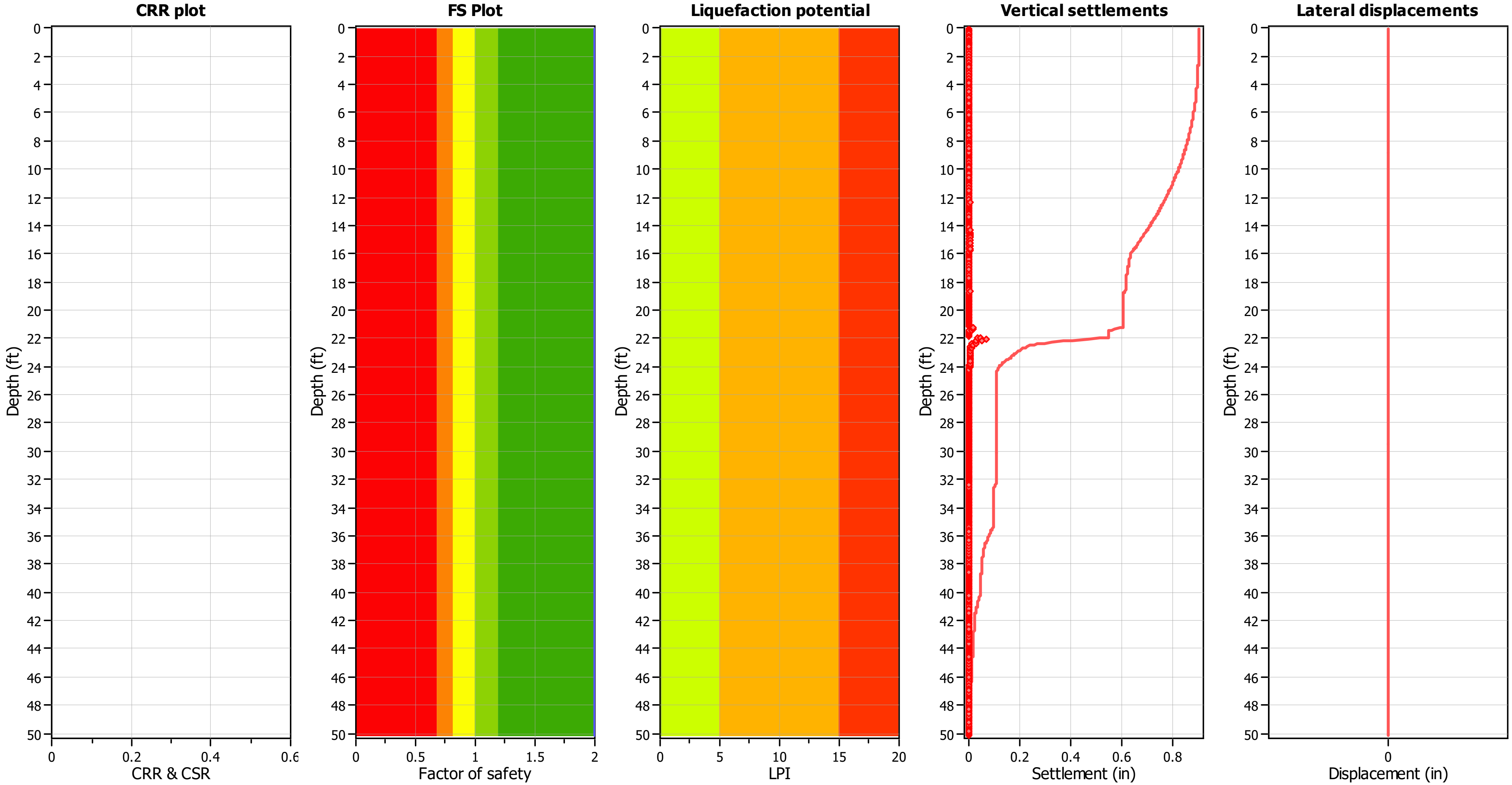
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	100.00 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:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	8.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	1.06	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	200.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

SBTn legend

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	100.00 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:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	8.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	1.06	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	200.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

Leighton
038.0000020707

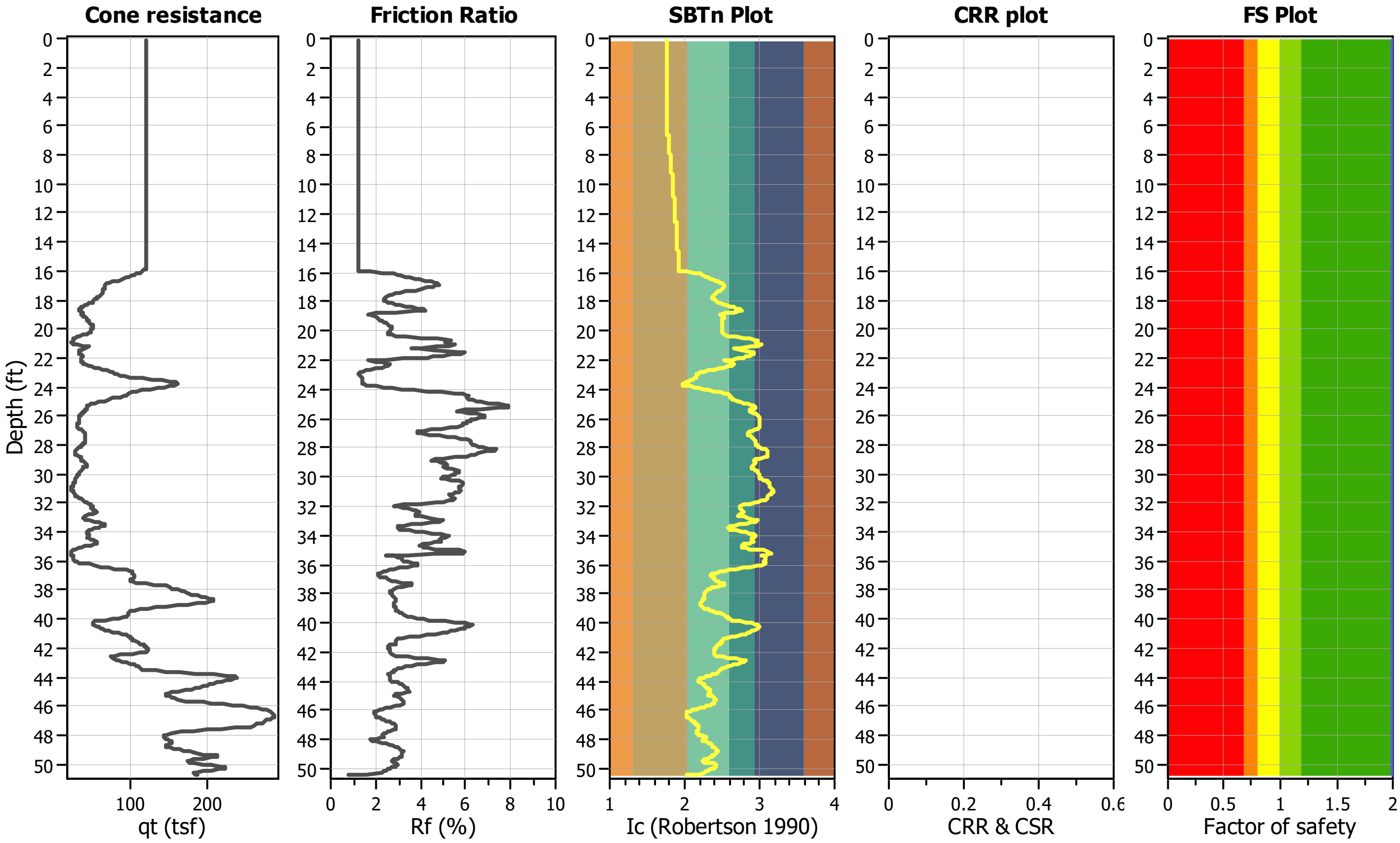
LIQUEFACTION ANALYSIS REPORT

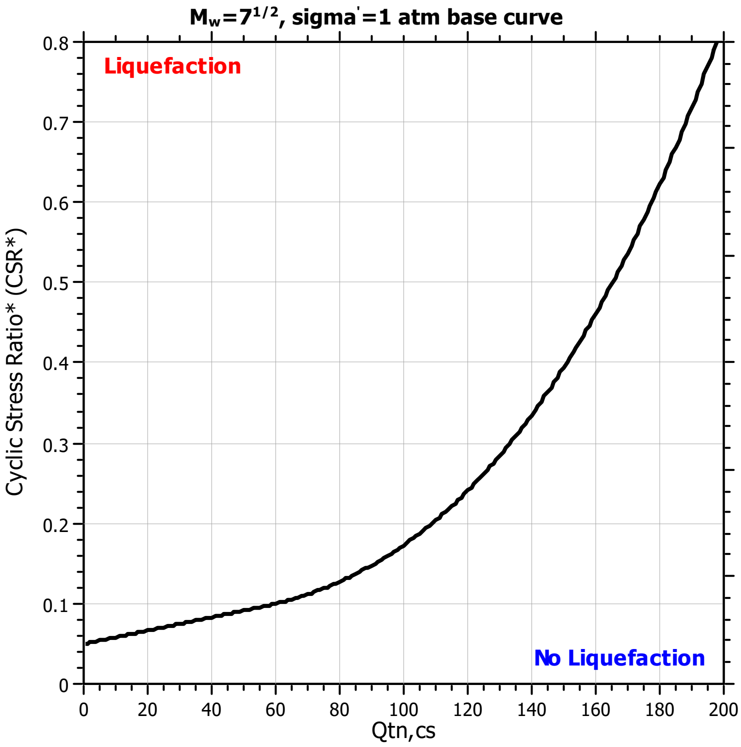
Project title : Colton Middle School Pavilion and Admin **Location : Colton California**

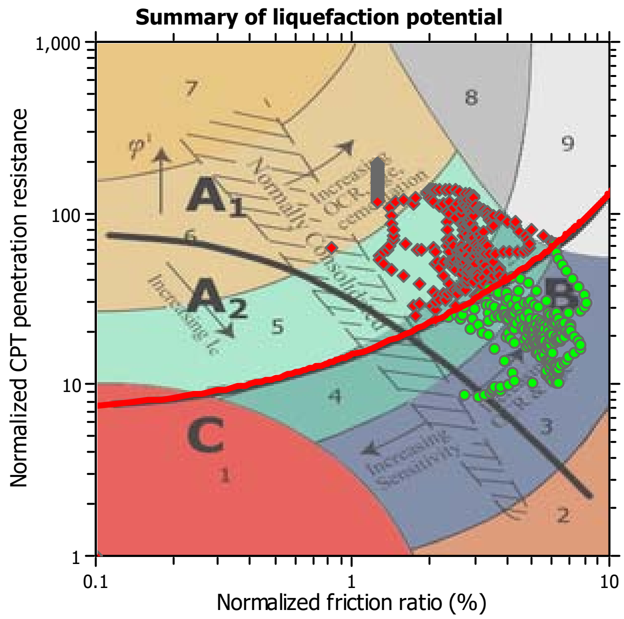
CPT file : CPT-2

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	200.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	100.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	50.00 ft
Earthquake magnitude M_w:	8.10	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	1.06	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

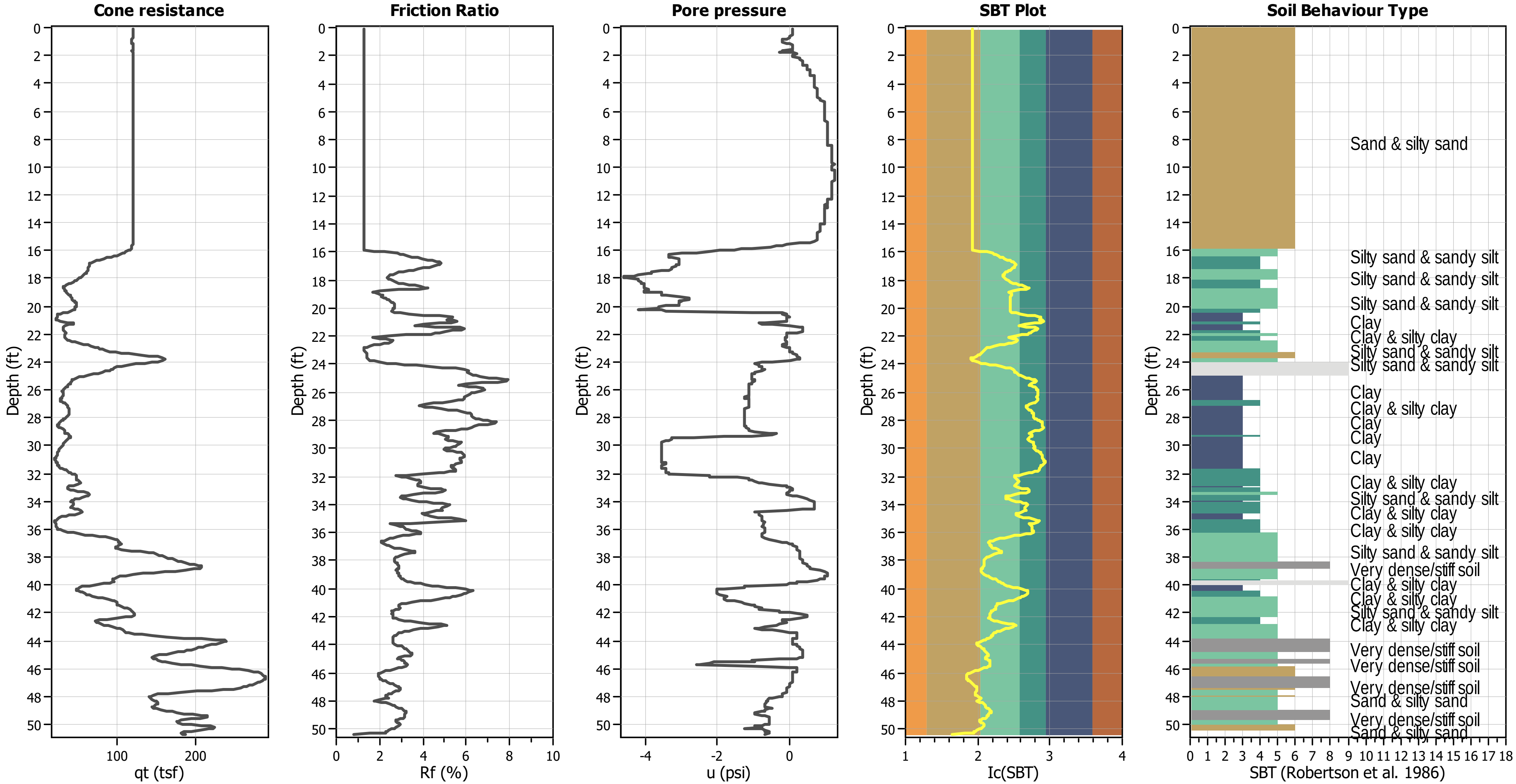






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



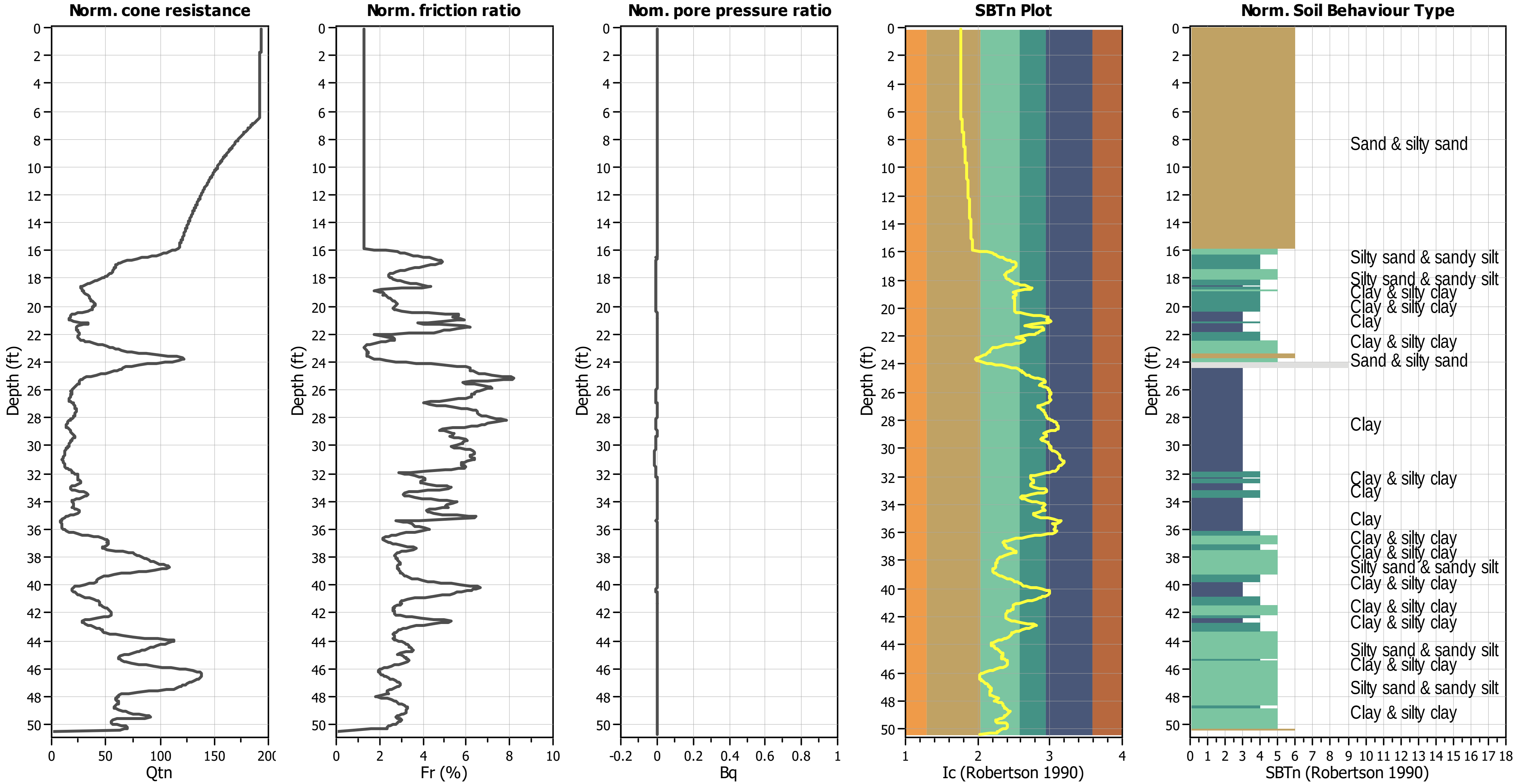
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	100.00 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:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	8.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	1.06	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	200.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

