APPENDIX F

GEOTECHNICAL REPORT AND PALEONTOLOGICAL RESOURCES SURVEY

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UPDATE GEOTECHNICAL INVESTIGATION REPORT AND RESPONSE TO THIRD PARTY REVIEW PROPOSED GANAHL LUMBER FACILITY DEVELOPEMENT SAN JUAN CAPISTRANO, CALIFORNIA

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NOVEMBER 15, 2018

November 15, 2018

Mr. Patrick Ganahl
Ganahl Lumber Company
1200 East Ball Road
Anaheim, CA 92805

Subject: Update Geotechnical Investigation Report and Response to Third Party Review
Proposed Ganahl Lumber Facility Development, San Juan Capistrano, California
Willdan Geotechnical Project No. 108164-2000

Dear Mr. Ganahl,

Willdan Engineering, Geotechnical Group (Willdan Geotechnical) is pleased to present this report presenting our review of all available reports and plans, and reanalysis of available data from geotechnical viewpoint relevant to the proposed development and provide responses to review comments generated by the Third Party Reviewer of the City of San Juan Capistrano, as well as our conclusions and recommendations for the design and construction of the proposed developments.

In preparation of this report we have reviewed all the readily available subsurface data, borings and cone penetration test (CPT) soundings relevant to the proposed project site, laboratory test results and analyses presented in the following referenced reports:

1. "Preliminary Geotechnical Investigation, Proposed Commercial Development and Ganahl Lumber Facility, Stonehill Drive and San Juan Creek Trail, San Juan Capistrano, California", Prepared by G.A. Nicoll and Associates, Dated October 5, 2017 (Original), February 16, 2018 (Revision 1), and March 21, 2018 (Revision 2), Project 7082-04.

2. "Third Party Review of G. A. Nicoll and Associates, Inc., Preliminary Geotechnical Investigation, Proposed Commercial Development and Ganahl Lumber Facility, Stonehill Drive and San Juan Creek Trail, San Juan Capistrano, California", Prepared by LGC Geotechnical, Inc., Dated June 22, 2018, Project No. 11126-01, City of SJC Project No. DA17-003.

3. "Conceptual Grading Plans, Ganahl Lumber, Stonehill Drive along the East Side of the San Juan Creek Channel, City of San Juan Capistrano, Sheet C-7 through C-20", Prepared by Joseph C. Truxaw and Associates, Inc., Dated 6-1-18.

4. "Geotechnical Report, San Juan Creek (L01) Channel Levee Protection, Phases 4 & 5 (Station 51+00 to 112+00), San Juan Capistrano, California", Prepared by AMEC Earth & Environmental, Inc., Dated June 24, 2010, Job No. 9-212-100147.

5. "Design Level Analysis for Sheet Pile Wall, San Juan Creek (L01) – Phases 4 &5, East Levee Station 51+00 to Station 112+00, Orange County, CA", Prepared by TETRA TECH, Dated March 25, 2016.

Based on the results of our review of the aforementioned documents and engineering evaluation and analyses, the proposed developments are feasible from a geotechnical standpoint, provided the recommendations in this report are followed.

We appreciate the opportunity to assist you and look forward to future projects. If you have any questions, please contact us.

Respectfully submitted,
WILLDAN ENGINEERING
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1. SITE DESCRIPTION

The subject property is a rectangular shape, approximately 16-acre parcel, bounded by Stonehill Drive on the south, BNSF Railroad on the east, existing mobile home park on the north, and the San Juan Creek on the west. The San Juan Creek drainage extends in the southwesterly direction from the Santa Ana Mountains in the easterly portion of Orange County. The general area, historically has been a flood plain along the flow of the San Juan Creek. The site is presently fenced and used for the storage of dealer inventory of automobiles. The project site location is shown on Figure 1 in Appendix A.

2. PROPOSED DEVELOPMENT

It is our understanding that the proposed development will consist of a total of four commercial/industrial building pads and relatively flat, paved and unpaved driveways, surface storage, and parking areas. The most recent conceptual plans show an elevated pad adjacent to Stonehill Drive using additional fill and a retaining wall. Structural loads were not available at the time of preparation of this report.

3. GEOLOGY

The subject site lies within the southerly portion of the Central Block of Los Angeles Basin. The Los Angeles Basin is a northwest trending alluvial lowland plain about 50 miles long and 20 miles wide. Mountains and hills that generally expose late Mesozoic to late Pleistocene age sedimentary and igneous rocks bound the Basin along the north, northeast, east and southeast. The Basin is part of the Peninsular Ranges Geomorphic Province of California, which is characterized by regional compression due to the bend in the San Andreas Fault and sub-parallel blocks sliced longitudinally by young, steeply dipping northwest trending fault zones. The Basin is a site of Active sedimentation, and strata are interpreted to be much as 31,000 feet thick in the center of the trough.

The site locally is situated in an area of generally underlain by estuarine deposits of the San Juan Creek flood plain. Subsequently, some of these areas have been modified by addition of the artificial fill materials described in the attached boring logs and subsurface geological maps. This fill predominantly includes fine-grained materials such as silt and clay. Artificial fill materials also appear within the levee system of the San Juan Creek drainage at the west side of the subject project site. This fill has been identified as silty sand, poorly graded sand by AMEC (2009). This lies on the young alluvial floor along the San Juan Creek drainage which has been eroded through the bedrock and was filled by stream alluvial.

In the hillside areas, particularly to the east of the site, coastal hills and ridges composed of sedimentary bedrock of the Miocene age siltstone facies of Capistrano Formation are exposed. None of these materials were encountered within the limits of the subjects site. Based on the published geologic maps (Morton, Russel and Miller, 1973) numerous landslides and landslide complexes have been mapped within Capistrano Formation bedrock in the immediate vicinity east of the site

4. SUBSURFACE CONDITIONS

According to the references, the subsurface conditions of the site were explored and documented by:

- Five (5) deep hollow-stem auger (HSA) borings (B-1 through B-5) drilled to depths between 51.5 and 61.5 feet below ground surface (bgs), six (6) relatively shallow HSA borings (P-1 through P-6) drilled to depths between 6.5 and 16.5 feet bgs, and three (3) shallow HSA borings (SSGB-1 through SSGB-3) drilled to depth of 16.6 feet bgs, These borings logs are presented in Reference 1 above.
- Eleven (11) CPT soundings advanced to depths between 25 and 60 feet bgs. These CPT soundings are presented in Reference 1 above.
- Three (3) deep HSA borings (B-1 through B-3) drilled to depth of 81.5 feet, and three (3) CPT soundings (CPT-1, CPT-2, and CPT-7) advanced to depths between 43.64 and 71.85 feet bgs, on top of the berm, along San Juan Creek. These boring logs and CPT soundings are presented in References 4 and 5, above.

The borings and CPT soundings locations are shown on Figure 2 in Appendix A. Also, the boring logs and CPT data are excerpted from the references and are provided in Appendix B.

Review of the available site-specific borings and CPT data indicates that the site is covered by a layer of man-made, undocumented fill to depths between 15 and 20 feet bgs, as visually defined during drilling hollow-stem auger borings and as interpreted from review of the CPT data. The fill is classified as brown to gray sandy silt to clayey silt and silty sand with traces of fine to coarse gravel. The fill was found in soft to stiff and medium dense at dry to moist conditions.

The underlying alluvial deposits, under the fill as encountered in the borings and CPT soundings consist of fine to coarse silty sand and gravel. The alluvial soils also included dark gray to dark brown sandy silt and sandy clay. Standard Penetration Test (SPT) N-values for alluvial layer varied from 10 to greater than 100 blows per foot indicating that alluvial deposits are interbedded lenses and layers of soft to hard fine material and very loose to very dense granular material. Occasional

hard drilling was experienced, and unsuccessful sample recoveries were encountered at different depths within alluvial deposits due to presence of gravels and cobbles.

Bedrock exposures near the subject site are marine sedimentary rocks of Miocene and Pliocene age, specifically, the Niguel Formation described as a fine sandstone and silty sandstone, and Capistrano Formation described as a siltstone, mudstone and soft diatomaceous and silty shale. None of these materials were encountered within limits of the subject site. The cross sections depicting the project site subsurface conditions have been prepared and are provided in Appendix A of this report.

5. GROUNDWATER

Groundwater was encountered in all borings at depths ranging from 18 to 22 feet bgs at the locations explored during the drilling. Historical groundwater within the subject project site has not been identified by California Geological Survey (CGS). Generally, groundwater depth can be affected by seasonal fluctuations of rainfall and environmental changes such as irrigation or pumping and in this case the water presence and flow in the adjacent Creek. Groundwater is expected to be a significant issue for site development.

6. SEISMIC CONSIDERATIONS

6.1. REGIONAL SEISMICITY

The project site is located in the general proximity of several active and potentially active faults. The southern California region is known to be seismically active and much geologic and seismologic evidence is readily available. It is our opinion that the faults of most concern to this project site are active faults. Active faults are those which have ruptured during the past 11,000 years. The available literature indicates that no active fault crosses the subject site and the site is not located within an Alquist-Priolo Special Studies (AP) Zone.

6.2. LOCAL FAULTING

The closest identified active fault is the Newport-Inglewood-Rose Canyon Fault (Dana Point section) is the most important for the seismic evaluation of the subject site. This fault lies to the south and southwest of the site at approximately 3.7 miles, capable to produce strong ground motion. A significant contribution to potential ground motion is also indicated for the San Joaquin Hills Fault located approximately 5.6 miles northwest of the project site.

6.3. GROUND SHAKING AND SEISMIC DESIGN PARAMETERS

A site location of Longitude 117.6777° W and Latitude 33.4758° N and Site Class D was used for developing seismic ground motion parameters. The site class per Section 1613.3.2 of the CBC 2016 is based upon the site soil conditions. Utilizing the United States Geologic Survey (USGS) Unified Hazard Tool, for a 2475-year return period (2% probability of exceedance in 50 years), deaggregation of the earthquake magnitude and distance from USGS model indicate that this peak acceleration is associated with a mean magnitude of 6.7 at a mean hypocentral distance of 11.74 km. This mean magnitude and hypocentral distance is associated with the Newport-Inglewood fault.

For the purposes of this report, an acceleration of 0.550g may be used for the design maximum considered earthquake geometric mean (MCE_G) peak ground acceleration adjusted for site class effects (PGA_M). This acceleration is based on the requirements addressed in Section 1803.5.12 of CBC 2016.

For design of the structures based on the seismic provisions of the CBC 2016, we recommend the parameters in the following Table 1:

Table 1. Seismic Design Parameters

Seismic Item	Value	IBC Reference
Site Class	D	Section 1613.3.2
F_a	1.0	Table 1613.3.3(1)
S_s	1.390	Figure 1613.3.1(1)
S_{MS}	1.390	Section 1613.3.3
S_{DS}	0.927	Section 1613.3.4
F_v	1.5	Table 1613.3.3(2)
S_1	0.521	Figure 1613.3.1(2)
S_{M1}	0.781	Section 1613.3.3
S_{D1}	0.521	Section 1613.3.4

Site Coordinates: Latitude: 33.4758° N Longitude: 117.6777° W

6.4. SOIL LIQUEFACTION

Liquefaction is the full or partial loss of shear strength in soils during shaking caused by earthquake. Potential adverse consequences of liquefaction include loss of bearing capacity leading to structural damage or collapse and ground settlement.

