APPENDIX D

Geologic Hazards
&
Geotechnical Engineering Report

LUSD HOUSTON – JOE SERNA SCHOOL

Acampo, California

MPE No. 04401-01

MID PACIFIC ENGINEERING, INC.

March 29, 2019

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Geologic Hazards and Geotechnical Engineering Report

LUSD HOUSTON – JOE SERNA SCHOOL IMPROVEMENTS

4600 Acampo Road
Acampo, California
MPE No. 04401-01
March 29, 2019

INTRODUCTION

We have completed a Geologic Hazards and Geotechnical Engineering investigation for the site of the proposed improvements at the existing Houston Middle School campus located at 4600 Acampo Road in Acampo, California. The purposes of our study have been to investigate the site, soil, geologic and groundwater conditions of the school site, and to prepare Geologic and Geotechnical Engineering conclusions and recommendations for use by the other members of the design team in preparing project plans and specifications. Our work has been performed in general accordance with the conditions of our proposal to the Lodi Unified School District (c/o Petralogix Engineering, Inc.), dated March 7, 2019. This report presents the results of our work.

SCOPE OF SERVICES

Our scope of work included the following:

1. Site reconnaissance;
2. Review of available historic aerial photographs, topographic maps and groundwater information of the area;
3. Review of geologic maps and fault maps;
4. Review of historic seismicity within 100 kilometers of the site;
5. Subsurface exploration, including the:
   A. Drilling and sampling of four test borings to maximum depths of approximately 14 to 25 feet below the existing ground surface; and,
   B. The completion of two Cone Penetration Test (CPT) soundings to a maximum depth of approximately 50 feet below existing site grades.
6. Collection of bulk samples of near-surface soils;

7. Laboratory testing of selected soil samples;
8. Engineering analyses; and,
9. Preparation of this report.

FIGURES AND ATTACHMENTS

Figure	Title	Figure	Title
1	Topographic Map	9	Regional Fault Map
2	Regional Geologic Map	10	Earthquake Epicenter Map
3	Boring Location Map	11	FEMA Flood Map
4-7	Logs of Soil Borings	12	Geologic Cross Section A-A'
8	Unified Soil Classification System		

Appended to this report are:

- Appendix A – General information regarding project concepts; exploratory methods used during our field investigation; and, laboratory test results not included on the boring logs.
- Appendix B – *Guide Earthwork Specifications* that may be used in the preparation of contract documents.
- Appendix C – Output files from the EQFAULT/EQSEARCH programs.
- Appendix D – The results of the CPT soundings and the CLiq Liquefaction Analyses.
- Appendix E – A list of references cited.

PROPOSED DEVELOPMENT

Based on the review of the *Increment 01 – Relocatable Buildings Houston School*, prepared by Henry and Associates Architects, we understand seven new modular structures are proposed in the mid-northern portion of the existing school campus. The proposed structures will consist of five classrooms (referenced as P1 through P5, and P8) and one-bathroom facility (referenced as P6). The classrooms have a building footprint of approximately 1,000 square feet (sf) each. The bathroom facility square footage was not provided during the preparation of this report, but based on our review of the drawings, we anticipate the facility will be less than 1,000 sf. We understand a majority of the structures

will be surrounded by concrete sidewalks. The proposed modular buildings will be supported by isolated and/or spread foundations with a raised wood floor. We anticipate light to moderate structural loads based on the anticipated type of construction.

A water tank is proposed in the mid-southern portion of the school property (refer to Figure 3). Based on the review of Sheet F1.1 of the *Increment 01 – Relocatable Buildings Houston School* plans, it is our understanding the tank will hold 20,000 gallons and be supported on an 18-inch thick concrete circular mat foundation underlain by 12-inches of compacted Class II aggregate base (AB). The width of the foundation is proposed to be two feet plus the tank diameter. The diameter of the tank was not provided in the plans.

We understand new renovations to the existing pavement for the bus stop area is proposed, north of the proposed structures.

Associated improvements will consist of construction of asphalt concrete parking lots. Additionally, new construction is anticipated to include exterior concrete flatwork, underground utilities, and landscaping.

Based on the review of the grading details on Sheet C2.1 of the *Increment 01 – Relocatable Buildings Houston School* plans, it is our understanding maximum excavations and fills on the order of two feet for development of the planned improvements.

SITE HISTORY

We reviewed historical aerial photographs of the site from Google Earth, taken in May 1993 through August 2018. In May 1993, the existing Houston Middle School is shown as being developed. Existing trees and an existing sport, chain-linked backstop are visible within the area of the proposed modular structures. In addition, another existing sport, chain-linked backstop is observed within proposed water tank area. Between May 1993 and November 2004, the site remained relatively unchanged. In November 2004, the existing trees within the proposed modular structures have been removed. Trees are then visible again within the proposed modular structure areas in August, 2005, and remain until August 2018.

The site has remained relatively unchanged between May 1993 and August 2018, with the exception of the trees referenced above.

FINDINGS

SITE DESCRIPTION

The existing Houston Middle School campus encompasses a total area of approximately eight acres and is located at 4600 East Acampo Road in Acampo, California. The center of the proposed classroom modular structures is located at approximately latitude 38.1744° north and longitude 121.2602° west. The school campus is bounded to the north by East Acampo Road, beyond which are residential structures; to the east by agricultural fields; to the west by North 99 Frontage Road, beyond which is California State Route 99; and, to the south by agricultural fields and a rural residence. Topography across the property is relatively flat with an average surface elevation of approximately +58 feet relative to mean sea level (msl), based on the review of the 1968 *United States Geological Survey (USGS) 7.5-Minute Series Topographic Map Lodi North Quadrangle, California* (See Figure 1)

At the time of our investigation on March 15 and 26, 2019, the area of the proposed modular structures and water tank supported irrigated, undeveloped land consisting of light amounts of grass. A sports, chain-linked backstop and trees, were located within the area of proposed improvements. The area of the proposed parking lot renovations supported an existing asphalt concrete paved parking area. The pavements were observed to be in fair condition.

GEOLOGIC STRUCTURE

The project site is located within the Great Valley Geomorphic Province of California (Great Valley), a ~100 million-year-old sedimentary basin that formed as a low-lying region between a subducting oceanic plate to the west and the Sierra Nevada mountain range to the east. The Great Valley is approximately 450 miles long and 50 miles wide and is comprised of two northwest to southeast-trending sub-basins: the Sacramento Valley to the northwest and the San Joaquin Valley to the southeast (CEC, *Geologic Hazards and Resources*). Each of these basins is filled by thick sequences of Mesozoic to Quaternary sediment, whose terrigenous and subaerial depositional sources are traced to the Sierra Nevada and Coast Range Geomorphic Provinces to the east and west, respectively (Anderson, 1943).

The Great Valley and the Sierra Nevada Geomorphic Province form the Sierran Block, a stable crustal block comprised of a Mesozoic basement (CEC, *Geologic Hazards and*

Resources). The western boundary of the Great Valley is characterized by strike-ridges and valleys associated with the Upper Mesozoic strata of the Coast Ranges Geomorphic Province, which dip beneath the alluvium of the Great Valley (California Geological Survey [CGS], Note 36).

Surface elevations within the Great Valley range from several feet below mean sea level (msl) to elevations greater than 1,000 feet above msl. Most notably, the Sutter Buttes (a volcanic remnant) rises to an elevation of approximately 1,980 feet above the surrounding Sacramento Valley floor.

Regional Geology

Review of the *Preliminary Geologic Map of the Lodi 30'x60' Quadrangle, California* (CGS, 2009) indicates that the school site is underlain by late Pleistocene-aged alluvium (Map Symbol: Q_{m2}) of the Modesto Formation. These deposits primarily consist of arkosic sands with minor silts and gravels that form terraces, floodplains and alluvial fans along the Mokelumne and Consumnes Rivers (Dawson, 2009; See Figure 2).

The soil conditions encountered in our borings were generally consistent with the soils typically mapped as the Modesto Formation.

Existing Pavement Sections

The existing pavement sections encountered in our R-Value sample locations (RV1 and RV2, see Figure 3) generally consisted of 4½ inches of asphalt concrete over soil subgrade. No aggregate base was encountered.

Subsurface Soil Conditions

The surface and near-surface soil conditions encountered by our four test borings performed at the project site generally consisted of very loose and loose, slightly clayey, silty sands to approximate depths of five to nine feet below existing grades. The near-surface soils were underlain by medium dense to dense silty sands, medium dense poorly graded sands with silt and dense sandy silt to the maximum depth explored of approximately 25 feet below existing grades.

To supplement our soil borings, two Cone Penetration Test (CPT) soundings were performed to maximum depths of approximately 50 feet below existing site grades. The soil conditions encountered at the CPT locations were generally consistent with those encountered in the soil borings; however, the near-surface soils within CPT-02 indicates soils having "clay-like" behavior. Near-surface clays were not encountered in any of our drilled borings or R-Value sample locations.

For more detail regarding the soil conditions at a specific location, please refer to the Logs of Soil Borings on Figures 4 through 7. The results of the CPT soundings are presented in Appendix D.

GROUNDWATER

Groundwater was not encountered within our soil borings and CPT soundings that were performed on March 15 and 26, 2019, to a maximum depth explored of approximately 50 feet below existing grades.

To supplement our groundwater information, we reviewed groundwater elevation data obtained from one nearby California Department of Water Resources (DWR) groundwater monitoring well # 381802N1212527W001, located approximately 1/4-mile northeast of the subject property. Surface elevation at the well is indicated to be approximately +65 feet above msl. The DWR has periodically measured groundwater elevations in this well from at least March 1, 1960 to October 1, 2013. During this time period, the groundwater elevations have ranged from approximately +17.4 to -28 above feet msl (about 47.6 to 93 feet below grade at the well).

We also reviewed the available groundwater data on the California State Water Resources Control Board's GeoTracker Groundwater Ambient Monitoring and Assessment (GAMA) website. Groundwater measurements recorded between June 2003 through January 2010 in environmental monitoring wells located approximately 1¼-mile to the south of the site indicate that groundwater depths have ranged from approximately +8.6 to 2.4 feet above msl (about 50 to 61 feet below existing grades).

Recent measurements taken over the past 30 years by the DWR and California State Water Resources Control Board indicates the groundwater elevation in this area has varied between approximately 50 to 93 feet below existing site grades.

FAULTING

There were no indications of surface rupture or fault-related surface disturbance at the site during our review of aerial photographs, site reconnaissance, or geotechnical investigation.

The site is not located within a state designated *Alquist-Priolo* Earthquake Hazard Fault Zone (Hart and Bryant, 2007). The closest Earthquake Fault Zones are the Foothills Fault Zone located approximately 21.2 miles (34.1 kilometers). The next closest Earthquake Fault Zones are the Great Valley Fault System and the Mount Diablo Thrust Fault located approximately 27.3 and 37.0 miles (43.9 and 59.5 kilometers), from the project site, respectively. The nearest identified fault trace, the Stockton fault, is not considered to be an active fault. A Regional Fault Map (Figure 9) is included with this report.

Using the USGS Earthquake Hazards Program, 2008 National Seismic Hazard Maps-Source Parameters (https://earthquake.usgs.gov/cfusion/hazfaults_2008_search/query_results.cfm) we have prepared Table 1, which contains CGS Class A and B faults and fault systems within 62 miles (100 km) of the site. The identified faults are considered to be capable of producing earthquakes with moment magnitudes (M_W) of 6.4 or greater. The closest active faults to the site are the Great Valley -Segment 7 Fault (33.6 miles/54.1 kilometers), Great Valley - Segment 5/Pittsburg Kirby Hills Fault (33.7 miles/54.2 kilometers), and the Greenville Connected Fault (37.2 miles/59.9 kilometers). The Great Valley - Segment 7 Fault is a 28 mile (45 kilometer) long, northwest to southeast-striking thrust fault, and the Great Valley - Segment 5, Pittsburg Kirby Hills Fault is a 20 mile (32 kilometer) long, northwest to southeast-striking reverse fault. Both faults are located to the west of the project site. The Greenville Connected Fault is a northwest to southeast-trending strike-slip fault located southwest of the project site.

Faults Influential to the Houston Middle School

Fault Name	Maximum Magnitude (M_W)	Distance to Site Miles (km)
Foothills Fault System – Segment 1	6.5	21.2 (34.1)
Great Valley Fault System – Segment 5	6.5	27.3 (43.9)
Foothills Fault System – Segment 2	6.5	29.2 (47.0)
Great Valley Fault System – Segment 7	6.7	33.6 (54.1)
Foothills Fault System – Segment 3	6.5	33.9 (54.5)

Fault Name	Maximum Magnitude (M_W)	Distance to Site Miles (km)
Great Valley Fault System – Segment 4	6.6	35.4 (56.9)
Mount Diablo – MTD	6.7	37.0 (59.5)
Greenville – GN	6.7	37.0 (59.6)
Greenville – Floating	6.2	40.3 (64.8)
Greenville – GS	6.6	40.3 (64.8)
Greenville – GS+GN	6.9	40.3 (64.8)
Concord/GV – Floating	6.2	43.9 (70.7)
Concord/GV – CON	6.3	43.9 (70.7)
Concord/GV – CON+GVS	6.6	43.9 (70.7)
Concord/GV – CON+GVS+GVN	6.7	43.9 (70.7)
Concord/GV – GVS+GVM	6.5	45.3 (72.9)
Concord/GV – GVS	6.2	45.3 (72.9)
Calaveras CS+CC+CN	6.9	47.6 (76.6)
Calaveras – CC+CN	6.2	47.6 (76.6)
Calaveras – Floating	6.2	47.6 (76.6)
Calaveras – CN	6.8	47.6 (76.6)
Concord/GV – GVN	6.0	48.5 (78.0)
Great Valley Fault System – Segment 8	6.6	51.4 (82.8)
Great Valley Fault System – Segment 3	6.9	53.1 (85.4)
West Napa	6.5	53.5 (86.1)
Hunting Creek – Berryessa	7.1	54.4 (87.6)
Hayward – Floating	6.9	56.3 (90.6)
Hayward – HS+HN+RC	7.3	56.3 (90.6)
Hayward – HS	6.7	56.3 (90.6)
Hayward – HS+HN	6.9	56.3 (90.6)
Hayward – HN+RC	7.1	57.0 (91.8)
Hayward – HN	6.5	57.0 (91.8)
Calaveras – CS+CC	6.4	58.5 (94.2)
Calaveras CC	6.2	58.5 (94.2)
Calaveras – CS+CC Floating	6.2	58.5 (94.2)

Review of the *Earthquake Outlook for the San Francisco Bay Region 2014–2043* (https://pubs.usgs.gov/fs/2016/3020/fs20163020.pdf), indicates the Hayward-Rodgers Creek Fault System has the highest probability (33 percent) of producing a magnitude 6.7 or

greater earthquake in the next 30 years. The Greenville Fault, Mt. Diablo Thrust Fault, and the Green Valley fault were assigned a 16 percent probability of producing a magnitude 6.7 or greater earthquake in the next 30 years. Based on supplementary review of USGS fault parameters and EQFault data files, it is our opinion that the Great Valley Fault System should also be considered a potential causative fault system.

HISTORIC SEISMICITY

Seismological data regarding significant historical earthquakes affecting the site was obtained using the commercially available software program EQSEARCH (Blake, 2000; database updated 2018). The EQSEARCH database was developed by extracting records of events equal to or greater than magnitude 5.0 from the DMG Comprehensive Computerized Earthquake Catalog and supplemented by records from the USGS; University of California, Berkeley; and the California Institute of Technology. A search radius of 62 miles (100 km) was specified for this analysis. A historic earthquake epicenter map showing earthquakes (magnitude 5 or greater) within a 62-mile (100 km) radius of the project site is presented as Figure 10.

A review of the historical earthquake data indicates that the most significant earthquake shaking experienced at the project site occurred during two separate earthquake events; the M_R 6.8 earthquake of October 21, 1868, with an epicenter located approximately 56.3 miles (90.5 kilometers) southwest of the project site, and the M_R 6.8 earthquake of June 10, 1836, with an epicenter located approximately 57.3 miles (92.2 kilometers) southwest of the project site. An examination of the tabulated EQSEARCH data suggests that the project site has not experienced a ground shaking equivalent to Modified Mercalli Intensity X[1]. The closest earthquake to the site was 33.1 miles (53.3 kilometers) northwest, and measured M_R of 5.5.

The largest earthquake to occur within the EQSEARCH radius of 62 miles (100 km) was measured at Mw 6.8, and the largest accelerations experienced at the site were estimated to be 0.077 g. The number of earthquakes greater than Mw 5.5 within a 62-mile (100 km) radius of the site is presented in the following table.

[1] Most masonry and frame structure and their foundations destroyed. Ground badly cracked. Landslides. Wholesale destruction.

TABLE OF MAGNITUDES AND EXCEEDANCES	
Earthquake Magnitude	Number of Times Exceeded
5.5	18
6.0	8
6.5	2
7.0	N/A
7.5	N/A
8.0	N/A

Output files from the EQFAULT/EQSEARCH programs are included in Appendix C.

COSEISMIC GROUND DEFORMATION

The California State Legislature passed the Seismic Hazards Mapping Act (SHMA) in 1990 as a result of earthquake damage caused by the 1987 Whittier Narrows and 1989 Loma Prieta earthquakes. The SHMA was enacted to protect public safety from the effects of strong ground shaking, liquefaction, landslides, or other ground failure, and other hazards caused by earthquakes (CGS, Special Publication [SP] 117).

There are currently no State designated Seismic Hazard Zone maps or Earthquake Fault Zone maps for Acampo or San Joaquin County. For both Earthquake Fault Zones and Seismic Hazard Zones, San Joaquin County is currently listed as "not affected", therefore no maps are available. The project site is not located within a designated Seismic Hazard Zone.

CONCLUSIONS

SEISMIC HAZARDS

No active or potentially active faults are shown to cross the project site, as indicated on the published geologic maps and aerial photographs reviewed for this report. The project site is not located within an Earthquake Fault Zone or a designated seismic hazard zone. Therefore, a site-specific ground motion analysis is not warranted. The project site is located within a region of seismic activity. However, building structure designs in conformance with the 2016 edition of the California Building Code (Title 24 of the California Code of

Regulations, Chapter 16A) should be sufficient to prevent significant damage from ground shaking during seismic events induced the by movement of any fault or fault system discussed in this report.

Shear Wave Seismic Velocity and Seismic Site Class

Shear wave velocity data was obtained from our seismic CPTs and utilized to determine the average shear wave velocity (ASCE 7-10, Equation 20.4-1). Although based on our calculations, the average shear wave velocity would fall within the range of Site Class C (ASCE 7-10, Table 20.3-1), it is our opinion due to the loose nature of silty sands, variable densities and blow counts encountered within the upper portions of our drilled test borings, that Site Class D is more appropriate in determining seismic design forces for this project in accordance with Table 1613A.3.2 of the 2016 CBC.

Seismic Code Parameters

Section 1613 of the 2016 edition of the CBC references ASCE Standard 7-10 for seismic design. The following seismic parameters were determined based on the site latitude and longitude using software provided by the Structural Engineers Association of California in association with the California Office of Statewide Health Planning and Development (SEAOC/OSHPD). The seismic design parameters summarized in the following table may be used for seismic design of the proposed improvements.

2016 CBC/ASCE 7-10 Seismic Design Parameters				
Latitude: 38.1744° N Longitude: 121.2602° W	ASCE 7-10 Table/Figure	2016 CBC Table/Figure	Factor/ Coefficient	Value
Short-Period MCE at 0.2s	Figure 22-1	Figure 1613.3.1(1)	S_S	0.702 g
1.0s Period MCE	Figure 22-2	Figure 1613.3.1(2)	S_1	0.291 g
Soil Class	Table 20.3-1	Section 1613.3.2	Site Class	D
Site Coefficient	Table 11.4-1	Table 1613.3.3(1)	F_a	1.238
Site Coefficient	Table 11.4-2	Table 1613.3.3(2)	F_v	1.819
Adjusted MCE Spectral Response Parameters	Equation 11.4-1	Equation 16-37	S_{MS}	0.870 g
	Equation 11.4-2	Equation 16-38	S_{M1}	0.529 g

2016 CBC/ASCE 7-10 Seismic Design Parameters				
Latitude: 38.1744° N Longitude: 121.2602° W	ASCE 7-10 Table/Figure	2016 CBC Table/Figure	Factor/ Coefficient	Value
Design Spectral Acceleration Parameters	Equation 11.4-3	Equation 16-39	S_{DS}	0.580 g
	Equation 11.4-4	Equation 16-40	S_{D1}	0.352 g
Seismic Design Category	Table 11.6-1	Section 1613.3.5(1)	Risk Category I to IV	D
	Table 11.6-2	Section 1613.3.5(2)	Risk Category I to IV	D

MCE – Maximum Considered Earthquake
g – Acceleration due to gravity

The PGA_M (Equation 11.8-1, ASCE 7-10) for the site is 0.32 g.

SEISMIC SOURCES

Several active and potentially active faults were identified as potential seismic sources within 62 miles (100 km) of the project site. These faults and fault systems include the Foothills Fault System, Great Valley Fault System, the Greenville Connected Fault, the Mount Diablo Thrust Fault, the Calaveras Fault System, and the Hayward Fault, among others. The closest active faults are Segments 7 and 5 of the Great Valley Fault System located 33.6 and 33.7 miles (54.1 and 54.2 kilometers), respectively, from the project site. The Maximum Magnitude Earthquakes (M_{max}) for the faults within 62 miles (100 km) of the project site are listed in the table within the FAULTING section of this report. The M_{max} value represents the maximum earthquake believed possible for each fault.

The Central Valley and the Sierra Nevada margin are defined in the region by the Foothills Fault System. This fault zone is less active than the Central Coast area's strike-slip faults and the CRCV boundary located along the west side of the Sacramento and San Joaquin Valley. The Foothills Fault System is regarded as an aerial earthquake source that is based on poorly constrained Quaternary slip rates across the Bear Mountain and Melones Fault Zones (CDMG, 1996; Woodward-Clyde Consultants, 1978). Wakabayashi and Smith (1994) describe the Foothills Fault Zone as lacking evidence of active crustal shorting and note that deformation along the eastside of the Central Valley is extensional or transtensional.

The Great Valley Fault System extends from the southern San Joaquin Valley in Kern County northward into Tehama County, and serves as the boundary between the Coast Range and the Great Valley Geomorphic Provinces of California. It is characterized by a zone of low-angle, or blind-thrust, and reverse faults that do not rupture the ground surface during sizable earthquake events. Although not exposed at the surface, regional studies have suggested that the Great Valley Fault System may be comprised of 18 to 25 segments that range in length from 7 to 35 miles (11.2 to 56.3 kilometers) – with most segment lengths measuring between 12 and 19 miles (19.3 to 30.6 kilometers). Several notable earthquake events have occurred along segments of the Great Valley Fault System, including: the 1892 M_W 6.4 and 6.2 Winters-Vacaville earthquakes, 1983 M_W 6.5 Coalinga earthquake, and the 1985 M_W 6.1 Kettleman Hills earthquake.

The Greenville Fault is an active dextral strike-slip fault situated within the Diablo Range of California. It, along with the Green Valley Fault, defines the easternmost extent of the San Andreas Fault System in the San Francisco Bay region. Recent studies of the Greenville Fault have determined a long-term creep rate of 2 mm/year along the northern third of the fault system, with diminished aseismic releases in the two southern segments. A lack of large fault surface expressions (greater than 1 kilometer) and significant locking along the southern two-thirds of the Greenville Fault supplement seismic evidence for historic rupture events during the late Holocene. Estimations by Lienkaemper et al. (2013) imply that the resulting strain accumulation along the fault system is sufficient enough to generate a M_W 6.9 earthquake with a mean recurrence of approximately 600 years.

The Hayward-Rodgers Creek Fault System is a significant seismic source located in the northern San Francisco Bay area. The Working Group on California Earthquake Probabilities (WGCEP, 2012) defined the Hayward-Rodgers Creek Fault System as having the greatest probability in the San Francisco Bay region of generating an earthquake of M_W 6.7 or greater. Most investigators interpreted the Rodgers Creek Fault as a single fault system capable of generating a M_W 7.1 earthquake, or if it ruptures simultaneously with the northern Hayward Fault, a M_W 7.3 earthquake (WGCEP, 2012). The roughly 37-mile (60 kilometers) long Rodgers Creek Fault, located between San Pablo Bay and Santa Rosa, strikes approximately N35˚W, and is characterized by a late Holocene right-lateral slip rate of 6.4 to 10.4 mm/yr (Budding et. al, 1991; Schwartz et. al, 1992). The Rodgers Creek Fault is one fault in a series of right-stepping en echelon faults that include the Hayward fault to the south, and the Healdsburg and Maacama Faults to the north. The surface expression of the Rodgers Creek Fault, as mapped by Randolph and Caskey (2001) and Hart (1992), includes classic fault-related

geomorphic features such as offset drainages, side hill benches, tonal lineaments, sag ponds, and springs.

SURFACE FAULT RUPTURE

No known faults are mapped crossing the immediate vicinity of the site. The site does not lie within an Alquist-Priolo Earthquake Fault Zone as currently designated by the State of California, and no evidence of surface faulting was observed during our historical aerial photography review, site reconnaissance, or geotechnical investigation. It is our opinion that the potential of fault-related surface rupture at the site is low.

SEISMIC RISK

Based on review of the peak site accelerations obtained from EQFAULT analysis, the primary seismic site risks are from earthquakes along the Foothills Fault System Segment 1. The fault system lies within approximately 21.2 miles (34.1 km) of the project site and is capable of producing large earthquakes. Results of the EQFAULT analysis indicate an Mw 6.5 earthquake on the Foothills Fault System Segment 1 would result in a site acceleration of 0.1393 g, based on the Boore et al (1997) Soil (310) attenuation relation.

LIQUEFACTION

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

Review of the *Preliminary Geologic Map of the Lodi 30'x60' Quadrangle, California* (CGS, 2009) indicates that the school site is underlain by late Pleistocene-aged alluvium (Map Symbol: Q_{m2}) of the Modesto Formation. These deposits primarily consist of arkosic sands with minor silts and gravels that form terraces, floodplains and alluvial fans along the Mokelumne and Consumnes Rivers (Dawson, 2009; See Figure 2). Groundwater was not encountered within our drilled and CPT borings advanced at the project site to a maximum depth of 50

feet below existing grades. However, review of historical and recent groundwater measurements by DWR and Geotracker indicates historical high groundwater has been located within 47 feet below existing grades within the area.

The California Geological Survey has developed three criteria for delineating liquefaction hazards zones for the 1990 SHMA based on site geology, peak ground acceleration, and depth to groundwater (CGS SP 118, 1992; revised 2004). These criteria are:

(1) *Areas containing soil deposits of late Holocene age (current river channels and their historical floodplains, marshes and estuaries) where the M7.5-weighted peak acceleration that has a 10-percent probability of being exceeded in 50 years is greater than or equal to 0.10 g and the anticipated depth to saturated soil is less than 40 feet;*
(2) *Areas containing soil deposits of Holocene age (less than 11,000 years), where the M7.5-weighted peak acceleration that has a 10-percent probability of being exceeded in 50 years is greater than or equal to 0.20 g and the anticipated depth to saturated soil is less than 30 feet; or,*
(3) *Areas containing soil deposits of latest Pleistocene age (between 11,000 years and 15,000 years), where the M7.5-weighted peak acceleration that has a 10-percent probability of being exceeded in 50 years is greater than or equal to 0.30 g and the anticipated depth to saturated soil is less than 20 feet.*

It is our opinion that the site is <u>not</u> susceptible to large scale liquefaction based on the age and composition of the Pleistocene-aged alluvium deposits, site seismologic constraints (i.e., PGA_M= 0.32g from Section 1803A.5.11 of the 2016 CBC), and depth to groundwater (greater than 45 feet).

However, to confirm this opinion, we performed a liquefaction based on the site specific soils encountered in the CPTs.

Liquefaction Analysis Results & Seismically Induced Settlement

We performed our liquefaction analysis for the CPT soundings CPT-1 and CPT-2 using the commercially available software program CLiq (Version 2.0) developed by Geologismiki. The analysis was performed using the Robertson (2009) methodology. Input earthquake ground motion for the liquefaction analysis was 0.32g (*PGA_M, 2016 CBC Section 1803A.5.11 for Site*

Classification D); M6.7 earthquake (*USGS Interactive Deaggregations webpage*); and, an in-situ depth to groundwater of about 45 feet determined based on historical groundwater measurements for wells monitored by DRW and Geotracker located approximately 1/4-mile of the site. As required by Note 48, a factor of safety (FS) of 1.3 against liquefaction was used in the analysis. Appendix D of this report includes the output files of our liquefaction analysis.

Based on the results of our subsurface exploration, lack of groundwater encountered in our borings, laboratory testing and analyses using the CLiq software program, the soils are not considered potentially liquefiable and susceptible to only minor seismic settlements. Analysis using the CLiq software program and the current subsurface data indicates estimated maximum total seismic settlements due to liquefaction would be less than 1/10-inch. We estimate differential seismic settlements to be about half of the total seismic settlement. The Liquefaction Potential Index (LPI) value estimate from the analysis is zero for both CPT soundings. LPI values range from zero to 100. Iwasaki et al. (1982) suggested that liquefaction effects are low for 0 < LPI < 5; moderate for 5 < LPI < 15; and, major for LPI > 15. LPI combines depth, thickness, and factor of safety of liquefiable material inferred from a CPT sounding into a single parameter. The estimated LPI values fall into the low risk range. Based on our work, we consider the estimated seismic settlement to be conservative and a worst-case estimate.

Cyclic Softening

The soils encountered in our borings are generally granular (sandy) in nature and soft, low strength clays were not encountered; therefore, it is our opinion the potential for cyclic softening occurring beneath the site is low.

Dry Sand Seismic Settlement

Dry sand seismic settlement can be evaluated using the methodology developed by Robertson and Shao (2010) based on the earlier work by Pradel (1998). The on-site soils above the groundwater surface generally consisted of loose silty sands. Based on our analyses using the CLiq software program (utilizing Robertson and Shao), the surface sands encountered in CPT-01 may be susceptible to post-earthquake settlement of dry sands. Analysis using the CLiq software program and the current subsurface data indicates

estimated maximum total post-earthquake settlements of dry sands would be approximately ½-inch.

VOLCANIC HAZARDS

Review of the USGS Map of Potential Hazards from Future Volcanic Eruptions in California (Miller, 2011), shows there are six volcanic hazard zones in California. The project site does not lie within any of these six recognized volcanic hazard areas. The closest known volcanic center is the Clear Lake area, approximately 61 miles (98 km) northwest of the site. The most recent volcanic eruption from the Clear Lake area occurred approximately 10,000 years ago. Based on the above information, the volcanic hazard potential is low.

LANDSLIDES

Based on site observations and a review of the most recent topographic maps, the site has relatively flat topography. According to the 1968 *United States Geological Survey (USGS) 7.5-Minute Series Topographic Map Lodi North Quadrangle, California,* the average surface elevation across the site is approximately +58 feet mean sea level (msl). There are no slopes in the immediate or general area. Due to the relatively flat topography of the site and general area, potential for landslides is not considered applicable to the site.

SLOPE STABILITY

The project is located on a relatively flat site that has been previously developed. The proposed improvements to the site do not incorporate the formation of new slopes. Based on the current and anticipated final site conditions, slope stability is not considered a risk factor in site development.

NATURALLY OCCURRING ASBESTOS (NOA)

Asbestos is the generic term for the naturally occurring fibrous (asbestiform) varieties of six silicate minerals (croicidolite, tremolite, actinolite, anthophyllite, amosite, and chrysotile). These asbestiform minerals are naturally occurring in igneous ultramafic rock formations such as dunite, pyroxenite, peridotite, and hornblendite which form below the Earth's surface at high temperatures and then exposed by uplift and erosion. Chrysotile, the most common asbestos mineral in California, forms fibrous crystals in small veins in the altered

metamorphic rock serpentinite. According to the USGS Open-File Report 2011-1188, *Reported Historic Asbestos Mines, Historic Asbestos Prospects, and Other Natural Occurrences of Asbestos in California* (Van Gosen and Clinkenbeard, 2011), the project site does not lie within an area mapped as containing Naturally Occurring Asbestos (NOA).

RADON GAS

Radon is a naturally occurring, colorless and tasteless gas produced in soil or rock by the decay of uranium and radium; radon is a known cause of lung cancer in the United States. Sections 307 and 309 of the Indoor Radon Abatement Act of 1988 (IRAA) directed EPA to list and identify areas of the U.S. with the potential for elevated indoor radon levels. EPA's Map of Radon Zones assigns each of the 3,141 counties in the U.S. to one of three zones based on radon potential. San Joaquin County and the project site are located in Zone 3 for radon potential. Zone 3 counties have a predicted average indoor radon screening level less than 2 pCi/L and are anticipated to have a low potential for radon.

FLOOD HAZARDS

The site is not located within a Special Flood Hazard Area (SFHA) as designated by the Federal Emergency Management Agency (FEMA). According to the Flood Insurance Rate Map (FIRM) Panel 170, Map Number 06077C0170F, published by the Federal Emergency Management Agency (FEMA), with an effective date of October 16, 2009, the school campus is within a segment of Zone X (unshaded) that is defined an area determined to be outside the 500-year flood and protected by levee from 100-year flood.

The site is located within the San Joaquin County (SJC) Department of Public Works Special Flood Hazard Area – Historic Flood Area (non-FIRM) based on historic flooding recorded for the site and surrounding area in 1958. The site is also located within the East Bay Municipal Utility District's (EBMUD) flood control area; EBMUD operates the Pardee and Camanche Reservoirs with a reported combined storage to provide up to 200,000-acre feet of flood control space, with the primary flood control space at Camanche (EBMUD, 2019). Although the site is located within this SJC Historic Flood Area, it should be noted that since the construction of the Camanche dam in 1963, no flood event has exceeded the 5,000 cubic feet per second (cfs) channel capacity, whereas prior Camanche flows were reported in excess of 10,000 cfs (Burley, 2007). The site is located within less than 400 feet east of the western boundary of the 1958 historic flood area as mapped by SJC. Based on the Lodi

Unified School District and Houston School anecdotal accounts of recent record precipitation years (1997, 2006, and 2011) (EBMUD, 2011), the only portion of the site that experienced flooding has been observed in the south central and southeast portions of the site, away from proposed new structures.

DAM INUNDATION

Based on review of the *San Joaquin County Flood and Dam Failure Hazard Annex* (adopted March 2019), the school site is located within an area of potential dam inundation zone. Surface water stored in reservoirs on the Calaveras, Mokelumne, and Stanislaus River systems present a potential risk to inhabitants of the Acampo area. Dams that present a threat of inundation to the site include Camanche, Camanche South and North Dikes, and Pardee.

TSUNAMIS AND SEICHES

The project site is inland and there are no significant bodies of standing water near the site; therefore, the potential for a tsunami hazard the site is low.

There are no water bodies adjacent to the site. The project site is located approximately 2.5 miles (4.0 kms) northeast of Lodi Lake. Due to the project site's distance from the lake, it is our opinion that the potential for seiches influencing the site is very low.

SUBSIDENCE AND HYDROCOLLAPSE

Regional subsidence occurs when large areas of land sink in response to withdrawal of groundwater, petroleum, or natural gas. The site is within the San Joaquin Valley, a region historically subject to subsidence from over pumping of groundwater, petroleum or natural gas withdrawal and peat oxidation. According to a review of the *Areas of Land Subsidence in California Map* (California Water Science Center), the site is not currently located within an area of land subsidence from groundwater pumping, peat loss, or oil extraction. According to the *State of California Public Utilities Commission – Lodi Gas Storage Project Area and Map*, the site is located approximately 3 miles (4.8 kms) southwest of the Lodi Gas Field. In our opinion, the site is not located in an area subject to high subsidence, due to the absence of factors and conditions needed to cause subsidence (excessive withdrawal of groundwater, petroleum, or natural gas). In addition, due to the age and composition of the native soils

and geologic materials encountered during our field exploration, it is our opinion that subsidence of the on-site soils as the result of groundwater withdrawal is unlikely.

Due to the age and composition of the native soils and geologic materials encountered during our field exploration, it is our opinion that hydrocollapse of the on-site soils as the result of rain or irrigation water percolation is unlikely.

Bearing Capacity And Foundation Support

Based on our field and laboratory investigations, it is our opinion that the surface and near-surface soils across the site are loose and variable with respect to density and strength characteristics. Sub-excavation and thorough processing and recompaction of the upper soils, will be recommended and is crucial to providing uniform support for the planned modular buildings.

Specific recommendations for sub-excavation, processing and recompaction are presented in the Sub-excavation and Site Preparation sections of this report.

In our opinion, recompacted soils, as recommended, are capable of supporting the proposed modular structures, provided the further recommendations regarding site preparation and soils compaction are followed. Our work also indicates that engineered fill, properly placed and compacted in accordance with the recommendations of this report, will be capable of supporting the proposed improvements.

Excavation Conditions

Based on our field investigation, the native soils on the site should be readily excavatable with conventional earthmoving and trenching equipment typically used in the area. Based on the loose and relatively clean, silty sands exposed in all of our borings, excavations likely will be subject to sloughing or caving during excavation, especially if left open for an extended period of time, or if the soils are allowed to dry, or become saturated. Excavations entered by workers must conform to current OSHA requirements (i.e., sloped or braced shoring).

EXPANSIVE SOILS

The results of our subsurface exploration indicate the majority of the on-site surface and near-surface soils consist of slightly clayey, silty sands. Results from our CPT fieldwork indicates the near-surface soils within CPT-2 contained soils with a "clay-like behavior"; however, near-surface clays were not encountered in any of our drilled borings or R-Value sample locations.

Laboratory testing on the near-surface slightly clayey, silty sands indicates these soils possess a very low expansion potential when testing in accordance with ASTM D4829 (See Figure A1). Based on the generally granular nature of the soils encountered in our field exploration and results of laboratory testing, it is our opinion that special site preparation or foundation design to mitigate expansive soil will not be required for development of this site.

FILL MATERIAL SUITABILITY

In our opinion, the on-site soils encountered in our test borings are considered suitable for use as engineered fill materials, provided they are free of rubble, debris, roots and organics, and are at a proper moisture content to achieve the desired degree of compaction. Removal of roots, organics, rubble and debris from the on-site soils may require laborers handpicking the fill materials to properly clean the soils prior to allowing their use as engineered fill.

PAVEMENT SUBGRADE QUALITY & SUPPORT

Laboratory test results indicate the near-surface slightly clayey, silty sands are moderate quality materials for the support of asphalt concrete pavements with a Resistance ("R") – value of 56, when tested in accordance with California Test (CT) 301 (see Figure A2). Based on our experience and the anticipated mixing of soils, it is our opinion that a Resistance-value of 30 is considered appropriate for design of pavements at the site.

GROUNDWATER AND SEASONAL WATER

Based upon anticipated groundwater depths, we conclude that the permanent groundwater level should not be a significant factor in design and construction of the structures at this site.

The near-surface soils may be in a near-saturated condition during and for a period of time following the rainy season. If grading operations are to proceed shortly after the rainy season, and before prolonged periods of warm dry weather, the near-surface soils may be at moisture contents where significant aeration or chemical-treatment may be required to dry the soils to moisture content where the specified degree of compaction can be achieved. The contractor should anticipate the additional time and effort necessary to achieve a compactable moisture content.

In addition, soils located within or adjacent to irrigated and landscaped areas, will likely be at elevated moisture contents regardless of the time of year of construction and require drying. Wet soils should be anticipated and considered in the construction schedule for this project.

SOIL CORROSION POTENTIAL

One representative sample of the near-surface soils were submitted to Sunland Analytical to determine soil pH, minimum resistivity, chloride and sulfate concentrations to help evaluate potential for corrosive attack upon reinforced concrete and exposed buried metal. The results of the corrosivity testing are summarized in the table on the following page.

Soil Corrosivity Testing		
Analyte	Test Method	Sample Identification
		D1 (0-1')
pH	CA DOT Test #643 Modified (Sm. Cell)	6.63
Minimum Resistivity		4,560 Ω-cm
Chloride	CA DOT 417	2.6 ppm
Sulfate	CA DOT 422	4.0 ppm

Ω-cm = Ohm-centimeters ppm = Parts per million

The California Department of Transportation Corrosion Technology Section, Office of Materials and Foundations, Corrosion Guidelines Version 3.0, March 2018, considers a site to be corrosive to foundation elements if one or more of the following conditions exists for the representative soil and/or water samples taken: has a chloride concentration greater than or equal to 500 ppm, sulfate concentration greater than or equal to 1500 ppm, or the pH is 5.5 or less. Based on this criterion, the on-site soils are not considered corrosive to steel reinforcement properly embedded within Portland cement concrete for the samples tested.

Table 19.3.1.1 – *Exposure Categories and Classes*, American Concrete Institute (ACI) 318-14, Section 19.3, as referenced in Section 1904.1 of the 2016 CBC, indicates the severity of sulfate exposure for the samples tested is "not a concern". Ordinary Type I-II Portland cement is considered suitable for use on this project, assuming a minimum concrete cover is maintained over the reinforcement.

Mid Pacific Engineering, Inc. are not corrosion engineers. Therefore, to further define the soil corrosion potential at the site, or to determine the need or design parameters for cathodic protection or grounding systems, a corrosion engineer should be consulted.

Import fills, if used for construction, should be sampled and tested to verify the materials have corrosion characteristics within acceptable limits and generally should be similar to the tested on-site soils.

RECOMMENDATIONS

Based on existing site topography, we anticipate maximum excavations and fills to obtain finished subgrades to be on the order of zero to two feet. The recommendations contained in this report are based upon this assumption. We consider it essential that our office review final site, grading, and structural foundation plans to verify the applicability of the following recommendations, perform additional investigations, and provide supplemental recommendations, as conditions dictate. Our recommendations are contingent upon our office performing the recommended plan reviews and providing a letter indicating that the recommendations of this report are applicable to the proposed construction.

Specific recommendations for sub-excavations, additional processing and recompaction of the near-surface soils are presented below to promote more uniform support for the planned structures.

The recommendations presented below are appropriate for typical construction in the late spring through fall months. The on-site soils likely will be saturated by rainfall in the winter and spring months, and will not be compactable without drying by aeration or the addition of lime (or a similar product) to dry the soils. Should the construction schedule require work to continue during the wet months, additional recommendations should be provided by the Geotechnical Engineer retained to provide services during construction.

SITE CLEARING

Prior to site grading, the construction areas should be cleared of all surface and subsurface structures associated with previous development of the site, existing structures, septic systems, leach lines, concrete slabs, foundations, asphalt concrete, undocumented fills, utilities to be relocated or abandoned including all associated backfill, fences, trees, demolition debris, rubbish, rubble, and other deleterious materials. Adequate removal of roots, rubble or debris may require laborers and handpicking to clear the subgrade soils to the satisfaction of our representative, prior to further site preparation. Trees designated for removal should include the rootball and all exposed roots greater than ½-inch in diameter. Existing underground utilities and leach lines, located within the proposed building pads should be completely removed and/or rerouted as necessary. Removal of underground utilities should include all associated trench backfill. Utilities located outside the building area should be properly abandoned (i.e., fully grouted provided the abandoned utility is

situated at least 2½ feet below the final subgrade level to reduce the potential for localized "hard spots"). Where practical, the clearing should extend a minimum of five feet beyond the limits of the proposed improvements and structural areas of the site.

Our representative should be present during clearing, excavation and grading operations to verify adequate removal of existing rubble and debris and determine the need for additional sub-excavation. Any loose, disturbed, soft or otherwise unsuitable materials, should be removed to expose a firm base for the support of the fill needed to restore the areas back to the required grades. Excavations resulting from clearing operations should be left as shallow dish-shaped depressions for proper location and to allow proper access with compaction equipment during grading operations.

All depressions resulting from the removal of such items, as well as all loose, disturbed or saturated soils in areas of clearing operations, as identified by our representative in the field, should be cleaned out to firm, undisturbed soil, as determined by our representative and should be restored to grade with engineered fill compacted in accordance with the recommendations of this report. It is considered essential that our representative be notified prior to site clearing operations to schedule periodic site visits.

It is very important that our representative be present during clearing operations to verify adequate removal of existing structures and pavements to determine the need for additional over-excavation of areas. If clearing and removal of structures takes place without our direct observation, additional over-excavation of the areas of existing structures and the building pad or structural area affected will be required. It is important that excavations resulting from clearing operations be left as shallow dish-shaped depressions for proper location and to allow proper access with compaction equipment during grading operations. If this is not the case, deeper over-excavations will be required.

The upper 12 inches of soil subgrades within areas of removed concrete slabs, flatwork, pavements, and trees should be ripped and cross-ripped to expose any remaining rubble, roots or debris. All exposed rubble, roots and debris should be cleared from the site. Adequate removal of debris may require laborers and handpicking to the clear the subgrade soils to the satisfaction of our on-site representative, prior to further site preparation.

The existing pavements and flatwork (asphalt concrete and concrete) that are not incorporated into the new design should be pulverized and can be re-used in engineered fill

construction. Reuse of the pulverized asphalt concrete, when mixed with an adequate volume of soil, is suitable for on-site fills from a geotechnical standpoint. However, reuse of asphalt concrete in building pads is not recommended due to potential environmental concerns, especially if environmental standards change in the future. Portland cement concrete rubble may be used as fill provided it is processed into fragments less than three inches in largest dimension and is mixed with soil to form a compactable mixture.

It has been our experience that subgrade soils under demolished pavements or concrete flatwork, or those soils within or adjacent to landscaped areas likely will be too wet to properly compact and may require drying, probably by aeration depending on site and weather conditions, prior to achieving compaction. Evaluation of the condition and determination of the appropriate drying technique should be made by our representative at the time of construction.

Following removal of existing structures, the site should be stripped of surface vegetation and organically contaminated topsoil; strippings may be re-used in non-structural areas or disposed of off-site. *If used, on-site strippings may be placed in landscape or other non-structural areas, provided they are kept at least five feet from all structural areas (building pads, pavement areas, subgrades supporting exterior concrete flatwork) moisture conditioned and compacted*. Strippings should not be used in landscaped berms that will support either retaining walls or sound walls.

SUB-EXCAVATION

The native soils are very loose and variable; therefore, we recommend the building pad supporting the modular structures be sub-excavated to a minimum depth of 12 inches below existing grades or to the bottom of the planned foundation, whichever is deeper. The soils exposed at the bottom of the excavation should be scarified 12 inches, thoroughly moisture conditioned to at least the optimum moisture content, and uniformly compacted to at least 95 percent of the ASTM D1557 maximum dry density to promote more uniform support for the planned structure. Disturbed soils or debris encountered during excavation or scarification activities should be removed, and resulting excavation restored to grade with engineered fill compacted in accordance with the recommendations in the ENGINEERED FILL CONSTRUCTION section of this report.

The sub-excavations should extend at least five feet beyond the proposed exterior edge of perimeter foundations and any exterior columns, where possible.

Site Preparation

All structural subgrade areas outside of the sub-excavations, designated to receive fill, remain at-grade, or achieved by excavation should be scarified to a depth of at least 12 inches, thoroughly moisture conditioned to at least the optimum moisture content, and uniformly compacted to not less than 90 percent of the ASTM D1557 maximum dry density.

Compaction operations should be undertaken with a heavy, self-propelled, compactor and should be performed in the presence of our representative who will evaluate the performance of the subgrade under compactive load and identify loose or unstable soils that could require additional excavation and/or compaction. Loose, soft, or unstable soils, as identified by our representative in the field, should be cleaned out to firm, undisturbed and stable soils, as determined by our representative, and should be restored to grade with engineered fill compacted in accordance with the recommendations of this report. Difficulty in achieving subgrade compaction or unusual soil instability may be indications of loose fill associated with past subsurface items. Should these conditions exist, the materials should be excavated to check for subsurface structures and the excavations backfilled with engineered fill. We recommend construction bid documents contain a unit price (price per cubic yard) for all excess excavation due to loose, soft, or unstable materials and replacement with engineered fill.

Engineered Fill Construction

Engineered fill should be placed in horizontal lifts not exceeding six inches in compacted thickness. Each lift should be thoroughly moisture conditioned to at least the optimum moisture content and uniformly compacted to at least 90 percent of the ASTM D1557 maximum dry density. Each lift of engineered fill should be property benched into adjacent side slopes to remove loose soils and promote uniformity.

The on-site soils will be suitable for use as engineered fill if the materials are at a workable moisture content and free of rubbish, rubble, debris, roots and concentrations of organics, and have a maximum particle size of three inches or less. Removal of roots, organics, rubble

and debris from the on-site soils may require laborers handpicking the fill materials to properly clean the soils prior to allowing their use as engineered fill.

Imported fill material, if required, should consist of granular soils or well graded aggregates with a Plasticity Index of 15 or less, an Expansion Index of 20 or less, and should have no particles greater than three inches in maximum dimension. Clean, open graded gravels (such as crushed rock or pea gravel) and other such materials are *not* acceptable for fill construction. The contractor also should supply appropriate documentation for imported fill materials indicating the materials are free of known contamination and have corrosion characteristics within acceptable limits. The imported materials should be sampled, tested, and approved well in advance (at least one week) of being transported to the project site.

The upper 12 inches of final building pad subgrades should be brought to at least the optimum moisture content and uniformly compacted to not less than 90 percent of the maximum dry density, regardless of whether final grade is achieved by excavation, filling or left at existing grade.

The upper six inches of final exterior flatwork subgrades should be scarified, brought to at least the optimum moisture content, and uniformly compacted to not less than 90 percent of the maximum dry density, as determined by ASTM D1557, regardless of whether final grade is completed by excavation, filling, or left at-grade.

The upper six inches of pavement subgrades and exterior slab subgrades supporting vehicle loadings should be scarified, moisture conditioned to at least the optimum moisture content, processed, and uniformly compacted to at least 95 percent of the maximum dry density, regardless of whether final grade is completed by excavation, filling, or left at existing grade. Final pavement subgrade preparation and compaction should be performed just prior to placement of aggregate base, after construction of underground utilities is complete. The completed pavement subgrades must be stable under construction traffic prior to placement of aggregate base.

Permanent excavation and fill slopes should be constructed no steeper than two horizontal to one vertical (2:1) and should be vegetated as soon as practical following grading to minimize erosion. As a minimum, erosion control measures including placement of straw bale sediment barriers or construction of silt filter fences in areas where surface run-off may

be concentrated would be prudent. Slopes should be over-built and cutback to design grades and inclinations.

Site preparation should be accomplished in accordance with the recommendations of this section and appended *Guide Earthwork Specifications* provided in Appendix B. It is essential that a representative of the Geotechnical Engineer be present on a nearly full-time basis during site clearing and preparation and all grading operations to identify unstable soil deposits, observe the earthwork construction, perform compaction testing and verify compliance with our recommendations and the job specifications.

PRELIMINARY STABILIZATION RECOMMENDATIONS

The soils beneath removed pavements or flatwork or those subgrades located adjacent to landscaped areas, and soils removed from excavations, may be in an over optimum or wet moisture condition, and too wet or unstable to properly compact. If such conditions are exposed, alternate stabilization recommendations will be needed to allow pavement subgrade construction to proceed. The following are preliminary options to help facilitate pavement construction. Final recommendations can be provided at the time of grading based on the actual field conditions exposed at the time.

Aeration

The first option would be to aerate the wet soils to dry them back to a compactable moisture content. This would involve near continuous scarification and aeration of the upper 12 inches of soils and exposure to the sun and wind for an extended period of time, to provide a better opportunity for drying. Factors influencing the usefulness and applicability of aeration include the depth of saturation and instability, and construction schedule constraints.

Removal and Replacement

Another acceptable alternative would be to completely remove the saturated/unstable soils to expose a firm, stable base and replace them to design soil subgrade elevation with dry, on-site or imported granular soils or Class 2 aggregate base (AB) (or on-site pavement grindings, where applicable) placed and properly compacted as engineered fill. The actual

lateral extent and depth of excavation needed for stabilization will depend upon the observed soil conditions at the time of excavation and should be anticipated to be variable.

Mechanical Stabilization (Geogrid)

An alternative to complete removal of the unstable soils within pavement areas would be to excavate, as a minimum, an additional 12 to 18 inches of soils below the soil subgrade elevation, place a geogrid soil reinforcement (Tensar BX1100 or better) over the exposed soils and backfill to the design AB grades with Class 2 aggregate base. During excavation it is essential that our representative be present to help identify isolated areas of obviously deeper deposits of wet and very unstable soils that may require deeper sub-excavation, prior to placing geogrid.

With this option, backfill below a planned pavement subgrade elevation can be either Class 2 AB or approved on-site grindings; however, all backfill above the planned pavement soil subgrade elevation must be Class 2 AB.

Aggregate base (or approved grindings) used for stabilization should be compacted in thin lifts to at least 95 percent of the ASTM D1557 maximum dry density at a uniform moisture content near the optimum.

UTILITY TRENCH BACKFILL

Utility trench backfill within structural areas should be mechanically compacted as engineered fill in accordance with the following recommendations. We recommend that native soil be used as trench backfill within the perimeter of the building foundations to help minimize soil moisture variations beneath the structures. The native soil backfill should extend at least three feet horizontally beyond perimeter foundation lines. Utility trench backfill should be placed in maximum six-inch lifts, moisture conditioned to near the optimum moisture content, and mechanically compacted to at least 90 percent of the maximum dry density as determined by ASTM D1557.

We recommend that underground utility trenches that are aligned nearly parallel with foundations be at least three feet laterally from the outer edge of foundations, wherever possible. As a general rule, trenches should not encroach into the zone extending outward at a 1:1 inclination below the bottom of the foundations. Additionally, trenches parallel to

foundations should not remain open longer than 72 hours. The intent of these recommendations is to prevent loss of both lateral and vertical support of foundations, resulting in possible settlement.

FOUNDATION DESIGN

Based on our fieldwork and engineering analysis, it is our opinion the foundations supporting the proposed modular structures should be designed to resist 1-inch of total settlement (static and seismic) and ½-inch of differential settlement.

We are providing design soil values for the analysis of the foundations, and suggested minimums for dimensions, but only from a Geotechnical Engineering perspective. The project Structural Engineer should determine final foundation width and depth dimensions, concrete strengths, and reinforcement requirements, based on their specific structural design which should include an appropriate factor of safety applied to the overall design.

The proposed modular buildings may be supported upon continuous and isolated spread foundations extending at least 12 inches into the prepared building pad, or at least 12 inches below the lowest adjacent soil grade, whichever is deeper. Continuous foundations should be at least 12 inches wide; isolated foundations should be at least 18 inches wide.

Foundations so established may be sized for a maximum allowable soil pressure of 1500 pounds per square foot (psf) for the dead plus live load condition with a 1/3 increase in allowable soil pressure for consideration of seismic or wind forces may be used in sizing foundations. The weight of foundation concrete may be excluded in sizing computations.

We recommend that all foundations be adequately reinforced to provide structural continuity, mitigate cracking and permit spanning of local soil irregularities. As a minimum, continuous foundations should contain *at least* two No. 4 steel reinforcing bars placed one each, near the top and bottom of the foundations. The project designer should determine the need for additional reinforcement based on structural requirements.

Resistance to lateral displacement of shallow foundations may be computed using an allowable friction factor of 0.30 multiplied by the effective vertical load on each foundation. Additional lateral resistance may be achieved using an allowable passive earth pressure against the vertical projection of the foundation equal to an equivalent fluid pressure of 250

psf per foot of depth. These two modes of resistance should not be added unless the frictional component is reduced by 50 percent since mobilization of the passive resistance requires some horizontal movement, effectively reducing the frictional resistance.

WATER TANK

The proposed 20,000-gallon water tank is noted on the preliminary plans to be supported on an 18-inch thick concrete circular mat foundation underlain by 12-inches of compacted Class II aggregate base (AB). The width of the foundation is proposed to be two feet plus the tank diameter. The diameter of the tank was not provided in the plans.

Prior to placing the 12-inch layer of AB, the soils subgrade should be scarified 12 inches, moisture conditioned to the optimum moisture content and compacted to at least 95 percent of the ASTM D1557 maximum dry density. Aggregate base should be compacted to 95 percent relative compaction.

The proposed 18-inch thick concrete mat foundation supported on a 12-inch thick 95 percent compacted AB layer over a 95 percent compacted subgrade may be sized for a maximum allowable soil pressure of 1000 pounds per square foot (psf) for the dead plus live load condition with a 1/3 increase in allowable soil pressure for consideration of seismic or wind forces may be used in sizing foundations. Resistance to lateral displacement of the mat foundation may be computed using the same allowable friction factor and passive resistance as contained above for the modular building.

EXTERIOR FLATWORK (NON-PAVEMENT AREAS)

Subgrades to receive exterior concrete flatwork (i.e., sidewalks, patios, etc.) should be scarified six inches, moisture conditioned to at least the optimum moisture content and uniformly compacted to not less than 90 percent of the maximum ASTM D1557 dry unit weight, immediately prior to the placement of the concrete. Proper moisture conditioning of the subgrade soils is considered essential to the performance of the exterior flatwork. All engineered fill placed under flatwork should be compacted as recommended in the ENGINEERED FILL CONSTRUCTION section of this report. A leveling course of crushed gravel may be placed for support of the concrete; however, the gravel should not exceed six inches in thickness.

Expansion joints should be provided to allow for minor vertical movement of the flatwork. Exterior flatwork should be constructed independent of perimeter building foundations by the placement of a layer of felt material between the flatwork and the foundation. Consideration should be given to thickening the outer edges of sidewalks to at least twice the slab thickness.

The architect or project civil engineer should determine the final thickness, strength, reinforcement, and joint spacing of exterior slab-on-grade concrete; however, we offer the following suggested minimum guidelines. Reinforcement should consist of steel reinforcing bars, placed mid-depth of the slab. Edges thickened to at least twice the slab thickness may be constructed along the perimeter of exterior slabs where intermittent light loading is expected over the slabs. Slabs receiving wheeled traffic should be designed as pavements and be appropriately thickened and reinforced. For increased support and performance, the exterior slabs may be underlain by a minimum four inches of Class 2 aggregate compacted to 95 percent relative compaction.

Proper and thorough moisture conditioning of subgrade soils is important to reduce the risk of non-uniform moisture withdrawal from the concrete and the possibility of plastic shrinkage cracks. Practices recommended by the Portland Cement Association (PCA) and the American Concrete Institute (ACI) for proper placement and curing of concrete, as well as for joint spacing and construction, should be followed during exterior concrete slab construction.

SITE DRAINAGE

Site drainage should be accomplished to provide positive drainage of surface water away from the buildings and prevent ponding of water adjacent to structures. The grade adjacent to the structures should be sloped away from foundations at a minimum two percent. Proper control of surface water drainage is essential to the performance of foundations and pavements. We recommend using full-roof gutters, with downspouts from roof drains connected to rigid non-perforated piping directed to an appropriate drainage point away from the structures, or discharging onto paved surfaces leading away from the structures and foundations. Concentrated storm water discharge collected from roof downspouts or surface drains should not be allowed to drain on unprotected slopes adjacent to structures. Finished grades should be graded to drain positively away from all pavement and building structures. Ponding of surface water should be avoided near foundations and pavements.

Landscape berms, if planned, should be constructed in such a manner as to promote drainage away from the buildings. All excavations should be protected from concentrated storm water run-off to minimize potential erosion. Ponding of surface water or allowing sheet flow of water over any open excavation must be avoided.

PAVEMENT DESIGN RECOMMENDATIONS

Based on the anticipated traffic loads, we are providing pavement designs for Traffic Indices (TI's) of 4.5, 6.0 and 7.0. The following pavement sections presented in the table on the following page have been calculated based on an R-value of 30, the assumed TI's, and the procedures contained within Chapters 600 to 670 of the 6th Edition of the California Highway Design Manual. The project civil engineer should determine the appropriate traffic index based on anticipated traffic conditions. Additional pavement sections can be provided upon request.

ASPHALT CONCRETE PAVEMENT DESIGN ALTERNATIVES

Traffic Index (TI)	Traffic Condition	Untreated Pavement Subgrade R-value = 30	
		Asphalt Concrete (inches)	Class 2 Aggregate Base (inches)
4.5	Automobile Parking Only	2½	6
		3*	5
6.0	Driveways / Fire Lanes	2½	10
		3½*	8
7.0	Bus Lanes	3	12
		4*	10

* = Asphalt concrete thickness includes the Caltrans Safety Factor.

We emphasize that the performance of pavements is critically dependent upon adequate and uniform compaction of the subgrade soils, including utility trench backfill within the limits of the pavements.

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

The upper six inches of final pavement subgrades should be uniformly moisture conditioned to at least the optimum moisture content and compacted to at least 95 percent relative compaction. Pavement subgrades should be proof-rolled with a loaded water truck and must be stable under construction traffic prior to placement of aggregate base. All aggregate base (AB) should be compacted to at least 95 percent of the maximum dry density. The AB should be proof rolled with a loaded water truck. Any areas of observed instability should be stabilized and recompacted as necessary to achieve the compaction requirements above. Earthwork construction within the limits of the pavements should be performed in accordance with the recommendation contained within this report. Material quality and construction of the structural section should conform to the applicable provisions of the Caltrans Standard Specifications, latest editions.

In the summer heat, high axle loads coupled with shear stresses induced by sharply turning tire movements can lead to failure in asphalt concrete pavements. Therefore, we recommend that consideration be given to using a Portland cement concrete (PCC) section in areas subjected to concentrated heavy wheel loading, such as entry driveways, truck maneuvering areas, and in front of trash enclosures. At the time this report was prepared, the need for, and locations of, PCC pavements had not yet been determined. Therefore, when more information is available regarding uses, loading and potential subgrade conditions, we should review the information and provide specific thicknesses as applicable.

For preliminary purposes, it may be assumed that Portland cement concrete slabs in areas of entry driveways, truck maneuvering areas, and in front of trash enclosures should be at least 6 inches thick and be underlain by at least 6 inches of 95 percent compacted Class 2 aggregate base. Thicker slabs will be needed in areas of frequent bus traffic, in heavy duty areas, or areas subjected to high traffic frequencies by heavy trucks or equipment. In these areas, Portland cement concrete slabs with a minimum thickness of 7 inches and underlain by at least 6 inches of 95 percent compacted Class 2 aggregate base may be needed. These

sections are preliminary and subject to revision based on review of additional information regarding loadings and traffic frequencies.

We suggest the concrete slabs be constructed with thickened edges in accordance with American Concrete Institute (ACI) design standards. Reinforcing for crack control, if desired, should consist of No. 4 reinforcing bars placed on maximum 24-inch centers each way throughout the slab. Reinforcement must be located at mid-slab depth to be effective. Construction of Portland cement concrete pavements should be performed in accordance with applicable American Concrete Institute (ACI) or PCA standards. Portland cement concrete utilized in pavements should attain a compressive strength of at least 3500 psi at 28 days.

Pavement Drainage

Efficient drainage of all surface water to avoid infiltration and saturation of the supporting aggregate base and subgrade soils is important to pavement performance. Consideration should be given to using full-depth curbs between landscaped areas and pavements to serve as a cut off for water that could migrate into the pavement base materials or subgrade soils. Geotextile water barriers also could be used to prevent migration of water into pavement base materials, if extruded curbs are used. Proprietary geotextile moisture barriers and curb details should be reviewed and approved by our office prior to construction. Weep holes are recommended in parking lot drop inlets to allow accumulating water moving through the aggregate base to drain from beneath the pavements.

Earthwork construction within the limits of the pavements should be performed in accordance with the recommendation contained within this report.

EARTHWORK TESTING AND OBSERVATION

Site preparation should be accomplished in accordance with the recommendations of this report and the appended *Guide Earthwork Specifications*. Representatives of Mid Pacific Engineering, Inc. must be present during site preparation and all grading operations to observe and test the fills to verify compliance with our recommendations and the job specifications. In the event that MPE is not retained to provide geotechnical engineering observation and testing services during construction, the Geotechnical Engineer retained to provide this service should indicate in writing that they agree with the recommendations of this report, and prepare supplemental recommendations as necessary.

A final report by the "Geotechnical Engineer" should be prepared upon completion of the project indicating compliance with or deviations from this report and the project plans and specifications. Please be aware that the title Geotechnical Engineer is restricted in the State of California to a Civil Engineer authorized by the State of California to use the title "Geotechnical Engineer."

FUTURE SERVICES

We recommend that our firm be given the opportunity to review the final plans and specifications to verify that the intent of our recommendations has been implemented in those documents. Testing and approval of proposed import sources is an essential requirement to qualify the proposed soils for use as engineered fill for this project. This sampling and testing should be completed well in advance of the proposed start of construction.

LIMITATIONS

Our recommendations are based upon the information provided regarding the proposed construction, combined with our analysis of site conditions revealed by the field exploration and laboratory testing programs. We have used our best engineering judgment based upon the information provided and the data generated from our investigation. This report has been prepared in accordance with generally accepted standards of practice existing in northern California at the time of the report. No warranty, either express or implied, is provided.

If the proposed construction is modified or re-sited; or, if it is found during construction that subsurface conditions differ from those we encountered at the boring locations, we should be afforded the opportunity to review the new information or changed conditions to determine if our conclusions and recommendations must be modified. Mid Pacific Engineering, Inc., should be retained to review the final plans and specifications to verify that the intent of our recommendations has been implemented in those documents.

We emphasize that this report is applicable only to the proposed construction and the investigated site and should not be utilized for construction on any other site. The conclusions and recommendations of this report are considered valid for a period of two years. If design is not completed and construction has not started within two years of the date of this report, the report must be reviewed and updated, as necessary.

Mid Pacific Engineering, Inc.

Martin S. Osier, PE
Project Engineer

REGISTERED PROFESSIONAL ENGINEER
MARTIN S. OSIER
No. 89860
Exp. 6/30/19
CIVIL
STATE OF CALIFORNIA

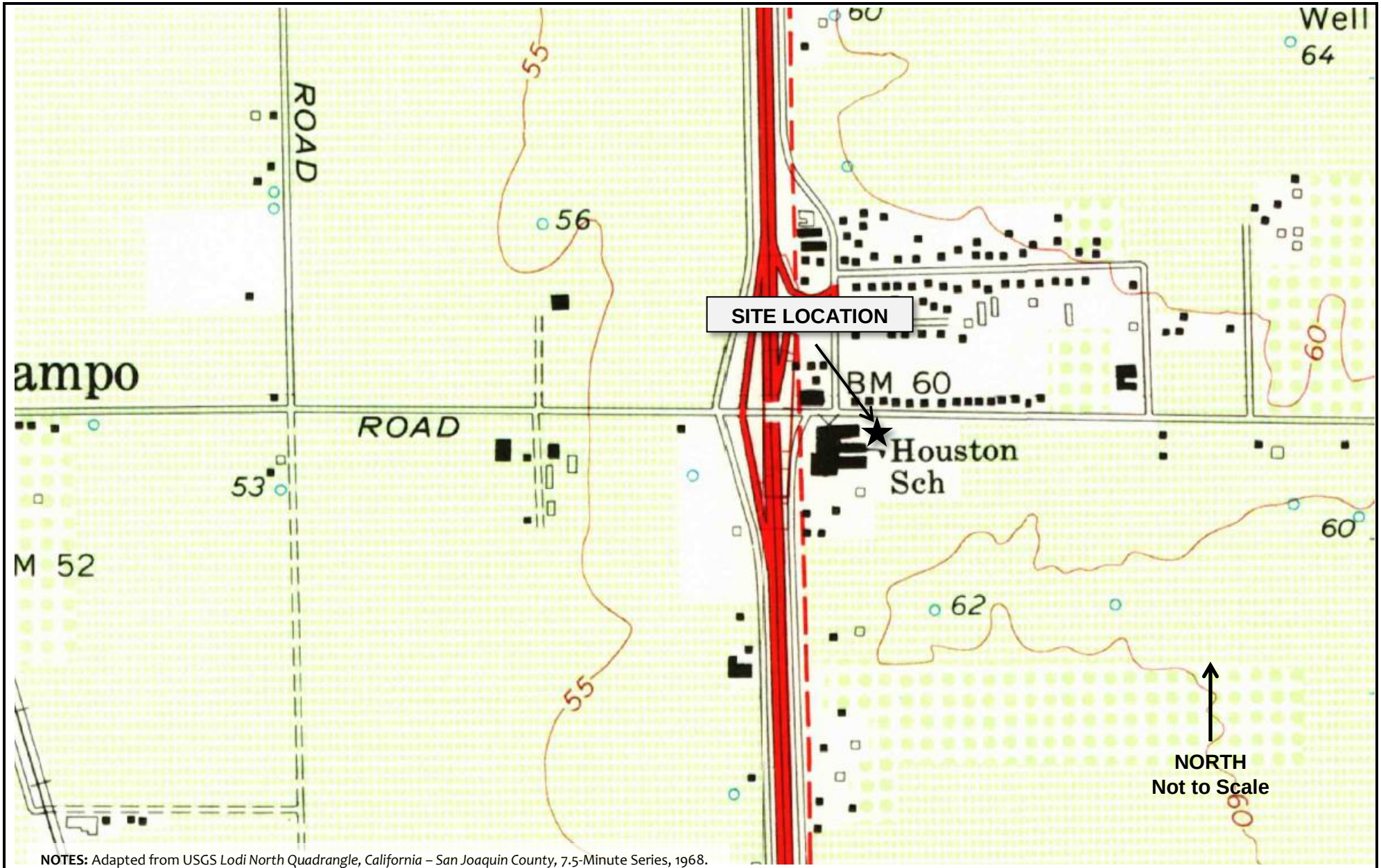
Daniel E. Kramer, CEG
Engineering Geologist

PROFESSIONAL GEOLOGIST
DANIEL E. KRAMER
No. 2588
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

Daniel C. Smith, GE
Principal Engineer

REGISTERED PROFESSIONAL ENGINEER
DANIEL C. SMITH
No. 2530
Exp. 6/30/19
GEOTECHNICAL
STATE OF CALIFORNIA

FIGURES



NOTES: Adapted from USGS *Lodi North Quadrangle, California – San Joaquin County*, 7.5-Minute Series, 1968.

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VICINITY MAP

LUSD HOUSTON – JOE SERNA SCHOOL

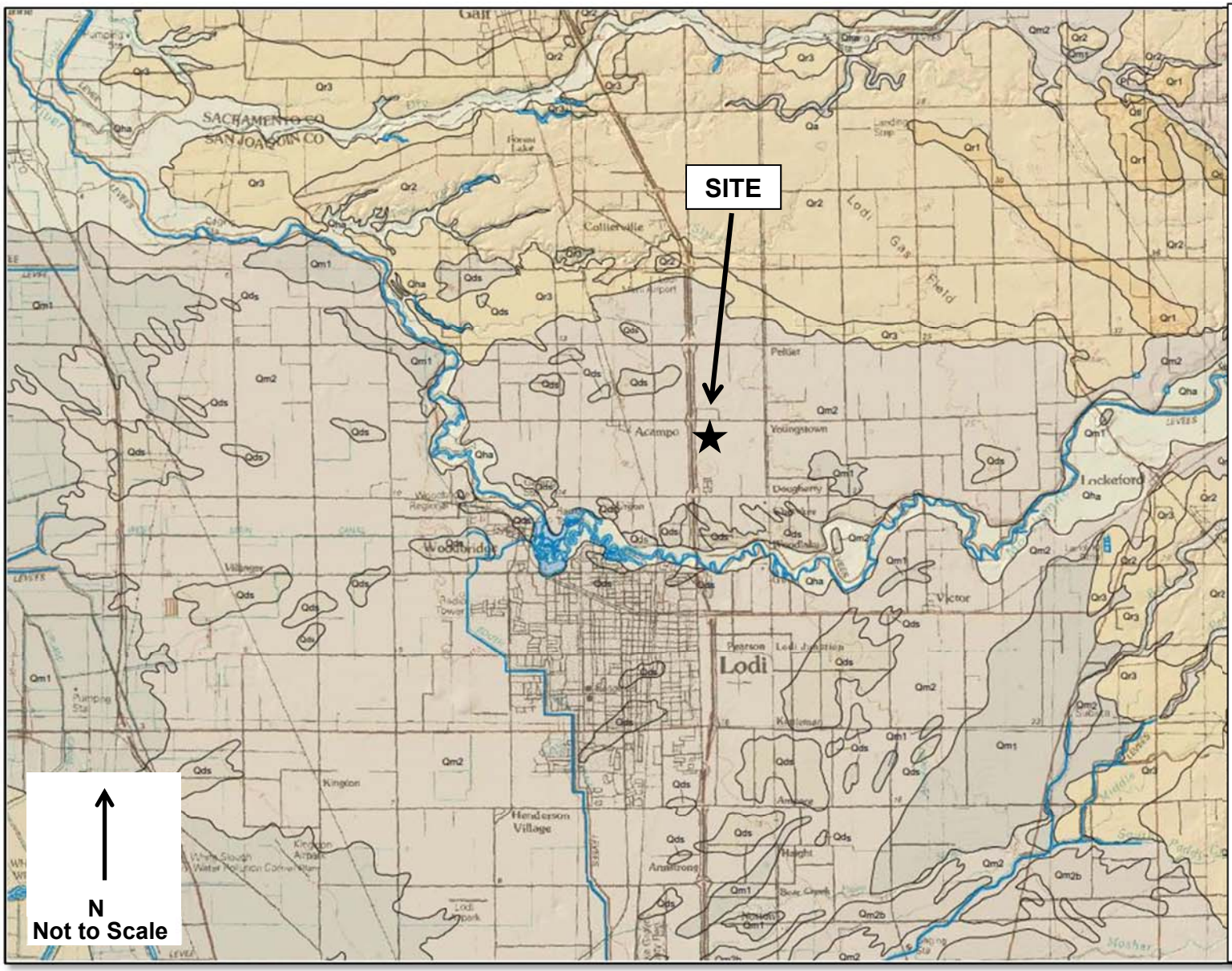
4600 E Acampo Road

Acampo, California

FIGURE 1

Date: 03/19

MPE No. 04401-01



EXPLANATION

Surficial Deposits

- af - Artificial fill
- Qhc - Stream channel deposits
- Qhbm - Estuarine deposits
- Qha - Holocene Alluvium, undivided
- Qa - Alluvium
- Qhf- Alluvial fan deposits
- Qls - Landslide deposits

Modesto Formation

- Qm - Undivided
- Qm2 - Upper member, undivided alluvium
- Qm2b – Upper member, fine-grained
- Qm1 – Lower member, undivided alluvium
- Qm1b - Lower member, fine-grained

Riverbank Formation

- Qr - Undivided
- Qr3 - Upper unit
- Qr2 - Middle unit
- Qr1 - Lower unit

GEOLOGIC MAP SYMBOLS

- Geologic contact
- Fault

Adapted from the *Preliminary Geologic Map of the Lodi 30 x 60 Minute Quadrangle, California* (Timothy E. Dawson, CGS, 2009).

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REGIONAL GEOLOGIC MAP

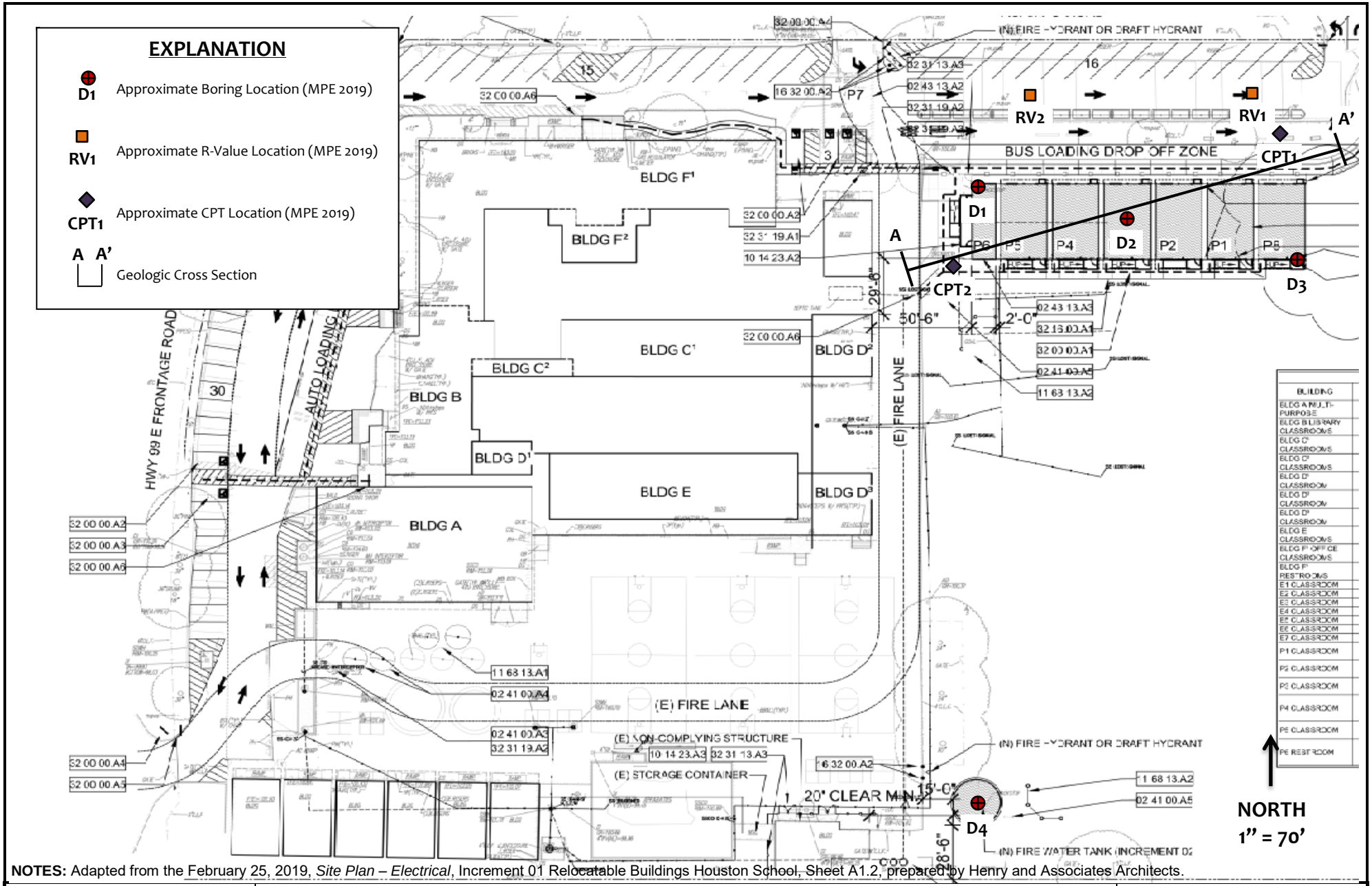
LUSD HOUSTON – JOE SERNA SCHOOL

4600 E Acampo Road
Acampo, California

FIGURE 2

Date: 03/19

MPE No. 04401-01



NOTES: Adapted from the February 25, 2019, *Site Plan – Electrical*, Increment 01 Relocatable Buildings Houston School, Sheet A1.2, prepared by Henry and Associates Architects.