SBT legend

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

CPT basic interpretation plots (normalized)



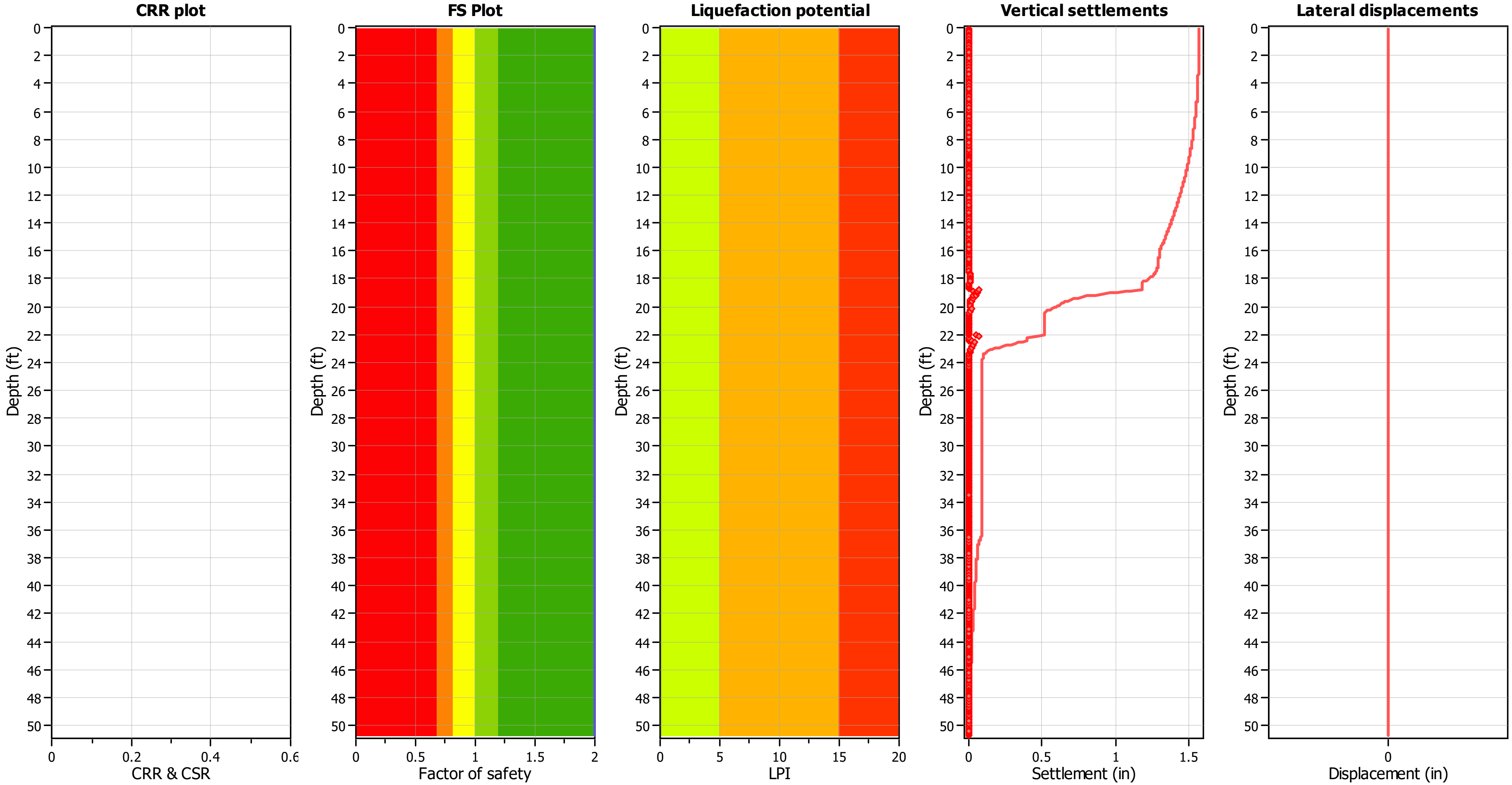
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	100.00 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:	2.60	K_{σ} applied:	Yes
Earthquake magnitude M_w:	8.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	1.06	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	200.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

SBTn legend

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	100.00 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:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	8.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	1.06	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	200.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

Leighton
038.0000020707

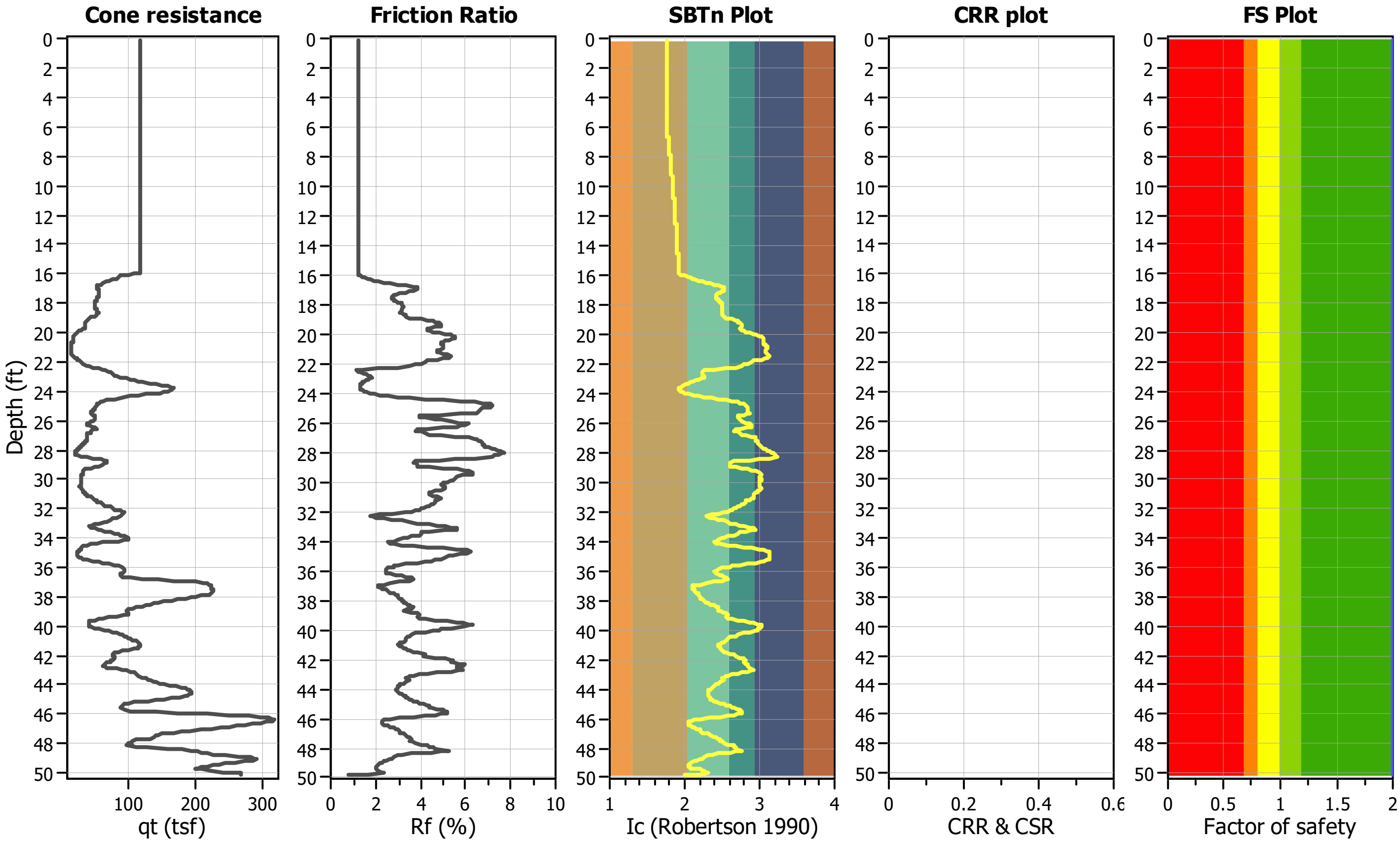
LIQUEFACTION ANALYSIS REPORT

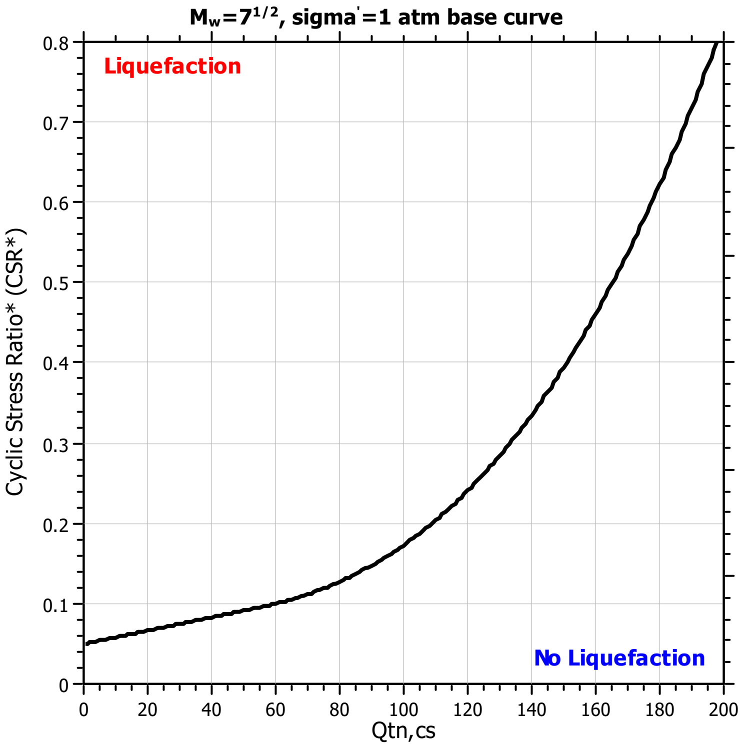
Project title : Colton Middle School Pavilion and Admin Building **Location : Colton California**

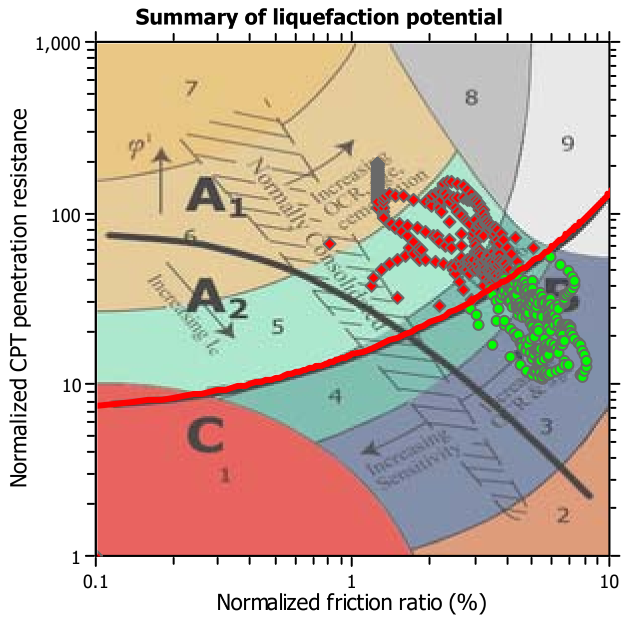
CPT file : CPT-3

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	200.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	100.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	50.00 ft
Earthquake magnitude M_w:	8.10	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	1.06	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