The project site is in a State of California designated Liquefaction Hazard Zones, Dana Point Quadrangle (CDMG 2001). The liquefaction potential is greatest where the groundwater level is shallow, and where saturated, loose, fine sands occur within a depth of about 50 feet or less. Liquefaction potential decreases as clay and gravel content increase.

We analyzed liquefaction potential of the site using CPT data and the computer program CLiq 1.7 (GeoLogismiki, 2014). We performed our liquefaction evaluation for each CPT, that provides a continuous subsurface profile at the point of exploration, assuming groundwater at a depth of 20 feet below the ground surface. The results of the liquefaction analyses are provided in Appendix C. Liquefaction analyses was not performed for borings, since boring logs are prepared based on the samples taken at 5 feet intervals and augur cuttings between points of sampling which does not provide as accurate profile of subsurface conditions as CPT data, and may result in misleading and non-accurate results.

The results of our analyses indicate that sand and sandy silt layers within the alluvial deposits are likely to liquefy during earthquake. These sand layers will experience a loss of shear strength associated with liquefaction that will likely generate ground deformation and settlement. The result of our analysis indicates that the seismic settlements of the existing conditions at the site, due to liquefaction and dry settlement of material above the water level, will be up to 2.0 inches. This estimated settlement will be reduced to 1.75 inches upon completion of recommended removal and re-compaction of the top 12 feet of the existing fill.

6.5. LANDSLIDE

Seismic hazard zone map for Dana Point 7.5-Minute Quadrangle (CGS, 2001a) does not indicate that the site is susceptible to landslide. Also, the project site area is generally flat and there is not a potential for landslides. As such, it is our opinion that landslide is not a potential hazard at the project site.

6.6. LATERAL SPREADING

Liquefaction may lead to lateral spreading. Lateral spreading happens when surficial soil moves in a direction parallel to the ground surface due to liquefaction of underlying subsurface soils layers. Lateral spreads generally move down gentle slopes, usually less than 6%, (Naeim 1989) or slip toward a free face such as an incised river channel. Lateral spreading of the San Juan Capistrano Creek Levee was analyzed with the constructed sheet piles (AMEC 2010). It should be noted that lateral spreading at the subject property is not a concern due to proposed final level

ground surface and recently constructed sheet pile system along the San Juan Creek, penetrating below the lowest liquefiable layer identified within the site for protection of the creek levee.

7. CONCLUSIONS AND RECOMMENDATIONS

7.1. GENERAL

Based on our review of all available data (References) and engineering analysis, it is our opinion that the proposed project is suitable for construction provided the recommendations in this report are incorporated into grading and design. The geologic and geotechnical hazards described in the previous sections that will affect geotechnical design includes seismic ground shaking, potential for liquefaction and associated settlement, and presence of undocumented fill within the upper 15 to 20 feet bgs.

The grading of the site should consider remedial measures for removing and re-compaction of the undocumented fill to the recommended depths and foundation design to accommodate potential static and seismic settlement. The following sections present more details of our conclusions and recommendations.

7.2. EARTHWORKS

Prior to any grading activities, organics and debris shall be removed and hauled off-site. The undocumented fill within the entire proposed development limit should be over-excavated to a minimum depth of 12 feet below proposed grade or saturated zone, whichever occurs first. The bottom of excavated area should be underlain by a layer of filter fabric (Mirafi 140) overlain by minimum two (2) feet of crushed rock, reinforced with a geogrid layer (Tensar Triax TX160). The recommended filter fabric will prevent contamination of crushed aggregate base from underlying fine soils and the geogrid will provide additional reinforcement by spreading the vertical stresses laterally and minimizing propagation/manifestation of the vertical settlements to the surface. The combined positive effect of the above measure will provide a relatively stiff layer over potentially saturated alluvium and act as a competent surface to receive the proposed engineered fill layer.

The excavated zone then shall be backfilled with engineered fill. Unless stated otherwise, all fill materials should be placed in loose lifts of 8 inches or less, moisture-conditioned within optimum and 3% above optimum moisture content and compacted to at least 90% relative compaction of the maximum density as determined by the ASTM D1557. Compaction should be verified by observation, probing and testing by a geotechnical consultant's representative.

7.3. FILL MATERIAL

The on-site soils with an EI less than 35 and free of organic materials, debris and cobbles larger than 3 inches may be used for backfilling purposes. Also, imported granular soils may be used in

the required compacted fills within the subject project site. Imported materials should contain sufficient fines (binder material) so as to be relatively impermeable and result in a stable subgrade when compacted. The imported materials should also be non-expansive, with an EI less than 35 and free of organic materials, debris and cobbles larger than 3 inches, with no more than 25 percent of materials being larger than 2 inches in size and no more than 25 percent passing #200 Sieve. Within the upper 2 feet of fills the materials should be free of particles greater than 2 inches in size. A bulk sample of potential import material, weighing at least 30 pounds, should be submitted to the Geotechnical Consultant at least 48 hours before fill operations. All proposed import materials should be approved by the Geotechnical Consultant prior to being placed at the site.

7.4. UTILITY TRENCH BEDDING AND BACKFILL

Bedding materials consisting of sand, gravel, or crushed aggregate should be used to backfill around utility pipes to approximately one foot above the top of the pipe. Onsite soils which have a Sand Equivalent (SE) of 30 or greater can also be used as bedding material. Prior to placing the pipes, the pipe trench subgrade should be observed by a representative of the project geotechnical engineer. If the exposed subgrade is loose or unstable, the unsuitable subgrade soil must be excavated and replaced with bedding material. Bedding must be placed uniformly on each side of the pipe and mechanically compacted. Flooding or jetting to densify the bedding materials is not allowed due to the clayey nature of onsite soils. The fill should be placed in loose lifts not to exceed 8 inches, moisture-conditioned within optimum and 3 percent above optimum moisture content, and mechanically compacted to at least 90 percent relative compaction in accordance with ASTM D1557. Thinner lifts may be necessary to achieve the recommended level of compaction of the backfill due to equipment limitations.

Trenches in pavement areas should be capped with at least 12 inches of compacted, on-site soil similar to that of the adjoining subgrade. The upper 12 inches of trench backfill in areas to be paved should be compacted to at least 95 percent relative compaction. Special care should be taken in the control of utility trench backfilling in the pavement areas. Poor compaction may cause excessive settlement resulting in damage to the pavement structural section.

7.5. TEMPORARY EXCAVATIONS

Temporary excavations must be properly sloped or shored. Based on the earth materials encountered in our borings, excavation of 3.5 feet or less in depth may be performed with vertical sidewalls. Deeper excavation up to a depth of 10 feet can be accomplished in accordance with the Occupational Safety and Health Administration (OSHA) requirements for Type C soils and may be laid back at 1H:1.5V gradient, or 1H:1V, upon review and approval by the project geotechnical engineer.

The contractor is responsible for maintaining the stability of the cuts and personnel safety in the field during construction. All excavations shall be performed in accordance with applicable

requirements established by the State, County, or local government. The regulatory requirement may supersede the recommendations presented in this section. The Geotechnical Engineer of Record's representative should be present during all excavations.

7.6. SHORING DESIGN

Typical cantilever shoring up to 20 feet should be designed based on an active fluid pressure of 35 pounds per cubic foot (pcf), assuming level ground above the shoring. If excavations are braced at specific design intervals, the active pressure may then be approximated by a trapezoidal soil pressure distribution with the pressure per foot of width equal to 25H pounds per square foot (psf) applied within the middle 0.6H of the excavation, where H is the depth of the excavation in feet. Surcharge loads within a 1H:1V plane extending up from the base of the excavation should be included in the design lateral pressures by taking 35 percent of the surcharge pressure applied as a uniform load along the shoring system.

For a soldier beam shoring system, the soldier piles should be spaced at a maximum of 8 feet on-center. For design purposes, the lagging should be designed using a uniform pressure of 300 psf. The passive pressure used to design the soldier pile may be taken as 500 psf per foot of depth. The maximum passive pressure should not be taken more than 5,000 psf. The space between the soil and the soldier beam should be backfilled with concrete with a minimum compressive strength of 2,500 pounds per cubic inch (psi). A factor of safety of 1.5 shall be considered for passive resistance.

All shoring should be designed in accordance with the latest edition of the Trenching and Shoring Manual (Caltrans, 2011). The geotechnical consultant should review the contractor's shoring design. The shoring design must consider support of the proposed adjacent traffic lanes, parking, structures and/or underground utilities. A licensed surveyor should be retained to establish monuments on the shoring and the surrounding ground prior to excavation. Such monuments should be monitored for horizontal and vertical movement during construction. Results of the monitoring program should be provided immediately to the project structural (shoring) engineer and Willdan Geotechnical for review and evaluation. It is recommended that Willdan Geotechnical review the shoring plans for conformance with our recommendations and that a geotechnical consultant's representative observe the installation of shoring.

7.7. FOUNDATION DESIGN

General: It is our opinion that the proposed structures may be supported on shallow foundations. The shallow foundation may be spread/strip footings with slab on grade or mat foundation, capable of tolerating the total and differential settlements as addressed in the forthcoming sections.

Conventional Spread/Strip Footings: Spread and/or strip footings should be at least 24 and 18 inches wide, respectively, and embedded at least 18 inches below the lowest adjacent grade in the engineered fill prepared as recommended in "Earthworks" section. The footings may be designed

to impose a maximum allowable pressure of 2,500 pounds per square foot (psf) due to dead plus live loads. The bearing capacity may be increased by one-third for transient loads such as seismic or wind.

The slab-on-grade should be at least 5 inches thick and reinforced with No. 3 rebar at 18 inches on center. Concrete slab-on-grade may be designed using a maximum bearing pressure of 1,000 psf. The structural design of the slab based on applied loads may exceed the above recommended minimum thickness and reinforcement.

In order to maintain adequate support for the foundations located adjacent to utility trenches, including existing utility trenches or other footings, the footings should be deepened as necessary so that their bearing surfaces are below an imaginary plane having an inclination of 1H:1V, extending upward from the bottom edge of the adjacent trench or footing.

Mat Foundation: Mat foundation system would be appropriate alternative when the estimated settlements cannot be tolerated by spread and strip footings design or as is desired by the owner for more rigid foundation. The mat should be at least 10 inches thick and be embedded at least 18 inches below the lowest adjacent grade in the engineered fill prepared as recommended in "Earthworks" section. The mat footing may be designed to impose a maximum allowable pressure of 1,000 pounds per square foot (psf) due to dead plus live loads. The bearing capacity may be increased by one-third for transient loads such as seismic or wind. A modulus of subgrade reaction, K_s, equal to 75 pounds per cubic inch (pci), and a subgrade modulus of elasticity, E_s, equal to 1,200 pounds per square inch (psi) may be used for design of the mat foundation.