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SITE PLAN

LUSD HOUSTON – JOE SERNA SCHOOL
4600 E Acampo Road
Acampo, California

FIGURE 3
Date: 03/19
MPE No. 04194-01

Project: LUSD Houston - Joe Serna School Site	LOG OF SOIL BORING D1
Project Location: 4600 Acampo Road, Acampo, CA	
MPE Number: 04401-01	Sheet 1 of 1

Date(s) Drilled: 3/15/2019	Logged By: MSO	Checked By: MSO
Drilling Method: Solid Flight Augers	Drilling Contractor: V&W Drilling	Total Depth of Drill Hole: 14 Feet
Drill Rig Type: CME-55	Diameter(s) of Hole, inches: 6 Inches	Approx. Surface Elevation, ft MSL: + 58
Groundwater Depth [Elevation], feet: Not Encountered	Sampling Method(s): 140 Lb Hammer/30" Drop	Drill Hole Backfill: Neat Cement
Remarks:		

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE NUMBER	BLOWS PER FOOT	TEST DATA: MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
			Brown, moist, loose, slightly clayey, silty fine sand (SM)						
					D1-1	9			
			wet, very loose		D1-2	4	15.5	110	
53	5								
			orange brown/brown, slightly moist, medium dense						
					D1-4	24	13.2	105	
48	10								
			no clay, dense		D1-5	50/6"			
43	15								
38	20								
33	25								

MPE *Mid Pacific Engineering, Inc .*

FIGURE 4

Project: LUSD Houston - Joe Serna School Site	LOG OF SOIL BORING D2
Project Location: 4600 Acampo Road, Acampo, CA	
MPE Number: 04194-01	Sheet 1 of 1

Date(s) Drilled: 3/15/2019	Logged By: MSO	Checked By: MSO
Drilling Method: Solid Flight Augers	Drilling Contractor: V&W Drilling	Total Depth of Drill Hole: 25 Feet
Drill Rig Type: CME-55	Diameter(s) of Hole, inches: 6 Inches	Approx. Surface Elevation, ft MSL: + 58
Groundwater Depth [Elevation], feet: Not Encountered	Sampling Method(s): 140 Lb Hammer/30" Drop	Drill Hole Backfill: Neat Cement
Remarks:		

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE NUMBER	BLOWS PER FOOT	TEST DATA: MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
			Brown, moist, very loose, slightly clayey, silty fine sand (SM)						
					D2-1	3	13.5	111	
			loose, increased silt content		D2-2	5			
53	5								
			wet		D2-3	7			
48	10		Brown/orange brown, very moist, fine sandy silt (ML) with some weakly cemented fragments						
			slightly moist, dense, very fine sandy silt		D2-4	50/6"			
43	15								
			Brown, moist, medium dense, poorly graded fine to medium sand with silt (SP-SM)		D2-5	35	12.2	106	%-200 5.4
38	20								
			Light brown, moist, medium dense, silty fine sand (SM)						
33	25				D2-6	27	13.0	111	

Project: LUSD Houston - Joe Serna School Site	LOG OF SOIL BORING D3
Project Location: 4600 Acampo Road, Acampo, CA	
MPE Number: 04401-01	Sheet 1 of 1

Date(s) Drilled	3/15/2019	Logged By	MSO	Checked By	MSO
Drilling Method	Solid Flight Augers	Drilling Contractor	V&W Drilling	Total Depth of Drill Hole	16.5 Feet
Drill Rig Type	CME-55	Diameter(s) of Hole, inches	6 Inches	Approx. Surface Elevation, ft MSL	+ 58
Groundwater Depth [Elevation], feet	Not Encountered	Sampling Method(s)	140 Lb Hammer/30" Drop	Drill Hole Backfill	Neat Cement
Remarks					

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA			TEST DATA		
				SAMPLE	SAMPLE NUMBER	BLOWS PER FOOT	MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
			Brown, moist, very loose, slightly clayey, silty fine sand (SM)		D3-1	2	13.9	111	Direct Shear Φ=39 C=600
53	5		loose		D3-2	5	16.8	110	
48	10		Brown, moist, medium dense, poorly graded fine to medium sand with silt (SP-SM)		D3-3	17			%-200 10.2
43	15		Brown, moist, medium dense, silty fine to medium sand (SM)		D3-4	35	10.8	111	
38	20								
33	25								

Project: LUSD Houston - Joe Serna School Site	LOG OF SOIL BORING D4
Project Location: 4600 Acampo Road, Acampo, CA	
MPE Number: 04401-01	Sheet 1 of 1

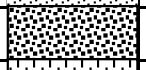
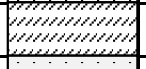
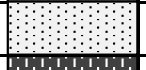
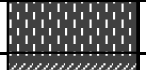
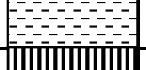
Date(s) Drilled: 3/15/2019	Logged By: MSO	Checked By: MSO
Drilling Method: Solid Flight Augers	Drilling Contractor: V&W Drilling	Total Depth of Drill Hole: 16.5 Feet
Drill Rig Type: CME-55	Diameter(s) of Hole, inches: 6 Inches	Approx. Surface Elevation, ft MSL: + 58
Groundwater Depth [Elevation], feet: Not Encountered	Sampling Method(s): 140 Lb Hammer/30" Drop	Drill Hole Backfill: Neat Cement
Remarks:		

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: SAMPLE NUMBER	SAMPLE DATA: BLOWS PER FOOT	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
			Dark brown, moist, very loose, slightly clayey, silty fine sand (SM)						
					D4-1	4	11.2	113	
53	5		loose		D4-2	6			
48	10		light brown/orange brown, medium dense		D4-3	17	10.9	114	
43	15		dense		D4-4	57			
38	20								
33	25								

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FIGURE 7

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS		SYMBOL	CODE	TYPICAL NAMES
COARSE GRAINED SOILS (More than 50% of soil > no. 200 sieve size)	GRAVELS (More than 50% of coarse fraction > no. 4 sieve size)	GW		Well graded gravels or gravel - sand mixtures, little or no fines
		GP		Poorly graded gravels or gravel - sand mixtures, little or no fines
		GM		Silty gravels, gravel - sand - silt mixtures
		GC		Clayey gravels, gravel - sand - silt mixtures
	SANDS (50% or more of coarse fraction < no. 4 sieve size)	SW		Well graded sands or gravelly sands, little or no fines
		SP		Poorly graded sands or gravelly sands, little or no fines
		SM		Silty sands, sand - silt mixtures
		SC		Clayey sands, sand clay mixtures
FINE GRAINED SOILS (More than 50% of soil < no. 200 sieve size)	SILTS & CLAYS LL< 50	ML		Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity
		CL		Inorganic clays of low to medium plasticity, gravely clays, sandy clays, silty clays, lean clays
		OL		Organic silts and organic silty clays of low plasticity
	SILTS & CLAYS LL ≥ 50	MH		Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
		CH		Inorganic clays of high plasticity, fat clays
		OH		Organic clays of medium to high plasticity, organic silty clays, organic silts
HIGHLY ORGANIC SOILS		Pt		Peat and other highly organic soils
ROCK		RX		Rocks, weathered to fresh
FILL		FILL		Artificially placed fill material

OTHER SYMBOLS

 = Drive Sample: 2-1/2" O.D. Modified California sampler

 = Hand Driven Sample

 =SPT Sampler

 = Initial Water Level

 = Final Water Level

 = Estimated or gradational material change line

 = Observed material change line

Laboratory Tests

PI = Plasticity Index
EI =Expansive Index
UCC = Unconfined Compression Test
TR = Triaxial Compression Test
GR = Gradation Analysis (Sieve)
K = Permeability Test

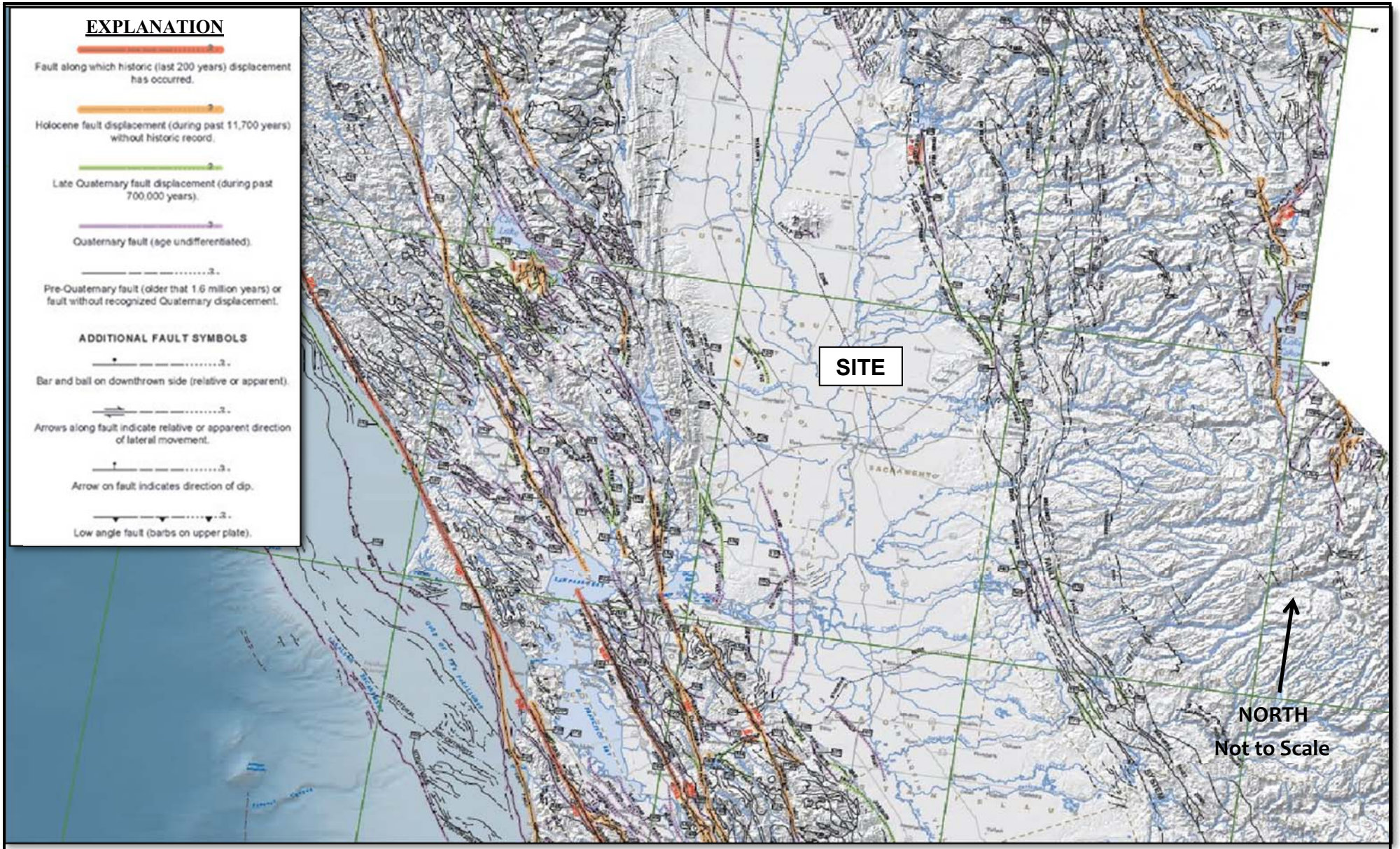
GRAIN SIZE CLASSIFICATION

CLASSIFICATION	RANGE OF GRAIN SIZES	
	U.S. Standard Sieve Size	Grain Size in Millimeters
BOULDERS	Above 12"	Above 305
COBBLES	12" to 3"	305 to 76.2
GRAVEL coarse (c) fine (f)	3" to No. 4 3" to 3/4" 3/4" to No. 4	76.2 to 4.76 76.2 to 19.1 19.1 to 4.76
SAND coarse (c) Medium (m) fine (f)	No. 4 to No. 200 No. 4 to No. 10 No. 10 to No. 40 No. 40 to No. 200	4.76 to 0.074 4.76 to 2.00 2.00 to 0.420 0.420 to 0.074
SILT & CLAY	Below No. 200	Below 0.074

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UNIFIED SOIL CLASSIFICATION SYSTEM
LUSD HOUSTON - JOE SERNA SCHOOL
4600 E Acampo Road
Acampo, California

FIGURE 8
Date: 03/19
MPE No. 04401-01



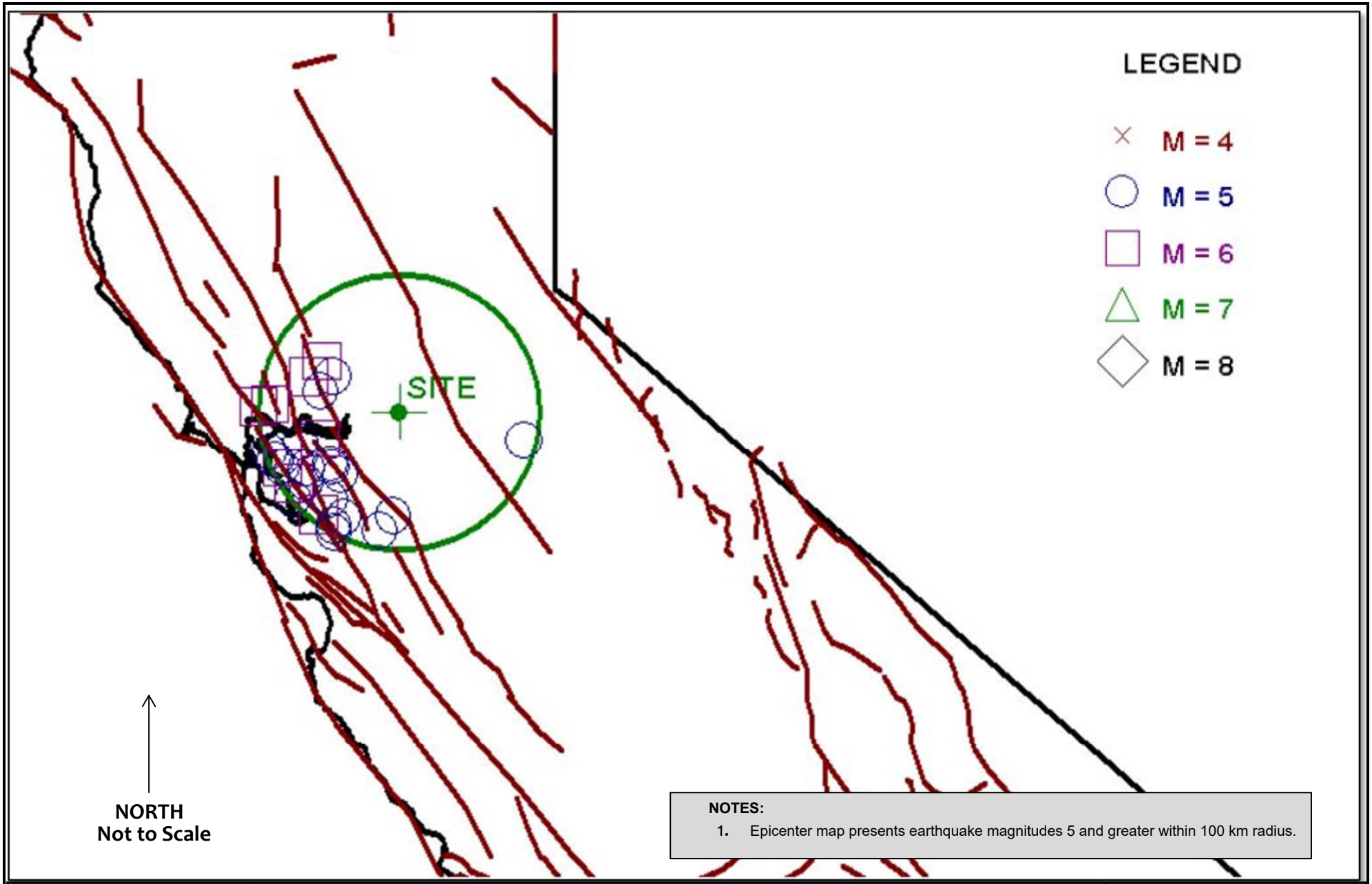
Adapted from: *Fault Activity Map of California 2010.* California Geological Survey, Geologic Data Map No. 6. Compilation and Interpretation by C.W. Jennings and W.A. Bryant

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REGIONAL FAULT MAP

LUSD HOUSTON – JOE SERNA SCHOOL
4600 E Acampo Road
Acampo, California

FIGURE 9
Date: 03/19
MPE No. 04401-01



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EARTHQUAKE EPICENTER MAP

LUSD HOUSTON – JOE SERNA SCHOOL
4600 E Acampo Road
Acampo, California

FIGURE 10
Date: 03/19
MPE No. 04401-01



Flood Hazard Area

0.2% Annual Chance Flood Hazard

N

Not to Scale

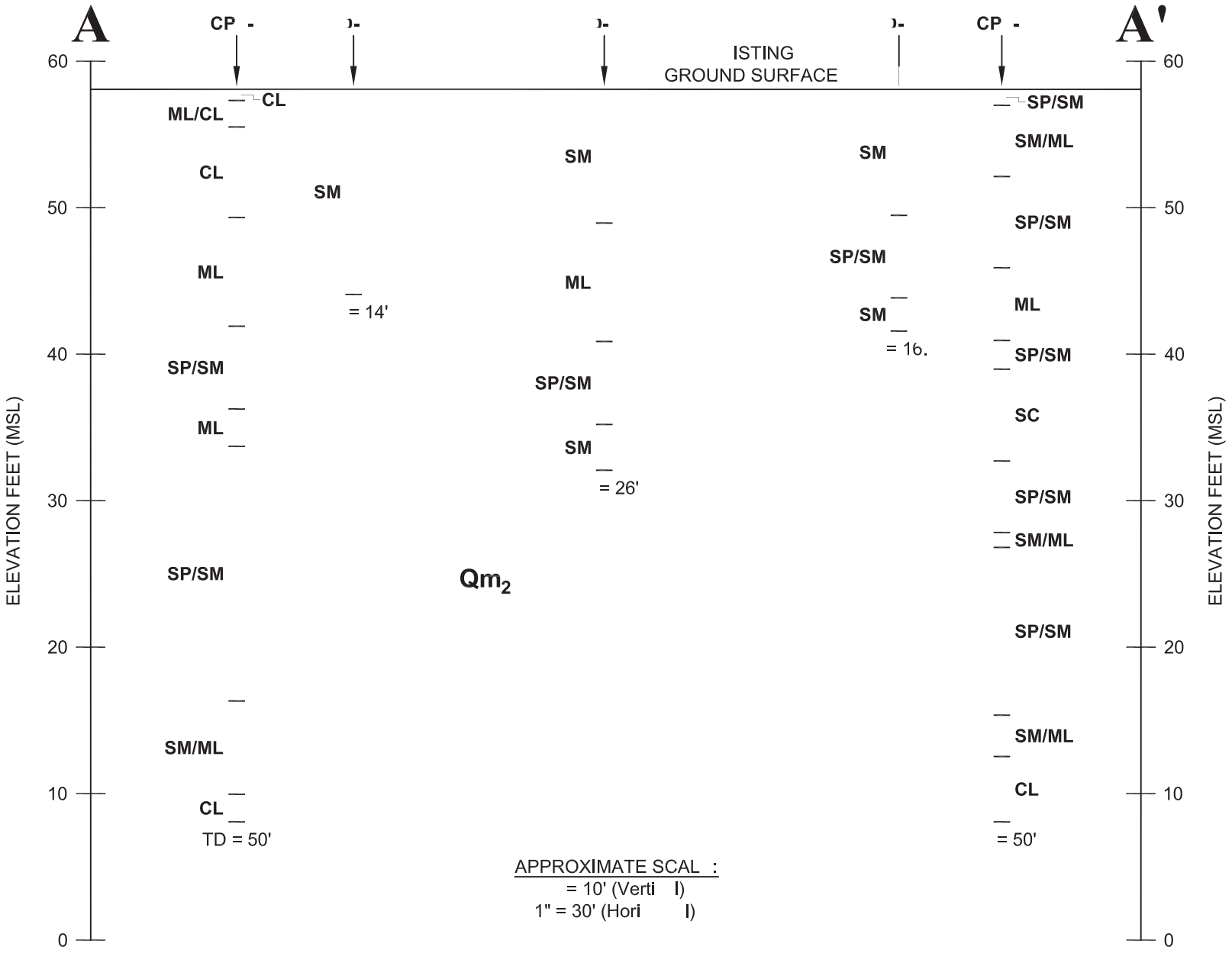
Adapted from: Federal Emergency Management Agency (FEMA), Flood Insurance Rate Map (FIRM), Map Number 06077C0170F, dated October 16, 2009

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FEMA FLOOD MAP

LUSD HOUSTON – JOE SERNA SCHOOL
4600 E Acampo Road
Acampo, California

FIGURE 11
Date: 03/19
MPE No. 04401-01



GEOLOGIC CROSS SECTION / -
\ - \A SCHOOL
4600 E Acampo Road
Acampo, Cali i

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FIGURE 12

Date: /19

MPE N -

APPENDICES

APPENDIX A

APPENDIX A

A. GENERAL INFORMATION

The performance of a Geologic Hazards and Geotechnical Engineering Investigation for the proposed improvements at the existing Houston Middle School campus located at 4600 Acampo Road in Acampo, California, was authorized by the Vickie Brum with the Lodi Unified School District. Authorization was for an investigation as described in our proposal letter of March 7, 2019, sent to our client, Lodi Unified School District (c/o Petralogix Engineering, Inc.), whose mailing address is 26675 Bruella Road, Galt, California 95687; telephone (209) 331-7223.

The project Architect is Henry and Associates Architects, whose mailing address 730 Howe Avenue, Suite 450, Sacramento, California 95825; telephone (916) 921-2122

In performing this investigation, we made reference to the *Increment 01 – Relocatable Buildings Houston School*, dated February 25, 2019.

B. FIELD EXPLORATION

A total of four soil borings were drilled at the approximate locations indicated on Figure 3.

The drilled soil borings utilized a CME-55 truck-mounted drill rig equipped with eight-inch diameter, hollow-stem helical flight augers. The borings were drilled to maximum depths of approximately 14 to 25 feet below existing site grades.

In addition, two Cone Penetration Test (CPT) soundings were performed at the approximate locations indicated on Figure 3, utilizing a 25-ton truck-mounted CPT rig to a maximum depth of approximately 50 feet below existing site grades.

At various intervals, relatively undisturbed soil samples were recovered from the drilled soil borings with a 2½-inch O.D., 2-inch I.D. Modified California sampler (ASTM D3550) driven by an automatic 140-pound hammer freely falling 30 inches. The number of blows of the hammer required to drive the 18-inch long sampler each 6-inch interval was recorded with the sum of the blows required to drive the sampler the lower 12-inch interval being designated the penetration resistance or "blow count" for that particular drive.

The samples obtained with the modified California sampler were retained in 2-inch diameter by 6-inch long, thin-walled brass tubes contained within the sampler. Immediately after recovery, the field engineer visually classified the soil in the tubes and the ends of the tubes were sealed to preserve the natural moisture contents.

Disturbed bulk samples of the surface materials also were obtained at various locations and depths. Soil samples were taken to our laboratory for additional classification (ASTM D2488) and selection of samples for testing.

The Logs of Soil Borings, Figures 4 through 7, contain descriptions of the soils encountered in each boring. A Boring Legend explaining the Unified Soil Classification System and the symbols used on the logs is contained on Figure 8. The results of the CPT soundings are attached in Appendix D.

C. LABORATORY TESTING

Selected undisturbed samples of the soils were tested to determine dry unit weight (ASTM D2937), natural moisture content (ASTM D2216), direct shear testing (ASTM D3080) and percent passing the 200 sieve (ASTM D1140). The results of these tests are included on the boring logs at the depth each sample was obtained.

One bulk sample of the near-surface soils was subjected to Expansion Index testing (ASTM D4829). The results of this testing are presented on Figure A1.

One bulk sample of the anticipated pavement subgrade soils was subjected to Resistance ("R-") value testing, which were used in the pavement design, are presented on Figure A2.

One sample of the near-surface soils was subjected to Atterberg Limits testing (ASTM D4318) and tested for grain-size distribution (ASTM D422 and C136). The results of these tests are contained on Figures A3.

Three samples of near-surface soils were submitted to Sunland Analytical in Rancho Cordova, California, for corrosivity testing in accordance with No. 643 (Modified Small Cell), CT 532, CT 422, and CT 417. The analytical results are presented in the text of the report.

/

EXPANSION INDEX TEST RESULTS
(ASTM D4829)
(UBC 18-2)

Material Description: Brown, slightly clayey, silty fine sand (SM)
Location: D1 (0 to 2 feet)

Sample Number	Pre-Test Moisture (%)	Post-Test Moisture (%)	Dry Density (pcf)	Expansion Index
D1 (0-2')	7.7	13.1	116	2

CLASSIFICATION OF EXPANSIVE SOIL

EXPANSION INDEX	POTENTIAL EXPANSION
0 - 20	Very Low
21 - 50	Low
51 - 90	Medium
91 - 130	High
Above 130	Very High

MPE

EXPANSION INDEX TEST RESULTS
LUSD HOUSTON – JOE SERNA SCHOOL
4600 E Acampo Road
Acampo, California

FIGURE A1
Date: 03/19
MPE No. 04401-01

RESISTANCE VALUE TEST RESULTS
(California Test 301)

Material Description: Brown, slightly clayey, silty sand (SM)

Location: RV2 (0 to 3 feet)

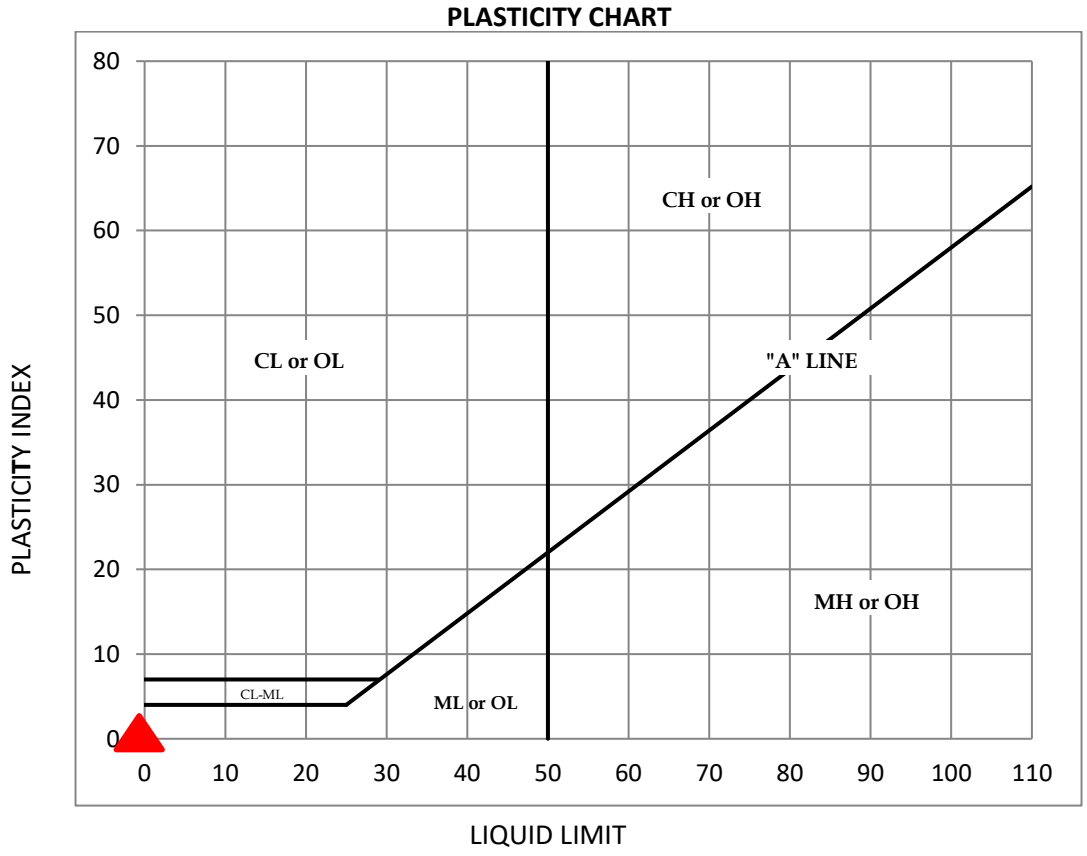
Specimen No.	Dry Unit Weight (pcf)	Moisture at Compaction (%)	Exudation Pressure (psi)	Expansion Pressure (psf)	R-Value
1	123.7	10.8	100	0	19
2	128.2	8.7	263	0	53
3	129.8	7.1	783	17	79

R-value at 300 psi exudation pressure = 56

MPE	**RESISTANCE VALUE TEST RESULTS** **LUSD HOUSTON – JOE SERNA SCHOOL** 4600 E Acampo Road Acampo, California	**FIGURE A2** Date: 03/19 MPE No. 04401-01

ATTERBERG LIMITS & #200 WASH
(ASTM D4318 & D1140)

Symbol	Sample & Depth (ft)	Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Percent Passing #200 Sieve
▲	D3 (0–2')	-	-	NP	44.7



MPE	**ATTERBERG LIMITS & #200 WASH TEST RESULTS** **LUSD HOUSTON – JOE SERNA SCHOOL** 4600 E Acampo Road Acampo, California	**FIGURE A3** Date: 03/19 MPE No. 04401-01

APPENDIX B

APPENDIX B

GUIDE EARTHWORK SPECIFICATIONS

LUSD HOUSTON – JOE SERNA SCHOOL IMPROVEMENTS

4600 East Acampo Road

Acampo, California

MPE No. 04401-01

PART 1: GENERAL

1.1 SCOPE

A. General Description

This item shall include clearing of all surface and subsurface structures associated with previous development of the site, existing structures, septic systems, leach lines, concrete slabs, foundations, asphalt concrete, undocumented fills, utilities to be relocated or abandoned including all associated backfill, fences, trees, demolition debris, rubbish, rubble, rubbish and associated items; preparation of surfaces to be filled, filling, spreading, compaction, observation and testing of the fill; and all subsidiary work necessary to complete the grading of the building areas to conform with the lines, grades and slopes as shown on the accepted Drawings.

B. Related Work Specified Elsewhere

1. Trenching and backfilling for sanitary sewer system: Section _____.
2. Trenching and backfilling for storm drain system: Section _____.
3. Trenching and backfilling for underground water, natural gas, and electric supplies: Section _____.

C. Geotechnical Engineer

Where specific reference is made to "Geotechnical Engineer" this designation shall be understood to include either him or his representative.

1.2 PROTECTION

A. Adequate protection measures shall be provided to protect workers and passers-by at the site. Streets and adjacent property shall be fully protected throughout the operations.

B. In accordance with generally accepted construction practices, the Contractor shall be solely and completely responsible for working conditions at the job site, including safety of all persons and property during performance of the work. This requirement shall apply continuously and shall not be limited to normal working hours.

C. Any construction review of the Contractor's performance conducted by the Geotechnical Engineer is not intended to include review of the adequacy of the Contractor's safety measures, in, on or near the construction site.

D. Adjacent streets and sidewalks shall be kept free of mud, dirt or similar nuisances resulting from earthwork operations.

E. Surface drainage provisions shall be made during the period of construction in a manner to avoid creating a nuisance to adjacent areas.

F. The site and adjacent influenced areas shall be watered as required to suppress dust nuisance.

1.3 GEOTECHNICAL REPORT

A. A Geologic Hazards and Geotechnical Engineering Report (MPE No. 04401-01; dated March 29, 2019) has been prepared for this site by Mid Pacific Engineering, Inc., Geotechnical Engineers. A copy is available for review at the office of Mid Pacific Engineering, Inc., 840 Embarcadero Drive, Suite 20, West Sacramento, California 95605.

B. The information contained in this report was obtained for design purposes only. The Contractor is responsible for any conclusions he/she may draw from this report; should the Contractor prefer not to assume such risk, he/she should employ their own experts to analyze available information and/or to make additional borings upon which to base their conclusions, all at no cost to the Owner.

1.4 EXISTING SITE CONDITIONS

The Contractor shall be acquainted with all site conditions. If unshown active utilities are encountered during the work, the Architect shall be promptly notified for instructions. Failure to notify will make the Contractor liable for damage to these utilities arising from Contractor's operations subsequent to the discovery of such unshown utilities.

1.5 SEASONAL LIMITS

Fill material shall not be placed, spread or rolled during unfavorable weather conditions. When the work is interrupted by heavy rains, fill operations shall not be resumed until field tests indicate that the moisture contents of the subgrade and fill materials are satisfactory.

PART 2: PRODUCTS

2.1 MATERIALS

A. All fill shall be of approved local materials from required excavations, supplemented by imported fill, if necessary. Approved local materials are defined as local soils with a maximum particle size of approximately three inches (3"); free from significant quantities of rubble, rubbish and vegetation; and, having been tested and approved by the Geotechnical Engineer prior to use.

B. Imported fill materials shall be approved by the Geotechnical Engineer; they shall meet the above requirements; shall have plasticity indices not exceeding

fifteen (15), when tested in accordance with ASTM D4318; shall have a maximum Expansion Index not exceeding twenty (20) when tested in accordance with ASTM D4829; and, shall be of three-inch (3") maximum particle size. Import fill shall be clean of contamination with appropriate documentation. All imported materials shall be approved by the Geotechnical Engineer prior to being transported to the site.

C. Asphalt concrete, aggregate base, aggregate subbase, and other paving products shall comply with the appropriate provisions of the *State of California (Caltrans) Standard Specifications* Standards, latest editions.

PART 3: EXECUTION

3.1 LAYOUT AND PREPARATION

Lay out all work, establish grades, locate existing underground utilities, set markers and stakes, set up and maintain barricades and protection of utilities-all prior to beginning actual earthwork operations.

3.2 CLEARING, GRUBBING AND PREPARING BUILDING PADS AND PAVEMENT AREAS

A. The site shall be cleared of existing structures designated for removal including but not limited to, existing structures, septic systems, leach lines, concrete slabs, foundations, asphalt concrete, undocumented fills, utilities to be relocated or abandoned including all associated backfill, fences, trees, demolition debris, rubbish, rubble and other unsuitable materials. Subsurface utilities to be relocated or abandoned shall be removed from within and to at least five feet beyond the perimeter of the proposed structural areas; remaining piping beyond the structure that is not removed shall be plugged. Trees and shrubs designated to be removed shall include the entire rootball and all roots larger than one-half inch (½") in diameter. Excavations and depressions resulting from the removal of such items, as well as any existing excavations or loose soil deposits, as determined by the Geotechnical

Engineer, shall be cleaned out to firm, undisturbed soil and backfilled with suitable materials in accordance with these specifications.

B. The upper twelve inches (12") of soil subgrades within areas of removed concrete slabs, flatwork, pavements, and trees shall be ripped and cross-ripped to expose any remaining remnants, roots, rubble and debris. All exposed rubble, roots, rubble and debris shall be removed from the subgrades. Hand picking of exposed roots, rubble and debris shall be performed by the Contractor to adequately clear the grades.

C. Over-excavation of the modular structures shall be performed as recommended in the Geotechnical Engineering Report.

D. The surfaces upon which fill is to be placed, as well as at-grade areas or areas achieved by excavation, shall be plowed or scarified to a depth of at least twelve inches (12") until the surface is free from ruts, hummocks or other uneven features which would tend to prevent uniform compaction by the selected equipment.

E. When the moisture content of the subgrade is below that required to achieve the specified density, and that minimum content recommended in the geotechnical report, water shall be added until the proper moisture content is achieved.

F. When the moisture content of the subgrade is too high to permit the specified compaction to be achieved, the subgrade shall be aerated by blading or other methods until the moisture content is satisfactory for compaction.

G. After the foundations for fill have been cleared, plowed or scarified, they shall be disced or bladed until uniform and free from large clods, brought to the proper moisture content and compacted to not less than ninety percent (95%) for the building pad and tank excavations, and not less than ninety percent (90%) for other structural areas, of the maximum dry density as determined by the ASTM D1557-91 Compaction Test. Soils compaction shall be performed

using a heavy, self-propelled sheepsfoot compactor (Caterpillar 815 compactor or an equivalent-size compactor). Compaction operations shall be performed in the presence of the Geotechnical Engineer who will evaluate the performance of the materials under compactive load. Unstable soil deposits, as determined by the Geotechnical Engineer, shall be excavated to expose a firm base and grades restored with engineered fill in accordance with these specifications.

3.3 PLACING, SPREADING AND COMPACTING FILL MATERIAL

A. Engineered fills shall be placed in layers which when compacted shall not exceed six inches (6") in thickness. Each layer shall be spread evenly and shall be thoroughly mixed during the spreading to promote uniformity of material in each layer.

B. When the moisture content of the fill material is below that required to achieve the specified density, and that minimum content recommended in the geotechnical report, water shall be added until the proper moisture content is achieved.

C. When the moisture content of the fill material is too high to permit the specified degree of compaction to be achieved, the fill material shall be aerated by blading or other methods until the moisture content is satisfactory.

D. After each layer has been placed, mixed and spread evenly, soils shall be thoroughly compacted to at least ninety percent (90%) of the ASTM D1557 maximum dry density. Soils compaction shall be performed using a heavy, self-propelled sheepsfoot compactor (Caterpillar 815 compactor or an equivalent-size compactor), to the satisfaction of our on-site representative. Each layer shall be compacted over its entire area until the desired density has been obtained. Each lift of engineered fill shall be benched into adjacent side slopes to remove loose soils and promote uniformity.

E. The filling operations shall be continued until the fills have been brought to the finished slopes and grades as shown on the accepted Drawings.

3.4 FINAL SUBGRADE PREPARATION

A. The upper twelve inches (12") of final soil subgrades supporting buildings, shall be brought to a uniform moisture content of at least above the optimum moisture content and shall be uniformly compacted to at least ninety percent (90%) relative compaction, regardless of whether final subgrade elevations are attained by filling, excavation, or are left at existing grades.

B. The upper six inches (6") of final soil subgrades supporting exterior flatwork, shall be brought to a uniform moisture content of at least above the optimum moisture content and shall be uniformly compacted to at least ninety percent (90%) relative compaction, regardless of whether final subgrade elevations are attained by filling, excavation, or are left at existing grades.

C. The upper six inches (6") of final subgrades supporting pavements and exterior slab subgrades supporting vehicle traffic shall be brought to a uniform moisture content of at least the optimum moisture content, and shall be uniformly compacted to at least ninety-five (95%) relative compaction, regardless of whether the final subgrade elevations are attained by filling, excavation, or are left at existing grades.

3.5 TRENCH BACKFILL

A. Utility trench backfill shall be placed in lifts of no more than six inches (6") in compacted thickness. Each lift shall be compacted to at least ninety percent (90%) compaction, at a moisture content of at least optimum moisture, as defined by ASTM D1557, except that the upper six inches of backfill within pavement areas shall be compacted in accordance with Section 3.4.C.

3.6 TESTING AND OBSERVATION

A. Grading operations shall be observed by the Geotechnical Engineer, serving as the representative of the Owner.

B. Field density tests shall be made by the Geotechnical Engineer after compaction of each layer of fill. Additional layers of fill shall not be spread until the field density tests indicate that the minimum specified density has been obtained.

C. Earthwork shall not be performed without the notification or approval of the Geotechnical Engineer. The Contractor shall notify the Geotechnical Engineer at least two (2) working days prior to commencement of any aspect of the site earthwork.

D. If the Contractor should fail to meet the technical or design requirements embodied in this document and on the applicable plans, the Contractor shall make the necessary readjustments until all work is deemed satisfactory, as determined by the Geotechnical Engineer and the Project Design Engineer. No deviation from the specifications shall be made except upon written approval of the Geotechnical Engineer or Project Design Engineer.

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APPENDIX C

EQ FAULT OUTPUT

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* *
* E Q F A U L T *
* *
* Version 3.00 *
* *
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DETERMINISTIC ESTIMATION OF
PEAK ACCELERATION FROM DIGITIZED FAULTS

JOB NUMBER: 04401-01

DATE: 03-11-2019

JOB NAME: LUSD Houston-Joe Serna School

CALCULATION NAME: NEHRP D

FAULT-DATA-FILE NAME: C:\Program Files\EQFAULT1\CGSFLTE.DAT

SITE COORDINATES:
   SITE LATITUDE: 38.1744
   SITE LONGITUDE: 121.2601

SEARCH RADIUS: 62 mi

ATTENUATION RELATION: 3) Boore et al. (1997) Horiz. - NEHRP D (250)
   UNCERTAINTY (M=Median, S=Sigma): M Number of Sigmas: 0.0
   DISTANCE MEASURE: cd_2drp
   SCOND: 0
   Basement Depth: 5.00 km Campbell SSR: Campbell SHR:
   COMPUTE PEAK HORIZONTAL ACCELERATION

FAULT-DATA FILE USED: C:\Program Files\EQFAULT1\CGSFLTE.DAT

MINIMUM DEPTH VALUE (km): 0.0

EQFAULT SUMMARY

DETERMINISTIC SITE PARAMETERS

Page 1

ABBREVIATED FAULT NAME	APPROXIMATE DISTANCE mi (km)	ESTIMATED MAX. EARTHQUAKE EVENT: MAXIMUM EARTHQUAKE MAG.(Mw)	ESTIMATED MAX. EARTHQUAKE EVENT: PEAK SITE ACCEL. g	ESTIMATED MAX. EARTHQUAKE EVENT: EST. SITE INTENSITY MOD.MERC.
FOOTHILLS FAULT SYSTEM 1	21.2(34.1)	6.5	0.139	VIII
GREAT VALLEY 5	27.3(43.9)	6.5	0.115	VII
FOOTHILLS FAULT SYSTEM 2	29.2(47.0)	6.5	0.109	VII
GREAT VALLEY 7	33.6(54.1)	6.7	0.109	VII
FOOTHILLS FAULT SYSTEM 3	33.9(54.5)	6.5	0.097	VII
GREAT VALLEY 4	35.4(56.9)	6.6	0.099	VII
MOUNT DIABLO (MTD)	37.0(59.5)	6.7	0.098	VII
GREENVILLE (GN)	37.0(59.6)	6.7	0.081	VII
GREENVILLE (FLOATING)	40.3(64.8)	6.2	0.060	VI
GREENVILLE (GS)	40.3(64.8)	6.6	0.074	VII
GREENVILLE (GS+GN)	40.3(64.8)	6.9	0.088	VII
CONCORD/GV (FLOATING)	43.9(70.7)	6.2	0.056	VI

CONCORD/GV (CON)	43.9(70.7)	6.3	0.057	VI
CONCORD/GV (CON+GVS)	43.9(70.7)	6.6	0.068	VI
CONCORD/GV (CON+GVS+GVN)	43.9(70.7)	6.7	0.073	VII
CONCORD/GV (GVS+GVN)	45.3(72.9)	6.5	0.063	VI
CONCORD/GV (GVS)	45.3(72.9)	6.2	0.056	VI
CALAVERAS (CS+CC+CN)	47.6(76.6)	6.9	0.077	VII
CALAVERAS (CC+CN)	47.6(76.6)	6.2	0.053	VI
CALAVERAS (FLOATING)	47.6(76.6)	6.2	0.052	VI
CALAVERAS (CN)	47.6(76.6)	6.8	0.071	VI
CONCORD/GV (GVN)	48.5(78.0)	6.0	0.047	VI
GREAT VALLEY 8	51.4(82.8)	6.6	0.074	VII
GREAT VALLEY 3	53.1(85.4)	6.9	0.085	VII
WEST NAPA	53.5(86.1)	6.5	0.056	VI
HUNTING CREEK - BERRYESSA	54.4(87.6)	7.1	0.076	VII
HAYWARD (FLOATING)	56.3(90.6)	6.9	0.067	VI
HAYWARD (HS+HN+RC)	56.3(90.6)	7.3	0.081	VII
HAYWARD (HS)	56.3(90.6)	6.7	0.059	VI
HAYWARD (HS+HN)	56.3(90.6)	6.9	0.067	VI
HAYWARD (HN+RC)	57.0(91.8)	7.1	0.074	VII
HAYWARD (HN)	57.0(91.8)	6.5	0.053	VI
CALAVERAS (CS+CC)	58.5(94.2)	6.4	0.049	VI
CALAVERAS (CC)	58.5(94.2)	6.2	0.045	VI
CALAVERAS (CS+CC FLOATING)	58.5(94.2)	6.2	0.045	VI

****

-END OF SEARCH- 35 FAULTS FOUND WITHIN THE SPECIFIED SEARCH RADIUS.

THE FOOTHILLS FAULT SYSTEM 1 FAULT IS CLOSEST TO THE SITE.
IT IS ABOUT 21.2 MILES (34.1 km) AWAY.

LARGEST MAXIMUM-EARTHQUAKE SITE ACCELERATION: 0.1393 g

EQ SEARCH OUTPUT

EQSEARCH - NEHRP D

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*                      *
*    E Q S E A R C H   *
*                      *
*     Version 3.00     *
*                      *
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ESTIMATION OF
PEAK ACCELERATION FROM
CALIFORNIA EARTHQUAKE CATALOGS

JOB NUMBER: 04401-01

DATE: 03-11-2019

JOB NAME: LUSD Houston - Joe Serna School

EARTHQUAKE-CATALOG-FILE NAME: ALLQUAKE.DAT

MAGNITUDE RANGE:
   MINIMUM MAGNITUDE: 5.00
   MAXIMUM MAGNITUDE: 9.00

SITE COORDINATES:
   SITE LATITUDE: 38.1744
   SITE LONGITUDE: 121.2601

SEARCH DATES:
           START DATE: 1800
           END DATE: 2018

SEARCH RADIUS:
           62.0 mi
           99.8 km

ATTENUATION RELATION: 3) Boore et al. (1997) Horiz. - NEHRP D (250)
   UNCERTAINTY (M=Median, S=Sigma): M   Number of Sigmas: 0.0
   ASSUMED SOURCE TYPE: BT [SS=Strike-slip, DS=Reverse-slip, BT=Blind-thrust]
   SCOND: 0 Depth Source: A
   Basement Depth: 5.00 km   Campbell SSR: Campbell SHR:
   COMPUTE PEAK HORIZONTAL ACCELERATION

MINIMUM DEPTH VALUE (km): 0.0

EARTHQUAKE SEARCH RESULTS

Page 1

FILE CODE	LAT. NORTH	LONG. WEST	DATE	TIME (UTC) H M Sec	DEPTH (km)	QUAKE MAG.	SITE ACC. g	SITE MM INT.	APPROX. DISTANCE mi [km]
DMG	38.4000	121.8000	04/30/1892	0 9 0.0	0.0	5.50	0.058	VI	33.1(53.3)
DMG	38.3000	121.9000	05/19/1902	1831 0.0	0.0	5.50	0.055	VI	35.8(57.6)
DMG	38.0000	121.9000	05/19/1889	1110 0.0	0.0	6.00	0.070	VI	36.8(59.2)
BRK	37.8300	121.8100	01/24/1980	19 0 9.0	0.0	5.80	0.061	VI	38.2(61.5)
BRK	37.8100	121.7900	01/24/1980	19 1 2.0	0.0	5.10	0.042	VI	38.3(61.6)
BRK	37.7600	121.7300	01/27/1980	23336.0	0.0	5.40	0.049	VI	38.4(61.8)
DMG	38.5000	121.9000	04/21/1892	1743 0.0	0.0	6.20	0.071	VI	41.3(66.5)
DMG	38.4000	122.0000	04/19/1892	1050 0.0	0.0	6.40	0.077	VII	43.0(69.2)
DMG	37.9700	122.0500	10/24/1955	41044.0	0.0	5.40	0.044	VI	45.2(72.7)
DMG	37.5000	121.3000	07/15/1866	630 0.0	0.0	5.80	0.053	VI	46.6(75.0)
DMG	37.8000	122.0000	07/04/1861	011 0.0	0.0	5.60	0.046	VI	47.8(77.0)
DMG	37.6000	121.8000	06/11/1903	1312 0.0	0.0	5.50	0.043	VI	49.4(79.5)
DMG	37.7000	122.0000	03/05/1864	1649 0.0	0.0	5.70	0.046	VI	51.9(83.6)

GSB	37.4830	121.6900	03/31/1986	115540.0	8.0	5.70	0.045	VI	53.2(85.6)
DMG	37.4000	121.4000	04/10/1881	10 0 0.0	0.0	5.90	0.049	VI	54.0(86.9)
T-A	38.0000	120.2500	04/11/1872	12 0 0.0	0.0	5.00	0.030	V	56.2(90.4)
DMG	37.7000	122.1000	10/21/1868	1553 0.0	0.0	6.80	0.077	VII	56.3(90.5)
GSB	38.2152	122.3123	08/24/2014	102044.1	11.1	6.02	0.050	VI	57.2(92.0)
DMG	37.8000	122.2000	06/10/1836	1530 0.0	0.0	6.80	0.076	VII	57.3(92.2)
DMG	37.8000	122.2000	07/31/1889	1247 0.0	0.0	5.20	0.033	V	57.3(92.2)
DMG	37.5000	121.9000	11/26/1858	835 0.0	0.0	6.10	0.052	VI	58.2(93.6)
GSB	37.4340	121.7740	10/31/2007	030454.8	10.0	5.50	0.038	V	58.3(93.8)
MGI	37.8500	122.2500	09/10/1935	2355 0.0	0.0	5.00	0.029	V	58.3(93.8)
DMG	37.9000	122.3000	04/02/1870	1948 0.0	0.0	5.30	0.033	V	59.6(96.0)
DMG	37.6000	122.1000	05/21/1864	2 1 0.0	0.0	5.30	0.033	V	60.6(97.5)
GSB	37.3850	121.7720	06/13/1988	014536.8	7.0	5.40	0.034	V	61.2(98.6)
DMG	38.2000	122.4000	03/31/1898	743 0.0	0.0	6.20	0.052	VI	61.9(99.6)

****
-END OF SEARCH- 27 EARTHQUAKES FOUND WITHIN THE SPECIFIED SEARCH AREA.

TIME PERIOD OF SEARCH: 1800 TO 2018

LENGTH OF SEARCH TIME: 219 years

THE EARTHQUAKE CLOSEST TO THE SITE IS ABOUT 33.1 MILES (53.3 km) AWAY.

LARGEST EARTHQUAKE MAGNITUDE FOUND IN THE SEARCH RADIUS: 6.8

LARGEST EARTHQUAKE SITE ACCELERATION FROM THIS SEARCH: 0.077 g

COEFFICIENTS FOR GUTENBERG & RICHTER RECURRENCE RELATION:
a-value= 0.183
b-value= 0.247
beta-value= 0.568

TABLE OF MAGNITUDES AND EXCEEDANCES:

Earthquake Magnitude	Number of Times Exceeded	Cumulative No. / Year
4.0	27	0.12329
4.5	27	0.12329
5.0	27	0.12329
5.5	18	0.08219
6.0	8	0.03653
6.5	2	0.00913

APPENDIX D

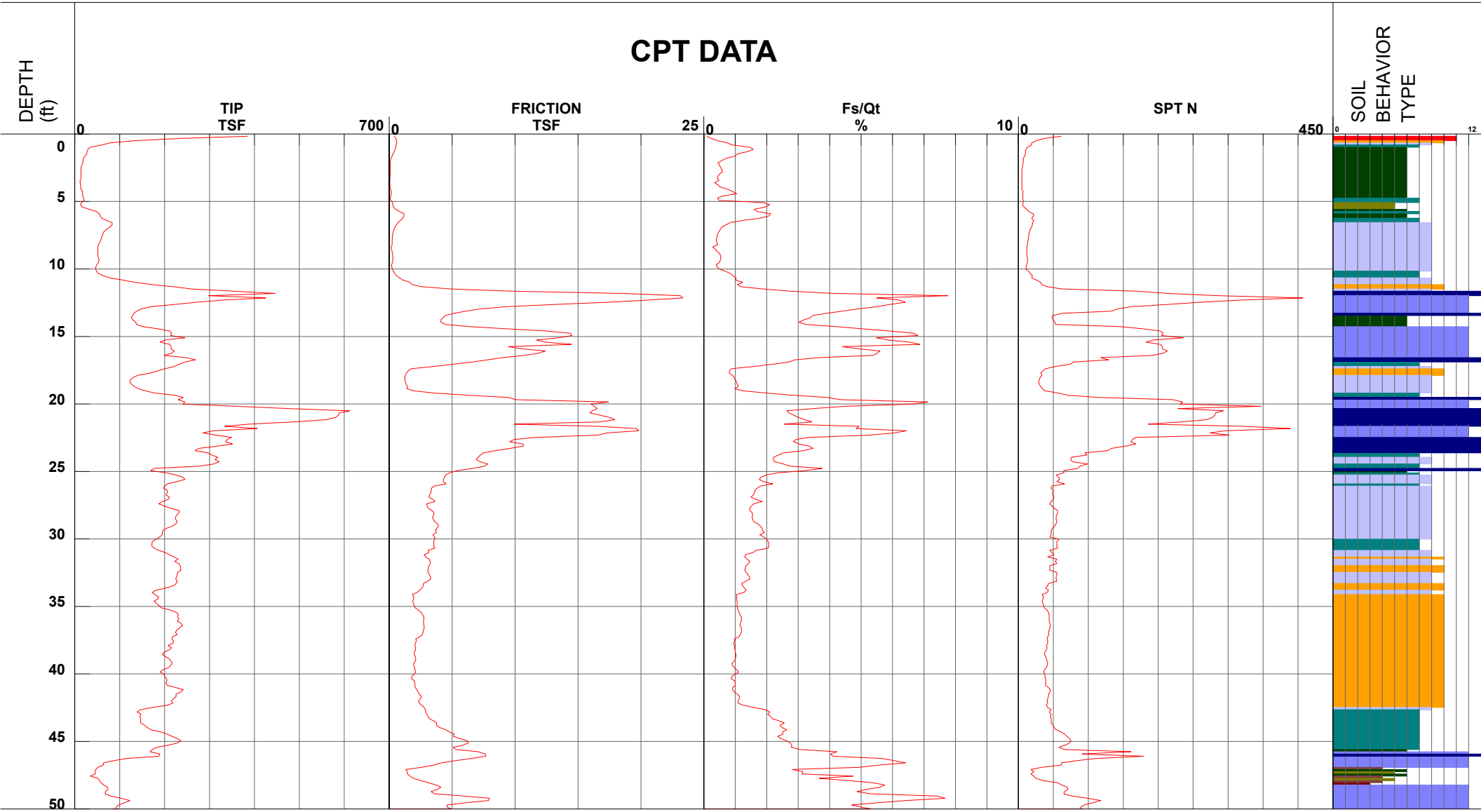
CONE PENETRATION TEST RESULTS

Mid Pacific Engineering

Project	LUSD Houston Joe Serna School Site GER-(	Operator	JM-BH	Filename	SDF(205).cpt
Job Number	04401-01	Cone Number	DDG1448	GPS	
Hole Number	CPT-01	Date and Time	3/26/2019 1:01:43 PM	Maximum Depth	50.69 ft
EST GW Depth During Test		23.00 ft			

Net Area Ratio .8

CPT DATA



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

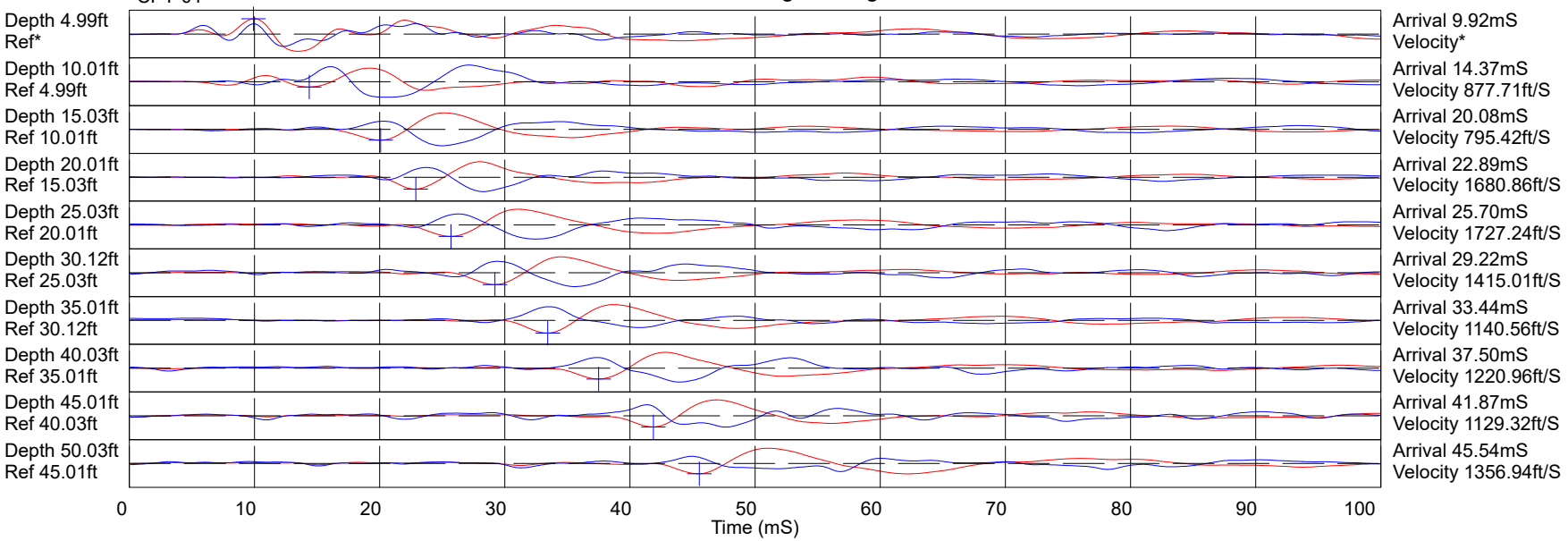
Cone Size 15cm squared

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

CPT-01

Mid Pacific Engineering

LUSD Houston Joe Serna School Site GER-GHZ



Hammer to Rod String Distance (ft): 5.83
* = Not Determined

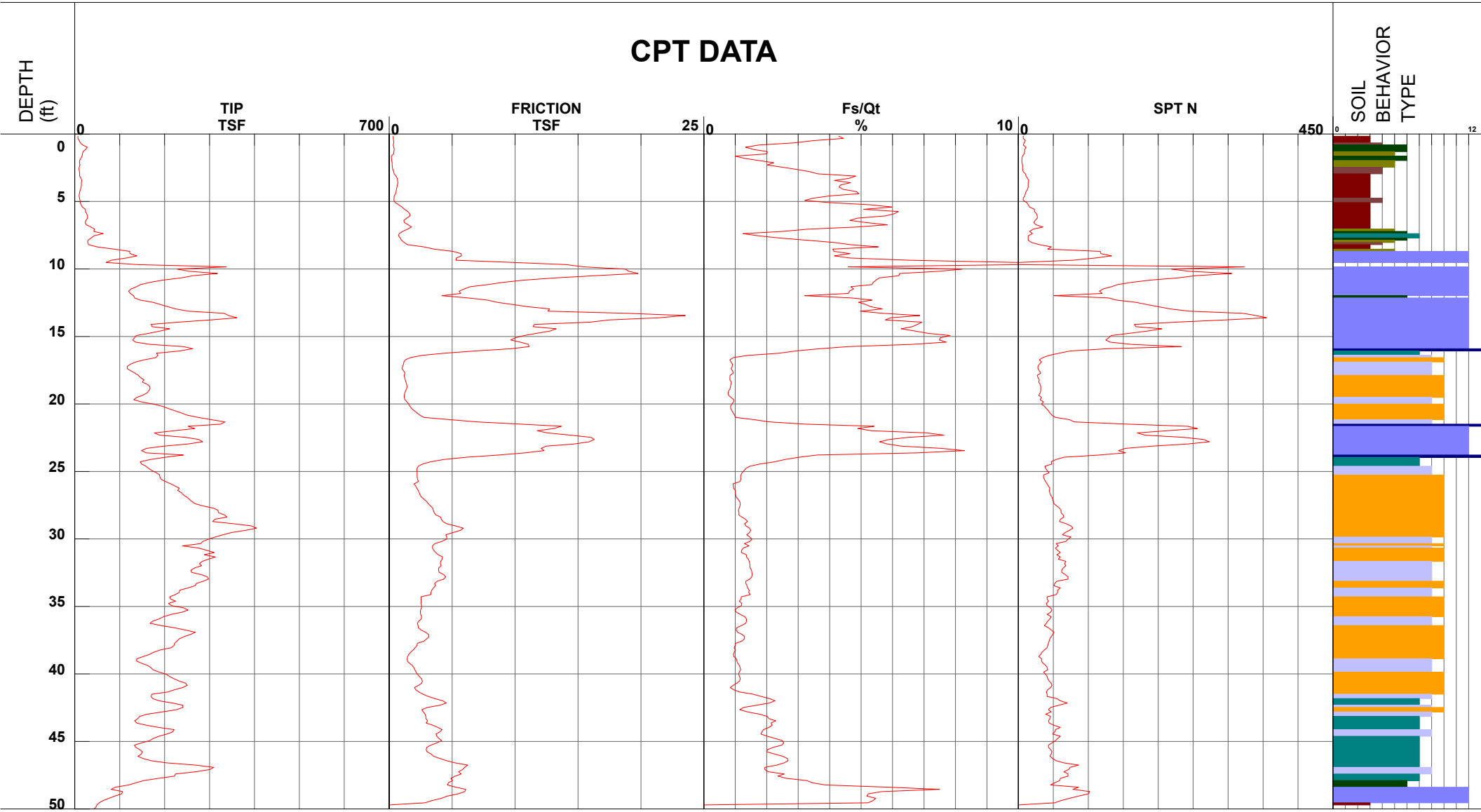
COMMENT:

Mid Pacific Engineering

Project	LUSD Houston Joe Serna School Site GER-(	Operator	JM-BH	Filename	SDF(208).cpt
Job Number	04401-01	Cone Number	DDG1448	GPS	
Hole Number	CPT-02B	Date and Time	3/26/2019 3:11:14 PM	Maximum Depth	50.03 ft
EST GW Depth During Test		23.00 ft			

Net Area Ratio .8

CPT DATA



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

Cone Size 15cm squared

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

CLiq OUTPUT

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CPT-01 results

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

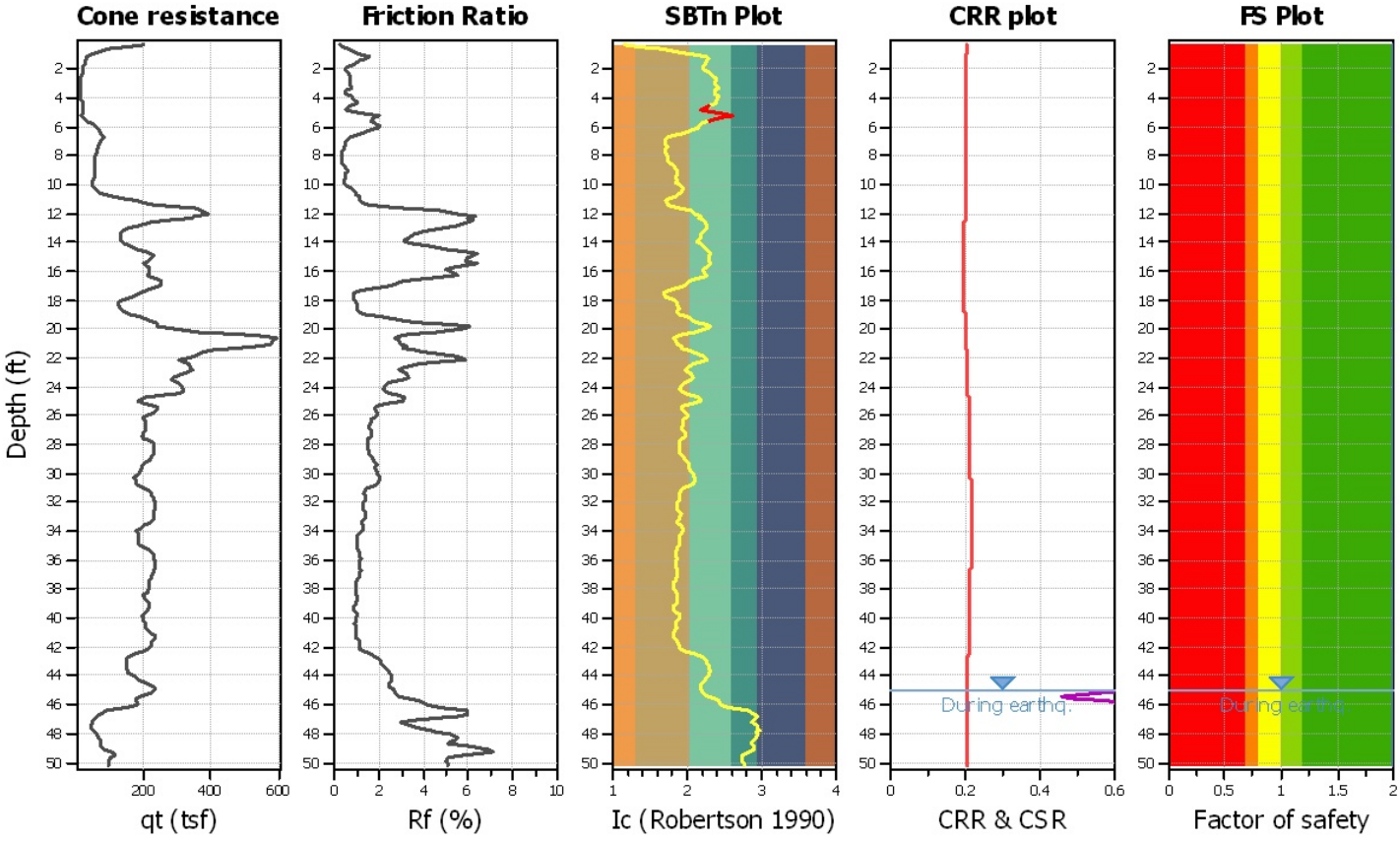
LIQUEFACTION ANALYSIS REPORT

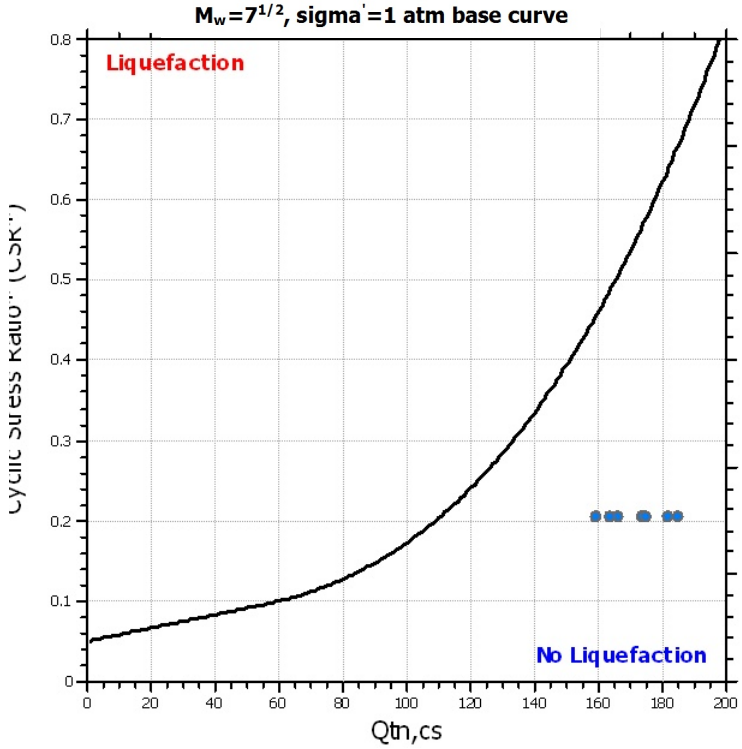
Project title : **Location :**

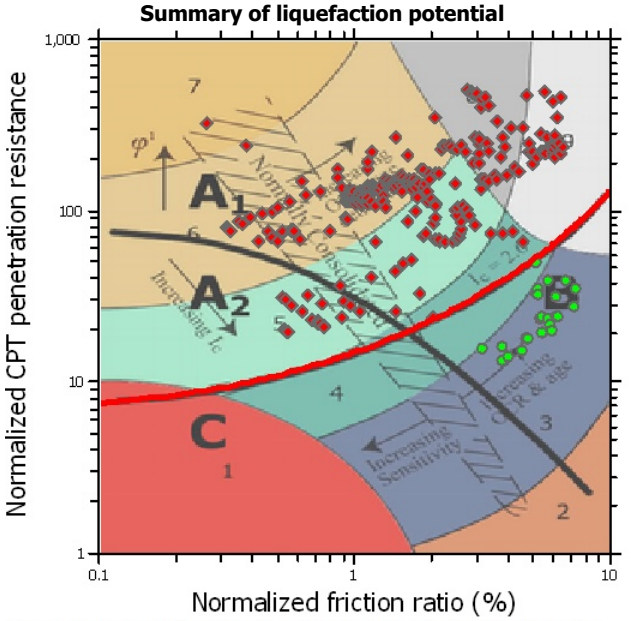
CPT file : CPT-01

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	45.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	45.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.70	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.32	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

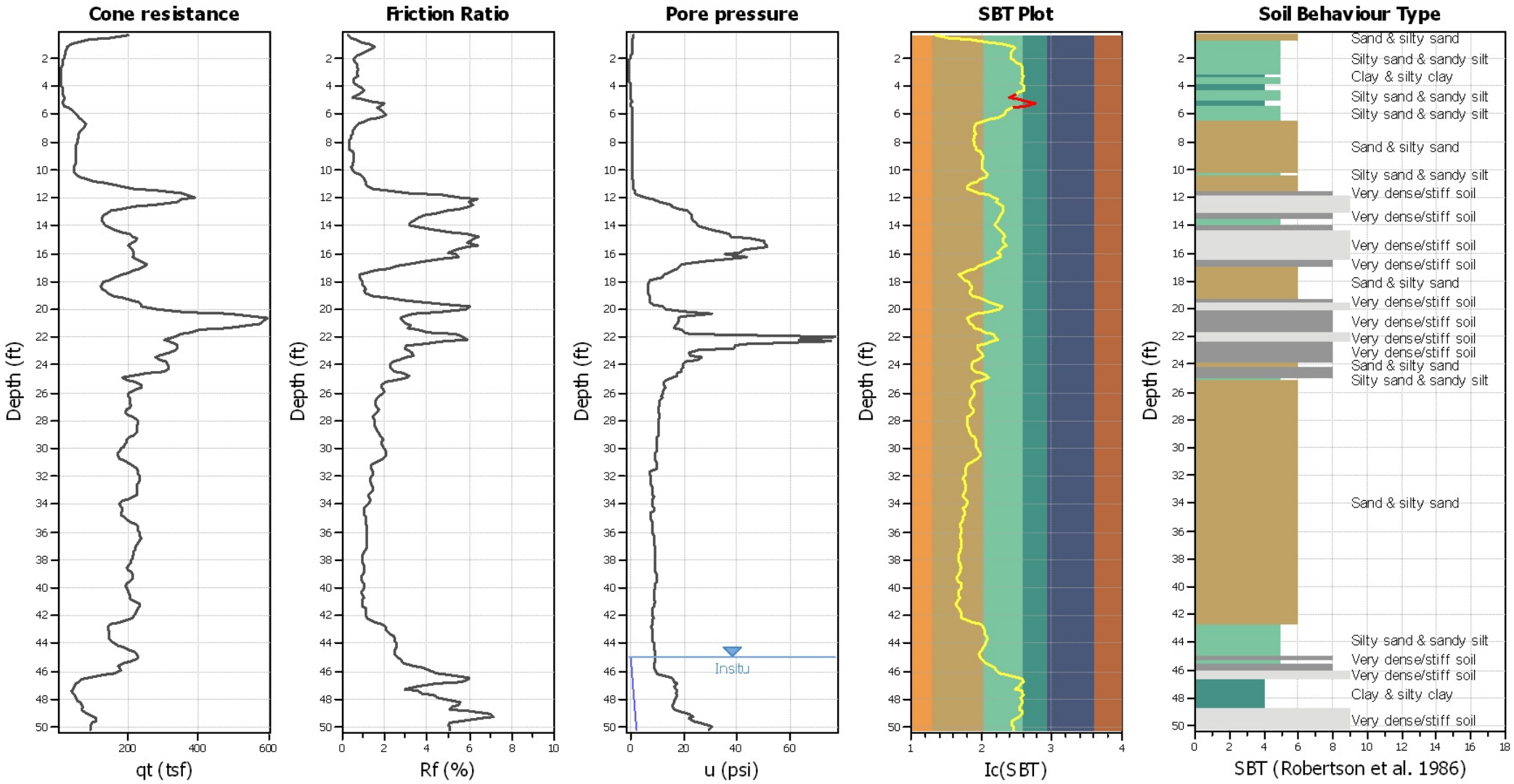






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plo



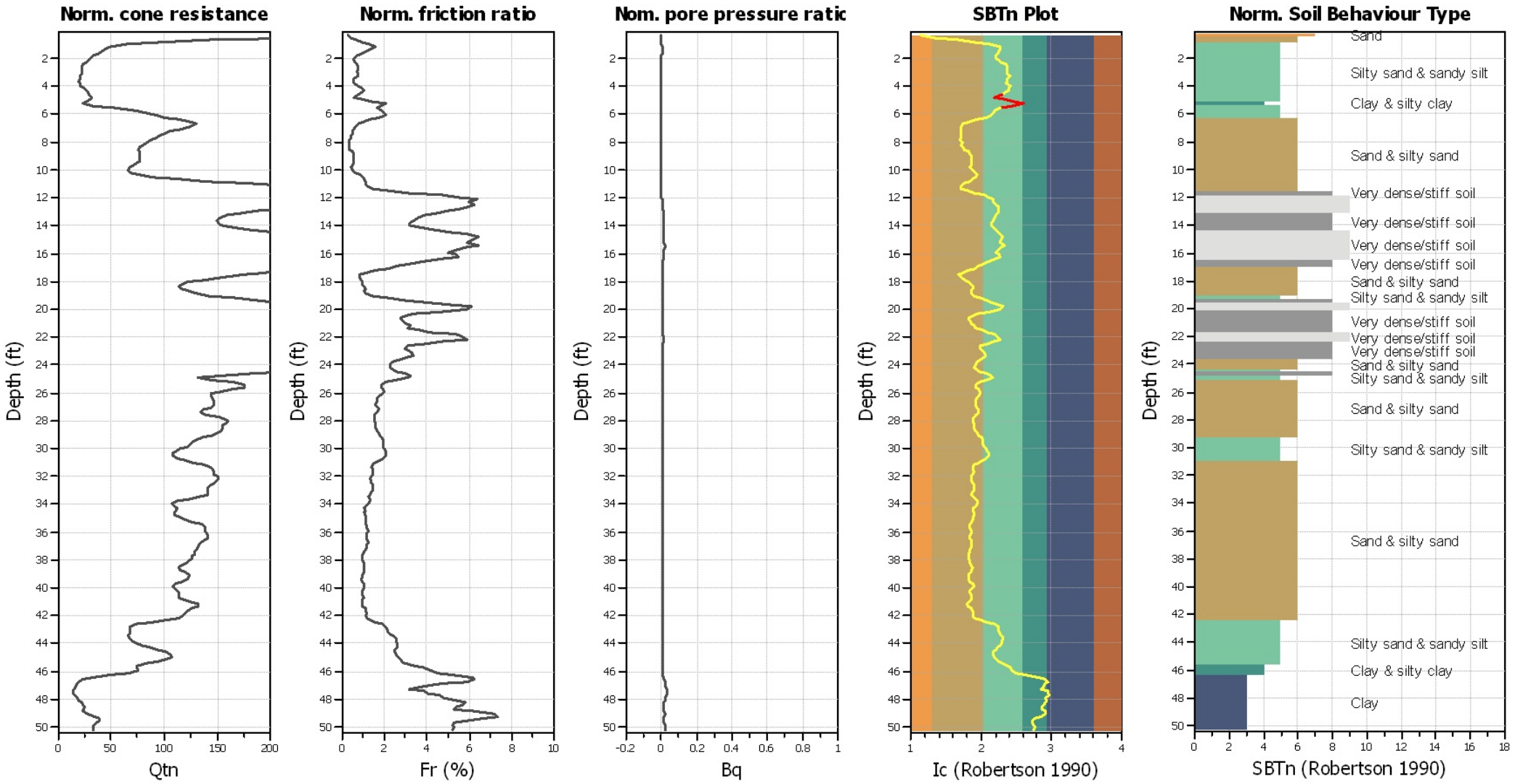
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	45.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.32	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	45.00 ft	Fill height:	N/A	Limit depth:	N/A

SBT legend

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

CPT basic interpretation plots (normaliz



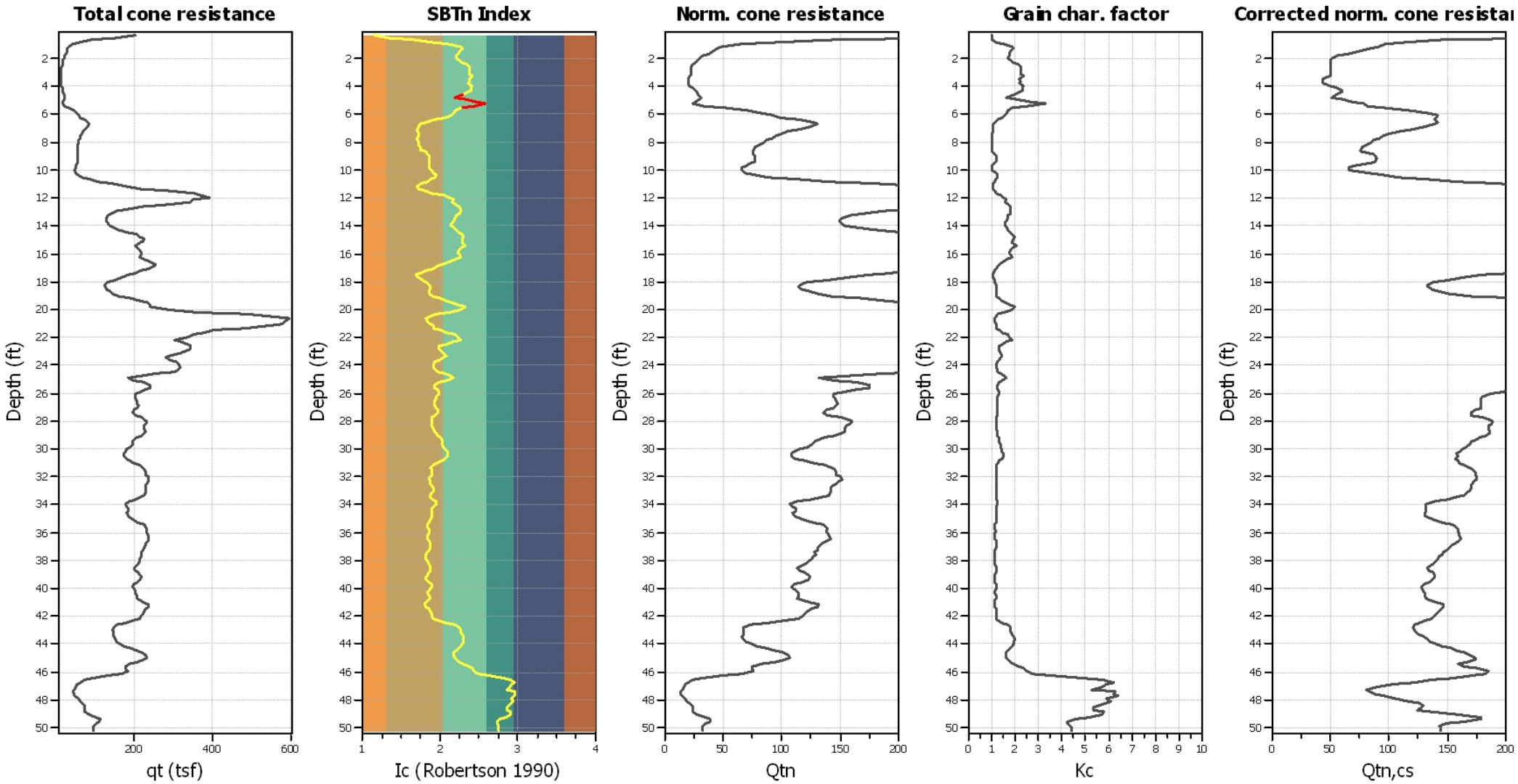
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	45.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.32	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	45.00 ft	Fill height:	N/A	Limit depth:	N/A