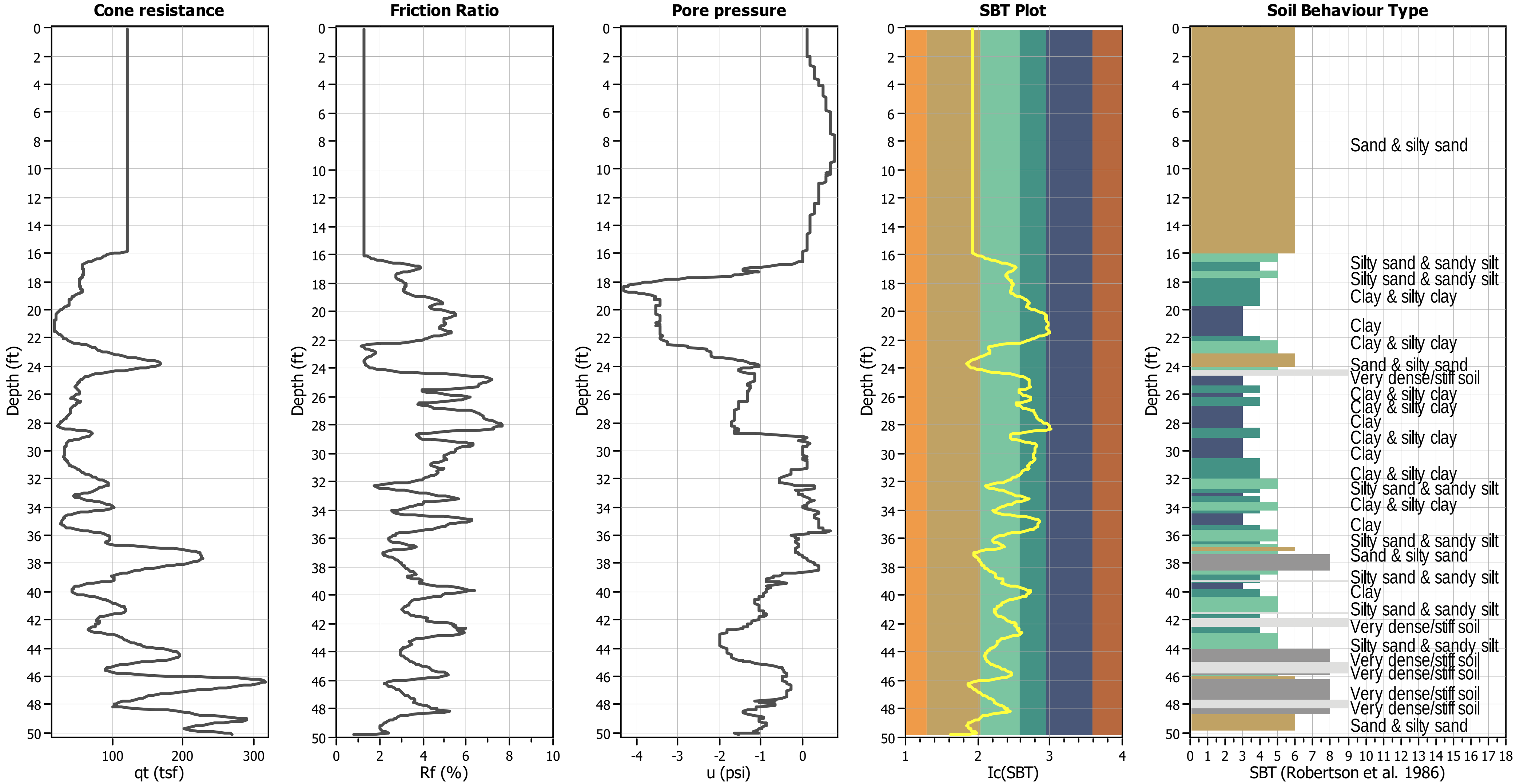






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



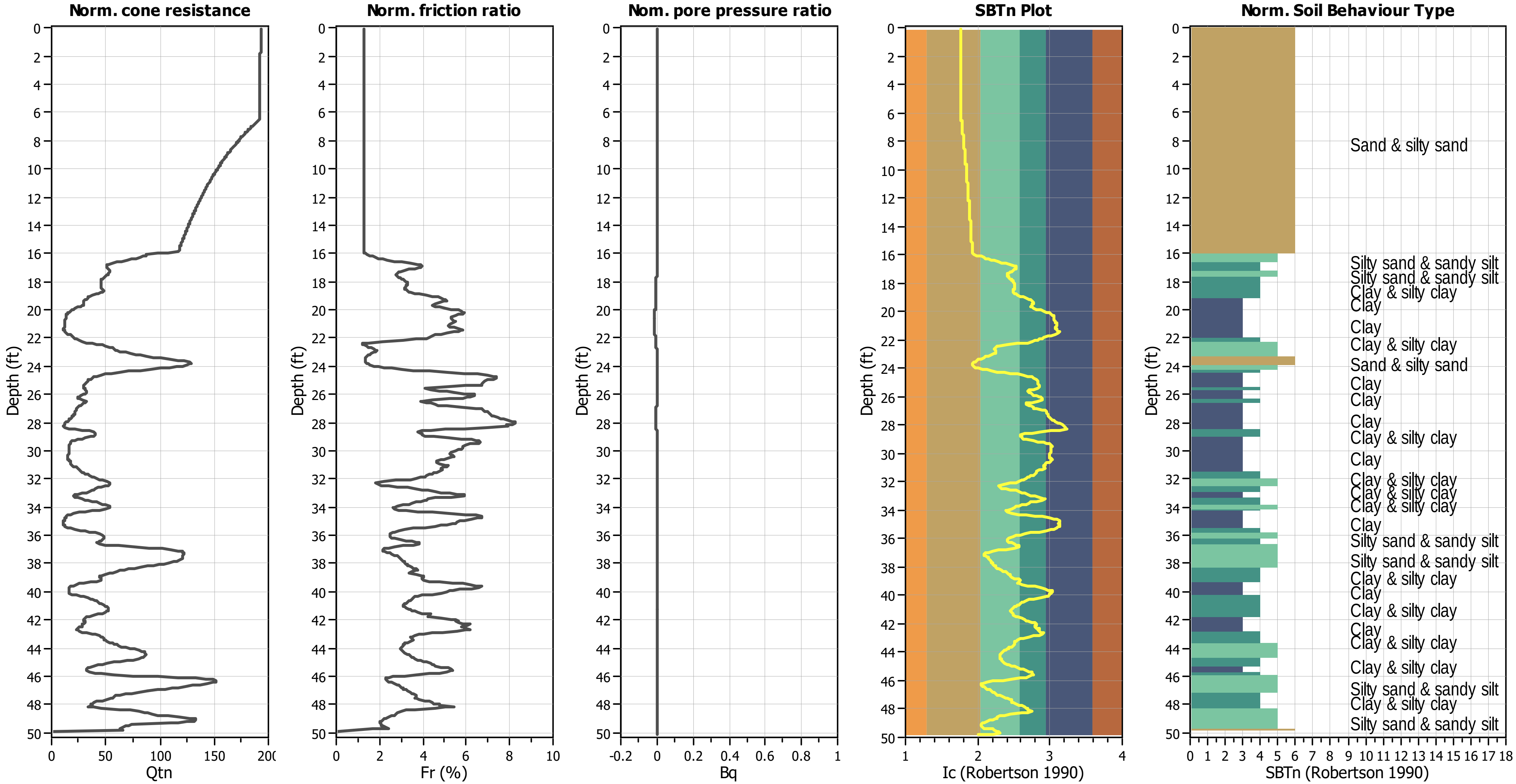
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	100.00 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:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	8.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	1.06	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	200.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

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)



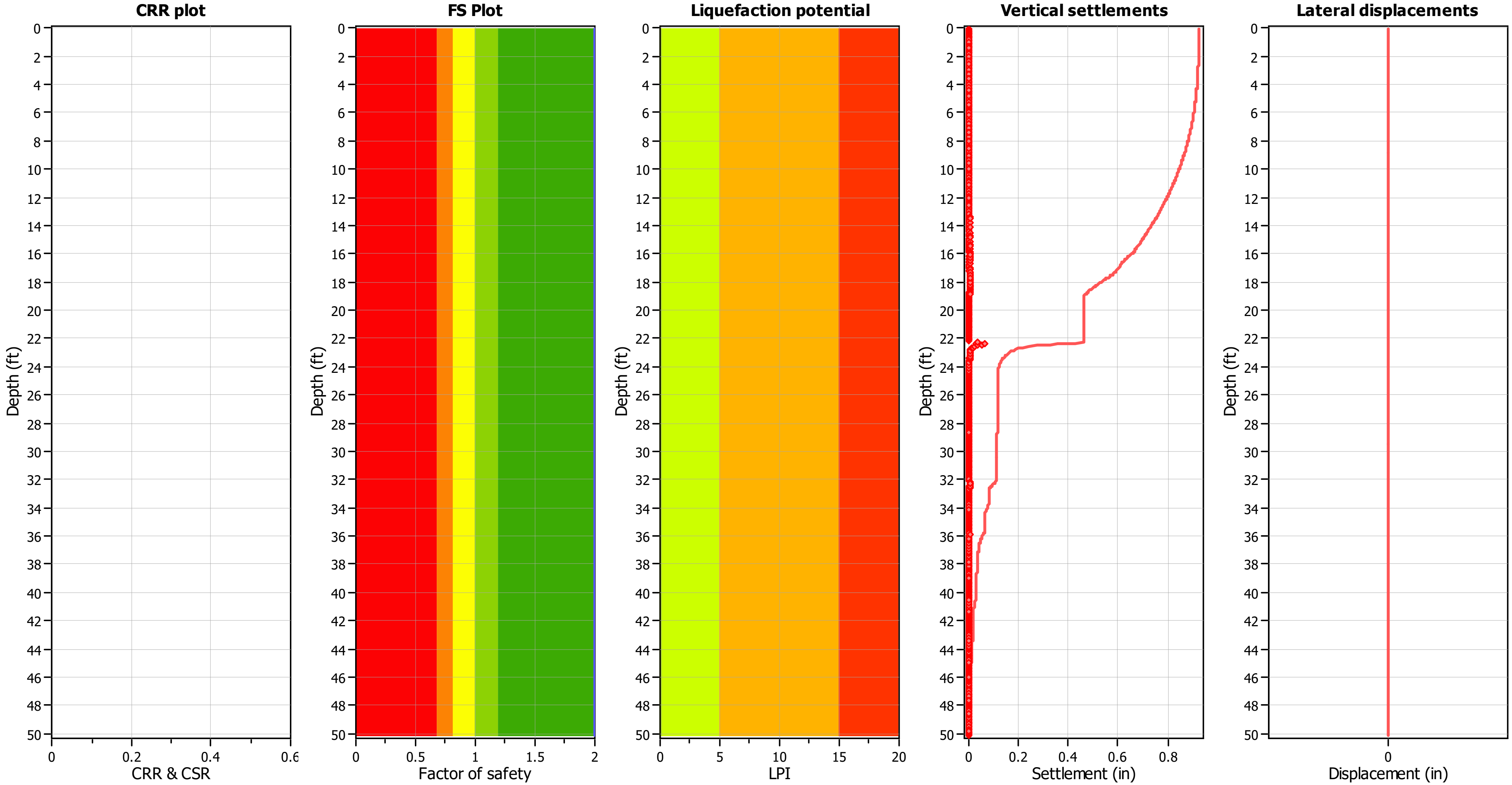
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	100.00 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:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	8.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	1.06	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	200.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

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 (erthq.):	100.00 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:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	8.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	1.06	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	200.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

Leighton
038.0000020707

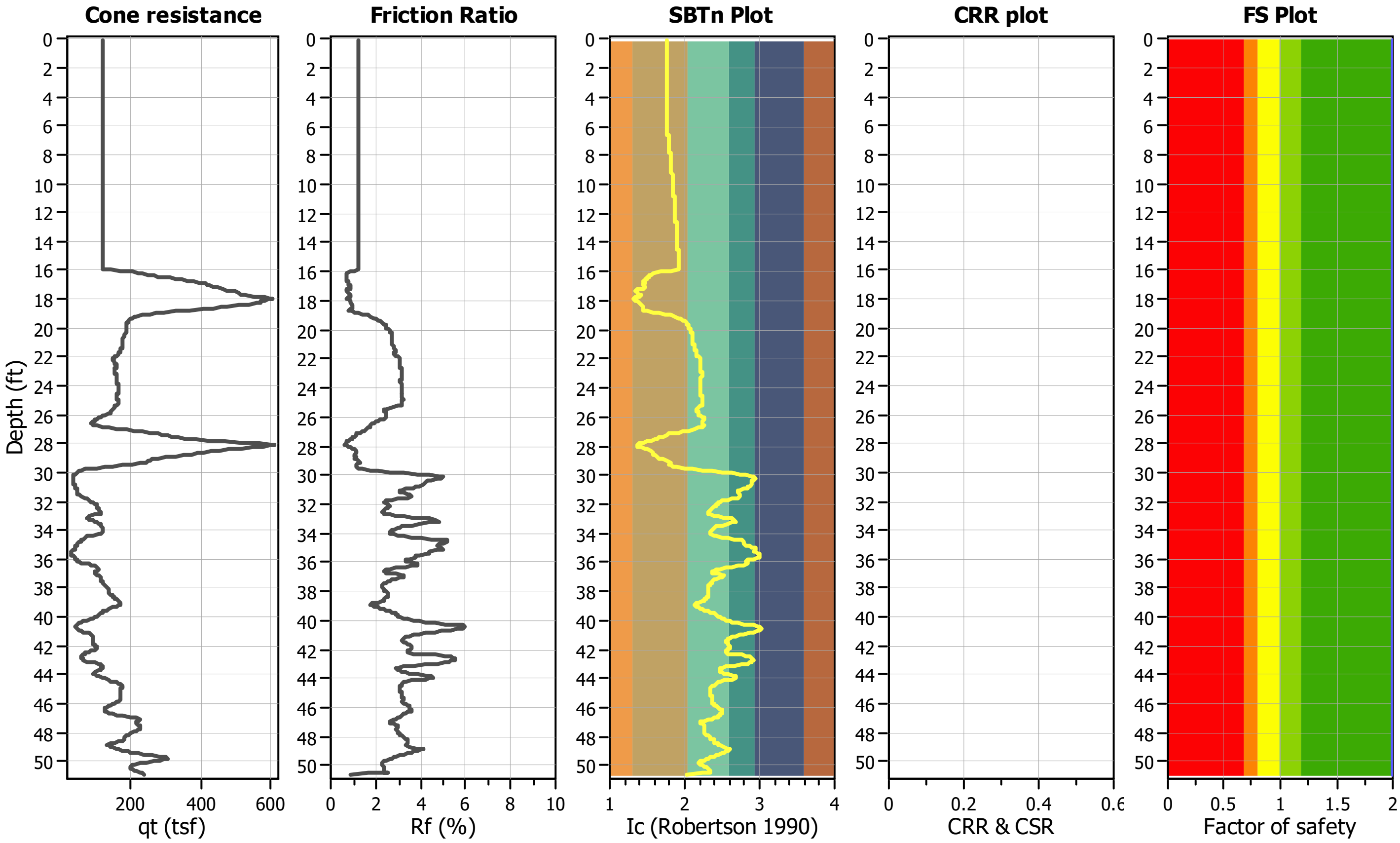
LIQUEFACTION ANALYSIS REPORT

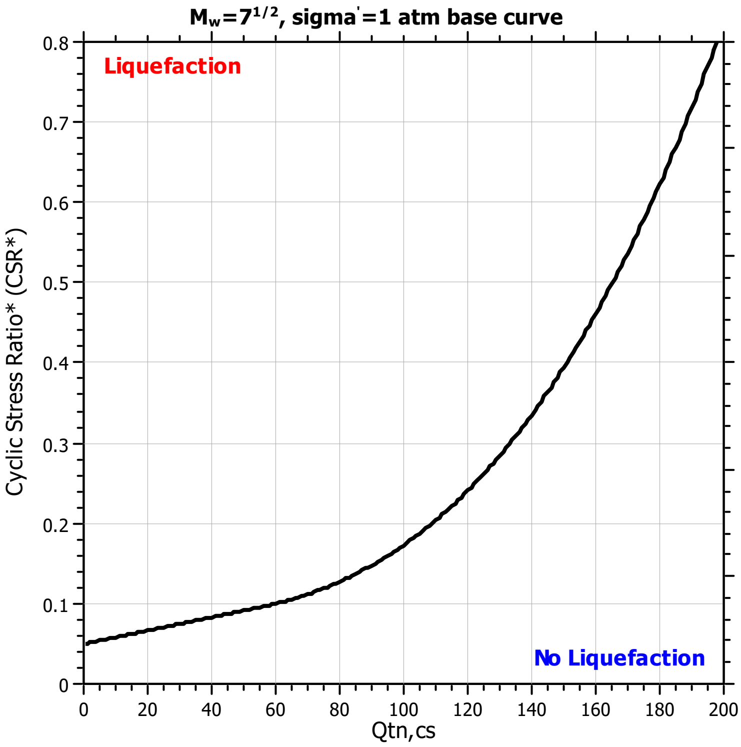
Project title : Colton Middle School Pavilion and Admin **Location : Colton California**

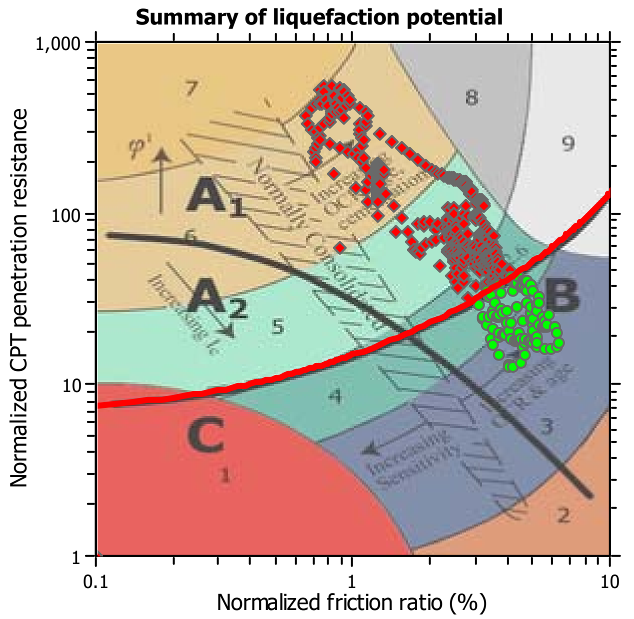
CPT file : CPT-4

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	200.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	100.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	50.00 ft
Earthquake magnitude M_w:	8.10	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	1.06	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