Resistance to Lateral Loads: Lateral soil resistance will be provided by a combination of frictional resistance between the bottom of the footings and the underlying soils and by passive soil resistance acting against side of the footing. For frictional resistance between concrete and soil, a frictional coefficient of 0.35 may be used. For passive resistance, an allowable fluid pressure of 350 pcf may be used for a level ground surface condition in front of the footing/wall. When combining both frictional and passive resistance, the passive resistance should be reduced by one-third. The recommended value may be increased by one-third for short-term loading.

Settlement: Based on the results of our analyses and considering the above grading remediations, the total static settlements due to structural loads are expected to be less than 0.5 inch, and the differential static settlements are expected to be less than 0.25 inch over a 50-foot span. Also, the total seismic settlements are expected to be less than 1.75 inches, and the differential seismic settlements are expected to be less than 1.0 inch over a 50-foot span.

7.8. MOISTURE SENSITIVE FLOOR COVERING

In areas where moisture-sensitive floor coverings (such as tile, hardwood floors, linoleum or carpeting) are planned, an impermeable membrane (vapor barrier) should be installed below the

concrete slab or mat to reduce excess vapor drive through the slab. The membrane should be at least 10-mil thick and care should be taken to preserve the continuity and integrity of the membrane beneath the floor slab. At least 4 inches of free drainage gravel, with no more than 2 percent passing No. 200 sieve, should be placed below the vapor barrier to serve as a capillary break. The gravel layer shall be compacted to a minimum of 92% relative compaction per ASTM D1557. The gradation for the free drainage material used shall conform to the requirements for No. 3 Concrete Aggregates as specified in section 200-1.4 of the latest edition of Greenbook.

7.9. CONCRETE FLATWORKS

Frequent construction or control joints should be provided in all concrete slabs where cracking is objectionable. Contraction or weakened plane joints should extend slightly deeper than one-quarter the slab thickness to be effective. Control joints should be spaced a minimum of 10-feet intervals on both directions. The contractor should be responsible for monitoring of the concrete during initial set or hardening and to determine the optimal timing for cutting of the slabs.

Exterior concrete slab-on-grade may be subjected to periods of drying, and consequently, to edge effects due to the fluctuation in the moisture content of the subgrade soils along the outer edges of the slab. Deepened edge sections (also referred to as down turned curbs) will aid in reducing the potential for the shrinkage and swelling of the underling soils. By deepening the edge section to a minimum of 12 inches below the subgrade soils, there is less potential for soil moisture change below at least the perimeter of the slabs.

The above recommendations, including deepened edge sections and steel reinforcement are intended to help reduce the potential for distress in concrete slab, but may not eliminate such distress completely.

7.10. RETAINING WALLS

Lateral Earth Pressures: Anticipated lateral earth pressures and frictional coefficients for the design of the foundations and retaining structures at the site are listed in the following Table 2. Active pressure should be used for design of a retaining wall which is free to rotate at the top. At-rest pressures should be utilized if the wall is restrained from moving at the top, or in the case of below-grade walls of structures such as the planned inspection pits, or any utility and/or cable vault walls.

Table 2. Summary of Earth Lateral Loads and Resistance Factors

Active Pressure (Equivalent Fluid Density)	40 pcf
Passive Pressure (Equivalent Fluid Density)	350 pcf
At-rest Pressure (Equivalent Fluid Density)	55 pcf
Friction Factor	0.35

The distribution of active and passive pressures on a cantilever wall is equal to that pressure developed by an equivalent fluid with a density as presented in Table 2.

Also, retaining walls of 6 feet or taller in height should also be designed for additional seismic pressure equal to hydrostatic pressure of an equivalent liquid with density of 24 pcf as inverted triangular distribution.

A drainage system should be provided behind the walls to reduce the potential for development of hydrostatic pressure. If a drainage system is not installed, the wall should be designed to resist a hydrostatic pressure in addition to the introduced pressures.

Retaining Wall Foundation: The footing for the retaining wall should be embedded a minimum of 18 inches below the lowest adjacent finish grade supported on a minimum of 2 feet of fill compacted to at least 90% relative compaction. The retaining wall may be supported on strip footings designed using a maximum allowable bearing capacity of 2,000 psf. A one-third increase in the bearing capacity may be used when considering wind or seismic loads.

The footings may be designed for resisting against lateral loads using the passive pressure and friction factor values provided in Table 2. The top one foot of the subgrade should be deleted in passive pressure computations for the buried structures. When combining both frictional and passive resistance, the passive resistance should be reduced by one-third. The recommended value may be increased by one-third for short-term loading.

Retaining Wall Backfill: All the backfill should be placed in layers which, when loose, should not exceed 8 inches per layer, and compacted to a minimum relative compaction of 90% of maximum density per ASTM D1557. Subdrain systems shall be installed to prevent hydrostatic pressure build-up acting as an additional lateral load. The Geotechnical Consultant may recommend additional subdrains and/or changes in subdrain extent, location, grade, or material depending on conditions encountered during grading.

7.11. SURFACE DRAINAGE

Inadequate control of run-off water and/or heavy irrigation after construction of the proposed developments may lead to adverse conditions. Maintaining adequate surface drainage, proper disposal of run-off water, and control of irrigation will help reduce the potential for future moisture related problems and differential movements from soil heave/settlement. Surface drainage should be carefully taken into consideration during grading, landscaping and building construction. Positive surface drainage should be provided to direct surface water away from wall and toward a suitable drainage device.

7.12. ON-SITE INFILTRATION

Following the recommendations provided in this report, and considering the groundwater levels encountered in the borings, the final site subsurface conditions will consist of up to 20 feet of fill underlain by alluvial deposits with groundwater at bottom of fill or less than 5 feet below the engineered fill. As such, it is our opinion that the subject site is not feasible for onsite infiltration and infiltration test is not warranted.

7.13. PAVEMENT DESIGN

Pavement sections have been developed in accordance with the procedures presented in the Caltrans Highway Design Manual (HDM). This pavement design procedure is based on the volume of traffic (Traffic Index, or "TI") and the subgrade R-value. The following pavement sections are recommended for various Traffic Indices, using an assumed R-value of 25 for the subgrade soils. Bulk samples should be collected from within the pavement subgrade at the project site upon completion of grading for laboratory testing, and the pavement design should be revised accordingly.

Table 3. Flexible Pavement Design (R-Value = 25)

TI	AC/AB (in/in)	Full Depth AC (in)
6	3.0/9.5	8.0
8	4.5/13.0	10.5
10 (Fire Truck Access Road)	6.0/16.5	13.5

The subgrade shall be scarified for a minimum of 8 inches and compacted to a minimum of 90% relative compaction per ASTM D1557. The scarification should laterally extend at least 2 feet beyond the perimeter of the proposed pavement area. The base material shall consist of crushed aggregate base (CAB) or crushed miscellaneous base (CMB) as specified in the Greenbook and compacted to a minimum of 95% relative compaction per ASTM D1557.

7.14. SOIL CORROSIVITY

A representative bulk sample of soils in contact with concrete and pipes should be collected and tested for pH, minimum resistivity, soluble chloride content and soluble sulfate content. The test results will be used to determine the chemical properties and provide appropriate recommendations.

8. REFERENCES

- "Geotechnical Report, San Juan Creek (L01) Channel Levee Protection, Phases 4 & 5 (Station 51+00 to 112+00), San Juan Capistrano, California", Prepared by AMEC Earth & Environmental, Inc., Dated June 24, 2010

- "Final Geotechnical Investigation Report for San Juan Creek (L01) Channel Levee Protection Project, Phase 6 (Western Levee Station 51+00 to 72+00), Cities of Dana Point and San Juan Capistrano, Orange County, California", Prepared by URS Corporation, Dated April 14, 2011

- "Supplemental Geotechnical Investigation, San Juan Creek East Levee Protection Phases 4 and 5, County Project No. EF0379+1, Station 51+00 to Station 112+00, San Juan Capistrano, California", Prepared by Tetra Tech Bas Geoscience, Dated November 4, 2015

- "San Juan Creek (L01) – Phases 4 & 5, East Levee Station 51+00 to 112+00, Orange County, CA, DRAFT, Design-Level Analysis for Steel Sheet Pile Wall", Prepared by Tetra Tech Bas Geoscience, Dated March 25, 2016

- "Preliminary Geotechnical Investigation, Proposed Commercial Development and Ganahl Lumber Facility, Stonehill Drive and San Juan Creek Trail, San Juan Capistrano, California", Prepared by G.A., Nicoll and Associates, Dated October 5, 2017

- "Preliminary Geotechnical Investigation, Proposed Commercial Development and Ganahl Lumber Facility, Stonehill Drive and San Juan Creek Trail, San Juan Capistrano, California", Prepared by G.A., Nicoll and Associates, Dated October 5, 2017 (Revision 1 – February 16, 2018) (Revision 2 – March 21, 2018).

- American Society for Testing and Materials (ASTM), Annual Book of Standards, Soil and Rock; Dimension Stone; Geosynthetics, Vol. 04.08.

- California Building Code, CBC 2016.

- State of California Geological Survey (CGS), 2001, Seismic Hazard Zone Report for the Dana Point 7.5-Minute Quadrangle, Orange County, California, Seismic Hazard Zone Report 049.

- State of California Geological Survey (CGS), 1998, Earthquake Zones of Required Investigation, Dana Point Quadrangle, Seismic Hazard Zones, December 21, 2001.