SBTn legend

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

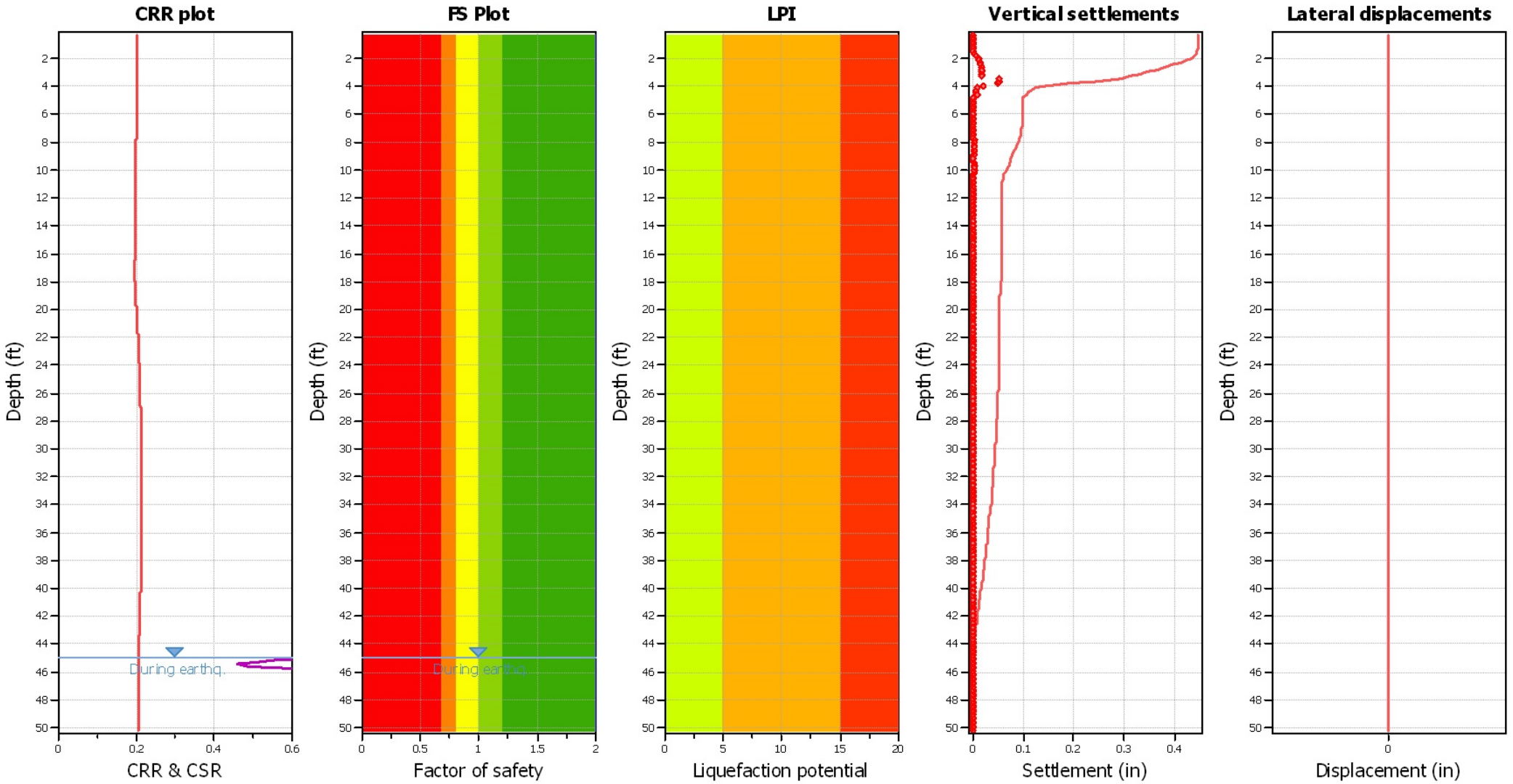
Liquefaction analysis overall plots (intermediate resu



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	45.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.32	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	45.00 ft	Fill height:	N/A	Limit depth:	N/A

Liquefaction analysis overall plot



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	45.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.32	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	45.00 ft	Fill height:	N/A	Limit depth:	N/A

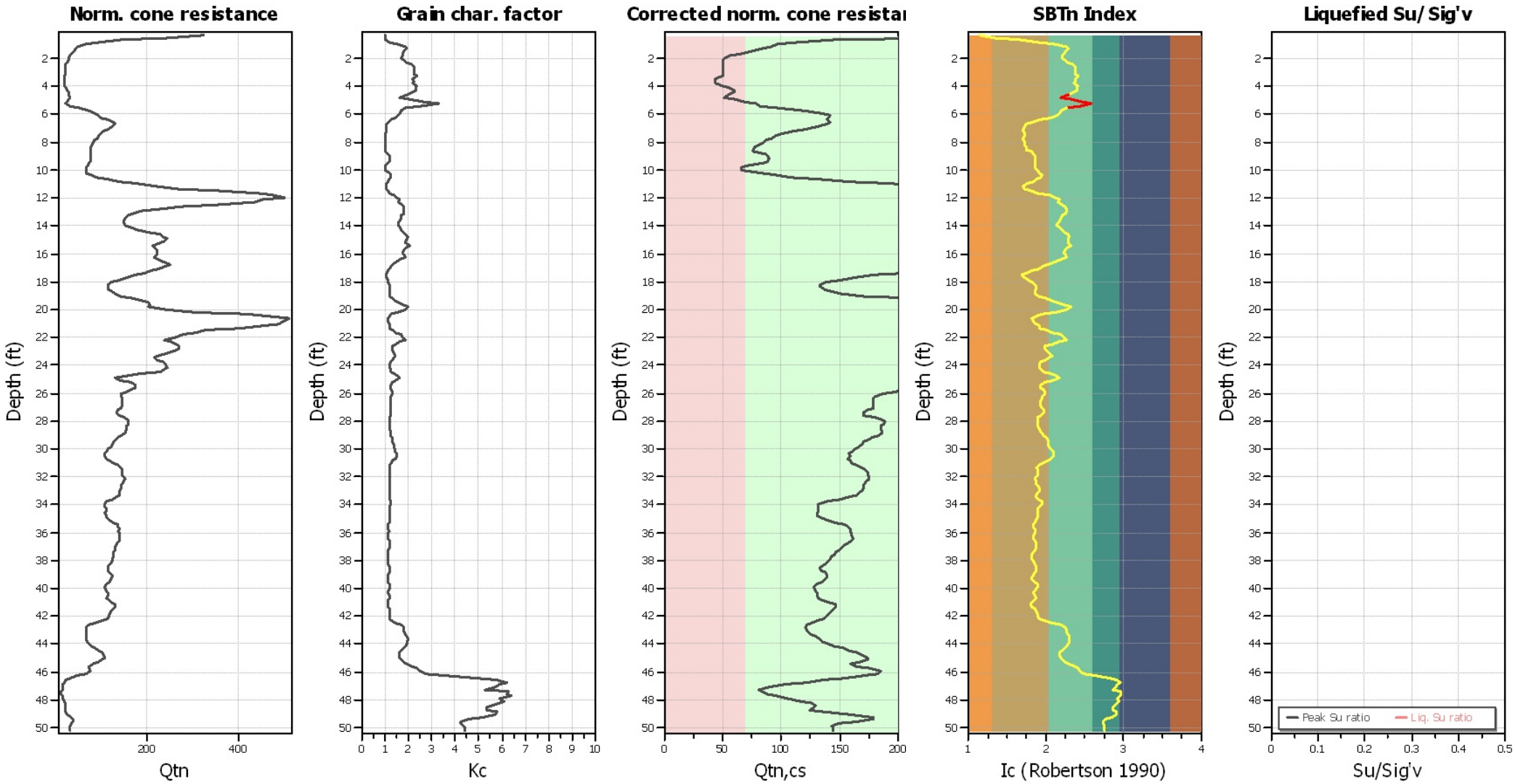
F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

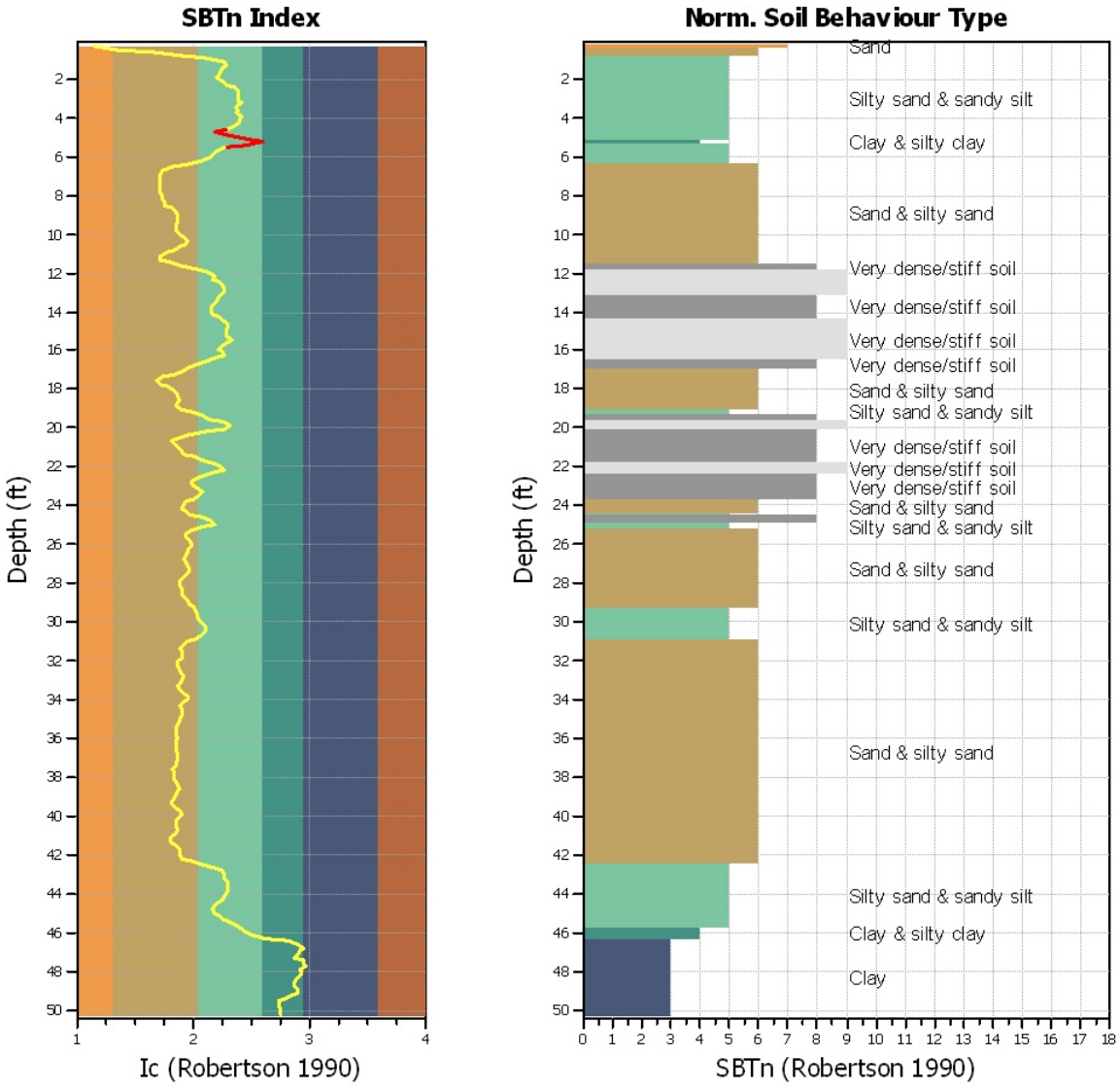
Analysis method:	NCEER (1998)	Depth to water table (erthq.):	45.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.32	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	45.00 ft	Fill height:	N/A	Limit depth:	N/A

TRANSITION LAYER DETECTION ALGORITHM REPORT
Summary Details & Plots

Short description

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

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



Transition layer algorithm properties		General statistics	
I_c minimum check value:	1.70	Total points in CPT file:	305
I_c maximum check value:	3.00	Total points excluded:	8
I_c change ratio value:	0.0250	Exclusion percentage:	2.62%
Minimum number of points in layer:	4	Number of layers detected:	2

Transition layer No	Number of points	Depth	SBT_n number	SBT_n description
Transition layer 1	4	Start depth: 4.76 (ft)	5	Silty sand & sandy silt
		End depth: 5.25 (ft)	4	Clay & silty clay
Transition layer 2	4	Start depth: 5.25 (ft)	4	Clay & silty clay
		End depth: 5.74 (ft)	5	Silty sand & sandy silt

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

:: Field input data ::

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
1	0.33	235.40	0.50	1.10	0.00	118.62
2	0.49	135.10	0.60	0.90	0.94	118.33
3	0.66	78.90	0.60	0.70	5.24	117.12
4	0.82	59.60	0.50	0.70	10.75	115.56
5	0.98	34.60	0.50	0.60	15.94	114.27
6	1.15	29.20	0.50	0.70	21.49	113.02
7	1.31	27.20	0.40	0.70	21.92	111.68
8	1.48	27.10	0.30	0.60	20.97	109.39
9	1.64	23.00	0.20	0.60	19.90	106.16
10	1.80	19.30	0.10	0.10	19.59	102.87
11	1.97	18.60	0.10	-0.30	19.26	100.57
12	2.13	18.40	0.10	-0.40	20.48	100.43
13	2.30	16.00	0.10	-0.40	22.18	100.23
14	2.46	14.50	0.10	-0.50	24.44	99.98
15	2.62	13.70	0.10	-0.50	25.70	99.85
16	2.79	13.70	0.10	-0.60	25.83	99.84
17	2.95	14.30	0.10	-0.50	25.50	99.88
18	3.12	14.30	0.10	-0.50	25.63	99.86
19	3.28	13.50	0.10	-0.50	26.93	99.73
20	3.45	12.10	0.10	-0.50	25.24	96.63
21	3.61	12.10	0.00	-0.50	25.62	96.59
22	3.77	12.90	0.10	0.00	24.89	96.67
23	3.94	13.30	0.10	0.10	26.79	99.75
24	4.10	14.00	0.10	0.00	26.31	102.15
25	4.27	18.00	0.20	0.00	26.53	103.96
26	4.43	16.70	0.20	0.00	24.68	104.15
27	4.59	17.90	0.10	0.00	22.03	102.60
28	4.76	20.00	0.10	0.00	18.52	100.68
29	4.92	21.00	0.10	-0.10	23.30	104.30
30	5.09	14.90	0.30	0.30	29.76	106.44
31	5.25	13.10	0.30	0.20	35.02	108.07
32	5.41	17.10	0.30	0.20	28.15	110.34
33	5.58	32.50	0.50	0.30	21.39	114.17
34	5.74	48.10	0.80	0.30	18.78	118.23
35	5.91	55.10	1.20	0.40	17.91	120.44
36	6.07	56.50	1.20	0.40	17.35	121.27
37	6.23	60.20	1.10	0.50	14.91	120.82
38	6.40	70.40	0.90	0.60	11.28	119.91
39	6.56	83.30	0.70	0.50	8.40	118.66
40	6.73	83.40	0.60	0.50	6.82	117.27
41	6.89	78.50	0.50	0.50	6.47	115.82
42	7.05	71.30	0.40	0.60	6.33	113.99
43	7.22	65.40	0.30	0.50	6.39	112.47
44	7.38	63.10	0.30	0.60	5.00	111.58
45	7.55	61.40	0.30	0.50	5.00	110.64
46	7.71	59.40	0.20	0.50	5.00	109.60
47	7.87	58.20	0.20	0.50	5.00	108.39
48	8.04	55.60	0.20	0.50	5.00	108.30

:: Field input data :: (continued)

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
49	8.20	53.10	0.20	0.60	5.00	106.87
50	8.37	51.70	0.10	0.60	5.00	106.80
51	8.53	51.40	0.20	0.50	5.00	106.78
52	8.69	51.80	0.20	0.70	5.00	109.24
53	8.86	51.20	0.30	0.60	9.08	110.22
54	9.02	51.90	0.30	0.60	9.59	111.11
55	9.19	53.30	0.30	0.60	9.45	111.15
56	9.35	54.00	0.30	0.60	9.48	111.16
57	9.51	52.60	0.30	0.70	9.31	110.24
58	9.68	49.60	0.20	0.70	5.00	109.15
59	9.84	47.10	0.20	0.60	5.00	107.93
60	10.01	46.80	0.20	0.70	5.00	109.04
61	10.17	48.40	0.30	0.70	10.86	110.98
62	10.34	53.30	0.40	0.70	11.55	113.92
63	10.50	62.80	0.60	0.70	11.19	116.71
64	10.66	78.50	0.80	0.70	9.89	119.72
65	10.83	107.70	1.10	0.80	8.91	123.00
66	10.99	134.30	1.70	0.90	7.34	125.41
67	11.16	171.20	1.80	1.00	6.32	128.06
68	11.32	219.60	2.60	1.10	6.57	131.67
69	11.48	259.60	4.90	1.40	7.98	136.78
70	11.65	355.10	9.70	1.60	10.39	137.28
71	11.81	446.60	18.50	2.30	14.34	137.28
72	11.98	298.00	23.10	5.20	16.11	137.28
73	12.14	424.90	23.30	8.00	18.36	137.28
74	12.30	331.70	20.60	10.90	17.75	137.28
75	12.47	270.00	17.30	15.50	19.56	137.28
76	12.63	220.30	13.00	15.40	20.65	137.28
77	12.80	169.20	9.30	18.30	21.01	137.28
78	12.96	148.20	7.20	21.50	21.08	137.28
79	13.12	138.20	6.10	22.10	20.39	135.59
80	13.29	131.40	5.10	22.70	19.46	134.26
81	13.45	128.70	4.40	23.10	18.74	133.29
82	13.62	126.10	4.30	23.50	18.10	132.73
83	13.78	129.10	4.10	24.40	17.57	132.60
84	13.94	135.90	4.10	25.20	17.19	132.73
85	14.11	137.40	4.40	26.20	18.06	134.09
86	14.27	151.80	6.40	29.80	19.47	136.54
87	14.44	184.90	9.30	34.70	20.80	137.28
88	14.60	211.60	12.50	37.20	21.87	137.28
89	14.76	215.80	14.40	37.40	22.82	137.28
90	14.93	213.20	14.50	44.70	22.11	137.28
91	15.09	245.80	13.50	50.20	21.76	137.28
92	15.26	200.50	11.70	50.00	21.85	137.28
93	15.42	190.10	12.40	51.20	23.50	137.28
94	15.58	211.10	14.50	51.10	22.25	137.28
95	15.75	214.70	9.50	42.60	20.79	137.28
96	15.91	214.30	10.50	40.90	19.72	137.28

:: Field input data :: (continued)

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
97	16.08	221.60	12.40	35.70	20.69	137.28
98	16.24	215.40	11.90	43.80	21.32	137.28
99	16.40	199.40	10.70	38.60	19.26	137.28
100	16.57	247.00	9.00	27.20	16.19	137.28
101	16.73	268.90	7.80	19.20	13.43	137.28
102	16.90	246.00	6.60	18.30	12.02	137.28
103	17.06	232.30	5.10	17.40	10.81	135.45
104	17.23	221.60	3.50	16.10	8.75	132.51
105	17.39	201.00	1.80	14.10	6.84	129.21
106	17.55	185.00	1.50	12.60	5.79	126.29
107	17.72	168.10	1.40	11.70	6.55	125.18
108	17.88	140.50	1.30	6.90	7.63	124.35
109	18.05	129.60	1.20	6.80	8.75	123.70
110	18.21	123.90	1.20	6.60	9.43	123.59
111	18.37	122.90	1.30	6.60	9.76	123.77
112	18.54	126.70	1.30	6.60	9.99	124.38
113	18.70	132.60	1.50	6.70	9.49	124.68
114	18.87	141.90	1.40	6.70	9.39	125.83
115	19.03	157.30	1.90	6.80	10.57	128.74
116	19.19	178.80	3.60	6.90	12.71	133.11
117	19.36	223.00	6.40	6.90	15.21	137.06
118	19.52	241.20	9.50	7.20	16.96	137.28
119	19.69	230.40	10.00	8.80	20.78	137.28
120	19.85	244.90	17.40	12.20	23.08	137.28
121	20.01	241.10	16.00	13.20	21.31	137.28
122	20.18	362.30	16.30	22.10	16.35	137.28
123	20.34	475.30	16.50	30.30	11.51	137.28
124	20.51	611.60	16.10	18.90	9.40	137.28
125	20.67	588.50	15.90	17.80	8.64	137.28
126	20.83	586.80	16.80	18.10	9.14	137.28
127	21.00	580.10	17.50	17.30	9.74	137.28
128	21.16	560.70	17.90	17.00	10.59	137.28
129	21.33	487.00	16.80	16.40	10.90	137.28
130	21.49	388.30	9.90	18.80	13.28	137.28
131	21.65	333.80	16.50	20.10	15.19	137.28
132	21.82	405.90	19.60	22.50	19.01	137.28
133	21.98	308.10	19.80	77.00	20.20	137.28
134	22.15	285.40	17.30	63.10	21.49	137.28
135	22.31	314.60	16.50	75.60	18.43	137.28
136	22.47	349.20	11.70	42.80	15.30	137.28
137	22.64	339.20	9.90	39.50	12.82	137.28
138	22.80	336.00	9.60	38.80	12.46	137.28
139	22.97	351.10	10.60	25.60	13.11	137.28
140	23.13	318.30	10.70	21.70	14.19	137.28
141	23.30	276.60	9.60	22.30	15.11	137.28
142	23.46	267.60	8.50	26.80	14.34	137.28
143	23.62	296.00	7.50	25.10	12.78	137.28
144	23.79	305.20	7.20	20.50	11.30	137.28

:: Field input data :: (continued)

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
145	23.95	318.20	7.10	19.70	10.80	137.28
146	24.12	312.20	6.90	19.60	10.58	137.28
147	24.28	321.00	7.20	19.20	11.04	137.28
148	24.44	309.50	7.80	18.80	11.99	137.28
149	24.61	276.10	7.60	17.70	14.79	137.28
150	24.77	177.10	6.70	17.40	17.49	137.06
151	24.94	169.10	5.40	15.70	18.31	135.63
152	25.10	203.80	4.80	12.90	15.14	134.82
153	25.26	225.50	4.50	12.70	12.44	134.58
154	25.43	241.60	4.40	12.70	11.15	134.45
155	25.59	245.00	4.30	12.90	11.01	134.35
156	25.76	227.50	4.30	12.40	11.93	134.28
157	25.92	206.40	4.50	11.90	12.63	133.71
158	26.08	199.90	3.60	11.80	12.71	132.98
159	26.25	197.90	3.30	11.60	11.84	132.24
160	26.41	206.60	3.40	11.70	11.44	132.05
161	26.58	206.10	3.30	10.80	11.25	132.00
162	26.74	203.10	3.20	10.80	11.00	131.86
163	26.90	210.90	3.20	10.70	11.14	132.02
164	27.07	208.50	3.50	10.60	11.72	132.28
165	27.23	195.30	3.60	10.50	12.25	132.04
166	27.40	187.00	3.00	10.50	12.10	131.63
167	27.56	199.60	3.00	10.80	11.16	131.31
168	27.72	213.20	3.10	11.00	10.38	131.81
169	27.89	232.10	3.40	10.30	10.13	132.37
170	28.05	232.30	3.60	10.30	10.14	132.71
171	28.22	227.80	3.50	10.30	10.35	132.68
172	28.38	224.40	3.40	10.20	10.48	132.59
173	28.54	224.50	3.50	10.20	10.58	132.66
174	28.71	228.10	3.60	10.20	10.97	133.00
175	28.87	225.60	3.90	10.20	11.45	133.24
176	29.04	218.70	3.90	10.20	12.22	133.28
177	29.20	205.20	3.80	10.00	12.89	133.05
178	29.36	196.60	3.70	10.00	13.54	132.89
179	29.53	194.90	3.80	9.80	13.64	132.65
180	29.69	195.10	3.50	9.90	13.83	132.55
181	29.86	188.70	3.60	10.00	14.12	132.36
182	30.02	181.80	3.60	9.90	14.92	132.26
183	30.19	172.80	3.50	9.60	15.57	132.18
184	30.35	172.10	3.60	9.40	15.90	132.07
185	30.51	171.60	3.50	9.50	15.90	132.15
186	30.68	176.30	3.60	9.40	14.90	131.87
187	30.84	186.80	3.10	9.50	13.62	131.78
188	31.01	201.40	3.20	9.90	11.83	131.31
189	31.17	210.80	2.80	9.90	10.72	131.29
190	31.33	221.60	2.90	9.60	10.03	131.39
191	31.50	230.30	3.20	9.90	10.22	131.84
192	31.66	222.50	3.30	7.20	10.36	132.18

:: Field input data :: (continued)

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
193	31.83	231.20	3.30	7.30	10.20	132.12
194	31.99	234.70	3.10	7.40	9.76	132.01
195	32.15	235.80	3.10	7.50	9.50	131.87
196	32.32	236.60	3.10	7.60	9.65	131.85
197	32.48	228.90	3.10	7.70	9.93	131.91
198	32.65	228.00	3.20	7.80	10.36	132.02
199	32.81	226.70	3.30	7.90	10.65	132.16
200	32.97	224.70	3.30	8.10	10.58	132.09
201	33.14	228.60	3.10	8.30	10.11	131.62
202	33.30	225.80	2.70	8.40	9.70	131.10
203	33.47	220.20	2.70	8.50	9.85	130.56
204	33.63	203.30	2.60	8.30	10.75	130.11
205	33.79	180.30	2.40	8.20	11.61	129.42
206	33.96	173.00	2.20	8.30	11.46	128.44
207	34.12	178.30	1.80	8.40	10.77	128.00
208	34.29	186.80	2.00	8.60	10.05	127.68
209	34.45	185.10	1.90	8.60	10.24	127.80
210	34.61	177.00	1.90	7.70	10.30	127.65
211	34.78	181.40	1.90	7.80	10.36	127.79
212	34.94	188.10	2.00	7.80	10.19	128.11
213	35.11	192.40	2.10	7.70	9.84	128.71
214	35.27	212.30	2.30	8.00	9.44	129.41
215	35.43	226.00	2.50	8.20	9.07	130.07
216	35.60	230.70	2.60	8.30	9.11	130.51
217	35.76	229.10	2.70	8.20	9.28	130.81
218	35.93	232.00	2.80	8.30	9.44	130.89
219	36.09	228.40	2.70	8.40	9.31	130.92
220	36.26	236.20	2.70	8.50	9.15	130.94
221	36.42	240.10	2.80	8.90	9.15	131.05
222	36.58	233.70	2.80	8.80	9.36	131.02
223	36.75	227.60	2.70	8.80	9.66	130.88
224	36.91	223.90	2.70	8.80	9.61	130.68
225	37.08	228.20	2.60	9.10	9.66	130.46
226	37.24	218.20	2.50	9.00	9.26	129.84
227	37.40	216.20	2.10	9.10	9.05	129.39
228	37.57	220.00	2.20	9.20	8.63	128.95
229	37.73	218.60	2.10	9.40	8.74	128.81
230	37.90	207.80	2.00	9.20	8.74	128.67
231	38.06	215.80	2.10	9.30	8.97	128.64
232	38.22	210.30	2.10	9.40	9.20	128.61
233	38.39	199.30	2.00	9.20	9.64	128.41
234	38.55	195.00	2.00	9.20	9.88	128.37
235	38.72	202.10	2.10	9.30	9.72	128.54
236	38.88	210.50	2.10	9.50	9.37	128.73
237	39.04	214.10	2.10	9.70	8.79	128.55
238	39.21	216.80	1.90	9.70	8.51	128.32
239	39.37	213.70	1.90	9.80	8.53	128.17
240	39.54	208.70	2.00	9.70	9.21	128.21

:: Field input data :: (continued)

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
241	39.70	195.10	2.00	9.00	10.10	128.36
242	39.86	190.30	2.10	9.00	10.40	128.32
243	40.03	199.10	2.00	9.00	10.02	128.10
244	40.19	200.10	1.80	8.90	9.27	127.78
245	40.36	204.80	1.80	8.70	9.14	127.80
246	40.52	204.90	2.00	8.70	9.34	128.07
247	40.68	203.00	2.00	8.80	9.71	128.44
248	40.85	205.60	2.10	8.90	9.33	128.64
249	41.01	225.20	2.10	9.10	8.66	129.02
250	41.18	241.30	2.20	8.50	8.22	129.35
251	41.34	236.00	2.30	8.50	8.55	129.67
252	41.50	225.40	2.40	8.40	9.33	130.03
253	41.67	225.70	2.60	8.40	9.93	130.18
254	41.83	220.60	2.50	8.40	10.10	130.04
255	42.00	214.90	2.30	8.40	10.09	129.81
256	42.16	218.50	2.40	8.50	10.59	129.86
257	42.32	206.60	2.60	8.30	12.32	130.19
258	42.49	174.50	2.80	8.10	15.45	130.33
259	42.65	146.60	2.90	7.90	18.91	130.25
260	42.82	138.80	2.90	7.80	20.67	130.27
261	42.98	147.50	3.00	7.90	21.08	130.43
262	43.15	144.90	3.10	8.00	21.04	130.71
263	43.31	146.90	3.20	8.10	21.77	131.09
264	43.47	146.50	3.50	8.20	22.53	131.61
265	43.64	147.30	3.80	8.20	22.79	132.06
266	43.80	155.30	3.80	8.30	22.55	132.46
267	43.97	161.20	4.00	8.50	22.12	133.01
268	44.13	169.50	4.50	8.50	21.35	133.75
269	44.29	190.90	4.80	8.70	20.45	134.58
270	44.46	205.30	5.20	8.90	19.09	135.07
271	44.62	216.10	5.10	9.10	18.35	135.59
272	44.79	228.40	5.60	9.20	18.05	136.15
273	44.95	236.30	6.20	9.20	18.45	136.70
274	45.11	229.40	6.30	9.30	19.33	136.75
275	45.28	209.10	5.90	9.10	20.57	136.10
276	45.44	182.60	5.10	8.70	22.22	135.43
277	45.61	172.80	5.30	8.70	25.25	135.77
278	45.77	167.90	7.10	8.80	26.85	136.78
279	45.93	189.70	7.60	9.00	27.84	137.28
280	46.10	187.00	7.70	9.70	30.53	137.22
281	46.26	114.90	6.50	10.70	36.41	135.79
282	46.43	86.10	5.20	15.20	47.14	133.37
283	46.59	64.40	4.10	15.80	52.16	131.30
284	46.75	63.50	3.50	16.20	55.27	129.14
285	46.92	51.60	2.50	17.20	53.32	126.52
286	47.08	46.90	1.30	16.60	52.03	123.75
287	47.25	45.70	1.40	16.70	49.47	121.92
288	47.41	45.90	1.40	17.30	55.55	122.38

:: Field input data :: (continued)

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
289	47.57	34.80	1.70	17.00	55.39	123.26
290	47.74	51.90	1.90	17.30	56.18	124.88
291	47.90	54.90	2.50	16.90	53.27	126.76
292	48.07	58.30	3.10	16.50	54.30	128.52
293	48.23	64.80	3.70	16.10	53.14	129.92
294	48.39	73.20	4.10	15.70	50.99	130.56
295	48.56	74.00	3.80	15.60	49.55	130.35
296	48.72	68.50	3.30	16.60	49.73	129.95
297	48.89	68.00	3.60	18.20	52.35	131.39
298	49.05	80.30	6.00	21.90	52.28	134.03
299	49.22	103.90	8.00	23.30	48.44	136.11
300	49.38	122.90	7.90	21.60	44.69	136.37
301	49.54	110.50	6.10	23.20	42.11	135.10
302	49.71	97.70	4.60	25.90	42.19	133.44
303	49.87	92.00	4.60	29.50	43.15	132.75
304	50.04	93.10	5.00	30.30	43.63	132.78
305	50.20	95.50	4.70	29.40	43.30	132.86

Abbreviations

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

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

Point ID	Depth (ft)	σ_v (tsf)	u_0 (tsf)	σ_v' (tsf)	r_d	CSR	MSF	CSR_{eq}	K_σ	User FS	CSR^*	Belongs to transition
1	0.33	0.02	0.00	0.02	1.00	0.208	1.33	0.156	1.00	1.30	2.000	No
2	0.49	0.03	0.00	0.03	1.00	0.208	1.33	0.156	1.00	1.30	2.000	No
3	0.66	0.04	0.00	0.04	1.00	0.208	1.33	0.156	1.00	1.30	2.000	No
4	0.82	0.05	0.00	0.05	1.00	0.208	1.33	0.156	1.00	1.30	2.000	No
5	0.98	0.06	0.00	0.06	1.00	0.208	1.33	0.156	1.00	1.30	2.000	No
6	1.15	0.07	0.00	0.07	1.00	0.208	1.33	0.156	1.00	1.30	2.000	No
7	1.31	0.08	0.00	0.08	1.00	0.208	1.33	0.156	1.00	1.30	2.000	No
8	1.48	0.09	0.00	0.09	1.00	0.208	1.33	0.156	1.00	1.30	2.000	No
9	1.64	0.09	0.00	0.09	1.00	0.208	1.33	0.156	1.00	1.30	2.000	No
10	1.80	0.10	0.00	0.10	1.00	0.208	1.33	0.156	1.00	1.30	2.000	No
11	1.97	0.11	0.00	0.11	1.00	0.207	1.33	0.155	1.00	1.30	2.000	No
12	2.13	0.12	0.00	0.12	1.00	0.207	1.33	0.155	1.00	1.30	2.000	No
13	2.30	0.13	0.00	0.13	1.00	0.207	1.33	0.155	1.00	1.30	2.000	No
14	2.46	0.14	0.00	0.14	1.00	0.207	1.33	0.155	1.00	1.30	2.000	No
15	2.62	0.14	0.00	0.14	1.00	0.207	1.33	0.155	1.00	1.30	2.000	No
16	2.79	0.15	0.00	0.15	1.00	0.207	1.33	0.155	1.00	1.30	2.000	No
17	2.95	0.16	0.00	0.16	1.00	0.207	1.33	0.155	1.00	1.30	2.000	No
18	3.12	0.17	0.00	0.17	0.99	0.207	1.33	0.155	1.00	1.30	2.000	No
19	3.28	0.18	0.00	0.18	0.99	0.207	1.33	0.155	1.00	1.30	2.000	No
20	3.45	0.18	0.00	0.18	0.99	0.207	1.33	0.155	1.00	1.30	2.000	No
21	3.61	0.19	0.00	0.19	0.99	0.207	1.33	0.155	1.00	1.30	2.000	No
22	3.77	0.20	0.00	0.20	0.99	0.207	1.33	0.155	1.00	1.30	2.000	No
23	3.94	0.21	0.00	0.21	0.99	0.206	1.33	0.155	1.00	1.30	2.000	No
24	4.10	0.22	0.00	0.22	0.99	0.206	1.33	0.155	1.00	1.30	2.000	No
25	4.27	0.23	0.00	0.23	0.99	0.206	1.33	0.155	1.00	1.30	2.000	No
26	4.43	0.23	0.00	0.23	0.99	0.206	1.33	0.155	1.00	1.30	2.000	No
27	4.59	0.24	0.00	0.24	0.99	0.206	1.33	0.155	1.00	1.30	2.000	No
28	4.76	0.25	0.00	0.25	0.99	0.206	1.33	0.154	1.00	1.30	2.000	Yes
29	4.92	0.26	0.00	0.26	0.99	0.206	1.33	0.154	1.00	1.30	2.000	Yes
30	5.09	0.27	0.00	0.27	0.99	0.206	1.33	0.154	1.00	1.30	2.000	Yes
31	5.25	0.28	0.00	0.28	0.99	0.206	1.33	0.154	1.00	1.30	2.000	Yes
32	5.41	0.29	0.00	0.29	0.99	0.206	1.33	0.154	1.00	1.30	2.000	Yes
33	5.58	0.29	0.00	0.29	0.99	0.206	1.33	0.154	1.00	1.30	2.000	Yes
34	5.74	0.30	0.00	0.30	0.99	0.206	1.33	0.154	1.00	1.30	2.000	Yes
35	5.91	0.31	0.00	0.31	0.99	0.206	1.33	0.154	1.00	1.30	2.000	No
36	6.07	0.32	0.00	0.32	0.99	0.205	1.33	0.154	1.00	1.30	2.000	No
37	6.23	0.33	0.00	0.33	0.99	0.205	1.33	0.154	1.00	1.30	2.000	No
38	6.40	0.34	0.00	0.34	0.99	0.205	1.33	0.154	1.00	1.30	2.000	No
39	6.56	0.35	0.00	0.35	0.99	0.205	1.33	0.154	1.00	1.30	2.000	No
40	6.73	0.36	0.00	0.36	0.99	0.205	1.33	0.154	1.00	1.30	2.000	No
41	6.89	0.37	0.00	0.37	0.99	0.205	1.33	0.154	1.00	1.30	2.000	No
42	7.05	0.38	0.00	0.38	0.99	0.205	1.33	0.154	1.00	1.30	2.000	No
43	7.22	0.39	0.00	0.39	0.99	0.205	1.33	0.154	1.00	1.30	2.000	No
44	7.38	0.40	0.00	0.40	0.98	0.205	1.33	0.154	1.00	1.30	2.000	No
45	7.55	0.41	0.00	0.41	0.98	0.205	1.33	0.153	1.00	1.30	2.000	No
46	7.71	0.42	0.00	0.42	0.98	0.205	1.33	0.153	1.00	1.30	2.000	No
47	7.87	0.43	0.00	0.43	0.98	0.205	1.33	0.153	1.00	1.30	2.000	No
48	8.04	0.44	0.00	0.44	0.98	0.205	1.33	0.153	1.00	1.30	2.000	No

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

Point ID	Depth (ft)	σ_v (tsf)	u_0 (tsf)	σ_v' (tsf)	r_d	CSR	MSF	CSR_{eq}	K_σ	User FS	CSR^*	Belongs to transition
49	8.20	0.44	0.00	0.44	0.98	0.204	1.33	0.153	1.00	1.30	2.000	No
50	8.37	0.45	0.00	0.45	0.98	0.204	1.33	0.153	1.00	1.30	2.000	No
51	8.53	0.46	0.00	0.46	0.98	0.204	1.33	0.153	1.00	1.30	2.000	No
52	8.69	0.47	0.00	0.47	0.98	0.204	1.33	0.153	1.00	1.30	2.000	No
53	8.86	0.48	0.00	0.48	0.98	0.204	1.33	0.153	1.00	1.30	2.000	No
54	9.02	0.49	0.00	0.49	0.98	0.204	1.33	0.153	1.00	1.30	2.000	No
55	9.19	0.50	0.00	0.50	0.98	0.204	1.33	0.153	1.00	1.30	2.000	No
56	9.35	0.51	0.00	0.51	0.98	0.204	1.33	0.153	1.00	1.30	2.000	No
57	9.51	0.52	0.00	0.52	0.98	0.204	1.33	0.153	1.00	1.30	2.000	No
58	9.68	0.53	0.00	0.53	0.98	0.204	1.33	0.153	1.00	1.30	2.000	No
59	9.84	0.53	0.00	0.53	0.98	0.204	1.33	0.153	1.00	1.30	2.000	No
60	10.01	0.54	0.00	0.54	0.98	0.204	1.33	0.153	1.00	1.30	2.000	No
61	10.17	0.55	0.00	0.55	0.98	0.204	1.33	0.153	1.00	1.30	2.000	No
62	10.34	0.56	0.00	0.56	0.98	0.204	1.33	0.153	1.00	1.30	2.000	No
63	10.50	0.57	0.00	0.57	0.98	0.203	1.33	0.152	1.00	1.30	2.000	No
64	10.66	0.58	0.00	0.58	0.98	0.203	1.33	0.152	1.00	1.30	2.000	No
65	10.83	0.59	0.00	0.59	0.98	0.203	1.33	0.152	1.00	1.30	2.000	No
66	10.99	0.60	0.00	0.60	0.98	0.203	1.33	0.152	1.00	1.30	2.000	No
67	11.16	0.61	0.00	0.61	0.98	0.203	1.33	0.152	1.00	1.30	2.000	No
68	11.32	0.62	0.00	0.62	0.98	0.203	1.33	0.152	1.00	1.30	2.000	No
69	11.48	0.63	0.00	0.63	0.98	0.203	1.33	0.152	1.00	1.30	2.000	No
70	11.65	0.65	0.00	0.65	0.98	0.203	1.33	0.152	1.00	1.30	2.000	No
71	11.81	0.66	0.00	0.66	0.98	0.203	1.33	0.152	1.00	1.30	2.000	No
72	11.98	0.67	0.00	0.67	0.97	0.203	1.33	0.152	1.00	1.30	2.000	No
73	12.14	0.68	0.00	0.68	0.97	0.203	1.33	0.152	1.00	1.30	2.000	No
74	12.30	0.69	0.00	0.69	0.97	0.203	1.33	0.152	1.00	1.30	2.000	No
75	12.47	0.70	0.00	0.70	0.97	0.203	1.33	0.152	1.00	1.30	2.000	No
76	12.63	0.71	0.00	0.71	0.97	0.203	1.33	0.152	1.00	1.30	2.000	No
77	12.80	0.72	0.00	0.72	0.97	0.202	1.33	0.152	1.00	1.30	2.000	No
78	12.96	0.74	0.00	0.74	0.97	0.202	1.33	0.152	1.00	1.30	2.000	No
79	13.12	0.75	0.00	0.75	0.97	0.202	1.33	0.152	1.00	1.30	2.000	No
80	13.29	0.76	0.00	0.76	0.97	0.202	1.33	0.152	1.00	1.30	2.000	No
81	13.45	0.77	0.00	0.77	0.97	0.202	1.33	0.152	1.00	1.30	2.000	No
82	13.62	0.78	0.00	0.78	0.97	0.202	1.33	0.151	1.00	1.30	2.000	No
83	13.78	0.79	0.00	0.79	0.97	0.202	1.33	0.151	1.00	1.30	2.000	No
84	13.94	0.80	0.00	0.80	0.97	0.202	1.33	0.151	1.00	1.30	2.000	No
85	14.11	0.81	0.00	0.81	0.97	0.202	1.33	0.151	1.00	1.30	2.000	No
86	14.27	0.82	0.00	0.82	0.97	0.202	1.33	0.151	1.00	1.30	2.000	No
87	14.44	0.84	0.00	0.84	0.97	0.202	1.33	0.151	1.00	1.30	2.000	No
88	14.60	0.85	0.00	0.85	0.97	0.202	1.33	0.151	1.00	1.30	2.000	No
89	14.76	0.86	0.00	0.86	0.97	0.202	1.33	0.151	1.00	1.30	2.000	No
90	14.93	0.87	0.00	0.87	0.97	0.201	1.33	0.151	1.00	1.30	2.000	No
91	15.09	0.88	0.00	0.88	0.97	0.201	1.33	0.151	1.00	1.30	2.000	No
92	15.26	0.89	0.00	0.89	0.97	0.201	1.33	0.151	1.00	1.30	2.000	No
93	15.42	0.90	0.00	0.90	0.97	0.201	1.33	0.151	1.00	1.30	2.000	No
94	15.58	0.91	0.00	0.91	0.97	0.201	1.33	0.151	1.00	1.30	2.000	No
95	15.75	0.93	0.00	0.93	0.97	0.201	1.33	0.151	1.00	1.30	2.000	No
96	15.91	0.94	0.00	0.94	0.97	0.201	1.33	0.151	1.00	1.30	2.000	No

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

Point ID	Depth (ft)	σ_v (tsf)	u_0 (tsf)	σ_v' (tsf)	r_d	CSR	MSF	CSR_{eq}	K_σ	User FS	CSR^*	Belongs to transition
97	16.08	0.95	0.00	0.95	0.97	0.201	1.33	0.151	1.00	1.30	2.000	No
98	16.24	0.96	0.00	0.96	0.97	0.201	1.33	0.151	1.00	1.30	2.000	No
99	16.40	0.97	0.00	0.97	0.97	0.201	1.33	0.151	1.00	1.30	2.000	No
100	16.57	0.98	0.00	0.98	0.97	0.201	1.33	0.150	1.00	1.30	2.000	No
101	16.73	0.99	0.00	0.99	0.96	0.201	1.33	0.150	1.00	1.30	2.000	No
102	16.90	1.00	0.00	1.00	0.96	0.201	1.33	0.150	1.00	1.30	2.000	No
103	17.06	1.01	0.00	1.01	0.96	0.201	1.33	0.150	1.00	1.30	2.000	No
104	17.23	1.03	0.00	1.03	0.96	0.200	1.33	0.150	1.00	1.30	2.000	No
105	17.39	1.04	0.00	1.04	0.96	0.200	1.33	0.150	1.00	1.30	2.000	No
106	17.55	1.05	0.00	1.05	0.96	0.200	1.33	0.150	1.00	1.30	2.000	No
107	17.72	1.06	0.00	1.06	0.96	0.200	1.33	0.150	1.00	1.30	2.000	No
108	17.88	1.07	0.00	1.07	0.96	0.200	1.33	0.150	1.00	1.30	2.000	No
109	18.05	1.08	0.00	1.08	0.96	0.200	1.33	0.150	1.00	1.30	2.000	No
110	18.21	1.09	0.00	1.09	0.96	0.200	1.33	0.150	0.99	1.30	2.000	No
111	18.37	1.10	0.00	1.10	0.96	0.200	1.33	0.150	0.99	1.30	2.000	No
112	18.54	1.11	0.00	1.11	0.96	0.200	1.33	0.150	0.99	1.30	2.000	No
113	18.70	1.12	0.00	1.12	0.96	0.200	1.33	0.150	0.99	1.30	2.000	No
114	18.87	1.13	0.00	1.13	0.96	0.200	1.33	0.150	0.99	1.30	2.000	No
115	19.03	1.14	0.00	1.14	0.96	0.200	1.33	0.150	0.98	1.30	2.000	No
116	19.19	1.15	0.00	1.15	0.96	0.199	1.33	0.149	0.98	1.30	2.000	No
117	19.36	1.16	0.00	1.16	0.96	0.199	1.33	0.149	0.98	1.30	2.000	No
118	19.52	1.17	0.00	1.17	0.96	0.199	1.33	0.149	0.98	1.30	2.000	No
119	19.69	1.18	0.00	1.18	0.96	0.199	1.33	0.149	0.97	1.30	2.000	No
120	19.85	1.20	0.00	1.20	0.96	0.199	1.33	0.149	0.97	1.30	2.000	No
121	20.01	1.21	0.00	1.21	0.96	0.199	1.33	0.149	0.97	1.30	2.000	No
122	20.18	1.22	0.00	1.22	0.96	0.199	1.33	0.149	0.97	1.30	2.000	No
123	20.34	1.23	0.00	1.23	0.96	0.199	1.33	0.149	0.97	1.30	2.000	No
124	20.51	1.24	0.00	1.24	0.96	0.199	1.33	0.149	0.96	1.30	2.000	No
125	20.67	1.25	0.00	1.25	0.96	0.199	1.33	0.149	0.96	1.30	2.000	No
126	20.83	1.26	0.00	1.26	0.95	0.199	1.33	0.149	0.96	1.30	2.000	No
127	21.00	1.27	0.00	1.27	0.95	0.198	1.33	0.149	0.96	1.30	2.000	No
128	21.16	1.28	0.00	1.28	0.95	0.198	1.33	0.149	0.96	1.30	2.000	No
129	21.33	1.30	0.00	1.30	0.95	0.198	1.33	0.149	0.95	1.30	2.000	No
130	21.49	1.31	0.00	1.31	0.95	0.198	1.33	0.149	0.95	1.30	2.000	No
131	21.65	1.32	0.00	1.32	0.95	0.198	1.33	0.148	0.95	1.30	2.000	No
132	21.82	1.33	0.00	1.33	0.95	0.198	1.33	0.148	0.95	1.30	2.000	No
133	21.98	1.34	0.00	1.34	0.95	0.198	1.33	0.148	0.95	1.30	2.000	No
134	22.15	1.35	0.00	1.35	0.95	0.198	1.33	0.148	0.95	1.30	2.000	No
135	22.31	1.36	0.00	1.36	0.95	0.198	1.33	0.148	0.94	1.30	2.000	No
136	22.47	1.37	0.00	1.37	0.95	0.198	1.33	0.148	0.94	1.30	2.000	No
137	22.64	1.39	0.00	1.39	0.95	0.198	1.33	0.148	0.94	1.30	2.000	No
138	22.80	1.40	0.00	1.40	0.95	0.197	1.33	0.148	0.94	1.30	2.000	No
139	22.97	1.41	0.00	1.41	0.95	0.197	1.33	0.148	0.94	1.30	2.000	No
140	23.13	1.42	0.00	1.42	0.95	0.197	1.33	0.148	0.93	1.30	2.000	No
141	23.30	1.43	0.00	1.43	0.95	0.197	1.33	0.148	0.93	1.30	2.000	No
142	23.46	1.44	0.00	1.44	0.95	0.197	1.33	0.148	0.93	1.30	2.000	No
143	23.62	1.45	0.00	1.45	0.95	0.197	1.33	0.148	0.93	1.30	2.000	No
144	23.79	1.47	0.00	1.47	0.95	0.197	1.33	0.147	0.93	1.30	2.000	No

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

Point ID	Depth (ft)	σ_v (tsf)	u_0 (tsf)	σ_v' (tsf)	r_d	CSR	MSF	CSR_{eq}	K_σ	User FS	CSR^*	Belongs to transition
145	23.95	1.48	0.00	1.48	0.95	0.197	1.33	0.147	0.93	1.30	2.000	No
146	24.12	1.49	0.00	1.49	0.94	0.197	1.33	0.147	0.92	1.30	2.000	No
147	24.28	1.50	0.00	1.50	0.94	0.196	1.33	0.147	0.92	1.30	2.000	No
148	24.44	1.51	0.00	1.51	0.94	0.196	1.33	0.147	0.92	1.30	2.000	No
149	24.61	1.52	0.00	1.52	0.94	0.196	1.33	0.147	0.92	1.30	2.000	No
150	24.77	1.53	0.00	1.53	0.94	0.196	1.33	0.147	0.92	1.30	2.000	No
151	24.94	1.54	0.00	1.54	0.94	0.196	1.33	0.147	0.92	1.30	2.000	No
152	25.10	1.56	0.00	1.56	0.94	0.196	1.33	0.147	0.92	1.30	2.000	No
153	25.26	1.57	0.00	1.57	0.94	0.196	1.33	0.147	0.91	1.30	2.000	No
154	25.43	1.58	0.00	1.58	0.94	0.196	1.33	0.147	0.91	1.30	2.000	No
155	25.59	1.59	0.00	1.59	0.94	0.195	1.33	0.146	0.91	1.30	2.000	No
156	25.76	1.60	0.00	1.60	0.94	0.195	1.33	0.146	0.91	1.30	2.000	No
157	25.92	1.61	0.00	1.61	0.94	0.195	1.33	0.146	0.91	1.30	2.000	No
158	26.08	1.62	0.00	1.62	0.94	0.195	1.33	0.146	0.91	1.30	2.000	No
159	26.25	1.63	0.00	1.63	0.94	0.195	1.33	0.146	0.91	1.30	2.000	No
160	26.41	1.64	0.00	1.64	0.94	0.195	1.33	0.146	0.90	1.30	2.000	No
161	26.58	1.65	0.00	1.65	0.94	0.195	1.33	0.146	0.90	1.30	2.000	No
162	26.74	1.66	0.00	1.66	0.94	0.195	1.33	0.146	0.90	1.30	2.000	No
163	26.90	1.67	0.00	1.67	0.93	0.194	1.33	0.146	0.90	1.30	2.000	No
164	27.07	1.69	0.00	1.69	0.93	0.194	1.33	0.146	0.90	1.30	2.000	No
165	27.23	1.70	0.00	1.70	0.93	0.194	1.33	0.145	0.90	1.30	2.000	No
166	27.40	1.71	0.00	1.71	0.93	0.194	1.33	0.145	0.90	1.30	2.000	No
167	27.56	1.72	0.00	1.72	0.93	0.194	1.33	0.145	0.89	1.30	2.000	No
168	27.72	1.73	0.00	1.73	0.93	0.194	1.33	0.145	0.89	1.30	2.000	No
169	27.89	1.74	0.00	1.74	0.93	0.194	1.33	0.145	0.89	1.30	2.000	No
170	28.05	1.75	0.00	1.75	0.93	0.193	1.33	0.145	0.89	1.30	2.000	No
171	28.22	1.76	0.00	1.76	0.93	0.193	1.33	0.145	0.89	1.30	2.000	No
172	28.38	1.77	0.00	1.77	0.93	0.193	1.33	0.145	0.89	1.30	2.000	No
173	28.54	1.78	0.00	1.78	0.93	0.193	1.33	0.145	0.89	1.30	2.000	No
174	28.71	1.79	0.00	1.79	0.93	0.193	1.33	0.144	0.89	1.30	2.000	No
175	28.87	1.81	0.00	1.81	0.93	0.193	1.33	0.144	0.88	1.30	2.000	No
176	29.04	1.82	0.00	1.82	0.93	0.192	1.33	0.144	0.88	1.30	2.000	No
177	29.20	1.83	0.00	1.83	0.92	0.192	1.33	0.144	0.88	1.30	2.000	No
178	29.36	1.84	0.00	1.84	0.92	0.192	1.33	0.144	0.88	1.30	2.000	No
179	29.53	1.85	0.00	1.85	0.92	0.192	1.33	0.144	0.88	1.30	2.000	No
180	29.69	1.86	0.00	1.86	0.92	0.192	1.33	0.144	0.88	1.30	2.000	No
181	29.86	1.87	0.00	1.87	0.92	0.192	1.33	0.144	0.88	1.30	2.000	No
182	30.02	1.88	0.00	1.88	0.92	0.191	1.33	0.143	0.88	1.30	2.000	No
183	30.19	1.89	0.00	1.89	0.92	0.191	1.33	0.143	0.87	1.30	2.000	No
184	30.35	1.90	0.00	1.90	0.92	0.191	1.33	0.143	0.87	1.30	2.000	No
185	30.51	1.91	0.00	1.91	0.92	0.191	1.33	0.143	0.87	1.30	2.000	No
186	30.68	1.93	0.00	1.93	0.92	0.191	1.33	0.143	0.87	1.30	2.000	No
187	30.84	1.94	0.00	1.94	0.92	0.191	1.33	0.143	0.87	1.30	2.000	No
188	31.01	1.95	0.00	1.95	0.92	0.190	1.33	0.143	0.87	1.30	2.000	No
189	31.17	1.96	0.00	1.96	0.91	0.190	1.33	0.143	0.87	1.30	2.000	No
190	31.33	1.97	0.00	1.97	0.91	0.190	1.33	0.142	0.87	1.30	2.000	No
191	31.50	1.98	0.00	1.98	0.91	0.190	1.33	0.142	0.87	1.30	2.000	No
192	31.66	1.99	0.00	1.99	0.91	0.190	1.33	0.142	0.86	1.30	2.000	No

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

Point ID	Depth (ft)	σ_v (tsf)	u_0 (tsf)	σ_v' (tsf)	r_d	CSR	MSF	CSR_{eq}	K_σ	User FS	CSR^*	Belongs to transition
193	31.83	2.00	0.00	2.00	0.91	0.189	1.33	0.142	0.86	1.30	2.000	No
194	31.99	2.01	0.00	2.01	0.91	0.189	1.33	0.142	0.86	1.30	2.000	No
195	32.15	2.02	0.00	2.02	0.91	0.189	1.33	0.142	0.86	1.30	2.000	No
196	32.32	2.03	0.00	2.03	0.91	0.189	1.33	0.142	0.86	1.30	2.000	No
197	32.48	2.04	0.00	2.04	0.91	0.189	1.33	0.141	0.86	1.30	2.000	No
198	32.65	2.05	0.00	2.05	0.91	0.188	1.33	0.141	0.86	1.30	2.000	No
199	32.81	2.07	0.00	2.07	0.90	0.188	1.33	0.141	0.86	1.30	2.000	No
200	32.97	2.08	0.00	2.08	0.90	0.188	1.33	0.141	0.86	1.30	2.000	No
201	33.14	2.09	0.00	2.09	0.90	0.188	1.33	0.141	0.86	1.30	2.000	No
202	33.30	2.10	0.00	2.10	0.90	0.188	1.33	0.141	0.85	1.30	2.000	No
203	33.47	2.11	0.00	2.11	0.90	0.187	1.33	0.140	0.85	1.30	2.000	No
204	33.63	2.12	0.00	2.12	0.90	0.187	1.33	0.140	0.85	1.30	2.000	No
205	33.79	2.13	0.00	2.13	0.90	0.187	1.33	0.140	0.85	1.30	2.000	No
206	33.96	2.14	0.00	2.14	0.90	0.187	1.33	0.140	0.85	1.30	2.000	No
207	34.12	2.15	0.00	2.15	0.90	0.186	1.33	0.140	0.85	1.30	2.000	No
208	34.29	2.16	0.00	2.16	0.90	0.186	1.33	0.140	0.85	1.30	2.000	No
209	34.45	2.17	0.00	2.17	0.89	0.186	1.33	0.139	0.85	1.30	2.000	No
210	34.61	2.18	0.00	2.18	0.89	0.186	1.33	0.139	0.85	1.30	2.000	No
211	34.78	2.19	0.00	2.19	0.89	0.186	1.33	0.139	0.85	1.30	2.000	No
212	34.94	2.20	0.00	2.20	0.89	0.185	1.33	0.139	0.84	1.30	2.000	No
213	35.11	2.21	0.00	2.21	0.89	0.185	1.33	0.139	0.84	1.30	2.000	No
214	35.27	2.22	0.00	2.22	0.89	0.185	1.33	0.139	0.84	1.30	2.000	No
215	35.43	2.23	0.00	2.23	0.89	0.185	1.33	0.138	0.84	1.30	2.000	No
216	35.60	2.25	0.00	2.25	0.89	0.184	1.33	0.138	0.84	1.30	2.000	No
217	35.76	2.26	0.00	2.26	0.89	0.184	1.33	0.138	0.84	1.30	2.000	No
218	35.93	2.27	0.00	2.27	0.88	0.184	1.33	0.138	0.84	1.30	2.000	No
219	36.09	2.28	0.00	2.28	0.88	0.184	1.33	0.138	0.84	1.30	2.000	No
220	36.26	2.29	0.00	2.29	0.88	0.183	1.33	0.137	0.84	1.30	2.000	No
221	36.42	2.30	0.00	2.30	0.88	0.183	1.33	0.137	0.84	1.30	2.000	No
222	36.58	2.31	0.00	2.31	0.88	0.183	1.33	0.137	0.84	1.30	2.000	No
223	36.75	2.32	0.00	2.32	0.88	0.183	1.33	0.137	0.83	1.30	2.000	No
224	36.91	2.33	0.00	2.33	0.88	0.182	1.33	0.137	0.83	1.30	2.000	No
225	37.08	2.34	0.00	2.34	0.88	0.182	1.33	0.136	0.83	1.30	2.000	No
226	37.24	2.35	0.00	2.35	0.87	0.182	1.33	0.136	0.83	1.30	2.000	No
227	37.40	2.36	0.00	2.36	0.87	0.182	1.33	0.136	0.83	1.30	2.000	No
228	37.57	2.37	0.00	2.37	0.87	0.181	1.33	0.136	0.83	1.30	2.000	No
229	37.73	2.38	0.00	2.38	0.87	0.181	1.33	0.136	0.83	1.30	2.000	No
230	37.90	2.40	0.00	2.40	0.87	0.181	1.33	0.135	0.83	1.30	2.000	No
231	38.06	2.41	0.00	2.41	0.87	0.180	1.33	0.135	0.83	1.30	2.000	No
232	38.22	2.42	0.00	2.42	0.87	0.180	1.33	0.135	0.83	1.30	2.000	No
233	38.39	2.43	0.00	2.43	0.86	0.180	1.33	0.135	0.83	1.30	2.000	No
234	38.55	2.44	0.00	2.44	0.86	0.180	1.33	0.135	0.83	1.30	2.000	No
235	38.72	2.45	0.00	2.45	0.86	0.179	1.33	0.134	0.82	1.30	2.000	No
236	38.88	2.46	0.00	2.46	0.86	0.179	1.33	0.134	0.82	1.30	2.000	No
237	39.04	2.47	0.00	2.47	0.86	0.179	1.33	0.134	0.82	1.30	2.000	No
238	39.21	2.48	0.00	2.48	0.86	0.178	1.33	0.134	0.82	1.30	2.000	No
239	39.37	2.49	0.00	2.49	0.86	0.178	1.33	0.134	0.82	1.30	2.000	No
240	39.54	2.50	0.00	2.50	0.86	0.178	1.33	0.133	0.82	1.30	2.000	No

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

Point ID	Depth (ft)	σ_v (tsf)	u_0 (tsf)	σ_v' (tsf)	r_d	CSR	MSF	CSR_{eq}	K_σ	User FS	CSR^*	Belongs to transition
241	39.70	2.51	0.00	2.51	0.85	0.178	1.33	0.133	0.82	1.30	2.000	No
242	39.86	2.52	0.00	2.52	0.85	0.177	1.33	0.133	0.82	1.30	2.000	No
243	40.03	2.53	0.00	2.53	0.85	0.177	1.33	0.133	0.82	1.30	2.000	No
244	40.19	2.54	0.00	2.54	0.85	0.177	1.33	0.132	0.82	1.30	2.000	No
245	40.36	2.55	0.00	2.55	0.85	0.176	1.33	0.132	0.82	1.30	2.000	No
246	40.52	2.56	0.00	2.56	0.85	0.176	1.33	0.132	0.82	1.30	2.000	No
247	40.68	2.57	0.00	2.57	0.84	0.176	1.33	0.132	0.82	1.30	2.000	No
248	40.85	2.59	0.00	2.59	0.84	0.175	1.33	0.131	0.81	1.30	2.000	No
249	41.01	2.60	0.00	2.60	0.84	0.175	1.33	0.131	0.81	1.30	2.000	No
250	41.18	2.61	0.00	2.61	0.84	0.175	1.33	0.131	0.81	1.30	2.000	No
251	41.34	2.62	0.00	2.62	0.84	0.175	1.33	0.131	0.81	1.30	2.000	No
252	41.50	2.63	0.00	2.63	0.84	0.174	1.33	0.131	0.81	1.30	2.000	No
253	41.67	2.64	0.00	2.64	0.84	0.174	1.33	0.130	0.81	1.30	2.000	No
254	41.83	2.65	0.00	2.65	0.83	0.174	1.33	0.130	0.81	1.30	2.000	No
255	42.00	2.66	0.00	2.66	0.83	0.173	1.33	0.130	0.81	1.30	2.000	No
256	42.16	2.67	0.00	2.67	0.83	0.173	1.33	0.130	0.81	1.30	2.000	No
257	42.32	2.68	0.00	2.68	0.83	0.173	1.33	0.129	0.81	1.30	2.000	No
258	42.49	2.69	0.00	2.69	0.83	0.172	1.33	0.129	0.81	1.30	2.000	No
259	42.65	2.70	0.00	2.70	0.83	0.172	1.33	0.129	0.81	1.30	2.000	No
260	42.82	2.71	0.00	2.71	0.83	0.172	1.33	0.129	0.81	1.30	2.000	No
261	42.98	2.72	0.00	2.72	0.82	0.171	1.33	0.128	0.80	1.30	2.000	No
262	43.15	2.73	0.00	2.73	0.82	0.171	1.33	0.128	0.80	1.30	2.000	No
263	43.31	2.75	0.00	2.75	0.82	0.171	1.33	0.128	0.80	1.30	2.000	No
264	43.47	2.76	0.00	2.76	0.82	0.170	1.33	0.128	0.80	1.30	2.000	No
265	43.64	2.77	0.00	2.77	0.82	0.170	1.33	0.127	0.80	1.30	2.000	No
266	43.80	2.78	0.00	2.78	0.82	0.170	1.33	0.127	0.80	1.30	2.000	No
267	43.97	2.79	0.00	2.79	0.81	0.169	1.33	0.127	0.80	1.30	2.000	No
268	44.13	2.80	0.00	2.80	0.81	0.169	1.33	0.127	0.80	1.30	2.000	No
269	44.29	2.81	0.00	2.81	0.81	0.169	1.33	0.126	0.80	1.30	2.000	No
270	44.46	2.82	0.00	2.82	0.81	0.168	1.33	0.126	0.80	1.30	2.000	No
271	44.62	2.83	0.00	2.83	0.81	0.168	1.33	0.126	0.80	1.30	2.000	No
272	44.79	2.84	0.00	2.84	0.81	0.168	1.33	0.126	0.80	1.30	2.000	No
273	44.95	2.86	0.00	2.86	0.80	0.167	1.33	0.125	0.80	1.30	2.000	No
274	45.11	2.87	0.00	2.86	0.80	0.167	1.33	0.125	0.80	1.30	0.205	No
275	45.28	2.88	0.01	2.87	0.80	0.167	1.33	0.125	0.80	1.30	0.205	No
276	45.44	2.89	0.01	2.87	0.80	0.167	1.33	0.125	0.79	1.30	0.205	No
277	45.61	2.90	0.02	2.88	0.80	0.167	1.33	0.125	0.79	1.30	0.205	No
278	45.77	2.91	0.02	2.89	0.80	0.167	1.33	0.125	0.79	1.30	0.205	No
279	45.93	2.92	0.03	2.89	0.79	0.167	1.33	0.125	0.79	1.30	0.205	No
280	46.10	2.93	0.03	2.90	0.79	0.167	1.33	0.125	0.79	1.30	0.205	No
281	46.26	2.94	0.04	2.91	0.79	0.167	1.33	0.125	0.79	1.30	0.205	No
282	46.43	2.96	0.04	2.91	0.79	0.167	1.33	0.125	0.79	1.30	0.205	No
283	46.59	2.97	0.05	2.92	0.79	0.167	1.33	0.125	0.79	1.30	0.205	No
284	46.75	2.98	0.05	2.92	0.79	0.167	1.33	0.125	0.79	1.30	0.205	No
285	46.92	2.99	0.06	2.93	0.78	0.166	1.33	0.125	0.79	1.30	0.205	No
286	47.08	3.00	0.06	2.93	0.78	0.166	1.33	0.125	0.79	1.30	0.205	No
287	47.25	3.01	0.07	2.94	0.78	0.166	1.33	0.125	0.79	1.30	0.205	No
288	47.41	3.02	0.08	2.94	0.78	0.166	1.33	0.125	0.79	1.30	0.205	No

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

Point ID	Depth (ft)	σ_v (tsf)	u_0 (tsf)	σ_v' (tsf)	r_d	CSR	MSF	CSR_{eq}	K_σ	User FS	CSR^*	Belongs to transition
289	47.57	3.03	0.08	2.95	0.78	0.166	1.33	0.125	0.79	1.30	0.205	No
290	47.74	3.04	0.09	2.95	0.78	0.166	1.33	0.124	0.79	1.30	0.205	No
291	47.90	3.05	0.09	2.96	0.77	0.166	1.33	0.124	0.79	1.30	0.205	No
292	48.07	3.06	0.10	2.96	0.77	0.166	1.33	0.124	0.79	1.30	0.205	No
293	48.23	3.07	0.10	2.97	0.77	0.166	1.33	0.124	0.79	1.30	0.205	No
294	48.39	3.08	0.11	2.97	0.77	0.166	1.33	0.124	0.79	1.30	0.205	No
295	48.56	3.09	0.11	2.98	0.77	0.166	1.33	0.124	0.79	1.30	0.205	No
296	48.72	3.10	0.12	2.99	0.77	0.165	1.33	0.124	0.79	1.30	0.205	No
297	48.89	3.11	0.12	2.99	0.76	0.165	1.33	0.124	0.79	1.30	0.205	No
298	49.05	3.12	0.13	3.00	0.76	0.165	1.33	0.124	0.79	1.30	0.205	No
299	49.22	3.13	0.13	3.00	0.76	0.165	1.33	0.124	0.79	1.30	0.205	No
300	49.38	3.15	0.14	3.01	0.76	0.165	1.33	0.124	0.79	1.30	0.205	No
301	49.54	3.16	0.14	3.01	0.76	0.165	1.33	0.124	0.79	1.30	0.204	No
302	49.71	3.17	0.15	3.02	0.76	0.165	1.33	0.124	0.79	1.30	0.204	No
303	49.87	3.18	0.15	3.03	0.75	0.165	1.33	0.123	0.79	1.30	0.204	No
304	50.04	3.19	0.16	3.03	0.75	0.165	1.33	0.123	0.78	1.30	0.204	No
305	50.20	3.20	0.16	3.04	0.75	0.164	1.33	0.123	0.78	1.30	0.204	No

Abbreviations

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

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

Point ID	Depth (ft)	q_t (tsf)	I_c	Fr (%)	n	Q_{tn}	K_c	$Q_{tn,cs}$	$CRR_{7.5}$	Belongs to trans. layer	Clay-like behaviour	FS
1	0.33	201.98	1.15	0.26	0.50	324.48	1.00	324.48	4.000	No	No	2.00
2	0.49	149.81	1.35	0.38	0.50	240.65	1.00	240.65	4.000	No	No	2.00
3	0.66	91.21	1.65	0.62	0.50	146.48	1.00	147.15	4.000	No	No	2.00
4	0.82	57.71	1.91	0.92	0.60	92.64	1.20	111.46	4.000	No	No	2.00
5	0.98	41.14	2.10	1.22	0.68	66.01	1.46	96.53	4.000	No	No	2.00
6	1.15	30.34	2.27	1.54	0.74	48.64	1.86	90.55	4.000	No	No	2.00
7	1.31	27.84	2.28	1.44	0.75	44.61	1.90	84.63	4.000	No	No	2.00
8	1.48	25.78	2.26	1.17	0.74	41.28	1.82	75.09	4.000	No	No	2.00
9	1.64	23.14	2.23	0.87	0.72	37.03	1.73	64.22	4.000	No	No	2.00
10	1.80	20.30	2.22	0.66	0.72	32.45	1.71	55.52	4.000	No	No	2.00
11	1.97	18.76	2.21	0.54	0.72	29.97	1.69	50.53	4.000	No	No	2.00
12	2.13	17.66	2.24	0.57	0.73	28.19	1.78	50.16	4.000	No	No	2.00
13	2.30	16.29	2.29	0.62	0.75	25.97	1.92	49.86	4.000	No	No	2.00
14	2.46	14.73	2.35	0.69	0.77	23.44	2.12	49.73	4.000	No	No	2.00
15	2.62	13.96	2.38	0.72	0.78	22.20	2.24	49.76	4.000	No	No	2.00
16	2.79	13.89	2.39	0.73	0.78	22.08	2.25	49.77	4.000	No	No	2.00
17	2.95	14.09	2.38	0.72	0.78	22.39	2.22	49.75	4.000	No	No	2.00
18	3.12	14.03	2.38	0.72	0.78	22.27	2.23	49.76	4.000	No	No	2.00
19	3.28	13.29	2.41	0.76	0.79	21.07	2.37	49.84	4.000	No	No	2.00
20	3.45	12.56	2.37	0.54	0.78	19.88	2.20	43.68	4.000	No	No	2.00
21	3.61	12.36	2.38	0.55	0.78	19.55	2.23	43.68	4.000	No	No	2.00
22	3.77	12.76	2.36	0.53	0.78	20.19	2.16	43.69	4.000	No	No	2.00
23	3.94	13.40	2.41	0.76	0.79	21.20	2.35	49.83	4.000	No	No	2.00
24	4.10	15.10	2.40	0.90	0.79	23.91	2.30	55.05	4.000	No	No	2.00
25	4.27	16.23	2.40	1.04	0.79	25.72	2.32	59.78	4.000	No	No	2.00
26	4.43	17.53	2.36	0.96	0.77	27.79	2.14	59.60	4.000	No	No	2.00
27	4.59	18.20	2.29	0.74	0.75	28.85	1.91	55.01	4.000	No	No	2.00
28	4.76	19.63	2.19	0.52	0.71	31.14	1.63	50.83	4.000	Yes	No	2.00
29	4.92	18.63	2.32	0.91	0.76	29.52	2.02	59.56	4.000	Yes	No	2.00
30	5.09	16.34	2.48	1.45	0.82	25.81	2.66	68.80	4.000	Yes	No	2.00
31	5.25	15.04	2.59	2.03	0.86	23.71	3.28	77.89	4.000	Yes	No	2.00
32	5.41	20.90	2.44	1.78	0.81	33.13	2.49	82.54	4.000	Yes	No	2.00
33	5.58	32.57	2.27	1.65	0.74	51.86	1.85	96.11	4.000	Yes	No	2.00
34	5.74	45.24	2.19	1.85	0.71	72.19	1.65	119.21	4.000	Yes	No	2.00
35	5.91	53.24	2.17	2.02	0.70	85.03	1.59	135.20	4.000	No	No	2.00
36	6.07	57.27	2.15	2.05	0.69	91.50	1.55	142.02	4.000	No	No	2.00
37	6.23	62.37	2.07	1.72	0.66	99.68	1.40	139.77	4.000	No	No	2.00
38	6.40	71.31	1.94	1.27	0.61	114.01	1.22	139.62	4.000	No	No	2.00
39	6.56	79.04	1.81	0.93	0.57	126.42	1.12	141.11	4.000	No	No	2.00
40	6.73	81.74	1.74	0.74	0.54	130.74	1.06	138.90	4.000	No	No	2.00
41	6.89	77.74	1.72	0.65	0.53	124.30	1.05	130.57	4.000	No	No	2.00
42	7.05	71.74	1.71	0.56	0.53	114.65	1.05	119.85	4.000	No	No	2.00
43	7.22	66.61	1.71	0.50	0.53	105.84	1.05	110.87	4.000	No	No	2.00
44	7.38	63.31	1.72	0.48	0.53	99.72	1.00	99.72	4.000	No	No	2.00
45	7.55	61.31	1.72	0.44	0.53	95.31	1.00	95.31	4.000	No	No	2.00
46	7.71	59.67	1.71	0.39	0.53	91.50	1.00	91.50	4.000	No	No	2.00
47	7.87	57.74	1.71	0.35	0.53	87.38	1.00	87.38	4.000	No	No	2.00
48	8.04	55.64	1.73	0.36	0.54	83.88	1.00	83.88	4.000	No	No	2.00