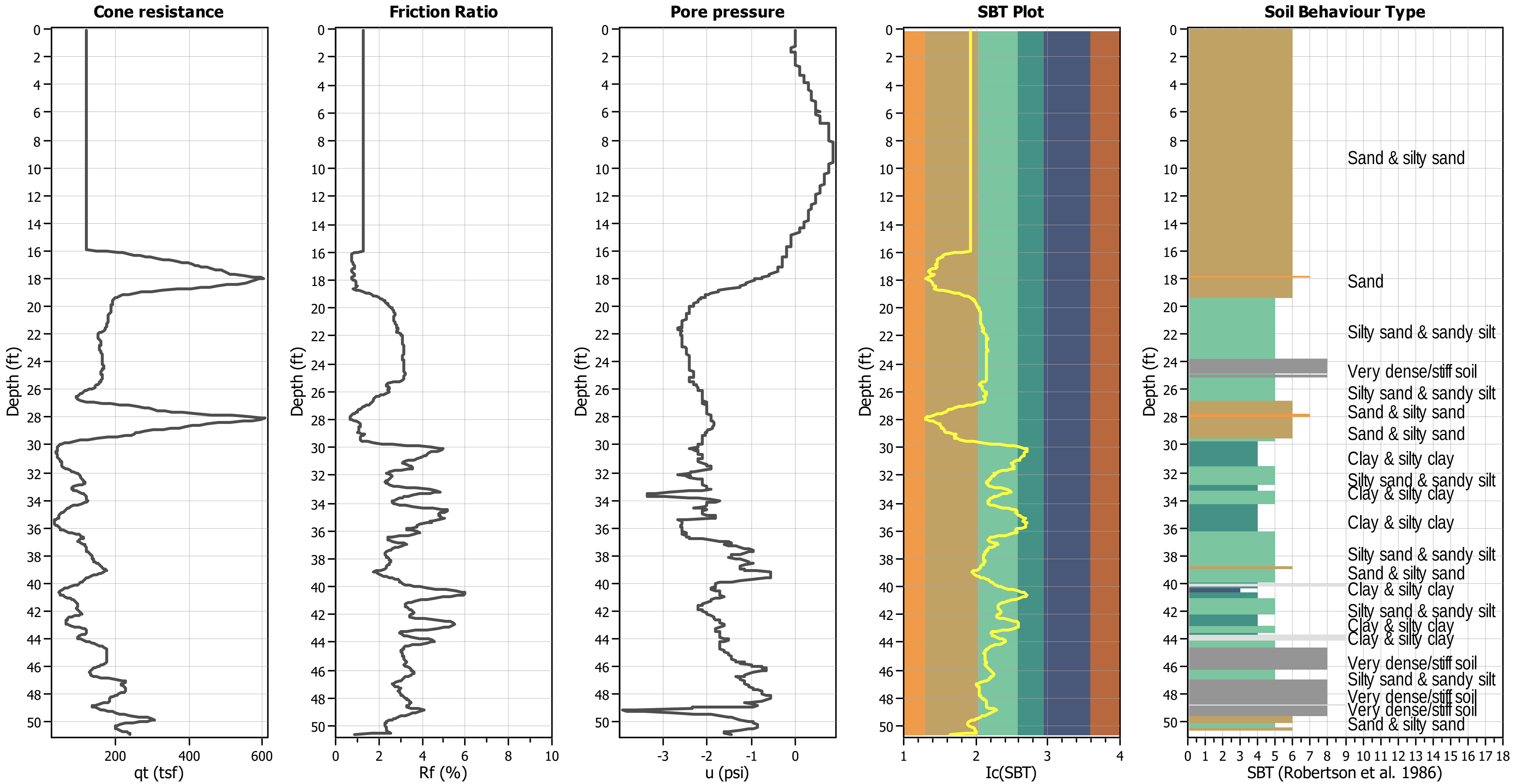






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



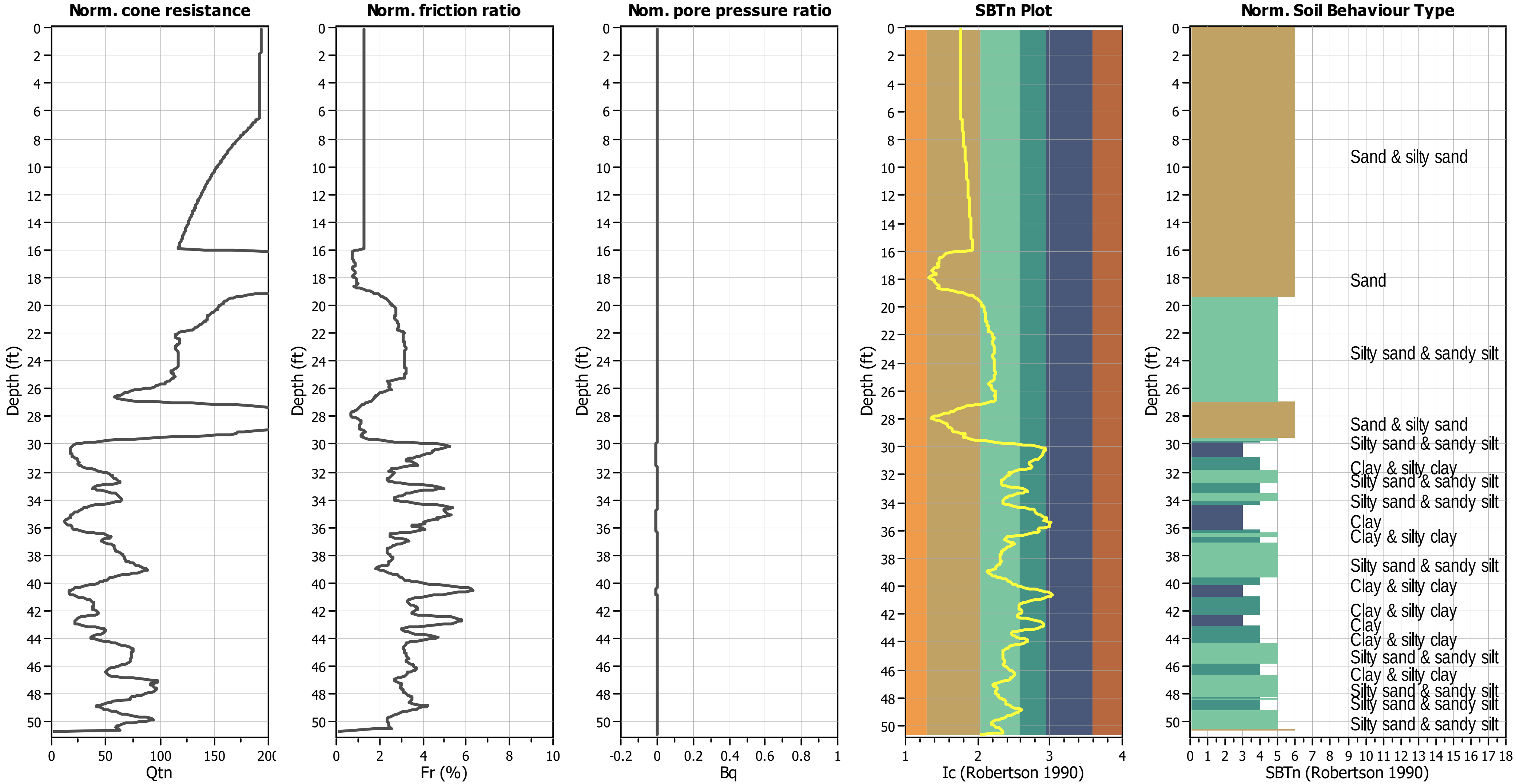
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	100.00 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:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	8.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	1.06	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	200.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

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)



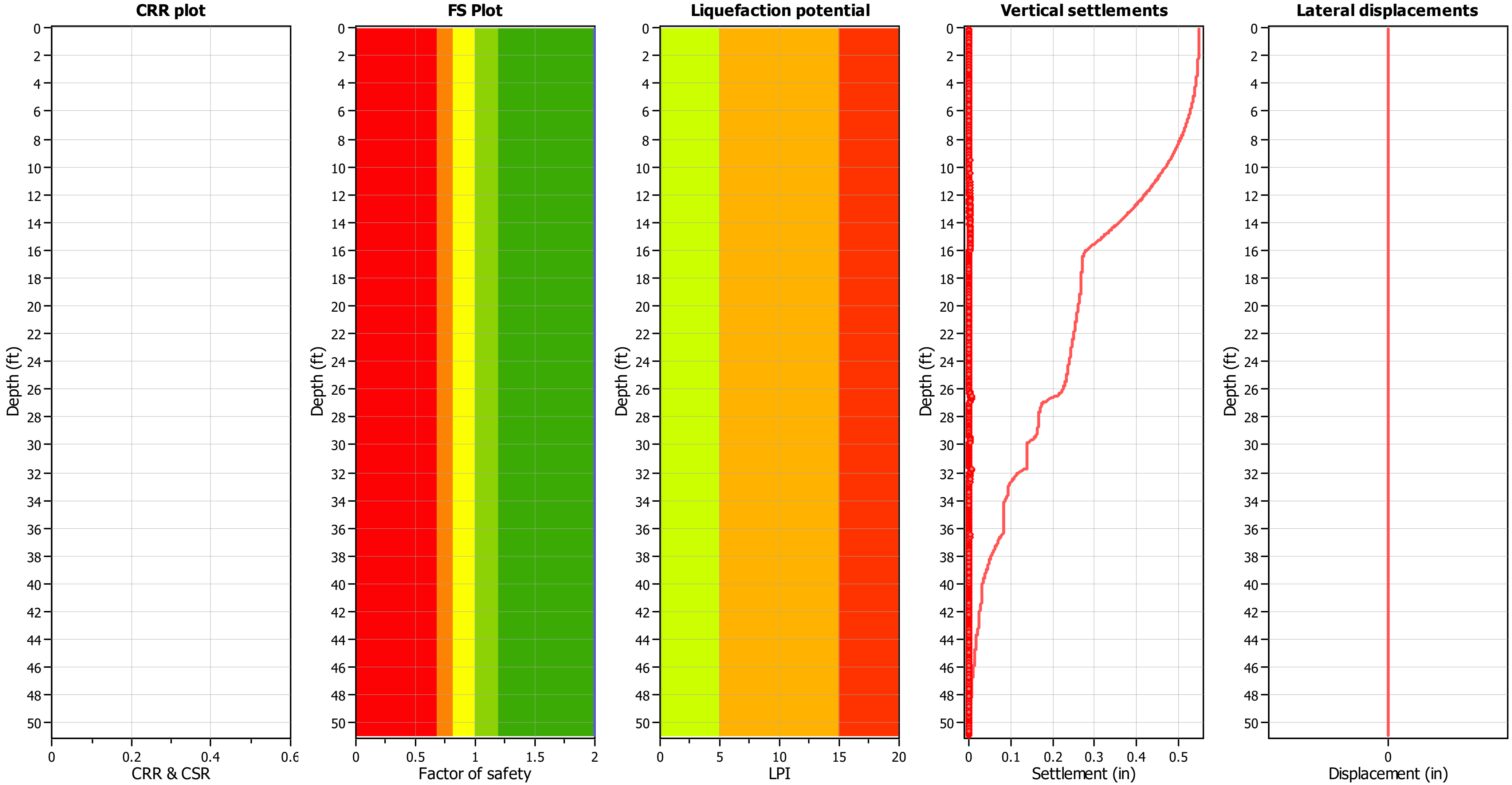
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	100.00 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:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	8.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	1.06	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	200.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

SBTn legend

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	100.00 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:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	8.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	1.06	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	200.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

Leighton
038.0000020707

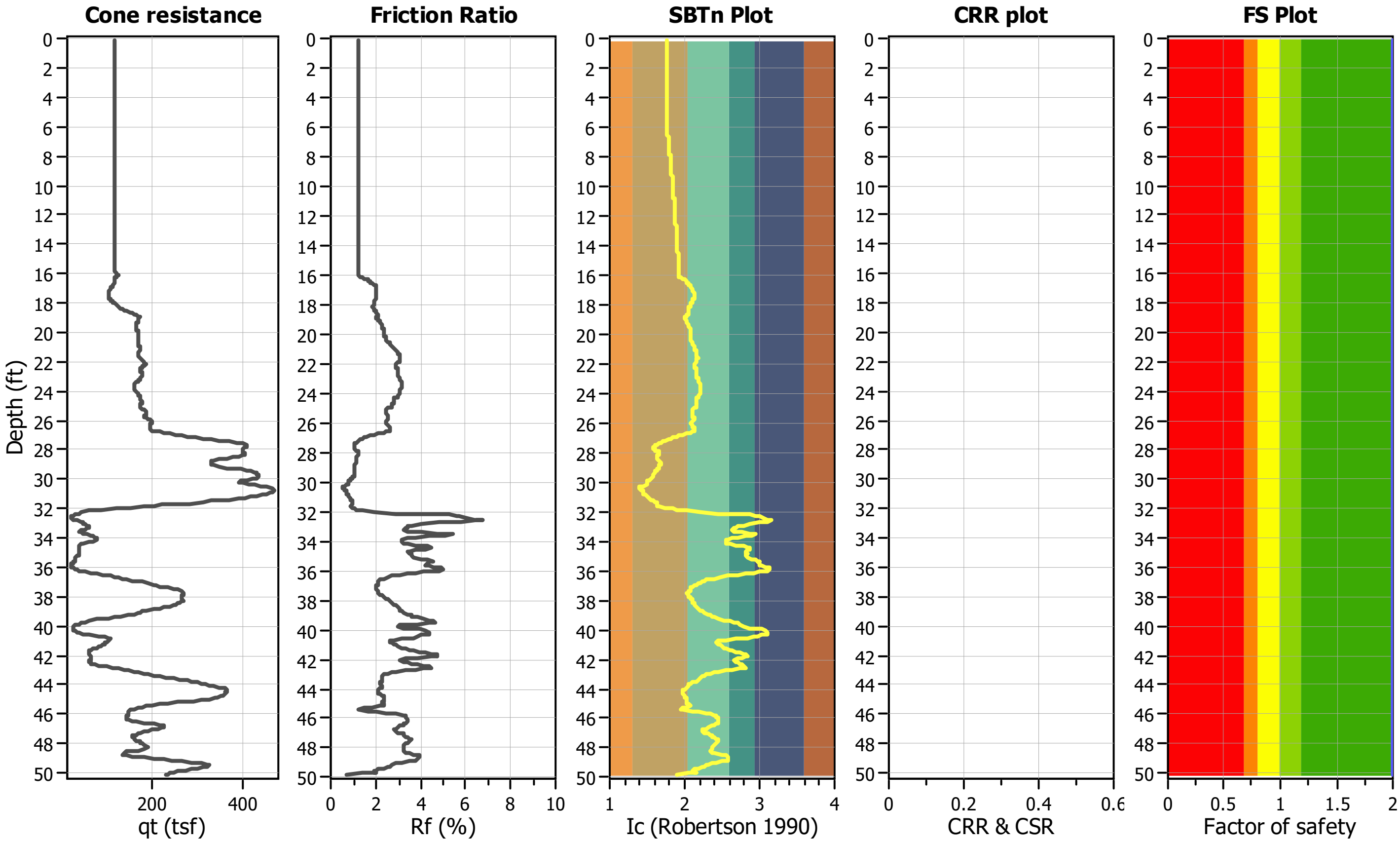
LIQUEFACTION ANALYSIS REPORT

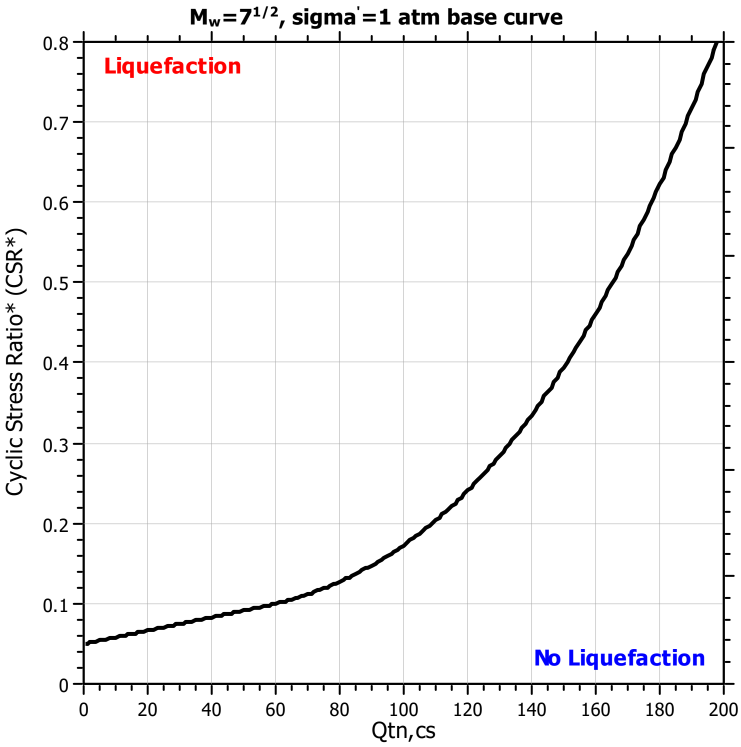
Project title : Colton Middle School Pavilion and Admin Building **Location : Colton California**

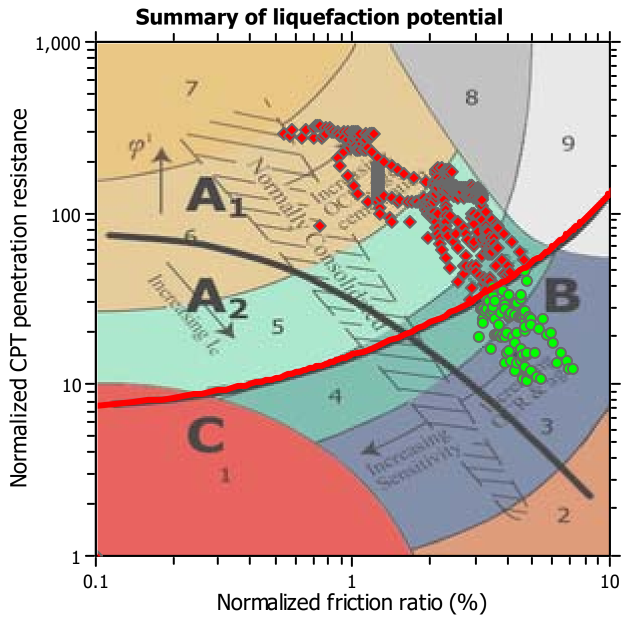
CPT file : CPT-5

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	200.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	100.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	50.00 ft
Earthquake magnitude M_w:	8.10	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	1.06	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