APPENDIX A. FIGURES

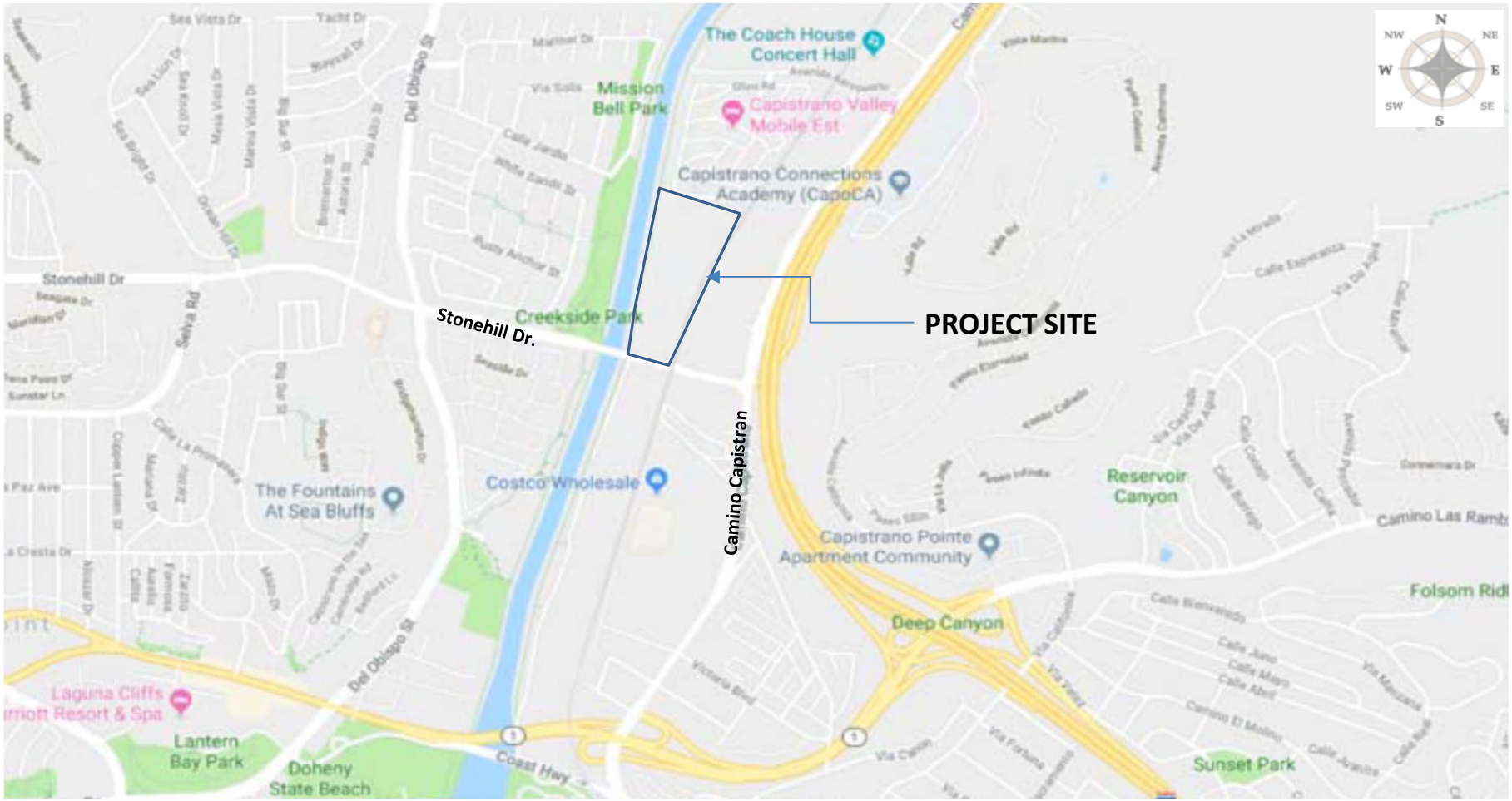


FIGURE 1. SITE LOCATION MAP

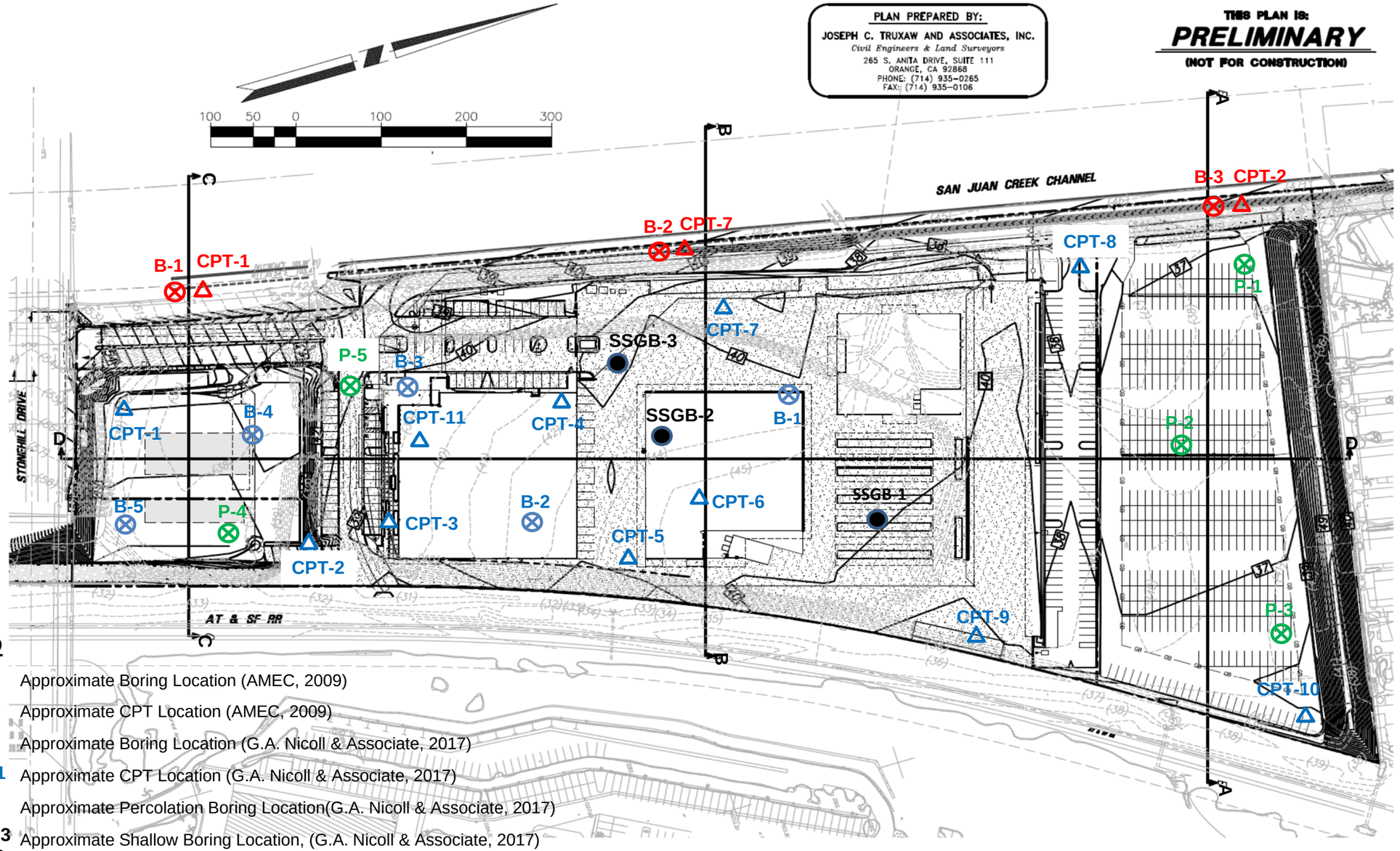
PROPOSED DEVELOPMENT AND GANAHL LUMBER FACILITY,
SAN JUAN CAPISTRANO, CALIFORNIA

WILLDAN Geotechnical | extending your reach

Drawn By:	AM	Date:	20-Sep-18
Approved By:	MR	Project No.:	108164-2000

PLAN PREPARED BY:
JOSEPH C. TRUXAW AND ASSOCIATES, INC.
Civil Engineers & Land Surveyors
265 S. ANITA DRIVE, SUITE 111
ORANGE, CA 92868
PHONE: (714) 935-0265
FAX: (714) 935-0106

THIS PLAN IS:
PRELIMINARY
(NOT FOR CONSTRUCTION)



LEGEND

B-3	Approximate Boring Location (AMEC, 2009)
CPT-7	Approximate CPT Location (AMEC, 2009)
B-5	Approximate Boring Location (G.A. Nicoll & Associate, 2017)
CPT-11	Approximate CPT Location (G.A. Nicoll & Associate, 2017)
P-5	Approximate Percolation Boring Location(G.A. Nicoll & Associate, 2017)
SSGB-3	Approximate Shallow Boring Location, (G.A. Nicoll & Associate, 2017)
D D	Approximate Location of Geologic Cross Section

FIGURE 2. EXPLORATORY BORING, PERCOLATION BORING, CPT, AND CROSS SECTION LOCATION PLAN

PROPOSED COMMERCIAL DEVELOPMENT AND GANAHL LUMBER FACILITY

WILLDAN Geotechnical *extending your reach*

Drawn By: AM Date: September 19, 2018

Approved By: MR Project No.: 108164-2000

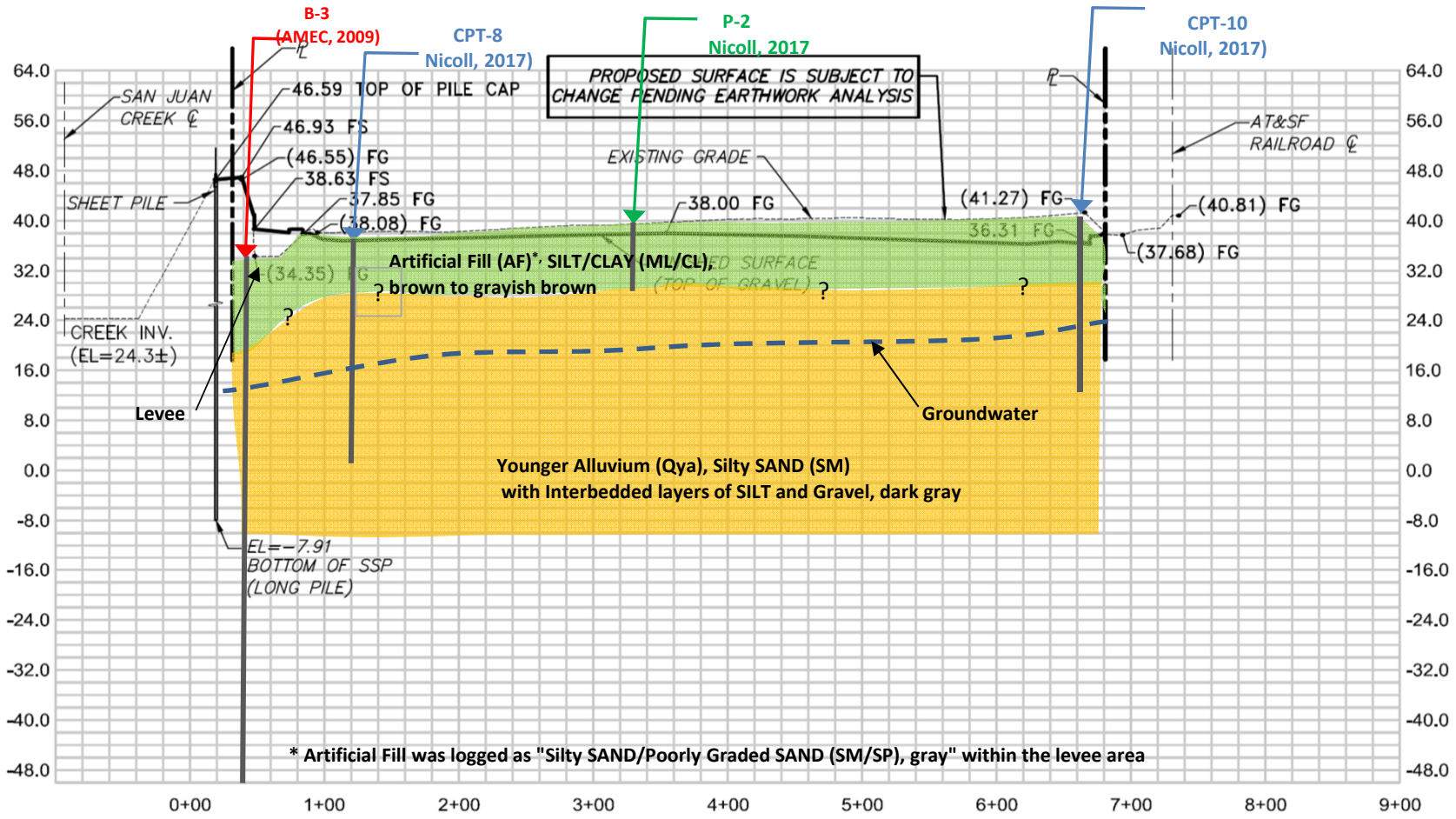


FIGURE 3A. SUBSURFACE GEOLOGICAL MAP - CROSS SECTION A-A

PROPOSED DEVELOPMENT AND GANAHL LUMBER FACILITY
SAN JUAN CAPISTRANO, CALIFORNIA

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Drawn By:	AM	Date:	20-Sep-18
Approved By:	MR	Project No.:	108164-2000