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

Point ID	Depth (ft)	q_t (tsf)	I_c	Fr (%)	n	Q_{tn}	K_c	$Q_{tn,cs}$	$CRR_{7.5}$	Belongs to trans. layer	Clay-like behaviour	FS
49	8.20	53.47	1.73	0.31	0.53	79.49	1.00	79.49	4.000	No	No	2.00
50	8.37	52.07	1.74	0.32	0.54	76.98	1.00	76.98	4.000	No	No	2.00
51	8.53	51.64	1.75	0.33	0.54	75.75	1.00	75.75	4.000	No	No	2.00
52	8.69	51.48	1.82	0.46	0.57	76.23	1.00	76.23	4.000	No	No	2.00
53	8.86	51.64	1.84	0.52	0.58	76.25	1.14	86.92	4.000	No	No	2.00
54	9.02	52.14	1.87	0.58	0.59	76.68	1.16	88.82	4.000	No	No	2.00
55	9.19	53.08	1.86	0.57	0.58	77.05	1.15	88.87	4.000	No	No	2.00
56	9.35	53.31	1.86	0.57	0.58	76.61	1.15	88.43	4.000	No	No	2.00
57	9.51	52.08	1.85	0.52	0.58	73.90	1.15	84.85	4.000	No	No	2.00
58	9.68	49.78	1.86	0.47	0.58	69.91	1.00	69.91	4.000	No	No	2.00
59	9.84	47.84	1.85	0.42	0.58	66.45	1.00	66.45	4.000	No	No	2.00
60	10.01	47.44	1.89	0.50	0.59	65.84	1.00	65.84	4.000	No	No	2.00
61	10.17	49.51	1.92	0.61	0.61	68.58	1.21	82.82	4.000	No	No	2.00
62	10.34	54.84	1.95	0.80	0.62	75.74	1.24	93.63	4.000	No	No	2.00
63	10.50	64.88	1.93	0.93	0.61	88.53	1.22	108.12	4.000	No	No	2.00
64	10.66	83.01	1.88	1.01	0.59	110.97	1.17	129.78	4.000	No	No	2.00
65	10.83	106.84	1.84	1.13	0.57	140.21	1.13	158.98	4.000	No	No	2.00
66	10.99	137.75	1.76	1.12	0.55	176.42	1.08	190.54	4.000	No	No	2.00
67	11.16	175.05	1.71	1.17	0.53	219.84	1.05	229.79	4.000	No	No	2.00
68	11.32	216.82	1.72	1.43	0.53	270.73	1.05	285.30	4.000	No	No	2.00
69	11.48	278.12	1.79	2.07	0.56	349.00	1.10	384.56	4.000	No	No	2.00
70	11.65	353.79	1.90	3.12	0.60	448.56	1.19	533.24	4.000	No	No	2.00
71	11.81	366.61	2.05	4.67	0.66	472.88	1.37	648.41	4.000	No	No	2.00
72	11.98	389.91	2.11	5.56	0.68	502.48	1.47	740.22	4.000	No	No	2.00
73	12.14	351.65	2.18	6.36	0.71	453.49	1.62	735.38	4.000	No	No	2.00
74	12.30	342.37	2.16	5.97	0.70	435.18	1.58	687.19	4.000	No	No	2.00
75	12.47	274.20	2.22	6.20	0.72	347.24	1.71	593.45	4.000	No	No	2.00
76	12.63	220.07	2.25	6.02	0.73	276.71	1.79	496.19	4.000	No	No	2.00
77	12.80	179.50	2.26	5.50	0.74	223.18	1.82	406.70	4.000	No	No	2.00
78	12.96	152.16	2.26	4.97	0.74	187.01	1.83	341.87	4.000	No	No	2.00
79	13.12	139.58	2.24	4.42	0.73	169.18	1.77	299.85	4.000	No	No	2.00
80	13.29	133.09	2.21	3.93	0.72	158.94	1.70	270.46	4.000	No	No	2.00
81	13.45	129.07	2.19	3.59	0.71	152.16	1.65	250.86	4.000	No	No	2.00
82	13.62	128.31	2.17	3.35	0.70	149.35	1.60	239.46	4.000	No	No	2.00
83	13.78	130.72	2.16	3.21	0.70	150.44	1.57	235.68	4.000	No	No	2.00
84	13.94	134.50	2.14	3.14	0.69	153.18	1.54	236.12	4.000	No	No	2.00
85	14.11	142.09	2.17	3.52	0.70	160.73	1.60	257.19	4.000	No	No	2.00
86	14.27	158.47	2.21	4.25	0.72	178.39	1.70	303.56	4.000	No	No	2.00
87	14.44	183.25	2.25	5.15	0.73	205.06	1.81	370.23	4.000	No	No	2.00
88	14.60	204.62	2.28	5.92	0.74	227.45	1.89	430.60	4.000	No	No	2.00
89	14.76	214.11	2.31	6.47	0.75	236.24	1.98	466.61	4.000	No	No	2.00
90	14.93	225.57	2.29	6.29	0.75	246.04	1.91	470.84	4.000	No	No	2.00
91	15.09	220.53	2.28	6.02	0.74	238.10	1.88	448.55	4.000	No	No	2.00
92	15.26	212.86	2.28	5.91	0.74	227.57	1.89	430.36	4.000	No	No	2.00
93	15.42	201.30	2.33	6.42	0.76	213.77	2.04	435.10	4.000	No	No	2.00
94	15.58	206.00	2.29	5.92	0.75	216.36	1.93	416.55	4.000	No	No	2.00
95	15.75	214.01	2.25	5.40	0.73	222.22	1.80	400.99	4.000	No	No	2.00
96	15.91	217.44	2.22	4.99	0.72	223.51	1.72	384.61	4.000	No	No	2.00

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

Point ID	Depth (ft)	q_t (tsf)	I_c	Fr (%)	n	Q_{tn}	K_c	$Q_{tn,cs}$	$CRR_{7.5}$	Belongs to trans. layer	Clay-like behaviour	FS
97	16.08	217.68	2.25	5.35	0.73	222.01	1.80	398.80	4.000	No	No	2.00
98	16.24	212.70	2.27	5.51	0.74	215.22	1.85	397.54	4.000	No	No	2.00
99	16.40	221.13	2.21	4.78	0.72	221.47	1.69	373.40	4.000	No	No	2.00
100	16.57	238.84	2.11	3.85	0.68	236.59	1.48	349.62	4.000	No	No	2.00
101	16.73	254.28	2.02	3.08	0.64	249.45	1.32	330.16	4.000	No	No	2.00
102	16.90	249.33	1.96	2.62	0.62	242.48	1.26	304.72	4.000	No	No	2.00
103	17.06	233.55	1.92	2.18	0.61	225.37	1.21	271.70	4.000	No	No	2.00
104	17.23	218.53	1.83	1.59	0.57	209.19	1.13	236.02	4.000	No	No	2.00
105	17.39	202.74	1.74	1.12	0.54	192.74	1.06	204.91	4.000	No	No	2.00
106	17.55	184.88	1.68	0.85	0.52	174.72	1.03	179.26	4.000	No	No	2.00
107	17.72	164.68	1.72	0.86	0.53	154.70	1.05	162.92	4.000	No	No	2.00
108	17.88	146.19	1.78	0.90	0.55	136.50	1.09	148.77	4.000	No	No	2.00
109	18.05	131.43	1.83	0.95	0.57	121.90	1.13	137.57	4.000	No	No	2.00
110	18.21	125.56	1.86	0.99	0.58	115.76	1.15	133.44	4.000	No	No	2.00
111	18.37	124.60	1.87	1.03	0.59	114.23	1.16	133.05	4.000	No	No	2.00
112	18.54	127.50	1.88	1.08	0.59	116.22	1.17	136.35	4.000	No	No	2.00
113	18.70	133.83	1.86	1.05	0.58	121.44	1.15	140.23	4.000	No	No	2.00
114	18.87	144.03	1.86	1.12	0.58	130.06	1.15	149.69	4.000	No	No	2.00
115	19.03	159.43	1.91	1.45	0.60	143.10	1.20	171.14	4.000	No	No	2.00
116	19.19	186.47	1.99	2.14	0.63	166.16	1.29	214.14	4.000	No	No	2.00
117	19.36	214.43	2.08	3.05	0.67	189.41	1.42	268.85	4.000	No	No	2.00
118	19.52	231.64	2.14	3.75	0.69	202.94	1.53	309.83	4.000	No	No	2.00
119	19.69	238.97	2.25	5.17	0.73	206.94	1.80	373.28	4.000	No	No	2.00
120	19.85	238.96	2.31	6.08	0.76	204.93	2.00	409.34	4.000	No	No	2.00
121	20.01	282.99	2.27	5.88	0.74	241.78	1.85	446.41	4.000	No	No	2.00
122	20.18	359.88	2.12	4.54	0.68	308.00	1.49	458.26	4.000	No	No	2.00
123	20.34	483.41	1.95	3.38	0.62	415.60	1.23	513.09	4.000	No	No	2.00
124	20.51	558.79	1.86	2.90	0.58	480.30	1.15	553.13	4.000	No	No	2.00
125	20.67	595.90	1.82	2.74	0.57	510.75	1.12	574.27	4.000	No	No	2.00
126	20.83	585.39	1.85	2.86	0.58	498.46	1.14	569.31	4.000	No	No	2.00
127	21.00	576.12	1.87	3.03	0.59	487.04	1.16	566.84	4.000	No	No	2.00
128	21.16	542.84	1.91	3.21	0.60	455.31	1.20	544.84	4.000	No	No	2.00
129	21.33	478.92	1.92	3.11	0.61	398.98	1.21	482.46	4.000	No	No	2.00
130	21.49	403.30	2.01	3.58	0.64	331.64	1.32	436.51	4.000	No	No	2.00
131	21.65	376.29	2.08	4.09	0.67	305.97	1.42	434.04	4.000	No	No	2.00
132	21.82	349.84	2.20	5.35	0.71	279.74	1.67	466.57	4.000	No	No	2.00
133	21.98	333.91	2.24	5.68	0.73	264.55	1.76	464.94	4.000	No	No	2.00
134	22.15	303.74	2.27	5.91	0.74	238.21	1.86	443.36	4.000	No	No	2.00
135	22.31	317.27	2.18	4.80	0.71	249.50	1.63	405.82	4.000	No	No	2.00
136	22.47	335.09	2.08	3.81	0.67	264.71	1.42	377.08	4.000	No	No	2.00
137	22.64	342.05	2.00	3.05	0.64	271.13	1.29	350.80	4.000	No	No	2.00
138	22.80	342.60	1.98	2.94	0.63	270.59	1.28	345.53	4.000	No	No	2.00
139	22.97	335.55	2.01	3.08	0.64	262.91	1.31	343.80	4.000	No	No	2.00
140	23.13	315.67	2.04	3.28	0.65	244.96	1.36	333.85	4.000	No	No	2.00
141	23.30	287.84	2.08	3.35	0.67	221.26	1.41	312.80	4.000	No	No	2.00
142	23.46	280.42	2.05	3.06	0.66	215.09	1.37	294.90	4.000	No	No	2.00
143	23.62	289.95	1.99	2.68	0.63	222.85	1.29	287.94	4.000	No	No	2.00
144	23.79	306.78	1.94	2.38	0.61	236.32	1.23	289.64	4.000	No	No	2.00

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

Point ID	Depth (ft)	q_t (tsf)	I_c	Fr (%)	n	Q_{tn}	K_c	$Q_{tn,cs}$	$CRR_{7.5}$	Belongs to trans. layer	Clay-like behaviour	FS
145	23.95	312.15	1.92	2.27	0.61	239.98	1.21	289.21	4.000	No	No	2.00
146	24.12	317.41	1.91	2.24	0.60	243.16	1.20	290.85	4.000	No	No	2.00
147	24.28	314.51	1.93	2.33	0.61	239.25	1.21	290.67	4.000	No	No	2.00
148	24.44	302.47	1.96	2.50	0.62	227.86	1.26	286.09	4.000	No	No	2.00
149	24.61	254.49	2.07	2.91	0.66	187.95	1.40	262.34	4.000	No	No	2.00
150	24.77	207.68	2.15	3.19	0.70	150.54	1.56	235.02	4.000	No	No	2.00
151	24.94	183.55	2.18	3.10	0.71	131.74	1.62	213.12	4.000	No	No	2.00
152	25.10	199.66	2.08	2.47	0.67	144.84	1.42	205.04	4.000	No	No	2.00
153	25.26	223.82	1.98	2.05	0.63	164.10	1.28	209.37	4.000	No	No	2.00
154	25.43	237.55	1.93	1.86	0.61	174.75	1.22	213.11	4.000	No	No	2.00
155	25.59	238.22	1.93	1.83	0.61	174.67	1.21	211.95	4.000	No	No	2.00
156	25.76	226.48	1.96	1.94	0.62	164.33	1.25	205.90	4.000	No	No	2.00
157	25.92	211.44	1.99	1.97	0.63	152.05	1.28	195.35	4.000	No	No	2.00
158	26.08	201.57	1.99	1.90	0.63	144.21	1.29	185.86	4.000	No	No	2.00
159	26.25	201.64	1.96	1.72	0.62	144.42	1.25	180.33	4.000	No	No	2.00
160	26.41	203.70	1.94	1.65	0.62	145.69	1.23	179.44	4.000	No	No	2.00
161	26.58	205.43	1.93	1.62	0.61	146.50	1.22	179.26	4.000	No	No	2.00
162	26.74	206.86	1.92	1.58	0.61	147.21	1.21	178.57	4.000	No	No	2.00
163	26.90	207.65	1.93	1.60	0.61	147.06	1.22	179.24	4.000	No	No	2.00
164	27.07	205.05	1.95	1.69	0.62	144.01	1.24	179.09	4.000	No	No	2.00
165	27.23	197.09	1.97	1.72	0.63	137.32	1.27	174.02	4.000	No	No	2.00
166	27.40	194.12	1.97	1.66	0.62	134.82	1.26	169.90	4.000	No	No	2.00
167	27.56	200.09	1.93	1.53	0.61	139.40	1.22	170.05	4.000	No	No	2.00
168	27.72	215.12	1.90	1.48	0.60	150.29	1.19	178.60	4.000	No	No	2.00
169	27.89	226.02	1.89	1.50	0.59	157.65	1.18	185.84	4.000	No	No	2.00
170	28.05	230.88	1.89	1.53	0.60	160.47	1.18	189.22	4.000	No	No	2.00
171	28.22	228.31	1.90	1.54	0.60	157.80	1.19	187.31	4.000	No	No	2.00
172	28.38	225.71	1.90	1.55	0.60	155.25	1.19	185.08	4.000	No	No	2.00
173	28.54	225.81	1.91	1.56	0.60	154.63	1.20	184.95	4.000	No	No	2.00
174	28.71	226.21	1.92	1.63	0.61	153.82	1.21	186.41	4.000	No	No	2.00
175	28.87	224.28	1.94	1.71	0.62	151.35	1.23	186.44	4.000	No	No	2.00
176	29.04	216.65	1.97	1.80	0.63	144.69	1.27	183.16	4.000	No	No	2.00
177	29.20	206.98	2.00	1.85	0.64	136.95	1.30	177.64	4.000	No	No	2.00
178	29.36	199.04	2.02	1.91	0.65	130.50	1.33	173.49	4.000	No	No	2.00
179	29.53	195.68	2.03	1.89	0.65	127.67	1.33	170.33	4.000	No	No	2.00
180	29.69	193.04	2.03	1.90	0.65	125.27	1.34	168.39	4.000	No	No	2.00
181	29.86	188.68	2.04	1.91	0.65	121.66	1.36	165.35	4.000	No	No	2.00
182	30.02	181.24	2.07	1.99	0.66	115.67	1.40	162.28	4.000	No	No	2.00
183	30.19	175.71	2.09	2.05	0.67	111.11	1.44	160.03	4.000	No	No	2.00
184	30.35	172.30	2.10	2.07	0.68	108.25	1.46	158.06	4.000	No	No	2.00
185	30.51	173.47	2.10	2.08	0.68	108.58	1.46	158.53	4.000	No	No	2.00
186	30.68	178.37	2.07	1.93	0.66	112.09	1.40	157.14	4.000	No	No	2.00
187	30.84	188.30	2.02	1.77	0.65	119.19	1.33	158.90	4.000	No	No	2.00
188	31.01	199.81	1.96	1.53	0.62	128.04	1.25	159.85	4.000	No	No	2.00
189	31.17	211.41	1.91	1.42	0.60	136.49	1.20	164.06	4.000	No	No	2.00
190	31.33	221.04	1.89	1.35	0.59	143.26	1.18	168.34	4.000	No	No	2.00
191	31.50	224.93	1.89	1.41	0.60	145.03	1.18	171.47	4.000	No	No	2.00
192	31.66	228.12	1.90	1.44	0.60	146.43	1.19	173.90	4.000	No	No	2.00

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

Point ID	Depth (ft)	q_t (tsf)	I_c	Fr (%)	n	Q_{tn}	K_c	$Q_{tn,cs}$	$CRR_{7.5}$	Belongs to trans. layer	Clay-like behaviour	FS
193	31.83	229.57	1.89	1.42	0.60	147.10	1.18	173.80	4.000	No	No	2.00
194	31.99	234.01	1.87	1.36	0.59	150.18	1.16	174.92	4.000	No	No	2.00
195	32.15	235.81	1.86	1.33	0.58	151.30	1.16	174.75	4.000	No	No	2.00
196	32.32	233.88	1.87	1.34	0.59	149.31	1.16	173.29	4.000	No	No	2.00
197	32.48	231.28	1.88	1.37	0.59	146.74	1.17	171.86	4.000	No	No	2.00
198	32.65	227.98	1.90	1.42	0.60	143.50	1.19	170.40	4.000	No	No	2.00
199	32.81	226.58	1.91	1.45	0.60	141.73	1.20	169.95	4.000	No	No	2.00
200	32.97	226.78	1.91	1.44	0.60	141.52	1.20	169.28	4.000	No	No	2.00
201	33.14	226.49	1.89	1.35	0.59	141.59	1.18	166.76	4.000	No	No	2.00
202	33.30	224.99	1.87	1.27	0.59	140.85	1.16	163.72	4.000	No	No	2.00
203	33.47	216.55	1.88	1.24	0.59	134.86	1.17	157.54	4.000	No	No	2.00
204	33.63	201.39	1.91	1.29	0.60	123.72	1.20	148.84	4.000	No	No	2.00
205	33.79	185.65	1.95	1.31	0.62	112.58	1.24	139.45	4.000	No	No	2.00
206	33.96	177.32	1.94	1.22	0.62	107.28	1.23	132.23	4.000	No	No	2.00
207	34.12	179.49	1.92	1.13	0.61	109.09	1.20	131.34	4.000	No	No	2.00
208	34.29	183.52	1.89	1.05	0.59	112.15	1.18	131.83	4.000	No	No	2.00
209	34.45	183.09	1.89	1.07	0.60	111.31	1.18	131.67	4.000	No	No	2.00
210	34.61	181.28	1.90	1.06	0.60	109.81	1.19	130.14	4.000	No	No	2.00
211	34.78	182.28	1.90	1.07	0.60	110.00	1.19	130.65	4.000	No	No	2.00
212	34.94	187.41	1.89	1.08	0.60	113.04	1.18	133.51	4.000	No	No	2.00
213	35.11	197.71	1.88	1.09	0.59	119.47	1.17	139.50	4.000	No	No	2.00
214	35.27	210.35	1.86	1.11	0.58	127.45	1.15	146.96	4.000	No	No	2.00
215	35.43	223.12	1.84	1.12	0.58	135.52	1.14	154.46	4.000	No	No	2.00
216	35.60	228.72	1.84	1.15	0.58	138.50	1.14	158.01	4.000	No	No	2.00
217	35.76	230.72	1.85	1.18	0.58	139.04	1.15	159.48	4.000	No	No	2.00
218	35.93	229.95	1.86	1.20	0.58	137.87	1.15	158.98	4.000	No	No	2.00
219	36.09	232.32	1.85	1.19	0.58	139.17	1.15	159.78	4.000	No	No	2.00
220	36.26	235.02	1.85	1.17	0.58	140.69	1.14	160.73	4.000	No	No	2.00
221	36.42	236.79	1.85	1.18	0.58	141.38	1.14	161.51	4.000	No	No	2.00
222	36.58	233.93	1.86	1.19	0.58	138.89	1.15	159.72	4.000	No	No	2.00
223	36.75	228.53	1.87	1.21	0.59	134.75	1.16	156.42	4.000	No	No	2.00
224	36.91	226.69	1.87	1.19	0.59	133.37	1.16	154.62	4.000	No	No	2.00
225	37.08	223.56	1.87	1.18	0.59	131.05	1.16	152.17	4.000	No	No	2.00
226	37.24	221.00	1.85	1.10	0.58	129.87	1.15	148.90	4.000	No	No	2.00
227	37.40	218.26	1.84	1.05	0.58	128.27	1.14	146.11	4.000	No	No	2.00
228	37.57	218.40	1.82	0.99	0.57	128.75	1.12	144.75	4.000	No	No	2.00
229	37.73	215.60	1.83	0.98	0.57	126.58	1.13	142.77	4.000	No	No	2.00
230	37.90	214.20	1.83	0.98	0.57	125.40	1.13	141.47	4.000	No	No	2.00
231	38.06	211.43	1.84	0.99	0.58	123.07	1.14	139.79	4.000	No	No	2.00
232	38.22	208.60	1.85	1.00	0.58	120.71	1.14	138.10	4.000	No	No	2.00
233	38.39	201.67	1.87	1.02	0.59	115.63	1.16	134.15	4.000	No	No	2.00
234	38.55	198.93	1.88	1.03	0.59	113.38	1.17	132.56	4.000	No	No	2.00
235	38.72	202.67	1.87	1.03	0.59	115.47	1.16	134.33	4.000	No	No	2.00
236	38.88	209.04	1.86	1.02	0.58	119.43	1.15	137.38	4.000	No	No	2.00
237	39.04	213.94	1.83	0.96	0.57	122.97	1.13	138.94	4.000	No	No	2.00
238	39.21	215.01	1.82	0.93	0.57	123.79	1.12	138.63	4.000	No	No	2.00
239	39.37	213.21	1.82	0.92	0.57	122.40	1.12	137.19	4.000	No	No	2.00
240	39.54	205.97	1.85	0.97	0.58	116.73	1.14	133.61	4.000	No	No	2.00

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

Point ID	Depth (ft)	q_t (tsf)	I_c	Fr (%)	n	Q_{tn}	K_c	$Q_{tn,cs}$	$CRR_{7.5}$	Belongs to trans. layer	Clay-like behaviour	FS
241	39.70	198.17	1.89	1.04	0.59	110.57	1.18	130.21	4.000	No	No	2.00
242	39.86	194.96	1.90	1.06	0.60	108.05	1.19	128.47	4.000	No	No	2.00
243	40.03	196.63	1.88	1.01	0.59	109.26	1.17	128.35	4.000	No	No	2.00
244	40.19	201.46	1.85	0.94	0.58	112.92	1.15	129.50	4.000	No	No	2.00
245	40.36	203.39	1.85	0.93	0.58	113.95	1.14	130.15	4.000	No	No	2.00
246	40.52	204.36	1.86	0.96	0.58	113.89	1.15	130.89	4.000	No	No	2.00
247	40.68	204.63	1.87	1.01	0.59	113.16	1.16	131.58	4.000	No	No	2.00
248	40.85	211.40	1.85	0.99	0.58	117.31	1.15	134.77	4.000	No	No	2.00
249	41.01	224.16	1.82	0.96	0.57	125.46	1.13	141.15	4.000	No	No	2.00
250	41.18	234.29	1.80	0.95	0.56	131.77	1.11	146.28	4.000	No	No	2.00
251	41.34	234.36	1.82	0.99	0.57	130.83	1.12	146.71	4.000	No	No	2.00
252	41.50	229.15	1.85	1.07	0.58	126.06	1.15	144.85	4.000	No	No	2.00
253	41.67	224.02	1.88	1.13	0.59	121.80	1.17	142.64	4.000	No	No	2.00
254	41.83	220.52	1.89	1.13	0.60	119.28	1.18	140.48	4.000	No	No	2.00
255	42.00	218.12	1.89	1.11	0.59	117.69	1.18	138.56	4.000	No	No	2.00
256	42.16	213.45	1.91	1.15	0.60	114.03	1.20	136.45	4.000	No	No	2.00
257	42.32	199.99	1.98	1.32	0.63	103.95	1.27	132.07	4.000	No	No	2.00
258	42.49	176.02	2.09	1.60	0.67	87.54	1.43	125.47	4.000	No	No	2.00
259	42.65	153.41	2.20	1.90	0.71	73.02	1.66	121.25	4.000	No	No	2.00
260	42.82	144.41	2.25	2.07	0.73	67.20	1.80	120.63	4.000	No	No	2.00
261	42.98	143.85	2.26	2.13	0.74	66.47	1.83	121.47	4.000	No	No	2.00
262	43.15	146.55	2.26	2.16	0.74	67.55	1.82	123.26	4.000	No	No	2.00
263	43.31	146.22	2.28	2.28	0.74	66.71	1.89	125.75	4.000	No	No	2.00
264	43.47	147.02	2.30	2.43	0.75	66.38	1.95	129.43	4.000	No	No	2.00
265	43.64	149.82	2.31	2.52	0.75	67.29	1.97	132.70	4.000	No	No	2.00
266	43.80	154.72	2.30	2.54	0.75	69.50	1.95	135.59	4.000	No	No	2.00
267	43.97	162.12	2.29	2.57	0.75	72.96	1.91	139.70	4.000	No	No	2.00
268	44.13	173.99	2.27	2.59	0.74	78.79	1.85	145.75	4.000	No	No	2.00
269	44.29	188.69	2.24	2.60	0.73	86.11	1.78	153.08	4.000	No	No	2.00
270	44.46	204.23	2.20	2.50	0.71	94.42	1.67	158.02	4.000	No	No	2.00
271	44.62	216.73	2.18	2.48	0.71	100.83	1.62	163.43	4.000	No	No	2.00
272	44.79	227.07	2.17	2.51	0.70	105.77	1.60	169.16	4.000	No	No	2.00
273	44.95	231.50	2.18	2.64	0.71	107.06	1.63	174.29	4.000	No	No	2.00
274	45.11	225.07	2.21	2.76	0.72	102.82	1.69	173.95	0.569	No	No	2.00
275	45.28	207.16	2.25	2.82	0.73	93.11	1.79	166.37	0.508	No	No	2.00
276	45.44	188.29	2.29	2.93	0.75	82.91	1.92	159.43	0.457	No	No	2.00
277	45.61	174.56	2.37	3.40	0.78	74.36	2.20	163.49	0.486	No	No	2.00
278	45.77	176.93	2.41	3.83	0.79	74.13	2.36	174.73	0.576	No	No	2.00
279	45.93	181.67	2.43	4.18	0.80	75.33	2.46	185.21	0.671	No	No	2.00
280	46.10	164.01	2.50	4.51	0.83	66.17	2.75	182.08	0.641	No	No	2.00
281	46.26	129.50	2.62	5.11	0.87	49.47	3.46	171.18	4.000	No	Yes	2.00
282	46.43	88.67	2.82	6.14	0.95	30.97	4.95	153.43	4.000	No	Yes	2.00
283	46.59	71.56	2.90	6.22	0.98	23.97	5.72	137.19	4.000	No	Yes	2.00
284	46.75	60.07	2.95	5.90	1.00	19.54	6.22	121.52	4.000	No	Yes	2.00
285	46.92	54.24	2.92	4.75	0.99	17.72	5.91	104.66	4.000	No	Yes	2.00
286	47.08	48.31	2.90	3.83	0.98	15.76	5.70	89.91	4.000	No	Yes	2.00
287	47.25	46.41	2.86	3.15	0.96	15.31	5.31	81.26	4.000	No	Yes	2.00
288	47.41	42.38	2.96	3.81	1.00	13.38	6.26	83.80	4.000	No	Yes	2.00

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

Point ID	Depth (ft)	q_t (tsf)	I_c	Fr (%)	n	Q_{tn}	K_c	$Q_{tn,cs}$	$CRR_{7.5}$	Belongs to trans. layer	Clay-like behaviour	FS
289	47.57	44.45	2.95	4.02	1.00	14.06	6.24	87.68	4.000	No	Yes	2.00
290	47.74	47.45	2.97	4.58	1.00	15.04	6.37	95.77	4.000	No	Yes	2.00
291	47.90	55.28	2.92	4.79	0.99	17.88	5.90	105.48	4.000	No	Yes	2.00
292	48.07	59.57	2.94	5.49	0.99	19.18	6.06	116.28	4.000	No	Yes	2.00
293	48.23	65.67	2.92	5.80	0.99	21.37	5.88	125.61	4.000	No	Yes	2.00
294	48.39	70.89	2.88	5.70	0.97	23.42	5.54	129.78	4.000	No	Yes	2.00
295	48.56	72.13	2.86	5.41	0.97	24.02	5.32	127.72	4.000	No	Yes	2.00
296	48.72	70.41	2.86	5.30	0.97	23.35	5.35	124.81	4.000	No	Yes	2.00
297	48.89	72.54	2.91	6.19	0.98	23.64	5.75	136.01	4.000	No	Yes	2.00
298	49.05	84.37	2.90	7.22	0.98	27.62	5.74	158.64	4.000	No	Yes	2.00
299	49.22	102.69	2.84	7.33	0.96	34.62	5.15	178.32	4.000	No	Yes	2.00
300	49.38	112.76	2.78	6.69	0.93	39.03	4.59	179.29	4.000	No	Yes	2.00
301	49.54	110.71	2.73	5.76	0.92	38.93	4.23	164.48	4.000	No	Yes	2.00
302	49.71	100.44	2.73	5.24	0.92	35.12	4.24	148.82	4.000	No	Yes	2.00
303	49.87	94.68	2.75	5.17	0.92	32.75	4.37	143.20	4.000	No	Yes	2.00
304	50.04	93.96	2.76	5.25	0.93	32.32	4.44	143.53	4.000	No	Yes	2.00
305	50.20	95.13	2.75	5.22	0.92	32.75	4.39	143.93	4.000	No	Yes	2.00

Abbreviations

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

:: Liquefaction Potential Index calculation data ::

Depth (ft)	FS	F_L	w_z	d_z	LPI	Depth (ft)	FS	F_L	w_z	d_z	LPI
0.33	2.00	0.00	9.95	0.16	0.00	0.49	2.00	0.00	9.93	0.16	0.00
0.66	2.00	0.00	9.90	0.17	0.00	0.82	2.00	0.00	9.88	0.16	0.00
0.98	2.00	0.00	9.85	0.16	0.00	1.15	2.00	0.00	9.82	0.17	0.00
1.31	2.00	0.00	9.80	0.16	0.00	1.48	2.00	0.00	9.77	0.17	0.00
1.64	2.00	0.00	9.75	0.16	0.00	1.80	2.00	0.00	9.73	0.16	0.00
1.97	2.00	0.00	9.70	0.17	0.00	2.13	2.00	0.00	9.68	0.16	0.00
2.30	2.00	0.00	9.65	0.17	0.00	2.46	2.00	0.00	9.63	0.16	0.00
2.62	2.00	0.00	9.60	0.16	0.00	2.79	2.00	0.00	9.57	0.17	0.00
2.95	2.00	0.00	9.55	0.16	0.00	3.12	2.00	0.00	9.52	0.17	0.00
3.28	2.00	0.00	9.50	0.16	0.00	3.45	2.00	0.00	9.47	0.17	0.00
3.61	2.00	0.00	9.45	0.16	0.00	3.77	2.00	0.00	9.43	0.16	0.00
3.94	2.00	0.00	9.40	0.17	0.00	4.10	2.00	0.00	9.38	0.16	0.00
4.27	2.00	0.00	9.35	0.17	0.00	4.43	2.00	0.00	9.32	0.16	0.00
4.59	2.00	0.00	9.30	0.16	0.00	4.76	2.00	0.00	9.27	0.17	0.00
4.92	2.00	0.00	9.25	0.16	0.00	5.09	2.00	0.00	9.22	0.17	0.00
5.25	2.00	0.00	9.20	0.16	0.00	5.41	2.00	0.00	9.18	0.16	0.00
5.58	2.00	0.00	9.15	0.17	0.00	5.74	2.00	0.00	9.13	0.16	0.00
5.91	2.00	0.00	9.10	0.17	0.00	6.07	2.00	0.00	9.07	0.16	0.00
6.23	2.00	0.00	9.05	0.16	0.00	6.40	2.00	0.00	9.02	0.17	0.00
6.56	2.00	0.00	9.00	0.16	0.00	6.73	2.00	0.00	8.97	0.17	0.00
6.89	2.00	0.00	8.95	0.16	0.00	7.05	2.00	0.00	8.93	0.16	0.00
7.22	2.00	0.00	8.90	0.17	0.00	7.38	2.00	0.00	8.88	0.16	0.00
7.55	2.00	0.00	8.85	0.17	0.00	7.71	2.00	0.00	8.82	0.16	0.00
7.87	2.00	0.00	8.80	0.16	0.00	8.04	2.00	0.00	8.77	0.17	0.00
8.20	2.00	0.00	8.75	0.16	0.00	8.37	2.00	0.00	8.72	0.17	0.00
8.53	2.00	0.00	8.70	0.16	0.00	8.69	2.00	0.00	8.68	0.16	0.00
8.86	2.00	0.00	8.65	0.17	0.00	9.02	2.00	0.00	8.63	0.16	0.00
9.19	2.00	0.00	8.60	0.17	0.00	9.35	2.00	0.00	8.58	0.16	0.00
9.51	2.00	0.00	8.55	0.16	0.00	9.68	2.00	0.00	8.52	0.17	0.00
9.84	2.00	0.00	8.50	0.16	0.00	10.01	2.00	0.00	8.47	0.17	0.00
10.17	2.00	0.00	8.45	0.16	0.00	10.34	2.00	0.00	8.42	0.17	0.00
10.50	2.00	0.00	8.40	0.16	0.00	10.66	2.00	0.00	8.38	0.16	0.00
10.83	2.00	0.00	8.35	0.17	0.00	10.99	2.00	0.00	8.33	0.16	0.00
11.16	2.00	0.00	8.30	0.17	0.00	11.32	2.00	0.00	8.27	0.16	0.00
11.48	2.00	0.00	8.25	0.16	0.00	11.65	2.00	0.00	8.22	0.17	0.00
11.81	2.00	0.00	8.20	0.16	0.00	11.98	2.00	0.00	8.17	0.17	0.00
12.14	2.00	0.00	8.15	0.16	0.00	12.30	2.00	0.00	8.13	0.16	0.00
12.47	2.00	0.00	8.10	0.17	0.00	12.63	2.00	0.00	8.08	0.16	0.00
12.80	2.00	0.00	8.05	0.17	0.00	12.96	2.00	0.00	8.02	0.16	0.00
13.12	2.00	0.00	8.00	0.16	0.00	13.29	2.00	0.00	7.97	0.17	0.00
13.45	2.00	0.00	7.95	0.16	0.00	13.62	2.00	0.00	7.92	0.17	0.00
13.78	2.00	0.00	7.90	0.16	0.00	13.94	2.00	0.00	7.88	0.16	0.00
14.11	2.00	0.00	7.85	0.17	0.00	14.27	2.00	0.00	7.83	0.16	0.00
14.44	2.00	0.00	7.80	0.17	0.00	14.60	2.00	0.00	7.77	0.16	0.00
14.76	2.00	0.00	7.75	0.16	0.00	14.93	2.00	0.00	7.72	0.17	0.00
15.09	2.00	0.00	7.70	0.16	0.00	15.26	2.00	0.00	7.67	0.17	0.00
15.42	2.00	0.00	7.65	0.16	0.00	15.58	2.00	0.00	7.63	0.16	0.00
15.75	2.00	0.00	7.60	0.17	0.00	15.91	2.00	0.00	7.58	0.16	0.00

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

Depth (ft)	FS	F_L	w_z	d_z	LPI	Depth (ft)	FS	F_L	w_z	d_z	LPI
16.08	2.00	0.00	7.55	0.17	0.00	16.24	2.00	0.00	7.53	0.16	0.00
16.40	2.00	0.00	7.50	0.16	0.00	16.57	2.00	0.00	7.47	0.17	0.00
16.73	2.00	0.00	7.45	0.16	0.00	16.90	2.00	0.00	7.42	0.17	0.00
17.06	2.00	0.00	7.40	0.16	0.00	17.23	2.00	0.00	7.37	0.17	0.00
17.39	2.00	0.00	7.35	0.16	0.00	17.55	2.00	0.00	7.33	0.16	0.00
17.72	2.00	0.00	7.30	0.17	0.00	17.88	2.00	0.00	7.28	0.16	0.00
18.05	2.00	0.00	7.25	0.17	0.00	18.21	2.00	0.00	7.22	0.16	0.00
18.37	2.00	0.00	7.20	0.16	0.00	18.54	2.00	0.00	7.17	0.17	0.00
18.70	2.00	0.00	7.15	0.16	0.00	18.87	2.00	0.00	7.12	0.17	0.00
19.03	2.00	0.00	7.10	0.16	0.00	19.19	2.00	0.00	7.08	0.16	0.00
19.36	2.00	0.00	7.05	0.17	0.00	19.52	2.00	0.00	7.03	0.16	0.00
19.69	2.00	0.00	7.00	0.17	0.00	19.85	2.00	0.00	6.97	0.16	0.00
20.01	2.00	0.00	6.95	0.16	0.00	20.18	2.00	0.00	6.92	0.17	0.00
20.34	2.00	0.00	6.90	0.16	0.00	20.51	2.00	0.00	6.87	0.17	0.00
20.67	2.00	0.00	6.85	0.16	0.00	20.83	2.00	0.00	6.83	0.16	0.00
21.00	2.00	0.00	6.80	0.17	0.00	21.16	2.00	0.00	6.78	0.16	0.00
21.33	2.00	0.00	6.75	0.17	0.00	21.49	2.00	0.00	6.72	0.16	0.00
21.65	2.00	0.00	6.70	0.16	0.00	21.82	2.00	0.00	6.67	0.17	0.00
21.98	2.00	0.00	6.65	0.16	0.00	22.15	2.00	0.00	6.62	0.17	0.00
22.31	2.00	0.00	6.60	0.16	0.00	22.47	2.00	0.00	6.58	0.16	0.00
22.64	2.00	0.00	6.55	0.17	0.00	22.80	2.00	0.00	6.53	0.16	0.00
22.97	2.00	0.00	6.50	0.17	0.00	23.13	2.00	0.00	6.47	0.16	0.00
23.30	2.00	0.00	6.45	0.17	0.00	23.46	2.00	0.00	6.42	0.16	0.00
23.62	2.00	0.00	6.40	0.16	0.00	23.79	2.00	0.00	6.37	0.17	0.00
23.95	2.00	0.00	6.35	0.16	0.00	24.12	2.00	0.00	6.32	0.17	0.00
24.28	2.00	0.00	6.30	0.16	0.00	24.44	2.00	0.00	6.28	0.16	0.00
24.61	2.00	0.00	6.25	0.17	0.00	24.77	2.00	0.00	6.23	0.16	0.00
24.94	2.00	0.00	6.20	0.17	0.00	25.10	2.00	0.00	6.17	0.16	0.00
25.26	2.00	0.00	6.15	0.16	0.00	25.43	2.00	0.00	6.12	0.17	0.00
25.59	2.00	0.00	6.10	0.16	0.00	25.76	2.00	0.00	6.07	0.17	0.00
25.92	2.00	0.00	6.05	0.16	0.00	26.08	2.00	0.00	6.03	0.16	0.00
26.25	2.00	0.00	6.00	0.17	0.00	26.41	2.00	0.00	5.98	0.16	0.00
26.58	2.00	0.00	5.95	0.17	0.00	26.74	2.00	0.00	5.92	0.16	0.00
26.90	2.00	0.00	5.90	0.16	0.00	27.07	2.00	0.00	5.87	0.17	0.00
27.23	2.00	0.00	5.85	0.16	0.00	27.40	2.00	0.00	5.82	0.17	0.00
27.56	2.00	0.00	5.80	0.16	0.00	27.72	2.00	0.00	5.78	0.16	0.00
27.89	2.00	0.00	5.75	0.17	0.00	28.05	2.00	0.00	5.73	0.16	0.00
28.22	2.00	0.00	5.70	0.17	0.00	28.38	2.00	0.00	5.67	0.16	0.00
28.54	2.00	0.00	5.65	0.16	0.00	28.71	2.00	0.00	5.62	0.17	0.00
28.87	2.00	0.00	5.60	0.16	0.00	29.04	2.00	0.00	5.57	0.17	0.00
29.20	2.00	0.00	5.55	0.16	0.00	29.36	2.00	0.00	5.53	0.16	0.00
29.53	2.00	0.00	5.50	0.17	0.00	29.69	2.00	0.00	5.48	0.16	0.00
29.86	2.00	0.00	5.45	0.17	0.00	30.02	2.00	0.00	5.42	0.16	0.00
30.19	2.00	0.00	5.40	0.17	0.00	30.35	2.00	0.00	5.37	0.16	0.00
30.51	2.00	0.00	5.35	0.16	0.00	30.68	2.00	0.00	5.32	0.17	0.00
30.84	2.00	0.00	5.30	0.16	0.00	31.01	2.00	0.00	5.27	0.17	0.00
31.17	2.00	0.00	5.25	0.16	0.00	31.33	2.00	0.00	5.23	0.16	0.00
31.50	2.00	0.00	5.20	0.17	0.00	31.66	2.00	0.00	5.18	0.16	0.00

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

Depth (ft)	FS	F_L	w_z	d_z	LPI	Depth (ft)	FS	F_L	w_z	d_z	LPI
31.83	2.00	0.00	5.15	0.17	0.00	31.99	2.00	0.00	5.12	0.16	0.00
32.15	2.00	0.00	5.10	0.16	0.00	32.32	2.00	0.00	5.07	0.17	0.00
32.48	2.00	0.00	5.05	0.16	0.00	32.65	2.00	0.00	5.02	0.17	0.00
32.81	2.00	0.00	5.00	0.16	0.00	32.97	2.00	0.00	4.98	0.16	0.00
33.14	2.00	0.00	4.95	0.17	0.00	33.30	2.00	0.00	4.93	0.16	0.00
33.47	2.00	0.00	4.90	0.17	0.00	33.63	2.00	0.00	4.87	0.16	0.00
33.79	2.00	0.00	4.85	0.16	0.00	33.96	2.00	0.00	4.82	0.17	0.00
34.12	2.00	0.00	4.80	0.16	0.00	34.29	2.00	0.00	4.77	0.17	0.00
34.45	2.00	0.00	4.75	0.16	0.00	34.61	2.00	0.00	4.73	0.16	0.00
34.78	2.00	0.00	4.70	0.17	0.00	34.94	2.00	0.00	4.68	0.16	0.00
35.11	2.00	0.00	4.65	0.17	0.00	35.27	2.00	0.00	4.62	0.16	0.00
35.43	2.00	0.00	4.60	0.16	0.00	35.60	2.00	0.00	4.57	0.17	0.00
35.76	2.00	0.00	4.55	0.16	0.00	35.93	2.00	0.00	4.52	0.17	0.00
36.09	2.00	0.00	4.50	0.16	0.00	36.26	2.00	0.00	4.47	0.17	0.00
36.42	2.00	0.00	4.45	0.16	0.00	36.58	2.00	0.00	4.43	0.16	0.00
36.75	2.00	0.00	4.40	0.17	0.00	36.91	2.00	0.00	4.37	0.16	0.00
37.08	2.00	0.00	4.35	0.17	0.00	37.24	2.00	0.00	4.32	0.16	0.00
37.40	2.00	0.00	4.30	0.16	0.00	37.57	2.00	0.00	4.27	0.17	0.00
37.73	2.00	0.00	4.25	0.16	0.00	37.90	2.00	0.00	4.22	0.17	0.00
38.06	2.00	0.00	4.20	0.16	0.00	38.22	2.00	0.00	4.18	0.16	0.00
38.39	2.00	0.00	4.15	0.17	0.00	38.55	2.00	0.00	4.12	0.16	0.00
38.72	2.00	0.00	4.10	0.17	0.00	38.88	2.00	0.00	4.07	0.16	0.00
39.04	2.00	0.00	4.05	0.16	0.00	39.21	2.00	0.00	4.02	0.17	0.00
39.37	2.00	0.00	4.00	0.16	0.00	39.54	2.00	0.00	3.97	0.17	0.00
39.70	2.00	0.00	3.95	0.16	0.00	39.86	2.00	0.00	3.93	0.16	0.00
40.03	2.00	0.00	3.90	0.17	0.00	40.19	2.00	0.00	3.88	0.16	0.00
40.36	2.00	0.00	3.85	0.17	0.00	40.52	2.00	0.00	3.82	0.16	0.00
40.68	2.00	0.00	3.80	0.16	0.00	40.85	2.00	0.00	3.77	0.17	0.00
41.01	2.00	0.00	3.75	0.16	0.00	41.18	2.00	0.00	3.72	0.17	0.00
41.34	2.00	0.00	3.70	0.16	0.00	41.50	2.00	0.00	3.68	0.16	0.00
41.67	2.00	0.00	3.65	0.17	0.00	41.83	2.00	0.00	3.63	0.16	0.00
42.00	2.00	0.00	3.60	0.17	0.00	42.16	2.00	0.00	3.57	0.16	0.00
42.32	2.00	0.00	3.55	0.16	0.00	42.49	2.00	0.00	3.52	0.17	0.00
42.65	2.00	0.00	3.50	0.16	0.00	42.82	2.00	0.00	3.47	0.17	0.00
42.98	2.00	0.00	3.45	0.16	0.00	43.15	2.00	0.00	3.42	0.17	0.00
43.31	2.00	0.00	3.40	0.16	0.00	43.47	2.00	0.00	3.38	0.16	0.00
43.64	2.00	0.00	3.35	0.17	0.00	43.80	2.00	0.00	3.32	0.16	0.00
43.97	2.00	0.00	3.30	0.17	0.00	44.13	2.00	0.00	3.27	0.16	0.00
44.29	2.00	0.00	3.25	0.16	0.00	44.46	2.00	0.00	3.22	0.17	0.00
44.62	2.00	0.00	3.20	0.16	0.00	44.79	2.00	0.00	3.17	0.17	0.00
44.95	2.00	0.00	3.15	0.16	0.00	45.11	2.00	0.00	3.13	0.16	0.00
45.28	2.00	0.00	3.10	0.17	0.00	45.44	2.00	0.00	3.07	0.16	0.00
45.61	2.00	0.00	3.05	0.17	0.00	45.77	2.00	0.00	3.02	0.16	0.00
45.93	2.00	0.00	3.00	0.16	0.00	46.10	2.00	0.00	2.97	0.17	0.00
46.26	2.00	0.00	2.95	0.16	0.00	46.43	2.00	0.00	2.92	0.17	0.00
46.59	2.00	0.00	2.90	0.16	0.00	46.75	2.00	0.00	2.88	0.16	0.00
46.92	2.00	0.00	2.85	0.17	0.00	47.08	2.00	0.00	2.83	0.16	0.00
47.25	2.00	0.00	2.80	0.17	0.00	47.41	2.00	0.00	2.77	0.16	0.00

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

Depth (ft)	FS	F_L	w_z	d_z	LPI	Depth (ft)	FS	F_L	w_z	d_z	LPI
47.57	2.00	0.00	2.75	0.16	0.00	47.74	2.00	0.00	2.72	0.17	0.00
47.90	2.00	0.00	2.70	0.16	0.00	48.07	2.00	0.00	2.67	0.17	0.00
48.23	2.00	0.00	2.65	0.16	0.00	48.39	2.00	0.00	2.63	0.16	0.00
48.56	2.00	0.00	2.60	0.17	0.00	48.72	2.00	0.00	2.58	0.16	0.00
48.89	2.00	0.00	2.55	0.17	0.00	49.05	2.00	0.00	2.52	0.16	0.00
49.22	2.00	0.00	2.50	0.17	0.00	49.38	2.00	0.00	2.47	0.16	0.00
49.54	2.00	0.00	2.45	0.16	0.00	49.71	2.00	0.00	2.42	0.17	0.00
49.87	2.00	0.00	2.40	0.16	0.00	50.04	2.00	0.00	2.37	0.17	0.00
50.20	2.00	0.00	2.35	0.16	0.00						

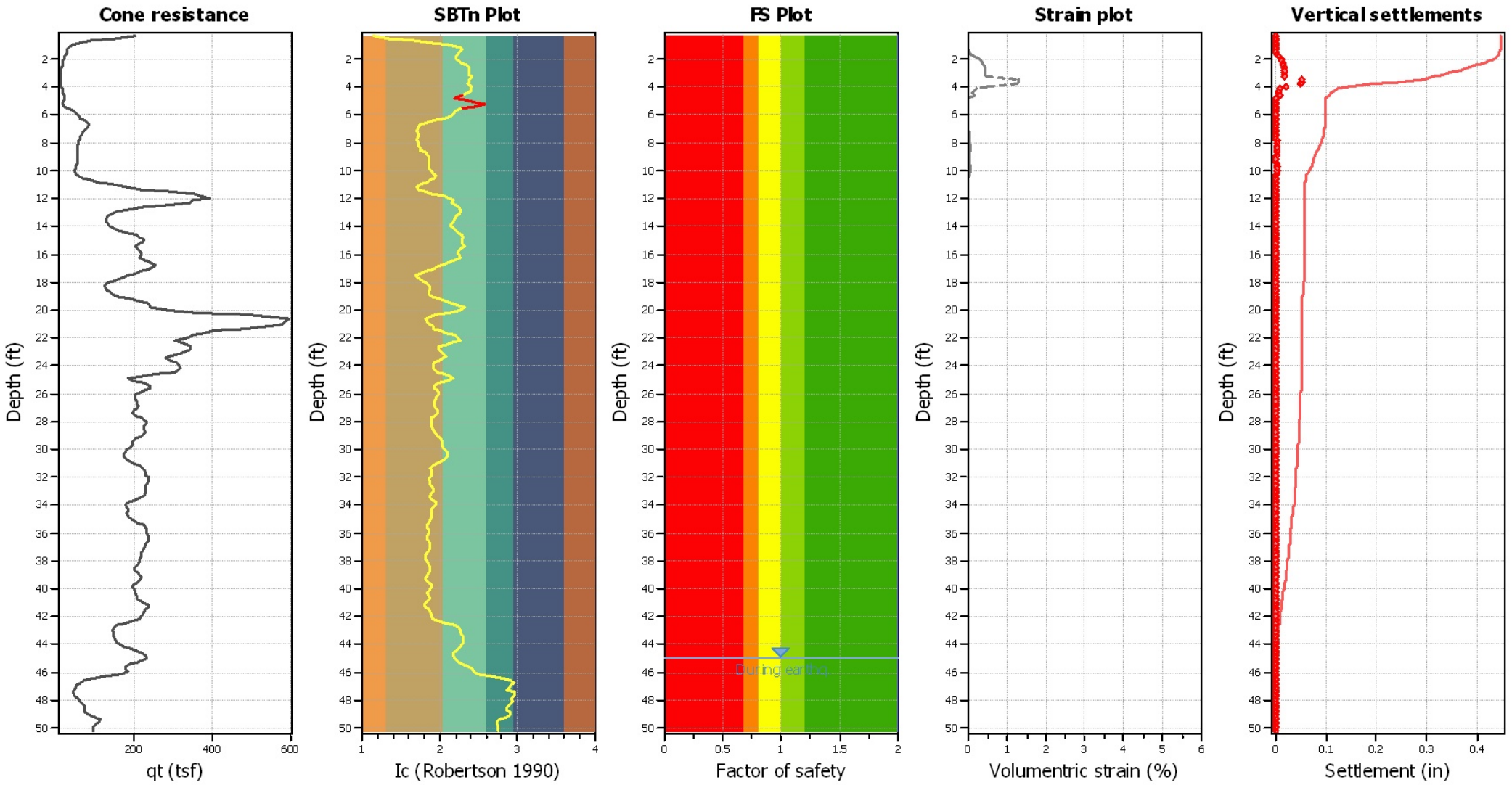
Overall liquefaction potential: 0.00

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

Abbreviations

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

Estimation of post-earthquake settlements



Abbreviations

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

:: Post-earthquake settlement of dry sands ::

Depth (ft)	Ic	Kc	Qc1n	Qc1n,cs	N1,60 (blows)	Vs (ft/s)	Gmax (tsf)	CSR	Shear, γ (%)	Svol,15 (%)	Nc	ev (%)	Settle. (in)
0.33	1.15	1.00	324.48	324.48	51	848.9	181	0.20	0.003	0.00	8.63	0.00	0.000
0.49	1.35	1.00	240.65	240.65	40	827.6	209	0.20	0.004	0.00	8.63	0.00	0.000
0.66	1.65	1.00	146.48	147.15	27	781.8	213	0.20	0.006	0.00	8.63	0.00	0.000
0.82	1.91	1.20	92.64	111.46	22	734.4	207	0.20	0.008	0.01	8.63	0.01	0.000
0.98	2.10	1.46	66.01	96.53	21	698.9	202	0.20	0.011	0.01	8.63	0.01	0.000
1.15	2.27	1.86	48.64	90.55	21	667.2	197	0.20	0.015	0.01	8.63	0.01	0.000
1.31	2.28	1.90	44.61	84.63	20	643.7	193	0.20	0.019	0.02	8.63	0.02	0.001
1.48	2.26	1.82	41.28	75.09	17	609.0	179	0.20	0.028	0.03	8.63	0.03	0.001
1.64	2.23	1.73	37.03	64.22	15	565.7	157	0.20	0.053	0.08	8.63	0.06	0.002
1.80	2.22	1.71	32.45	55.52	13	526.5	138	0.20	0.110	0.19	8.63	0.15	0.006
1.97	2.21	1.69	29.97	50.53	11	502.9	128	0.20	0.192	0.37	8.63	0.29	0.012
2.13	2.24	1.78	28.19	50.16	12	498.8	130	0.20	0.211	0.41	8.63	0.32	0.012
2.30	2.29	1.92	25.97	49.86	12	493.4	131	0.20	0.240	0.46	8.63	0.36	0.015
2.46	2.35	2.12	23.44	49.73	12	486.8	132	0.20	0.282	0.52	8.63	0.41	0.016
2.62	2.38	2.24	22.20	49.76	12	483.4	133	0.20	0.307	0.56	8.63	0.44	0.017
2.79	2.39	2.25	22.08	49.77	12	483.0	137	0.20	0.311	0.56	8.63	0.44	0.018
2.95	2.38	2.22	22.39	49.75	12	483.9	141	0.20	0.305	0.56	8.63	0.43	0.017
3.12	2.38	2.23	22.27	49.76	12	483.6	145	0.20	0.309	0.56	8.63	0.44	0.018
3.28	2.41	2.37	21.07	49.84	12	480.1	146	0.20	0.337	0.60	8.63	0.47	0.018
3.45	2.37	2.20	19.88	43.68	11	454.1	129	0.20	0.770	1.65	8.63	1.29	0.052
3.61	2.38	2.23	19.55	43.68	11	453.1	131	0.20	0.793	1.69	8.63	1.32	0.051
3.77	2.36	2.16	20.19	43.69	11	455.1	135	0.20	0.747	1.61	8.63	1.25	0.048
3.94	2.41	2.35	21.20	49.83	12	480.5	159	0.20	0.337	0.60	8.63	0.47	0.019
4.10	2.40	2.30	23.91	55.05	14	506.5	184	0.20	0.179	0.29	8.63	0.22	0.009
4.27	2.40	2.32	25.72	59.78	15	527.1	207	0.20	0.119	0.17	8.63	0.13	0.005
4.43	2.36	2.14	27.79	59.60	14	532.2	215	0.20	0.110	0.16	8.63	0.13	0.005
4.59	2.29	1.91	28.85	55.01	13	518.7	205	0.20	0.146	0.25	8.63	0.19	0.007
4.76	2.19	1.63	31.14	50.83	0	0.0	0	0.20	0.000	0.00	0.00	0.00	0.000
4.92	2.32	2.02	29.52	59.56	0	0.0	0	0.20	0.000	0.00	0.00	0.00	0.000
5.09	2.48	2.66	25.81	68.80	0	0.0	0	0.20	0.000	0.00	0.00	0.00	0.000
5.25	2.59	3.28	23.71	77.89	0	0.0	0	0.20	0.000	0.00	0.00	0.00	0.000
5.41	2.44	2.49	33.13	82.54	0	0.0	0	0.20	0.000	0.00	0.00	0.00	0.000
5.58	2.27	1.85	51.86	96.11	0	0.0	0	0.20	0.000	0.00	0.00	0.00	0.000
5.74	2.19	1.65	72.19	119.21	0	0.0	0	0.20	0.000	0.00	0.00	0.00	0.000
5.91	2.17	1.59	85.03	135.20	30	825.6	695	0.20	0.012	0.01	8.63	0.01	0.000
6.07	2.15	1.55	91.50	142.02	31	846.9	748	0.20	0.011	0.01	8.63	0.01	0.000
6.23	2.07	1.40	99.68	139.77	30	840.3	744	0.20	0.012	0.01	8.63	0.01	0.000
6.40	1.94	1.22	114.01	139.62	28	825.7	724	0.20	0.013	0.01	8.63	0.01	0.000
6.56	1.81	1.12	126.42	141.11	27	804.3	689	0.20	0.014	0.01	8.63	0.01	0.000
6.73	1.74	1.06	130.74	138.90	26	779.3	649	0.20	0.016	0.01	8.63	0.01	0.000
6.89	1.72	1.05	124.30	130.57	25	751.4	603	0.20	0.018	0.01	8.63	0.01	0.000
7.05	1.71	1.05	114.65	119.85	22	718.2	549	0.20	0.022	0.02	8.63	0.01	0.001
7.22	1.71	1.05	105.84	110.87	21	691.4	508	0.20	0.026	0.02	8.63	0.02	0.001
7.38	1.72	1.00	99.72	99.72	19	675.2	486	0.20	0.029	0.03	8.63	0.02	0.001
7.55	1.72	1.00	95.31	95.31	18	659.3	465	0.20	0.033	0.04	8.63	0.03	0.001
7.71	1.71	1.00	91.50	91.50	17	643.1	443	0.20	0.038	0.05	8.63	0.04	0.001
7.87	1.71	1.00	87.38	87.38	16	625.9	419	0.20	0.044	0.06	8.63	0.04	0.002
8.04	1.73	1.00	83.88	83.88	16	622.3	418	0.20	0.045	0.06	8.63	0.05	0.002

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

Depth (ft)	Ic	Kc	Qc1n	Qc1n,cs	N1,60 (blows)	Vs (ft/s)	Gmax (tsf)	CSR	Shear, γ (%)	Svol,15 (%)	Nc	ev (%)	Settle. (in)
8.20	1.73	1.00	79.49	79.49	15	603.6	392	0.20	0.055	0.08	8.63	0.06	0.002
8.37	1.74	1.00	76.98	76.98	15	600.6	392	0.20	0.057	0.08	8.63	0.06	0.003
8.53	1.75	1.00	75.75	75.75	14	598.8	393	0.20	0.058	0.09	8.63	0.07	0.003
8.69	1.82	1.00	76.23	76.23	15	625.7	443	0.20	0.045	0.06	8.63	0.05	0.002
8.86	1.84	1.14	76.25	86.92	17	637.0	468	0.20	0.041	0.05	8.63	0.04	0.002
9.02	1.87	1.16	76.68	88.82	18	647.8	493	0.20	0.038	0.04	8.63	0.03	0.001
9.19	1.86	1.15	77.05	88.87	18	647.0	496	0.20	0.038	0.04	8.63	0.03	0.001
9.35	1.86	1.15	76.61	88.43	17	645.6	499	0.20	0.039	0.05	8.63	0.04	0.001
9.51	1.85	1.15	73.90	84.85	17	631.1	477	0.20	0.044	0.05	8.63	0.04	0.002
9.68	1.86	1.00	69.91	69.91	14	614.6	452	0.20	0.051	0.08	8.63	0.06	0.003
9.84	1.85	1.00	66.45	66.45	13	597.8	426	0.20	0.060	0.10	8.63	0.08	0.003
10.01	1.89	1.00	65.84	65.84	13	609.1	451	0.20	0.054	0.09	8.63	0.07	0.003
10.17	1.92	1.21	68.58	82.82	17	633.7	501	0.20	0.043	0.05	8.63	0.04	0.002
10.34	1.95	1.24	75.74	93.63	19	677.6	592	0.20	0.032	0.03	8.63	0.03	0.001
10.50	1.93	1.22	88.53	108.12	22	726.1	703	0.20	0.024	0.02	8.63	0.02	0.001
10.66	1.88	1.17	110.97	129.78	26	785.7	851	0.20	0.018	0.01	8.63	0.01	0.000
10.83	1.84	1.13	140.21	158.98	31	859.6	1056	0.20	0.014	0.01	8.63	0.01	0.000
10.99	1.76	1.08	176.42	190.54	36	920.2	1244	0.20	0.012	0.01	8.63	0.00	0.000
11.16	1.71	1.05	219.84	229.79	43	994.4	1497	0.20	0.009	0.00	8.63	0.00	0.000
11.32	1.72	1.05	270.73	285.30	54	1112.4	1943	0.20	0.007	0.00	8.63	0.00	0.000
11.48	1.79	1.10	349.00	384.56	74	1320.0	2867	0.20	0.005	0.00	8.63	0.00	0.000
11.65	1.90	1.19	448.56	533.24	107	1601.0	4271	0.20	0.003	0.00	8.63	0.00	0.000
11.81	2.05	1.37	472.88	648.41	138	1807.7	5491	0.20	0.002	0.00	8.63	0.00	0.000
11.98	2.11	1.47	502.48	740.22	161	1935.5	6351	0.20	0.002	0.00	8.63	0.00	0.000
12.14	2.18	1.62	453.49	735.38	165	1923.3	6322	0.20	0.002	0.00	8.63	0.00	0.000
12.30	2.16	1.58	435.18	687.19	153	1861.8	5972	0.20	0.002	0.00	8.63	0.00	0.000
12.47	2.22	1.71	347.24	593.45	135	1721.6	5149	0.20	0.003	0.00	8.63	0.00	0.000
12.63	2.25	1.79	276.71	496.19	114	1567.7	4303	0.20	0.003	0.00	8.63	0.00	0.000
12.80	2.26	1.82	223.18	406.70	94	1417.0	3545	0.20	0.004	0.00	8.63	0.00	0.000
12.96	2.26	1.83	187.01	341.87	79	1298.8	3000	0.20	0.005	0.00	8.63	0.00	0.000
13.12	2.24	1.77	169.18	299.85	69	1220.0	2634	0.20	0.006	0.00	8.63	0.00	0.000
13.29	2.21	1.70	158.94	270.46	61	1162.6	2386	0.20	0.007	0.00	8.63	0.00	0.000
13.45	2.19	1.65	152.16	250.86	56	1122.2	2223	0.20	0.008	0.00	8.63	0.00	0.000
13.62	2.17	1.60	149.35	239.46	53	1098.2	2135	0.20	0.008	0.00	8.63	0.00	0.000
13.78	2.16	1.57	150.44	235.68	52	1090.7	2118	0.20	0.008	0.00	8.63	0.00	0.000
13.94	2.14	1.54	153.18	236.12	52	1092.3	2141	0.20	0.008	0.00	8.63	0.00	0.000
14.11	2.17	1.60	160.73	257.19	57	1138.3	2365	0.20	0.008	0.00	8.63	0.00	0.000
14.27	2.21	1.70	178.39	303.56	69	1231.7	2839	0.20	0.006	0.00	8.63	0.00	0.000
14.44	2.25	1.81	205.06	370.23	85	1353.3	3470	0.20	0.005	0.00	8.63	0.00	0.000
14.60	2.28	1.89	227.45	430.60	101	1452.3	4023	0.20	0.004	0.00	8.63	0.00	0.000
14.76	2.31	1.98	236.24	466.61	110	1504.5	4345	0.20	0.004	0.00	8.63	0.00	0.000
14.93	2.29	1.91	246.04	470.84	110	1516.8	4447	0.20	0.004	0.00	8.63	0.00	0.000
15.09	2.28	1.88	238.10	448.55	105	1483.1	4277	0.20	0.004	0.00	8.63	0.00	0.000
15.26	2.28	1.89	227.57	430.36	100	1452.1	4128	0.20	0.005	0.00	8.63	0.00	0.000
15.42	2.33	2.04	213.77	435.10	104	1447.6	4127	0.20	0.005	0.00	8.63	0.00	0.000
15.58	2.29	1.93	216.36	416.55	98	1425.7	4028	0.20	0.005	0.00	8.63	0.00	0.000
15.75	2.25	1.80	222.22	400.99	92	1408.4	3956	0.20	0.005	0.00	8.63	0.00	0.000
15.91	2.22	1.72	223.51	384.61	88	1385.2	3849	0.20	0.005	0.00	8.63	0.00	0.000

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

Depth (ft)	Ic	Kc	Qc1n	Qc1n,cs	N1,60 (blows)	Vs (ft/s)	Gmax (tsf)	CSR	Shear, γ (%)	Svol,15 (%)	Nc	ev (%)	Settle. (in)
16.08	2.25	1.80	222.01	398.80	92	1405.2	3986	0.20	0.005	0.00	8.63	0.00	0.000
16.24	2.27	1.85	215.22	397.54	92	1399.1	3974	0.20	0.005	0.00	8.63	0.00	0.000
16.40	2.21	1.69	221.47	373.40	84	1367.0	3816	0.20	0.005	0.00	8.63	0.00	0.000
16.57	2.11	1.48	236.59	349.62	76	1330.2	3634	0.20	0.006	0.00	8.63	0.00	0.000
16.73	2.02	1.32	249.45	330.16	69	1286.1	3417	0.20	0.006	0.00	8.63	0.00	0.000
16.90	1.96	1.26	242.48	304.72	63	1226.5	3125	0.20	0.007	0.00	8.63	0.00	0.000
17.06	1.92	1.21	225.37	271.70	55	1147.3	2713	0.20	0.008	0.00	8.63	0.00	0.000
17.23	1.83	1.13	209.19	236.02	46	1045.2	2214	0.20	0.010	0.00	8.63	0.00	0.000
17.39	1.74	1.06	192.74	204.91	39	946.9	1781	0.20	0.013	0.01	8.63	0.00	0.000
17.55	1.68	1.03	174.72	179.26	33	870.7	1479	0.20	0.017	0.01	8.63	0.01	0.000
17.72	1.72	1.05	154.70	162.92	31	840.3	1373	0.20	0.019	0.01	8.63	0.01	0.000
17.88	1.78	1.09	136.50	148.77	29	816.8	1294	0.20	0.021	0.01	8.63	0.01	0.000
18.05	1.83	1.13	121.90	137.57	27	798.0	1235	0.20	0.022	0.02	8.63	0.01	0.001
18.21	1.86	1.15	115.76	133.44	26	792.6	1223	0.20	0.023	0.02	8.63	0.01	0.000
18.37	1.87	1.16	114.23	133.05	26	794.4	1236	0.20	0.023	0.02	8.63	0.01	0.000
18.54	1.88	1.17	116.22	136.35	27	806.2	1285	0.20	0.022	0.02	8.63	0.01	0.000
18.70	1.86	1.15	121.44	140.23	28	813.0	1316	0.20	0.021	0.01	8.63	0.01	0.000
18.87	1.86	1.15	130.06	149.69	30	839.0	1421	0.20	0.020	0.01	8.63	0.01	0.000
19.03	1.91	1.20	143.10	171.14	34	908.5	1713	0.20	0.016	0.01	8.63	0.01	0.000
19.19	1.99	1.29	166.16	214.14	44	1032.4	2297	0.20	0.011	0.00	8.63	0.00	0.000
19.36	2.08	1.42	189.41	268.85	58	1165.9	3032	0.20	0.008	0.00	8.63	0.00	0.000
19.52	2.14	1.53	202.94	309.83	68	1251.6	3517	0.20	0.007	0.00	8.63	0.00	0.000
19.69	2.25	1.80	206.94	373.28	86	1358.9	4166	0.20	0.006	0.00	8.63	0.00	0.000
19.85	2.31	2.00	204.93	409.34	97	1407.3	4489	0.20	0.006	0.00	8.63	0.00	0.000
20.01	2.27	1.85	241.78	446.41	104	1482.7	5005	0.20	0.005	0.00	8.63	0.00	0.000
20.18	2.12	1.49	308.00	458.26	100	1522.8	5305	0.20	0.005	0.00	8.63	0.00	0.000
20.34	1.95	1.23	415.60	513.09	105	1585.8	5779	0.20	0.004	0.00	8.63	0.00	0.000
20.51	1.86	1.15	480.30	553.13	109	1613.2	6009	0.20	0.004	0.00	8.63	0.00	0.000
20.67	1.82	1.12	510.75	574.27	112	1627.9	6146	0.20	0.004	0.00	8.63	0.00	0.000
20.83	1.85	1.14	498.46	569.31	112	1631.4	6199	0.20	0.004	0.00	8.63	0.00	0.000
21.00	1.87	1.16	487.04	566.84	112	1639.3	6289	0.20	0.004	0.00	8.63	0.00	0.000
21.16	1.91	1.20	455.31	544.84	110	1621.4	6178	0.20	0.004	0.00	8.63	0.00	0.000
21.33	1.92	1.21	398.98	482.46	97	1530.1	5527	0.20	0.005	0.00	8.63	0.00	0.000
21.49	2.01	1.32	331.64	436.51	91	1478.0	5179	0.20	0.005	0.00	8.63	0.00	0.000
21.65	2.08	1.42	305.97	434.04	93	1481.3	5224	0.20	0.005	0.00	8.63	0.00	0.000
21.82	2.20	1.67	279.74	466.57	105	1529.3	5592	0.20	0.005	0.00	8.63	0.00	0.000
21.98	2.24	1.76	264.55	464.94	106	1520.3	5550	0.20	0.005	0.00	8.63	0.00	0.000
22.15	2.27	1.86	238.21	443.36	103	1476.4	5256	0.20	0.005	0.00	8.63	0.00	0.000
22.31	2.18	1.63	249.50	405.82	91	1428.5	4941	0.20	0.006	0.00	8.63	0.00	0.000
22.47	2.08	1.42	264.71	377.08	81	1380.9	4635	0.20	0.006	0.00	8.63	0.00	0.000
22.64	2.00	1.29	271.13	350.80	73	1322.1	4267	0.20	0.007	0.00	8.63	0.00	0.000
22.80	1.98	1.28	270.59	345.53	71	1309.6	4204	0.21	0.007	0.00	8.63	0.00	0.000
22.97	2.01	1.31	262.91	343.80	72	1310.6	4228	0.21	0.007	0.00	8.63	0.00	0.000
23.13	2.04	1.36	244.96	333.85	71	1296.6	4154	0.21	0.007	0.00	8.63	0.00	0.000
23.30	2.08	1.41	221.26	312.80	67	1257.4	3922	0.21	0.008	0.00	8.63	0.00	0.000
23.46	2.05	1.37	215.09	294.90	63	1219.1	3701	0.21	0.008	0.00	8.63	0.00	0.000
23.62	1.99	1.29	222.85	287.94	60	1197.6	3585	0.21	0.009	0.00	8.63	0.00	0.000
23.79	1.94	1.23	236.32	289.64	59	1189.5	3551	0.21	0.009	0.00	8.63	0.00	0.000

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

Depth (ft)	Ic	Kc	Qc1n	Qc1n,cs	N1,60 (blows)	Vs (ft/s)	Gmax (tsf)	CSR	Shear, γ (%)	Svol,15 (%)	Nc	ev (%)	Settle. (in)
23.95	1.92	1.21	239.98	289.21	58	1183.6	3529	0.21	0.009	0.00	8.63	0.00	0.000
24.12	1.91	1.20	243.16	290.85	58	1184.5	3548	0.21	0.009	0.00	8.63	0.00	0.000
24.28	1.93	1.21	239.25	290.67	59	1189.1	3589	0.21	0.009	0.00	8.63	0.00	0.000
24.44	1.96	1.26	227.86	286.09	59	1188.2	3597	0.21	0.009	0.00	8.63	0.00	0.000
24.61	2.07	1.40	187.95	262.34	56	1150.9	3388	0.21	0.010	0.00	8.63	0.00	0.000
24.77	2.15	1.56	150.54	235.02	52	1089.3	3041	0.21	0.011	0.00	8.63	0.00	0.000
24.94	2.18	1.62	131.74	213.12	48	1035.6	2730	0.21	0.012	0.00	8.63	0.00	0.000
25.10	2.08	1.42	144.84	205.04	44	1018.1	2632	0.21	0.013	0.01	8.63	0.00	0.000
25.26	1.98	1.28	164.10	209.37	43	1019.3	2642	0.21	0.013	0.01	8.63	0.00	0.000
25.43	1.93	1.22	174.75	213.11	43	1019.1	2649	0.21	0.013	0.01	8.63	0.00	0.000
25.59	1.93	1.21	174.67	211.95	43	1015.1	2635	0.21	0.013	0.01	8.63	0.00	0.000
25.76	1.96	1.25	164.33	205.90	42	1007.6	2604	0.21	0.014	0.01	8.63	0.00	0.000
25.92	1.99	1.28	152.05	195.35	40	985.6	2489	0.21	0.014	0.01	8.63	0.00	0.000
26.08	1.99	1.29	144.21	185.86	39	961.8	2365	0.21	0.015	0.01	8.63	0.01	0.000
26.25	1.96	1.25	144.42	180.33	37	942.3	2266	0.21	0.016	0.01	8.63	0.01	0.000
26.41	1.94	1.23	145.69	179.44	37	937.3	2245	0.21	0.017	0.01	8.63	0.01	0.000
26.58	1.93	1.22	146.50	179.26	36	935.4	2243	0.21	0.017	0.01	8.63	0.01	0.000
26.74	1.92	1.21	147.21	178.57	36	931.7	2230	0.21	0.017	0.01	8.63	0.01	0.000
26.90	1.93	1.22	147.06	179.24	36	934.5	2253	0.21	0.017	0.01	8.63	0.01	0.000
27.07	1.95	1.24	144.01	179.09	37	938.3	2284	0.21	0.017	0.01	8.63	0.01	0.000
27.23	1.97	1.27	137.32	174.02	36	928.2	2238	0.21	0.017	0.01	8.63	0.01	0.000
27.40	1.97	1.26	134.82	169.90	35	916.3	2181	0.21	0.018	0.01	8.63	0.01	0.000
27.56	1.93	1.22	139.40	170.05	34	910.4	2155	0.21	0.018	0.01	8.63	0.01	0.000
27.72	1.90	1.19	150.29	178.60	36	926.4	2246	0.21	0.017	0.01	8.63	0.01	0.000
27.89	1.89	1.18	157.65	185.84	37	942.6	2343	0.21	0.017	0.01	8.63	0.01	0.000
28.05	1.89	1.18	160.47	189.22	38	951.3	2400	0.21	0.016	0.01	8.63	0.01	0.000
28.22	1.90	1.19	157.80	187.31	38	948.4	2393	0.21	0.016	0.01	8.63	0.01	0.000
28.38	1.90	1.19	155.25	185.08	37	944.0	2376	0.21	0.017	0.01	8.63	0.01	0.000
28.54	1.91	1.20	154.63	184.95	37	944.5	2387	0.21	0.017	0.01	8.63	0.01	0.000
28.71	1.92	1.21	153.82	186.41	38	951.6	2437	0.21	0.016	0.01	8.63	0.01	0.000
28.87	1.94	1.23	151.35	186.44	38	955.4	2468	0.21	0.016	0.01	8.63	0.01	0.000
29.04	1.97	1.27	144.69	183.16	38	952.1	2459	0.21	0.016	0.01	8.63	0.01	0.000
29.20	2.00	1.30	136.95	177.64	37	941.2	2406	0.21	0.017	0.01	8.63	0.01	0.000
29.36	2.02	1.33	130.50	173.49	36	932.8	2367	0.21	0.017	0.01	8.63	0.01	0.000
29.53	2.03	1.33	127.67	170.33	36	924.5	2328	0.21	0.018	0.01	8.63	0.01	0.000
29.69	2.03	1.34	125.27	168.39	35	919.9	2310	0.21	0.018	0.01	8.63	0.01	0.000
29.86	2.04	1.36	121.66	165.35	35	912.3	2276	0.21	0.018	0.01	8.63	0.01	0.000
30.02	2.07	1.40	115.67	162.28	35	905.4	2246	0.21	0.019	0.01	8.63	0.01	0.000
30.19	2.09	1.44	111.11	160.03	35	899.8	2224	0.21	0.019	0.01	8.63	0.01	0.000
30.35	2.10	1.46	108.25	158.06	34	894.4	2201	0.21	0.019	0.01	8.63	0.01	0.000
30.51	2.10	1.46	108.58	158.53	34	895.7	2215	0.21	0.019	0.01	8.63	0.01	0.000
30.68	2.07	1.40	112.09	157.14	34	890.9	2193	0.21	0.020	0.01	8.63	0.01	0.000
30.84	2.02	1.33	119.19	158.90	33	892.9	2208	0.21	0.020	0.01	8.63	0.01	0.000
31.01	1.96	1.25	128.04	159.85	33	887.2	2178	0.21	0.020	0.01	8.63	0.01	0.000
31.17	1.91	1.20	136.49	164.06	33	890.8	2201	0.21	0.020	0.01	8.63	0.01	0.000
31.33	1.89	1.18	143.26	168.34	34	896.3	2236	0.21	0.020	0.01	8.63	0.01	0.000
31.50	1.89	1.18	145.03	171.47	34	906.3	2301	0.21	0.019	0.01	8.63	0.01	0.000
31.66	1.90	1.19	146.43	173.90	35	914.0	2352	0.21	0.019	0.01	8.63	0.01	0.000

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

Depth (ft)	Ic	Kc	Qc1n	Qc1n,cs	N1,60 (blows)	Vs (ft/s)	Gmax (tsf)	CSR	Shear, γ (%)	Svol,15 (%)	Nc	ev (%)	Settle. (in)
31.83	1.89	1.18	147.10	173.80	35	912.3	2349	0.21	0.019	0.01	8.63	0.01	0.000
31.99	1.87	1.16	150.18	174.92	35	910.9	2346	0.21	0.019	0.01	8.63	0.01	0.000
32.15	1.86	1.16	151.30	174.75	35	907.7	2333	0.21	0.019	0.01	8.63	0.01	0.000
32.32	1.87	1.16	149.31	173.29	34	905.5	2328	0.21	0.019	0.01	8.63	0.01	0.000
32.48	1.88	1.17	146.74	171.86	34	904.6	2330	0.21	0.019	0.01	8.63	0.01	0.000
32.65	1.90	1.19	143.50	170.40	34	904.7	2340	0.21	0.019	0.01	8.63	0.01	0.000
32.81	1.91	1.20	141.73	169.95	34	906.1	2355	0.21	0.019	0.01	8.63	0.01	0.000
32.97	1.91	1.20	141.52	169.28	34	903.7	2347	0.21	0.020	0.01	8.63	0.01	0.000
33.14	1.89	1.18	141.59	166.76	33	892.7	2289	0.21	0.020	0.01	8.63	0.01	0.000
33.30	1.87	1.16	140.85	163.72	32	880.6	2224	0.21	0.021	0.01	8.63	0.01	0.000
33.47	1.88	1.17	134.86	157.54	31	865.3	2144	0.21	0.022	0.01	8.63	0.01	0.000
33.63	1.91	1.20	123.72	148.84	30	848.7	2061	0.21	0.023	0.01	8.63	0.01	0.000
33.79	1.95	1.24	112.58	139.45	28	827.3	1952	0.21	0.025	0.02	8.63	0.01	0.000
33.96	1.94	1.23	107.28	132.23	27	804.8	1838	0.21	0.027	0.02	8.63	0.01	0.001
34.12	1.92	1.20	109.09	131.34	26	797.4	1803	0.21	0.028	0.02	8.63	0.02	0.001
34.29	1.89	1.18	112.15	131.83	26	793.2	1784	0.21	0.029	0.02	8.63	0.02	0.001
34.45	1.89	1.18	111.31	131.67	26	794.3	1795	0.21	0.028	0.02	8.63	0.02	0.001
34.61	1.90	1.19	109.81	130.14	26	790.1	1778	0.21	0.029	0.02	8.63	0.02	0.001
34.78	1.90	1.19	110.00	130.65	26	792.2	1794	0.21	0.029	0.02	8.63	0.02	0.001
34.94	1.89	1.18	113.04	133.51	27	799.5	1835	0.21	0.028	0.02	8.63	0.02	0.001
35.11	1.88	1.17	119.47	139.50	28	814.2	1917	0.21	0.026	0.02	8.63	0.01	0.001
35.27	1.86	1.15	127.45	146.96	29	831.9	2017	0.21	0.025	0.02	8.63	0.01	0.000
35.43	1.84	1.14	135.52	154.46	30	849.0	2117	0.21	0.024	0.01	8.63	0.01	0.000
35.60	1.84	1.14	138.50	158.01	31	859.1	2180	0.21	0.023	0.01	8.63	0.01	0.000
35.76	1.85	1.15	139.04	159.48	31	864.9	2220	0.21	0.022	0.01	8.63	0.01	0.000
35.93	1.86	1.15	137.87	158.98	31	865.3	2229	0.21	0.022	0.01	8.63	0.01	0.000
36.09	1.85	1.15	139.17	159.78	31	866.0	2238	0.21	0.022	0.01	8.63	0.01	0.000
36.26	1.85	1.14	140.69	160.73	32	866.9	2249	0.21	0.022	0.01	8.63	0.01	0.000
36.42	1.85	1.14	141.38	161.51	32	869.0	2266	0.21	0.022	0.01	8.63	0.01	0.000
36.58	1.86	1.15	138.89	159.72	31	866.4	2257	0.21	0.022	0.01	8.63	0.01	0.000
36.75	1.87	1.16	134.75	156.42	31	860.4	2229	0.21	0.023	0.01	8.63	0.01	0.000
36.91	1.87	1.16	133.37	154.62	31	855.0	2203	0.21	0.023	0.01	8.63	0.01	0.000
37.08	1.87	1.16	131.05	152.17	30	848.7	2172	0.21	0.024	0.01	8.63	0.01	0.000
37.24	1.85	1.15	129.87	148.90	29	835.5	2100	0.21	0.025	0.02	8.63	0.01	0.000
37.40	1.84	1.14	128.27	146.11	29	825.6	2048	0.21	0.026	0.02	8.63	0.01	0.000
37.57	1.82	1.12	128.75	144.75	28	817.2	2004	0.21	0.026	0.02	8.63	0.01	0.001
37.73	1.83	1.13	126.58	142.77	28	812.7	1984	0.21	0.027	0.02	8.63	0.01	0.001
37.90	1.83	1.13	125.40	141.47	28	809.1	1969	0.21	0.027	0.02	8.63	0.01	0.001
38.06	1.84	1.14	123.07	139.79	27	806.6	1961	0.21	0.027	0.02	8.63	0.01	0.001
38.22	1.85	1.14	120.71	138.10	27	804.0	1952	0.21	0.028	0.02	8.63	0.01	0.001
38.39	1.87	1.16	115.63	134.15	27	796.6	1917	0.21	0.028	0.02	8.63	0.02	0.001
38.55	1.88	1.17	113.38	132.56	26	794.0	1908	0.21	0.029	0.02	8.63	0.02	0.001
38.72	1.87	1.16	115.47	134.33	27	797.9	1934	0.21	0.028	0.02	8.63	0.02	0.001
38.88	1.86	1.15	119.43	137.38	27	803.6	1969	0.21	0.028	0.02	8.63	0.02	0.001
39.04	1.83	1.13	122.97	138.94	27	802.4	1964	0.21	0.028	0.02	8.63	0.02	0.001
39.21	1.82	1.12	123.79	138.63	27	798.4	1945	0.21	0.028	0.02	8.63	0.02	0.001
39.37	1.82	1.12	122.40	137.19	27	794.6	1928	0.21	0.029	0.02	8.63	0.02	0.001
39.54	1.85	1.14	116.73	133.61	26	791.0	1916	0.21	0.029	0.02	8.63	0.02	0.001