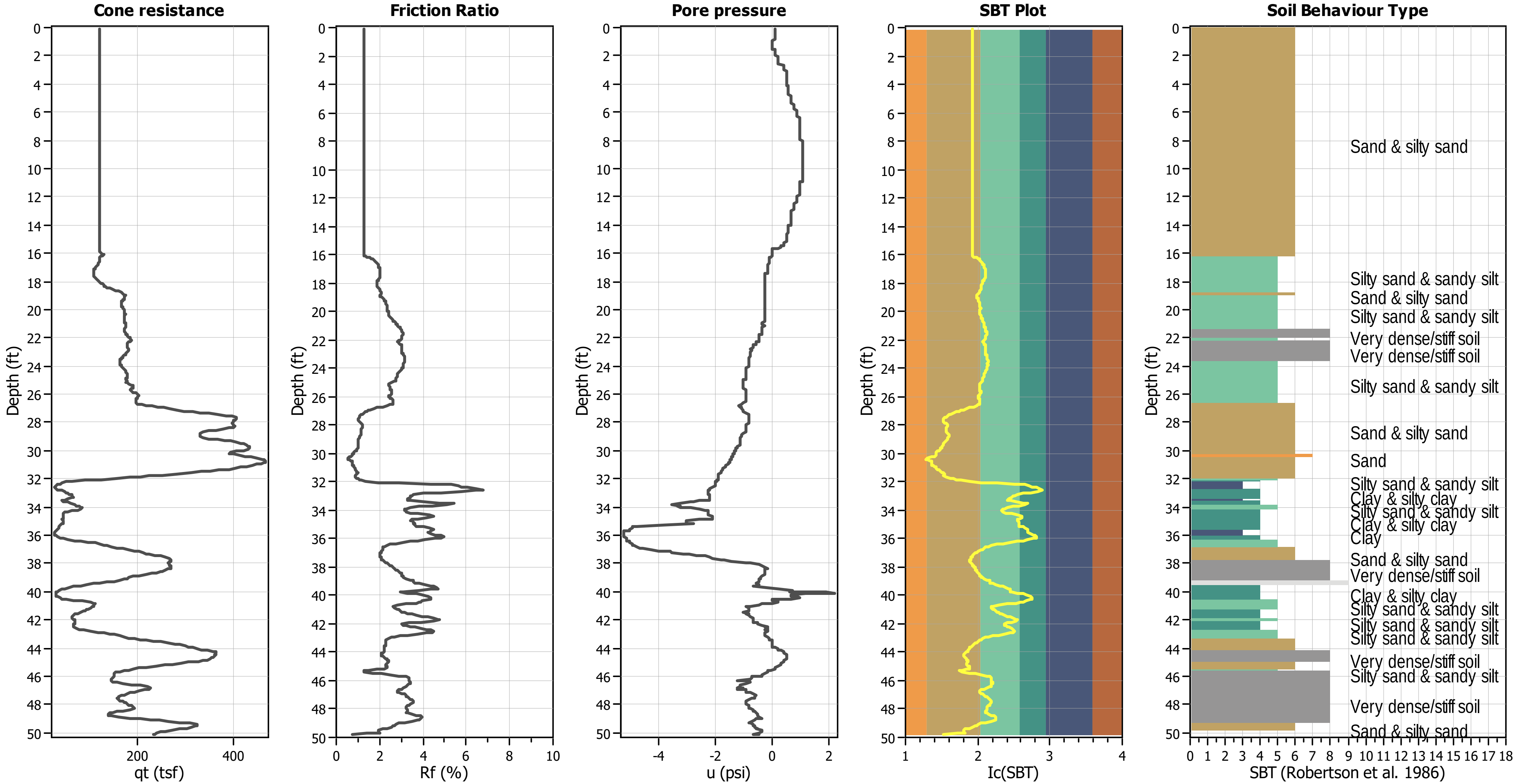






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



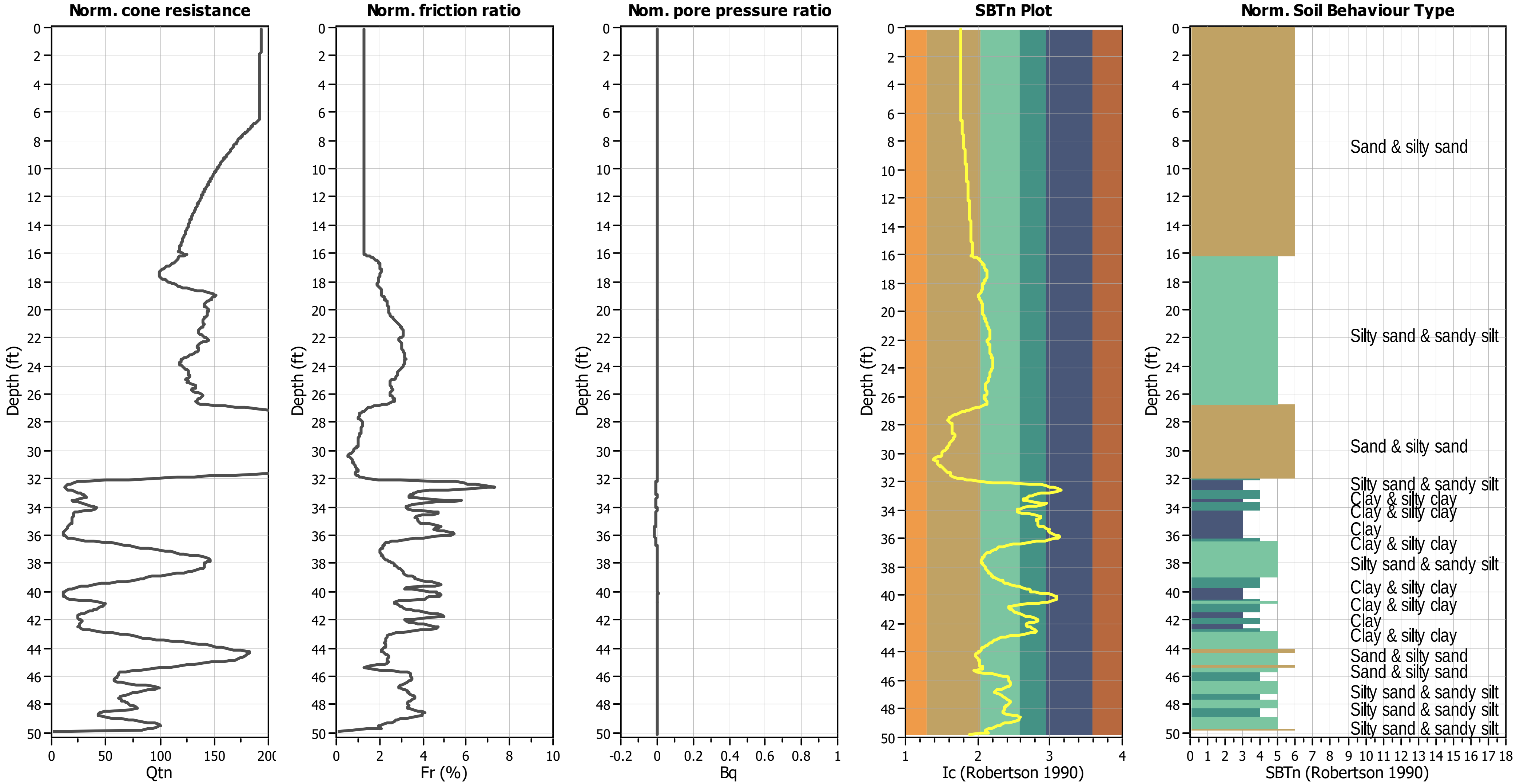
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	100.00 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:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	8.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	1.06	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	200.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

SBT legend

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

CPT basic interpretation plots (normalized)



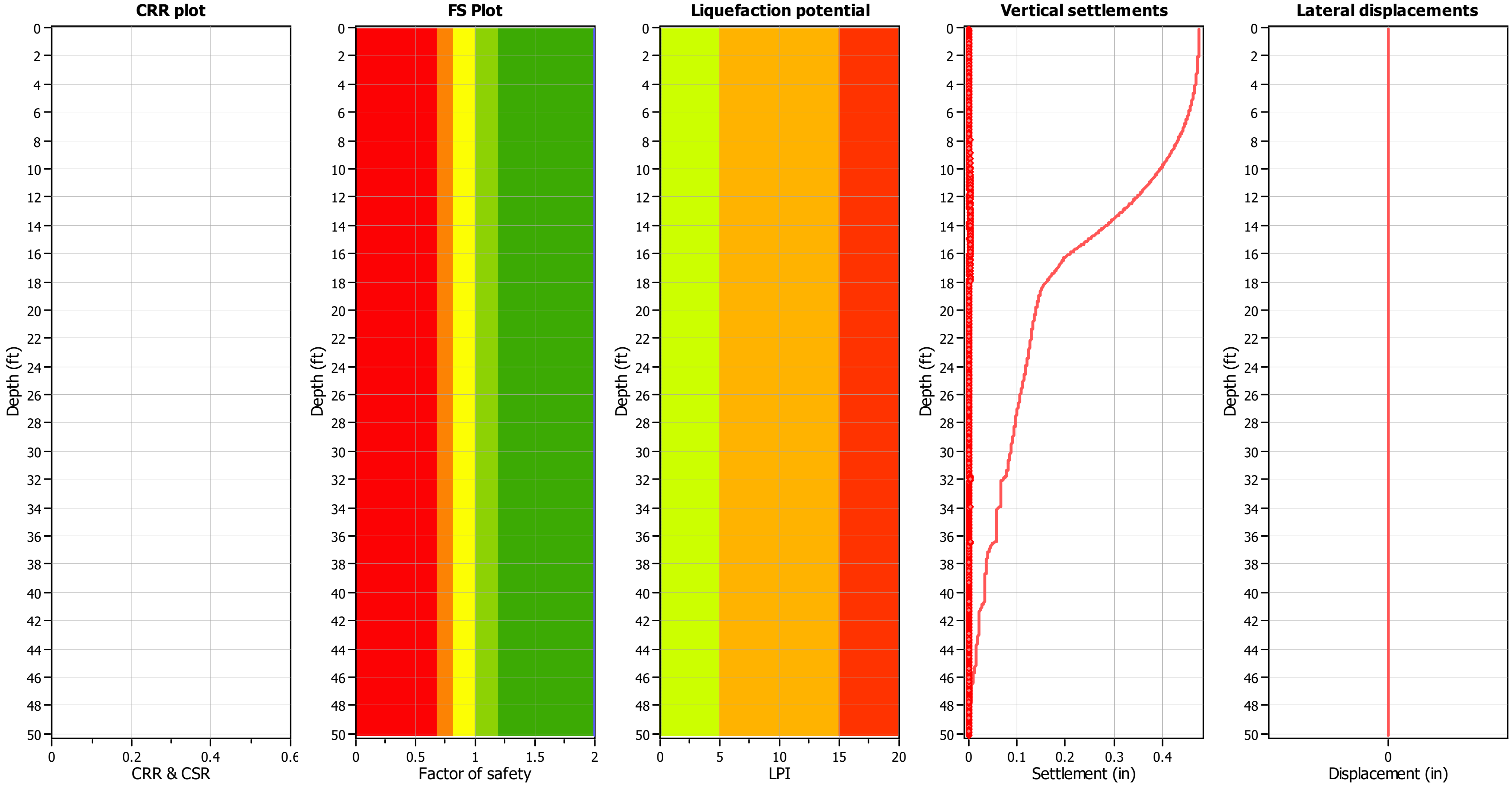
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	100.00 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:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	8.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	1.06	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	200.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

SBTn legend

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	100.00 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:	2.60	K_{σ} applied:	Yes
Earthquake magnitude M_w:	8.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	1.06	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	200.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

Leighton
038.0000020707

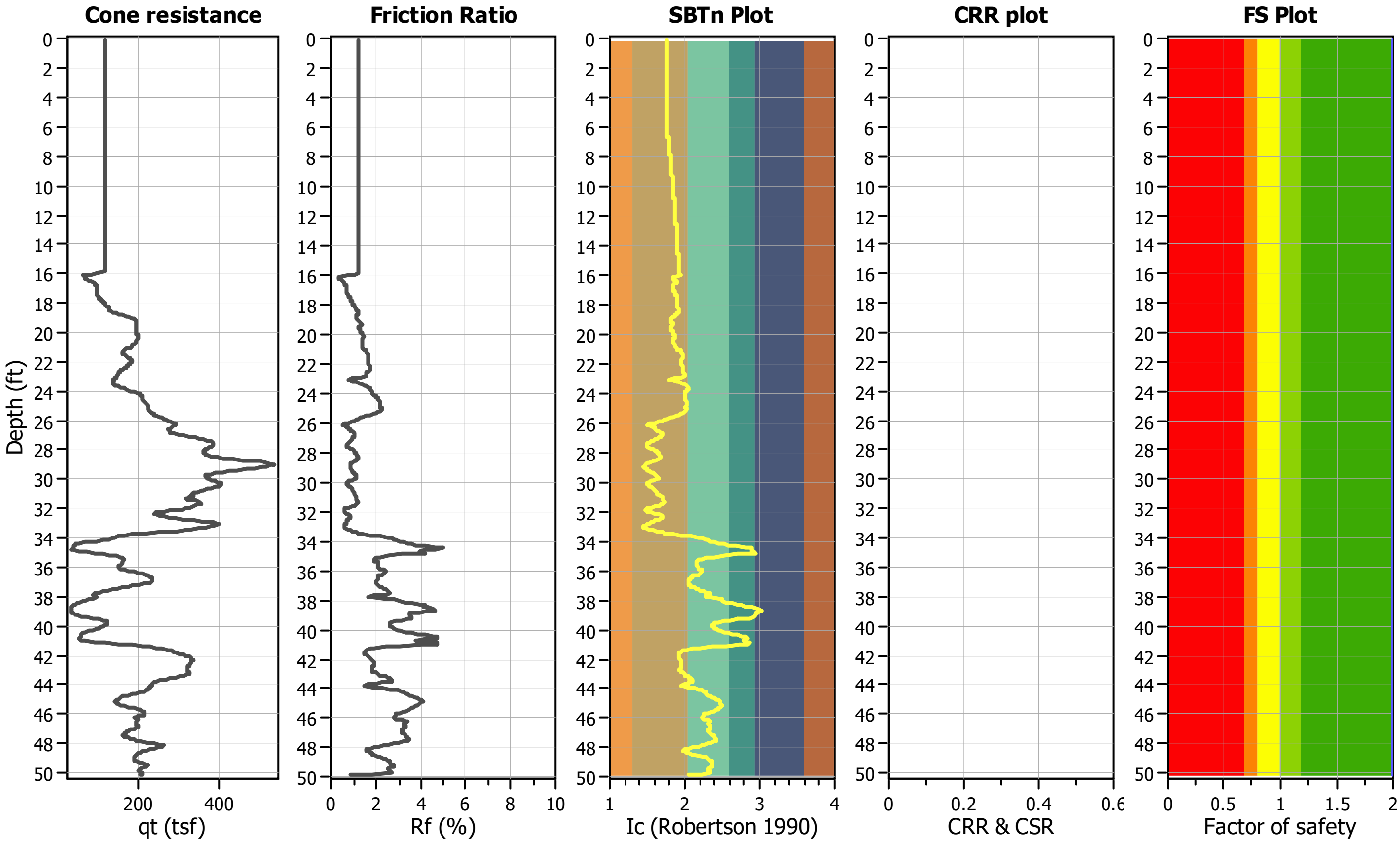
LIQUEFACTION ANALYSIS REPORT

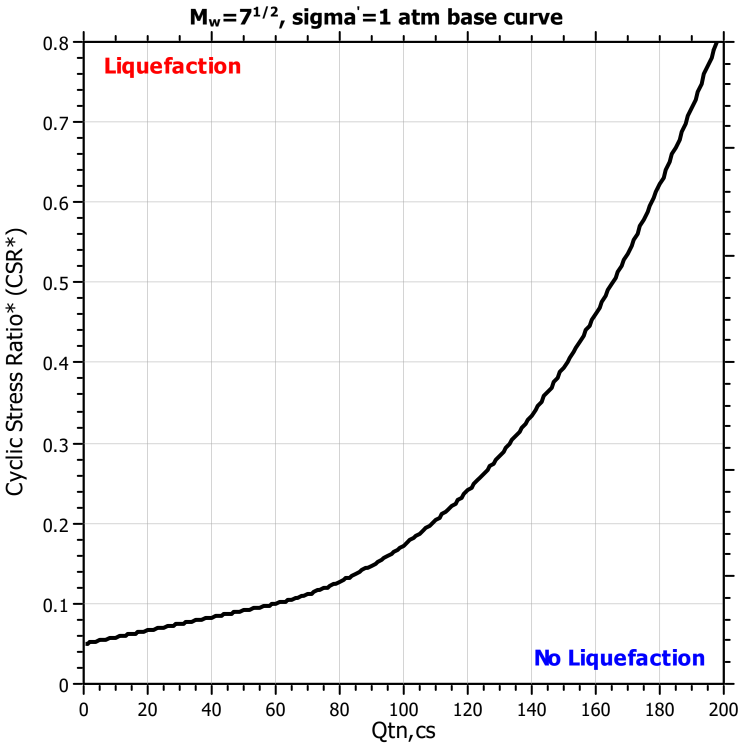
Project title : Colton Middle School Pavilion and Admin **Location : Colton California**

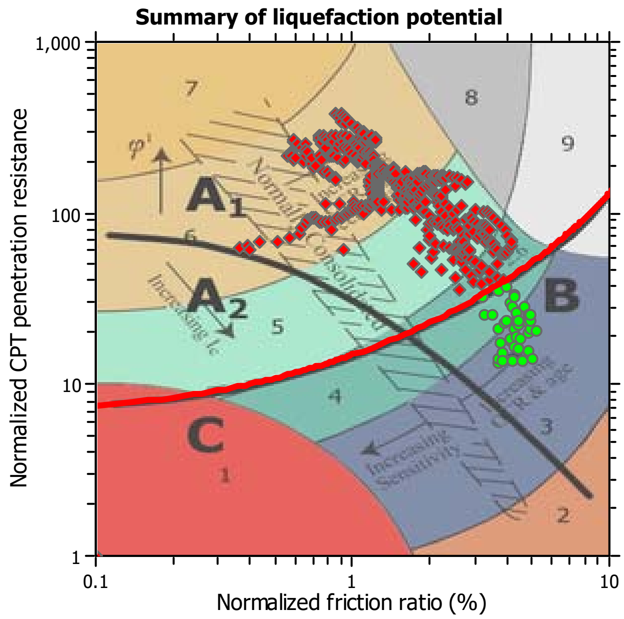
CPT file : CPT-6

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	200.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	100.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	50.00 ft
Earthquake magnitude M_w:	8.10	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	1.06	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