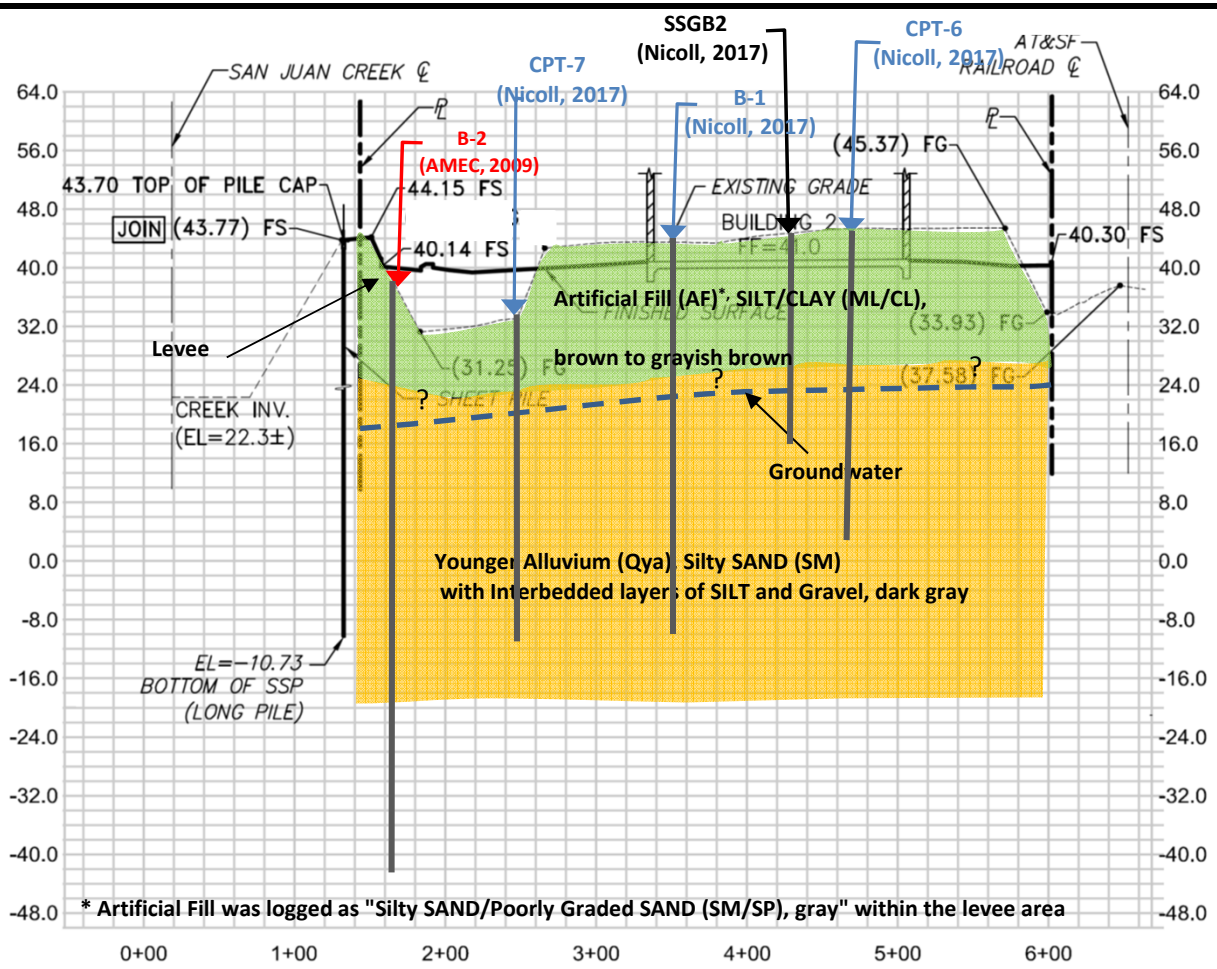

FIGURE 3B. SUBSURFACE GEOLOGICAL MAP - CROSS SECTION B-B

PROPOSED DEVELOPMENT AND GANAHL LUMBER FACILITY
SAN JUAN CAPISTRANO, CALIFORNIA

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Approved By:	MR	Project No.:	108164-2000

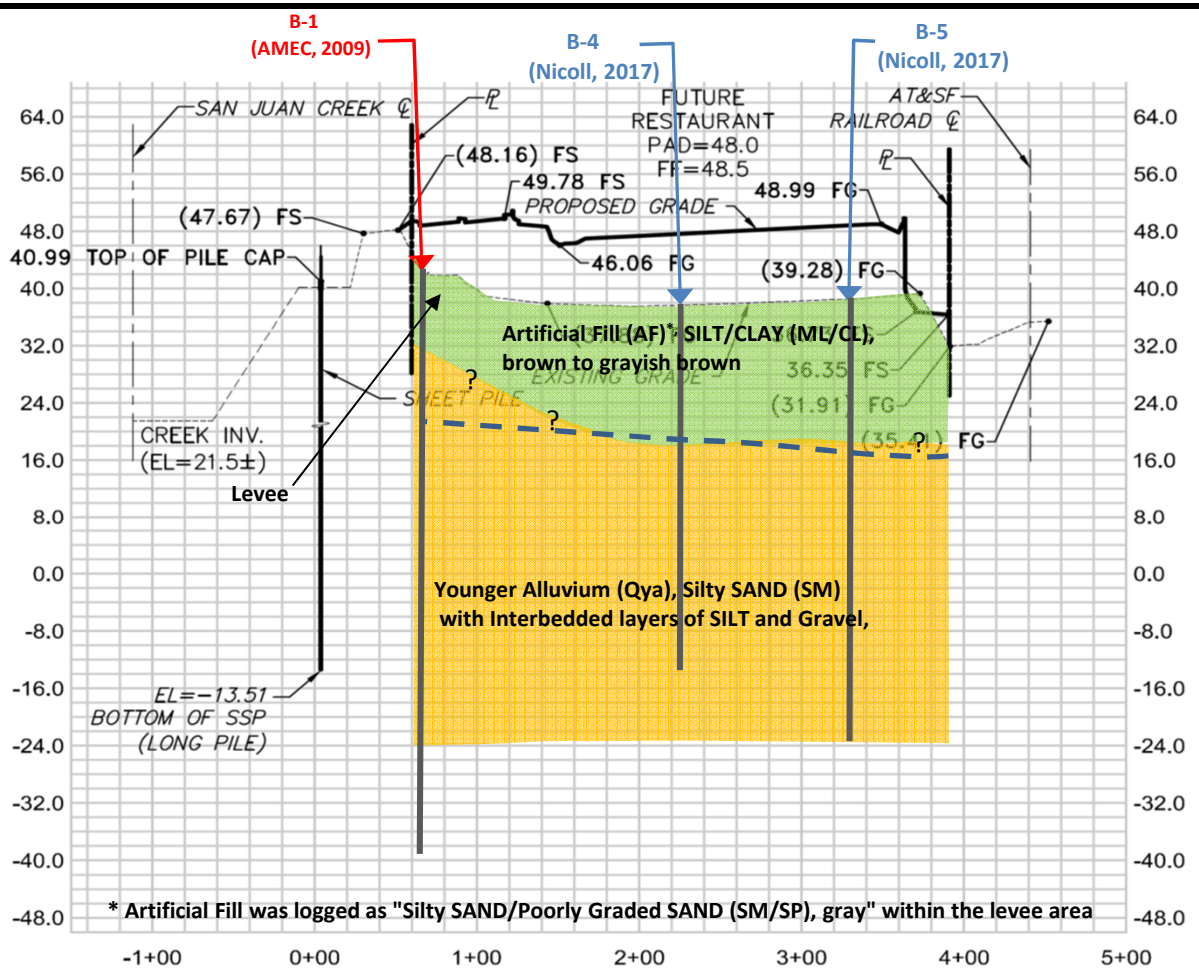

FIGURE 3C. SUBSURFACE GEOLOGICAL MAP - CROSS SECTION C-C

PROPOSED DEVELOPMENT AND GANAHL LUMBER FACILITY
SAN JUAN CAPISTRANO, CALIFORNIA

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Drawn By:	AM	Date:	20-Sep-18
Approved By:	MR	Project No.:	108164-2000