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

Depth (ft)	Ic	Kc	Qc1n	Qc1n,cs	N1,60 (blows)	Vs (ft/s)	Gmax (tsf)	CSR	Shear, γ (%)	Svol,15 (%)	Nc	ev (%)	Settle. (in)
39.70	1.89	1.18	110.57	130.21	26	788.8	1912	0.21	0.029	0.02	8.63	0.02	0.001
39.86	1.90	1.19	108.05	128.47	26	785.8	1901	0.21	0.030	0.02	8.63	0.02	0.001
40.03	1.88	1.17	109.26	128.35	26	782.5	1885	0.21	0.030	0.02	8.63	0.02	0.001
40.19	1.85	1.15	112.92	129.50	26	779.3	1869	0.21	0.030	0.02	8.63	0.02	0.001
40.36	1.85	1.14	113.95	130.15	26	780.0	1877	0.21	0.030	0.02	8.63	0.02	0.001
40.52	1.86	1.15	113.89	130.89	26	784.1	1904	0.21	0.030	0.02	8.63	0.02	0.001
40.68	1.87	1.16	113.16	131.58	26	789.6	1940	0.21	0.029	0.02	8.63	0.02	0.001
40.85	1.85	1.15	117.31	134.77	27	795.5	1977	0.21	0.029	0.02	8.63	0.02	0.001
41.01	1.82	1.13	125.46	141.15	28	807.3	2046	0.21	0.027	0.02	8.63	0.01	0.001
41.18	1.80	1.11	131.77	146.28	28	817.0	2105	0.21	0.026	0.02	8.63	0.01	0.001
41.34	1.82	1.12	130.83	146.71	29	821.8	2140	0.21	0.026	0.02	8.63	0.01	0.001
41.50	1.85	1.15	126.06	144.85	29	824.8	2166	0.21	0.026	0.02	8.63	0.01	0.001
41.67	1.88	1.17	121.80	142.64	28	824.1	2168	0.21	0.026	0.02	8.63	0.01	0.001
41.83	1.89	1.18	119.28	140.48	28	819.3	2146	0.21	0.026	0.02	8.63	0.01	0.001
42.00	1.89	1.18	117.69	138.56	28	813.6	2117	0.21	0.027	0.02	8.63	0.01	0.001
42.16	1.91	1.20	114.03	136.45	27	811.4	2110	0.21	0.027	0.02	8.63	0.01	0.001
42.32	1.98	1.27	103.95	132.07	27	809.0	2107	0.21	0.027	0.02	8.63	0.01	0.001
42.49	2.09	1.43	87.54	125.47	27	796.7	2049	0.21	0.028	0.02	8.63	0.02	0.001
42.65	2.20	1.66	73.02	121.25	27	779.8	1966	0.21	0.030	0.02	8.63	0.02	0.001
42.82	2.25	1.80	67.20	120.63	28	772.9	1936	0.21	0.030	0.02	8.63	0.02	0.001
42.98	2.26	1.83	66.47	121.47	28	774.2	1948	0.21	0.030	0.02	8.63	0.02	0.001
43.15	2.26	1.82	67.55	123.26	28	780.0	1986	0.21	0.029	0.02	8.63	0.01	0.001
43.31	2.28	1.89	66.71	125.75	29	785.2	2022	0.21	0.029	0.02	8.63	0.01	0.001
43.47	2.30	1.95	66.38	129.43	30	793.6	2078	0.21	0.028	0.02	8.63	0.01	0.001
43.64	2.31	1.97	67.29	132.70	31	802.5	2136	0.21	0.027	0.02	8.63	0.01	0.000
43.80	2.30	1.95	69.50	135.59	32	812.2	2199	0.21	0.026	0.01	8.63	0.01	0.000
43.97	2.29	1.91	72.96	139.70	33	826.2	2290	0.21	0.025	0.01	8.63	0.01	0.000
44.13	2.27	1.85	78.79	145.75	34	847.0	2425	0.21	0.023	0.01	8.63	0.01	0.000
44.29	2.24	1.78	86.11	153.08	35	871.4	2587	0.21	0.021	0.01	8.63	0.01	0.000
44.46	2.20	1.67	94.42	158.02	36	889.8	2713	0.21	0.020	0.01	8.63	0.01	0.000
44.62	2.18	1.62	100.83	163.43	37	906.7	2834	0.21	0.019	0.01	8.63	0.01	0.000
44.79	2.17	1.60	105.77	169.16	38	923.2	2955	0.20	0.018	0.01	8.63	0.01	0.000
44.95	2.18	1.63	107.06	174.29	39	936.1	3057	0.20	0.018	0.01	8.63	0.01	0.000

Total estimated settlement: 0.45

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

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
45.11	173.95	2.00	0.00	1.00	0.00	45.28	166.37	2.00	0.00	1.00	0.00
45.44	159.43	2.00	0.00	1.00	0.00	45.61	163.49	2.00	0.00	1.00	0.00
45.77	174.73	2.00	0.00	1.00	0.00	45.93	185.21	2.00	0.00	1.00	0.00
46.10	182.08	2.00	0.00	1.00	0.00	46.26	171.18	2.00	0.00	1.00	0.00
46.43	153.43	2.00	0.00	1.00	0.00	46.59	137.19	2.00	0.00	1.00	0.00
46.75	121.52	2.00	0.00	1.00	0.00	46.92	104.66	2.00	0.00	1.00	0.00
47.08	89.91	2.00	0.00	1.00	0.00	47.25	81.26	2.00	0.00	1.00	0.00
47.41	83.80	2.00	0.00	1.00	0.00	47.57	87.68	2.00	0.00	1.00	0.00
47.74	95.77	2.00	0.00	1.00	0.00	47.90	105.48	2.00	0.00	1.00	0.00

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

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
48.07	116.28	2.00	0.00	1.00	0.00	48.23	125.61	2.00	0.00	1.00	0.00
48.39	129.78	2.00	0.00	1.00	0.00	48.56	127.72	2.00	0.00	1.00	0.00
48.72	124.81	2.00	0.00	1.00	0.00	48.89	136.01	2.00	0.00	1.00	0.00
49.05	158.64	2.00	0.00	1.00	0.00	49.22	178.32	2.00	0.00	1.00	0.00
49.38	179.29	2.00	0.00	1.00	0.00	49.54	164.48	2.00	0.00	1.00	0.00
49.71	148.82	2.00	0.00	1.00	0.00	49.87	143.20	2.00	0.00	1.00	0.00
50.04	143.53	2.00	0.00	1.00	0.00	50.20	143.93	2.00	0.00	1.00	0.00

Total estimated settlement: 0.00

Abbreviations

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

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

Depth (ft)	q_t (tsf)	Q_{tn}	K_c	$Q_{tn,cs}$	I_c	$S_{u(liq)}/\sigma'_v$	$S_{u(peak)}/\sigma'_v$
0.33	201.98	324.48	1.00	324.48	1.15	N/A	N/A
0.49	149.81	240.65	1.00	240.65	1.35	N/A	N/A
0.66	91.21	146.48	1.00	147.15	1.65	N/A	N/A
0.82	57.71	92.64	1.20	111.46	1.91	N/A	N/A
0.98	41.14	66.01	1.46	96.53	2.10	N/A	N/A
1.15	30.34	48.64	1.86	90.55	2.27	N/A	N/A
1.31	27.84	44.61	1.90	84.63	2.28	N/A	N/A
1.48	25.78	41.28	1.82	75.09	2.26	N/A	N/A
1.64	23.14	37.03	1.73	64.22	2.23	N/A	N/A
1.80	20.30	32.45	1.71	55.52	2.22	N/A	N/A
1.97	18.76	29.97	1.69	50.53	2.21	N/A	N/A
2.13	17.66	28.19	1.78	50.16	2.24	N/A	N/A
2.30	16.29	25.97	1.92	49.86	2.29	N/A	N/A
2.46	14.73	23.44	2.12	49.73	2.35	N/A	N/A
2.62	13.96	22.20	2.24	49.76	2.38	N/A	N/A
2.79	13.89	22.08	2.25	49.77	2.39	N/A	N/A
2.95	14.09	22.39	2.22	49.75	2.38	N/A	N/A
3.12	14.03	22.27	2.23	49.76	2.38	N/A	N/A
3.28	13.29	21.07	2.37	49.84	2.41	N/A	N/A
3.45	12.56	19.88	2.20	43.68	2.37	N/A	N/A
3.61	12.36	19.55	2.23	43.68	2.38	N/A	N/A
3.77	12.76	20.19	2.16	43.69	2.36	N/A	N/A
3.94	13.40	21.20	2.35	49.83	2.41	N/A	N/A
4.10	15.10	23.91	2.30	55.05	2.40	N/A	N/A
4.27	16.23	25.72	2.32	59.78	2.40	N/A	N/A
4.43	17.53	27.79	2.14	59.60	2.36	N/A	N/A
4.59	18.20	28.85	1.91	55.01	2.29	N/A	N/A
4.76	19.63	31.14	1.63	50.83	2.19	N/A	N/A
4.92	18.63	29.52	2.02	59.56	2.32	N/A	N/A
5.09	16.34	25.81	2.66	68.80	2.48	N/A	N/A
5.25	15.04	23.71	3.28	77.89	2.59	N/A	N/A
5.41	20.90	33.13	2.49	82.54	2.44	N/A	N/A
5.58	32.57	51.86	1.85	96.11	2.27	N/A	N/A
5.74	45.24	72.19	1.65	119.21	2.19	N/A	N/A
5.91	53.24	85.03	1.59	135.20	2.17	N/A	N/A
6.07	57.27	91.50	1.55	142.02	2.15	N/A	N/A
6.23	62.37	99.68	1.40	139.77	2.07	N/A	N/A
6.40	71.31	114.01	1.22	139.62	1.94	N/A	N/A
6.56	79.04	126.42	1.12	141.11	1.81	N/A	N/A
6.73	81.74	130.74	1.06	138.90	1.74	N/A	N/A
6.89	77.74	124.30	1.05	130.57	1.72	N/A	N/A
7.05	71.74	114.65	1.05	119.85	1.71	N/A	N/A
7.22	66.61	105.84	1.05	110.87	1.71	N/A	N/A
7.38	63.31	99.72	1.00	99.72	1.72	N/A	N/A
7.55	61.31	95.31	1.00	95.31	1.72	N/A	N/A
7.71	59.67	91.50	1.00	91.50	1.71	N/A	N/A
7.87	57.74	87.38	1.00	87.38	1.71	N/A	N/A
8.04	55.64	83.88	1.00	83.88	1.73	N/A	N/A

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

Depth (ft)	q_t (tsf)	Q_{tn}	K_c	$Q_{tn,cs}$	I_c	$S_{u(liq)}/\sigma'_v$	$S_{u(peak)}/\sigma'_v$
8.20	53.47	79.49	1.00	79.49	1.73	N/A	N/A
8.37	52.07	76.98	1.00	76.98	1.74	N/A	N/A
8.53	51.64	75.75	1.00	75.75	1.75	N/A	N/A
8.69	51.48	76.23	1.00	76.23	1.82	N/A	N/A
8.86	51.64	76.25	1.14	86.92	1.84	N/A	N/A
9.02	52.14	76.68	1.16	88.82	1.87	N/A	N/A
9.19	53.08	77.05	1.15	88.87	1.86	N/A	N/A
9.35	53.31	76.61	1.15	88.43	1.86	N/A	N/A
9.51	52.08	73.90	1.15	84.85	1.85	N/A	N/A
9.68	49.78	69.91	1.00	69.91	1.86	N/A	N/A
9.84	47.84	66.45	1.00	66.45	1.85	N/A	N/A
10.01	47.44	65.84	1.00	65.84	1.89	N/A	N/A
10.17	49.51	68.58	1.21	82.82	1.92	N/A	N/A
10.34	54.84	75.74	1.24	93.63	1.95	N/A	N/A
10.50	64.88	88.53	1.22	108.12	1.93	N/A	N/A
10.66	83.01	110.97	1.17	129.78	1.88	N/A	N/A
10.83	106.84	140.21	1.13	158.98	1.84	N/A	N/A
10.99	137.75	176.42	1.08	190.54	1.76	N/A	N/A
11.16	175.05	219.84	1.05	229.79	1.71	N/A	N/A
11.32	216.82	270.73	1.05	285.30	1.72	N/A	N/A
11.48	278.12	349.00	1.10	384.56	1.79	N/A	N/A
11.65	353.79	448.56	1.19	533.24	1.90	N/A	N/A
11.81	366.61	472.88	1.37	648.41	2.05	N/A	N/A
11.98	389.91	502.48	1.47	740.22	2.11	N/A	N/A
12.14	351.65	453.49	1.62	735.38	2.18	N/A	N/A
12.30	342.37	435.18	1.58	687.19	2.16	N/A	N/A
12.47	274.20	347.24	1.71	593.45	2.22	N/A	N/A
12.63	220.07	276.71	1.79	496.19	2.25	N/A	N/A
12.80	179.50	223.18	1.82	406.70	2.26	N/A	N/A
12.96	152.16	187.01	1.83	341.87	2.26	N/A	N/A
13.12	139.58	169.18	1.77	299.85	2.24	N/A	N/A
13.29	133.09	158.94	1.70	270.46	2.21	N/A	N/A
13.45	129.07	152.16	1.65	250.86	2.19	N/A	N/A
13.62	128.31	149.35	1.60	239.46	2.17	N/A	N/A
13.78	130.72	150.44	1.57	235.68	2.16	N/A	N/A
13.94	134.50	153.18	1.54	236.12	2.14	N/A	N/A
14.11	142.09	160.73	1.60	257.19	2.17	N/A	N/A
14.27	158.47	178.39	1.70	303.56	2.21	N/A	N/A
14.44	183.25	205.06	1.81	370.23	2.25	N/A	N/A
14.60	204.62	227.45	1.89	430.60	2.28	N/A	N/A
14.76	214.11	236.24	1.98	466.61	2.31	N/A	N/A
14.93	225.57	246.04	1.91	470.84	2.29	N/A	N/A
15.09	220.53	238.10	1.88	448.55	2.28	N/A	N/A
15.26	212.86	227.57	1.89	430.36	2.28	N/A	N/A
15.42	201.30	213.77	2.04	435.10	2.33	N/A	N/A
15.58	206.00	216.36	1.93	416.55	2.29	N/A	N/A
15.75	214.01	222.22	1.80	400.99	2.25	N/A	N/A
15.91	217.44	223.51	1.72	384.61	2.22	N/A	N/A

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

Depth (ft)	q_t (tsf)	Q_{tn}	K_c	$Q_{tn,cs}$	I_c	$S_{u(liq)}/\sigma'_v$	$S_{u(peak)}/\sigma'_v$
16.08	217.68	222.01	1.80	398.80	2.25	N/A	N/A
16.24	212.70	215.22	1.85	397.54	2.27	N/A	N/A
16.40	221.13	221.47	1.69	373.40	2.21	N/A	N/A
16.57	238.84	236.59	1.48	349.62	2.11	N/A	N/A
16.73	254.28	249.45	1.32	330.16	2.02	N/A	N/A
16.90	249.33	242.48	1.26	304.72	1.96	N/A	N/A
17.06	233.55	225.37	1.21	271.70	1.92	N/A	N/A
17.23	218.53	209.19	1.13	236.02	1.83	N/A	N/A
17.39	202.74	192.74	1.06	204.91	1.74	N/A	N/A
17.55	184.88	174.72	1.03	179.26	1.68	N/A	N/A
17.72	164.68	154.70	1.05	162.92	1.72	N/A	N/A
17.88	146.19	136.50	1.09	148.77	1.78	N/A	N/A
18.05	131.43	121.90	1.13	137.57	1.83	N/A	N/A
18.21	125.56	115.76	1.15	133.44	1.86	N/A	N/A
18.37	124.60	114.23	1.16	133.05	1.87	N/A	N/A
18.54	127.50	116.22	1.17	136.35	1.88	N/A	N/A
18.70	133.83	121.44	1.15	140.23	1.86	N/A	N/A
18.87	144.03	130.06	1.15	149.69	1.86	N/A	N/A
19.03	159.43	143.10	1.20	171.14	1.91	N/A	N/A
19.19	186.47	166.16	1.29	214.14	1.99	N/A	N/A
19.36	214.43	189.41	1.42	268.85	2.08	N/A	N/A
19.52	231.64	202.94	1.53	309.83	2.14	N/A	N/A
19.69	238.97	206.94	1.80	373.28	2.25	N/A	N/A
19.85	238.96	204.93	2.00	409.34	2.31	N/A	N/A
20.01	282.99	241.78	1.85	446.41	2.27	N/A	N/A
20.18	359.88	308.00	1.49	458.26	2.12	N/A	N/A
20.34	483.41	415.60	1.23	513.09	1.95	N/A	N/A
20.51	558.79	480.30	1.15	553.13	1.86	N/A	N/A
20.67	595.90	510.75	1.12	574.27	1.82	N/A	N/A
20.83	585.39	498.46	1.14	569.31	1.85	N/A	N/A
21.00	576.12	487.04	1.16	566.84	1.87	N/A	N/A
21.16	542.84	455.31	1.20	544.84	1.91	N/A	N/A
21.33	478.92	398.98	1.21	482.46	1.92	N/A	N/A
21.49	403.30	331.64	1.32	436.51	2.01	N/A	N/A
21.65	376.29	305.97	1.42	434.04	2.08	N/A	N/A
21.82	349.84	279.74	1.67	466.57	2.20	N/A	N/A
21.98	333.91	264.55	1.76	464.94	2.24	N/A	N/A
22.15	303.74	238.21	1.86	443.36	2.27	N/A	N/A
22.31	317.27	249.50	1.63	405.82	2.18	N/A	N/A
22.47	335.09	264.71	1.42	377.08	2.08	N/A	N/A
22.64	342.05	271.13	1.29	350.80	2.00	N/A	N/A
22.80	342.60	270.59	1.28	345.53	1.98	N/A	N/A
22.97	335.55	262.91	1.31	343.80	2.01	N/A	N/A
23.13	315.67	244.96	1.36	333.85	2.04	N/A	N/A
23.30	287.84	221.26	1.41	312.80	2.08	N/A	N/A
23.46	280.42	215.09	1.37	294.90	2.05	N/A	N/A
23.62	289.95	222.85	1.29	287.94	1.99	N/A	N/A
23.79	306.78	236.32	1.23	289.64	1.94	N/A	N/A

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

Depth (ft)	q_t (tsf)	Q_{tn}	K_c	$Q_{tn,cs}$	I_c	$S_{u(liq)}/\sigma'_v$	$S_{u(peak)}/\sigma'_v$
23.95	312.15	239.98	1.21	289.21	1.92	N/A	N/A
24.12	317.41	243.16	1.20	290.85	1.91	N/A	N/A
24.28	314.51	239.25	1.21	290.67	1.93	N/A	N/A
24.44	302.47	227.86	1.26	286.09	1.96	N/A	N/A
24.61	254.49	187.95	1.40	262.34	2.07	N/A	N/A
24.77	207.68	150.54	1.56	235.02	2.15	N/A	N/A
24.94	183.55	131.74	1.62	213.12	2.18	N/A	N/A
25.10	199.66	144.84	1.42	205.04	2.08	N/A	N/A
25.26	223.82	164.10	1.28	209.37	1.98	N/A	N/A
25.43	237.55	174.75	1.22	213.11	1.93	N/A	N/A
25.59	238.22	174.67	1.21	211.95	1.93	N/A	N/A
25.76	226.48	164.33	1.25	205.90	1.96	N/A	N/A
25.92	211.44	152.05	1.28	195.35	1.99	N/A	N/A
26.08	201.57	144.21	1.29	185.86	1.99	N/A	N/A
26.25	201.64	144.42	1.25	180.33	1.96	N/A	N/A
26.41	203.70	145.69	1.23	179.44	1.94	N/A	N/A
26.58	205.43	146.50	1.22	179.26	1.93	N/A	N/A
26.74	206.86	147.21	1.21	178.57	1.92	N/A	N/A
26.90	207.65	147.06	1.22	179.24	1.93	N/A	N/A
27.07	205.05	144.01	1.24	179.09	1.95	N/A	N/A
27.23	197.09	137.32	1.27	174.02	1.97	N/A	N/A
27.40	194.12	134.82	1.26	169.90	1.97	N/A	N/A
27.56	200.09	139.40	1.22	170.05	1.93	N/A	N/A
27.72	215.12	150.29	1.19	178.60	1.90	N/A	N/A
27.89	226.02	157.65	1.18	185.84	1.89	N/A	N/A
28.05	230.88	160.47	1.18	189.22	1.89	N/A	N/A
28.22	228.31	157.80	1.19	187.31	1.90	N/A	N/A
28.38	225.71	155.25	1.19	185.08	1.90	N/A	N/A
28.54	225.81	154.63	1.20	184.95	1.91	N/A	N/A
28.71	226.21	153.82	1.21	186.41	1.92	N/A	N/A
28.87	224.28	151.35	1.23	186.44	1.94	N/A	N/A
29.04	216.65	144.69	1.27	183.16	1.97	N/A	N/A
29.20	206.98	136.95	1.30	177.64	2.00	N/A	N/A
29.36	199.04	130.50	1.33	173.49	2.02	N/A	N/A
29.53	195.68	127.67	1.33	170.33	2.03	N/A	N/A
29.69	193.04	125.27	1.34	168.39	2.03	N/A	N/A
29.86	188.68	121.66	1.36	165.35	2.04	N/A	N/A
30.02	181.24	115.67	1.40	162.28	2.07	N/A	N/A
30.19	175.71	111.11	1.44	160.03	2.09	N/A	N/A
30.35	172.30	108.25	1.46	158.06	2.10	N/A	N/A
30.51	173.47	108.58	1.46	158.53	2.10	N/A	N/A
30.68	178.37	112.09	1.40	157.14	2.07	N/A	N/A
30.84	188.30	119.19	1.33	158.90	2.02	N/A	N/A
31.01	199.81	128.04	1.25	159.85	1.96	N/A	N/A
31.17	211.41	136.49	1.20	164.06	1.91	N/A	N/A
31.33	221.04	143.26	1.18	168.34	1.89	N/A	N/A
31.50	224.93	145.03	1.18	171.47	1.89	N/A	N/A
31.66	228.12	146.43	1.19	173.90	1.90	N/A	N/A

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

Depth (ft)	q_t (tsf)	Q_{tn}	K_c	$Q_{tn,cs}$	I_c	$S_{u(liq)}/\sigma'_v$	$S_{u(peak)}/\sigma'_v$
31.83	229.57	147.10	1.18	173.80	1.89	N/A	N/A
31.99	234.01	150.18	1.16	174.92	1.87	N/A	N/A
32.15	235.81	151.30	1.16	174.75	1.86	N/A	N/A
32.32	233.88	149.31	1.16	173.29	1.87	N/A	N/A
32.48	231.28	146.74	1.17	171.86	1.88	N/A	N/A
32.65	227.98	143.50	1.19	170.40	1.90	N/A	N/A
32.81	226.58	141.73	1.20	169.95	1.91	N/A	N/A
32.97	226.78	141.52	1.20	169.28	1.91	N/A	N/A
33.14	226.49	141.59	1.18	166.76	1.89	N/A	N/A
33.30	224.99	140.85	1.16	163.72	1.87	N/A	N/A
33.47	216.55	134.86	1.17	157.54	1.88	N/A	N/A
33.63	201.39	123.72	1.20	148.84	1.91	N/A	N/A
33.79	185.65	112.58	1.24	139.45	1.95	N/A	N/A
33.96	177.32	107.28	1.23	132.23	1.94	N/A	N/A
34.12	179.49	109.09	1.20	131.34	1.92	N/A	N/A
34.29	183.52	112.15	1.18	131.83	1.89	N/A	N/A
34.45	183.09	111.31	1.18	131.67	1.89	N/A	N/A
34.61	181.28	109.81	1.19	130.14	1.90	N/A	N/A
34.78	182.28	110.00	1.19	130.65	1.90	N/A	N/A
34.94	187.41	113.04	1.18	133.51	1.89	N/A	N/A
35.11	197.71	119.47	1.17	139.50	1.88	N/A	N/A
35.27	210.35	127.45	1.15	146.96	1.86	N/A	N/A
35.43	223.12	135.52	1.14	154.46	1.84	N/A	N/A
35.60	228.72	138.50	1.14	158.01	1.84	N/A	N/A
35.76	230.72	139.04	1.15	159.48	1.85	N/A	N/A
35.93	229.95	137.87	1.15	158.98	1.86	N/A	N/A
36.09	232.32	139.17	1.15	159.78	1.85	N/A	N/A
36.26	235.02	140.69	1.14	160.73	1.85	N/A	N/A
36.42	236.79	141.38	1.14	161.51	1.85	N/A	N/A
36.58	233.93	138.89	1.15	159.72	1.86	N/A	N/A
36.75	228.53	134.75	1.16	156.42	1.87	N/A	N/A
36.91	226.69	133.37	1.16	154.62	1.87	N/A	N/A
37.08	223.56	131.05	1.16	152.17	1.87	N/A	N/A
37.24	221.00	129.87	1.15	148.90	1.85	N/A	N/A
37.40	218.26	128.27	1.14	146.11	1.84	N/A	N/A
37.57	218.40	128.75	1.12	144.75	1.82	N/A	N/A
37.73	215.60	126.58	1.13	142.77	1.83	N/A	N/A
37.90	214.20	125.40	1.13	141.47	1.83	N/A	N/A
38.06	211.43	123.07	1.14	139.79	1.84	N/A	N/A
38.22	208.60	120.71	1.14	138.10	1.85	N/A	N/A
38.39	201.67	115.63	1.16	134.15	1.87	N/A	N/A
38.55	198.93	113.38	1.17	132.56	1.88	N/A	N/A
38.72	202.67	115.47	1.16	134.33	1.87	N/A	N/A
38.88	209.04	119.43	1.15	137.38	1.86	N/A	N/A
39.04	213.94	122.97	1.13	138.94	1.83	N/A	N/A
39.21	215.01	123.79	1.12	138.63	1.82	N/A	N/A
39.37	213.21	122.40	1.12	137.19	1.82	N/A	N/A
39.54	205.97	116.73	1.14	133.61	1.85	N/A	N/A

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

Depth (ft)	q_t (tsf)	Q_{tn}	K_c	$Q_{tn,cs}$	I_c	$S_{u(liq)}/\sigma'_v$	$S_{u(peak)}/\sigma'_v$
39.70	198.17	110.57	1.18	130.21	1.89	N/A	N/A
39.86	194.96	108.05	1.19	128.47	1.90	N/A	N/A
40.03	196.63	109.26	1.17	128.35	1.88	N/A	N/A
40.19	201.46	112.92	1.15	129.50	1.85	N/A	N/A
40.36	203.39	113.95	1.14	130.15	1.85	N/A	N/A
40.52	204.36	113.89	1.15	130.89	1.86	N/A	N/A
40.68	204.63	113.16	1.16	131.58	1.87	N/A	N/A
40.85	211.40	117.31	1.15	134.77	1.85	N/A	N/A
41.01	224.16	125.46	1.13	141.15	1.82	N/A	N/A
41.18	234.29	131.77	1.11	146.28	1.80	N/A	N/A
41.34	234.36	130.83	1.12	146.71	1.82	N/A	N/A
41.50	229.15	126.06	1.15	144.85	1.85	N/A	N/A
41.67	224.02	121.80	1.17	142.64	1.88	N/A	N/A
41.83	220.52	119.28	1.18	140.48	1.89	N/A	N/A
42.00	218.12	117.69	1.18	138.56	1.89	N/A	N/A
42.16	213.45	114.03	1.20	136.45	1.91	N/A	N/A
42.32	199.99	103.95	1.27	132.07	1.98	N/A	N/A
42.49	176.02	87.54	1.43	125.47	2.09	N/A	N/A
42.65	153.41	73.02	1.66	121.25	2.20	N/A	N/A
42.82	144.41	67.20	1.80	120.63	2.25	N/A	N/A
42.98	143.85	66.47	1.83	121.47	2.26	N/A	N/A
43.15	146.55	67.55	1.82	123.26	2.26	N/A	N/A
43.31	146.22	66.71	1.89	125.75	2.28	N/A	N/A
43.47	147.02	66.38	1.95	129.43	2.30	N/A	N/A
43.64	149.82	67.29	1.97	132.70	2.31	N/A	N/A
43.80	154.72	69.50	1.95	135.59	2.30	N/A	N/A
43.97	162.12	72.96	1.91	139.70	2.29	N/A	N/A
44.13	173.99	78.79	1.85	145.75	2.27	N/A	N/A
44.29	188.69	86.11	1.78	153.08	2.24	N/A	N/A
44.46	204.23	94.42	1.67	158.02	2.20	N/A	N/A
44.62	216.73	100.83	1.62	163.43	2.18	N/A	N/A
44.79	227.07	105.77	1.60	169.16	2.17	N/A	N/A
44.95	231.50	107.06	1.63	174.29	2.18	N/A	N/A
45.11	225.07	102.82	1.69	173.95	2.21	0.83	0.83
45.28	207.16	93.11	1.79	166.37	2.25	0.82	0.82
45.44	188.29	82.91	1.92	159.43	2.29	0.80	0.80
45.61	174.56	74.36	2.20	163.49	2.37	0.79	0.79
45.77	176.93	74.13	2.36	174.73	2.41	0.79	0.79
45.93	181.67	75.33	2.46	185.21	2.43	0.79	0.79
46.10	164.01	66.17	2.75	182.08	2.50	0.77	0.77
46.26	129.50	49.47	3.46	171.18	2.62	3.11	3.11
46.43	88.67	30.97	4.95	153.43	2.82	2.10	2.10
46.59	71.56	23.97	5.72	137.19	2.90	1.68	1.68
46.75	60.07	19.54	6.22	121.52	2.95	1.40	1.40
46.92	54.24	17.72	5.91	104.66	2.92	1.25	1.25
47.08	48.31	15.76	5.70	89.91	2.90	1.10	1.10
47.25	46.41	15.31	5.31	81.26	2.86	1.06	1.06
47.41	42.38	13.38	6.26	83.80	2.96	0.96	0.96

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

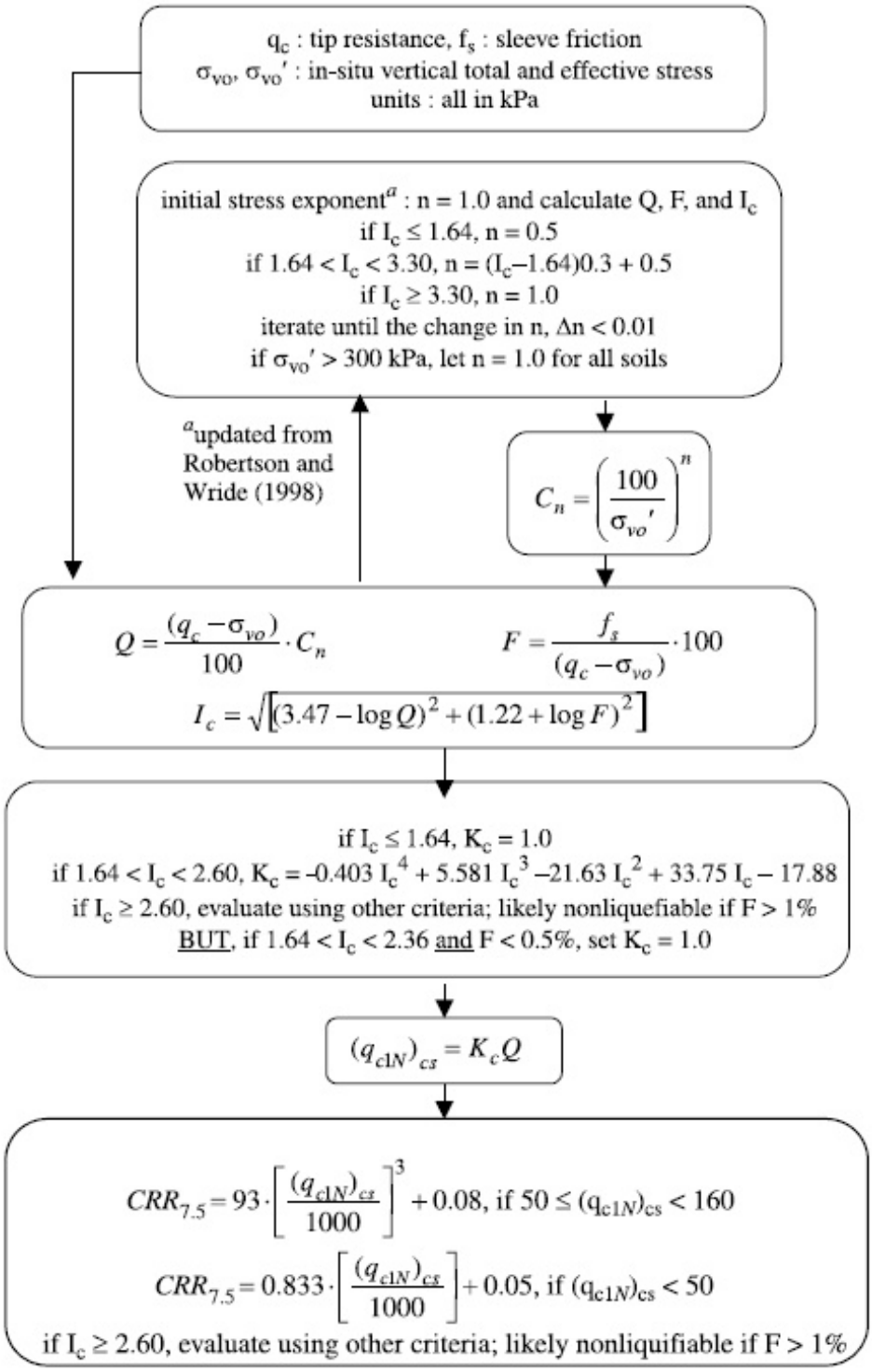
Depth (ft)	q_t (tsf)	Q_{tn}	K_c	$Q_{tn,cs}$	I_c	$S_{u(liq)}/\sigma'_v$	$S_{u(peak)}/\sigma'_v$
47.57	44.45	14.06	6.24	87.68	2.95	1.00	1.00
47.74	47.45	15.04	6.37	95.77	2.97	1.07	1.07
47.90	55.28	17.88	5.90	105.48	2.92	1.26	1.26
48.07	59.57	19.18	6.06	116.28	2.94	1.36	1.36
48.23	65.67	21.37	5.88	125.61	2.92	1.51	1.51
48.39	70.89	23.42	5.54	129.78	2.88	1.63	1.63
48.56	72.13	24.02	5.32	127.72	2.86	1.65	1.65
48.72	70.41	23.35	5.35	124.81	2.86	1.61	1.61
48.89	72.54	23.64	5.75	136.01	2.91	1.66	1.66
49.05	84.37	27.62	5.74	158.64	2.90	1.94	1.94
49.22	102.69	34.62	5.15	178.32	2.84	2.37	2.37
49.38	112.76	39.03	4.59	179.29	2.78	2.60	2.60
49.54	110.71	38.93	4.23	164.48	2.73	2.55	2.55
49.71	100.44	35.12	4.24	148.82	2.73	2.30	2.30
49.87	94.68	32.75	4.37	143.20	2.75	2.16	2.16
50.04	93.96	32.32	4.44	143.53	2.76	2.14	2.14
50.20	95.13	32.75	4.39	143.93	2.75	2.16	2.16

Abbreviations

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

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

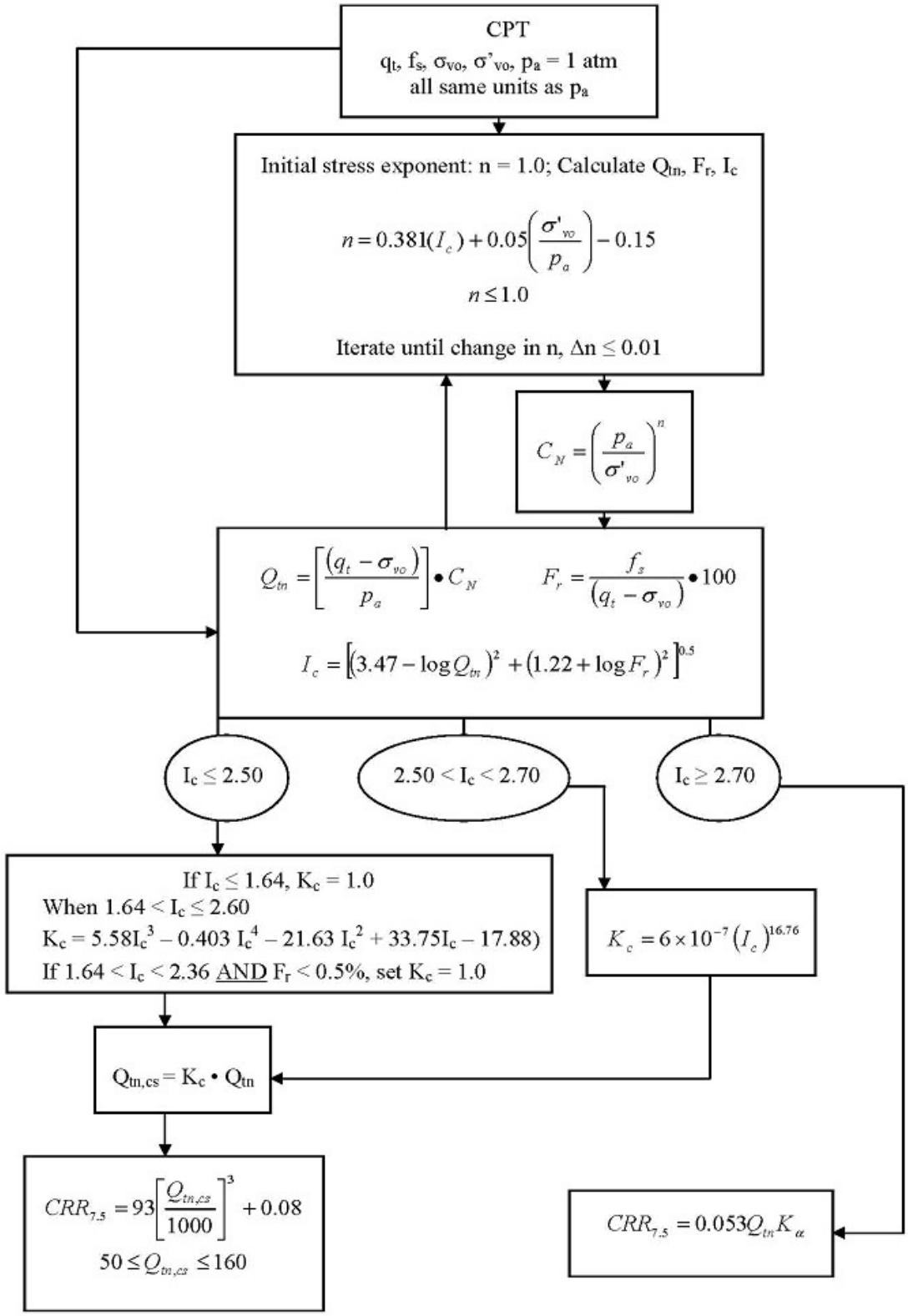
Calculation of soil resistance against liquefaction is performed according to the Robertson & Wride (1998) procedure. The procedure used in the software, slightly differs from the one originally published in NCEER-97-0022 (Proceedings of the NCEER Workshop on Evaluation of Liquefaction Resistance of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



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

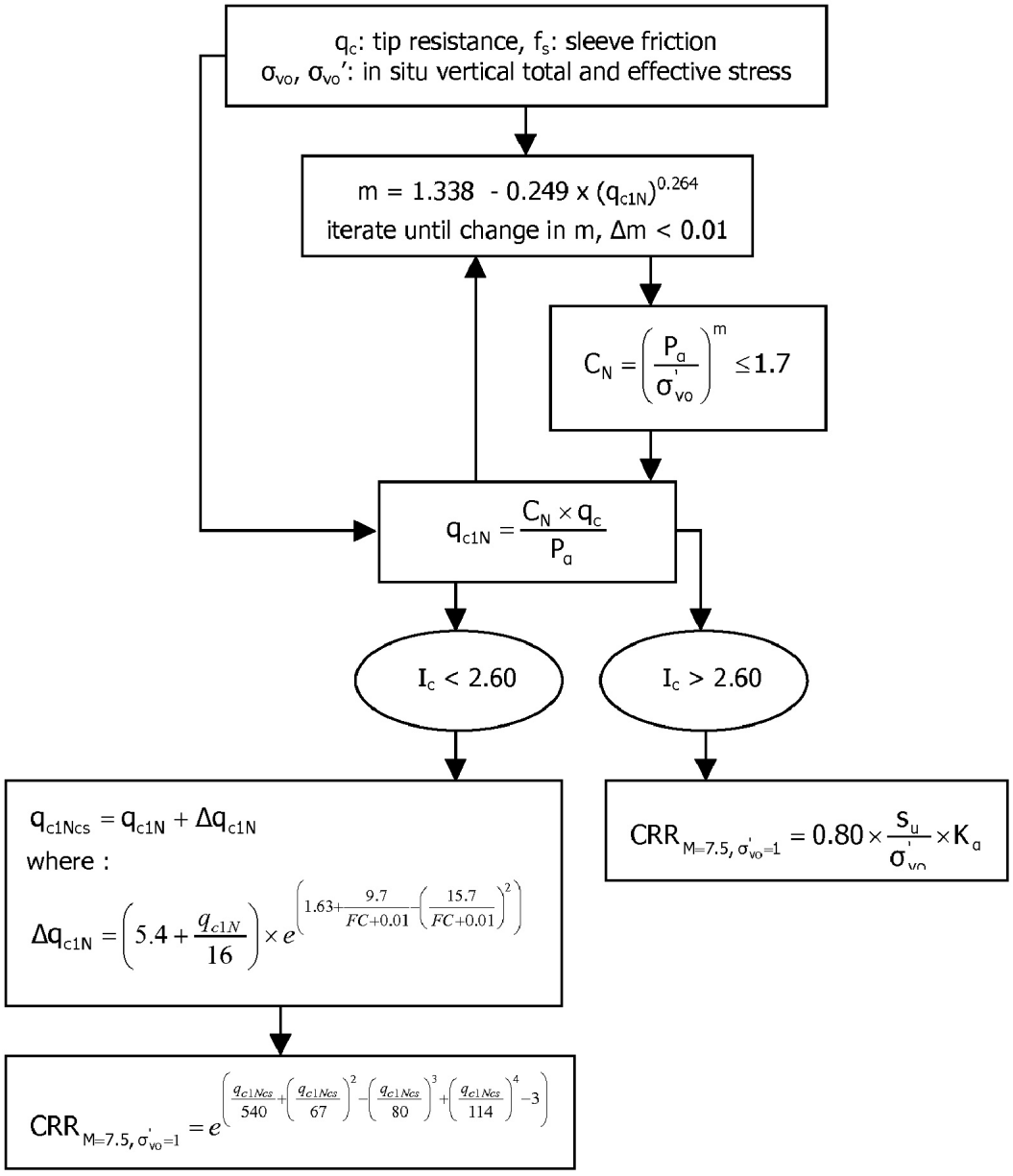
Procedure for the evaluation of soil liquefaction resistance (all soils), Robertson (2010)

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

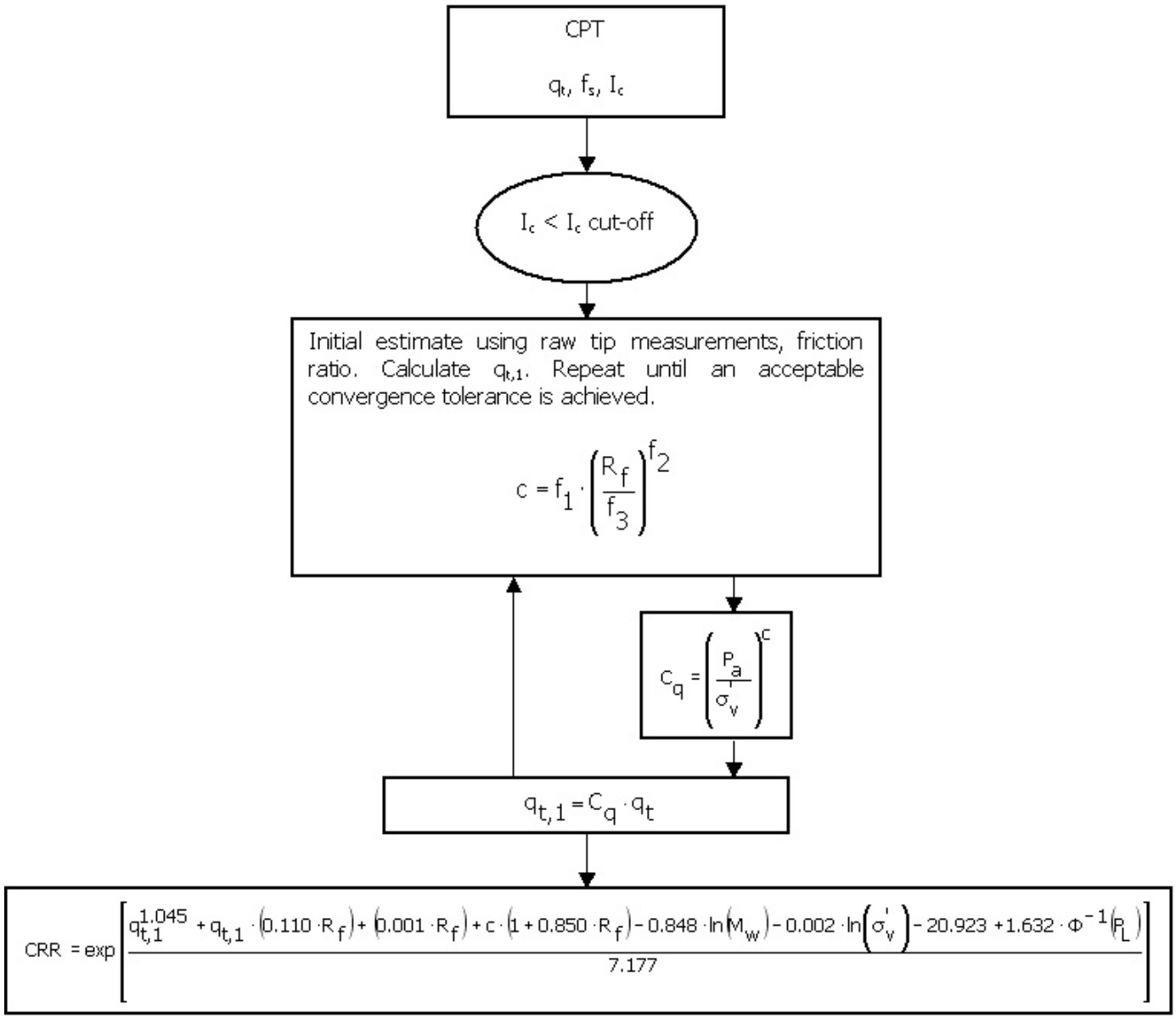


[1] P.K. Robertson, 2009. "Performance based earthquake design using the CPT", Keynote Lecture, International Conference on Performance-based Design in Earthquake Geotechnical Engineering – from case history to practice, IS-Tokyo, June 2009

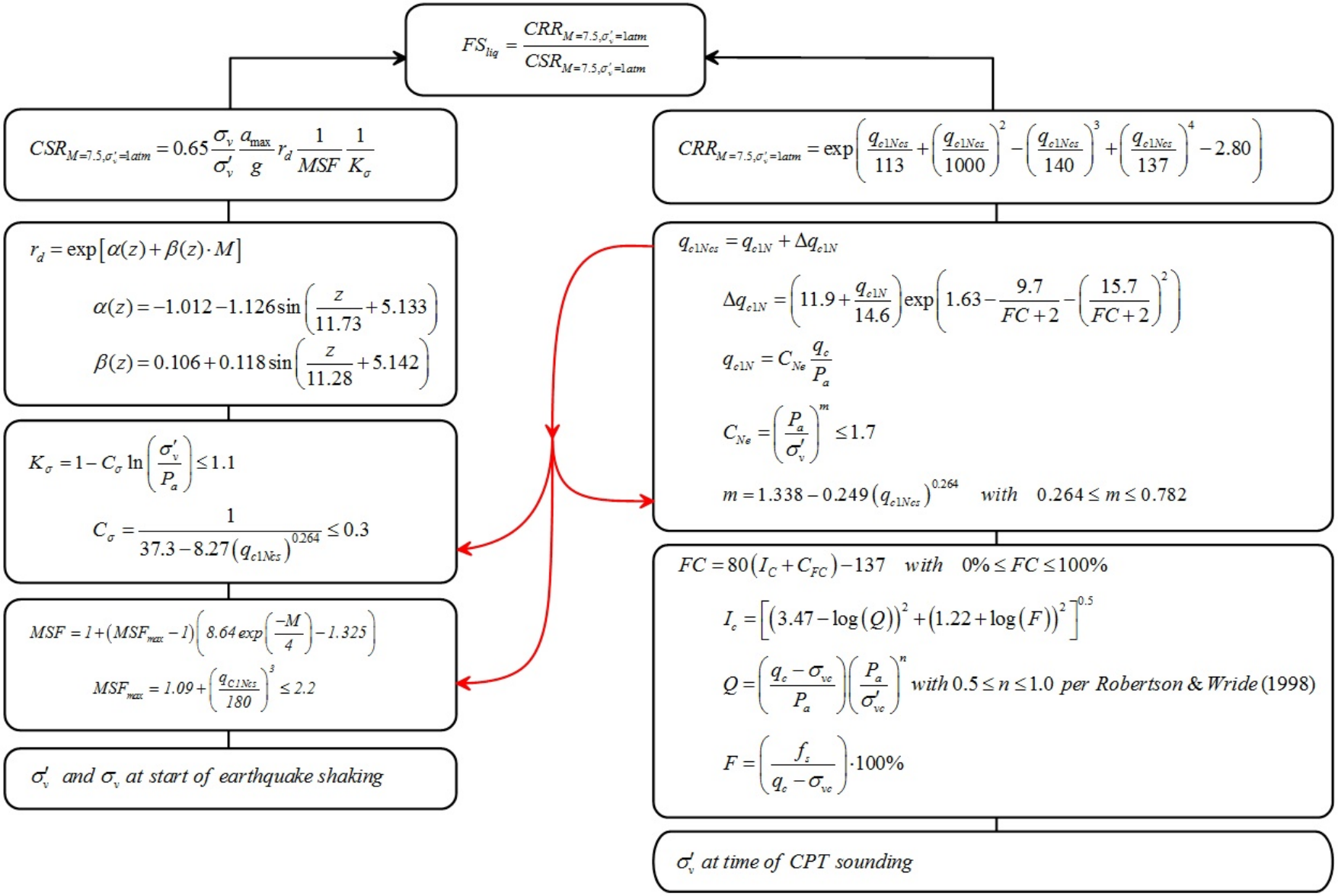
Procedure for the evaluation of soil liquefaction resistance, Idriss & Boulanger (2008)



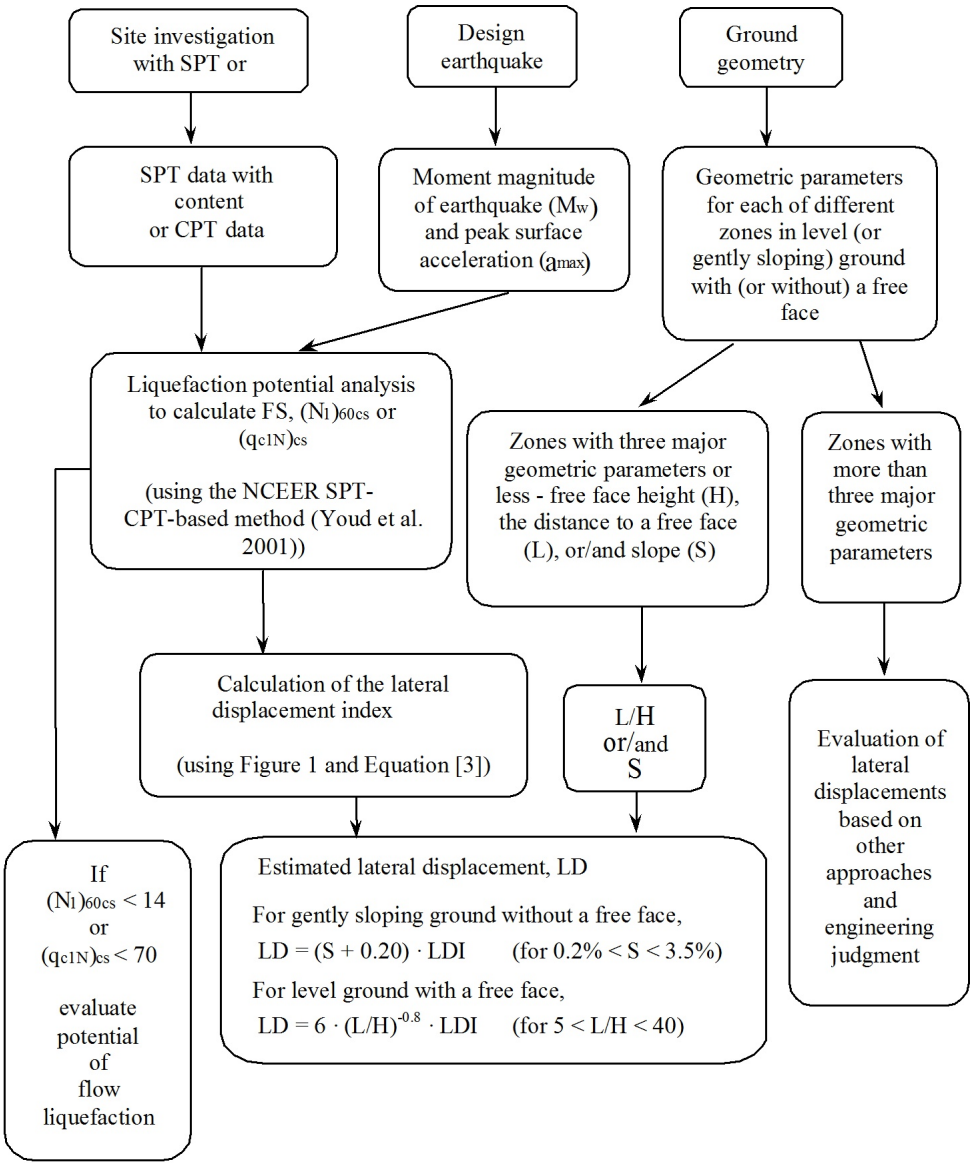
Procedure for the evaluation of soil liquefaction resistance (sandy soils), Moss et al. (2006)



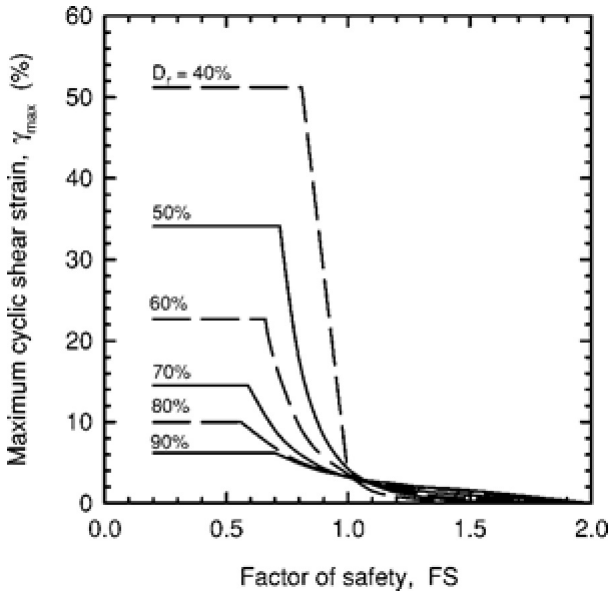
Procedure for the evaluation of soil liquefaction resistance, Boulanger & Idriss(2014)



Procedure for the evaluation of liquefaction-induced lateral spreading displacements



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



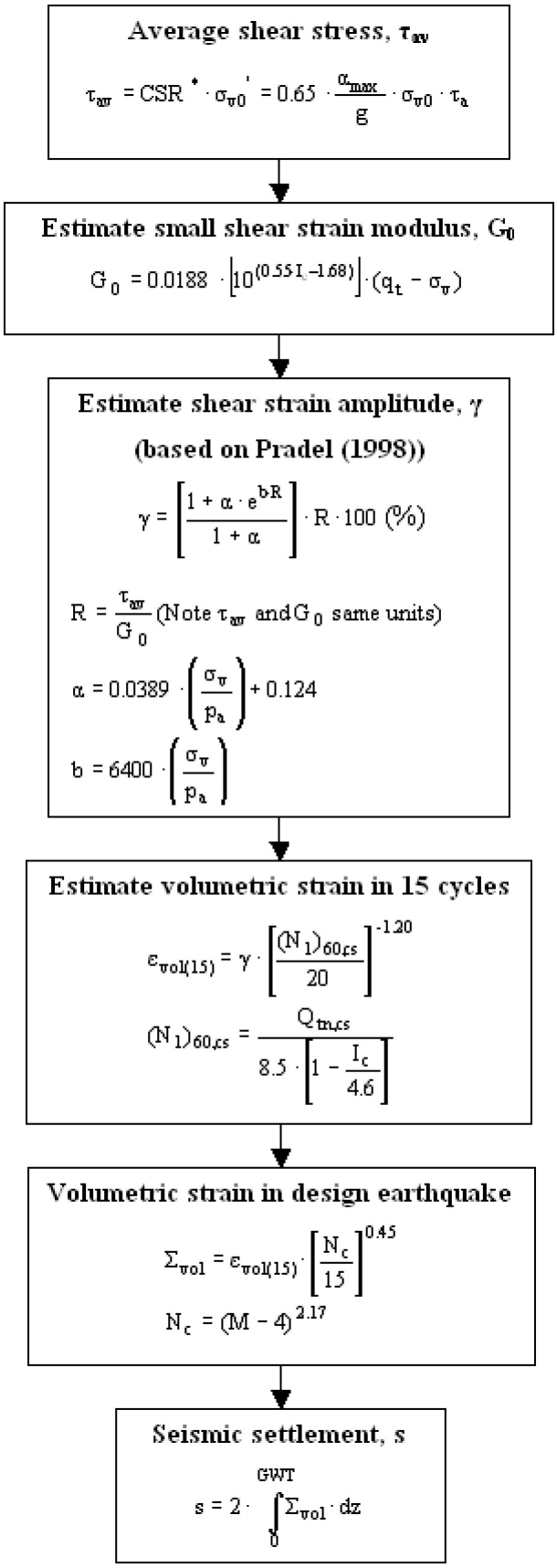
[1] **Figure 1**

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

[1] **Equation [3]**

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

Procedure for the estimation of seismic induced settlements in dry sands



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

Liquefaction Potential Index (LPI) calculation procedure

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

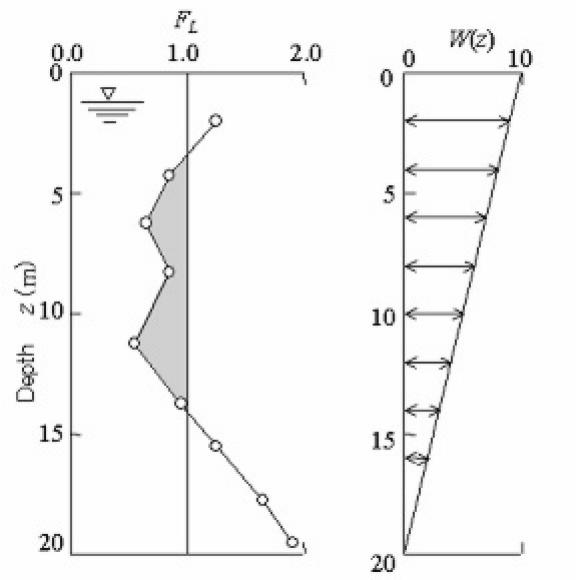
To estimate the severity of liquefaction extent at a given site, LPI is calculated based on the following equation:

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

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

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

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



Graphical presentation of the LPI calculation procedure

References

- Lunne, T., Robertson, P.K., and Powell, J.J.M 1997. Cone penetration testing in geotechnical practice, E & FN Spon Routledge, 352 p, ISBN 0-7514-0393-8.
- Boulanger, R.W. and Idriss, I. M., 2007. Evaluation of Cyclic Softening in Silts and Clays. ASCE Journal of Geotechnical and Geoenvironmental Engineering June, Vol. 133, No. 6 pp 641-652
- Boulanger, R.W. and Idriss, I. M., 2014. CPT AND SPT BASED LIQUEFACTION TRIGGERING PROCEDURES. DEPARTMENT OF CIVIL & ENVIRONMENTAL ENGINEERING COLLEGE OF ENGINEERING UNIVERSITY OF CALIFORNIA AT DAVIS
- Robertson, P.K. and Cabal, K.L., 2007, Guide to Cone Penetration Testing for Geotechnical Engineering. Available at no cost at http://www.geologismiki.gr/
- Robertson, P.K. 1990. Soil classification using the cone penetration test. Canadian Geotechnical Journal, 27 (1), 151-8.
- Robertson, P.K. and Wride, C.E., 1998. Cyclic Liquefaction and its Evaluation based on the CPT Canadian Geotechnical Journal, 1998, Vol. 35, August.
- Youd, T.L., Idriss, I.M., Andrus, R.D., Arango, I., Castro, G., Christian, J.T., Dobry, R., Finn, W.D.L., Harder, L.F., Hynes, M.E., Ishihara, K., Koester, J., Liao, S., Marcuson III, W.F., Martin, G.R., Mitchell, J.K., Moriwaki, Y., Power, M.S., Robertson, P.K., Seed, R., and Stokoe, K.H., Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER/NSF Workshop on Evaluation of Liquefaction Resistance of Soils, ASCE, Journal of Geotechnical & Geoenvironmental Engineering, Vol. 127, October, pp 817-833
- Zhang, G., Robertson. P.K., Brachman, R., 2002, Estimating Liquefaction Induced Ground Settlements from the CPT, Canadian Geotechnical Journal, 39: pp 1168-1180
- Zhang, G., Robertson. P.K., Brachman, R., 2004, Estimating Liquefaction Induced Lateral Displacements using the SPT and CPT, ASCE, Journal of Geotechnical & Geoenvironmental Engineering, Vol. 130, No. 8, 861-871
- Pradel, D., 1998, Procedure to Evaluate Earthquake-Induced Settlements in Dry Sandy Soils, ASCE, Journal of Geotechnical & Geoenvironmental Engineering, Vol. 124, No. 4, 364-368
- Iwasaki, T., 1986, Soil liquefaction studies in Japan: state-of-the-art, Soil Dynamics and Earthquake Engineering, Vol. 5, No. 1, 2-70
- Papathanassiou G., 2008, LPI-based approach for calibrating the severity of liquefaction-induced failures and for assessing the probability of liquefaction surface evidence, Eng. Geol. 96:94–104
- P.K. Robertson, 2009, Interpretation of Cone Penetration Tests - a unified approach., Canadian Geotechnical Journal, Vol. 46, No. 11, pp 1337-1355
- P.K. Robertson, 2009. "Performance based earthquake design using the CPT", Keynote Lecture, International Conference on Performance-based Design in Earthquake Geotechnical Engineering - from case history to practice, IS-Tokyo, June 2009
- Robertson, P.K. and Lisheng, S., 2010, "Estimation of seismic compression in dry soils using the CPT" FIFTH INTERNATIONAL CONFERENCE ON RECENT ADVANCES IN GEOTECHNICAL EARTHQUAKE ENGINEERING AND SOIL DYNAMICS, *Symposium in honor of professor I. M. Idriss,* SAN diego, CA
- R. E. S. Moss, R. B. Seed, R. E. Kayen, J. P. Stewart, A. Der Kiureghian, K. O. Cetin, CPT-Based Probabilistic and Deterministic Assessment of In Situ Seismic Soil Liquefaction Potential, Journal of Geotechnical and Geoenvironmental Engineering, Vol. 132, No. 8, August 1, 2006
- I. M. Idriss and R. W. Boulanger, 2008. Soil liquefaction during earthquakes, Earthquake Engineering Research Institute MNO-12

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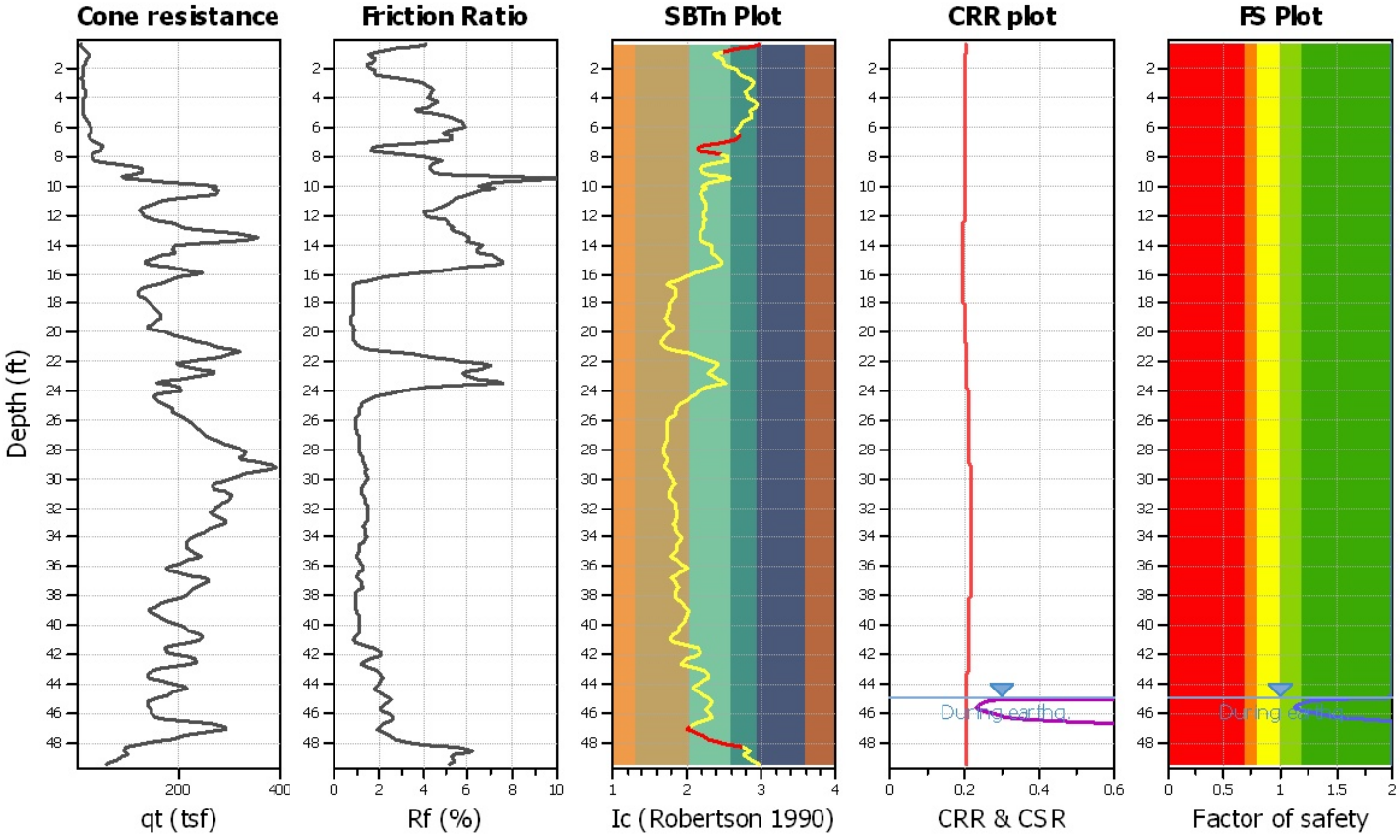
LIQUEFACTION ANALYSIS REPORT

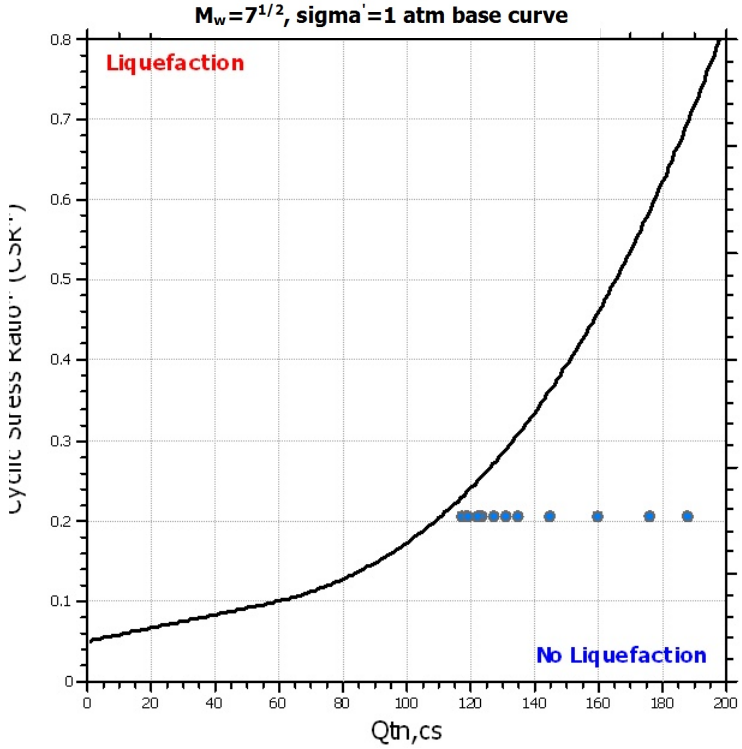
Project title : **Location :**

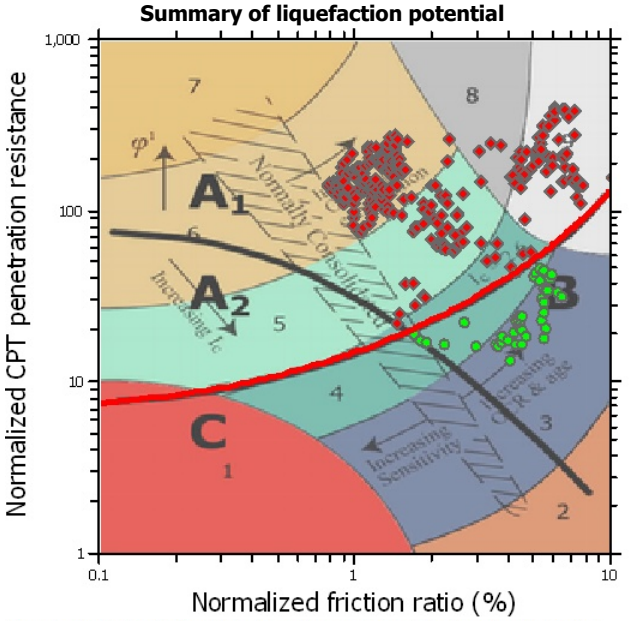
CPT file : CPT-02

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	45.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	45.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.70	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.32	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

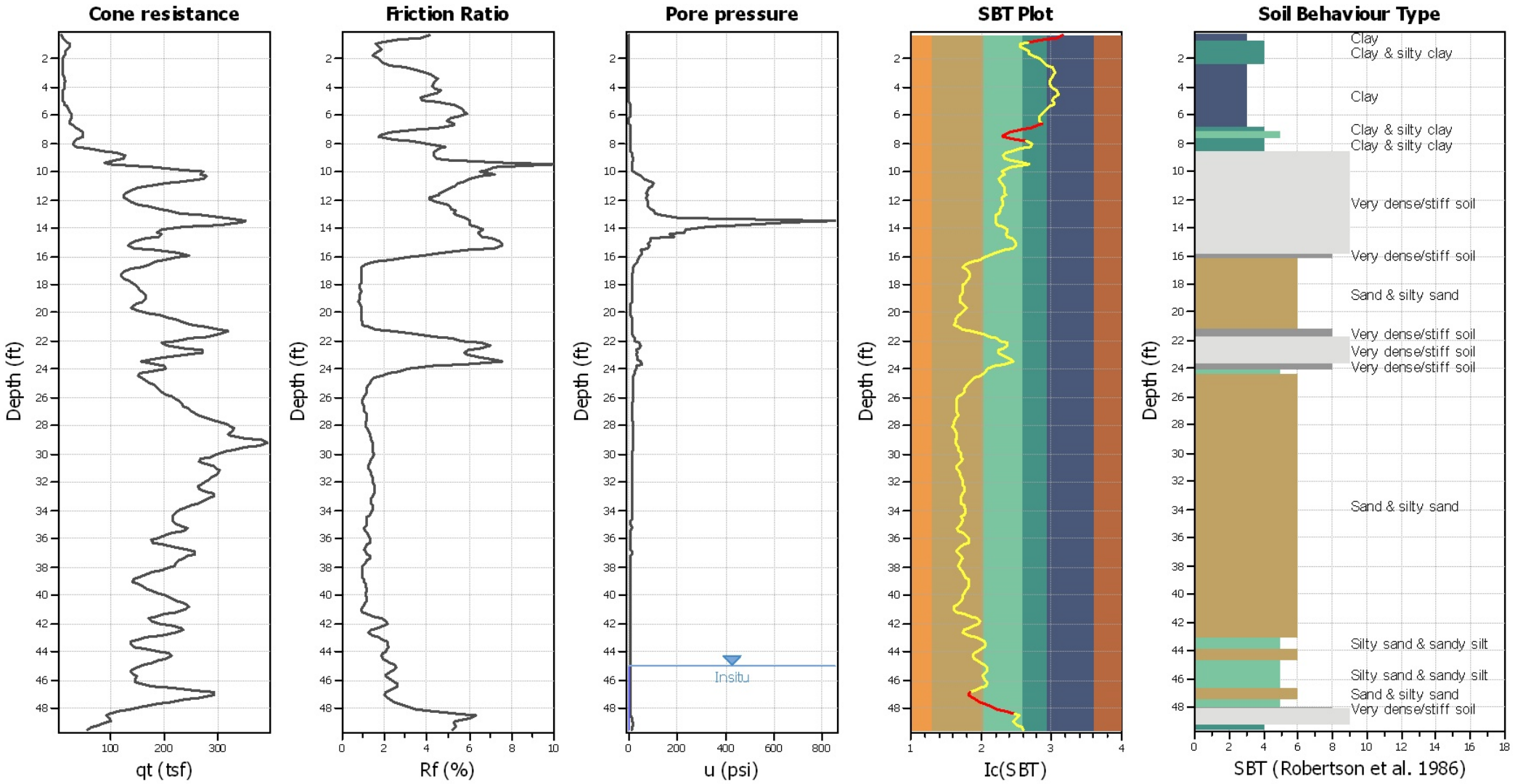






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plo



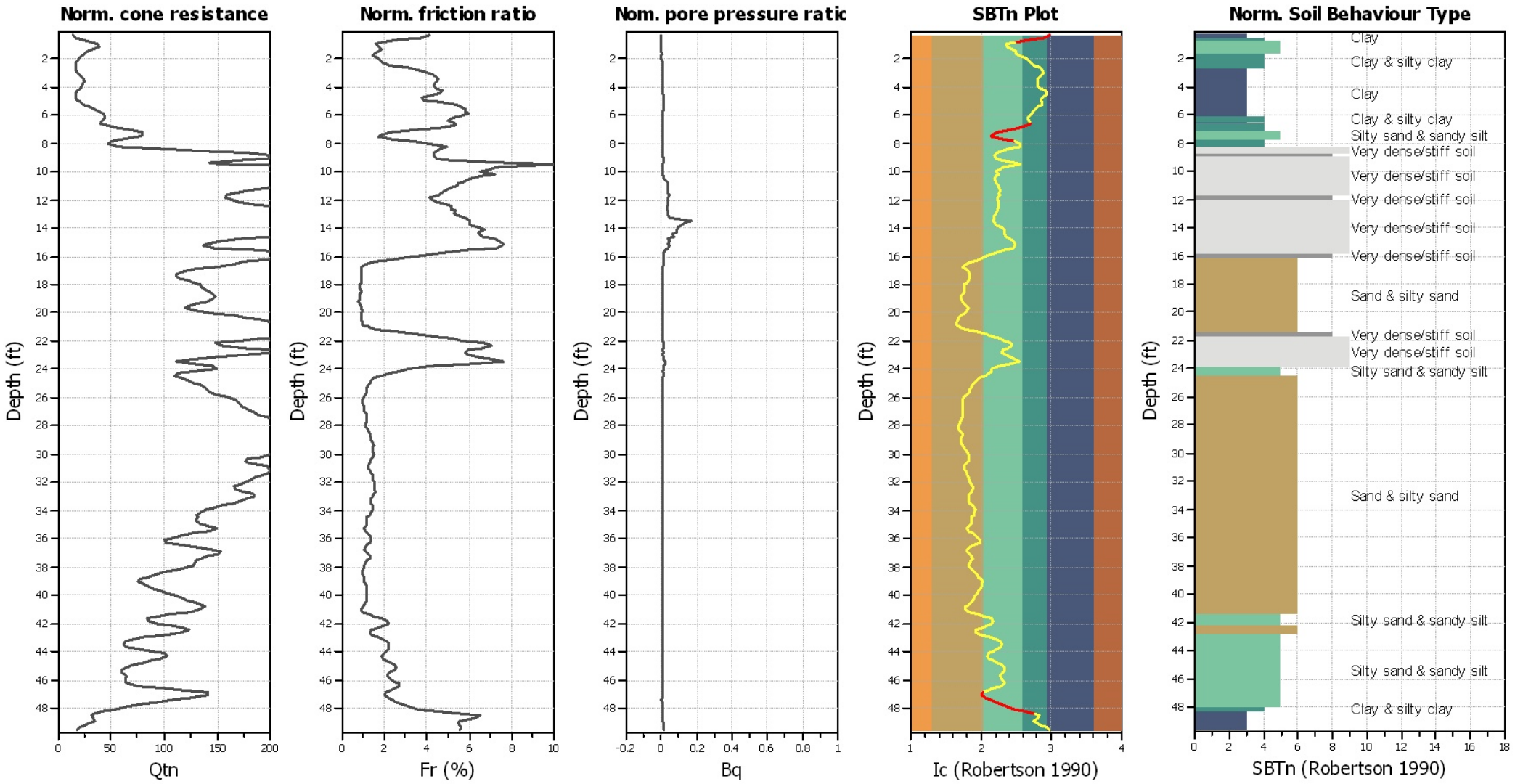
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	45.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.32	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	45.00 ft	Fill height:	N/A	Limit depth:	N/A