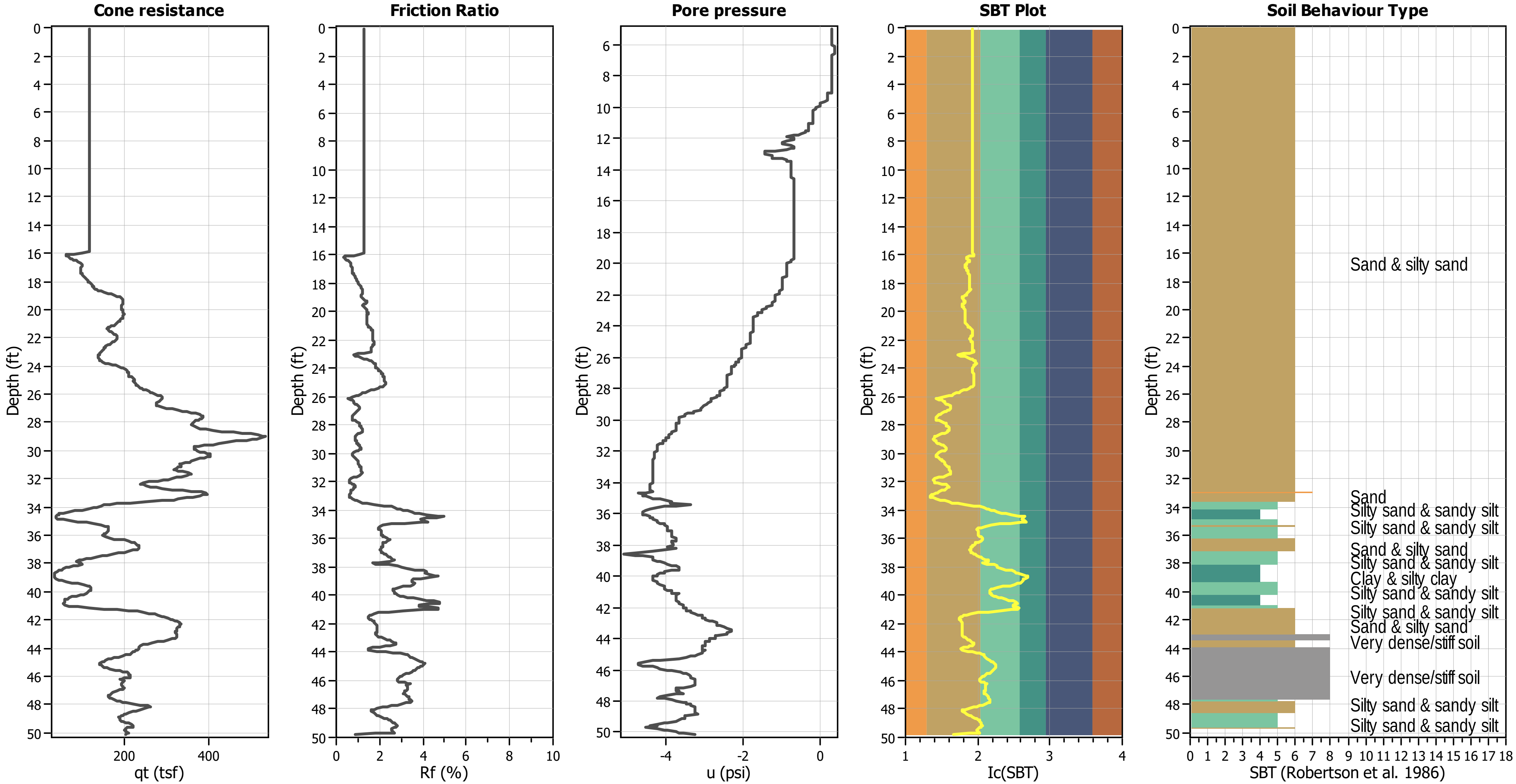






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



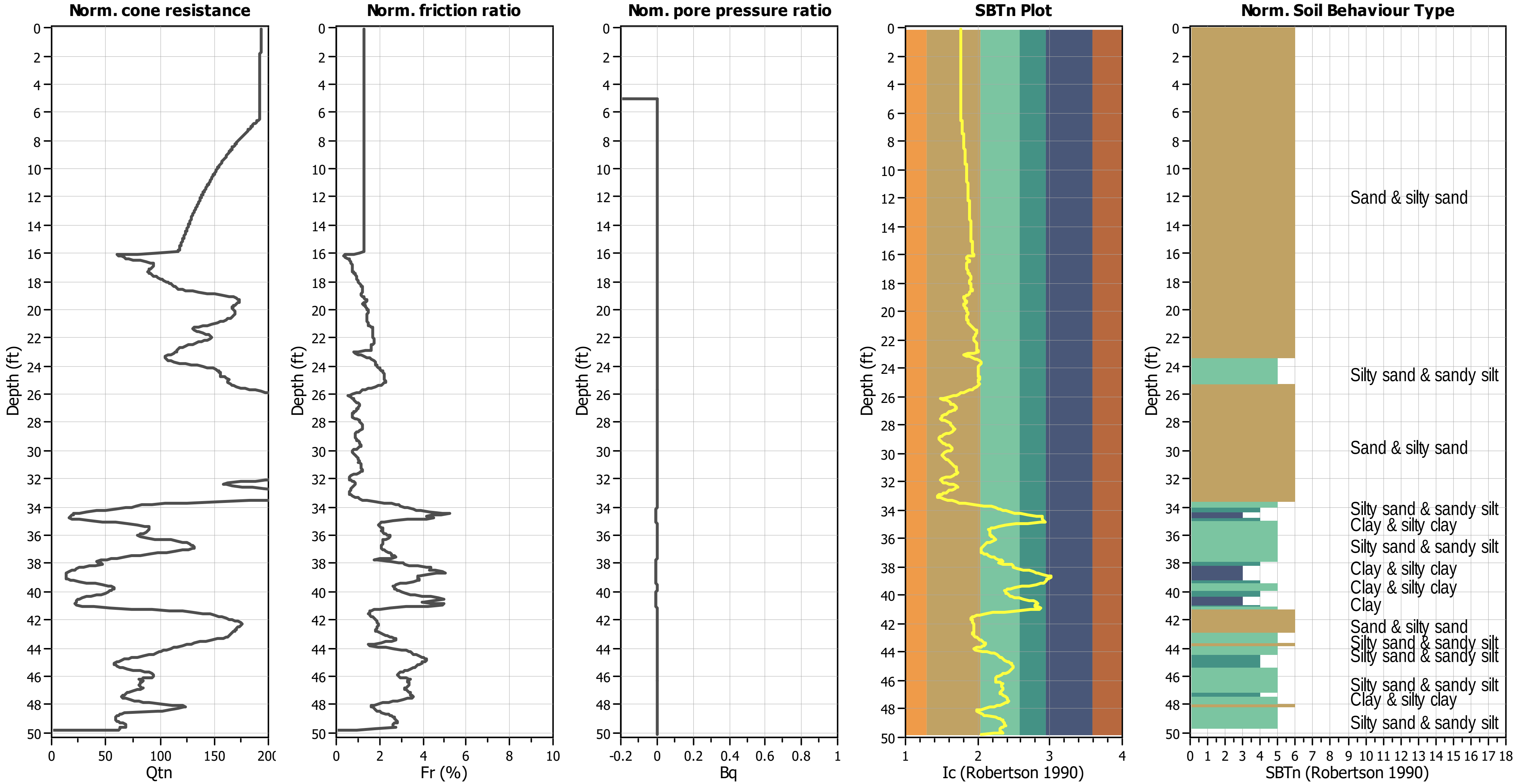
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	100.00 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:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	8.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	1.06	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	200.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

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)



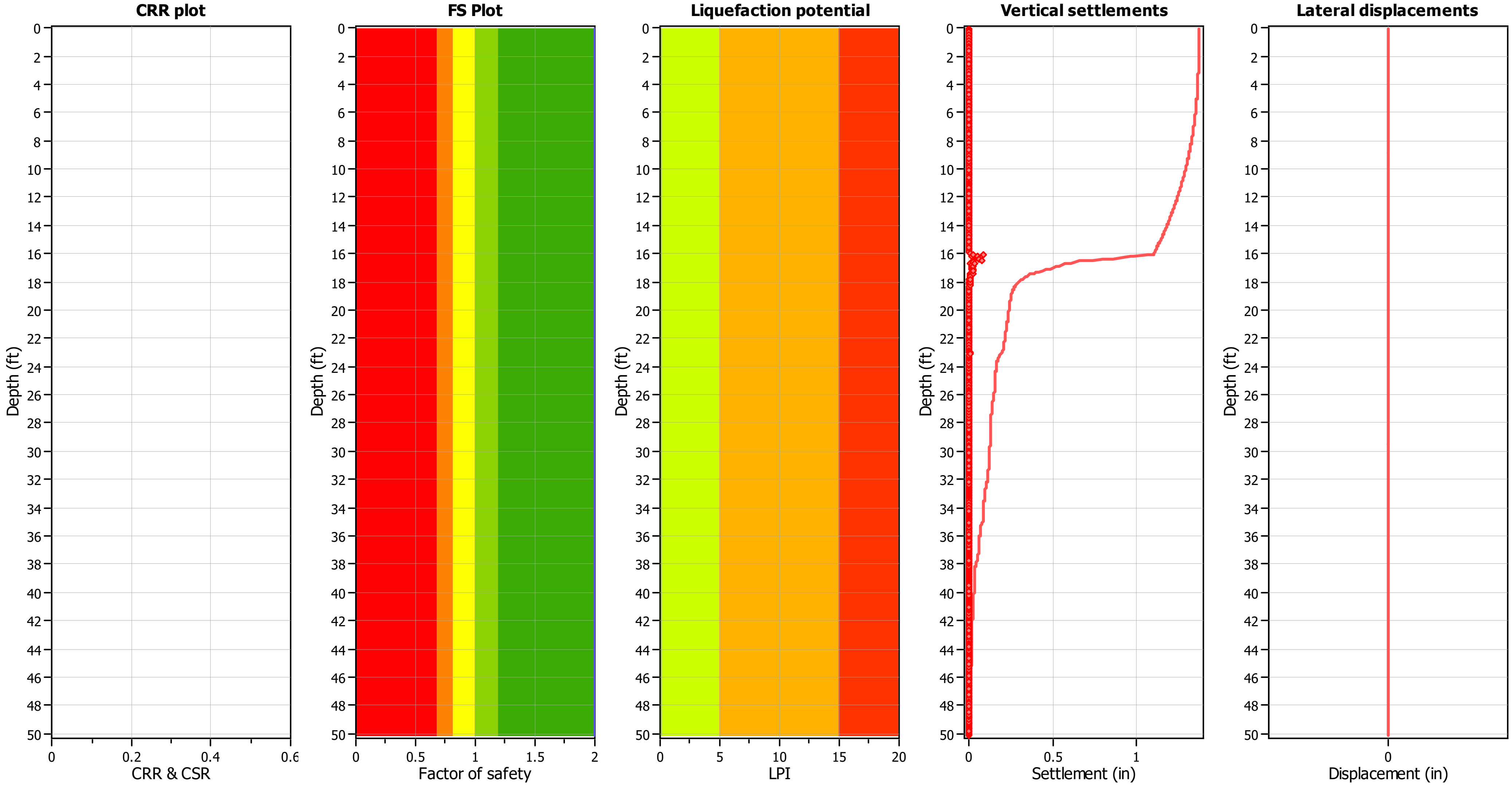
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	100.00 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:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	8.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	1.06	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	200.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

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 (erthq.):	100.00 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:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	8.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	1.06	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	200.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

Leighton
038.0000020707

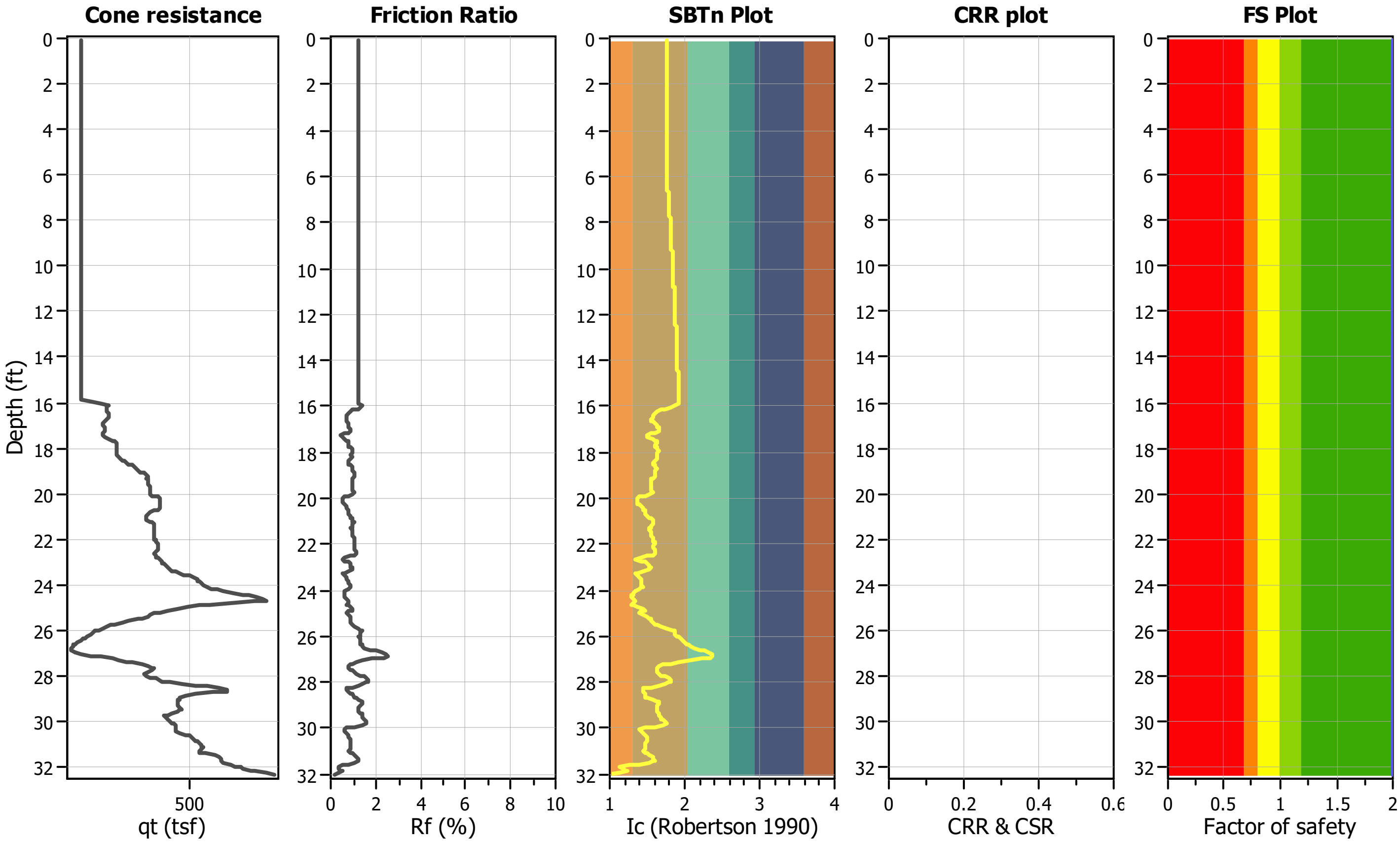
LIQUEFACTION ANALYSIS REPORT

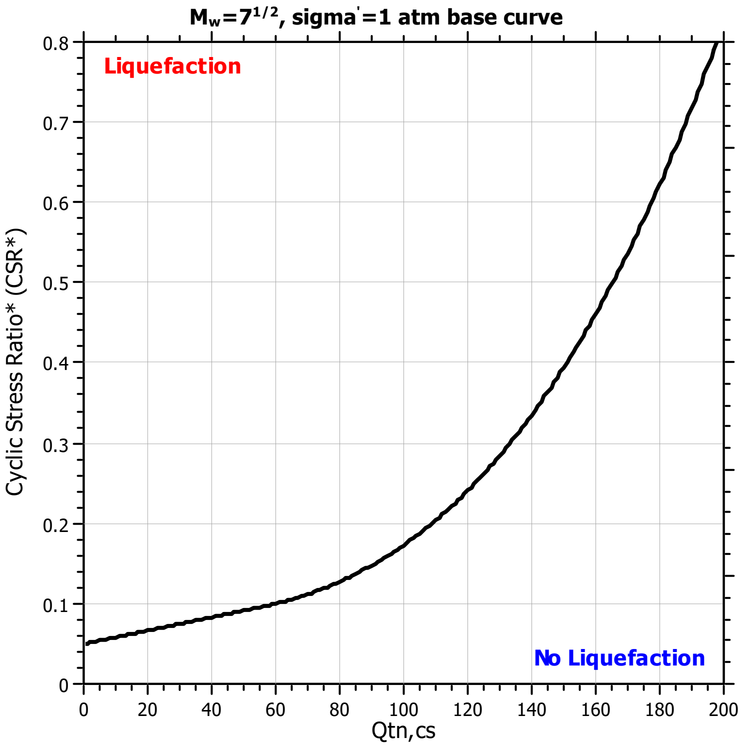
Project title : Colton Middle School Pavilion and Admin **Location : Colton California**