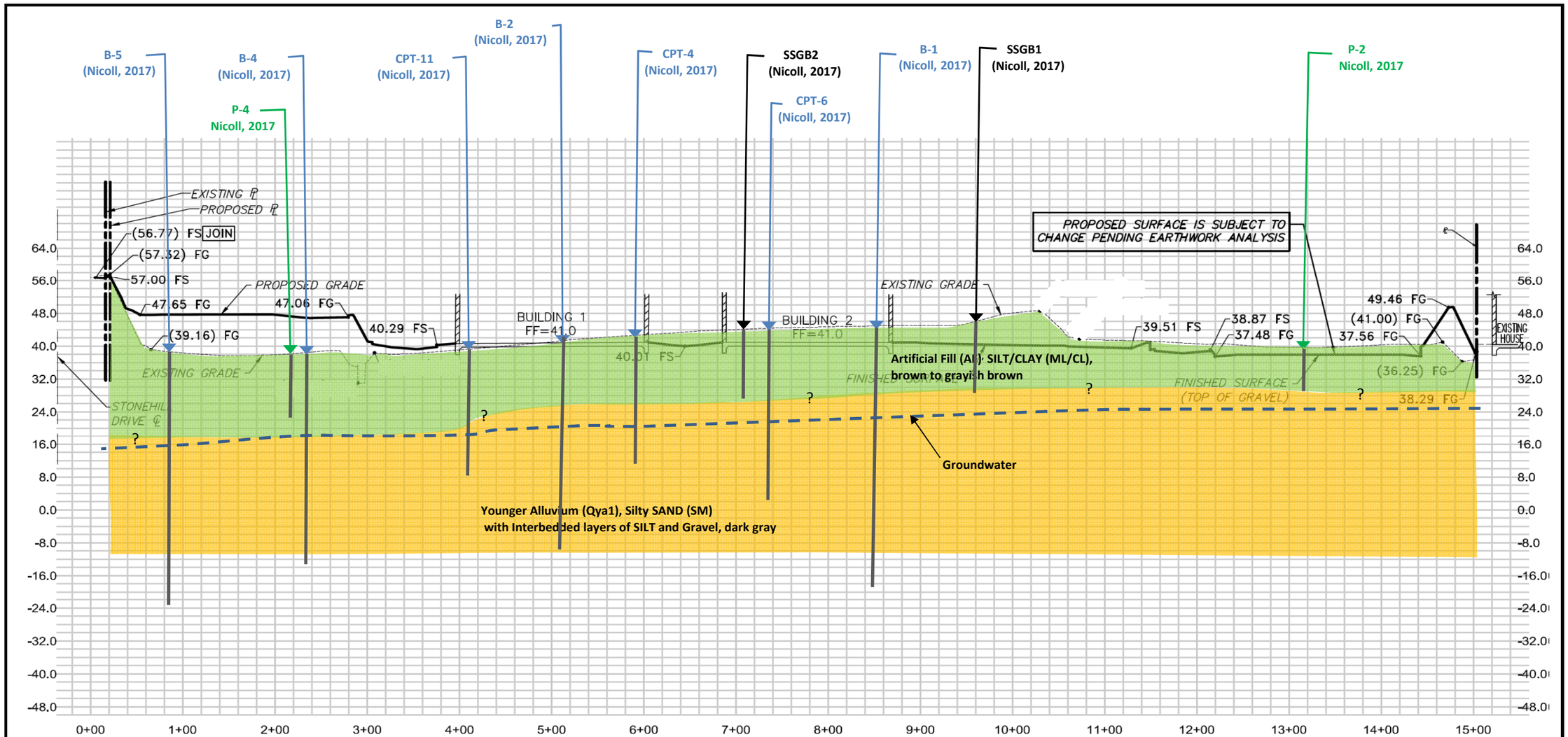

FIGURE 3D. SUBSURFACE GEOLOGICAL MAP - CROSS SECTION D-D

PROPOSED DEVELOPMENT AND GANAHL LUMBER FACILITY
SAN JUAN CAPISTRANO, CALIFORNIA

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Drawn By:	AM	Date:	September 20, 2018
Approved By:	MR	Project No.	108164-2000

APPENDIX B. BORING LOGS AND CPT DATA

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP SYMBOLS		DESCRIPTIONS
COARSE GRAINED SOILS (More than 50% of material is LARGER than No. 200 sieve size.)	GRAVELS (More than 50% of coarse fraction is LARGER than the No. 4 sieve size.)	CLEAN GRAVELS (Little or no fines)		GW	Well graded gravels, gravel-sand mixtures, little or no fines.
				GP	Poorly graded gravels or gravel-sand mixtures, little or no fines.
		GRAVELS WITH FINES (Appreciable amount of fines)		GM	Silty gravels, gravel-sand-silt mixtures.
				GC	Clayey gravels, gravel-sand-clay mixtures.
	SANDS (More than 50% of coarse fraction is SMALLER than the No. 4 sieve size.)	CLEAN SANDS (Little or no fines)		SW	Well graded sands, gravelly sands, little or no fines.
				SP	Poorly graded sands or gravelly sands, little or no fines.
		SANDS WITH FINES (Appreciable amount of fines)		SM	Silty sands, sand-silt mixtures.
				SC	Clayey sands, sand-clay mixtures.
FINE GRAINED SOILS (More than 50% of material is SMALLER than No. 200 sieve size.)	SILTS AND CLAYS (Liquid limit LESS than 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, gravelly clays, sandy clays, silty clays, lean clays.
				OL	Organic silts and organic silty clays of low plasticity.
	SILTS AND CLAYS (Liquid limit GREATER than 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 silts.
HIGHLY ORGANIC SOILS				Pt	Peat and other highly organic soils.

BOUNDARY CLASSIFICATIONS: Soils possessing characteristics of two groups are designated by combinations of group symbols.

PARTICLE SIZE LIMITS

SILT OR CLAY	SAND			GRAVEL		COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	COARSE		

No. 200 No. 40 No. 10 No.4 ¾ in. 3 in. 12 in.

U.S. STANDARD SIEVE SIZE

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Tustin, California

Ganahl Construction Corporation
Ganahl Lumber Facility
Stonehill & San Juan
Creek Trail, San Juan Capistrano, CA

Date: October 2017

Project No.: 7082-04

Figure No.: B-3

LOG OF BORING

Drill Rig:	Boring Diameter:	Boring Elevation:	Boring No.
Hollow Stem Auger	8 inches		B-1

Date Drilled: 9/6-7/2017 JS

This log is a representation of subsurface conditions at the time and place of drilling With the passage of time or at any other location, there may be consequential changes in conditions

SAMPLE										
12" DROP	BULK	TUBE OR SPT	BLOWS/6"	FIELD MOISTURE % DRY WEIGHT	DRY DENSITY LB./CU. FT	SHEAR RESISTANCE KIPS/SQ. FT	DEPTH FEET	SOIL/ROCK SYMBOL	SOIL/ROCK TYPE	Descriptions and Remarks
	X								ML	@ 0 feet, ARTIFICIAL FILL, (AF): SILT: light brown, dry, very soft
		X	5/10/9 N=19	13.2	104.9		5		ML/ CL	@ 5 feet, Clayey SILT and Silty CLAY: medium brown to brownish-gray, moist, stiff, some iron-oxide staining, mottled, trace coarse and fine-grained, mottled
		X	4/6/10 N=16	15.5	98.2		10		ML/ CL	@ 10 feet, The materials encountered are generally the same as those described above
		X	6/9/1 N=10	8.7	88.6		15		ML	@ 15 feet, SILT: medium brown, moist, stiff and some very fine, dark gray, very fine sand, mottled
									SM	@ 16 feet, CONTACT: YOUNGER ALLUVIUM, (Qyal): Silty SAND: dark gray, moist, medium dense, fine to very fine-grained
		X	2/6/13 N=19	29.8	92.1		20		SM/ ML	@ 20 feet, transitions from dark gray, moist, fine SAND to very dark gray, very moist SILT, medium dense to stiff
										@ 21 feet, groundwater encountered
		X	14/8/17 N=25	21.8	103.4		25		SM	@ 25 feet, Silty SAND: very dark gray, saturated, very dense, fine to medium-grained

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Tustin, California

Ganahl Construction Corporation
Ganahl Lumber Facility
Stonehill and San Juan Creek Trail
San Juan Capistrano, California

Project No.:	Figure No.:
7082-04	B-4.1

LOG OF BORING

Drill Rig:	Boring Diameter:	Boring Elevation:	Boring No.
Hollow Stem Auger	8 inches		B-1

Date Drilled: 9/6-7/2017 JS

This log is a representation of subsurface conditions at the time and place of drilling. With the passage of time or at any other location, there may be consequential changes in conditions.

SAMPLE

12" DROP	BULK	TUBE OR SPT	BLOWS/6"	FIELD MOISTURE % DRY WEIGHT	DRY DENSITY LB./CU. FT	SHEAR RESISTANCE KIPS/SQ. FT	DEPTH FEET	SOIL/ROCK SYMBOL	SOIL/ROCK TYPE	Descriptions and Remarks
		X	5/10/15 N=15	28.6	93.2				ML/ GW	@ 30 feet, transitions from black SILT to well graded (poorly sorted) gravelly, very coarse to medium green Silty SAND, fine to medium SAND, saturted, medium dense
		X	5/13/18 N=31	19.8	104.4		35		SM	@ 35 feet, Silty SAND: very dark gray to black, saturted, medium dense, very fine to medium-grained
		X	19/50 for 3"	18.1	111.6		40		SM/ GW	@ 40 feet, transitions from black, very fine SAND to dark gray, well graded medium to very coarse SAND and some fine GRAVEL: saturated, very dense
		X	22/50 for 4"	18.9	105.1		45		SM	@ 45 feet, transitions from very fine to coarse Silty SAND: light brown, saturated, very dense
			10/22/37 N=59	10 2			50		SM/ GW	@ 50 feet, transitions from coarse, Silty SAND to silty, medium to coarse Sandy fine GRAVEL: medium brownish-gray to greenish-gray, saturated, very dense
		X	23/50 for 4"				55			@ 55 feet, Silty SAND: gray, saturated, poor recovery

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San Juan Capistrano, California

Project No.: 7082-04

Figure No.: B-4.2

LOG OF BORING

Drill Rig:	Boring Diameter:	Boring Elevation:	Boring No.
Hollow Stem Auger	8 inchees		B-1

Date Drilled: 9/6-7/2017 JS

This log is a representation of subsurface conditions at the time and place of drilling. With the passage of time or at any other location, there may be consequential changes in conditions

SAMPLE										
12" DROP	BULK	TUBE OR SPT	BLOWS/FT.	FIELD MOISTURE % DRY WEIGHT	DRY DENSITY LB./CU. FT	SHEAR RESISTANCE KIPS/SQ. FT	DEPTH FEET	SOIL/ROCK SYMBOL	SOIL/ROCK TYPE	Descriptions and Remarks
			14/16/12 N=28	10.5					SM/ GW	
							65			
							70			
							75			
							80			
							85			

Bottom of boring at 61.5 feet.
NOTE:
1) Groundwater encountered at 21 feet.
2) Caving experienced from 21 feet to total depth.

SPT = Standard Penetrometer Test

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Project No.: 7082-04

Figure No.: B-4.3

LOG OF BORING

Drill Rig:	Boring Diameter:	Boring Elevation:	Boring No.
Hollow Stem Auger	8 inches		B-2

Date Drilled: 9/6-7/2017 JS

This log is a representation of subsurface conditions at the time and place of drilling. With the passage of time or at any other location, there may be consequential changes in conditions

SAMPLE 12" DROP	SAMPLE BULK	SAMPLE TUBE OR SPT	BLOWS/6"	FIELD MOISTURE % DRY WEIGHT	DRY DENSITY LB./CU. FT	SHEAR RESISTANCE KIPS/SQ. FT	DEPTH FEET	SOIL/ROCK SYMBOL	SOIL/ROCK TYPE	Descriptions and Remarks
							0		ML	@ 0 feet, ARTIFICIAL FILL, (AF): SILT: light brown, dry, soft
		X	5/8/7 N=15	4.9	95.5		5		ML	@ 5 feet, SILT: medium brown, moist, stiff, some fine to very coarse sand and fine gravel; some iron-oxide staining, mottled
		X	4/7/9 N=16	11.4	101.2		10		ML	@ 10 feet, The materials encountered are generally the same as those described above
		X	2/4/8 N=12	27.0	87.1		15		ML	@ 15 feet, CONTACT: YOUNGER ALLUVIUM, (Qyal): SILT. very dark gray, moist, very stiff, some very fine sand and organics
		X	1/16/23 N=39	14.8	107.8		20		SM	@ 20 feet, Silty SAND: very dark gray, groundwater encountered, dense, some coare gravel, trace fine gravel and coarse sand
		X	13/24/16 N=40	17.0	107.3		25		SM	@ 25 feet, Silty SAND: very dark green, saturated, dense, very fine to fine gravel

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Project No.: 7082-04

Figure No.: B-5.1

LOG OF BORING

Drill Rig:	Boring Diameter:	Boring Elevation:	Boring No.
Hollow Stem Auger			
Date Drilled: 9/6-7/2017 JS	This log is a representation of subsurface conditions at the time and place of drilling. With the passage of time or at any other location, there may be consequential changes in conditions.		B-2