SBT legend

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

CPT basic interpretation plots (normaliz



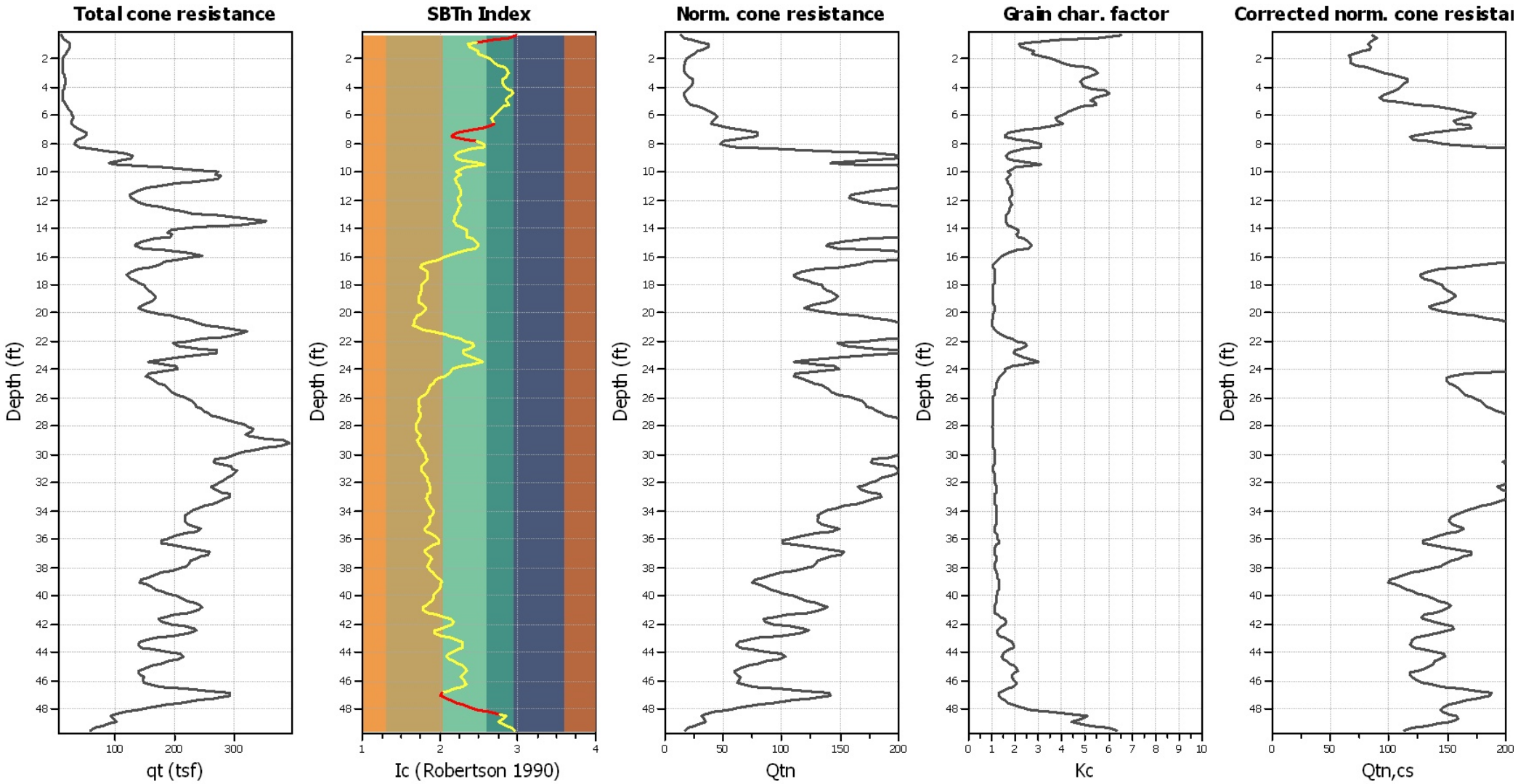
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	45.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.32	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	45.00 ft	Fill height:	N/A	Limit depth:	N/A

SBTn legend

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

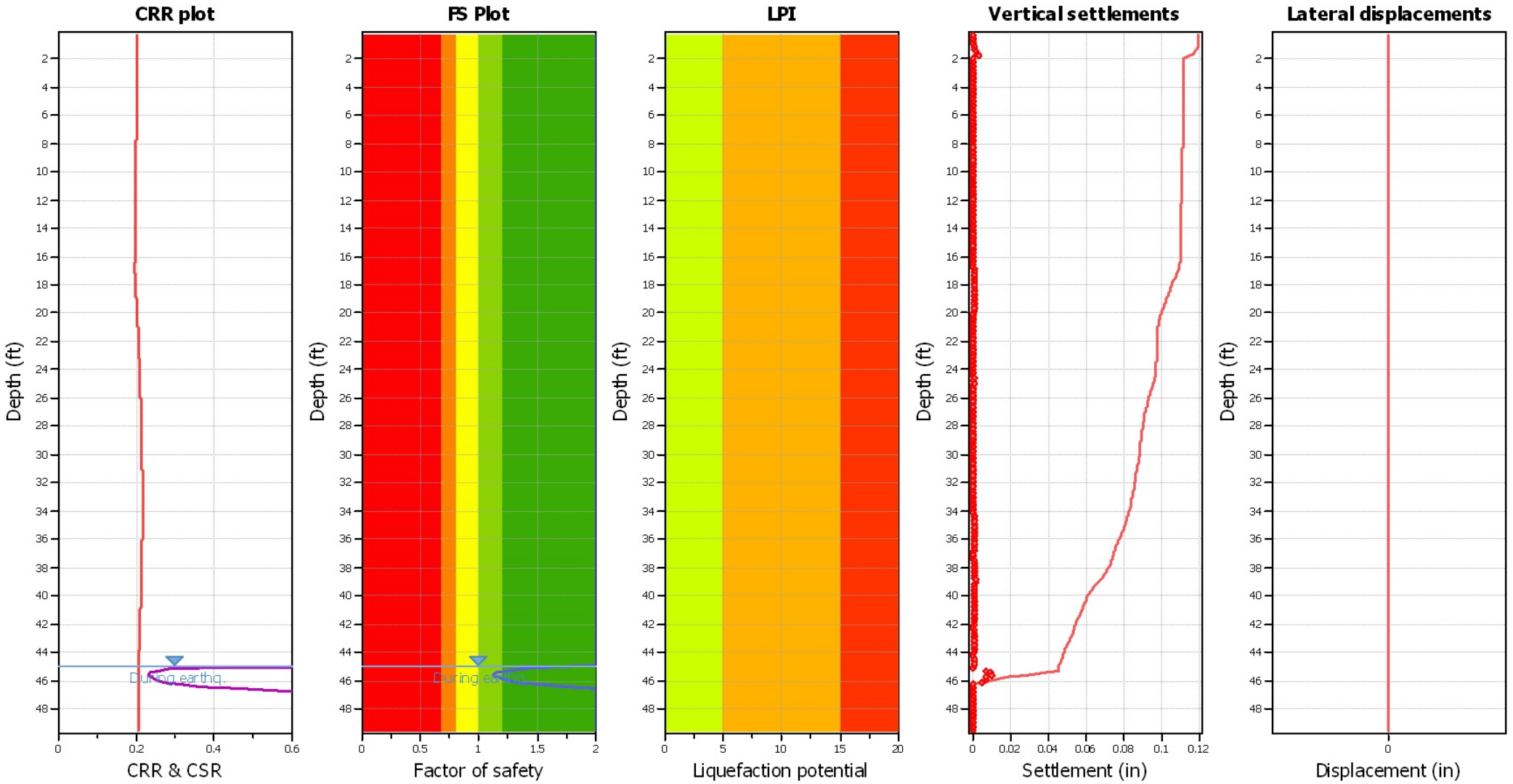
Liquefaction analysis overall plots (intermediate resu



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	45.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.32	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	45.00 ft	Fill height:	N/A	Limit depth:	N/A

Liquefaction analysis overall plot



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	45.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.32	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	45.00 ft	Fill height:	N/A	Limit depth:	N/A

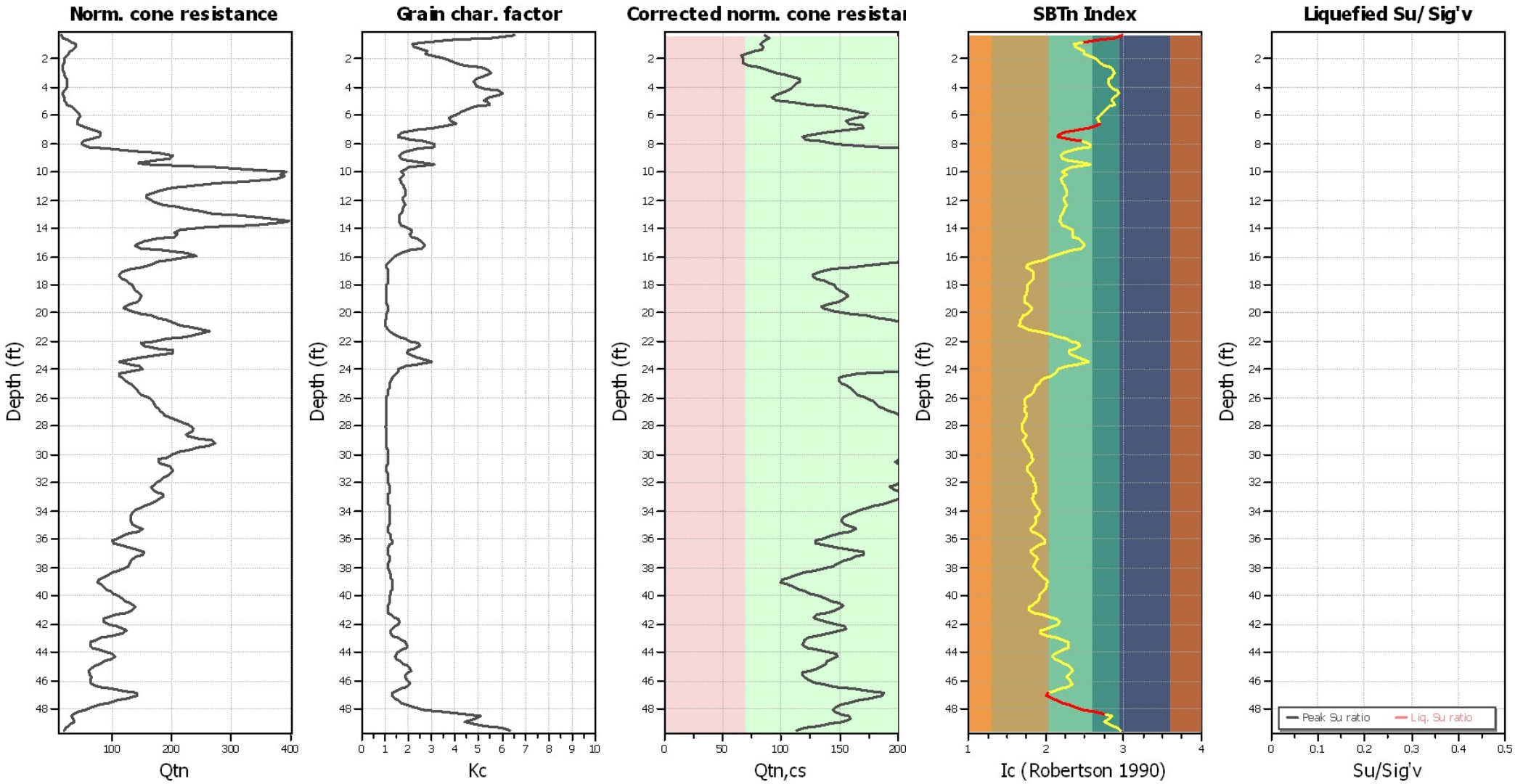
F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

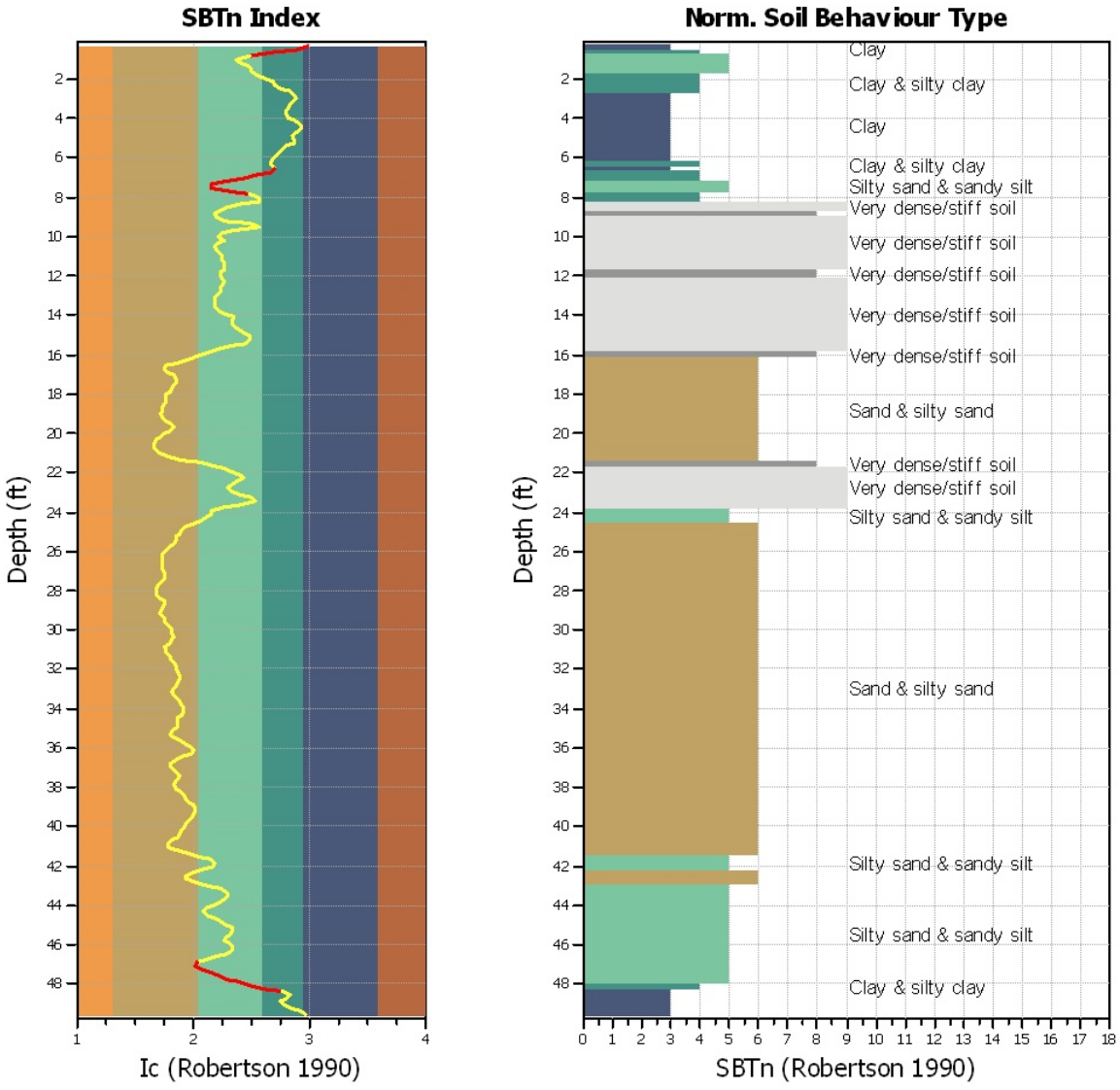
Analysis method:	NCEER (1998)	Depth to water table (erthq.):	45.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.32	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	45.00 ft	Fill height:	N/A	Limit depth:	N/A

TRANSITION LAYER DETECTION ALGORITHM REPORT
Summary Details & Plots

Short description

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

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



Transition layer algorithm properties		General statistics	
I_c minimum check value:	1.70	Total points in CPT file:	301
I_c maximum check value:	3.00	Total points excluded:	24
I_c change ratio value:	0.0250	Exclusion percentage:	7.97%
Minimum number of points in layer:	4	Number of layers detected:	4

Transition layer No	Number of points	Depth	SBT_n number	SBT_n description
Transition layer 1	5	Start depth: 0.33 (ft)	3	Clay
		End depth: 0.98 (ft)	5	Silty sand & sandy silt
Transition layer 2	5	Start depth: 6.73 (ft)	4	Clay & silty clay
		End depth: 7.38 (ft)	5	Silty sand & sandy silt
Transition layer 3	4	Start depth: 7.55 (ft)	5	Silty sand & sandy silt
		End depth: 8.04 (ft)	4	Clay & silty clay
Transition layer 4	10	Start depth: 47.08 (ft)	5	Silty sand & sandy silt
		End depth: 48.56 (ft)	3	Clay

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

:: Field input data ::

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
1	0.33	7.20	0.30	0.10	57.27	107.36
2	0.49	10.10	0.40	0.10	51.02	108.55
3	0.66	12.70	0.40	0.10	40.28	109.30
4	0.82	18.00	0.30	0.10	29.63	110.18
5	0.98	27.90	0.40	0.20	25.06	110.62
6	1.15	24.30	0.40	0.20	25.84	111.27
7	1.31	18.40	0.40	0.20	29.03	110.24
8	1.48	17.30	0.30	0.30	30.66	108.42
9	1.64	16.20	0.20	0.30	30.41	106.35
10	1.80	13.80	0.20	0.20	32.61	104.88
11	1.97	11.10	0.20	0.20	37.17	104.50
12	2.13	10.30	0.20	0.50	39.20	104.34
13	2.30	11.60	0.20	0.40	40.41	104.25
14	2.46	9.90	0.20	0.40	43.23	105.33
15	2.62	9.60	0.30	0.50	47.96	107.10
16	2.79	10.70	0.40	0.70	49.96	108.64
17	2.95	10.90	0.40	0.80	50.99	109.98
18	3.12	11.10	0.50	0.80	49.90	111.26
19	3.28	13.90	0.60	1.30	48.25	112.90
20	3.45	15.80	0.70	1.30	46.89	113.89
21	3.61	14.80	0.70	1.20	46.11	113.94
22	3.77	14.90	0.60	1.50	46.47	113.48
23	3.94	14.30	0.60	1.40	47.02	112.99
24	4.10	13.10	0.60	1.30	49.46	112.35
25	4.27	11.20	0.50	1.30	52.75	111.63
26	4.43	10.20	0.50	1.30	54.25	110.42
27	4.59	9.90	0.40	2.30	53.34	109.86
28	4.76	10.90	0.40	2.40	50.27	109.38
29	4.92	11.60	0.40	2.80	49.02	110.13
30	5.09	12.20	0.50	2.90	50.15	112.32
31	5.25	14.20	0.80	3.10	50.45	114.85
32	5.41	17.00	1.00	3.10	46.41	117.37
33	5.58	23.80	1.20	3.20	44.33	119.30
34	5.74	23.90	1.50	3.10	42.05	120.75
35	5.91	26.90	1.60	3.10	41.50	121.55
36	6.07	28.60	1.60	3.00	39.33	121.53
37	6.23	28.40	1.40	2.70	38.63	120.80
38	6.40	24.90	1.20	2.80	39.13	119.91
39	6.56	23.40	1.20	2.90	40.69	120.02
40	6.73	25.80	1.50	3.10	38.41	121.41
41	6.89	36.30	1.80	3.20	32.83	122.41
42	7.05	44.10	1.50	3.40	27.63	122.13
43	7.22	42.40	1.10	3.50	19.87	120.73
44	7.38	63.30	0.80	3.60	17.38	118.74
45	7.55	42.70	0.70	3.40	17.44	118.06
46	7.71	36.50	0.90	3.30	24.16	117.99
47	7.87	29.60	1.00	3.20	29.83	118.94
48	8.04	28.90	1.20	3.60	33.66	119.89

:: Field input data :: (continued)

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
49	8.20	30.90	1.40	3.50	33.58	123.21
50	8.37	49.40	2.70	4.00	27.36	126.98
51	8.53	87.00	3.60	5.20	22.21	130.91
52	8.69	122.40	5.10	10.10	19.79	133.23
53	8.86	122.90	5.70	13.60	18.63	134.58
54	9.02	138.30	5.70	18.10	19.25	134.62
55	9.19	115.00	5.30	17.30	21.40	134.16
56	9.35	81.10	5.30	14.30	30.07	135.28
57	9.51	70.00	9.90	12.00	33.78	137.28
58	9.68	139.40	14.10	10.80	23.26	137.28
59	9.84	337.30	15.50	14.00	20.97	137.28
60	10.01	228.60	18.80	17.30	19.46	137.28
61	10.17	253.50	19.00	34.80	21.03	137.28
62	10.34	317.60	19.80	47.60	19.69	137.28
63	10.50	262.90	16.30	58.60	18.69	137.28
64	10.66	237.60	13.30	90.90	19.15	137.28
65	10.83	196.40	10.70	100.20	19.50	137.28
66	10.99	168.20	9.10	94.20	20.50	137.28
67	11.16	146.50	7.80	85.80	20.91	137.28
68	11.32	137.50	6.40	76.40	21.20	136.20
69	11.48	125.10	5.90	74.10	21.17	135.15
70	11.65	119.90	5.50	75.80	21.53	134.76
71	11.81	123.80	5.70	71.60	20.03	134.03
72	11.98	130.80	4.20	73.30	20.02	134.49
73	12.14	133.50	6.30	76.20	20.47	135.52
74	12.30	145.60	7.80	77.30	21.20	137.28
75	12.47	174.00	8.60	78.50	20.67	137.28
76	12.63	190.80	9.80	90.30	19.91	137.28
77	12.80	207.20	11.00	104.10	19.95	137.28
78	12.96	224.60	12.70	109.30	19.16	137.28
79	13.12	253.00	12.60	131.40	18.48	137.28
80	13.29	332.30	18.90	202.20	18.56	137.28
81	13.45	342.50	23.50	851.60	18.37	137.28
82	13.62	361.00	21.40	667.70	18.60	137.28
83	13.78	302.40	17.50	463.70	19.33	137.28
84	13.94	230.40	16.00	327.70	21.62	137.28
85	14.11	169.80	11.50	231.20	24.12	137.28
86	14.27	172.30	11.40	226.20	24.01	137.28
87	14.44	211.30	13.30	168.20	23.81	137.28
88	14.60	190.40	12.80	188.50	24.37	137.28
89	14.76	165.00	11.70	89.90	26.71	137.28
90	14.93	137.20	10.70	87.40	28.65	137.28
91	15.09	133.20	10.00	77.70	29.95	137.28
92	15.26	129.10	9.70	82.20	30.04	137.28
93	15.42	135.10	10.40	80.20	28.61	137.28
94	15.58	167.30	11.10	49.50	23.77	137.28
95	15.75	242.40	11.10	53.40	19.10	137.28
96	15.91	262.40	9.70	47.40	15.71	137.28

:: Field input data :: (continued)

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
97	16.08	232.50	6.80	40.80	14.23	137.28
98	16.24	182.20	4.30	36.70	12.24	134.31
99	16.40	185.10	2.60	36.40	9.76	130.69
100	16.57	180.70	1.70	26.70	7.53	127.42
101	16.73	154.30	1.30	20.40	7.07	125.07
102	16.90	135.50	1.20	17.80	7.84	123.62
103	17.06	123.60	1.10	15.70	8.80	122.97
104	17.23	116.90	1.10	14.60	9.16	122.41
105	17.39	117.10	1.00	13.60	9.16	122.42
106	17.55	124.80	1.10	13.00	8.92	122.97
107	17.72	134.20	1.30	12.60	8.45	123.55
108	17.88	141.80	1.20	12.00	7.95	123.88
109	18.05	146.70	1.20	11.80	7.39	123.99
110	18.21	154.00	1.30	11.40	7.33	124.23
111	18.37	150.60	1.30	9.40	7.28	124.68
112	18.54	160.60	1.40	9.50	7.12	124.93
113	18.70	167.00	1.40	9.50	6.86	125.19
114	18.87	167.40	1.40	9.30	6.65	125.03
115	19.03	164.90	1.30	9.20	6.56	124.64
116	19.19	160.50	1.20	9.00	6.71	124.17
117	19.36	150.90	1.20	8.80	7.32	123.82
118	19.52	137.70	1.20	8.50	8.24	123.66
119	19.69	131.30	1.20	8.20	8.69	124.04
120	19.85	148.40	1.40	8.30	8.19	124.98
121	20.01	174.60	1.60	8.70	7.20	126.12
122	20.18	194.90	1.70	8.90	6.35	126.99
123	20.34	208.60	1.80	9.00	5.86	127.74
124	20.51	223.00	2.00	9.10	5.62	128.53
125	20.67	237.10	2.20	9.60	5.49	129.38
126	20.83	250.60	2.40	9.90	5.38	130.38
127	21.00	274.40	2.80	10.40	6.27	132.79
128	21.16	304.10	4.80	11.10	7.71	135.80
129	21.33	334.00	7.00	11.90	10.45	137.28
130	21.49	324.90	10.50	12.30	14.71	137.28
131	21.65	252.80	13.70	16.90	18.27	137.28
132	21.82	267.10	13.10	23.50	21.54	137.28
133	21.98	220.60	11.80	25.50	23.63	137.28
134	22.15	177.20	12.60	43.90	27.27	137.28
135	22.31	188.70	14.40	49.80	27.80	137.28
136	22.47	247.30	16.00	41.40	25.38	137.28
137	22.64	276.50	16.30	32.90	22.93	137.28
138	22.80	284.30	15.90	37.30	22.46	137.28
139	22.97	252.30	14.70	31.40	23.61	137.28
140	23.13	198.60	12.50	35.40	26.84	137.28
141	23.30	159.60	12.10	37.60	30.86	137.28
142	23.46	148.60	12.30	45.40	32.45	137.28
143	23.62	158.90	10.80	52.60	26.46	137.28
144	23.79	241.90	8.70	32.90	21.23	137.28

:: Field input data :: (continued)

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
145	23.95	202.10	6.10	27.20	17.36	136.79
146	24.12	168.60	4.30	22.70	17.14	133.95
147	24.28	145.80	3.30	22.00	16.34	131.59
148	24.44	148.70	2.70	20.30	14.67	129.96
149	24.61	158.50	2.30	19.00	12.70	129.02
150	24.77	164.40	2.20	18.40	11.33	128.61
151	24.94	171.80	2.20	18.10	10.50	128.61
152	25.10	182.00	2.20	17.90	9.81	128.72
153	25.26	189.10	2.20	17.60	9.36	128.80
154	25.43	189.60	2.20	17.00	9.22	128.96
155	25.59	192.70	2.30	16.50	9.02	129.12
156	25.76	202.30	2.30	16.40	8.26	129.00
157	25.92	213.60	2.00	16.30	7.40	128.90
158	26.08	223.60	2.10	16.10	6.72	128.89
159	26.25	232.80	2.20	16.10	6.74	129.29
160	26.41	229.30	2.30	13.50	6.79	129.66
161	26.58	237.20	2.40	13.40	6.82	129.91
162	26.74	242.10	2.40	13.40	6.75	130.28
163	26.90	249.30	2.60	13.60	6.80	130.72
164	27.07	255.20	2.80	13.70	6.99	131.32
165	27.23	260.80	3.00	13.80	7.07	131.81
166	27.40	268.50	3.10	14.00	6.95	132.30
167	27.56	286.60	3.30	14.50	6.56	132.82
168	27.72	310.10	3.50	15.10	6.14	133.25
169	27.89	318.80	3.50	15.30	5.91	133.55
170	28.05	319.90	3.60	15.50	5.76	133.74
171	28.22	333.10	3.70	15.90	5.87	134.19
172	28.38	338.90	4.10	16.10	6.28	134.48
173	28.54	311.70	4.10	15.40	6.97	134.78
174	28.71	306.90	4.30	15.10	7.04	135.04
175	28.87	352.20	4.50	16.20	6.65	135.89
176	29.04	393.00	5.30	17.20	6.31	136.89
177	29.20	404.50	5.90	17.80	6.54	137.28
178	29.36	380.90	5.70	17.50	6.95	137.28
179	29.53	349.10	5.10	16.40	7.21	136.51
180	29.69	330.20	4.50	15.60	7.56	135.80
181	29.86	312.80	4.60	14.80	8.04	135.41
182	30.02	298.10	4.60	14.40	8.58	135.13
183	30.19	285.40	4.20	14.50	8.54	134.47
184	30.35	280.20	3.60	14.60	8.80	133.55
185	30.51	239.60	3.40	13.30	8.42	132.98
186	30.68	276.40	3.40	13.90	8.12	132.95
187	30.84	294.20	3.50	14.50	7.19	133.37
188	31.01	310.50	3.70	14.80	7.35	133.74
189	31.17	288.50	3.90	13.40	7.53	134.24
190	31.33	313.10	4.20	13.50	8.04	134.51
191	31.50	298.00	4.20	13.20	8.26	134.61
192	31.66	283.70	4.10	12.80	8.81	134.45

:: Field input data :: (continued)

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
193	31.83	277.50	4.10	12.40	9.05	134.35
194	31.99	282.20	4.10	12.60	9.25	134.18
195	32.15	266.30	3.90	12.40	9.50	134.00
196	32.32	258.40	3.90	12.10	9.88	133.87
197	32.48	260.00	4.00	12.20	9.88	134.16
198	32.65	281.50	4.30	12.70	9.61	134.62
199	32.81	294.80	4.50	12.90	9.15	134.90
200	32.97	297.50	4.30	13.20	8.78	134.63
201	33.14	286.00	3.80	13.10	8.64	134.02
202	33.30	270.70	3.60	12.40	8.78	133.54
203	33.47	267.70	3.70	12.70	9.22	133.24
204	33.63	252.00	3.50	12.30	9.84	132.99
205	33.79	233.60	3.40	12.00	10.32	132.59
206	33.96	232.40	3.30	11.90	10.83	132.35
207	34.12	223.90	3.30	11.70	10.61	131.58
208	34.29	211.50	2.50	11.40	10.37	130.83
209	34.45	213.30	2.50	11.60	9.58	130.09
210	34.61	224.50	2.50	11.60	9.68	130.08
211	34.78	208.40	2.50	8.50	9.75	130.19
212	34.94	215.70	2.60	8.60	9.47	130.35
213	35.11	241.50	2.60	9.10	8.51	130.50
214	35.27	252.30	2.50	9.30	7.99	130.48
215	35.43	237.90	2.50	8.90	8.47	130.29
216	35.60	214.50	2.50	8.50	9.83	130.19
217	35.76	197.80	2.60	8.20	11.18	130.00
218	35.93	187.90	2.50	8.10	12.22	129.63
219	36.09	173.70	2.30	7.80	12.78	129.09
220	36.26	167.60	2.20	7.60	12.42	128.89
221	36.42	191.80	2.30	7.90	10.93	129.11
222	36.58	221.80	2.30	8.20	9.21	129.73
223	36.75	246.40	2.50	8.60	8.16	130.59
224	36.91	268.50	2.90	9.00	8.20	131.43
225	37.08	257.10	3.10	9.00	8.86	132.00
226	37.24	243.40	3.20	8.90	9.72	131.96
227	37.40	232.40	3.00	8.50	10.15	131.62
228	37.57	227.40	2.80	8.50	9.73	130.68
229	37.73	222.10	2.20	8.30	9.22	129.87
230	37.90	220.90	2.20	8.20	8.80	129.08
231	38.06	214.60	2.10	8.30	9.23	128.61
232	38.22	190.90	1.90	6.90	9.83	127.81
233	38.39	175.90	1.70	6.80	10.60	126.93
234	38.55	166.50	1.60	6.60	11.29	126.17
235	38.72	153.00	1.50	6.30	12.23	125.50
236	38.88	138.20	1.40	6.10	13.11	125.01
237	39.04	137.60	1.40	6.10	13.56	125.15
238	39.21	147.70	1.60	6.10	13.27	125.92
239	39.37	161.90	1.80	6.20	12.98	126.95
240	39.54	169.60	2.00	6.30	12.59	127.60

:: Field input data :: (continued)

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
241	39.70	174.40	2.00	6.50	12.10	128.10
242	39.86	188.40	2.10	6.40	11.39	128.60
243	40.03	204.20	2.30	6.60	10.80	129.20
244	40.19	211.60	2.40	6.60	10.50	129.85
245	40.36	220.70	2.60	7.10	10.13	130.24
246	40.52	231.80	2.60	7.10	9.51	130.56
247	40.68	246.70	2.60	7.60	8.59	130.37
248	40.85	250.40	2.30	7.40	7.85	129.79
249	41.01	240.00	2.00	7.30	7.86	129.16
250	41.18	221.60	2.10	7.10	8.94	129.12
251	41.34	207.40	2.40	6.90	11.56	129.60
252	41.50	171.60	2.70	5.90	14.46	130.33
253	41.67	169.80	3.10	5.90	17.22	131.18
254	41.83	173.60	3.60	6.00	18.28	132.41
255	42.00	188.00	4.30	6.10	17.70	133.49
256	42.16	217.90	4.50	6.50	15.72	133.99
257	42.32	240.20	4.00	6.90	13.09	133.40
258	42.49	241.00	3.00	6.80	11.25	132.11
259	42.65	226.70	2.60	6.40	11.20	130.88
260	42.82	194.80	2.70	5.90	13.49	130.48
261	42.98	161.30	2.90	5.70	17.03	130.37
262	43.15	144.70	2.90	5.60	20.00	130.27
263	43.31	140.50	2.90	5.60	21.80	130.19
264	43.47	133.30	3.00	5.70	22.28	130.15
265	43.64	137.70	2.90	5.80	21.93	130.74
266	43.80	159.90	3.50	5.90	20.13	131.70
267	43.97	186.70	3.90	6.10	17.78	132.96
268	44.13	221.30	4.20	6.10	16.13	133.50
269	44.29	217.70	4.00	6.10	15.38	133.45
270	44.46	204.90	3.70	5.90	16.20	133.07
271	44.62	187.30	3.80	5.60	17.87	132.89
272	44.79	174.30	4.00	5.30	20.03	133.03
273	44.95	167.10	4.20	5.30	21.96	132.85
274	45.11	148.80	3.80	5.10	23.53	132.19
275	45.28	133.10	3.30	5.00	24.07	131.19
276	45.44	135.50	3.00	5.10	23.18	130.48
277	45.61	144.40	2.90	5.00	21.69	130.34
278	45.77	150.70	3.00	5.00	21.36	130.66
279	45.93	148.30	3.30	5.10	22.37	131.10
280	46.10	140.70	3.50	5.00	23.56	131.82
281	46.26	152.00	4.00	5.10	23.77	132.77
282	46.43	170.10	4.60	5.40	22.10	134.04
283	46.59	204.30	5.20	5.90	19.00	135.61
284	46.75	269.30	6.20	6.90	15.63	136.71
285	46.92	309.30	6.00	7.40	13.66	137.24
286	47.08	300.90	5.80	7.30	13.25	136.95
287	47.25	270.10	5.50	7.20	15.10	136.57
288	47.41	223.80	5.70	5.50	16.93	136.06

:: Field input data :: (continued)

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
289	47.57	222.40	5.20	5.40	19.35	135.48
290	47.74	186.70	4.90	4.70	21.72	134.86
291	47.90	153.30	5.00	4.30	25.77	134.21
292	48.07	136.70	4.70	4.20	30.00	133.69
293	48.23	120.10	4.60	4.40	35.98	133.44
294	48.39	90.00	5.30	5.70	44.37	133.68
295	48.56	81.10	6.10	8.00	48.18	134.18
296	48.72	106.00	6.00	10.90	46.27	134.38
297	48.89	104.60	5.50	13.80	43.38	133.80
298	49.05	89.30	4.60	16.70	45.34	132.68
299	49.22	76.10	4.20	15.50	49.26	131.11
300	49.38	63.30	3.40	13.70	53.52	129.54
301	49.54	54.40	2.80	12.70	56.02	128.19

Abbreviations

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

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

Point ID	Depth (ft)	σ_v (tsf)	u_0 (tsf)	σ_v' (tsf)	r_d	CSR	MSF	CSR_{eq}	K_σ	User FS	CSR^*	Belongs to transition
1	0.33	0.02	0.00	0.02	1.00	0.208	1.33	0.156	1.00	1.30	2.000	Yes
2	0.49	0.03	0.00	0.03	1.00	0.208	1.33	0.156	1.00	1.30	2.000	Yes
3	0.66	0.04	0.00	0.04	1.00	0.208	1.33	0.156	1.00	1.30	2.000	Yes
4	0.82	0.04	0.00	0.04	1.00	0.208	1.33	0.156	1.00	1.30	2.000	Yes
5	0.98	0.05	0.00	0.05	1.00	0.208	1.33	0.156	1.00	1.30	2.000	Yes
6	1.15	0.06	0.00	0.06	1.00	0.208	1.33	0.156	1.00	1.30	2.000	No
7	1.31	0.07	0.00	0.07	1.00	0.208	1.33	0.156	1.00	1.30	2.000	No
8	1.48	0.08	0.00	0.08	1.00	0.208	1.33	0.156	1.00	1.30	2.000	No
9	1.64	0.09	0.00	0.09	1.00	0.208	1.33	0.156	1.00	1.30	2.000	No
10	1.80	0.10	0.00	0.10	1.00	0.208	1.33	0.156	1.00	1.30	2.000	No
11	1.97	0.11	0.00	0.11	1.00	0.207	1.33	0.155	1.00	1.30	2.000	No
12	2.13	0.11	0.00	0.11	1.00	0.207	1.33	0.155	1.00	1.30	2.000	No
13	2.30	0.12	0.00	0.12	1.00	0.207	1.33	0.155	1.00	1.30	2.000	No
14	2.46	0.13	0.00	0.13	1.00	0.207	1.33	0.155	1.00	1.30	2.000	No
15	2.62	0.14	0.00	0.14	1.00	0.207	1.33	0.155	1.00	1.30	2.000	No
16	2.79	0.15	0.00	0.15	1.00	0.207	1.33	0.155	1.00	1.30	2.000	No
17	2.95	0.16	0.00	0.16	1.00	0.207	1.33	0.155	1.00	1.30	2.000	No
18	3.12	0.17	0.00	0.17	0.99	0.207	1.33	0.155	1.00	1.30	2.000	No
19	3.28	0.18	0.00	0.18	0.99	0.207	1.33	0.155	1.00	1.30	2.000	No
20	3.45	0.19	0.00	0.19	0.99	0.207	1.33	0.155	1.00	1.30	2.000	No
21	3.61	0.20	0.00	0.20	0.99	0.207	1.33	0.155	1.00	1.30	2.000	No
22	3.77	0.21	0.00	0.21	0.99	0.207	1.33	0.155	1.00	1.30	2.000	No
23	3.94	0.21	0.00	0.21	0.99	0.206	1.33	0.155	1.00	1.30	2.000	No
24	4.10	0.22	0.00	0.22	0.99	0.206	1.33	0.155	1.00	1.30	2.000	No
25	4.27	0.23	0.00	0.23	0.99	0.206	1.33	0.155	1.00	1.30	2.000	No
26	4.43	0.24	0.00	0.24	0.99	0.206	1.33	0.155	1.00	1.30	2.000	No
27	4.59	0.25	0.00	0.25	0.99	0.206	1.33	0.155	1.00	1.30	2.000	No
28	4.76	0.26	0.00	0.26	0.99	0.206	1.33	0.154	1.00	1.30	2.000	No
29	4.92	0.27	0.00	0.27	0.99	0.206	1.33	0.154	1.00	1.30	2.000	No
30	5.09	0.28	0.00	0.28	0.99	0.206	1.33	0.154	1.00	1.30	2.000	No
31	5.25	0.29	0.00	0.29	0.99	0.206	1.33	0.154	1.00	1.30	2.000	No
32	5.41	0.30	0.00	0.30	0.99	0.206	1.33	0.154	1.00	1.30	2.000	No
33	5.58	0.31	0.00	0.31	0.99	0.206	1.33	0.154	1.00	1.30	2.000	No
34	5.74	0.32	0.00	0.32	0.99	0.206	1.33	0.154	1.00	1.30	2.000	No
35	5.91	0.33	0.00	0.33	0.99	0.206	1.33	0.154	1.00	1.30	2.000	No
36	6.07	0.34	0.00	0.34	0.99	0.205	1.33	0.154	1.00	1.30	2.000	No
37	6.23	0.35	0.00	0.35	0.99	0.205	1.33	0.154	1.00	1.30	2.000	No
38	6.40	0.36	0.00	0.36	0.99	0.205	1.33	0.154	1.00	1.30	2.000	No
39	6.56	0.37	0.00	0.37	0.99	0.205	1.33	0.154	1.00	1.30	2.000	No
40	6.73	0.38	0.00	0.38	0.99	0.205	1.33	0.154	1.00	1.30	2.000	Yes
41	6.89	0.39	0.00	0.39	0.99	0.205	1.33	0.154	1.00	1.30	2.000	Yes
42	7.05	0.40	0.00	0.40	0.99	0.205	1.33	0.154	1.00	1.30	2.000	Yes
43	7.22	0.41	0.00	0.41	0.99	0.205	1.33	0.154	1.00	1.30	2.000	Yes
44	7.38	0.42	0.00	0.42	0.98	0.205	1.33	0.154	1.00	1.30	2.000	Yes
45	7.55	0.43	0.00	0.43	0.98	0.205	1.33	0.153	1.00	1.30	2.000	Yes
46	7.71	0.44	0.00	0.44	0.98	0.205	1.33	0.153	1.00	1.30	2.000	Yes
47	7.87	0.45	0.00	0.45	0.98	0.205	1.33	0.153	1.00	1.30	2.000	Yes
48	8.04	0.46	0.00	0.46	0.98	0.205	1.33	0.153	1.00	1.30	2.000	Yes

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

Point ID	Depth (ft)	σ_v (tsf)	u_0 (tsf)	σ_v' (tsf)	r_d	CSR	MSF	CSR_{eq}	K_σ	User FS	CSR^*	Belongs to transition
49	8.20	0.47	0.00	0.47	0.98	0.204	1.33	0.153	1.00	1.30	2.000	No
50	8.37	0.48	0.00	0.48	0.98	0.204	1.33	0.153	1.00	1.30	2.000	No
51	8.53	0.49	0.00	0.49	0.98	0.204	1.33	0.153	1.00	1.30	2.000	No
52	8.69	0.50	0.00	0.50	0.98	0.204	1.33	0.153	1.00	1.30	2.000	No
53	8.86	0.51	0.00	0.51	0.98	0.204	1.33	0.153	1.00	1.30	2.000	No
54	9.02	0.52	0.00	0.52	0.98	0.204	1.33	0.153	1.00	1.30	2.000	No
55	9.19	0.53	0.00	0.53	0.98	0.204	1.33	0.153	1.00	1.30	2.000	No
56	9.35	0.54	0.00	0.54	0.98	0.204	1.33	0.153	1.00	1.30	2.000	No
57	9.51	0.55	0.00	0.55	0.98	0.204	1.33	0.153	1.00	1.30	2.000	No
58	9.68	0.56	0.00	0.56	0.98	0.204	1.33	0.153	1.00	1.30	2.000	No
59	9.84	0.58	0.00	0.58	0.98	0.204	1.33	0.153	1.00	1.30	2.000	No
60	10.01	0.59	0.00	0.59	0.98	0.204	1.33	0.153	1.00	1.30	2.000	No
61	10.17	0.60	0.00	0.60	0.98	0.204	1.33	0.153	1.00	1.30	2.000	No
62	10.34	0.61	0.00	0.61	0.98	0.204	1.33	0.153	1.00	1.30	2.000	No
63	10.50	0.62	0.00	0.62	0.98	0.203	1.33	0.152	1.00	1.30	2.000	No
64	10.66	0.63	0.00	0.63	0.98	0.203	1.33	0.152	1.00	1.30	2.000	No
65	10.83	0.64	0.00	0.64	0.98	0.203	1.33	0.152	1.00	1.30	2.000	No
66	10.99	0.65	0.00	0.65	0.98	0.203	1.33	0.152	1.00	1.30	2.000	No
67	11.16	0.67	0.00	0.67	0.98	0.203	1.33	0.152	1.00	1.30	2.000	No
68	11.32	0.68	0.00	0.68	0.98	0.203	1.33	0.152	1.00	1.30	2.000	No
69	11.48	0.69	0.00	0.69	0.98	0.203	1.33	0.152	1.00	1.30	2.000	No
70	11.65	0.70	0.00	0.70	0.98	0.203	1.33	0.152	1.00	1.30	2.000	No
71	11.81	0.71	0.00	0.71	0.98	0.203	1.33	0.152	1.00	1.30	2.000	No
72	11.98	0.72	0.00	0.72	0.97	0.203	1.33	0.152	1.00	1.30	2.000	No
73	12.14	0.73	0.00	0.73	0.97	0.203	1.33	0.152	1.00	1.30	2.000	No
74	12.30	0.74	0.00	0.74	0.97	0.203	1.33	0.152	1.00	1.30	2.000	No
75	12.47	0.75	0.00	0.75	0.97	0.203	1.33	0.152	1.00	1.30	2.000	No
76	12.63	0.77	0.00	0.77	0.97	0.203	1.33	0.152	1.00	1.30	2.000	No
77	12.80	0.78	0.00	0.78	0.97	0.202	1.33	0.152	1.00	1.30	2.000	No
78	12.96	0.79	0.00	0.79	0.97	0.202	1.33	0.152	1.00	1.30	2.000	No
79	13.12	0.80	0.00	0.80	0.97	0.202	1.33	0.152	1.00	1.30	2.000	No
80	13.29	0.81	0.00	0.81	0.97	0.202	1.33	0.152	1.00	1.30	2.000	No
81	13.45	0.82	0.00	0.82	0.97	0.202	1.33	0.152	1.00	1.30	2.000	No
82	13.62	0.83	0.00	0.83	0.97	0.202	1.33	0.151	1.00	1.30	2.000	No
83	13.78	0.84	0.00	0.84	0.97	0.202	1.33	0.151	1.00	1.30	2.000	No
84	13.94	0.86	0.00	0.86	0.97	0.202	1.33	0.151	1.00	1.30	2.000	No
85	14.11	0.87	0.00	0.87	0.97	0.202	1.33	0.151	1.00	1.30	2.000	No
86	14.27	0.88	0.00	0.88	0.97	0.202	1.33	0.151	1.00	1.30	2.000	No
87	14.44	0.89	0.00	0.89	0.97	0.202	1.33	0.151	1.00	1.30	2.000	No
88	14.60	0.90	0.00	0.90	0.97	0.202	1.33	0.151	1.00	1.30	2.000	No
89	14.76	0.91	0.00	0.91	0.97	0.202	1.33	0.151	1.00	1.30	2.000	No
90	14.93	0.92	0.00	0.92	0.97	0.201	1.33	0.151	1.00	1.30	2.000	No
91	15.09	0.93	0.00	0.93	0.97	0.201	1.33	0.151	1.00	1.30	2.000	No
92	15.26	0.95	0.00	0.95	0.97	0.201	1.33	0.151	1.00	1.30	2.000	No
93	15.42	0.96	0.00	0.96	0.97	0.201	1.33	0.151	1.00	1.30	2.000	No
94	15.58	0.97	0.00	0.97	0.97	0.201	1.33	0.151	1.00	1.30	2.000	No
95	15.75	0.98	0.00	0.98	0.97	0.201	1.33	0.151	1.00	1.30	2.000	No
96	15.91	0.99	0.00	0.99	0.97	0.201	1.33	0.151	1.00	1.30	2.000	No

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

Point ID	Depth (ft)	σ_v (tsf)	u_0 (tsf)	σ_v' (tsf)	r_d	CSR	MSF	CSR_{eq}	K_σ	User FS	CSR^*	Belongs to transition
97	16.08	1.00	0.00	1.00	0.97	0.201	1.33	0.151	1.00	1.30	2.000	No
98	16.24	1.01	0.00	1.01	0.97	0.201	1.33	0.151	1.00	1.30	2.000	No
99	16.40	1.02	0.00	1.02	0.97	0.201	1.33	0.151	1.00	1.30	2.000	No
100	16.57	1.03	0.00	1.03	0.97	0.201	1.33	0.150	1.00	1.30	2.000	No
101	16.73	1.04	0.00	1.04	0.96	0.201	1.33	0.150	1.00	1.30	2.000	No
102	16.90	1.05	0.00	1.05	0.96	0.201	1.33	0.150	1.00	1.30	2.000	No
103	17.06	1.06	0.00	1.06	0.96	0.201	1.33	0.150	1.00	1.30	2.000	No
104	17.23	1.08	0.00	1.08	0.96	0.200	1.33	0.150	1.00	1.30	2.000	No
105	17.39	1.08	0.00	1.08	0.96	0.200	1.33	0.150	0.99	1.30	2.000	No
106	17.55	1.09	0.00	1.09	0.96	0.200	1.33	0.150	0.99	1.30	2.000	No
107	17.72	1.11	0.00	1.11	0.96	0.200	1.33	0.150	0.99	1.30	2.000	No
108	17.88	1.12	0.00	1.12	0.96	0.200	1.33	0.150	0.99	1.30	2.000	No
109	18.05	1.13	0.00	1.13	0.96	0.200	1.33	0.150	0.99	1.30	2.000	No
110	18.21	1.14	0.00	1.14	0.96	0.200	1.33	0.150	0.98	1.30	2.000	No
111	18.37	1.15	0.00	1.15	0.96	0.200	1.33	0.150	0.98	1.30	2.000	No
112	18.54	1.16	0.00	1.16	0.96	0.200	1.33	0.150	0.98	1.30	2.000	No
113	18.70	1.17	0.00	1.17	0.96	0.200	1.33	0.150	0.98	1.30	2.000	No
114	18.87	1.18	0.00	1.18	0.96	0.200	1.33	0.150	0.98	1.30	2.000	No
115	19.03	1.19	0.00	1.19	0.96	0.200	1.33	0.150	0.97	1.30	2.000	No
116	19.19	1.20	0.00	1.20	0.96	0.199	1.33	0.149	0.97	1.30	2.000	No
117	19.36	1.21	0.00	1.21	0.96	0.199	1.33	0.149	0.97	1.30	2.000	No
118	19.52	1.22	0.00	1.22	0.96	0.199	1.33	0.149	0.97	1.30	2.000	No
119	19.69	1.23	0.00	1.23	0.96	0.199	1.33	0.149	0.97	1.30	2.000	No
120	19.85	1.24	0.00	1.24	0.96	0.199	1.33	0.149	0.96	1.30	2.000	No
121	20.01	1.25	0.00	1.25	0.96	0.199	1.33	0.149	0.96	1.30	2.000	No
122	20.18	1.26	0.00	1.26	0.96	0.199	1.33	0.149	0.96	1.30	2.000	No
123	20.34	1.27	0.00	1.27	0.96	0.199	1.33	0.149	0.96	1.30	2.000	No
124	20.51	1.28	0.00	1.28	0.96	0.199	1.33	0.149	0.96	1.30	2.000	No
125	20.67	1.29	0.00	1.29	0.96	0.199	1.33	0.149	0.96	1.30	2.000	No
126	20.83	1.30	0.00	1.30	0.95	0.199	1.33	0.149	0.95	1.30	2.000	No
127	21.00	1.31	0.00	1.31	0.95	0.198	1.33	0.149	0.95	1.30	2.000	No
128	21.16	1.32	0.00	1.32	0.95	0.198	1.33	0.149	0.95	1.30	2.000	No
129	21.33	1.33	0.00	1.33	0.95	0.198	1.33	0.149	0.95	1.30	2.000	No
130	21.49	1.35	0.00	1.35	0.95	0.198	1.33	0.149	0.95	1.30	2.000	No
131	21.65	1.36	0.00	1.36	0.95	0.198	1.33	0.148	0.94	1.30	2.000	No
132	21.82	1.37	0.00	1.37	0.95	0.198	1.33	0.148	0.94	1.30	2.000	No
133	21.98	1.38	0.00	1.38	0.95	0.198	1.33	0.148	0.94	1.30	2.000	No
134	22.15	1.39	0.00	1.39	0.95	0.198	1.33	0.148	0.94	1.30	2.000	No
135	22.31	1.40	0.00	1.40	0.95	0.198	1.33	0.148	0.94	1.30	2.000	No
136	22.47	1.41	0.00	1.41	0.95	0.198	1.33	0.148	0.94	1.30	2.000	No
137	22.64	1.42	0.00	1.42	0.95	0.198	1.33	0.148	0.93	1.30	2.000	No
138	22.80	1.44	0.00	1.44	0.95	0.197	1.33	0.148	0.93	1.30	2.000	No
139	22.97	1.45	0.00	1.45	0.95	0.197	1.33	0.148	0.93	1.30	2.000	No
140	23.13	1.46	0.00	1.46	0.95	0.197	1.33	0.148	0.93	1.30	2.000	No
141	23.30	1.47	0.00	1.47	0.95	0.197	1.33	0.148	0.93	1.30	2.000	No
142	23.46	1.48	0.00	1.48	0.95	0.197	1.33	0.148	0.93	1.30	2.000	No
143	23.62	1.49	0.00	1.49	0.95	0.197	1.33	0.148	0.92	1.30	2.000	No
144	23.79	1.50	0.00	1.50	0.95	0.197	1.33	0.147	0.92	1.30	2.000	No

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

Point ID	Depth (ft)	σ_v (tsf)	u_0 (tsf)	σ_v' (tsf)	r_d	CSR	MSF	CSR_{eq}	K_σ	User FS	CSR^*	Belongs to transition
145	23.95	1.51	0.00	1.51	0.95	0.197	1.33	0.147	0.92	1.30	2.000	No
146	24.12	1.53	0.00	1.53	0.94	0.197	1.33	0.147	0.92	1.30	2.000	No
147	24.28	1.54	0.00	1.54	0.94	0.196	1.33	0.147	0.92	1.30	2.000	No
148	24.44	1.55	0.00	1.55	0.94	0.196	1.33	0.147	0.92	1.30	2.000	No
149	24.61	1.56	0.00	1.56	0.94	0.196	1.33	0.147	0.91	1.30	2.000	No
150	24.77	1.57	0.00	1.57	0.94	0.196	1.33	0.147	0.91	1.30	2.000	No
151	24.94	1.58	0.00	1.58	0.94	0.196	1.33	0.147	0.91	1.30	2.000	No
152	25.10	1.59	0.00	1.59	0.94	0.196	1.33	0.147	0.91	1.30	2.000	No
153	25.26	1.60	0.00	1.60	0.94	0.196	1.33	0.147	0.91	1.30	2.000	No
154	25.43	1.61	0.00	1.61	0.94	0.196	1.33	0.147	0.91	1.30	2.000	No
155	25.59	1.62	0.00	1.62	0.94	0.195	1.33	0.146	0.91	1.30	2.000	No
156	25.76	1.63	0.00	1.63	0.94	0.195	1.33	0.146	0.91	1.30	2.000	No
157	25.92	1.64	0.00	1.64	0.94	0.195	1.33	0.146	0.90	1.30	2.000	No
158	26.08	1.65	0.00	1.65	0.94	0.195	1.33	0.146	0.90	1.30	2.000	No
159	26.25	1.66	0.00	1.66	0.94	0.195	1.33	0.146	0.90	1.30	2.000	No
160	26.41	1.67	0.00	1.67	0.94	0.195	1.33	0.146	0.90	1.30	2.000	No
161	26.58	1.68	0.00	1.68	0.94	0.195	1.33	0.146	0.90	1.30	2.000	No
162	26.74	1.69	0.00	1.69	0.94	0.195	1.33	0.146	0.90	1.30	2.000	No
163	26.90	1.71	0.00	1.71	0.93	0.194	1.33	0.146	0.90	1.30	2.000	No
164	27.07	1.72	0.00	1.72	0.93	0.194	1.33	0.146	0.89	1.30	2.000	No
165	27.23	1.73	0.00	1.73	0.93	0.194	1.33	0.145	0.89	1.30	2.000	No
166	27.40	1.74	0.00	1.74	0.93	0.194	1.33	0.145	0.89	1.30	2.000	No
167	27.56	1.75	0.00	1.75	0.93	0.194	1.33	0.145	0.89	1.30	2.000	No
168	27.72	1.76	0.00	1.76	0.93	0.194	1.33	0.145	0.89	1.30	2.000	No
169	27.89	1.77	0.00	1.77	0.93	0.194	1.33	0.145	0.89	1.30	2.000	No
170	28.05	1.78	0.00	1.78	0.93	0.193	1.33	0.145	0.89	1.30	2.000	No
171	28.22	1.79	0.00	1.79	0.93	0.193	1.33	0.145	0.89	1.30	2.000	No
172	28.38	1.80	0.00	1.80	0.93	0.193	1.33	0.145	0.88	1.30	2.000	No
173	28.54	1.81	0.00	1.81	0.93	0.193	1.33	0.145	0.88	1.30	2.000	No
174	28.71	1.83	0.00	1.83	0.93	0.193	1.33	0.144	0.88	1.30	2.000	No
175	28.87	1.84	0.00	1.84	0.93	0.193	1.33	0.144	0.88	1.30	2.000	No
176	29.04	1.85	0.00	1.85	0.93	0.192	1.33	0.144	0.88	1.30	2.000	No
177	29.20	1.86	0.00	1.86	0.92	0.192	1.33	0.144	0.88	1.30	2.000	No
178	29.36	1.87	0.00	1.87	0.92	0.192	1.33	0.144	0.88	1.30	2.000	No
179	29.53	1.88	0.00	1.88	0.92	0.192	1.33	0.144	0.88	1.30	2.000	No
180	29.69	1.89	0.00	1.89	0.92	0.192	1.33	0.144	0.87	1.30	2.000	No
181	29.86	1.90	0.00	1.90	0.92	0.192	1.33	0.144	0.87	1.30	2.000	No
182	30.02	1.92	0.00	1.92	0.92	0.191	1.33	0.143	0.87	1.30	2.000	No
183	30.19	1.93	0.00	1.93	0.92	0.191	1.33	0.143	0.87	1.30	2.000	No
184	30.35	1.94	0.00	1.94	0.92	0.191	1.33	0.143	0.87	1.30	2.000	No
185	30.51	1.95	0.00	1.95	0.92	0.191	1.33	0.143	0.87	1.30	2.000	No
186	30.68	1.96	0.00	1.96	0.92	0.191	1.33	0.143	0.87	1.30	2.000	No
187	30.84	1.97	0.00	1.97	0.92	0.191	1.33	0.143	0.87	1.30	2.000	No
188	31.01	1.98	0.00	1.98	0.92	0.190	1.33	0.143	0.87	1.30	2.000	No
189	31.17	1.99	0.00	1.99	0.91	0.190	1.33	0.143	0.86	1.30	2.000	No
190	31.33	2.00	0.00	2.00	0.91	0.190	1.33	0.142	0.86	1.30	2.000	No
191	31.50	2.01	0.00	2.01	0.91	0.190	1.33	0.142	0.86	1.30	2.000	No
192	31.66	2.03	0.00	2.03	0.91	0.190	1.33	0.142	0.86	1.30	2.000	No

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

Point ID	Depth (ft)	σ_v (tsf)	u_0 (tsf)	σ_v' (tsf)	r_d	CSR	MSF	CSR_{eq}	K_σ	User FS	CSR^*	Belongs to transition
193	31.83	2.04	0.00	2.04	0.91	0.189	1.33	0.142	0.86	1.30	2.000	No
194	31.99	2.05	0.00	2.05	0.91	0.189	1.33	0.142	0.86	1.30	2.000	No
195	32.15	2.06	0.00	2.06	0.91	0.189	1.33	0.142	0.86	1.30	2.000	No
196	32.32	2.07	0.00	2.07	0.91	0.189	1.33	0.142	0.86	1.30	2.000	No
197	32.48	2.08	0.00	2.08	0.91	0.189	1.33	0.141	0.86	1.30	2.000	No
198	32.65	2.09	0.00	2.09	0.91	0.188	1.33	0.141	0.85	1.30	2.000	No
199	32.81	2.10	0.00	2.10	0.90	0.188	1.33	0.141	0.85	1.30	2.000	No
200	32.97	2.11	0.00	2.11	0.90	0.188	1.33	0.141	0.85	1.30	2.000	No
201	33.14	2.12	0.00	2.12	0.90	0.188	1.33	0.141	0.85	1.30	2.000	No
202	33.30	2.14	0.00	2.14	0.90	0.188	1.33	0.141	0.85	1.30	2.000	No
203	33.47	2.15	0.00	2.15	0.90	0.187	1.33	0.140	0.85	1.30	2.000	No
204	33.63	2.16	0.00	2.16	0.90	0.187	1.33	0.140	0.85	1.30	2.000	No
205	33.79	2.17	0.00	2.17	0.90	0.187	1.33	0.140	0.85	1.30	2.000	No
206	33.96	2.18	0.00	2.18	0.90	0.187	1.33	0.140	0.85	1.30	2.000	No
207	34.12	2.19	0.00	2.19	0.90	0.186	1.33	0.140	0.85	1.30	2.000	No
208	34.29	2.20	0.00	2.20	0.90	0.186	1.33	0.140	0.84	1.30	2.000	No
209	34.45	2.21	0.00	2.21	0.89	0.186	1.33	0.139	0.84	1.30	2.000	No
210	34.61	2.22	0.00	2.22	0.89	0.186	1.33	0.139	0.84	1.30	2.000	No
211	34.78	2.23	0.00	2.23	0.89	0.186	1.33	0.139	0.84	1.30	2.000	No
212	34.94	2.24	0.00	2.24	0.89	0.185	1.33	0.139	0.84	1.30	2.000	No
213	35.11	2.25	0.00	2.25	0.89	0.185	1.33	0.139	0.84	1.30	2.000	No
214	35.27	2.26	0.00	2.26	0.89	0.185	1.33	0.139	0.84	1.30	2.000	No
215	35.43	2.28	0.00	2.28	0.89	0.185	1.33	0.138	0.84	1.30	2.000	No
216	35.60	2.29	0.00	2.29	0.89	0.184	1.33	0.138	0.84	1.30	2.000	No
217	35.76	2.30	0.00	2.30	0.89	0.184	1.33	0.138	0.84	1.30	2.000	No
218	35.93	2.31	0.00	2.31	0.88	0.184	1.33	0.138	0.84	1.30	2.000	No
219	36.09	2.32	0.00	2.32	0.88	0.184	1.33	0.138	0.83	1.30	2.000	No
220	36.26	2.33	0.00	2.33	0.88	0.183	1.33	0.137	0.83	1.30	2.000	No
221	36.42	2.34	0.00	2.34	0.88	0.183	1.33	0.137	0.83	1.30	2.000	No
222	36.58	2.35	0.00	2.35	0.88	0.183	1.33	0.137	0.83	1.30	2.000	No
223	36.75	2.36	0.00	2.36	0.88	0.183	1.33	0.137	0.83	1.30	2.000	No
224	36.91	2.37	0.00	2.37	0.88	0.182	1.33	0.137	0.83	1.30	2.000	No
225	37.08	2.38	0.00	2.38	0.88	0.182	1.33	0.136	0.83	1.30	2.000	No
226	37.24	2.39	0.00	2.39	0.87	0.182	1.33	0.136	0.83	1.30	2.000	No
227	37.40	2.40	0.00	2.40	0.87	0.182	1.33	0.136	0.83	1.30	2.000	No
228	37.57	2.41	0.00	2.41	0.87	0.181	1.33	0.136	0.83	1.30	2.000	No
229	37.73	2.42	0.00	2.42	0.87	0.181	1.33	0.136	0.83	1.30	2.000	No
230	37.90	2.44	0.00	2.44	0.87	0.181	1.33	0.135	0.83	1.30	2.000	No
231	38.06	2.45	0.00	2.45	0.87	0.180	1.33	0.135	0.82	1.30	2.000	No
232	38.22	2.46	0.00	2.46	0.87	0.180	1.33	0.135	0.82	1.30	2.000	No
233	38.39	2.47	0.00	2.47	0.86	0.180	1.33	0.135	0.82	1.30	2.000	No
234	38.55	2.48	0.00	2.48	0.86	0.180	1.33	0.135	0.82	1.30	2.000	No
235	38.72	2.49	0.00	2.49	0.86	0.179	1.33	0.134	0.82	1.30	2.000	No
236	38.88	2.50	0.00	2.50	0.86	0.179	1.33	0.134	0.82	1.30	2.000	No
237	39.04	2.51	0.00	2.51	0.86	0.179	1.33	0.134	0.82	1.30	2.000	No
238	39.21	2.52	0.00	2.52	0.86	0.178	1.33	0.134	0.82	1.30	2.000	No
239	39.37	2.53	0.00	2.53	0.86	0.178	1.33	0.134	0.82	1.30	2.000	No
240	39.54	2.54	0.00	2.54	0.86	0.178	1.33	0.133	0.82	1.30	2.000	No

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

Point ID	Depth (ft)	σ_v (tsf)	u_0 (tsf)	σ_v' (tsf)	r_d	CSR	MSF	CSR_{eq}	K_σ	User FS	CSR^*	Belongs to transition
241	39.70	2.55	0.00	2.55	0.85	0.178	1.33	0.133	0.82	1.30	2.000	No
242	39.86	2.56	0.00	2.56	0.85	0.177	1.33	0.133	0.82	1.30	2.000	No
243	40.03	2.57	0.00	2.57	0.85	0.177	1.33	0.133	0.82	1.30	2.000	No
244	40.19	2.58	0.00	2.58	0.85	0.177	1.33	0.132	0.81	1.30	2.000	No
245	40.36	2.59	0.00	2.59	0.85	0.176	1.33	0.132	0.81	1.30	2.000	No
246	40.52	2.60	0.00	2.60	0.85	0.176	1.33	0.132	0.81	1.30	2.000	No
247	40.68	2.61	0.00	2.61	0.84	0.176	1.33	0.132	0.81	1.30	2.000	No
248	40.85	2.62	0.00	2.62	0.84	0.175	1.33	0.131	0.81	1.30	2.000	No
249	41.01	2.63	0.00	2.63	0.84	0.175	1.33	0.131	0.81	1.30	2.000	No
250	41.18	2.65	0.00	2.65	0.84	0.175	1.33	0.131	0.81	1.30	2.000	No
251	41.34	2.66	0.00	2.66	0.84	0.175	1.33	0.131	0.81	1.30	2.000	No
252	41.50	2.67	0.00	2.67	0.84	0.174	1.33	0.131	0.81	1.30	2.000	No
253	41.67	2.68	0.00	2.68	0.84	0.174	1.33	0.130	0.81	1.30	2.000	No
254	41.83	2.69	0.00	2.69	0.83	0.174	1.33	0.130	0.81	1.30	2.000	No
255	42.00	2.70	0.00	2.70	0.83	0.173	1.33	0.130	0.81	1.30	2.000	No
256	42.16	2.71	0.00	2.71	0.83	0.173	1.33	0.130	0.81	1.30	2.000	No
257	42.32	2.72	0.00	2.72	0.83	0.173	1.33	0.129	0.80	1.30	2.000	No
258	42.49	2.73	0.00	2.73	0.83	0.172	1.33	0.129	0.80	1.30	2.000	No
259	42.65	2.74	0.00	2.74	0.83	0.172	1.33	0.129	0.80	1.30	2.000	No
260	42.82	2.75	0.00	2.75	0.83	0.172	1.33	0.129	0.80	1.30	2.000	No
261	42.98	2.76	0.00	2.76	0.82	0.171	1.33	0.128	0.80	1.30	2.000	No
262	43.15	2.78	0.00	2.78	0.82	0.171	1.33	0.128	0.80	1.30	2.000	No
263	43.31	2.79	0.00	2.79	0.82	0.171	1.33	0.128	0.80	1.30	2.000	No
264	43.47	2.80	0.00	2.80	0.82	0.170	1.33	0.128	0.80	1.30	2.000	No
265	43.64	2.81	0.00	2.81	0.82	0.170	1.33	0.127	0.80	1.30	2.000	No
266	43.80	2.82	0.00	2.82	0.82	0.170	1.33	0.127	0.80	1.30	2.000	No
267	43.97	2.83	0.00	2.83	0.81	0.169	1.33	0.127	0.80	1.30	2.000	No
268	44.13	2.84	0.00	2.84	0.81	0.169	1.33	0.127	0.80	1.30	2.000	No
269	44.29	2.85	0.00	2.85	0.81	0.169	1.33	0.126	0.80	1.30	2.000	No
270	44.46	2.86	0.00	2.86	0.81	0.168	1.33	0.126	0.80	1.30	2.000	No
271	44.62	2.87	0.00	2.87	0.81	0.168	1.33	0.126	0.79	1.30	2.000	No
272	44.79	2.88	0.00	2.88	0.81	0.168	1.33	0.126	0.79	1.30	2.000	No
273	44.95	2.89	0.00	2.89	0.80	0.167	1.33	0.125	0.79	1.30	2.000	No
274	45.11	2.90	0.00	2.90	0.80	0.167	1.33	0.125	0.79	1.30	0.205	No
275	45.28	2.92	0.01	2.91	0.80	0.167	1.33	0.125	0.79	1.30	0.205	No
276	45.44	2.93	0.01	2.91	0.80	0.167	1.33	0.125	0.79	1.30	0.205	No
277	45.61	2.94	0.02	2.92	0.80	0.167	1.33	0.125	0.79	1.30	0.205	No
278	45.77	2.95	0.02	2.92	0.80	0.167	1.33	0.125	0.79	1.30	0.205	No
279	45.93	2.96	0.03	2.93	0.79	0.167	1.33	0.125	0.79	1.30	0.205	No
280	46.10	2.97	0.03	2.94	0.79	0.167	1.33	0.125	0.79	1.30	0.205	No
281	46.26	2.98	0.04	2.94	0.79	0.167	1.33	0.125	0.79	1.30	0.205	No
282	46.43	2.99	0.04	2.95	0.79	0.167	1.33	0.125	0.79	1.30	0.205	No
283	46.59	3.00	0.05	2.95	0.79	0.167	1.33	0.125	0.79	1.30	0.205	No
284	46.75	3.01	0.05	2.96	0.79	0.166	1.33	0.125	0.79	1.30	0.205	No
285	46.92	3.03	0.06	2.97	0.78	0.166	1.33	0.125	0.79	1.30	0.206	No
286	47.08	3.04	0.06	2.97	0.78	0.166	1.33	0.125	0.79	1.30	2.000	Yes
287	47.25	3.05	0.07	2.98	0.78	0.166	1.33	0.125	0.79	1.30	2.000	Yes
288	47.41	3.06	0.08	2.98	0.78	0.166	1.33	0.125	0.79	1.30	2.000	Yes

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

Point ID	Depth (ft)	σ_v (tsf)	u_0 (tsf)	σ_v' (tsf)	r_d	CSR	MSF	CSR_{eq}	K_σ	User FS	CSR^*	Belongs to transition
289	47.57	3.07	0.08	2.99	0.78	0.166	1.33	0.124	0.79	1.30	2.000	Yes
290	47.74	3.08	0.09	3.00	0.78	0.166	1.33	0.124	0.79	1.30	2.000	Yes
291	47.90	3.09	0.09	3.00	0.77	0.166	1.33	0.124	0.79	1.30	2.000	Yes
292	48.07	3.10	0.10	3.01	0.77	0.166	1.33	0.124	0.79	1.30	2.000	Yes
293	48.23	3.11	0.10	3.01	0.77	0.166	1.33	0.124	0.79	1.30	2.000	Yes
294	48.39	3.12	0.11	3.02	0.77	0.166	1.33	0.124	0.79	1.30	2.000	Yes
295	48.56	3.14	0.11	3.02	0.77	0.165	1.33	0.124	0.79	1.30	2.000	Yes
296	48.72	3.15	0.12	3.03	0.77	0.165	1.33	0.124	0.79	1.30	0.205	No
297	48.89	3.16	0.12	3.04	0.76	0.165	1.33	0.124	0.78	1.30	0.205	No
298	49.05	3.17	0.13	3.04	0.76	0.165	1.33	0.124	0.78	1.30	0.205	No
299	49.22	3.18	0.13	3.05	0.76	0.165	1.33	0.124	0.78	1.30	0.205	No
300	49.38	3.19	0.14	3.05	0.76	0.165	1.33	0.124	0.78	1.30	0.205	No
301	49.54	3.20	0.14	3.06	0.76	0.165	1.33	0.124	0.78	1.30	0.205	No

Abbreviations

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

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

Point ID	Depth (ft)	q_t (tsf)	I_c	Fr (%)	n	Q_{tn}	K_c	$Q_{tn,cs}$	$CRR_{7.5}$	Belongs to trans. layer	Clay-like behaviour	FS
1	0.33	8.17	2.98	4.09	1.00	13.09	6.54	85.69	4.000	Yes	Yes	2.00
2	0.49	10.00	2.88	3.68	0.97	16.03	5.55	88.87	4.000	Yes	Yes	2.00
3	0.66	13.60	2.70	2.70	0.90	21.80	3.97	86.58	4.000	Yes	Yes	2.00
4	0.82	19.54	2.48	1.88	0.82	31.31	2.65	83.00	4.000	Yes	No	2.00
5	0.98	23.40	2.37	1.57	0.78	37.51	2.18	81.77	4.000	Yes	No	2.00
6	1.15	23.54	2.39	1.70	0.78	37.71	2.26	85.06	4.000	No	No	2.00
7	1.31	20.00	2.46	1.84	0.81	32.02	2.59	82.81	4.000	No	No	2.00
8	1.48	17.30	2.50	1.74	0.83	27.67	2.77	76.53	4.000	No	No	2.00
9	1.64	15.77	2.49	1.49	0.83	25.19	2.74	68.96	4.000	No	No	2.00
10	1.80	13.70	2.54	1.47	0.84	21.86	2.99	65.39	4.000	No	No	2.00
11	1.97	11.74	2.64	1.72	0.88	18.69	3.56	66.49	4.000	No	Yes	2.00
12	2.13	11.01	2.68	1.84	0.89	17.50	3.83	66.94	4.000	No	Yes	2.00
13	2.30	10.61	2.70	1.91	0.90	16.84	3.99	67.20	4.000	No	Yes	2.00
14	2.46	10.37	2.75	2.28	0.92	16.45	4.38	72.12	4.000	No	Yes	2.00
15	2.62	10.07	2.83	3.02	0.95	15.96	5.08	81.03	4.000	No	Yes	2.00
16	2.79	10.41	2.87	3.57	0.97	16.48	5.38	88.72	4.000	No	Yes	2.00
17	2.95	10.91	2.88	4.03	0.97	17.27	5.54	95.73	4.000	No	Yes	2.00
18	3.12	11.98	2.87	4.23	0.97	18.98	5.37	101.97	4.000	No	Yes	2.00
19	3.28	13.62	2.84	4.46	0.96	21.59	5.12	110.58	4.000	No	Yes	2.00
20	3.45	14.85	2.82	4.55	0.95	23.56	4.92	115.84	4.000	No	Yes	2.00
21	3.61	15.19	2.80	4.45	0.94	24.08	4.80	115.62	4.000	No	Yes	2.00
22	3.77	14.69	2.81	4.37	0.95	23.27	4.86	112.96	4.000	No	Yes	2.00
23	3.94	14.12	2.82	4.31	0.95	22.34	4.94	110.28	4.000	No	Yes	2.00
24	4.10	12.89	2.86	4.48	0.96	20.34	5.31	107.93	4.000	No	Yes	2.00
25	4.27	11.52	2.91	4.73	0.98	18.13	5.82	105.48	4.000	No	Yes	2.00
26	4.43	10.46	2.94	4.57	0.99	16.41	6.06	99.38	4.000	No	Yes	2.00
27	4.59	10.36	2.92	4.29	0.99	16.25	5.91	96.01	4.000	No	Yes	2.00
28	4.76	10.84	2.87	3.78	0.97	16.99	5.43	92.25	4.000	No	Yes	2.00
29	4.92	11.61	2.85	3.82	0.96	18.21	5.24	95.41	4.000	No	Yes	2.00
30	5.09	12.71	2.87	4.56	0.97	19.97	5.41	108.06	4.000	No	Yes	2.00
31	5.25	14.51	2.87	5.39	0.97	22.85	5.46	124.71	4.000	No	Yes	2.00
32	5.41	18.38	2.81	5.53	0.94	29.05	4.85	140.75	4.000	No	Yes	2.00
33	5.58	21.61	2.77	5.79	0.93	34.23	4.54	155.45	4.000	No	Yes	2.00
34	5.74	24.91	2.73	5.83	0.92	39.52	4.22	166.65	4.000	No	Yes	2.00
35	5.91	26.51	2.72	5.98	0.91	42.07	4.14	174.17	4.000	No	Yes	2.00
36	6.07	28.01	2.68	5.54	0.90	44.46	3.84	170.90	4.000	No	Yes	2.00
37	6.23	27.34	2.67	5.19	0.89	43.37	3.75	162.61	4.000	No	Yes	2.00
38	6.40	25.61	2.67	5.02	0.89	40.57	3.82	154.81	4.000	No	Yes	2.00
39	6.56	24.74	2.70	5.33	0.91	39.16	4.03	157.79	4.000	No	Yes	2.00
40	6.73	28.54	2.66	5.33	0.89	45.25	3.72	168.36	4.000	Yes	Yes	2.00
41	6.89	35.45	2.55	4.56	0.85	56.33	3.02	170.00	4.000	Yes	No	2.00
42	7.05	40.98	2.43	3.61	0.80	65.21	2.44	158.90	4.000	Yes	No	2.00
43	7.22	49.98	2.23	2.29	0.72	79.65	1.73	138.01	4.000	Yes	No	2.00
44	7.38	49.52	2.15	1.77	0.69	78.89	1.55	122.62	4.000	Yes	No	2.00
45	7.55	47.55	2.15	1.70	0.70	75.71	1.56	117.95	4.000	Yes	No	2.00
46	7.71	36.31	2.34	2.42	0.77	57.64	2.10	120.80	4.000	Yes	No	2.00
47	7.87	31.72	2.48	3.30	0.82	50.24	2.67	134.27	4.000	Yes	No	2.00
48	8.04	29.85	2.56	4.08	0.85	47.23	3.12	147.20	4.000	Yes	No	2.00