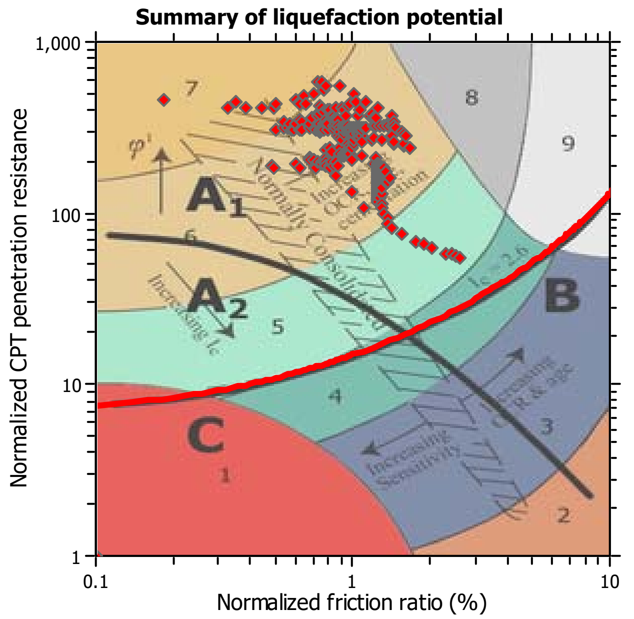
CPT file : CPT-7

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	200.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	100.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	50.00 ft
Earthquake magnitude M_w:	8.10	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	1.06	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

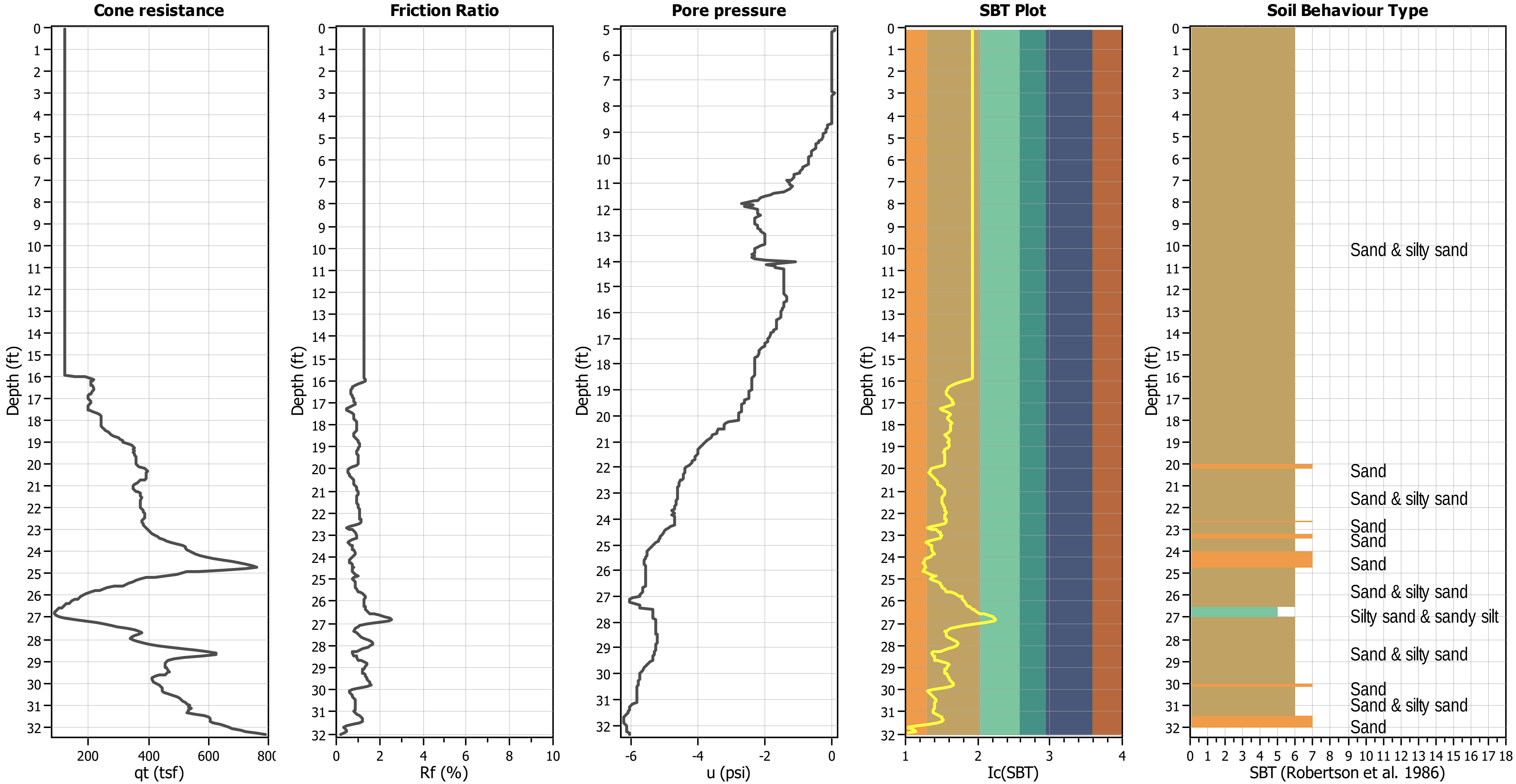






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



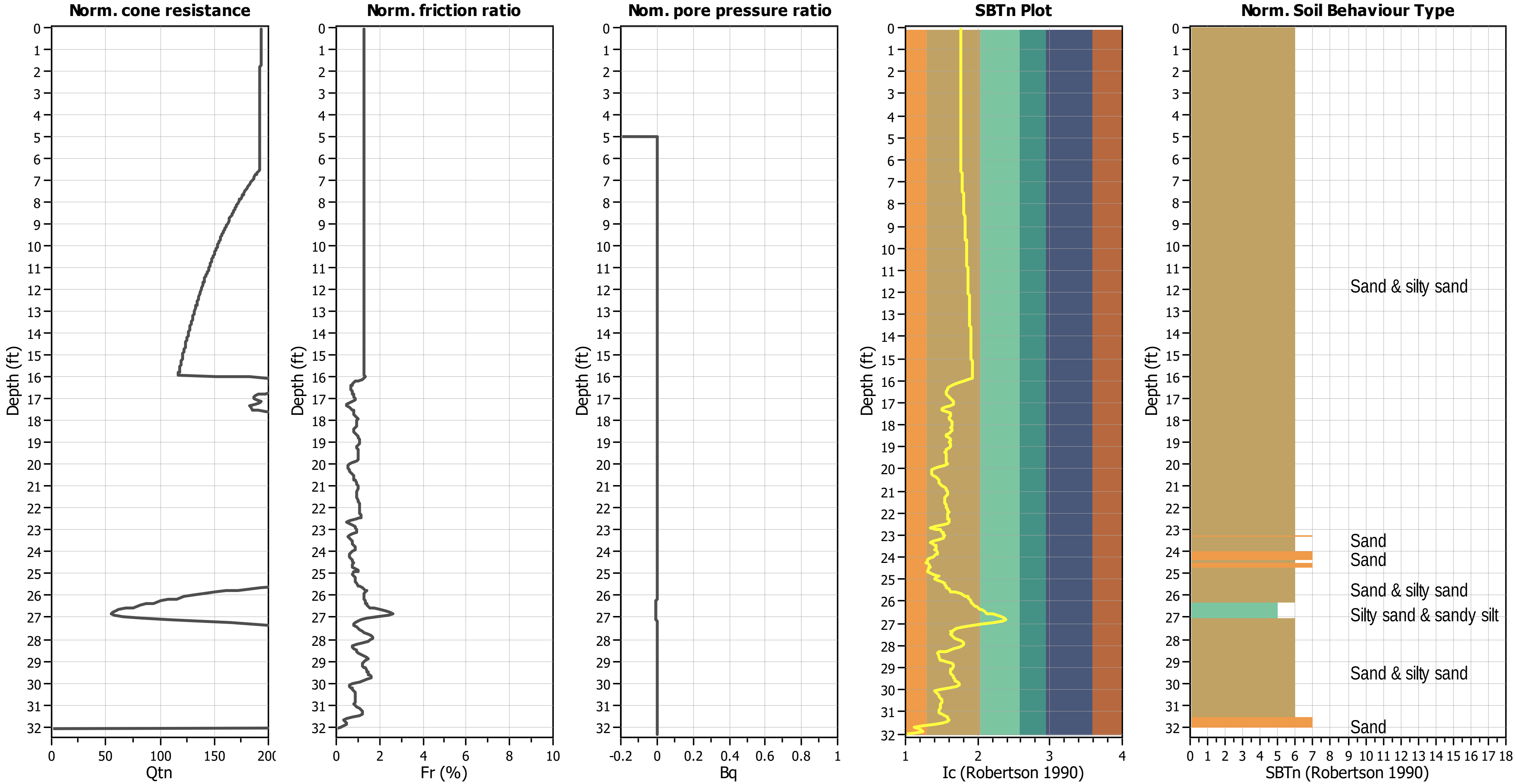
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	100.00 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:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	8.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	1.06	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	200.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

SBT legend

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

CPT basic interpretation plots (normalized)



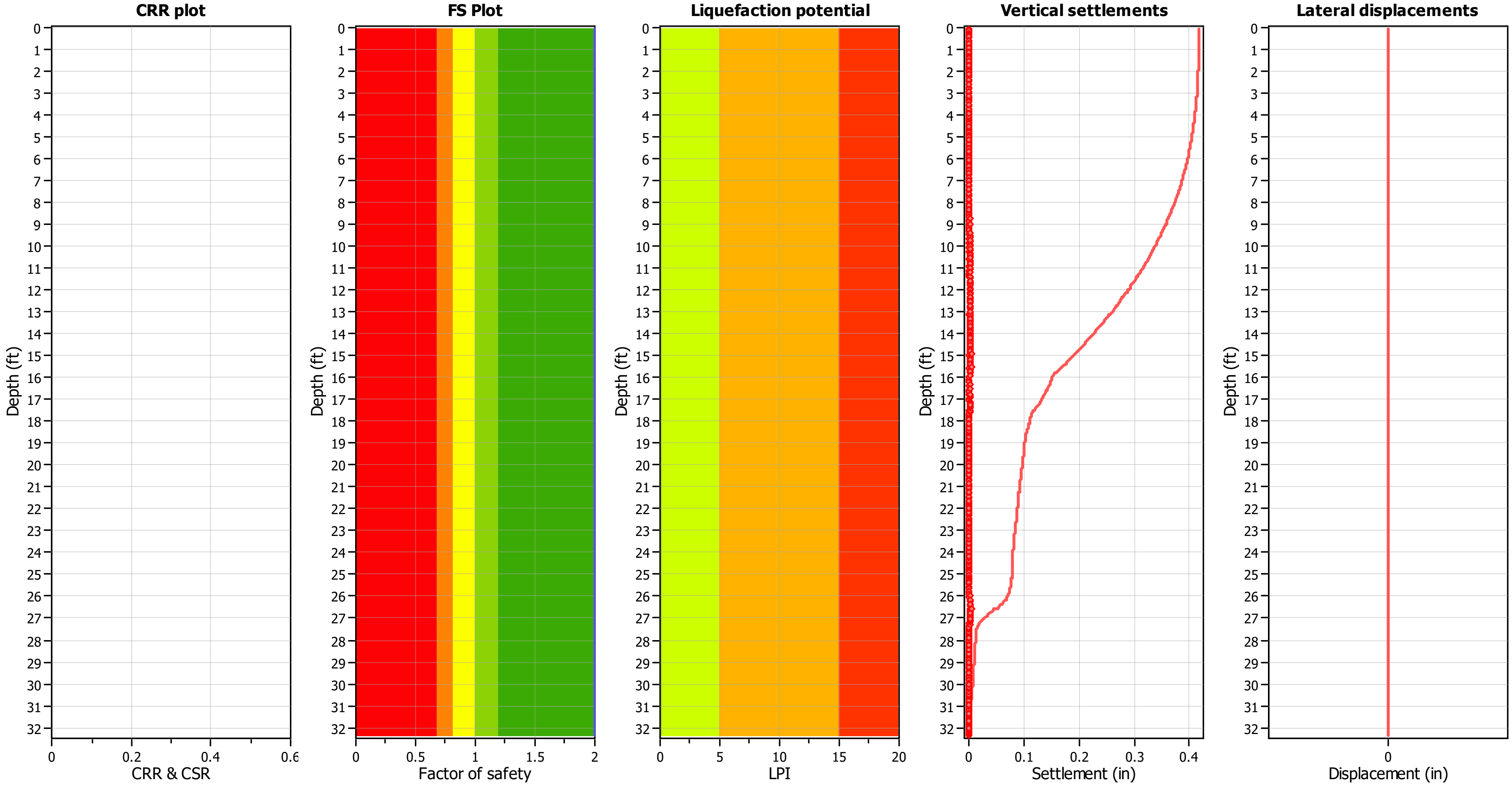
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	100.00 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:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	8.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	1.06	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	200.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

SBTn legend

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	100.00 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:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	8.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	1.06	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	200.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

Differential Settlement Summary Table						
		7 Foot Overexcavation (+1 Foot Recompaction Bottom)		15 Foot Overexcavation (+1 Foot Recompaction Bottom)		Affected Building
CPT No.	Distance Between CPTs (ft)	Differential (in)	ΔL	Differential (in)	ΔL	
1&2	40	1	0.0021	N/A	N/A	Pavilion
1&3	85	0.11	0.0001	0.03	0.0000	Both
2&3	75	0.89	0.0010	0.64	0.0007	Both
2&4	90	1.78	0.0016	1.02	0.0009	Both
2&5	110	1.84	0.0014	1.09	0.0008	Both
3&4	30	0.9	0.0025	0.38	0.0011	Locker
4&5	30	0.06	0.0002	0.07	0.0002	Locker

APPENDIX D

EARTHWORK AND GRADING GUIDE SPECIFICATIONS

LEIGHTON CONSULTING, INC.

GENERAL EARTHWORK AND GRADING SPECIFICATIONS FOR ROUGH GRADING

Table of Contents

1.0 General

1.1 Intent: These General Earthwork and Grading Specifications are for the grading and earthwork shown on the approved grading plan(s) and/or indicated in the geotechnical report(s). These Specifications are a part of the recommendations contained in the geotechnical report(s). In case of conflict, the specific recommendations in the geotechnical report shall supersede these more general Specifications. Observations of the earthwork by the project Geotechnical Consultant during the course of grading may result in new or revised recommendations that could supersede these specifications or the recommendations in the geotechnical report(s).

1.2 The Geotechnical Consultant of Record: Prior to commencement of work, the owner shall employ the Geotechnical Consultant of Record (Geotechnical Consultant). The Geotechnical Consultants shall be responsible for reviewing the approved geotechnical report(s) and accepting the adequacy of the preliminary geotechnical findings, conclusions, and recommendations prior to the commencement of the grading.

Prior to commencement of grading, the Geotechnical Consultant shall review the "work plan" prepared by the Earthwork Contractor (Contractor) and schedule sufficient personnel to perform the appropriate level of observation, mapping, and compaction testing.

During the grading and earthwork operations, the Geotechnical Consultant shall observe, map, and document the subsurface exposures to verify the geotechnical design assumptions. If the observed conditions are found to be significantly different than the interpreted assumptions during the design phase, the Geotechnical Consultant shall inform the owner, recommend appropriate changes in design to accommodate the observed conditions, and notify the review agency where required. Subsurface areas to be geotechnically observed, mapped, elevations recorded, and/or tested include natural ground after it has been cleared for receiving fill but before fill is placed, bottoms of all "remedial removal" areas, all key bottoms, and benches made on sloping ground to receive fill.

The Geotechnical Consultant shall observe the moisture-conditioning and processing of the subgrade and fill materials and perform relative compaction testing of fill to determine the attained level of compaction. The Geotechnical Consultant shall provide the test results to the owner and the Contractor on a routine and frequent basis.

1.3 The Earthwork Contractor: The Earthwork Contractor (Contractor) shall be qualified, experienced, and knowledgeable in earthwork logistics, preparation and processing of ground to receive fill, moisture-conditioning and processing of fill, and compacting fill. The Contractor shall review and accept the plans, geotechnical report(s), and these Specifications prior to commencement of grading. The

Contractor shall be solely responsible for performing the grading in accordance with the plans and specifications.

The Contractor shall prepare and submit to the owner and the Geotechnical Consultant a work plan that indicates the sequence of earthwork grading, the number of "spreads" of work and the estimated quantities of daily earthwork contemplated for the site prior to commencement of grading. The Contractor shall inform the owner and the Geotechnical Consultant of changes in work schedules and updates to the work plan at least 24 hours in advance of such changes so that appropriate observations and tests can be planned and accomplished. The Contractor shall not assume that the Geotechnical Consultant is aware of all grading operations.

The Contractor shall have the sole responsibility to provide adequate equipment and methods to accomplish the earthwork in accordance with the applicable grading codes and agency ordinances, these Specifications, and the recommendations in the approved geotechnical report(s) and grading plan(s). If, in the opinion of the Geotechnical Consultant, unsatisfactory conditions, such as unsuitable soil, improper moisture condition, inadequate compaction, insufficient buttress key size, adverse weather, etc., are resulting in a quality of work less than required in these specifications, the Geotechnical Consultant shall reject the work and may recommend to the owner that construction be stopped until the conditions are rectified.

2.0 Preparation of Areas to be Filled

2.1 Clearing and Grubbing: Vegetation, such as brush, grass, roots, and other deleterious material shall be sufficiently removed and properly disposed of in a method acceptable to the owner, governing agencies, and the Geotechnical Consultant.