SAMPLE 12" DROP	SAMPLE BULK	SAMPLE TUBE OR SPT	BLOWS/6"	FIELD MOISTURE % DRY WEIGHT	DRY DENSITY LB./CU. FT	SHEAR RESISTANCE KIPS/SQ. FT	DEPTH FEET	SOIL/ROCK SYMBOL	SOIL/ROCK TYPE	Descriptions and Remarks
		X	15/30/32 N=62	11.1	126.0				SP	@ SAND: very dark gray, saturated,very dense, coarsely-grained
		X	23/50 for 2"	12.6	122.7		35			@ 35 feet, SAND: very dark gray, saturated, very dense, fine to coarse-grained, trace fine gravel
		X	36/37/30 N=67	15.9	111.2		40			@ 40 feet, Silty SAND: very dark gray, saturated, very dense, fine to very coarse-grained, some medium to coarse gravel
			6/14/16 N=30	12.8			45		SM	@ 45 feet, The materials encountered are generally the same as those decribed above
			12/15/20 N=35	11.4			50			@ 50 feet, predominately very coarse SAND and fine GRAVEL
							55			Bottom of boring at 51.5 feet. NOTE: 1) Groundwater encountered at 20 feet. 2) Caving experienced from 20 feet to total depth. SPT = Standard Penetrometer Test

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Project No.:	Figure No.:
7082-04	B-5.2

LOG OF BORING

Drill Rig:	Boring Diameter:	Boring Elevation:	Boring No.
Hollow Stem Auger	8 inches		B-3
Date Drilled: 9/6-7/2017 JS	This log is a representation of subsurface conditions at the time and place of drilling. With the passage of time or at any other location, there may be consequential changes in conditions.		

SAMPLE 12" DROP	SAMPLE BULK	SAMPLE TUBE OR SPT	BLOWS/6"	FIELD MOISTURE % DRY WEIGHT	DRY DENSITY LB./CU. FT	SHEAR RESISTANCE KIPS/SQ. FT	DEPTH FEET	SOIL/ROCK SYMBOL	SOIL/ROCK TYPE	Descriptions and Remarks
							0		ML	@ 0 feet, SILT: light brown, dry, very soft
		X	8/10/11 N-21	11.9	104.2		5		CL/ ML	@ 5 feet, CLAY and Silty CLAY: light brown, slightly moist, hard, trace iron-oxide staining
		X	9/7/10 N=17	4.2	110.3		10		SM	@ 10 feet, Silty SAND: light brown, dry, medium dense, well graded, fine to very coarse, trace very fine gravel
		X	4/6/12 N=18	7.5	97.8		15		ML	@ 15 feet, SILT: very dark gray to rust brown, very moist, very stiff, mottled
										@ 18 feet, groundwater encountered
		X	6/9/8 N=17	14.3	114.4		20		SM	@ 20 feet, CONTACT, YOUNGER ALLUVIUM, (Qyal): Silty SAND: dark gray, saturated, fine to medium grained, trace very coarse SAND
		X	9/13/13 N=26				25		GW	@ 25 feet, No Recovery

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Project No.:	Figure No.:
7082-04	B-6.1

LOG OF BORING

Drill Rig:	Boring Diameter:	Boring Elevation:	Boring No.
Hollow Stem Auger	8 inches		
Date Drilled: 9/6-7/2017 JS	This log is a representation of subsurface conditions at the time and place of drilling. With the passage of time or at any other location, there may be consequential changes in conditions.		B-3

SAMPLE 12" DROP	SAMPLE BULK	SAMPLE TUBE OR SPT	BLOWS/6"	FIELD MOISTURE % DRY WEIGHT	DRY DENSITY LB./CU. FT	SHEAR RESISTANCE KIPS/SQ. FT	DEPTH FEET	SOIL/ROCK SYMBOL	SOIL/ROCK TYPE	Descriptions and Remarks
			6/12/20 N=32	10.2					SM/ GW	@ 30 feet, Gravelly SAND: dark gray, saturated, dense medium to very coarse-grained, fine to medium gravel
			5/6/7 N=13	29.4	94.0		35		ML	@ 35 feet, Clayey SILT: dark gray, saturated, stiff
			1/3/4 N=7	14.3			40			@ 40 feet, CLAY: dark gray, very moist, firm, highly plastic
			5/6/7 N=13	28.0	94.6		45		CL	@ 45 feet, The materials encountered are generally the same as those decribed above
			6/9/13 N=22	29.6			50			@ 50 feet, The materials encountered are generally the same as those decribed above
							55			Bottom of boring at 51.5 feet. NOTE: 1) Groundwater encountered at 18 feet. 2) Caving experienced from 18 feet to total depth. SPT = Standard Penetrometer Test

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Stonehill and San Juan Creek Trail
San Juan Capistrano, California

Project No.: 7082-04

Figure No.: B-6.2

LOG OF BORING

Drill Rig:	Boring Diameter:	Boring Elevation:	Boring No.
Hollow Stem Auger	8 inches		
Date Drilled: 9/6-7/2017 JS	This log is a representation of subsurface conditions at the time and place of drilling With the passage of time or at any other location, there may be consequential changes in conditions.		B-4

SAMPLE 12" DROP	SAMPLE BULK	SAMPLE TUBE OR SPT	BLOWS/6"	FIELD MOISTURE % DRY WEIGHT	DRY DENSITY LB./CU FT	SHEAR RESISTANCE KIPS/SQ. FT	DEPTH FEET	SOIL/ROCK SYMBOL	SOIL/ROCK TYPE	Descriptions and Remarks
							0		ML	@ 0 feet, ARTIFICIAL FILL, (AF): SILT: light brown, dry, very soft
		X	6/12/15 N=27	19.0	100.4		5		ML	@ 5 feet, SILT: light brown and gray, mottling, slightly moist, hard, mottled
		X	6/16/16 N=32	14.6	108.7		10			@ 10 feet, SILT, Sandy SILT and Clayey SILT: dark brown to light brown, dry to slightly moist, hard, fine to mdium and, mottled
		X	7/12/13 N=25	4.6	90.0		15		SM	@ 15 feet, dark gray, Silty, Clayey SAND and orange-brown Silty SAND: moist to very moist, medium dense, mottled
										@ 19 feet, groundwater encountered
		X	12/24/17 N=41	17.7	102.7		20		SM/ SP	@ 20 feet, CONTACT, YOUNGER ALLUVIUM, (Qyal): Silty SAND and SAND: predominately medium-grained, green, dark gray, dense, very dark gray, saturated, dense, poorly graded
			6/13/17 N=30	14.9			25		SM	@ 25 feet, Silty SAND: very dark gray, saturated, dense

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Tustin, California

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Ganahl Lumber Facility
Stonehill and San Juan Creek Trail
San Juan Capistrano, California

Project No.: 7082-04

Figure No : B-7.1

LOG OF BORING

Drill Rig:	Boring Diameter:	Boring Elevation:	Boring No.
Hollow Stem Auger	8 inches		B-4

Date Drilled: 9/6-7/2017 JS

This log is a representation of subsurface conditions at the time and place of drilling. With the passage of time or at any other location, there may be consequential changes in conditions.

SAMPLE 12" DROP	SAMPLE BULK	SAMPLE TUBE OR SPT	BLOWS/6"	FIELD MOISTURE % DRY WEIGHT	DRY DENSITY LB./CU. FT	SHEAR RESISTANCE KIPS/SQ. FT	DEPTH FEET	SOIL/ROCK SYMBOL	SOIL/ROCK TYPE	Descriptions and Remarks
		X	19/36/36 N=72	14.6	110.1				SM/ SP	@ 30 feet, Silty SAND and SAND: dark gray, saturated, very dense, poorly graded
		|	5/6/7 N=13	20.4			35		SM	@ 35 feet, Silty SAND: very dark gray, saturated, dense
			6/9/9 N=18							
		X	14/24/29 N=53	17.3	106.8		40		SM	@ 40 feet, Silty SAND: dark gray, saturated, very dense, fine to medium-grained
		|	10/12/13 N=25	19.4			45		SM	@ 45 feet, Silty SAND: dark gray, saturated, medium dense, predominately medium grained, trace fine gravel and clay
		X	5/6/8 N=25	32.2	88.6		50		CL	@ 50 feet, CLAY: very dark gray, saturated, very stiff, trace to some silt
							55			Bottom of boring at 51.5 feet. NOTE: 1) Groundwater encountered at 19 feet. 2) Caving experienced from 19 feet to total depth. SPT = Standard Penetrometer Test

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EARTH SCIENCE CONSULTANTS
Tustin, California

Ganahl Construction Corporation
Ganahl Lumber Facility
Stonehill and San Juan Creek Trail
San Juan Capistrano, California

Project No.:	Figure No.:
7082-04	B-7.2

LOG OF BORING

Drill Rig:	Boring Diameter:	Boring Elevation:	Boring No.
Hollow Stem Auger	8 inches		B-5
Date Drilled: 9/6-7/2017 JS	This log is a representation of subsurface conditions at the time and place of drilling. With the passage of time or at any other location, there may be consequential changes in conditions		

SAMPLE 12" DROP	SAMPLE BULK	SAMPLE TUBE OR SPT	BLOWS/6"	FIELD MOISTURE % DRY WEIGHT	DRY DENSITY LB./CU. FT	SHEAR RESISTANCE KIPS/SQ. FT	DEPTH FEET	SOIL/ROCK SYMBOL	SOIL/ROCK TYPE	Descriptions and Remarks
	X								ML	@ 0 feet, Clayey SILT and CLAY: light brown, dry, very soft, trace to some fine to coare SAND
		X	3/6/6 N=12	11.0	106.8		5		ML	@ 5 feet, Sandy SILT: light brown, dry, very stiff, fine to medium sand, trace very coarse and and fine gravel
		X	7/16/16 N=32	12.0	109.1		10		SM	@ 10 feet, Silty SAND. dark brown, dry to slightly moist, dense, fine to very coarse-grained, trace fine gravel, well graded
		X	11/10/7 N=17				15			@ 15 feet, No Recovery
		X	11/29/41 N=70	3.6	105.9		20		SM	@ 20 feet, CONTACT, YOUNGER ALLUVIUM, (Qyal): Silty SAND: light brown, moist, very dense, fine to medium-grained, some coarse sand
										@ 22 feet, groundwater encountered
		X	6/13/17 N=30	17.1			25		SM	@ 25 feet, some very coarse SAND

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Project No.:	Figure No.:
7082-04	B-8.1

LOG OF BORING

Drill Rig:	Boring Diameter:	Boring Elevation:	Boring No.
Hollow Stem Auger	8 inches		B-5

Date Drilled: 9/6-7/2017 JS

This log is a representation of subsurface conditions at the time and place of drilling. With the passage of time or at any other location, there may be consequential changes in conditions.