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

Point ID	Depth (ft)	q_t (tsf)	I_c	Fr (%)	n	Q_{tn}	K_c	$Q_{tn,cs}$	$CRR_{7.5}$	Belongs to trans. layer	Clay-like behaviour	FS
49	8.20	36.45	2.56	4.91	0.85	57.82	3.11	179.68	4.000	No	No	2.00
50	8.37	55.83	2.42	4.64	0.80	88.93	2.41	214.23	4.000	No	No	2.00
51	8.53	86.36	2.29	4.43	0.75	137.97	1.92	265.16	4.000	No	No	2.00
52	8.69	110.91	2.22	4.35	0.72	177.39	1.73	306.24	4.000	No	No	2.00
53	8.86	128.07	2.19	4.31	0.71	202.72	1.64	332.60	4.000	No	No	2.00
54	9.02	125.64	2.21	4.45	0.72	196.89	1.69	331.81	4.000	No	No	2.00
55	9.19	111.71	2.27	4.89	0.74	175.07	1.85	324.56	4.000	No	No	2.00
56	9.35	88.91	2.49	7.73	0.82	141.98	2.70	383.35	4.000	No	No	2.00
57	9.51	97.01	2.57	10.13	0.85	154.97	3.13	485.28	4.000	No	No	2.00
58	9.68	182.41	2.32	7.24	0.76	277.03	2.01	557.84	4.000	No	No	2.00
59	9.84	235.30	2.26	6.87	0.74	347.33	1.82	631.80	4.000	No	No	2.00
60	10.01	273.45	2.21	6.51	0.72	393.97	1.70	670.17	4.000	No	No	2.00
61	10.17	267.05	2.26	7.21	0.74	383.36	1.82	699.06	4.000	No	No	2.00
62	10.34	278.68	2.22	6.61	0.72	391.28	1.72	672.52	4.000	No	No	2.00
63	10.50	273.65	2.19	6.03	0.71	376.92	1.64	620.02	4.000	No	No	2.00
64	10.66	233.50	2.20	5.77	0.72	318.35	1.68	534.16	4.000	No	No	2.00
65	10.83	202.10	2.22	5.48	0.72	272.37	1.70	464.28	4.000	No	No	2.00
66	10.99	171.71	2.24	5.38	0.73	229.68	1.78	409.04	4.000	No	No	2.00
67	11.16	151.96	2.26	5.13	0.73	200.96	1.81	364.61	4.000	No	No	2.00
68	11.32	137.50	2.26	4.90	0.74	179.83	1.84	330.44	4.000	No	No	2.00
69	11.48	128.59	2.26	4.64	0.74	166.12	1.83	304.79	4.000	No	No	2.00
70	11.65	124.00	2.27	4.62	0.74	158.45	1.86	295.47	4.000	No	No	2.00
71	11.81	125.89	2.23	4.10	0.72	158.05	1.74	275.78	4.000	No	No	2.00
72	11.98	130.43	2.23	4.16	0.72	161.86	1.74	282.24	4.000	No	No	2.00
73	12.14	137.72	2.24	4.45	0.73	169.45	1.78	301.48	4.000	No	No	2.00
74	12.30	152.15	2.26	5.00	0.74	185.76	1.84	341.32	4.000	No	No	2.00
75	12.47	171.31	2.25	5.12	0.73	206.47	1.79	370.52	4.000	No	No	2.00
76	12.63	191.98	2.23	5.13	0.72	228.41	1.74	396.30	4.000	No	No	2.00
77	12.80	208.99	2.23	5.36	0.72	246.05	1.74	427.73	4.000	No	No	2.00
78	12.96	229.92	2.20	5.28	0.72	267.34	1.68	448.85	4.000	No	No	2.00
79	13.12	272.09	2.18	5.43	0.71	312.72	1.63	509.58	4.000	No	No	2.00
80	13.29	314.96	2.19	5.84	0.71	358.51	1.64	586.31	4.000	No	No	2.00
81	13.45	353.53	2.18	6.03	0.71	398.47	1.62	646.24	4.000	No	No	2.00
82	13.62	344.82	2.19	6.05	0.71	385.01	1.64	630.84	4.000	No	No	2.00
83	13.78	304.94	2.21	6.02	0.72	337.85	1.69	571.45	4.000	No	No	2.00
84	13.94	239.11	2.28	6.30	0.74	263.65	1.87	493.52	4.000	No	No	2.00
85	14.11	194.60	2.34	6.69	0.77	213.32	2.09	446.26	4.000	No	No	2.00
86	14.27	187.47	2.34	6.47	0.77	203.44	2.08	423.51	4.000	No	No	2.00
87	14.44	194.13	2.33	6.47	0.76	208.50	2.06	430.24	4.000	No	No	2.00
88	14.60	191.04	2.35	6.63	0.77	203.42	2.11	430.19	4.000	No	No	2.00
89	14.76	165.96	2.41	7.11	0.79	175.51	2.34	411.07	4.000	No	No	2.00
90	14.93	146.36	2.45	7.43	0.81	153.47	2.54	390.50	4.000	No	No	2.00
91	15.09	134.35	2.48	7.60	0.82	139.65	2.69	375.15	4.000	No	No	2.00
92	15.26	133.62	2.49	7.56	0.82	137.47	2.70	370.70	4.000	No	No	2.00
93	15.42	144.85	2.45	7.23	0.81	147.51	2.54	374.69	4.000	No	No	2.00
94	15.58	182.48	2.33	5.99	0.76	183.61	2.06	378.16	4.000	No	No	2.00
95	15.75	224.75	2.20	4.75	0.71	223.45	1.67	374.22	4.000	No	No	2.00
96	15.91	246.45	2.10	3.75	0.67	242.50	1.45	351.28	4.000	No	No	2.00

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

Point ID	Depth (ft)	q_t (tsf)	I_c	Fr (%)	n	Q_{tn}	K_c	$Q_{tn,cs}$	$CRR_{7.5}$	Belongs to trans. layer	Clay-like behaviour	FS
97	16.08	226.30	2.05	3.08	0.65	220.61	1.37	301.15	4.000	No	No	2.00
98	16.24	200.48	1.97	2.29	0.63	193.72	1.27	245.42	4.000	No	No	2.00
99	16.40	183.15	1.87	1.57	0.59	175.52	1.16	204.47	4.000	No	No	2.00
100	16.57	173.77	1.77	1.08	0.55	165.30	1.09	179.59	4.000	No	No	2.00
101	16.73	157.14	1.75	0.90	0.54	148.57	1.07	159.15	4.000	No	No	2.00
102	16.90	138.06	1.79	0.88	0.56	129.70	1.10	142.31	4.000	No	No	2.00
103	17.06	125.56	1.83	0.91	0.57	117.24	1.13	132.49	4.000	No	No	2.00
104	17.23	119.41	1.85	0.90	0.58	110.81	1.14	126.64	4.000	No	No	2.00
105	17.39	119.80	1.85	0.90	0.58	110.58	1.14	126.36	4.000	No	No	2.00
106	17.55	125.55	1.84	0.91	0.57	115.34	1.13	130.84	4.000	No	No	2.00
107	17.72	133.78	1.82	0.90	0.57	122.33	1.12	136.75	4.000	No	No	2.00
108	17.88	141.07	1.79	0.88	0.56	128.45	1.10	141.39	4.000	No	No	2.00
109	18.05	147.67	1.77	0.84	0.55	133.88	1.08	144.85	4.000	No	No	2.00
110	18.21	150.59	1.76	0.85	0.55	135.89	1.08	146.75	4.000	No	No	2.00
111	18.37	155.21	1.76	0.87	0.55	139.43	1.08	150.33	4.000	No	No	2.00
112	18.54	159.54	1.75	0.86	0.54	142.65	1.07	153.00	4.000	No	No	2.00
113	18.70	165.14	1.74	0.85	0.54	147.07	1.06	156.44	4.000	No	No	2.00
114	18.87	166.57	1.73	0.83	0.53	147.68	1.06	156.03	4.000	No	No	2.00
115	19.03	164.40	1.72	0.80	0.53	145.11	1.05	152.85	4.000	No	No	2.00
116	19.19	158.90	1.73	0.78	0.53	139.54	1.06	147.72	4.000	No	No	2.00
117	19.36	149.83	1.76	0.81	0.55	130.69	1.08	141.08	4.000	No	No	2.00
118	19.52	140.09	1.81	0.86	0.56	121.29	1.11	134.70	4.000	No	No	2.00
119	19.69	139.25	1.83	0.92	0.57	119.82	1.13	134.95	4.000	No	No	2.00
120	19.85	151.55	1.80	0.93	0.56	130.07	1.11	144.27	4.000	No	No	2.00
121	20.01	172.76	1.76	0.91	0.54	148.18	1.08	159.35	4.000	No	No	2.00
122	20.18	192.83	1.71	0.89	0.53	165.20	1.05	172.83	4.000	No	No	2.00
123	20.34	208.96	1.69	0.88	0.52	178.68	1.03	183.74	4.000	No	No	2.00
124	20.51	223.03	1.67	0.90	0.51	190.10	1.02	193.82	4.000	No	No	2.00
125	20.67	237.04	1.67	0.93	0.51	201.38	1.01	204.32	4.000	No	No	2.00
126	20.83	254.18	1.66	0.98	0.51	215.23	1.01	217.45	4.000	No	No	2.00
127	21.00	276.52	1.71	1.21	0.53	232.29	1.04	242.33	4.000	No	No	2.00
128	21.16	304.33	1.78	1.61	0.55	253.07	1.09	276.56	4.000	No	No	2.00
129	21.33	321.17	1.90	2.32	0.60	262.99	1.19	313.23	4.000	No	No	2.00
130	21.49	304.10	2.06	3.44	0.66	244.11	1.39	339.59	4.000	No	No	2.00
131	21.65	281.85	2.18	4.43	0.71	222.51	1.62	359.38	4.000	No	No	2.00
132	21.82	247.15	2.27	5.23	0.74	192.00	1.87	358.23	4.000	No	No	2.00
133	21.98	222.08	2.33	5.66	0.76	170.42	2.05	348.90	4.000	No	No	2.00
134	22.15	196.07	2.42	6.64	0.80	147.95	2.40	355.07	4.000	No	No	2.00
135	22.31	205.05	2.43	7.04	0.80	153.59	2.45	376.99	4.000	No	No	2.00
136	22.47	238.10	2.37	6.58	0.78	178.55	2.21	394.74	4.000	No	No	2.00
137	22.64	269.90	2.31	5.98	0.76	202.69	1.98	402.28	4.000	No	No	2.00
138	22.80	271.52	2.30	5.79	0.75	203.02	1.94	394.48	4.000	No	No	2.00
139	22.97	245.57	2.33	5.89	0.76	181.72	2.05	371.73	4.000	No	No	2.00
140	23.13	204.00	2.41	6.47	0.79	148.42	2.36	349.59	4.000	No	No	2.00
141	23.30	169.50	2.50	7.32	0.83	120.93	2.79	337.27	4.000	No	No	2.00
142	23.46	156.35	2.54	7.58	0.84	110.28	2.97	327.79	4.000	No	No	2.00
143	23.62	183.76	2.40	5.82	0.79	131.33	2.32	304.30	4.000	No	No	2.00
144	23.79	201.51	2.26	4.27	0.74	145.86	1.84	268.42	4.000	No	No	2.00

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

Point ID	Depth (ft)	q_t (tsf)	I_c	Fr (%)	n	Q_{tn}	K_c	$Q_{tn,cs}$	$CRR_{7.5}$	Belongs to trans. layer	Clay-like behaviour	FS
145	23.95	204.60	2.15	3.14	0.69	149.65	1.55	232.36	4.000	No	No	2.00
146	24.12	172.51	2.14	2.67	0.69	125.47	1.54	192.98	4.000	No	No	2.00
147	24.28	154.68	2.12	2.24	0.68	112.25	1.49	166.90	4.000	No	No	2.00
148	24.44	151.29	2.06	1.85	0.66	110.14	1.39	152.98	4.000	No	No	2.00
149	24.61	157.48	1.99	1.54	0.63	115.34	1.29	148.57	4.000	No	No	2.00
150	24.77	165.17	1.94	1.37	0.61	121.47	1.23	149.04	4.000	No	No	2.00
151	24.94	172.99	1.90	1.28	0.60	127.38	1.19	151.99	4.000	No	No	2.00
152	25.10	181.22	1.88	1.22	0.59	133.57	1.17	155.84	4.000	No	No	2.00
153	25.26	187.15	1.86	1.19	0.58	137.87	1.15	158.55	4.000	No	No	2.00
154	25.43	190.71	1.85	1.18	0.58	140.09	1.14	160.39	4.000	No	No	2.00
155	25.59	195.11	1.84	1.17	0.58	143.01	1.14	162.71	4.000	No	No	2.00
156	25.76	203.10	1.81	1.09	0.56	149.18	1.11	165.80	4.000	No	No	2.00
157	25.92	213.40	1.77	1.01	0.55	157.31	1.08	170.26	4.000	No	No	2.00
158	26.08	223.57	1.73	0.95	0.53	165.25	1.06	175.00	4.000	No	No	2.00
159	26.25	228.79	1.73	0.97	0.54	168.50	1.06	178.55	4.000	No	No	2.00
160	26.41	233.31	1.73	0.99	0.54	171.20	1.06	181.71	4.000	No	No	2.00
161	26.58	236.39	1.74	1.01	0.54	172.81	1.06	183.62	4.000	No	No	2.00
162	26.74	243.06	1.73	1.02	0.54	177.24	1.06	187.89	4.000	No	No	2.00
163	26.90	249.06	1.74	1.05	0.54	180.96	1.06	192.13	4.000	No	No	2.00
164	27.07	255.30	1.74	1.10	0.54	184.54	1.07	197.12	4.000	No	No	2.00
165	27.23	261.70	1.75	1.14	0.54	188.42	1.07	201.80	4.000	No	No	2.00
166	27.40	272.17	1.74	1.16	0.54	195.54	1.07	208.61	4.000	No	No	2.00
167	27.56	288.61	1.72	1.15	0.53	207.52	1.05	218.64	4.000	No	No	2.00
168	27.72	305.38	1.70	1.13	0.52	219.89	1.04	228.36	4.000	No	No	2.00
169	27.89	316.49	1.69	1.12	0.52	227.71	1.03	234.57	4.000	No	No	2.00
170	28.05	324.16	1.68	1.12	0.52	232.90	1.02	238.62	4.000	No	No	2.00
171	28.22	330.86	1.69	1.15	0.52	236.64	1.03	243.51	4.000	No	No	2.00
172	28.38	328.13	1.71	1.22	0.53	232.93	1.04	243.06	4.000	No	No	2.00
173	28.54	319.39	1.74	1.31	0.54	224.31	1.07	239.50	4.000	No	No	2.00
174	28.71	323.82	1.75	1.34	0.54	226.51	1.07	242.34	4.000	No	No	2.00
175	28.87	350.93	1.73	1.35	0.53	245.80	1.06	259.71	4.000	No	No	2.00
176	29.04	383.48	1.71	1.37	0.53	268.81	1.04	280.83	4.000	No	No	2.00
177	29.20	393.05	1.72	1.44	0.53	273.99	1.05	288.43	4.000	No	No	2.00
178	29.36	378.41	1.74	1.48	0.54	261.70	1.07	279.22	4.000	No	No	2.00
179	29.53	353.64	1.76	1.45	0.54	242.97	1.08	261.38	4.000	No	No	2.00
180	29.69	330.92	1.77	1.44	0.55	225.69	1.09	245.50	4.000	No	No	2.00
181	29.86	313.92	1.80	1.46	0.56	212.22	1.10	234.27	4.000	No	No	2.00
182	30.02	298.98	1.82	1.50	0.57	200.27	1.12	224.80	4.000	No	No	2.00
183	30.19	288.11	1.82	1.44	0.57	192.37	1.12	215.64	4.000	No	No	2.00
184	30.35	268.60	1.83	1.40	0.57	178.21	1.13	201.36	4.000	No	No	2.00
185	30.51	265.60	1.81	1.31	0.57	176.35	1.12	196.95	4.000	No	No	2.00
186	30.68	270.27	1.80	1.28	0.56	179.45	1.11	198.59	4.000	No	No	2.00
187	30.84	293.91	1.76	1.21	0.54	196.74	1.08	211.52	4.000	No	No	2.00
188	31.01	297.94	1.76	1.25	0.55	198.44	1.08	214.45	4.000	No	No	2.00
189	31.17	304.23	1.77	1.30	0.55	201.65	1.09	219.09	4.000	No	No	2.00
190	31.33	300.06	1.80	1.38	0.56	197.08	1.10	217.58	4.000	No	No	2.00
191	31.50	298.46	1.81	1.41	0.56	194.90	1.11	216.63	4.000	No	No	2.00
192	31.66	286.58	1.83	1.45	0.57	185.37	1.13	209.56	4.000	No	No	2.00

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

Point ID	Depth (ft)	q_t (tsf)	I_c	Fr (%)	n	Q_{tn}	K_c	$Q_{tn,cs}$	$CRR_{7.5}$	Belongs to trans. layer	Clay-like behaviour	FS
193	31.83	281.31	1.84	1.47	0.58	180.87	1.14	205.97	4.000	No	No	2.00
194	31.99	275.51	1.85	1.47	0.58	176.17	1.15	201.90	4.000	No	No	2.00
195	32.15	269.14	1.86	1.49	0.58	171.07	1.15	197.58	4.000	No	No	2.00
196	32.32	261.74	1.88	1.51	0.59	165.08	1.17	193.04	4.000	No	No	2.00
197	32.48	266.81	1.88	1.54	0.59	167.79	1.17	196.18	4.000	No	No	2.00
198	32.65	278.95	1.87	1.54	0.59	175.44	1.16	203.34	4.000	No	No	2.00
199	32.81	291.45	1.85	1.51	0.58	183.77	1.14	209.93	4.000	No	No	2.00
200	32.97	292.95	1.83	1.44	0.57	184.96	1.13	208.91	4.000	No	No	2.00
201	33.14	284.92	1.82	1.38	0.57	179.60	1.12	201.95	4.000	No	No	2.00
202	33.30	274.98	1.83	1.36	0.57	172.50	1.13	194.80	4.000	No	No	2.00
203	33.47	263.65	1.85	1.38	0.58	163.94	1.15	187.72	4.000	No	No	2.00
204	33.63	251.28	1.88	1.42	0.59	154.61	1.17	180.53	4.000	No	No	2.00
205	33.79	239.51	1.90	1.43	0.60	146.07	1.19	173.21	4.000	No	No	2.00
206	33.96	230.14	1.92	1.46	0.61	139.04	1.21	167.73	4.000	No	No	2.00
207	34.12	222.77	1.91	1.38	0.60	134.48	1.20	161.04	4.000	No	No	2.00
208	34.29	216.40	1.90	1.29	0.60	130.56	1.19	155.08	4.000	No	No	2.00
209	34.45	216.60	1.87	1.17	0.59	131.53	1.16	152.33	4.000	No	No	2.00
210	34.61	215.55	1.87	1.17	0.59	130.36	1.16	151.46	4.000	No	No	2.00
211	34.78	216.34	1.87	1.18	0.59	130.34	1.16	151.77	4.000	No	No	2.00
212	34.94	221.99	1.86	1.17	0.58	133.88	1.15	154.48	4.000	No	No	2.00
213	35.11	236.63	1.82	1.10	0.57	144.13	1.12	161.44	4.000	No	No	2.00
214	35.27	244.03	1.79	1.05	0.56	149.34	1.10	164.59	4.000	No	No	2.00
215	35.43	235.03	1.82	1.07	0.57	142.48	1.12	159.35	4.000	No	No	2.00
216	35.60	216.86	1.88	1.18	0.59	128.69	1.17	150.22	4.000	No	No	2.00
217	35.76	200.19	1.93	1.28	0.61	116.44	1.22	142.12	4.000	No	No	2.00
218	35.93	186.58	1.97	1.34	0.63	106.81	1.27	135.20	4.000	No	No	2.00
219	36.09	176.51	1.99	1.34	0.64	100.06	1.29	129.25	4.000	No	No	2.00
220	36.26	177.81	1.98	1.29	0.63	100.90	1.28	128.65	4.000	No	No	2.00
221	36.42	193.85	1.92	1.18	0.61	111.76	1.21	135.25	4.000	No	No	2.00
222	36.58	220.12	1.85	1.09	0.58	129.56	1.14	148.31	4.000	No	No	2.00
223	36.75	245.69	1.80	1.05	0.56	146.49	1.11	162.31	4.000	No	No	2.00
224	36.91	257.46	1.80	1.11	0.56	153.10	1.11	169.84	4.000	No	No	2.00
225	37.08	256.46	1.83	1.21	0.57	150.67	1.13	170.61	4.000	No	No	2.00
226	37.24	244.43	1.87	1.28	0.59	141.51	1.16	164.59	4.000	No	No	2.00
227	37.40	234.52	1.89	1.29	0.60	134.59	1.18	158.72	4.000	No	No	2.00
228	37.57	227.42	1.87	1.19	0.59	130.82	1.16	152.25	4.000	No	No	2.00
229	37.73	223.59	1.85	1.09	0.58	129.16	1.15	147.91	4.000	No	No	2.00
230	37.90	219.32	1.83	1.00	0.57	127.09	1.13	143.62	4.000	No	No	2.00
231	38.06	208.91	1.85	1.00	0.58	119.95	1.15	137.40	4.000	No	No	2.00
232	38.22	193.91	1.88	0.99	0.59	110.04	1.17	128.46	4.000	No	No	2.00
233	38.39	177.86	1.91	0.99	0.60	99.51	1.20	119.12	4.000	No	No	2.00
234	38.55	165.23	1.94	0.98	0.61	91.28	1.23	111.83	4.000	No	No	2.00
235	38.72	152.66	1.97	1.00	0.63	83.01	1.27	105.11	4.000	No	No	2.00
236	38.88	143.02	2.01	1.02	0.64	76.65	1.31	100.23	4.000	No	No	2.00
237	39.04	141.25	2.02	1.06	0.65	75.08	1.33	99.89	4.000	No	No	2.00
238	39.21	149.15	2.01	1.09	0.64	79.41	1.32	104.48	4.000	No	No	2.00
239	39.37	159.82	2.00	1.14	0.64	85.27	1.30	110.96	4.000	No	No	2.00
240	39.54	168.72	1.99	1.16	0.63	90.27	1.28	115.81	4.000	No	No	2.00

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

Point ID	Depth (ft)	q_t (tsf)	I_c	Fr (%)	n	Q_{tn}	K_c	$Q_{tn,cs}$	$CRR_{7.5}$	Belongs to trans. layer	Clay-like behaviour	FS
241	39.70	177.56	1.97	1.16	0.63	95.42	1.26	120.26	4.000	No	No	2.00
242	39.86	189.09	1.94	1.14	0.61	102.39	1.23	125.87	4.000	No	No	2.00
243	40.03	201.49	1.92	1.14	0.61	109.78	1.20	132.28	4.000	No	No	2.00
244	40.19	212.26	1.90	1.16	0.60	115.92	1.19	138.29	4.000	No	No	2.00
245	40.36	221.47	1.89	1.16	0.60	121.32	1.18	143.00	4.000	No	No	2.00
246	40.52	233.17	1.86	1.13	0.59	128.66	1.16	148.67	4.000	No	No	2.00
247	40.68	243.07	1.82	1.04	0.57	135.77	1.12	152.42	4.000	No	No	2.00
248	40.85	245.81	1.79	0.95	0.56	138.61	1.10	152.12	4.000	No	No	2.00
249	41.01	237.44	1.79	0.91	0.56	133.51	1.10	146.58	4.000	No	No	2.00
250	41.18	223.10	1.84	0.98	0.58	122.92	1.13	139.50	4.000	No	No	2.00
251	41.34	200.30	1.95	1.21	0.62	105.81	1.24	130.84	4.000	No	No	2.00
252	41.50	183.02	2.05	1.52	0.66	92.76	1.38	127.78	4.000	No	No	2.00
253	41.67	171.75	2.15	1.85	0.69	83.96	1.54	129.61	4.000	No	No	2.00
254	41.83	177.22	2.18	2.10	0.71	85.44	1.62	138.03	4.000	No	No	2.00
255	42.00	193.26	2.16	2.17	0.70	93.60	1.58	147.47	4.000	No	No	2.00
256	42.16	215.46	2.10	2.01	0.67	106.62	1.45	154.51	4.000	No	No	2.00
257	42.32	233.13	2.01	1.66	0.64	119.01	1.31	155.54	4.000	No	No	2.00
258	42.49	236.06	1.93	1.37	0.61	123.30	1.22	150.86	4.000	No	No	2.00
259	42.65	220.93	1.93	1.27	0.61	115.10	1.22	140.58	4.000	No	No	2.00
260	42.82	194.35	2.02	1.43	0.65	97.69	1.33	129.60	4.000	No	No	2.00
261	42.98	167.02	2.14	1.72	0.69	79.96	1.53	122.44	4.000	No	No	2.00
262	43.15	148.91	2.23	1.98	0.73	68.64	1.74	119.61	4.000	No	No	2.00
263	43.31	139.58	2.28	2.14	0.74	62.89	1.89	118.70	4.000	No	No	2.00
264	43.47	137.25	2.29	2.18	0.75	61.35	1.93	118.26	4.000	No	No	2.00
265	43.64	143.72	2.28	2.22	0.75	64.33	1.90	122.12	4.000	No	No	2.00
266	43.80	161.52	2.23	2.16	0.73	73.62	1.75	129.03	4.000	No	No	2.00
267	43.97	189.39	2.16	2.07	0.70	88.59	1.58	140.08	4.000	No	No	2.00
268	44.13	208.65	2.11	1.96	0.68	99.42	1.47	146.59	4.000	No	No	2.00
269	44.29	214.72	2.09	1.87	0.67	103.06	1.43	147.29	4.000	No	No	2.00
270	44.46	203.38	2.11	1.91	0.68	96.28	1.48	142.34	4.000	No	No	2.00
271	44.62	188.91	2.17	2.06	0.70	87.33	1.59	138.58	4.000	No	No	2.00
272	44.79	176.31	2.23	2.31	0.73	79.21	1.74	138.17	4.000	No	No	2.00
273	44.95	163.48	2.28	2.49	0.75	71.63	1.90	136.18	4.000	No	No	2.00
274	45.11	149.74	2.33	2.57	0.76	64.33	2.04	131.13	0.290	No	No	1.41
275	45.28	139.21	2.34	2.47	0.77	59.30	2.09	123.79	0.256	No	No	1.25
276	45.44	137.74	2.32	2.27	0.76	59.10	2.01	118.59	0.235	No	No	1.14
277	45.61	143.61	2.28	2.11	0.74	62.54	1.88	117.44	0.231	No	No	1.12
278	45.77	147.87	2.27	2.12	0.74	64.57	1.85	119.48	0.239	No	No	1.16
279	45.93	146.64	2.30	2.27	0.75	63.24	1.94	122.43	0.251	No	No	1.22
280	46.10	147.07	2.33	2.50	0.76	62.56	2.04	127.66	0.274	No	No	1.33
281	46.26	154.34	2.33	2.66	0.76	65.48	2.06	134.86	0.308	No	No	1.50
282	46.43	175.55	2.29	2.67	0.75	75.83	1.91	145.03	0.364	No	No	1.77
283	46.59	214.65	2.20	2.52	0.71	96.15	1.67	160.27	0.463	No	No	2.00
284	46.75	261.06	2.09	2.25	0.67	122.02	1.44	176.18	0.589	No	No	2.00
285	46.92	293.27	2.03	2.07	0.65	140.76	1.34	187.94	0.697	No	No	2.00
286	47.08	293.54	2.01	1.99	0.64	141.52	1.31	186.04	4.000	Yes	No	2.00
287	47.25	265.03	2.08	2.16	0.67	124.21	1.41	175.57	4.000	Yes	No	2.00
288	47.41	238.85	2.14	2.32	0.69	109.03	1.52	166.26	4.000	Yes	No	2.00

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

Point ID	Depth (ft)	q_t (tsf)	I_c	Fr (%)	n	Q_{tn}	K_c	$Q_{tn,cs}$	$CRR_{7.5}$	Belongs to trans. layer	Clay-like behaviour	FS
289	47.57	211.04	2.21	2.53	0.72	93.26	1.69	157.91	4.000	Yes	No	2.00
290	47.74	187.54	2.28	2.73	0.74	80.41	1.88	151.24	4.000	Yes	No	2.00
291	47.90	158.96	2.38	3.12	0.78	65.06	2.25	146.30	4.000	Yes	No	2.00
292	48.07	136.76	2.48	3.57	0.82	53.52	2.69	144.08	4.000	Yes	No	2.00
293	48.23	115.67	2.61	4.32	0.87	42.76	3.40	145.61	4.000	Yes	Yes	2.00
294	48.39	97.15	2.77	5.67	0.93	33.45	4.55	152.09	4.000	Yes	Yes	2.00
295	48.56	92.48	2.84	6.49	0.96	30.91	5.11	157.97	4.000	Yes	Yes	2.00
296	48.72	97.39	2.80	6.23	0.94	32.97	4.82	159.07	4.000	No	Yes	2.00
297	48.89	100.17	2.75	5.53	0.93	34.56	4.40	152.23	4.000	No	Yes	2.00
298	49.05	90.22	2.79	5.48	0.94	30.53	4.69	143.16	4.000	No	Yes	2.00
299	49.22	76.45	2.86	5.55	0.96	24.98	5.27	131.77	4.000	No	Yes	2.00
300	49.38	64.80	2.92	5.63	0.99	20.38	5.94	121.04	4.000	No	Yes	2.00
301	49.54	57.55	2.96	5.52	1.00	17.77	6.34	112.67	4.000	No	Yes	2.00

Abbreviations

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

:: Liquefaction Potential Index calculation data ::

Depth (ft)	FS	F_L	w_z	d_z	LPI	Depth (ft)	FS	F_L	w_z	d_z	LPI
0.33	2.00	0.00	9.95	0.16	0.00	0.49	2.00	0.00	9.93	0.16	0.00
0.66	2.00	0.00	9.90	0.17	0.00	0.82	2.00	0.00	9.88	0.16	0.00
0.98	2.00	0.00	9.85	0.16	0.00	1.15	2.00	0.00	9.82	0.17	0.00
1.31	2.00	0.00	9.80	0.16	0.00	1.48	2.00	0.00	9.77	0.17	0.00
1.64	2.00	0.00	9.75	0.16	0.00	1.80	2.00	0.00	9.73	0.16	0.00
1.97	2.00	0.00	9.70	0.17	0.00	2.13	2.00	0.00	9.68	0.16	0.00
2.30	2.00	0.00	9.65	0.17	0.00	2.46	2.00	0.00	9.63	0.16	0.00
2.62	2.00	0.00	9.60	0.16	0.00	2.79	2.00	0.00	9.57	0.17	0.00
2.95	2.00	0.00	9.55	0.16	0.00	3.12	2.00	0.00	9.52	0.17	0.00
3.28	2.00	0.00	9.50	0.16	0.00	3.45	2.00	0.00	9.47	0.17	0.00
3.61	2.00	0.00	9.45	0.16	0.00	3.77	2.00	0.00	9.43	0.16	0.00
3.94	2.00	0.00	9.40	0.17	0.00	4.10	2.00	0.00	9.38	0.16	0.00
4.27	2.00	0.00	9.35	0.17	0.00	4.43	2.00	0.00	9.32	0.16	0.00
4.59	2.00	0.00	9.30	0.16	0.00	4.76	2.00	0.00	9.27	0.17	0.00
4.92	2.00	0.00	9.25	0.16	0.00	5.09	2.00	0.00	9.22	0.17	0.00
5.25	2.00	0.00	9.20	0.16	0.00	5.41	2.00	0.00	9.18	0.16	0.00
5.58	2.00	0.00	9.15	0.17	0.00	5.74	2.00	0.00	9.13	0.16	0.00
5.91	2.00	0.00	9.10	0.17	0.00	6.07	2.00	0.00	9.07	0.16	0.00
6.23	2.00	0.00	9.05	0.16	0.00	6.40	2.00	0.00	9.02	0.17	0.00
6.56	2.00	0.00	9.00	0.16	0.00	6.73	2.00	0.00	8.97	0.17	0.00
6.89	2.00	0.00	8.95	0.16	0.00	7.05	2.00	0.00	8.93	0.16	0.00
7.22	2.00	0.00	8.90	0.17	0.00	7.38	2.00	0.00	8.88	0.16	0.00
7.55	2.00	0.00	8.85	0.17	0.00	7.71	2.00	0.00	8.82	0.16	0.00
7.87	2.00	0.00	8.80	0.16	0.00	8.04	2.00	0.00	8.77	0.17	0.00
8.20	2.00	0.00	8.75	0.16	0.00	8.37	2.00	0.00	8.72	0.17	0.00
8.53	2.00	0.00	8.70	0.16	0.00	8.69	2.00	0.00	8.68	0.16	0.00
8.86	2.00	0.00	8.65	0.17	0.00	9.02	2.00	0.00	8.63	0.16	0.00
9.19	2.00	0.00	8.60	0.17	0.00	9.35	2.00	0.00	8.58	0.16	0.00
9.51	2.00	0.00	8.55	0.16	0.00	9.68	2.00	0.00	8.52	0.17	0.00
9.84	2.00	0.00	8.50	0.16	0.00	10.01	2.00	0.00	8.47	0.17	0.00
10.17	2.00	0.00	8.45	0.16	0.00	10.34	2.00	0.00	8.42	0.17	0.00
10.50	2.00	0.00	8.40	0.16	0.00	10.66	2.00	0.00	8.38	0.16	0.00
10.83	2.00	0.00	8.35	0.17	0.00	10.99	2.00	0.00	8.33	0.16	0.00
11.16	2.00	0.00	8.30	0.17	0.00	11.32	2.00	0.00	8.27	0.16	0.00
11.48	2.00	0.00	8.25	0.16	0.00	11.65	2.00	0.00	8.22	0.17	0.00
11.81	2.00	0.00	8.20	0.16	0.00	11.98	2.00	0.00	8.17	0.17	0.00
12.14	2.00	0.00	8.15	0.16	0.00	12.30	2.00	0.00	8.13	0.16	0.00
12.47	2.00	0.00	8.10	0.17	0.00	12.63	2.00	0.00	8.08	0.16	0.00
12.80	2.00	0.00	8.05	0.17	0.00	12.96	2.00	0.00	8.02	0.16	0.00
13.12	2.00	0.00	8.00	0.16	0.00	13.29	2.00	0.00	7.97	0.17	0.00
13.45	2.00	0.00	7.95	0.16	0.00	13.62	2.00	0.00	7.92	0.17	0.00
13.78	2.00	0.00	7.90	0.16	0.00	13.94	2.00	0.00	7.88	0.16	0.00
14.11	2.00	0.00	7.85	0.17	0.00	14.27	2.00	0.00	7.83	0.16	0.00
14.44	2.00	0.00	7.80	0.17	0.00	14.60	2.00	0.00	7.77	0.16	0.00
14.76	2.00	0.00	7.75	0.16	0.00	14.93	2.00	0.00	7.72	0.17	0.00
15.09	2.00	0.00	7.70	0.16	0.00	15.26	2.00	0.00	7.67	0.17	0.00
15.42	2.00	0.00	7.65	0.16	0.00	15.58	2.00	0.00	7.63	0.16	0.00
15.75	2.00	0.00	7.60	0.17	0.00	15.91	2.00	0.00	7.58	0.16	0.00

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

Depth (ft)	FS	F_L	w_z	d_z	LPI	Depth (ft)	FS	F_L	w_z	d_z	LPI
16.08	2.00	0.00	7.55	0.17	0.00	16.24	2.00	0.00	7.53	0.16	0.00
16.40	2.00	0.00	7.50	0.16	0.00	16.57	2.00	0.00	7.47	0.17	0.00
16.73	2.00	0.00	7.45	0.16	0.00	16.90	2.00	0.00	7.42	0.17	0.00
17.06	2.00	0.00	7.40	0.16	0.00	17.23	2.00	0.00	7.37	0.17	0.00
17.39	2.00	0.00	7.35	0.16	0.00	17.55	2.00	0.00	7.33	0.16	0.00
17.72	2.00	0.00	7.30	0.17	0.00	17.88	2.00	0.00	7.28	0.16	0.00
18.05	2.00	0.00	7.25	0.17	0.00	18.21	2.00	0.00	7.22	0.16	0.00
18.37	2.00	0.00	7.20	0.16	0.00	18.54	2.00	0.00	7.17	0.17	0.00
18.70	2.00	0.00	7.15	0.16	0.00	18.87	2.00	0.00	7.12	0.17	0.00
19.03	2.00	0.00	7.10	0.16	0.00	19.19	2.00	0.00	7.08	0.16	0.00
19.36	2.00	0.00	7.05	0.17	0.00	19.52	2.00	0.00	7.03	0.16	0.00
19.69	2.00	0.00	7.00	0.17	0.00	19.85	2.00	0.00	6.97	0.16	0.00
20.01	2.00	0.00	6.95	0.16	0.00	20.18	2.00	0.00	6.92	0.17	0.00
20.34	2.00	0.00	6.90	0.16	0.00	20.51	2.00	0.00	6.87	0.17	0.00
20.67	2.00	0.00	6.85	0.16	0.00	20.83	2.00	0.00	6.83	0.16	0.00
21.00	2.00	0.00	6.80	0.17	0.00	21.16	2.00	0.00	6.78	0.16	0.00
21.33	2.00	0.00	6.75	0.17	0.00	21.49	2.00	0.00	6.72	0.16	0.00
21.65	2.00	0.00	6.70	0.16	0.00	21.82	2.00	0.00	6.67	0.17	0.00
21.98	2.00	0.00	6.65	0.16	0.00	22.15	2.00	0.00	6.62	0.17	0.00
22.31	2.00	0.00	6.60	0.16	0.00	22.47	2.00	0.00	6.58	0.16	0.00
22.64	2.00	0.00	6.55	0.17	0.00	22.80	2.00	0.00	6.53	0.16	0.00
22.97	2.00	0.00	6.50	0.17	0.00	23.13	2.00	0.00	6.47	0.16	0.00
23.30	2.00	0.00	6.45	0.17	0.00	23.46	2.00	0.00	6.42	0.16	0.00
23.62	2.00	0.00	6.40	0.16	0.00	23.79	2.00	0.00	6.37	0.17	0.00
23.95	2.00	0.00	6.35	0.16	0.00	24.12	2.00	0.00	6.32	0.17	0.00
24.28	2.00	0.00	6.30	0.16	0.00	24.44	2.00	0.00	6.28	0.16	0.00
24.61	2.00	0.00	6.25	0.17	0.00	24.77	2.00	0.00	6.23	0.16	0.00
24.94	2.00	0.00	6.20	0.17	0.00	25.10	2.00	0.00	6.17	0.16	0.00
25.26	2.00	0.00	6.15	0.16	0.00	25.43	2.00	0.00	6.12	0.17	0.00
25.59	2.00	0.00	6.10	0.16	0.00	25.76	2.00	0.00	6.07	0.17	0.00
25.92	2.00	0.00	6.05	0.16	0.00	26.08	2.00	0.00	6.03	0.16	0.00
26.25	2.00	0.00	6.00	0.17	0.00	26.41	2.00	0.00	5.98	0.16	0.00
26.58	2.00	0.00	5.95	0.17	0.00	26.74	2.00	0.00	5.92	0.16	0.00
26.90	2.00	0.00	5.90	0.16	0.00	27.07	2.00	0.00	5.87	0.17	0.00
27.23	2.00	0.00	5.85	0.16	0.00	27.40	2.00	0.00	5.82	0.17	0.00
27.56	2.00	0.00	5.80	0.16	0.00	27.72	2.00	0.00	5.78	0.16	0.00
27.89	2.00	0.00	5.75	0.17	0.00	28.05	2.00	0.00	5.73	0.16	0.00
28.22	2.00	0.00	5.70	0.17	0.00	28.38	2.00	0.00	5.67	0.16	0.00
28.54	2.00	0.00	5.65	0.16	0.00	28.71	2.00	0.00	5.62	0.17	0.00
28.87	2.00	0.00	5.60	0.16	0.00	29.04	2.00	0.00	5.57	0.17	0.00
29.20	2.00	0.00	5.55	0.16	0.00	29.36	2.00	0.00	5.53	0.16	0.00
29.53	2.00	0.00	5.50	0.17	0.00	29.69	2.00	0.00	5.48	0.16	0.00
29.86	2.00	0.00	5.45	0.17	0.00	30.02	2.00	0.00	5.42	0.16	0.00
30.19	2.00	0.00	5.40	0.17	0.00	30.35	2.00	0.00	5.37	0.16	0.00
30.51	2.00	0.00	5.35	0.16	0.00	30.68	2.00	0.00	5.32	0.17	0.00
30.84	2.00	0.00	5.30	0.16	0.00	31.01	2.00	0.00	5.27	0.17	0.00
31.17	2.00	0.00	5.25	0.16	0.00	31.33	2.00	0.00	5.23	0.16	0.00
31.50	2.00	0.00	5.20	0.17	0.00	31.66	2.00	0.00	5.18	0.16	0.00

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

Depth (ft)	FS	F_L	w_z	d_z	LPI	Depth (ft)	FS	F_L	w_z	d_z	LPI
31.83	2.00	0.00	5.15	0.17	0.00	31.99	2.00	0.00	5.12	0.16	0.00
32.15	2.00	0.00	5.10	0.16	0.00	32.32	2.00	0.00	5.07	0.17	0.00
32.48	2.00	0.00	5.05	0.16	0.00	32.65	2.00	0.00	5.02	0.17	0.00
32.81	2.00	0.00	5.00	0.16	0.00	32.97	2.00	0.00	4.98	0.16	0.00
33.14	2.00	0.00	4.95	0.17	0.00	33.30	2.00	0.00	4.93	0.16	0.00
33.47	2.00	0.00	4.90	0.17	0.00	33.63	2.00	0.00	4.87	0.16	0.00
33.79	2.00	0.00	4.85	0.16	0.00	33.96	2.00	0.00	4.82	0.17	0.00
34.12	2.00	0.00	4.80	0.16	0.00	34.29	2.00	0.00	4.77	0.17	0.00
34.45	2.00	0.00	4.75	0.16	0.00	34.61	2.00	0.00	4.73	0.16	0.00
34.78	2.00	0.00	4.70	0.17	0.00	34.94	2.00	0.00	4.68	0.16	0.00
35.11	2.00	0.00	4.65	0.17	0.00	35.27	2.00	0.00	4.62	0.16	0.00
35.43	2.00	0.00	4.60	0.16	0.00	35.60	2.00	0.00	4.57	0.17	0.00
35.76	2.00	0.00	4.55	0.16	0.00	35.93	2.00	0.00	4.52	0.17	0.00
36.09	2.00	0.00	4.50	0.16	0.00	36.26	2.00	0.00	4.47	0.17	0.00
36.42	2.00	0.00	4.45	0.16	0.00	36.58	2.00	0.00	4.43	0.16	0.00
36.75	2.00	0.00	4.40	0.17	0.00	36.91	2.00	0.00	4.37	0.16	0.00
37.08	2.00	0.00	4.35	0.17	0.00	37.24	2.00	0.00	4.32	0.16	0.00
37.40	2.00	0.00	4.30	0.16	0.00	37.57	2.00	0.00	4.27	0.17	0.00
37.73	2.00	0.00	4.25	0.16	0.00	37.90	2.00	0.00	4.22	0.17	0.00
38.06	2.00	0.00	4.20	0.16	0.00	38.22	2.00	0.00	4.18	0.16	0.00
38.39	2.00	0.00	4.15	0.17	0.00	38.55	2.00	0.00	4.12	0.16	0.00
38.72	2.00	0.00	4.10	0.17	0.00	38.88	2.00	0.00	4.07	0.16	0.00
39.04	2.00	0.00	4.05	0.16	0.00	39.21	2.00	0.00	4.02	0.17	0.00
39.37	2.00	0.00	4.00	0.16	0.00	39.54	2.00	0.00	3.97	0.17	0.00
39.70	2.00	0.00	3.95	0.16	0.00	39.86	2.00	0.00	3.93	0.16	0.00
40.03	2.00	0.00	3.90	0.17	0.00	40.19	2.00	0.00	3.88	0.16	0.00
40.36	2.00	0.00	3.85	0.17	0.00	40.52	2.00	0.00	3.82	0.16	0.00
40.68	2.00	0.00	3.80	0.16	0.00	40.85	2.00	0.00	3.77	0.17	0.00
41.01	2.00	0.00	3.75	0.16	0.00	41.18	2.00	0.00	3.72	0.17	0.00
41.34	2.00	0.00	3.70	0.16	0.00	41.50	2.00	0.00	3.68	0.16	0.00
41.67	2.00	0.00	3.65	0.17	0.00	41.83	2.00	0.00	3.63	0.16	0.00
42.00	2.00	0.00	3.60	0.17	0.00	42.16	2.00	0.00	3.57	0.16	0.00
42.32	2.00	0.00	3.55	0.16	0.00	42.49	2.00	0.00	3.52	0.17	0.00
42.65	2.00	0.00	3.50	0.16	0.00	42.82	2.00	0.00	3.47	0.17	0.00
42.98	2.00	0.00	3.45	0.16	0.00	43.15	2.00	0.00	3.42	0.17	0.00
43.31	2.00	0.00	3.40	0.16	0.00	43.47	2.00	0.00	3.38	0.16	0.00
43.64	2.00	0.00	3.35	0.17	0.00	43.80	2.00	0.00	3.32	0.16	0.00
43.97	2.00	0.00	3.30	0.17	0.00	44.13	2.00	0.00	3.27	0.16	0.00
44.29	2.00	0.00	3.25	0.16	0.00	44.46	2.00	0.00	3.22	0.17	0.00
44.62	2.00	0.00	3.20	0.16	0.00	44.79	2.00	0.00	3.17	0.17	0.00
44.95	2.00	0.00	3.15	0.16	0.00	45.11	1.41	0.00	3.13	0.16	0.00
45.28	1.25	0.00	3.10	0.17	0.00	45.44	1.14	0.00	3.07	0.16	0.00
45.61	1.12	0.00	3.05	0.17	0.00	45.77	1.16	0.00	3.02	0.16	0.00
45.93	1.22	0.00	3.00	0.16	0.00	46.10	1.33	0.00	2.97	0.17	0.00
46.26	1.50	0.00	2.95	0.16	0.00	46.43	1.77	0.00	2.92	0.17	0.00
46.59	2.00	0.00	2.90	0.16	0.00	46.75	2.00	0.00	2.88	0.16	0.00
46.92	2.00	0.00	2.85	0.17	0.00	47.08	2.00	0.00	2.83	0.16	0.00
47.25	2.00	0.00	2.80	0.17	0.00	47.41	2.00	0.00	2.77	0.16	0.00

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

Depth (ft)	FS	F_L	w_z	d_z	LPI	Depth (ft)	FS	F_L	w_z	d_z	LPI
47.57	2.00	0.00	2.75	0.16	0.00	47.74	2.00	0.00	2.72	0.17	0.00
47.90	2.00	0.00	2.70	0.16	0.00	48.07	2.00	0.00	2.67	0.17	0.00
48.23	2.00	0.00	2.65	0.16	0.00	48.39	2.00	0.00	2.63	0.16	0.00
48.56	2.00	0.00	2.60	0.17	0.00	48.72	2.00	0.00	2.58	0.16	0.00
48.89	2.00	0.00	2.55	0.17	0.00	49.05	2.00	0.00	2.52	0.16	0.00
49.22	2.00	0.00	2.50	0.17	0.00	49.38	2.00	0.00	2.47	0.16	0.00
49.54	2.00	0.00	2.45	0.16	0.00						

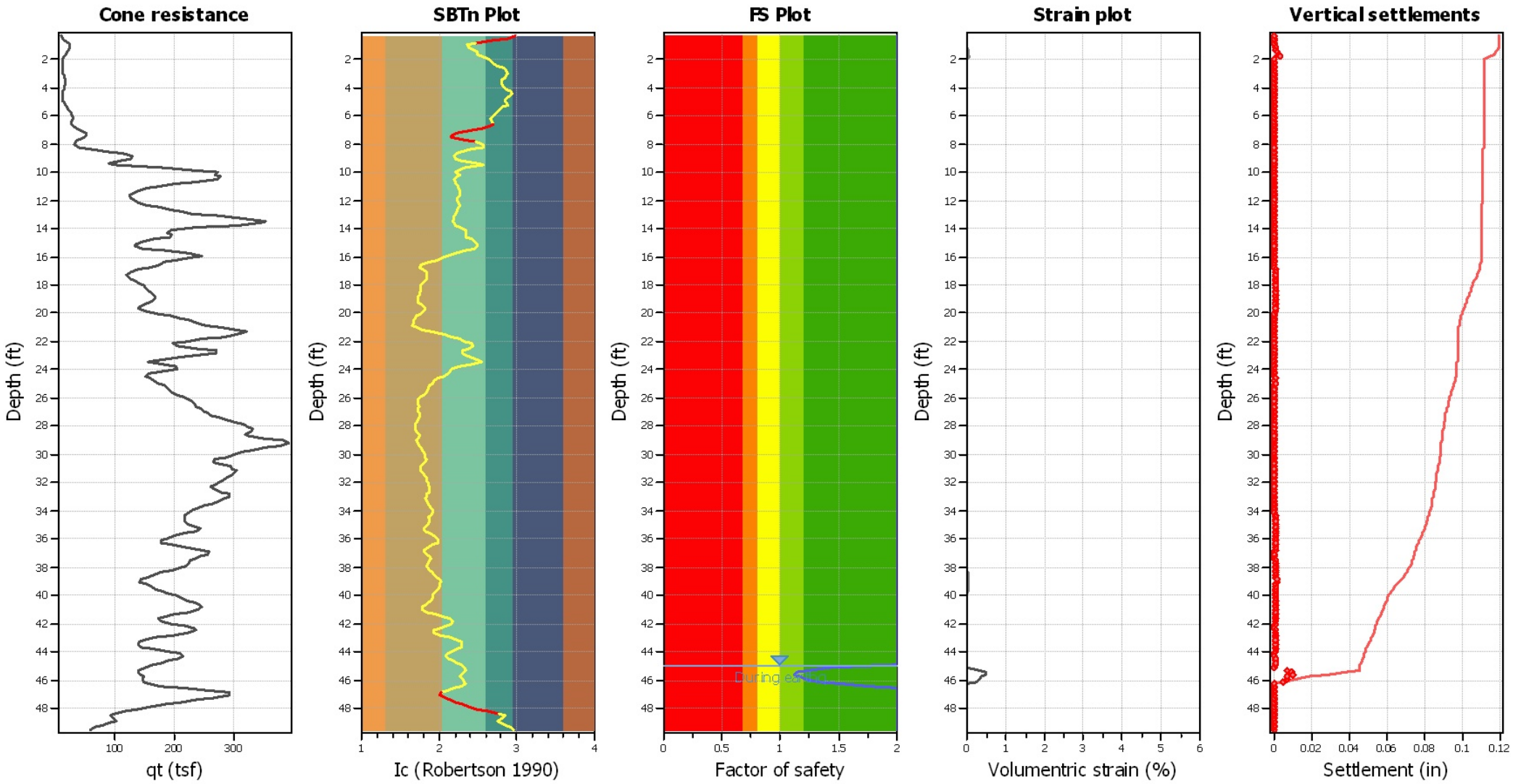
Overall liquefaction potential: 0.00

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

Abbreviations

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

Estimation of post-earthquake settlements



Abbreviations

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

:: Post-earthquake settlement of dry sands ::

Depth (ft)	Ic	Kc	Qc1n	Qc1n,cs	N1,60 (blows)	Vs (ft/s)	Gmax (tsf)	CSR	Shear, γ (%)	Svol,15 (%)	Nc	ev (%)	Settle. (in)
0.33	2.98	6.54	13.09	85.69	0	0.0	0	0.20	0.000	0.00	0.00	0.00	0.000
0.49	2.88	5.55	16.03	88.87	0	0.0	0	0.20	0.000	0.00	0.00	0.00	0.000
0.66	2.70	3.97	21.80	86.58	0	0.0	0	0.20	0.000	0.00	0.00	0.00	0.000
0.82	2.48	2.65	31.31	83.00	0	0.0	0	0.20	0.000	0.00	0.00	0.00	0.000
0.98	2.37	2.18	37.51	81.77	0	0.0	0	0.20	0.000	0.00	0.00	0.00	0.000
1.15	2.39	2.26	37.71	85.06	21	631.4	168	0.20	0.020	0.02	8.63	0.01	0.001
1.31	2.46	2.59	32.02	82.81	21	610.8	166	0.20	0.026	0.02	8.63	0.02	0.001
1.48	2.50	2.77	27.67	76.53	20	581.2	157	0.20	0.039	0.04	8.63	0.03	0.001
1.64	2.49	2.74	25.19	68.96	18	552.6	147	0.20	0.062	0.07	8.63	0.06	0.002
1.80	2.54	2.99	21.86	65.39	17	530.8	140	0.20	0.093	0.11	8.63	0.09	0.003
1.97	2.64	3.56	18.69	66.49	0	0.0	0	0.20	0.000	0.00	0.00	0.00	0.000
2.13	2.68	3.83	17.50	66.94	0	0.0	0	0.20	0.000	0.00	0.00	0.00	0.000
2.30	2.70	3.99	16.84	67.20	0	0.0	0	0.20	0.000	0.00	0.00	0.00	0.000
2.46	2.75	4.38	16.45	72.12	0	0.0	0	0.20	0.000	0.00	0.00	0.00	0.000
2.62	2.83	5.08	15.96	81.03	0	0.0	0	0.20	0.000	0.00	0.00	0.00	0.000
2.79	2.87	5.38	16.48	88.72	0	0.0	0	0.20	0.000	0.00	0.00	0.00	0.000
2.95	2.88	5.54	17.27	95.73	0	0.0	0	0.20	0.000	0.00	0.00	0.00	0.000
3.12	2.87	5.37	18.98	101.97	0	0.0	0	0.20	0.000	0.00	0.00	0.00	0.000
3.28	2.84	5.12	21.59	110.58	0	0.0	0	0.20	0.000	0.00	0.00	0.00	0.000
3.45	2.82	4.92	23.56	115.84	0	0.0	0	0.20	0.000	0.00	0.00	0.00	0.000
3.61	2.80	4.80	24.08	115.62	0	0.0	0	0.20	0.000	0.00	0.00	0.00	0.000
3.77	2.81	4.86	23.27	112.96	0	0.0	0	0.20	0.000	0.00	0.00	0.00	0.000
3.94	2.82	4.94	22.34	110.28	0	0.0	0	0.20	0.000	0.00	0.00	0.00	0.000
4.10	2.86	5.31	20.34	107.93	0	0.0	0	0.20	0.000	0.00	0.00	0.00	0.000
4.27	2.91	5.82	18.13	105.48	0	0.0	0	0.20	0.000	0.00	0.00	0.00	0.000
4.43	2.94	6.06	16.41	99.38	0	0.0	0	0.20	0.000	0.00	0.00	0.00	0.000
4.59	2.92	5.91	16.25	96.01	0	0.0	0	0.20	0.000	0.00	0.00	0.00	0.000
4.76	2.87	5.43	16.99	92.25	0	0.0	0	0.20	0.000	0.00	0.00	0.00	0.000
4.92	2.85	5.24	18.21	95.41	0	0.0	0	0.20	0.000	0.00	0.00	0.00	0.000
5.09	2.87	5.41	19.97	108.06	0	0.0	0	0.20	0.000	0.00	0.00	0.00	0.000
5.25	2.87	5.46	22.85	124.71	0	0.0	0	0.20	0.000	0.00	0.00	0.00	0.000
5.41	2.81	4.85	29.05	140.75	0	0.0	0	0.20	0.000	0.00	0.00	0.00	0.000
5.58	2.77	4.54	34.23	155.45	0	0.0	0	0.20	0.000	0.00	0.00	0.00	0.000
5.74	2.73	4.22	39.52	166.65	0	0.0	0	0.20	0.000	0.00	0.00	0.00	0.000
5.91	2.72	4.14	42.07	174.17	0	0.0	0	0.20	0.000	0.00	0.00	0.00	0.000
6.07	2.68	3.84	44.46	170.90	0	0.0	0	0.20	0.000	0.00	0.00	0.00	0.000
6.23	2.67	3.75	43.37	162.61	0	0.0	0	0.20	0.000	0.00	0.00	0.00	0.000
6.40	2.67	3.82	40.57	154.81	0	0.0	0	0.20	0.000	0.00	0.00	0.00	0.000
6.56	2.70	4.03	39.16	157.79	0	0.0	0	0.20	0.000	0.00	0.00	0.00	0.000
6.73	2.66	3.72	45.25	168.36	0	0.0	0	0.20	0.000	0.00	0.00	0.00	0.000
6.89	2.55	3.02	56.33	170.00	0	0.0	0	0.20	0.000	0.00	0.00	0.00	0.000
7.05	2.43	2.44	65.21	158.90	0	0.0	0	0.20	0.000	0.00	0.00	0.00	0.000
7.22	2.23	1.73	79.65	138.01	0	0.0	0	0.20	0.000	0.00	0.00	0.00	0.000
7.38	2.15	1.55	78.89	122.62	0	0.0	0	0.20	0.000	0.00	0.00	0.00	0.000
7.55	2.15	1.56	75.71	117.95	0	0.0	0	0.20	0.000	0.00	0.00	0.00	0.000
7.71	2.34	2.10	57.64	120.80	0	0.0	0	0.20	0.000	0.00	0.00	0.00	0.000
7.87	2.48	2.67	50.24	134.27	0	0.0	0	0.20	0.000	0.00	0.00	0.00	0.000
8.04	2.56	3.12	47.23	147.20	0	0.0	0	0.20	0.000	0.00	0.00	0.00	0.000

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

Depth (ft)	Ic	Kc	Qc1n	Qc1n,cs	N1,60 (blows)	Vs (ft/s)	Gmax (tsf)	CSR	Shear, γ (%)	Svol,15 (%)	Nc	ev (%)	Settle. (in)
8.20	2.56	3.11	57.82	179.68	48	874.7	971	0.20	0.012	0.00	8.63	0.00	0.000
8.37	2.42	2.41	88.93	214.23	53	992.8	1304	0.20	0.009	0.00	8.63	0.00	0.000
8.53	2.29	1.92	137.97	265.16	62	1137.8	1785	0.20	0.006	0.00	8.63	0.00	0.000
8.69	2.22	1.73	177.39	306.24	70	1235.7	2166	0.20	0.005	0.00	8.63	0.00	0.000
8.86	2.19	1.64	202.72	332.60	75	1292.6	2422	0.20	0.005	0.00	8.63	0.00	0.000
9.02	2.21	1.69	196.89	331.81	75	1288.7	2433	0.20	0.005	0.00	8.63	0.00	0.000
9.19	2.27	1.85	175.07	324.56	75	1263.7	2357	0.20	0.005	0.00	8.63	0.00	0.000
9.35	2.49	2.70	141.98	383.35	98	1305.6	2563	0.20	0.005	0.00	8.63	0.00	0.000
9.51	2.57	3.13	154.97	485.28	129	1435.7	3177	0.20	0.004	0.00	8.63	0.00	0.000
9.68	2.32	2.01	277.03	557.84	132	1641.2	4195	0.20	0.003	0.00	8.63	0.00	0.000
9.84	2.26	1.82	347.33	631.80	146	1766.5	4907	0.20	0.002	0.00	8.63	0.00	0.000
10.01	2.21	1.70	393.97	670.17	152	1830.2	5320	0.20	0.002	0.00	8.63	0.00	0.000
10.17	2.26	1.82	383.36	699.06	162	1857.7	5532	0.20	0.002	0.00	8.63	0.00	0.000
10.34	2.22	1.72	391.28	672.52	153	1831.9	5432	0.20	0.002	0.00	8.63	0.00	0.000
10.50	2.19	1.64	376.92	620.02	139	1764.5	5085	0.20	0.003	0.00	8.63	0.00	0.000
10.66	2.20	1.68	318.35	534.16	121	1635.6	4407	0.20	0.003	0.00	8.63	0.00	0.000
10.83	2.22	1.70	272.37	464.28	105	1523.1	3857	0.20	0.004	0.00	8.63	0.00	0.000
10.99	2.24	1.78	229.68	409.04	94	1424.3	3401	0.20	0.004	0.00	8.63	0.00	0.000
11.16	2.26	1.81	200.96	364.61	84	1342.3	3048	0.20	0.005	0.00	8.63	0.00	0.000
11.32	2.26	1.84	179.83	330.44	77	1276.2	2756	0.20	0.005	0.00	8.63	0.00	0.000
11.48	2.26	1.83	166.12	304.79	71	1225.9	2543	0.20	0.006	0.00	8.63	0.00	0.000
11.65	2.27	1.86	158.45	295.47	69	1205.0	2471	0.20	0.006	0.00	8.63	0.00	0.000
11.81	2.23	1.74	158.05	275.78	63	1171.6	2341	0.20	0.007	0.00	8.63	0.00	0.000
11.98	2.23	1.74	161.86	282.24	64	1185.3	2423	0.20	0.007	0.00	8.63	0.00	0.000
12.14	2.24	1.78	169.45	301.48	69	1222.9	2618	0.20	0.006	0.00	8.63	0.00	0.000
12.30	2.26	1.84	185.76	341.32	79	1297.1	3006	0.20	0.005	0.00	8.63	0.00	0.000
12.47	2.25	1.79	206.47	370.52	85	1354.6	3304	0.20	0.005	0.00	8.63	0.00	0.000
12.63	2.23	1.74	228.41	396.30	90	1405.1	3582	0.20	0.005	0.00	8.63	0.00	0.000
12.80	2.23	1.74	246.05	427.73	98	1459.6	3894	0.20	0.004	0.00	8.63	0.00	0.000
12.96	2.20	1.68	267.34	448.85	101	1499.3	4137	0.20	0.004	0.00	8.63	0.00	0.000
13.12	2.18	1.63	312.72	509.58	114	1600.6	4748	0.20	0.004	0.00	8.63	0.00	0.000
13.29	2.19	1.64	358.51	586.31	131	1716.5	5501	0.20	0.003	0.00	8.63	0.00	0.000
13.45	2.18	1.62	398.47	646.24	145	1803.0	6110	0.20	0.003	0.00	8.63	0.00	0.000
13.62	2.19	1.64	385.01	630.84	142	1780.3	5999	0.20	0.003	0.00	8.63	0.00	0.000
13.78	2.21	1.69	337.85	571.45	129	1690.7	5446	0.20	0.003	0.00	8.63	0.00	0.000
13.94	2.28	1.87	263.65	493.52	115	1556.7	4647	0.20	0.004	0.00	8.63	0.00	0.000
14.11	2.34	2.09	213.32	446.26	107	1461.0	4121	0.20	0.004	0.00	8.63	0.00	0.000
14.27	2.34	2.08	203.44	423.51	101	1424.1	3940	0.20	0.005	0.00	8.63	0.00	0.000
14.44	2.33	2.06	208.50	430.24	103	1437.0	4038	0.20	0.005	0.00	8.63	0.00	0.000
14.60	2.35	2.11	203.42	430.19	103	1432.4	4037	0.20	0.005	0.00	8.63	0.00	0.000
14.76	2.41	2.34	175.51	411.07	101	1380.8	3774	0.20	0.005	0.00	8.63	0.00	0.000
14.93	2.45	2.54	153.47	390.50	98	1329.6	3522	0.20	0.006	0.00	8.63	0.00	0.000
15.09	2.48	2.69	139.65	375.15	96	1292.6	3349	0.20	0.006	0.00	8.63	0.00	0.000
15.26	2.49	2.70	137.47	370.70	95	1284.2	3326	0.20	0.006	0.00	8.63	0.00	0.000
15.42	2.45	2.54	147.51	374.69	94	1302.7	3442	0.20	0.006	0.00	8.63	0.00	0.000
15.58	2.33	2.06	183.61	378.16	90	1347.5	3704	0.20	0.006	0.00	8.63	0.00	0.000
15.75	2.20	1.67	223.45	374.22	84	1369.2	3847	0.20	0.005	0.00	8.63	0.00	0.000
15.91	2.10	1.45	242.50	351.28	76	1333.2	3668	0.20	0.006	0.00	8.63	0.00	0.000

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

Depth (ft)	Ic	Kc	Qc1n	Qc1n,cs	N1,60 (blows)	Vs (ft/s)	Gmax (tsf)	CSR	Shear, γ (%)	Svol,15 (%)	Nc	ev (%)	Settle. (in)
16.08	2.05	1.37	220.61	301.15	64	1231.6	3149	0.20	0.007	0.00	8.63	0.00	0.000
16.24	1.97	1.27	193.72	245.42	51	1102.3	2481	0.20	0.009	0.00	8.63	0.00	0.000
16.40	1.87	1.16	175.52	204.47	41	984.9	1937	0.20	0.012	0.01	8.63	0.00	0.000
16.57	1.77	1.09	165.30	179.59	34	896.0	1571	0.20	0.016	0.01	8.63	0.01	0.000
16.73	1.75	1.07	148.57	159.15	30	837.6	1354	0.20	0.019	0.01	8.63	0.01	0.000
16.90	1.79	1.10	129.70	142.31	27	801.4	1232	0.20	0.022	0.02	8.63	0.01	0.000
17.06	1.83	1.13	117.24	132.49	26	783.6	1177	0.20	0.024	0.02	8.63	0.01	0.001
17.23	1.85	1.14	110.81	126.64	25	769.6	1135	0.20	0.025	0.02	8.63	0.02	0.001
17.39	1.85	1.14	110.58	126.36	25	768.7	1138	0.20	0.025	0.02	8.63	0.02	0.001
17.55	1.84	1.13	115.34	130.84	26	779.9	1182	0.20	0.024	0.02	8.63	0.01	0.001
17.72	1.82	1.12	122.33	136.75	27	792.4	1232	0.20	0.023	0.02	8.63	0.01	0.001
17.88	1.79	1.10	128.45	141.39	27	800.0	1264	0.20	0.023	0.02	8.63	0.01	0.000
18.05	1.77	1.08	133.88	144.85	28	803.1	1281	0.20	0.022	0.02	8.63	0.01	0.000
18.21	1.76	1.08	135.89	146.75	28	807.6	1304	0.20	0.022	0.01	8.63	0.01	0.000
18.37	1.76	1.08	139.43	150.33	29	816.7	1344	0.20	0.021	0.01	8.63	0.01	0.000
18.54	1.75	1.07	142.65	153.00	29	821.8	1370	0.20	0.021	0.01	8.63	0.01	0.000
18.70	1.74	1.06	147.07	156.44	30	827.6	1398	0.20	0.021	0.01	8.63	0.01	0.000
18.87	1.73	1.06	147.68	156.03	29	823.7	1390	0.20	0.021	0.01	8.63	0.01	0.000
19.03	1.72	1.05	145.11	152.85	29	814.1	1359	0.20	0.022	0.01	8.63	0.01	0.000
19.19	1.73	1.06	139.54	147.72	28	802.3	1320	0.20	0.023	0.02	8.63	0.01	0.000
19.36	1.76	1.08	130.69	141.08	27	791.6	1288	0.20	0.024	0.02	8.63	0.01	0.001
19.52	1.81	1.11	121.29	134.70	26	784.1	1267	0.20	0.025	0.02	8.63	0.01	0.001
19.69	1.83	1.13	119.82	134.95	26	789.7	1294	0.20	0.024	0.02	8.63	0.01	0.001
19.85	1.80	1.11	130.07	144.27	28	811.0	1381	0.20	0.023	0.02	8.63	0.01	0.000
20.01	1.76	1.08	148.18	159.35	30	839.8	1500	0.20	0.020	0.01	8.63	0.01	0.000
20.18	1.71	1.05	165.20	172.83	32	862.7	1601	0.20	0.019	0.01	8.63	0.01	0.000
20.34	1.69	1.03	178.68	183.74	34	882.4	1692	0.20	0.018	0.01	8.63	0.01	0.000
20.51	1.67	1.02	190.10	193.82	36	902.8	1790	0.20	0.017	0.01	8.63	0.01	0.000
20.67	1.67	1.01	201.38	204.32	38	925.0	1899	0.20	0.016	0.01	8.63	0.01	0.000
20.83	1.66	1.01	215.23	217.45	40	952.6	2038	0.20	0.015	0.01	8.63	0.00	0.000
21.00	1.71	1.04	232.29	242.33	45	1020.2	2391	0.20	0.012	0.00	8.63	0.00	0.000
21.16	1.78	1.09	253.07	276.56	53	1115.0	2933	0.20	0.010	0.00	8.63	0.00	0.000
21.33	1.90	1.19	262.99	313.23	63	1227.7	3610	0.20	0.008	0.00	8.63	0.00	0.000
21.49	2.06	1.39	244.11	339.59	72	1309.3	4122	0.20	0.007	0.00	8.63	0.00	0.000
21.65	2.18	1.62	222.51	359.38	80	1344.9	4367	0.20	0.007	0.00	8.63	0.00	0.000
21.82	2.27	1.87	192.00	358.23	83	1326.7	4268	0.20	0.007	0.00	8.63	0.00	0.000
21.98	2.33	2.05	170.42	348.90	83	1295.3	4085	0.20	0.007	0.00	8.63	0.00	0.000
22.15	2.42	2.40	147.95	355.07	88	1278.8	3998	0.21	0.007	0.00	8.63	0.00	0.000
22.31	2.43	2.45	153.59	376.99	94	1313.4	4234	0.21	0.007	0.00	8.63	0.00	0.000
22.47	2.37	2.21	178.55	394.74	96	1364.0	4585	0.21	0.006	0.00	8.63	0.00	0.000
22.64	2.31	1.98	202.69	402.28	95	1396.2	4823	0.21	0.006	0.00	8.63	0.00	0.000
22.80	2.30	1.94	203.02	394.48	93	1386.0	4772	0.21	0.006	0.00	8.63	0.00	0.000
22.97	2.33	2.05	181.72	371.73	89	1337.2	4459	0.21	0.007	0.00	8.63	0.00	0.000
23.13	2.41	2.36	148.42	349.59	86	1272.3	4052	0.21	0.008	0.00	8.63	0.00	0.000
23.30	2.50	2.79	120.93	337.27	87	1218.6	3732	0.21	0.008	0.00	8.63	0.00	0.000
23.46	2.54	2.97	110.28	327.79	86	1189.6	3570	0.21	0.009	0.00	8.63	0.00	0.000
23.62	2.40	2.32	131.33	304.30	75	1189.8	3585	0.21	0.009	0.00	8.63	0.00	0.000
23.79	2.26	1.84	145.86	268.42	62	1150.1	3362	0.21	0.010	0.00	8.63	0.00	0.000

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

Depth (ft)	Ic	Kc	Qc1n	Qc1n,cs	N1,60 (blows)	Vs (ft/s)	Gmax (tsf)	CSR	Shear, γ (%)	Svol,15 (%)	Nc	ev (%)	Settle. (in)
23.95	2.15	1.55	149.65	232.36	51	1083.3	2983	0.21	0.011	0.00	8.63	0.00	0.000
24.12	2.14	1.54	125.47	192.98	43	987.6	2437	0.21	0.014	0.01	8.63	0.00	0.000
24.28	2.12	1.49	112.25	166.90	36	919.0	2080	0.21	0.017	0.01	8.63	0.01	0.000
24.44	2.06	1.39	110.14	152.98	33	878.7	1885	0.21	0.019	0.01	8.63	0.01	0.000
24.61	1.99	1.29	115.34	148.57	31	859.9	1798	0.21	0.021	0.01	8.63	0.01	0.000
24.77	1.94	1.23	121.47	149.04	30	853.5	1772	0.21	0.021	0.01	8.63	0.01	0.000
24.94	1.90	1.19	127.38	151.99	31	855.7	1787	0.21	0.021	0.01	8.63	0.01	0.000
25.10	1.88	1.17	133.57	155.84	31	860.3	1814	0.21	0.021	0.01	8.63	0.01	0.000
25.26	1.86	1.15	137.87	158.55	31	863.2	1833	0.21	0.021	0.01	8.63	0.01	0.000
25.43	1.85	1.14	140.09	160.39	32	866.7	1857	0.21	0.020	0.01	8.63	0.01	0.000
25.59	1.84	1.14	143.01	162.71	32	870.8	1883	0.21	0.020	0.01	8.63	0.01	0.000
25.76	1.81	1.11	149.18	165.80	32	870.2	1884	0.21	0.020	0.01	8.63	0.01	0.000
25.92	1.77	1.08	157.31	170.26	33	870.8	1891	0.21	0.020	0.01	8.63	0.01	0.000
26.08	1.73	1.06	165.25	175.00	33	873.3	1908	0.21	0.020	0.01	8.63	0.01	0.000
26.25	1.73	1.06	168.50	178.55	34	882.4	1961	0.21	0.020	0.01	8.63	0.01	0.000
26.41	1.73	1.06	171.20	181.71	34	890.9	2011	0.21	0.019	0.01	8.63	0.01	0.000
26.58	1.74	1.06	172.81	183.62	35	896.1	2045	0.21	0.019	0.01	8.63	0.01	0.000
26.74	1.73	1.06	177.24	187.89	35	905.4	2100	0.21	0.018	0.01	8.63	0.01	0.000
26.90	1.74	1.06	180.96	192.13	36	916.3	2164	0.21	0.018	0.01	8.63	0.01	0.000
27.07	1.74	1.07	184.54	197.12	37	930.9	2252	0.21	0.017	0.01	8.63	0.01	0.000
27.23	1.75	1.07	188.42	201.80	38	943.1	2327	0.21	0.017	0.01	8.63	0.01	0.000
27.40	1.74	1.07	195.54	208.61	40	957.0	2413	0.21	0.016	0.01	8.63	0.01	0.000
27.56	1.72	1.05	207.52	218.64	41	973.7	2515	0.21	0.015	0.01	8.63	0.01	0.000
27.72	1.70	1.04	219.89	228.36	43	988.2	2607	0.21	0.015	0.01	8.63	0.00	0.000
27.89	1.69	1.03	227.71	234.57	44	997.8	2672	0.21	0.015	0.01	8.63	0.00	0.000
28.05	1.68	1.02	232.90	238.62	44	1003.9	2717	0.21	0.014	0.01	8.63	0.00	0.000
28.22	1.69	1.03	236.64	243.51	45	1016.1	2802	0.21	0.014	0.01	8.63	0.00	0.000
28.38	1.71	1.04	232.93	243.06	45	1021.9	2849	0.21	0.014	0.01	8.63	0.00	0.000
28.54	1.74	1.07	224.31	239.50	45	1025.9	2886	0.21	0.014	0.01	8.63	0.00	0.000
28.71	1.75	1.07	226.51	242.34	46	1033.0	2941	0.21	0.013	0.00	8.63	0.00	0.000
28.87	1.73	1.06	245.80	259.71	49	1062.7	3142	0.21	0.012	0.00	8.63	0.00	0.000
29.04	1.71	1.04	268.81	280.83	53	1099.0	3395	0.21	0.012	0.00	8.63	0.00	0.000
29.20	1.72	1.05	273.99	288.43	54	1117.9	3534	0.21	0.011	0.00	8.63	0.00	0.000
29.36	1.74	1.07	261.70	279.22	53	1107.3	3477	0.21	0.011	0.00	8.63	0.00	0.000
29.53	1.76	1.08	242.97	261.38	50	1075.7	3273	0.21	0.012	0.00	8.63	0.00	0.000
29.69	1.77	1.09	225.69	245.50	47	1048.2	3100	0.21	0.013	0.00	8.63	0.00	0.000
29.86	1.80	1.10	212.22	234.27	45	1031.2	3001	0.21	0.014	0.01	8.63	0.00	0.000
30.02	1.82	1.12	200.27	224.80	44	1017.8	2926	0.21	0.014	0.01	8.63	0.00	0.000
30.19	1.82	1.12	192.37	215.64	42	996.2	2798	0.21	0.015	0.01	8.63	0.00	0.000
30.35	1.83	1.13	178.21	201.36	39	966.0	2620	0.21	0.016	0.01	8.63	0.01	0.000
30.51	1.81	1.12	176.35	196.95	38	950.5	2533	0.21	0.017	0.01	8.63	0.01	0.000
30.68	1.80	1.11	179.45	198.59	38	950.5	2539	0.21	0.017	0.01	8.63	0.01	0.000
30.84	1.76	1.08	196.74	211.52	40	967.4	2646	0.21	0.016	0.01	8.63	0.01	0.000
31.01	1.76	1.08	198.44	214.45	41	976.5	2711	0.21	0.016	0.01	8.63	0.01	0.000
31.17	1.77	1.09	201.65	219.09	42	989.7	2803	0.21	0.015	0.01	8.63	0.00	0.000
31.33	1.80	1.10	197.08	217.58	42	993.8	2840	0.21	0.015	0.01	8.63	0.00	0.000
31.50	1.81	1.11	194.90	216.63	42	994.7	2855	0.21	0.015	0.01	8.63	0.00	0.000
31.66	1.83	1.13	185.37	209.56	41	985.6	2807	0.21	0.016	0.01	8.63	0.01	0.000