The Geotechnical Consultant shall evaluate the extent of these removals depending on specific site conditions. Earth fill material shall not contain more than 1 percent of organic materials (by volume). No fill lift shall contain more than 5 percent of organic matter. Nesting of the organic materials shall not be allowed.

If potentially hazardous materials are encountered, the Contractor shall stop work in the affected area, and a hazardous material specialist shall be informed immediately for proper evaluation and handling of these materials prior to continuing to work in that area.

As presently defined by the State of California, most refined petroleum products (gasoline, diesel fuel, motor oil, grease, coolant, etc.) have chemical constituents that are considered to be hazardous waste. As such, the indiscriminate dumping or spillage of these fluids onto the ground may constitute a misdemeanor, punishable by fines and/or imprisonment, and shall not be allowed.

2.2 Processing: Existing ground that has been declared satisfactory for support of fill by the Geotechnical Consultant shall be scarified to a minimum depth of 6 inches. Existing ground that is not satisfactory shall be overexcavated as specified in the following section. Scarification shall continue until soils are broken down and free of large clay lumps or clods and the working surface is reasonably uniform, flat, and free of uneven features that would inhibit uniform compaction.

2.3 Overexcavation: In addition to removals and overexcavations recommended in the approved geotechnical report(s) and the grading plan, soft, loose, dry, saturated, spongy, organic-rich, highly fractured or otherwise unsuitable ground shall be overexcavated to competent ground as evaluated by the Geotechnical Consultant during grading.

2.4 Benching: Where fills are to be placed on ground with slopes steeper than 5:1 (horizontal to vertical units), the ground shall be stepped or benched. Please see the Standard Details for a graphic illustration. The lowest bench or key shall be a minimum of 15 feet wide and at least 2 feet deep, into competent material as evaluated by the Geotechnical Consultant. Other benches shall be excavated a minimum height of 4 feet into competent material or as otherwise recommended by the Geotechnical Consultant. Fill placed on ground sloping flatter than 5:1 shall also be benched or otherwise overexcavated to provide a flat subgrade for the fill.

2.5 Evaluation/Acceptance of Fill Areas: All areas to receive fill, including removal and processed areas, key bottoms, and benches, shall be observed, mapped, elevations recorded, and/or tested prior to being accepted by the Geotechnical Consultant as suitable to receive fill. The Contractor shall obtain a written acceptance from the Geotechnical Consultant prior to fill placement. A licensed surveyor shall provide the survey control for determining elevations of processed areas, keys, and benches.

3.0 Fill Material

3.1 General: Material to be used as fill shall be essentially free of organic matter and other deleterious substances evaluated and accepted by the Geotechnical Consultant prior to placement. Soils of poor quality, such as those with unacceptable gradation, high expansion potential, or low strength shall be placed in areas acceptable to the Geotechnical Consultant or mixed with other soils to achieve satisfactory fill material.

3.2 Oversize: Oversize material defined as rock, or other irreducible material with a maximum dimension greater than 8 inches, shall not be buried or placed in fill unless location, materials, and placement methods are specifically accepted by the Geotechnical Consultant. Placement operations shall be such that nesting of oversized material does not occur and such that oversize material is completely surrounded by compacted or densified fill. Oversize material shall not be placed within 10 vertical feet of finish grade or within 2 feet of future utilities or underground construction.

3.3 Import: If importing of fill material is required for grading, proposed import material shall meet the requirements of Section 3.1. The potential import source shall be given to the Geotechnical Consultant at least 48 hours (2 working days) before importing begins so that its suitability can be determined and appropriate tests performed.

4.0 Fill Placement and Compaction

4.1 Fill Layers: Approved fill material shall be placed in areas prepared to receive fill (per Section 3.0) in near-horizontal layers not exceeding 8 inches in loose thickness. The Geotechnical Consultant may accept thicker layers if testing indicates the grading procedures can adequately compact the thicker layers. Each layer shall be spread evenly and mixed thoroughly to attain relative uniformity of material and moisture throughout.

4.2 Fill Moisture Conditioning: Fill soils shall be watered, dried back, blended, and/or mixed, as necessary to attain a relatively uniform moisture content at or slightly over optimum. Maximum density and optimum soil moisture content tests shall be performed in accordance with the American Society of Testing and Materials (ASTM Test Method D1557-91).

4.3 Compaction of Fill: After each layer has been moisture-conditioned, mixed, and evenly spread, it shall be uniformly compacted to not less than 90 percent of maximum dry density (ASTM Test Method D1557-91). Compaction equipment shall be adequately sized and be either specifically designed for soil compaction or of proven reliability to efficiently achieve the specified level of compaction with uniformity.

4.4 Compaction of Fill Slopes: In addition to normal compaction procedures specified above, compaction of slopes shall be accomplished by backrolling of slopes with sheepsfoot rollers at increments of 3 to 4 feet in fill elevation, or by other methods producing satisfactory results acceptable to the Geotechnical Consultant. Upon completion of grading, relative compaction of the fill, out to the slope face, shall be at least 90 percent of maximum density per ASTM Test Method D1557-91.

4.5 Compaction Testing: Field tests for moisture content and relative compaction of the fill soils shall be performed by the Geotechnical Consultant. Location and frequency of tests shall be at the Consultant's discretion based on field conditions encountered. Compaction test locations will not necessarily be selected on a random basis. Test locations shall be selected to verify adequacy of compaction levels in areas that are judged to be prone to inadequate compaction (such as close to slope faces and at the fill/bedrock benches).

4.6 Frequency of Compaction Testing: Tests shall be taken at intervals not exceeding 2 feet in vertical rise and/or 1,000 cubic yards of compacted fill soils embankment. In addition, as a guideline, at least one test shall be taken on slope faces for each 5,000 square feet of slope face and/or each 10 feet of vertical height of slope. The Contractor shall assure that fill construction is such that the testing schedule can be accomplished by the Geotechnical Consultant. The Contractor shall stop or slow down the earthwork construction if these minimum standards are not met.

4.7 Compaction Test Locations: The Geotechnical Consultant shall document the approximate elevation and horizontal coordinates of each test location. The Contractor shall coordinate with the project surveyor to assure that sufficient grade stakes are established so that the Geotechnical Consultant can determine the test locations with sufficient accuracy. At a minimum, two grade stakes within a horizontal distance of 100 feet and vertically less than 5 feet apart from potential test locations shall be provided.

5.0 Subdrain Installation

Subdrain systems shall be installed in accordance with the approved geotechnical report(s), the grading plan, and the Standard Details. The Geotechnical Consultant may recommend additional subdrains and/or changes in subdrain extent, location, grade, or material depending on conditions encountered during grading. All subdrains shall be surveyed by a land surveyor/civil engineer for line and grade after installation and prior to burial. Sufficient time should be allowed by the Contractor for these surveys.

6.0 Excavation

Excavations, as well as over-excavation for remedial purposes, shall be evaluated by the Geotechnical Consultant during grading. Remedial removal depths shown on geotechnical plans are estimates only. The actual extent of removal shall be determined by the Geotechnical Consultant based on the field evaluation of exposed conditions during grading. Where fill-over-cut slopes are to be graded, the cut portion of the slope shall be made, evaluated, and accepted by the Geotechnical Consultant prior to placement of materials for construction of the fill portion of the slope, unless otherwise recommended by the Geotechnical Consultant.

7.0 Trench Backfills

7.1 Safety: The Contractor shall follow all OHSA and Cal/OSHA requirements for safety of trench excavations.

7.2 Bedding and Backfill: All bedding and backfill of utility trenches shall be done in accordance with the applicable provisions of Standard Specifications of Public Works Construction. Bedding material shall have a Sand Equivalent greater than 30 (SE>30). The bedding shall be placed to 1 foot over the top of the conduit and densified by jetting. Backfill shall be placed and densified to a minimum of 90 percent of maximum from 1 foot above the top of the conduit to the surface.

The Geotechnical Consultant shall test the trench backfill for relative compaction. At least one test should be made for every 300 feet of trench and 2 feet of fill.

7.3 Lift Thickness: Lift thickness of trench backfill shall not exceed those allowed in the Standard Specifications of Public Works Construction unless the Contractor can demonstrate to the Geotechnical Consultant that the fill lift can be compacted to the minimum relative compaction by his alternative equipment and method.

7.4 Observation and Testing: The jetting of the bedding around the conduits shall be observed by the Geotechnical Consultant.

APPENDIX E

CGS NOTE 48 CHECKLIST
WITH REFERENCES TO THIS REPORT

California Geological Survey - Note 48

Checklist for the Review of Engineering Geology and Seismology Reports for California Public Schools, Hospitals, and Essential Services Buildings

October 2013

Note 48 is used by the California Geological Survey (CGS) to review the geology, seismology, and geologic hazards evaluated in reports that are prepared under California Code of Regulations (CCR), Title 24, California Building Code. CCR Title 24 applies to California Public Schools, Hospitals, Skilled Nursing Facilities, and Essential Services Buildings. The Building Official for public schools is the Division of the State Architect (DSA). Hospitals and Skilled Nursing Facilities in California are under the jurisdiction of the Office of Statewide Health Planning & Development (OSHPD). The California Geological Survey serves under contract with these two state agencies.

Project Name:
OSHPD or DSA File #: N/A
Date Reviewed:
Location:
Reviewed By:
California Certified Engineering Geologist #:

Checklist Item or Topic Within Consulting Report NA = not applicable NR = not addressed by consultant and therefore not reviewed at this time	**Section of this Report Addressed in**	
Project Location		
1. Site Location Map, Street Address, County Name: Correctly plot site on a 7½-minute USGS quadrangle base-map.	Figure 1, Cover letter	
2. Plot Plan with Exploration Data and Building Footprint: One boring or exploration shaft per 5000 ft^2, with minimum of two for any one building. Exploratory trench locations.	Figure 2; Sec 1.2	
3. Site Coordinates (Latitude & Longitude):	Sec 2.5.2	
Engineering Geology/Site Characterization		
4. Regional Geology and Regional Fault Maps: Concise page-sized illustrations with site plotted.	Figure 3; Figure 5	
5. Geologic Map of Site: Detailed (large-scale) geologic map with proper symbols and geologic legend.	Figure 3	
6. Subsurface Geology: Engineering geologic description summarized from boreholes or trench logs. Summarize ground water conditions.	Sec. 2.3; 2.4	
7. Geologic Cross Sections: Two or more detailed geologic sections with pertinent foundations and site grading.	Figure 4a; Figure 4b	
8. Active Faulting & Coseismic Deformation Across Site: Show proposed structures in relation to Alquist-Priolo Earthquake Fault Zones and/or any potential fault rupture hazard identified from the Safety Element of the local agency (city or county); show location of fault investigation trenches; 50-foot setbacks perpendicular from fault plane and proposed building footprints.	Sec. 2.5.1	
9. Geologic Hazard Zones (Liquefaction & Landslides): (*If applicable*) Show proposed structures in relation to CGS official map showing zones of required investigation for liquefaction and landslide, and/or any pertinent geologic hazard map from the Safety Element of the local agency (city or county).	Sec. 2.6	
10. Geotechnical Testing of Representative Samples: Broad suite of appropriate geotechnical tests.	Appendix A, Appendix B	
11. Consideration of Geology in Geotechnical Engineering Recommendations: Discuss engineering geologic aspects of excavation/grading/fill activities, foundation and support of structures. Include geologic and geotechnical inspections and problems anticipated during grading. Special design and construction provisions for bearing capacity failure and/or footings or foundations founded on weak or expansive soils. Consideration of seismic compression of fills; cut/fill differential settlement.	Sec. 3.2; 3.3	
Seismology & Calculation of Earthquake Ground Motion		
12. Evaluation of Historical Seismicity: Prepare a short description of how historical earthquakes have affected the site.	Sec. 2.5.3; Figure 5	
13. Classify the Geologic Subgrade (Site Class): ASCE 7, Chapter 20.	Sec. 2.5.2	
14. General Procedure Ground Motion Analysis: Follows CBC §1613A.5. Report parameters S_S, S_1, S_{DS} and S_{D1}. Recommended method for establishing map values found at: http://earthquake.usgs.gov/designmaps/us/application.php.	Sec. 2.5.2, 3.5	
15. Seismic Design Category: Report if $S_1 > 0.75$	Sec. 2.5.2	
16. Site-Specific Ground Motion Analysis: (*If applicable*) Required for sites where Seismic Design Category is E or F (CBC §1616A.1.3), and where required by ASCE 7 §11.47. See requirements in CBC §1803A.6.2. CGS suggests a table showing (a) 2%-in-50-years probabilistic spectrum, (b) risk coefficients if using ASCE 7 §21.2.1, Method 1), (c) probabilistic MCE_R, (d) 84% deterministic spectrum, (e) deterministic lower limit, (f) site-specific MCE_R (ASCE 7 §21.2.3), (g) 80% of map-based General Response Spectrum, (h) design response spectrum (ASCE 7 §21.3). Also	Sec. 2.5.2	

Checklist Item or Topic Within Consulting Report NA = not applicable NR = not addressed by consultant and therefore not reviewed at this time	Section of this Report Addressed in	
17. Deaggregated Seismic Source Parameters: (*If applicable*) If needed for liquefaction, slope stability analysis or for earthquake record selection, provide controlling magnitude (M) and fault distance (R). Might be either deterministic or deaggregate for modal M and R.	Sec. 2.5.2	
18. Time Histories of Earthquake Ground Motion: (*If applicable*) Identify target spectra (MCE or design); justify selected earthquake records; scale to target to meet ASCE 7 §16.1.3 or §17.3 and CBC §1616A.1.32; and show initial and scaled time histories and response spectra.	NA	

Liquefaction/Seismic Settlement Analysis

19. Geologic Setting for Occurrence of Liquefaction: Perform screening analysis to identify where the following conditions apply: depth of highest historical ground water surface <50 ft. low-density, non-plastic alluvium, typically *SPT* $(N_1)_{60}$<30.	Sec. 2.4; 2.6.1	
20. Seismic Settlement Calculations: (*If applicable*) Evaluate both saturated and unsaturated layers of the entire soil column; based on several detailed geologic cross sections. Provide calculations (no estimates) including all input parameters. Evaluate liquefaction using highest historical ground water elevation. Evaluate using PGA_M (CBC §1803A.5.12), and calculate liquefaction settlement for each layer where FS<1.3 (CGS SP117A).	Sec. 2.6.2	
21. Other Liquefaction Effects (*If applicable*) Bearing capacity failure and/or lateral spread	Sec. 2.6.1	
22. Mitigation Options for Liquefaction: (*If applicable*) Discuss effectiveness of options to mitigate liquefaction effects. Acceptance criteria for ground-improvement schemes.	Sec. 2.6.1	

Slope Stability Analysis

23. Geologic Setting for Occurrence of Landslides: Characterize the potential for landsliding both on and off-site affecting proposed project.	Sec. 2.7	
24. Determination of Static And Dynamic Strength Parameters: (*If applicable*) Conduct appropriate laboratory tests to determine material strength for both static and dynamic conditions.	Sec. 2.7	
25. Determination of Pseudo-Static Coefficient (K_{eq}): (*If applicable*) Recommended procedure available from http://www.conservation.ca.gov/cgs/shzp/webdocs/Documents/sp117.pdf. Recommend using design-level ground motion based on geometric mean and without risk coefficient (ie, $(PGA_M)/1.5$), or discuss with CGS.	Sec. 2.7	
26. Identify Critical Slip Surfaces for Static and Dynamic Analyses: (*If applicable*) Failure surfaces should be modeled to include existing slip surfaces, discontinuities, geologic structure and stratigraphy; include appropriate ground water conditions.	Sec. 2.7	
27. Dynamic Site Conditions: (*If applicable*) Site response analysis and topographic effects should be considered, if appropriate.	Sec. 2.7	
28. Mitigation Options for Landsliding/Other Slope Failure: (*If applicable*) Discuss effectiveness of options to mitigate landsliding/slope failure effects. Acceptance criteria for ground-improvement schemes.	Sec. 2.7	

Other Geologic Hazards or Adverse Site Conditions

These exceptional geologic hazards do not occur statewide; however, they may be pertinent to a particular site. Where these conditions exist relevant information should be communicated to the design team.

29. Expansive Soils	Sec. 2.3.2	
30. Corrosive/Reactive Geochemistry of Geologic Subgrade: soluble sulfates and corrosive soils.	Sec. 2.3.3, 2.3.4	
31. Conditional Geologic Assessment: Including but not limited to - **A. Hazardous materials** methane gas, hydrogen-sulfide gas, tar seeps; **B. Volcanic eruption**; **C. Flooding** Riverine (FEMA FIRMs or local zoning for 100-year flood); see CBC §1612A. Also consider alluvial fan and dam inundation. Is the site elevated or protected from hazard; **D. Tsunami and seiche inundation**; **E. Radon-222 gas**; **F. Naturally occurring asbestos** in geologic formations associated with serpentine; refer to CGS SP 124; **G. Hydrocollapse** of alluvial fan soils due to anthropic use of water; **H. Regional subsidence**; **I. Clays and cyclic softening**.	Sec. 2.3.1 (hydrocollapse), 2.6.3 (seiches/tsunamis), 2.8 (flooding/dam inundation), 2.9 (others)	

Report Documentation

32. Geology, Seismology, and Geotechnical References	References	
33. Certified Engineering Geologist: (CBC §1803A.1)	Cover Letter	
34. Registered Geotechnical Engineer: (CBC §1803A.1)	Cover Letter	