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

Depth (ft)	Ic	Kc	Qc1n	Qc1n,cs	N1,60 (blows)	Vs (ft/s)	Gmax (tsf)	CSR	Shear, γ (%)	Svol,15 (%)	Nc	ev (%)	Settle. (in)
31.83	1.84	1.14	180.87	205.97	40	980.1	2781	0.21	0.016	0.01	8.63	0.01	0.000
31.99	1.85	1.15	176.17	201.90	40	972.8	2744	0.21	0.016	0.01	8.63	0.01	0.000
32.15	1.86	1.15	171.07	197.58	39	965.2	2705	0.21	0.016	0.01	8.63	0.01	0.000
32.32	1.88	1.17	165.08	193.04	38	958.2	2670	0.21	0.017	0.01	8.63	0.01	0.000
32.48	1.88	1.17	167.79	196.18	39	965.9	2727	0.21	0.016	0.01	8.63	0.01	0.000
32.65	1.87	1.16	175.44	203.34	40	980.4	2826	0.21	0.016	0.01	8.63	0.01	0.000
32.81	1.85	1.14	183.77	209.93	41	990.7	2900	0.21	0.015	0.01	8.63	0.01	0.000
32.97	1.83	1.13	184.96	208.91	41	983.7	2860	0.21	0.016	0.01	8.63	0.01	0.000
33.14	1.82	1.12	179.60	201.95	39	965.4	2749	0.21	0.017	0.01	8.63	0.01	0.000
33.30	1.83	1.13	172.50	194.80	38	949.9	2659	0.21	0.017	0.01	8.63	0.01	0.000
33.47	1.85	1.15	163.94	187.72	37	937.7	2592	0.21	0.018	0.01	8.63	0.01	0.000
33.63	1.88	1.17	154.61	180.53	36	926.2	2531	0.21	0.019	0.01	8.63	0.01	0.000
33.79	1.90	1.19	146.07	173.21	35	911.8	2451	0.21	0.019	0.01	8.63	0.01	0.000
33.96	1.92	1.21	139.04	167.73	34	901.6	2398	0.21	0.020	0.01	8.63	0.01	0.000
34.12	1.91	1.20	134.48	161.04	32	881.7	2286	0.21	0.021	0.01	8.63	0.01	0.000
34.29	1.90	1.19	130.56	155.08	31	863.2	2184	0.21	0.023	0.01	8.63	0.01	0.000
34.45	1.87	1.16	131.53	152.33	30	848.3	2102	0.21	0.024	0.01	8.63	0.01	0.000
34.61	1.87	1.16	130.36	151.46	30	846.8	2100	0.21	0.024	0.01	8.63	0.01	0.000
34.78	1.87	1.16	130.34	151.77	30	848.4	2114	0.21	0.024	0.01	8.63	0.01	0.000
34.94	1.86	1.15	133.88	154.48	31	853.1	2146	0.21	0.023	0.01	8.63	0.01	0.000
35.11	1.82	1.12	144.13	161.44	31	861.7	2197	0.21	0.023	0.01	8.63	0.01	0.000
35.27	1.79	1.10	149.34	164.59	32	863.7	2212	0.21	0.023	0.01	8.63	0.01	0.000
35.43	1.82	1.12	142.48	159.35	31	855.5	2172	0.21	0.023	0.01	8.63	0.01	0.000
35.60	1.88	1.17	128.69	150.22	30	844.8	2122	0.21	0.024	0.01	8.63	0.01	0.000
35.76	1.93	1.22	116.44	142.12	29	832.4	2061	0.21	0.025	0.02	8.63	0.01	0.000
35.93	1.97	1.27	106.81	135.20	28	818.0	1990	0.21	0.026	0.02	8.63	0.01	0.001
36.09	1.99	1.29	100.06	129.25	27	802.3	1911	0.21	0.028	0.02	8.63	0.02	0.001
36.26	1.98	1.28	100.90	128.65	27	798.9	1896	0.21	0.028	0.02	8.63	0.02	0.001
36.42	1.92	1.21	111.76	135.25	27	810.3	1958	0.21	0.027	0.02	8.63	0.01	0.001
36.58	1.85	1.14	129.56	148.31	29	833.4	2086	0.21	0.025	0.02	8.63	0.01	0.000
36.75	1.80	1.11	146.49	162.31	31	859.8	2240	0.21	0.023	0.01	8.63	0.01	0.000
36.91	1.80	1.11	153.10	169.84	33	880.0	2367	0.21	0.022	0.01	8.63	0.01	0.000
37.08	1.83	1.13	150.67	170.61	33	889.9	2437	0.21	0.021	0.01	8.63	0.01	0.000
37.24	1.87	1.16	141.51	164.59	33	883.2	2405	0.21	0.021	0.01	8.63	0.01	0.000
37.40	1.89	1.18	134.59	158.72	32	871.3	2339	0.21	0.022	0.01	8.63	0.01	0.000
37.57	1.87	1.16	130.82	152.25	30	849.6	2213	0.21	0.024	0.01	8.63	0.01	0.000
37.73	1.85	1.15	129.16	147.91	29	832.4	2116	0.21	0.025	0.02	8.63	0.01	0.000
37.90	1.83	1.13	127.09	143.62	28	815.8	2025	0.21	0.027	0.02	8.63	0.01	0.001
38.06	1.85	1.15	119.95	137.40	27	802.4	1956	0.21	0.028	0.02	8.63	0.02	0.001
38.22	1.88	1.17	110.04	128.46	26	781.2	1846	0.21	0.030	0.02	8.63	0.02	0.001
38.39	1.91	1.20	99.51	119.12	24	758.2	1731	0.21	0.033	0.03	8.63	0.02	0.001
38.55	1.94	1.23	91.28	111.83	23	739.0	1638	0.21	0.036	0.03	8.63	0.02	0.001
38.72	1.97	1.27	83.01	105.11	22	721.3	1555	0.21	0.039	0.04	8.63	0.03	0.001
38.88	2.01	1.31	76.65	100.23	21	707.7	1494	0.21	0.041	0.04	8.63	0.03	0.001
39.04	2.02	1.33	75.08	99.89	21	707.8	1500	0.21	0.041	0.04	8.63	0.03	0.001
39.21	2.01	1.32	79.41	104.48	22	723.1	1578	0.21	0.038	0.03	8.63	0.03	0.001
39.37	2.00	1.30	85.27	110.96	23	744.1	1688	0.21	0.035	0.03	8.63	0.02	0.001
39.54	1.99	1.28	90.27	115.81	24	758.7	1768	0.21	0.033	0.03	8.63	0.02	0.001

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

Depth (ft)	Ic	Kc	Qc1n	Qc1n,cs	N1,60 (blows)	Vs (ft/s)	Gmax (tsf)	CSR	Shear, γ (%)	Svol,15 (%)	Nc	ev (%)	Settle. (in)
39.70	1.97	1.26	95.42	120.26	25	770.9	1836	0.21	0.031	0.02	8.63	0.02	0.001
39.86	1.94	1.23	102.39	125.87	26	784.7	1914	0.21	0.030	0.02	8.63	0.02	0.001
40.03	1.92	1.20	109.78	132.28	27	800.4	2005	0.21	0.028	0.02	8.63	0.02	0.001
40.19	1.90	1.19	115.92	138.29	28	816.1	2099	0.21	0.027	0.02	8.63	0.01	0.001
40.36	1.89	1.18	121.32	143.00	29	826.9	2166	0.21	0.026	0.02	8.63	0.01	0.001
40.52	1.86	1.16	128.66	148.67	29	837.4	2231	0.21	0.025	0.02	8.63	0.01	0.000
40.68	1.82	1.12	135.77	152.42	30	838.1	2236	0.21	0.025	0.02	8.63	0.01	0.000
40.85	1.79	1.10	138.61	152.12	29	828.6	2180	0.21	0.026	0.02	8.63	0.01	0.001
41.01	1.79	1.10	133.51	146.58	28	813.5	2096	0.21	0.027	0.02	8.63	0.01	0.001
41.18	1.84	1.13	122.92	139.50	27	805.5	2058	0.21	0.028	0.02	8.63	0.01	0.001
41.34	1.95	1.24	105.81	130.84	27	801.1	2047	0.21	0.028	0.02	8.63	0.02	0.001
41.50	2.05	1.38	92.76	127.78	27	802.7	2071	0.21	0.028	0.02	8.63	0.01	0.001
41.67	2.15	1.54	83.96	129.61	29	809.2	2123	0.21	0.027	0.02	8.63	0.01	0.001
41.83	2.18	1.62	85.44	138.03	31	833.4	2277	0.21	0.025	0.01	8.63	0.01	0.000
42.00	2.16	1.58	93.60	147.47	33	862.6	2465	0.21	0.022	0.01	8.63	0.01	0.000
42.16	2.10	1.45	106.62	154.51	33	884.2	2605	0.21	0.021	0.01	8.63	0.01	0.000
42.32	2.01	1.31	119.01	155.54	32	881.5	2582	0.21	0.021	0.01	8.63	0.01	0.000
42.49	1.93	1.22	123.30	150.86	31	858.1	2429	0.21	0.023	0.01	8.63	0.01	0.000
42.65	1.93	1.22	115.10	140.58	29	828.0	2245	0.21	0.025	0.02	8.63	0.01	0.000
42.82	2.02	1.33	97.69	129.60	27	806.0	2125	0.21	0.027	0.02	8.63	0.01	0.001
42.98	2.14	1.53	79.96	122.44	27	786.7	2026	0.21	0.029	0.02	8.63	0.02	0.001
43.15	2.23	1.74	68.64	119.61	27	771.7	1952	0.21	0.031	0.02	8.63	0.02	0.001
43.31	2.28	1.89	62.89	118.70	28	762.8	1909	0.21	0.032	0.02	8.63	0.02	0.001
43.47	2.29	1.93	61.35	118.26	28	759.6	1896	0.21	0.032	0.02	8.63	0.02	0.001
43.64	2.28	1.90	64.33	122.12	29	773.2	1978	0.21	0.030	0.02	8.63	0.02	0.001
43.80	2.23	1.75	73.62	129.03	30	801.1	2143	0.21	0.027	0.02	8.63	0.01	0.001
43.97	2.16	1.58	88.59	140.08	31	840.5	2386	0.21	0.024	0.01	8.63	0.01	0.000
44.13	2.11	1.47	99.42	146.59	32	861.3	2521	0.21	0.022	0.01	8.63	0.01	0.000
44.29	2.09	1.43	103.06	147.29	32	863.1	2535	0.21	0.022	0.01	8.63	0.01	0.000
44.46	2.11	1.48	96.28	142.34	31	848.7	2449	0.21	0.023	0.01	8.63	0.01	0.000
44.62	2.17	1.59	87.33	138.58	31	835.9	2377	0.21	0.024	0.01	8.63	0.01	0.000
44.79	2.23	1.74	79.21	138.17	32	829.3	2346	0.21	0.025	0.01	8.63	0.01	0.000
44.95	2.28	1.90	71.63	136.18	32	816.3	2275	0.21	0.026	0.01	8.63	0.01	0.000

Total estimated settlement: 0.07

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

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
45.11	131.13	1.41	0.00	1.00	0.00	45.28	123.79	1.25	0.35	1.00	0.01
45.44	118.59	1.14	0.49	1.00	0.01	45.61	117.44	1.12	0.50	1.00	0.01
45.77	119.48	1.16	0.36	1.00	0.01	45.93	122.43	1.22	0.35	1.00	0.01
46.10	127.66	1.33	0.24	1.00	0.00	46.26	134.86	1.50	0.00	1.00	0.00
46.43	145.03	1.77	0.00	1.00	0.00	46.59	160.27	2.00	0.00	1.00	0.00
46.75	176.18	2.00	0.00	1.00	0.00	46.92	187.94	2.00	0.00	1.00	0.00
47.08	186.04	2.00	0.00	1.00	0.00	47.25	175.57	2.00	0.00	1.00	0.00
47.41	166.26	2.00	0.00	1.00	0.00	47.57	157.91	2.00	0.00	1.00	0.00
47.74	151.24	2.00	0.00	1.00	0.00	47.90	146.30	2.00	0.00	1.00	0.00

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

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
48.07	144.08	2.00	0.00	1.00	0.00	48.23	145.61	2.00	0.00	1.00	0.00
48.39	152.09	2.00	0.00	1.00	0.00	48.56	157.97	2.00	0.00	1.00	0.00
48.72	159.07	2.00	0.00	1.00	0.00	48.89	152.23	2.00	0.00	1.00	0.00
49.05	143.16	2.00	0.00	1.00	0.00	49.22	131.77	2.00	0.00	1.00	0.00
49.38	121.04	2.00	0.00	1.00	0.00	49.54	112.67	2.00	0.00	1.00	0.00

Total estimated settlement: 0.05

Abbreviations

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

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

Depth (ft)	q_t (tsf)	Q_{tn}	K_c	$Q_{tn,cs}$	I_c	$S_{u(liq)}/\sigma'_v$	$S_{u(peak)}/\sigma'_v$
0.33	8.17	13.09	6.54	85.69	2.98	N/A	N/A
0.49	10.00	16.03	5.55	88.87	2.88	N/A	N/A
0.66	13.60	21.80	3.97	86.58	2.70	N/A	N/A
0.82	19.54	31.31	2.65	83.00	2.48	N/A	N/A
0.98	23.40	37.51	2.18	81.77	2.37	N/A	N/A
1.15	23.54	37.71	2.26	85.06	2.39	N/A	N/A
1.31	20.00	32.02	2.59	82.81	2.46	N/A	N/A
1.48	17.30	27.67	2.77	76.53	2.50	N/A	N/A
1.64	15.77	25.19	2.74	68.96	2.49	N/A	N/A
1.80	13.70	21.86	2.99	65.39	2.54	N/A	N/A
1.97	11.74	18.69	3.56	66.49	2.64	N/A	N/A
2.13	11.01	17.50	3.83	66.94	2.68	N/A	N/A
2.30	10.61	16.84	3.99	67.20	2.70	N/A	N/A
2.46	10.37	16.45	4.38	72.12	2.75	N/A	N/A
2.62	10.07	15.96	5.08	81.03	2.83	N/A	N/A
2.79	10.41	16.48	5.38	88.72	2.87	N/A	N/A
2.95	10.91	17.27	5.54	95.73	2.88	N/A	N/A
3.12	11.98	18.98	5.37	101.97	2.87	N/A	N/A
3.28	13.62	21.59	5.12	110.58	2.84	N/A	N/A
3.45	14.85	23.56	4.92	115.84	2.82	N/A	N/A
3.61	15.19	24.08	4.80	115.62	2.80	N/A	N/A
3.77	14.69	23.27	4.86	112.96	2.81	N/A	N/A
3.94	14.12	22.34	4.94	110.28	2.82	N/A	N/A
4.10	12.89	20.34	5.31	107.93	2.86	N/A	N/A
4.27	11.52	18.13	5.82	105.48	2.91	N/A	N/A
4.43	10.46	16.41	6.06	99.38	2.94	N/A	N/A
4.59	10.36	16.25	5.91	96.01	2.92	N/A	N/A
4.76	10.84	16.99	5.43	92.25	2.87	N/A	N/A
4.92	11.61	18.21	5.24	95.41	2.85	N/A	N/A
5.09	12.71	19.97	5.41	108.06	2.87	N/A	N/A
5.25	14.51	22.85	5.46	124.71	2.87	N/A	N/A
5.41	18.38	29.05	4.85	140.75	2.81	N/A	N/A
5.58	21.61	34.23	4.54	155.45	2.77	N/A	N/A
5.74	24.91	39.52	4.22	166.65	2.73	N/A	N/A
5.91	26.51	42.07	4.14	174.17	2.72	N/A	N/A
6.07	28.01	44.46	3.84	170.90	2.68	N/A	N/A
6.23	27.34	43.37	3.75	162.61	2.67	N/A	N/A
6.40	25.61	40.57	3.82	154.81	2.67	N/A	N/A
6.56	24.74	39.16	4.03	157.79	2.70	N/A	N/A
6.73	28.54	45.25	3.72	168.36	2.66	N/A	N/A
6.89	35.45	56.33	3.02	170.00	2.55	N/A	N/A
7.05	40.98	65.21	2.44	158.90	2.43	N/A	N/A
7.22	49.98	79.65	1.73	138.01	2.23	N/A	N/A
7.38	49.52	78.89	1.55	122.62	2.15	N/A	N/A
7.55	47.55	75.71	1.56	117.95	2.15	N/A	N/A
7.71	36.31	57.64	2.10	120.80	2.34	N/A	N/A
7.87	31.72	50.24	2.67	134.27	2.48	N/A	N/A
8.04	29.85	47.23	3.12	147.20	2.56	N/A	N/A

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

Depth (ft)	q_t (tsf)	Q_{tn}	K_c	$Q_{tn,cs}$	I_c	$S_{u(liq)}/\sigma'_v$	$S_{u(peak)}/\sigma'_v$
8.20	36.45	57.82	3.11	179.68	2.56	N/A	N/A
8.37	55.83	88.93	2.41	214.23	2.42	N/A	N/A
8.53	86.36	137.97	1.92	265.16	2.29	N/A	N/A
8.69	110.91	177.39	1.73	306.24	2.22	N/A	N/A
8.86	128.07	202.72	1.64	332.60	2.19	N/A	N/A
9.02	125.64	196.89	1.69	331.81	2.21	N/A	N/A
9.19	111.71	175.07	1.85	324.56	2.27	N/A	N/A
9.35	88.91	141.98	2.70	383.35	2.49	N/A	N/A
9.51	97.01	154.97	3.13	485.28	2.57	N/A	N/A
9.68	182.41	277.03	2.01	557.84	2.32	N/A	N/A
9.84	235.30	347.33	1.82	631.80	2.26	N/A	N/A
10.01	273.45	393.97	1.70	670.17	2.21	N/A	N/A
10.17	267.05	383.36	1.82	699.06	2.26	N/A	N/A
10.34	278.68	391.28	1.72	672.52	2.22	N/A	N/A
10.50	273.65	376.92	1.64	620.02	2.19	N/A	N/A
10.66	233.50	318.35	1.68	534.16	2.20	N/A	N/A
10.83	202.10	272.37	1.70	464.28	2.22	N/A	N/A
10.99	171.71	229.68	1.78	409.04	2.24	N/A	N/A
11.16	151.96	200.96	1.81	364.61	2.26	N/A	N/A
11.32	137.50	179.83	1.84	330.44	2.26	N/A	N/A
11.48	128.59	166.12	1.83	304.79	2.26	N/A	N/A
11.65	124.00	158.45	1.86	295.47	2.27	N/A	N/A
11.81	125.89	158.05	1.74	275.78	2.23	N/A	N/A
11.98	130.43	161.86	1.74	282.24	2.23	N/A	N/A
12.14	137.72	169.45	1.78	301.48	2.24	N/A	N/A
12.30	152.15	185.76	1.84	341.32	2.26	N/A	N/A
12.47	171.31	206.47	1.79	370.52	2.25	N/A	N/A
12.63	191.98	228.41	1.74	396.30	2.23	N/A	N/A
12.80	208.99	246.05	1.74	427.73	2.23	N/A	N/A
12.96	229.92	267.34	1.68	448.85	2.20	N/A	N/A
13.12	272.09	312.72	1.63	509.58	2.18	N/A	N/A
13.29	314.96	358.51	1.64	586.31	2.19	N/A	N/A
13.45	353.53	398.47	1.62	646.24	2.18	N/A	N/A
13.62	344.82	385.01	1.64	630.84	2.19	N/A	N/A
13.78	304.94	337.85	1.69	571.45	2.21	N/A	N/A
13.94	239.11	263.65	1.87	493.52	2.28	N/A	N/A
14.11	194.60	213.32	2.09	446.26	2.34	N/A	N/A
14.27	187.47	203.44	2.08	423.51	2.34	N/A	N/A
14.44	194.13	208.50	2.06	430.24	2.33	N/A	N/A
14.60	191.04	203.42	2.11	430.19	2.35	N/A	N/A
14.76	165.96	175.51	2.34	411.07	2.41	N/A	N/A
14.93	146.36	153.47	2.54	390.50	2.45	N/A	N/A
15.09	134.35	139.65	2.69	375.15	2.48	N/A	N/A
15.26	133.62	137.47	2.70	370.70	2.49	N/A	N/A
15.42	144.85	147.51	2.54	374.69	2.45	N/A	N/A
15.58	182.48	183.61	2.06	378.16	2.33	N/A	N/A
15.75	224.75	223.45	1.67	374.22	2.20	N/A	N/A
15.91	246.45	242.50	1.45	351.28	2.10	N/A	N/A

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

Depth (ft)	q_t (tsf)	Q_{tn}	K_c	$Q_{tn,cs}$	I_c	$S_{u(liq)}/\sigma'_v$	$S_{u(peak)}/\sigma'_v$
16.08	226.30	220.61	1.37	301.15	2.05	N/A	N/A
16.24	200.48	193.72	1.27	245.42	1.97	N/A	N/A
16.40	183.15	175.52	1.16	204.47	1.87	N/A	N/A
16.57	173.77	165.30	1.09	179.59	1.77	N/A	N/A
16.73	157.14	148.57	1.07	159.15	1.75	N/A	N/A
16.90	138.06	129.70	1.10	142.31	1.79	N/A	N/A
17.06	125.56	117.24	1.13	132.49	1.83	N/A	N/A
17.23	119.41	110.81	1.14	126.64	1.85	N/A	N/A
17.39	119.80	110.58	1.14	126.36	1.85	N/A	N/A
17.55	125.55	115.34	1.13	130.84	1.84	N/A	N/A
17.72	133.78	122.33	1.12	136.75	1.82	N/A	N/A
17.88	141.07	128.45	1.10	141.39	1.79	N/A	N/A
18.05	147.67	133.88	1.08	144.85	1.77	N/A	N/A
18.21	150.59	135.89	1.08	146.75	1.76	N/A	N/A
18.37	155.21	139.43	1.08	150.33	1.76	N/A	N/A
18.54	159.54	142.65	1.07	153.00	1.75	N/A	N/A
18.70	165.14	147.07	1.06	156.44	1.74	N/A	N/A
18.87	166.57	147.68	1.06	156.03	1.73	N/A	N/A
19.03	164.40	145.11	1.05	152.85	1.72	N/A	N/A
19.19	158.90	139.54	1.06	147.72	1.73	N/A	N/A
19.36	149.83	130.69	1.08	141.08	1.76	N/A	N/A
19.52	140.09	121.29	1.11	134.70	1.81	N/A	N/A
19.69	139.25	119.82	1.13	134.95	1.83	N/A	N/A
19.85	151.55	130.07	1.11	144.27	1.80	N/A	N/A
20.01	172.76	148.18	1.08	159.35	1.76	N/A	N/A
20.18	192.83	165.20	1.05	172.83	1.71	N/A	N/A
20.34	208.96	178.68	1.03	183.74	1.69	N/A	N/A
20.51	223.03	190.10	1.02	193.82	1.67	N/A	N/A
20.67	237.04	201.38	1.01	204.32	1.67	N/A	N/A
20.83	254.18	215.23	1.01	217.45	1.66	N/A	N/A
21.00	276.52	232.29	1.04	242.33	1.71	N/A	N/A
21.16	304.33	253.07	1.09	276.56	1.78	N/A	N/A
21.33	321.17	262.99	1.19	313.23	1.90	N/A	N/A
21.49	304.10	244.11	1.39	339.59	2.06	N/A	N/A
21.65	281.85	222.51	1.62	359.38	2.18	N/A	N/A
21.82	247.15	192.00	1.87	358.23	2.27	N/A	N/A
21.98	222.08	170.42	2.05	348.90	2.33	N/A	N/A
22.15	196.07	147.95	2.40	355.07	2.42	N/A	N/A
22.31	205.05	153.59	2.45	376.99	2.43	N/A	N/A
22.47	238.10	178.55	2.21	394.74	2.37	N/A	N/A
22.64	269.90	202.69	1.98	402.28	2.31	N/A	N/A
22.80	271.52	203.02	1.94	394.48	2.30	N/A	N/A
22.97	245.57	181.72	2.05	371.73	2.33	N/A	N/A
23.13	204.00	148.42	2.36	349.59	2.41	N/A	N/A
23.30	169.50	120.93	2.79	337.27	2.50	N/A	N/A
23.46	156.35	110.28	2.97	327.79	2.54	N/A	N/A
23.62	183.76	131.33	2.32	304.30	2.40	N/A	N/A
23.79	201.51	145.86	1.84	268.42	2.26	N/A	N/A

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

Depth (ft)	q_t (tsf)	Q_{tn}	K_c	$Q_{tn,cs}$	I_c	$S_{u(liq)}/\sigma'_v$	$S_{u(peak)}/\sigma'_v$
23.95	204.60	149.65	1.55	232.36	2.15	N/A	N/A
24.12	172.51	125.47	1.54	192.98	2.14	N/A	N/A
24.28	154.68	112.25	1.49	166.90	2.12	N/A	N/A
24.44	151.29	110.14	1.39	152.98	2.06	N/A	N/A
24.61	157.48	115.34	1.29	148.57	1.99	N/A	N/A
24.77	165.17	121.47	1.23	149.04	1.94	N/A	N/A
24.94	172.99	127.38	1.19	151.99	1.90	N/A	N/A
25.10	181.22	133.57	1.17	155.84	1.88	N/A	N/A
25.26	187.15	137.87	1.15	158.55	1.86	N/A	N/A
25.43	190.71	140.09	1.14	160.39	1.85	N/A	N/A
25.59	195.11	143.01	1.14	162.71	1.84	N/A	N/A
25.76	203.10	149.18	1.11	165.80	1.81	N/A	N/A
25.92	213.40	157.31	1.08	170.26	1.77	N/A	N/A
26.08	223.57	165.25	1.06	175.00	1.73	N/A	N/A
26.25	228.79	168.50	1.06	178.55	1.73	N/A	N/A
26.41	233.31	171.20	1.06	181.71	1.73	N/A	N/A
26.58	236.39	172.81	1.06	183.62	1.74	N/A	N/A
26.74	243.06	177.24	1.06	187.89	1.73	N/A	N/A
26.90	249.06	180.96	1.06	192.13	1.74	N/A	N/A
27.07	255.30	184.54	1.07	197.12	1.74	N/A	N/A
27.23	261.70	188.42	1.07	201.80	1.75	N/A	N/A
27.40	272.17	195.54	1.07	208.61	1.74	N/A	N/A
27.56	288.61	207.52	1.05	218.64	1.72	N/A	N/A
27.72	305.38	219.89	1.04	228.36	1.70	N/A	N/A
27.89	316.49	227.71	1.03	234.57	1.69	N/A	N/A
28.05	324.16	232.90	1.02	238.62	1.68	N/A	N/A
28.22	330.86	236.64	1.03	243.51	1.69	N/A	N/A
28.38	328.13	232.93	1.04	243.06	1.71	N/A	N/A
28.54	319.39	224.31	1.07	239.50	1.74	N/A	N/A
28.71	323.82	226.51	1.07	242.34	1.75	N/A	N/A
28.87	350.93	245.80	1.06	259.71	1.73	N/A	N/A
29.04	383.48	268.81	1.04	280.83	1.71	N/A	N/A
29.20	393.05	273.99	1.05	288.43	1.72	N/A	N/A
29.36	378.41	261.70	1.07	279.22	1.74	N/A	N/A
29.53	353.64	242.97	1.08	261.38	1.76	N/A	N/A
29.69	330.92	225.69	1.09	245.50	1.77	N/A	N/A
29.86	313.92	212.22	1.10	234.27	1.80	N/A	N/A
30.02	298.98	200.27	1.12	224.80	1.82	N/A	N/A
30.19	288.11	192.37	1.12	215.64	1.82	N/A	N/A
30.35	268.60	178.21	1.13	201.36	1.83	N/A	N/A
30.51	265.60	176.35	1.12	196.95	1.81	N/A	N/A
30.68	270.27	179.45	1.11	198.59	1.80	N/A	N/A
30.84	293.91	196.74	1.08	211.52	1.76	N/A	N/A
31.01	297.94	198.44	1.08	214.45	1.76	N/A	N/A
31.17	304.23	201.65	1.09	219.09	1.77	N/A	N/A
31.33	300.06	197.08	1.10	217.58	1.80	N/A	N/A
31.50	298.46	194.90	1.11	216.63	1.81	N/A	N/A
31.66	286.58	185.37	1.13	209.56	1.83	N/A	N/A

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

Depth (ft)	q_t (tsf)	Q_{tn}	K_c	$Q_{tn,cs}$	I_c	$S_{u(liq)}/\sigma'_v$	$S_{u(peak)}/\sigma'_v$
31.83	281.31	180.87	1.14	205.97	1.84	N/A	N/A
31.99	275.51	176.17	1.15	201.90	1.85	N/A	N/A
32.15	269.14	171.07	1.15	197.58	1.86	N/A	N/A
32.32	261.74	165.08	1.17	193.04	1.88	N/A	N/A
32.48	266.81	167.79	1.17	196.18	1.88	N/A	N/A
32.65	278.95	175.44	1.16	203.34	1.87	N/A	N/A
32.81	291.45	183.77	1.14	209.93	1.85	N/A	N/A
32.97	292.95	184.96	1.13	208.91	1.83	N/A	N/A
33.14	284.92	179.60	1.12	201.95	1.82	N/A	N/A
33.30	274.98	172.50	1.13	194.80	1.83	N/A	N/A
33.47	263.65	163.94	1.15	187.72	1.85	N/A	N/A
33.63	251.28	154.61	1.17	180.53	1.88	N/A	N/A
33.79	239.51	146.07	1.19	173.21	1.90	N/A	N/A
33.96	230.14	139.04	1.21	167.73	1.92	N/A	N/A
34.12	222.77	134.48	1.20	161.04	1.91	N/A	N/A
34.29	216.40	130.56	1.19	155.08	1.90	N/A	N/A
34.45	216.60	131.53	1.16	152.33	1.87	N/A	N/A
34.61	215.55	130.36	1.16	151.46	1.87	N/A	N/A
34.78	216.34	130.34	1.16	151.77	1.87	N/A	N/A
34.94	221.99	133.88	1.15	154.48	1.86	N/A	N/A
35.11	236.63	144.13	1.12	161.44	1.82	N/A	N/A
35.27	244.03	149.34	1.10	164.59	1.79	N/A	N/A
35.43	235.03	142.48	1.12	159.35	1.82	N/A	N/A
35.60	216.86	128.69	1.17	150.22	1.88	N/A	N/A
35.76	200.19	116.44	1.22	142.12	1.93	N/A	N/A
35.93	186.58	106.81	1.27	135.20	1.97	N/A	N/A
36.09	176.51	100.06	1.29	129.25	1.99	N/A	N/A
36.26	177.81	100.90	1.28	128.65	1.98	N/A	N/A
36.42	193.85	111.76	1.21	135.25	1.92	N/A	N/A
36.58	220.12	129.56	1.14	148.31	1.85	N/A	N/A
36.75	245.69	146.49	1.11	162.31	1.80	N/A	N/A
36.91	257.46	153.10	1.11	169.84	1.80	N/A	N/A
37.08	256.46	150.67	1.13	170.61	1.83	N/A	N/A
37.24	244.43	141.51	1.16	164.59	1.87	N/A	N/A
37.40	234.52	134.59	1.18	158.72	1.89	N/A	N/A
37.57	227.42	130.82	1.16	152.25	1.87	N/A	N/A
37.73	223.59	129.16	1.15	147.91	1.85	N/A	N/A
37.90	219.32	127.09	1.13	143.62	1.83	N/A	N/A
38.06	208.91	119.95	1.15	137.40	1.85	N/A	N/A
38.22	193.91	110.04	1.17	128.46	1.88	N/A	N/A
38.39	177.86	99.51	1.20	119.12	1.91	N/A	N/A
38.55	165.23	91.28	1.23	111.83	1.94	N/A	N/A
38.72	152.66	83.01	1.27	105.11	1.97	N/A	N/A
38.88	143.02	76.65	1.31	100.23	2.01	N/A	N/A
39.04	141.25	75.08	1.33	99.89	2.02	N/A	N/A
39.21	149.15	79.41	1.32	104.48	2.01	N/A	N/A
39.37	159.82	85.27	1.30	110.96	2.00	N/A	N/A
39.54	168.72	90.27	1.28	115.81	1.99	N/A	N/A

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

Depth (ft)	q_t (tsf)	Q_{tn}	K_c	$Q_{tn,cs}$	I_c	$S_{u(liq)}/\sigma'_v$	$S_{u(peak)}/\sigma'_v$
39.70	177.56	95.42	1.26	120.26	1.97	N/A	N/A
39.86	189.09	102.39	1.23	125.87	1.94	N/A	N/A
40.03	201.49	109.78	1.20	132.28	1.92	N/A	N/A
40.19	212.26	115.92	1.19	138.29	1.90	N/A	N/A
40.36	221.47	121.32	1.18	143.00	1.89	N/A	N/A
40.52	233.17	128.66	1.16	148.67	1.86	N/A	N/A
40.68	243.07	135.77	1.12	152.42	1.82	N/A	N/A
40.85	245.81	138.61	1.10	152.12	1.79	N/A	N/A
41.01	237.44	133.51	1.10	146.58	1.79	N/A	N/A
41.18	223.10	122.92	1.13	139.50	1.84	N/A	N/A
41.34	200.30	105.81	1.24	130.84	1.95	N/A	N/A
41.50	183.02	92.76	1.38	127.78	2.05	N/A	N/A
41.67	171.75	83.96	1.54	129.61	2.15	N/A	N/A
41.83	177.22	85.44	1.62	138.03	2.18	N/A	N/A
42.00	193.26	93.60	1.58	147.47	2.16	N/A	N/A
42.16	215.46	106.62	1.45	154.51	2.10	N/A	N/A
42.32	233.13	119.01	1.31	155.54	2.01	N/A	N/A
42.49	236.06	123.30	1.22	150.86	1.93	N/A	N/A
42.65	220.93	115.10	1.22	140.58	1.93	N/A	N/A
42.82	194.35	97.69	1.33	129.60	2.02	N/A	N/A
42.98	167.02	79.96	1.53	122.44	2.14	N/A	N/A
43.15	148.91	68.64	1.74	119.61	2.23	N/A	N/A
43.31	139.58	62.89	1.89	118.70	2.28	N/A	N/A
43.47	137.25	61.35	1.93	118.26	2.29	N/A	N/A
43.64	143.72	64.33	1.90	122.12	2.28	N/A	N/A
43.80	161.52	73.62	1.75	129.03	2.23	N/A	N/A
43.97	189.39	88.59	1.58	140.08	2.16	N/A	N/A
44.13	208.65	99.42	1.47	146.59	2.11	N/A	N/A
44.29	214.72	103.06	1.43	147.29	2.09	N/A	N/A
44.46	203.38	96.28	1.48	142.34	2.11	N/A	N/A
44.62	188.91	87.33	1.59	138.58	2.17	N/A	N/A
44.79	176.31	79.21	1.74	138.17	2.23	N/A	N/A
44.95	163.48	71.63	1.90	136.18	2.28	N/A	N/A
45.11	149.74	64.33	2.04	131.13	2.33	0.77	0.77
45.28	139.21	59.30	2.09	123.79	2.34	0.76	0.76
45.44	137.74	59.10	2.01	118.59	2.32	0.76	0.76
45.61	143.61	62.54	1.88	117.44	2.28	0.76	0.76
45.77	147.87	64.57	1.85	119.48	2.27	0.77	0.77
45.93	146.64	63.24	1.94	122.43	2.30	0.76	0.76
46.10	147.07	62.56	2.04	127.66	2.33	0.76	0.76
46.26	154.34	65.48	2.06	134.86	2.33	0.77	0.77
46.43	175.55	75.83	1.91	145.03	2.29	0.79	0.79
46.59	214.65	96.15	1.67	160.27	2.20	0.82	0.82
46.75	261.06	122.02	1.44	176.18	2.09	0.86	0.86
46.92	293.27	140.76	1.34	187.94	2.03	0.88	0.88
47.08	293.54	141.52	1.31	186.04	2.01	0.88	0.88
47.25	265.03	124.21	1.41	175.57	2.08	0.86	0.86
47.41	238.85	109.03	1.52	166.26	2.14	0.84	0.84

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

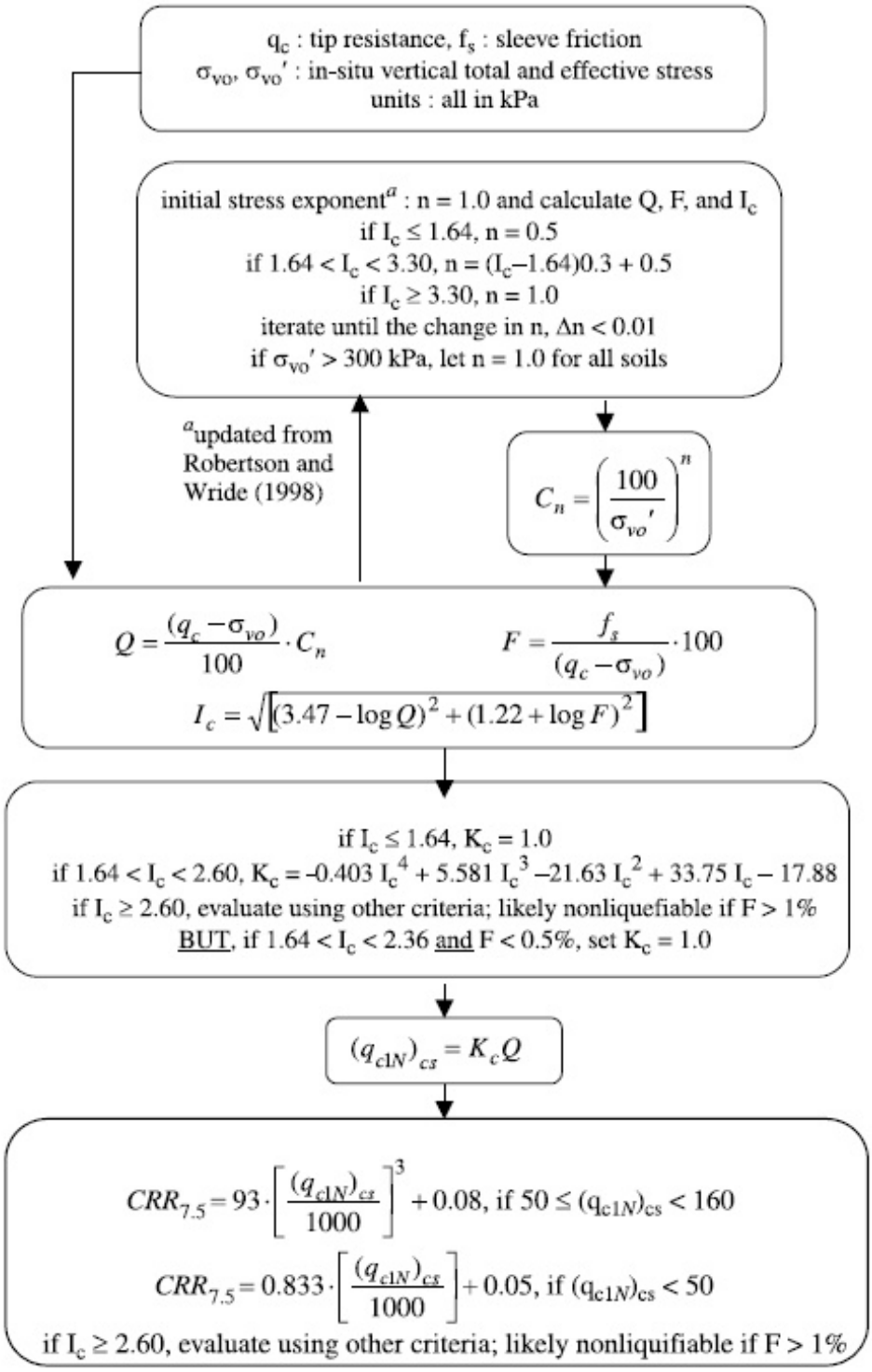
Depth (ft)	q_t (tsf)	Q_{tn}	K_c	$Q_{tn,cs}$	I_c	$S_{u(liq)}/\sigma'_v$	$S_{u(peak)}/\sigma'_v$
47.57	211.04	93.26	1.69	157.91	2.21	0.82	0.82
47.74	187.54	80.41	1.88	151.24	2.28	0.80	0.80
47.90	158.96	65.06	2.25	146.30	2.38	0.77	0.77
48.07	136.76	53.52	2.69	144.08	2.48	0.74	0.74
48.23	115.67	42.76	3.40	145.61	2.61	2.67	2.67
48.39	97.15	33.45	4.55	152.09	2.77	2.22	2.22
48.56	92.48	30.91	5.11	157.97	2.84	2.11	2.11
48.72	97.39	32.97	4.82	159.07	2.80	2.22	2.22
48.89	100.17	34.56	4.40	152.23	2.75	2.28	2.28
49.05	90.22	30.53	4.69	143.16	2.79	2.04	2.04
49.22	76.45	24.98	5.27	131.77	2.86	1.72	1.72
49.38	64.80	20.38	5.94	121.04	2.92	1.44	1.44
49.54	57.55	17.77	6.34	112.67	2.96	1.27	1.27

Abbreviations

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

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

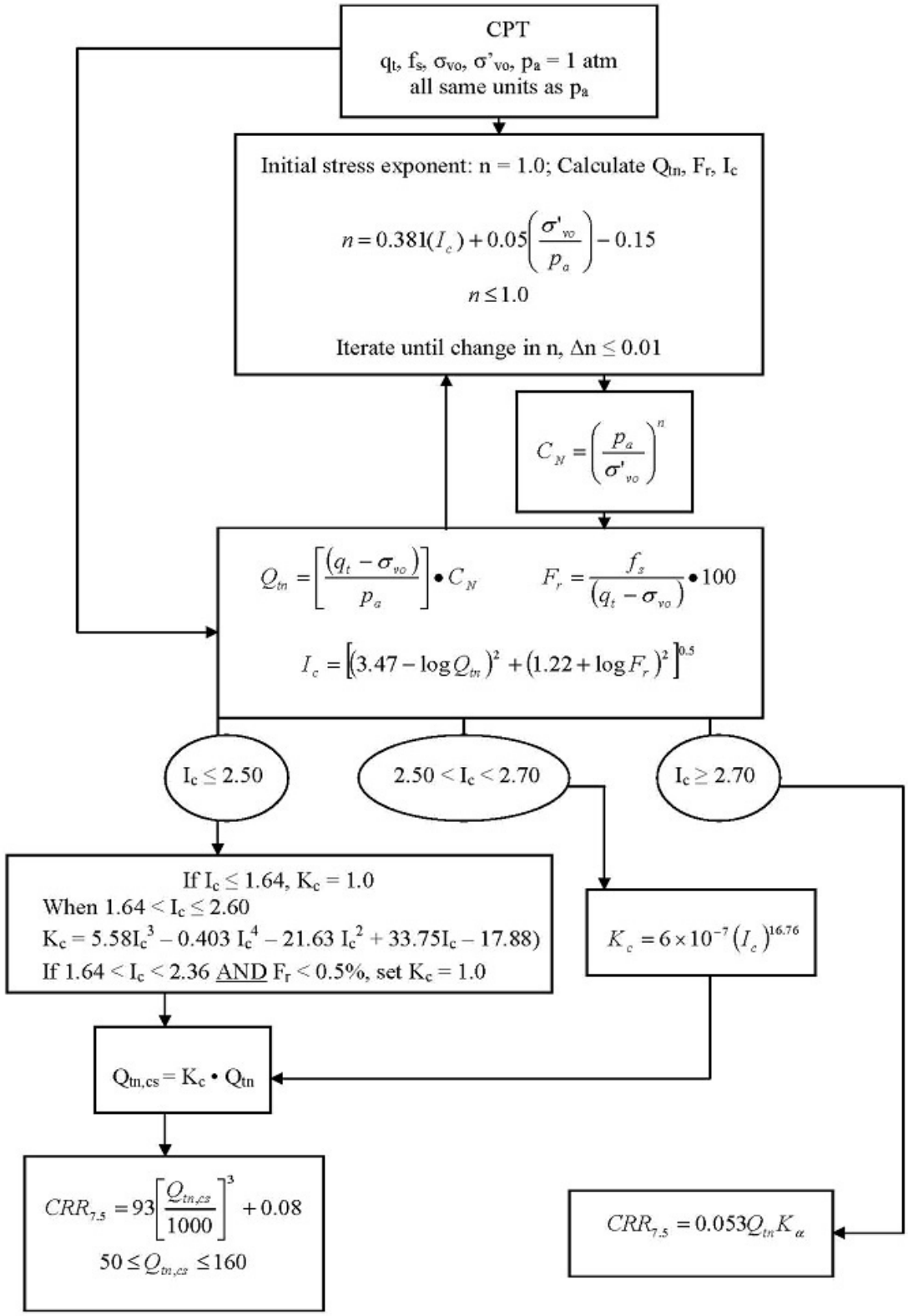
Calculation of soil resistance against liquefaction is performed according to the Robertson & Wride (1998) procedure. The procedure used in the software, slightly differs from the one originally published in NCEER-97-0022 (Proceedings of the NCEER Workshop on Evaluation of Liquefaction Resistance of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



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

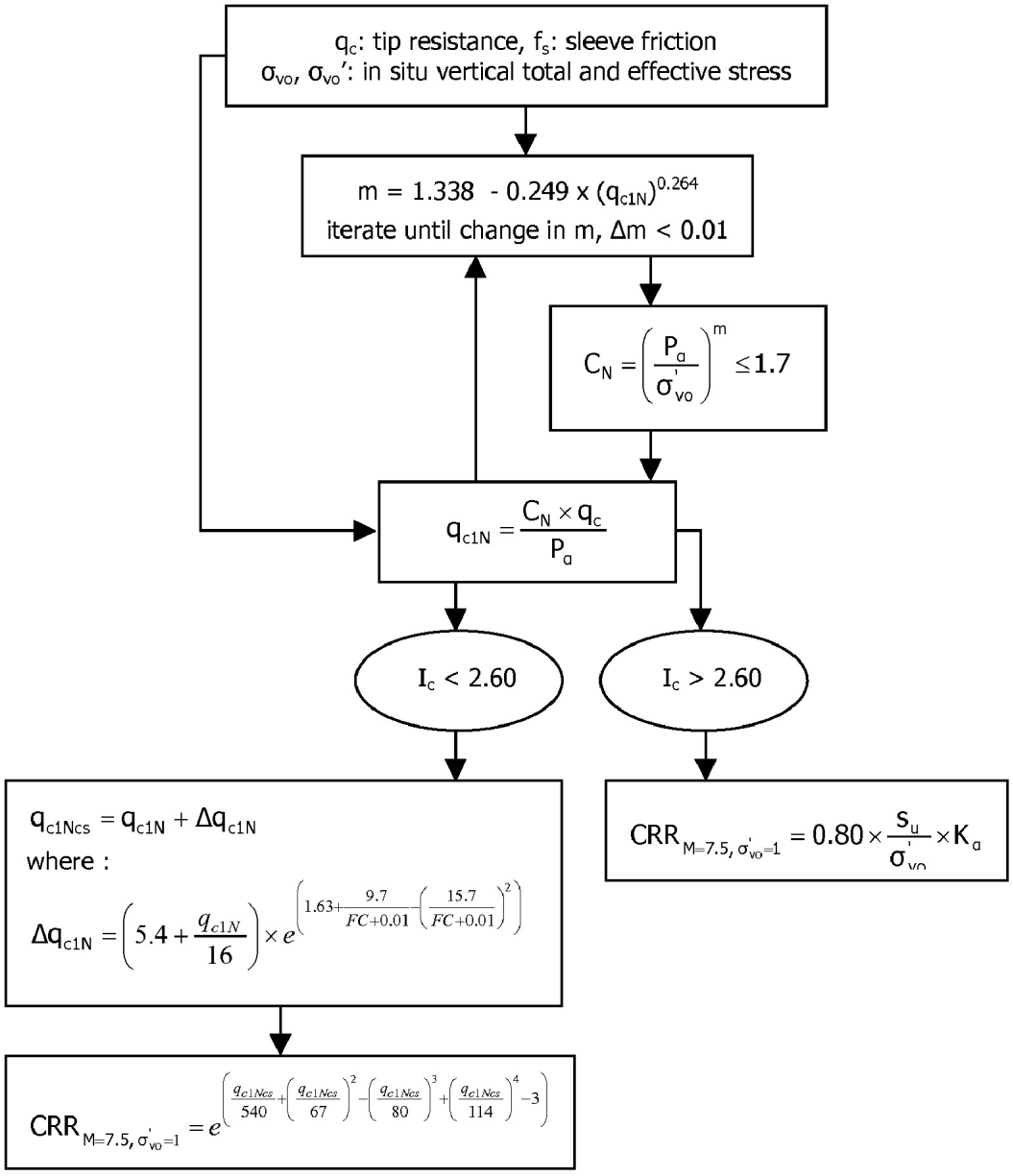
Procedure for the evaluation of soil liquefaction resistance (all soils), Robertson (2010)

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

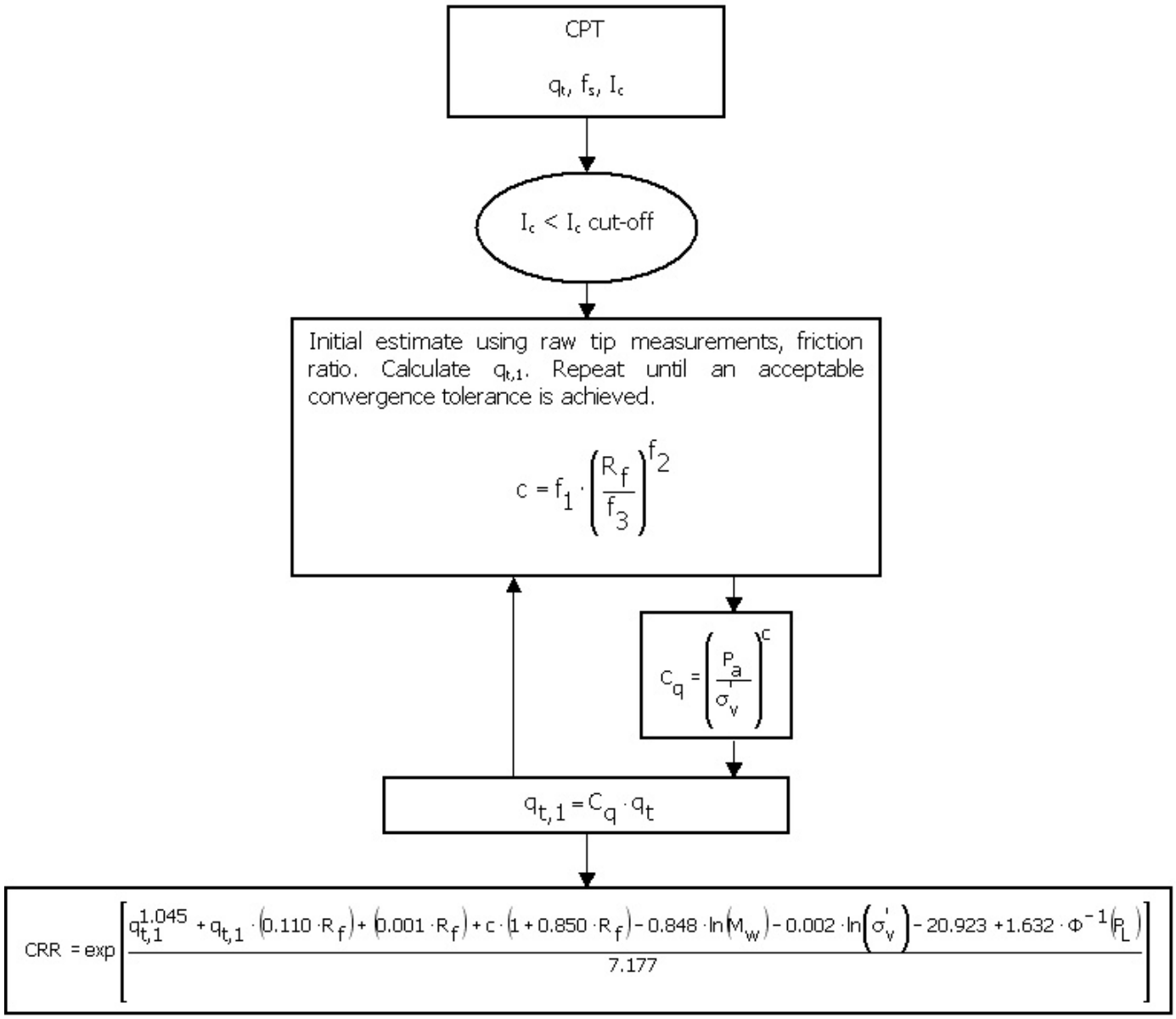


[1] P.K. Robertson, 2009. "Performance based earthquake design using the CPT", Keynote Lecture, International Conference on Performance-based Design in Earthquake Geotechnical Engineering – from case history to practice, IS-Tokyo, June 2009

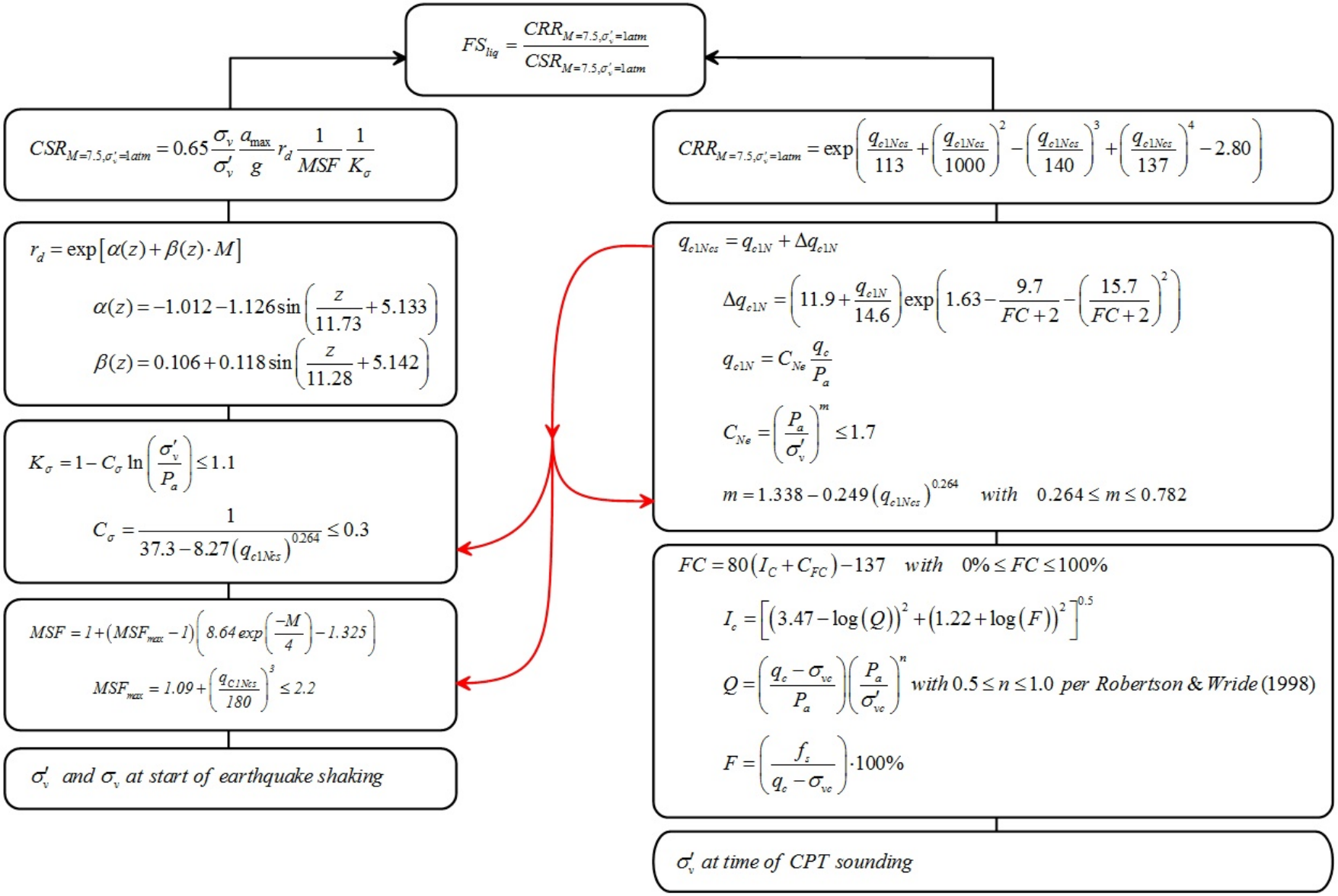
Procedure for the evaluation of soil liquefaction resistance, Idriss & Boulanger (2008)



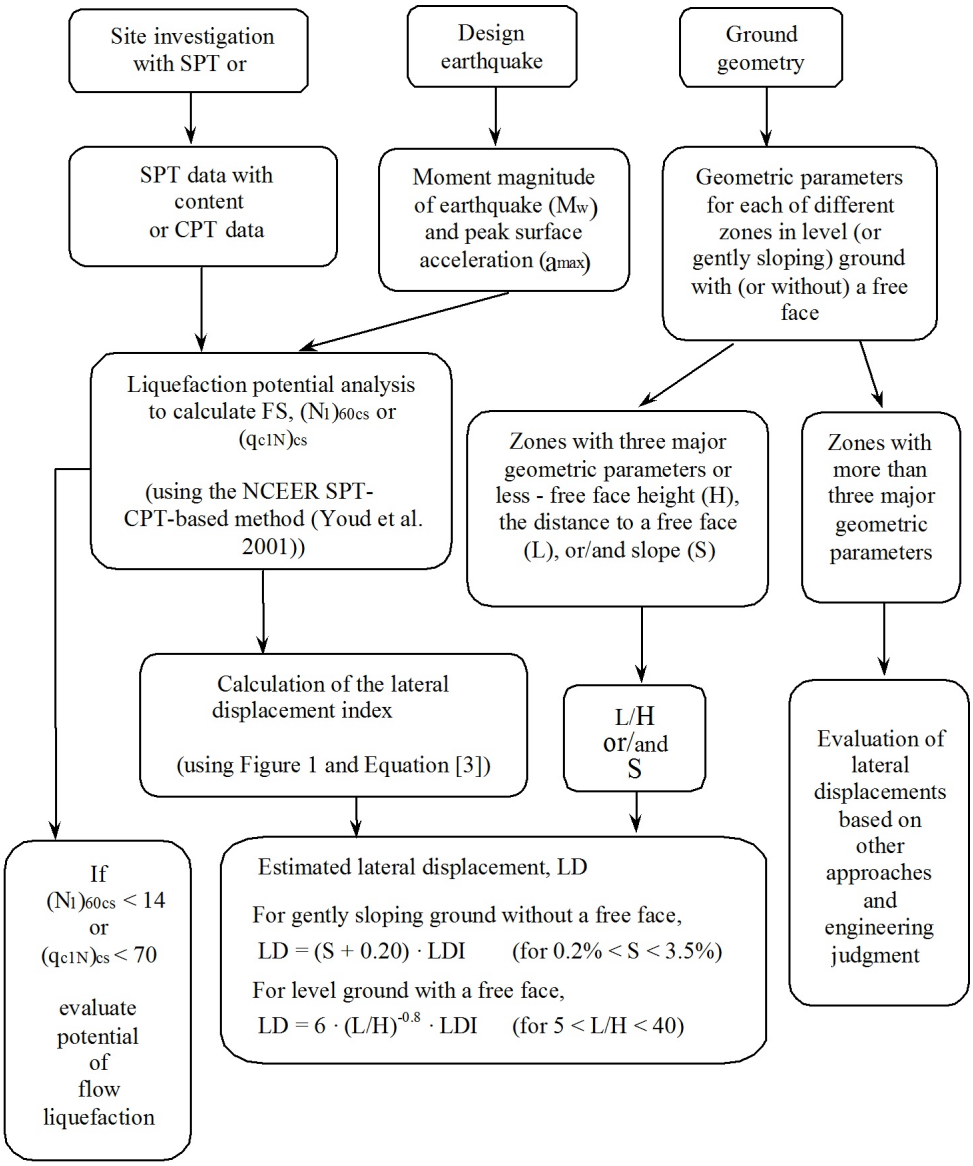
Procedure for the evaluation of soil liquefaction resistance (sandy soils), Moss et al. (2006)



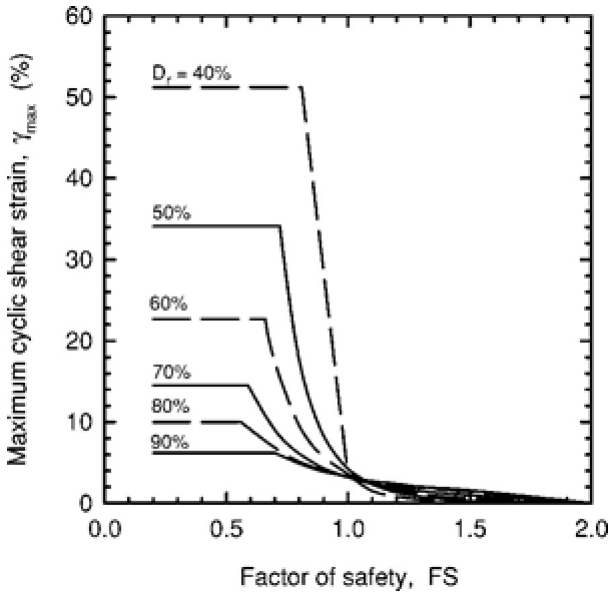
Procedure for the evaluation of soil liquefaction resistance, Boulanger & Idriss(2014)



Procedure for the evaluation of liquefaction-induced lateral spreading displacements



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



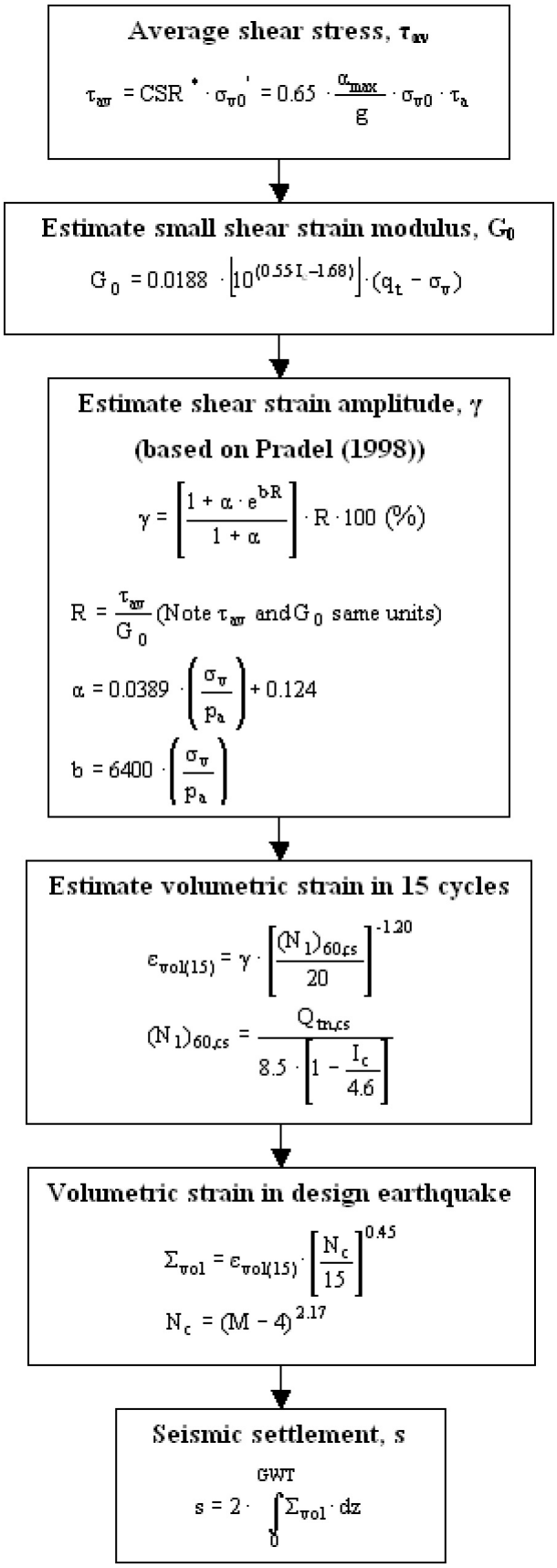
[1] **Figure 1**

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

[1] **Equation [3]**

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

Procedure for the estimation of seismic induced settlements in dry sands



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

Liquefaction Potential Index (LPI) calculation procedure

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

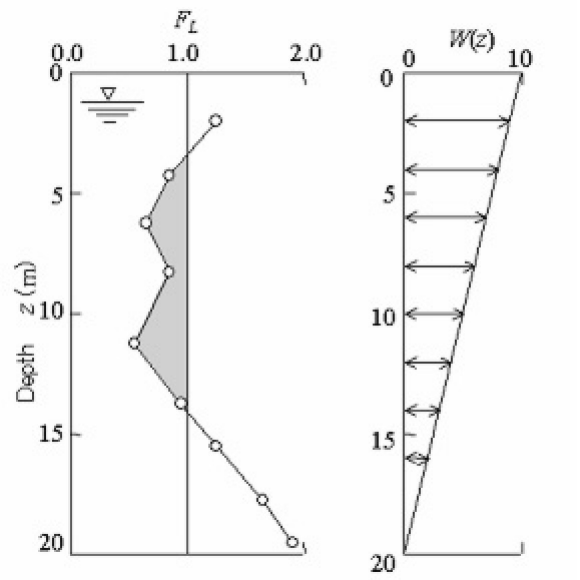
To estimate the severity of liquefaction extent at a given site, LPI is calculated based on the following equation:

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

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

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

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



Graphical presentation of the LPI calculation procedure

References

- Lunne, T., Robertson, P.K., and Powell, J.J.M 1997. Cone penetration testing in geotechnical practice, E & FN Spon Routledge, 352 p, ISBN 0-7514-0393-8.
- Boulanger, R.W. and Idriss, I. M., 2007. Evaluation of Cyclic Softening in Silts and Clays. ASCE Journal of Geotechnical and Geoenvironmental Engineering June, Vol. 133, No. 6 pp 641-652
- Boulanger, R.W. and Idriss, I. M., 2014. CPT AND SPT BASED LIQUEFACTION TRIGGERING PROCEDURES. DEPARTMENT OF CIVIL & ENVIRONMENTAL ENGINEERING COLLEGE OF ENGINEERING UNIVERSITY OF CALIFORNIA AT DAVIS
- Robertson, P.K. and Cabal, K.L., 2007, Guide to Cone Penetration Testing for Geotechnical Engineering. Available at no cost at http://www.geologismiki.gr/
- Robertson, P.K. 1990. Soil classification using the cone penetration test. Canadian Geotechnical Journal, 27 (1), 151-8.
- Robertson, P.K. and Wride, C.E., 1998. Cyclic Liquefaction and its Evaluation based on the CPT Canadian Geotechnical Journal, 1998, Vol. 35, August.
- Youd, T.L., Idriss, I.M., Andrus, R.D., Arango, I., Castro, G., Christian, J.T., Dobry, R., Finn, W.D.L., Harder, L.F., Hynes, M.E., Ishihara, K., Koester, J., Liao, S., Marcuson III, W.F., Martin, G.R., Mitchell, J.K., Moriwaki, Y., Power, M.S., Robertson, P.K., Seed, R., and Stokoe, K.H., Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER/NSF Workshop on Evaluation of Liquefaction Resistance of Soils, ASCE, Journal of Geotechnical & Geoenvironmental Engineering, Vol. 127, October, pp 817-833
- Zhang, G., Robertson. P.K., Brachman, R., 2002, Estimating Liquefaction Induced Ground Settlements from the CPT, Canadian Geotechnical Journal, 39: pp 1168-1180
- Zhang, G., Robertson. P.K., Brachman, R., 2004, Estimating Liquefaction Induced Lateral Displacements using the SPT and CPT, ASCE, Journal of Geotechnical & Geoenvironmental Engineering, Vol. 130, No. 8, 861-871
- Pradel, D., 1998, Procedure to Evaluate Earthquake-Induced Settlements in Dry Sandy Soils, ASCE, Journal of Geotechnical & Geoenvironmental Engineering, Vol. 124, No. 4, 364-368
- Iwasaki, T., 1986, Soil liquefaction studies in Japan: state-of-the-art, Soil Dynamics and Earthquake Engineering, Vol. 5, No. 1, 2-70
- Papathanassiou G., 2008, LPI-based approach for calibrating the severity of liquefaction-induced failures and for assessing the probability of liquefaction surface evidence, Eng. Geol. 96:94–104
- P.K. Robertson, 2009, Interpretation of Cone Penetration Tests - a unified approach., Canadian Geotechnical Journal, Vol. 46, No. 11, pp 1337-1355
- P.K. Robertson, 2009. "Performance based earthquake design using the CPT", Keynote Lecture, International Conference on Performance-based Design in Earthquake Geotechnical Engineering - from case history to practice, IS-Tokyo, June 2009
- Robertson, P.K. and Lisheng, S., 2010, "Estimation of seismic compression in dry soils using the CPT" FIFTH INTERNATIONAL CONFERENCE ON RECENT ADVANCES IN GEOTECHNICAL EARTHQUAKE ENGINEERING AND SOIL DYNAMICS, *Symposium in honor of professor I. M. Idriss,* SAN diego, CA
- R. E. S. Moss, R. B. Seed, R. E. Kayen, J. P. Stewart, A. Der Kiureghian, K. O. Cetin, CPT-Based Probabilistic and Deterministic Assessment of In Situ Seismic Soil Liquefaction Potential, Journal of Geotechnical and Geoenvironmental Engineering, Vol. 132, No. 8, August 1, 2006
- I. M. Idriss and R. W. Boulanger, 2008. Soil liquefaction during earthquakes, Earthquake Engineering Research Institute MNO-12

APPENDIX E

REFERENCES

REFERENCES

1. American Concrete Institute (ACI), 318-14, Building Code Requirements for Structural Concrete, 2014.
2. American Society of Civil Engineers, 2010, Minimum Design Loads for Buildings and Other Structures: ASCE/SEI 7-10, 650p.
3. Anderson, F.M., 1943, Synopsis of Later Mesozoic in California: California Division of Mines and Geology, Bulletin No.118, p. 183-186.
4. Blake, T.F., 2000 (updated 2018), *EQSEARCH, A Computer Program for the Estimation of Peak Horizontal Acceleration from California Historical Earthquake Catalogs*, Ver. 3.00
5. Blake, T.F., 2004, *EQFAULT, A Computer Program for the Deterministic Estimation of Peak Acceleration using Three-Dimensional California Faults as Earthquake Sources, Ver. 3.00*
6. Boore, D.M., Joyner, W.B., and Fumal, T.E., 1997, Equations for Estimating Horizontal Response Spectra and Peak Acceleration from Western North American Earethquakes: A Summary of recent Work, Seismological Research Letters, Vol. 68, No. 1, 128-153.
7. Budding, K. E., D. P. Schwartz, and D. H. Oppenheimer, 1991, Slip rate, earthquake recurrence, and seismogenic potential of the Rodgers Creek fault zone, northern California: Initial results, Geophys. Res. Lett.
8. Burley, Nathan Robert, 2007. Reducing Flood Storage Space at Reservoirs: A Benefit Cost Analysis for the Mokelumne River System: University of California, Davis, unpublished thesis, 11 p.
9. California Building Standards Commission, 2016, *California Code of Regulations*, Title 24, "California Building Code," California amendments to the 2012 edition of the International Building Code.
10. California Department of Transportation, *California Highway Design Manual, 6th Edition*, July 1, 2015.
11. California Department of Transportation, California Test Method 643 (CT 643)
12. California Department of Water Resources, 2019, http://www.water.ca.gov/waterdatalibrary
13. California Energy Commission, *Geologic Hazards and Resources.*
14. California Energy Geological Survey (CGS). 2008. *Guidelines for Evaluating and Mitigating Seismic Hazards in California: Special Publication 117A*.
15. California Geological Survey (CGS), 1992 (revised 2004), *Recommended Criteria for Delineating Seismic Hazard Zones in California: CGS Special Publication 118*, 12p.
16. California Geological Survey (2002), *Note 36: California Geomorphic Provinces.*

REFERENCES (cont'd)

17. California Geological Survey, 2008, *Guidelines for Geologic Investigations of Naturally Occurring Asbestos in California*: CGS Special Publication 124.
18. California Geological Survey, 2008, *Guidelines for Evaluating and Mitigating Seismic Hazards in California*: CGS Special Publication 117, 102p.
19. California Geological Survey, 2013, Note 48 *Checklist for the Review of Engineering Geology and Seismology Reports for California Public Schools, Hospitals, and Essential Services Buildings,* October 2013.
20. California State Resources Control Board, *GeoTracker Groundwater Ambient Measurement and Assessment (GAMA) http://geotracker.waterboards.ca.gov/gama/, 2019*
21. California Water Science Center, *Areas of Land Subsidence in California Map, https://ca.water.usgs.gov/land_subsidence/california-subsidence-areas.html*, accessed March 16, 2019.
22. Dawson, Timothy E., 2009. California Geologic Survey. Preliminary Geologic Map of the Lodi Quadrangle. 1:1000,000.
23. East Bay Municipal Utility District: Water Right Permit 10478 Time Extension Project, https://www.ebmud.com/water/about-your-water/water-supply/water-right-permit-10478-time-extension-project/, accessed April 4, 2019.
24. East Bay Municipal Utility District: EBMUD will increase its releases from Camanche Reservoir to the Mokelumne River. June 30, 2011. https://www.ebmud.com/about-us/news/press-releases/ebmud-will-increase-its-releases-camanche-reservoir-mokelumne-river/, accessed April 4, 2019.
25. Federal Emergency Management Agency (FEMA), October 16, 2009, *Flood Insurance Rate Map (FIRM)*, Panel 170, Map Number 06077C0170, San Joaquin County and Incorporated Areas, California.
26. Hart, E. W., 1992, Recently active traces of the Rodgers Creek fault, Sonoma County, California, Calif. Div. Mines Geol. Open-File Rept. 92-07, 14 pp., map scale 1:24,000
27. Hart, E.W. and Bryant W.A., 2007, *Fault-Rupture Hazard Zones in California, Alquist-Priolo Earthquake Fault Zoning Act with Index to Earthquake Fault Zones Maps*, California Geological Survey Special Publication 42, 38p.
28. Jennings, C.W., and Bryant, C.S., 2010, *Fault Activity Map of California*, DMG, 1:750,000, California Geological Survey Map No. 6.
29. Lodi Gas Project – Project Area Map. Retrieved March 16, 2019. (http://www.cpuc.ca.gov/environment/info/lodi/map.htm)

REFERENCES (cont'd)

30. Lienkaemper, Joseph J., et. al. 2013. The Greenville Fault: Preliminary Estimates of its Long-Term Creep Rate and Seismic Potential. Bulletin of the Seismological Society of America 103 (5): 2729-2738. (https://doi.org/10.1785/0120120169)
31. Martin, G.R., et. al, 1999, *Recommended Procedures for Implementation of DMG Special Publication 117 Guidelines for Analyzing and Mitigating Liquefaction Hazards in California*, Southern California Earthquake Center.
32. Miller, D.C., 2011, Map of Potential Hazards from Future Volcanic Eruptions in California: USGS, Bulletin 1847, 17p.
33. Mitchell, J. K., 1993, *Fundamentals of Soil Behavior*, 2nd Edition, John Wiley and Sons, Inc.
34. Petersen, M. D. and eight others, 1996, *Probabilistic seismic hazard assessment for the State of California: CDMG Open File Report 96-08.*
35. Pradel, D., 1998, Procedure to Evaluate Earthquake-Induced Settlements in Dry Sandy Soils: Journal of Geotechnical and Geoenvironmental Engineering v. 124, pp. 364-368.
36. Randolph, C.E, Caskey, J, 2001, *Neotectonic Investigation of the southern Rodgers Creek fault, Sonoma County, California,* American Geophysical Union, Fall Meeting 2001.
37. Robertson, P. K. and Shao, Lisheng, "Estimation of Seismic Compression in Dry Soils Using the CPT" (2010). International Conferences on Recent Advances in Geotechnical Earthquake Engineering and Soil Dynamics. 18. http://scholarsmine.mst.edu/icrageesd/05icrageesd/session04/18
38. Schwartz, D. P., D. Pantosti, S. Hecker, K. Okumura, K. E. Budding, and T. Powers 1992, Late Holocene behavior and seismogenic potential of the Rodgers Creek fault zone, Sonoma County, California, in Proc. of the Second Conference on Earthquake Hazards in the Eastern San Francisco Bay Area, G. Borchardt, S. E. Hirschfeld, J. J. Lienkaemper, P. McClellan, and I. G. Wong (Editors), Calif. Div. Mines Geology Spec. Publ. 113, 393–398
39. San Joaquin County, March 2019, *Flood and Dam Failure - Hazard Index*.
40. San Joaquin County District Viewer. Historic Flood Areas (non-FIRM). http://sjmap.org/website/DistrictViewer/Viewer.asp, 2019.
41. Toppozada, T.R., and Branum, D., Petersen, M., Hallstrom, C., Cramer, C., and Reichle, M., 2000, *Epicenters of and areas damaged by M≥5.5 California earthquakes*, 1800-1999: CGS Map Sheet 49.
42. United States Environmental Protection Agency, 1988, Indoor Radon Abatement Act of 1998

REFERENCES (cont'd)

43. Structural Engineers Association of California in association with the California Office of Statewide Health Planning and Development (SEAOC/OSHPD) Seismic Design Maps. Accessed March 28, 2019. (https://seismicmaps.org/)
44. United States Geological Survey, Earthquake Outlook for the San Francisco Bay Region. 2014-2043. Revised August 2016. (https://pubs.usgs.gov/fs/2016/3020/fs20163020.pdf)
45. United States Geological Survey, Earthquake Hazard Program, 2008 National Seismic Hazard Map – Fault Parameters, http://geohazards.usgs.gov/cfusion/hazfaults_2008_search/query_main.cfm
46. United States Geological Survey (USGS), 1968, 7.5-minute series, *Topographic Map Lodi Quadrangle, California*, 1:24,000.
47. Van Gosen, B.S., and Clinkenbeard, J.P., 2011, *Reported historic asbestos mines, historic asbestos prospects, and other natural occurrences of asbestos in California: USGS Open-File Report 2011–1188*, 22 p., 1 pl.
48. Wakabayashi, J., and Smith, D.L., 1994, Evaluation of recurrence intervals, characteristic earthquakes, and slip rates associated with thrusting along the Coast RangeCentral Valley geomorphic boundary, California: Bulletin of the Seismological Society of America, v. 84, n. 6, p. 1960- 1970.
49. Woodward-Clyde Consultants, 1978, Stanislaus nuclear project site suitability: Site safety report (unsubmitted) for Pacific Gas and Electric Company; Foothills fault study, v. 4, Appendices C.1 and C.2; v. 6, Appendices C.4 and C.4A.
50. Working Group on Northern California Earthquake Potential, 1996, revised 2012, Database of potential sources for earthquakes larger than magnitude 6 in northern California: U.S. Geological Survey Open-File Report 96–705, v. 1.1, 53 p. and GIS data. (Available at https://pubs.usgs.gov/of/1996/0705/.)