SAMPLE 12" DROP	SAMPLE BULK	SAMPLE TUBE OR SPT	BLOWS/6"	FIELD MOISTURE % DRY WEIGHT	DRY DENSITY LB./CU. FT	SHEAR RESISTANCE KIPS/SQ. FT	DEPTH FEET	SOIL/ROCK SYMBOL	SOIL/ROCK TYPE	Descriptions and Remarks
		X	7/15/15 N=30	19.4	107.5				SM	The materials encountered are generally the same as described at 20 feet, medium dense
		X	8/10/10 N=20	21.4			35		SM	@ 35 feet, Silty SAND: dark gray, saturated, medium dense
		X	15/28/29 N=57	16.7	111.6		40		SM	@ 40 feet, Silty SAND: very dark gray, saturated, very dense, fine-grained
			7/23/21 N=44	11.8			45		SM	@ 45 feet, Silty SAND: very dark gray, saturated, dense, trace fine gravel and clay, predominately medium grained sand
		X	28/50 for 5"	11.9	119.9		50		SP	@ 50 feet, SAND: light gray, saturated, very dense, predominately medium-grained
									SM/GW	@ 53 feet, Difficult drilling due to cobble layer
							55			@ 55 feet, No recovery

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Project No.: 7082-04

Figure No.: B-8.2

LOG OF BORING

Drill Rig:	Boring Diameter:	Boring Elevation:	Boring No.
Hollow Stem Auger	8 inches		B-5

Date Drilled: 9/6-7/2017 JS

This log is a representation of subsurface conditions at the time and place of drilling. With the passage of time or at any other location, there may be consequential changes in conditions.

SAMPLE										
12" DROP	BULK	TUBE OR SPT	BLOWS/FT.	FIELD MOISTURE % DRY WEIGHT	DRY DENSITY LB./CU. FT	SHEAR RESISTANCE KIPS/SQ. FT	DEPTH FEET	SOIL/ROCK SYMBOL	SOIL/ROCK TYPE	Descriptions and Remarks
									SM/ GW	@ 60 feet, No Recovery
							65			Bottom of boring at 61.5 feet. NOTE: 1) Groundwater encountered at 22 feet. 2) Caving experienced from 22 feet to total depth. SPT = Standard Penetrometer Test
							70			
							75			
							80			
							85			

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Project No.:	Figure No.:
7082-04	B-8.3

LOG OF BORING

Drill Rig:	Boring Diameter:	Boring Elevation:	Boring No.
Hollow Stem Auger	8 inches		P-1

Date Drilled: 9/6-7-2017 JS

This log is a representation of subsurface conditions at the time and place of drilling. With the passage of time or at any other location, there may be consequential changes in conditions.

SAMPLE BULK	SAMPLE TUBE	BLOWS/6"	FIELD MOISTURE % DRY WEIGHT	DRY DENSITY LB./CU. FT	SHEAR RESISTANCE KIPS/SQ. FT	DEPTH FEET	SOIL/ROCK SYMBOL	SOIL/ROCK TYPE	Descriptions and Remarks
								ML/ CL	@ 0 feet, ARTIFICIAL FILL, (AF), Silty CLAY/Clayey SILT: dark brown, moist, soft
	X	14/9/10 N=19	9.7	105.8					@ 3 feet, the materials encountered are generally the same as described above
	X	4/4/7 N=11	13.2	105.0		5		ML	@ 5 feet, SILT: light to medium brown, moist, firm, trace clay @ 5.5 feet, Sandy SILT: dark brown, moist, firm, fine to medium sand, trace fine gravel, mottled
						10			Total Depth at 6.5 feet. NOTE: 1) No ground water encountered. 2) No caving experienced.

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Project No.:	Figure No.:
7082-04	B-9

LOG OF BORING

Drill Rig:	Boring Diameter:	Boring Elevation:	Boring No.
Hollow Stem Auger	8 inches		P-2

Date Drilled: 9/6-7-2017 JS

This log is a representation of subsurface conditions at the time and place of drilling. With the passage of time or at any other location, there may be consequential changes in conditions.

SAMPLE BULK	SAMPLE TUBE	BLOWS/6"	FIELD MOISTURE % DRY WEIGHT	DRY DENSITY LB./CU. FT	SHEAR RESISTANCE KIPS/SQ. FT	DEPTH FEET	SOIL/ROCK SYMBOL	SOIL/ROCK TYPE	Descriptions and Remarks
									@ 0 feet, ARTIFICIAL FILL, (AF), SILT: very light brown, dry, very soft
								ML/ CL	@ 2 feet, mottled dark brown SILT: dark gray CLAY and light brown, very fine SAND: moist, firm
	X	6/9/9 N=18	15.5	110.2					
						5		ML/ SM	@ 5 feet, mottled soft and very fine SAND: dark gray-brown, slightly moist, firm, trace dry, coarse SAND and fine GRAVEL
	X	6/9/13 N=22	14.5	109.9					
								ML/ SM	
						10		ML	@ 10 feet, transitions from SILT: medium brown, slightly moist, very soft to organic SILT, very dark gray, very moist, very soft
	X	2/3/5 N=8	46.9	72.5					@ 11 feet, CONTACT: YOUNGER ALLUVIUM, (Qyal) possible estuarine deposits, very dark gray, very moist, poorly sorted
									Total Depth at 11.5 feet. NOTE: 1) No ground water encountered. 2) No caving experienced.

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Project No.:	Figure No.:
7082-04	B-10

LOG OF BORING

Drill Rig:	Boring Diameter:	Boring Elevation:	Boring No.
Hollow Stem Auger	8 inches		
Date Drilled: 9/6-7-2017 JS	This log is a representation of subsurface conditions at the time and place of drilling. With the passage of time or at any other location, there may be consequential changes in conditions.		P-3

SAMPLE BULK	SAMPLE TUBE	BLOWS/6"	FIELD MOISTURE % DRY WEIGHT	DRY DENSITY LB./CU. FT	SHEAR RESISTANCE KIPS/SQ. FT	DEPTH FEET	SOIL/ROCK SYMBOL	SOIL/ROCK TYPE	Descriptions and Remarks
								ML	@ 0 feet, ARTIFICIAL FILL, (AF), SILT: very light grayish-brown, dry, very loose, approximately 20% fine cobbles, some very
	X	15/18/15 N=33	11.5	108.7				ML	@ 3 feet, mottled, light brown SILT and dark gray plastic CLAY, dry to slightly moist, very dense, some iron-oxide staining, fine gravel-size angular rock fragments
	X	5/8/9 N=17	14.5	111.5		5		ML	@ 5 feet, mottled dark brown SILT: very light brown, very fine SAND, very dark gray CLAY, slightly moist, stiff to medium dense
	X	3/4/5 N=9	13.2	108.5		10		ML	@ 10 feet, SILT: medium brownish-gray, moist, soft, some iron-oxide staining, poor recovery
									Total Depth at 11.5 feet. NOTE: 1) No ground water encountered. 2) No caving experienced.

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Project No.:	Figure No.:
7082-04	B-11

LOG OF BORING

Drill Rig:	Boring Diameter:	Boring Elevation:	Boring No.
Hollow Stem Auger	8 inches		P-4

Date Drilled: 9/6-7-2017 JS

This log is a representation of subsurface conditions at the time and place of drilling. With the passage of time or at any other location, there may be consequential changes in conditions.

SAMPLE BULK	SAMPLE TUBE	BLOWS/6"	FIELD MOISTURE % DRY WEIGHT	DRY DENSITY LB./CU FT	SHEAR RESISTANCE KIPS/SQ. FT	DEPTH FEET	SOIL/ROCK SYMBOL	SOIL/ROCK TYPE	Descriptions and Remarks
								ML	@ 0 feet, ARTIFICIAL FILL, (AF), SILT: light brown, dry, very soft, some clay
								ML	
						5			
								SM/ CL	
	X	7/9/11 N=20	9.6	107.7					@ 7 feet, mottled fine-grained, Silty SAND: cream, light to medium brown and dark grayish-brown clay, dry, stiff
								SM/ CL	
						10		ML	@ 10 feet, SILT: medium brownish-gray, moist, soft, some iron-oxide staining, poor recovery
	X	7/11/11 N=22	6.8	101.2				ML	@ 12 feet, SILT: dark brown, dry, stiff, trace to some clay
									Total Depth at 15 feet. NOTE: 1) No ground water encountered. 2) No caving experienced.

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Project No.:	Figure No.:
7082-04	B-12

LOG OF BORING

Drill Rig:	Boring Diameter:	Boring Elevation:	Boring No.
Hollow Stem Auger	8 inches		P-5

Date Drilled: 9/6-7/2017 JS

This log is a representation of subsurface conditions at the time and place of drilling. With the passage of time or at any other location, there may be consequential changes in cond tions

SAMPLE 12" DROP	SAMPLE BULK	SAMPLE TUBE	BLOWS/6"	FIELD MOISTURE % DRY WEIGHT	DRY DENSITY LB./CU. FT	SHEAR RESISTANCE KIPS/SQ. FT	DEPTH FEET	SOIL/ROCK SYMBOL	SOIL/ROCK TYPE	Descriptions and Remarks
							0		ML	@ 0 feet, ARTIFICIAL FILL, (AF): SILT: light brown, dry, very soft, trace to some clay
							5			
		X	6/7/11 N=18	9.7	115.5				ML/ CL	@ 7 feet, SILT: very dark brown, dry, stiff, some clay
		X	7/11/12 N=23	2.9	110.7		10		SM	@ 10 feet, Silty SAND: light brown, slightly moist, stiff, fine to medium-grained, trce fine gravel
		X	9/11/11 N=23	17.9	108.3		15		SM	@ 15 feet, CLAY: light brown, moist, stiff, some silt
							20			Total Depth at 16.5 feet. NOTE: 1) No ground water encountered. 2) No caving experienced.
							25			

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Project No.: 7082-04

Figure No.: B-13

LOG OF BORING

Drill Rig:	Boring Diameter:	Boring Elevation:	Boring No.
Hollow Stem Auger	8 inches		P-6

Date Drilled: 9/6-7-2017 JS

This log is a representation of subsurface conditions at the time and place of drilling. With the passage of time or at any other location, there may be consequential changes in conditions.

SAMPLE

BULK	TUBE	BLOWS/6"	FIELD MOISTURE % DRY WEIGHT	DRY DENSITY LB./CU. FT	SHEAR RESISTANCE KIPS/SQ. FT	DEPTH FEET	SOIL/ROCK SYMBOL	SOIL/ROCK TYPE	Descriptions and Remarks
						0		ML	@ 0 feet, SILT: light brown, dry, very loose
	X	5/7/9 N=16	4.8	87.8				ML	@ 3 feet, SILT: light grayish-brown, dry, firm, trace fine sand and clay
						5			
	X	3/4/5 N=9	2.5	95.2				SM/ SP	@ 7 feet, SAND: light orange-bown, dry, loose, fine to medium-grained, trace to some silt, poorly graded
						10			Total Depth at 8.5 feet. NOTE: 1) No ground water encountered. 2) Caving experienced from 7 feet to total depth.

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Project No.:	Figure No.:
7082-04	B-14

LOG OF BORING

Drill Rig:	Boring Diameter:	Boring Elevation:	Boring No.
Hollow Stem Auger	8 inchees		SSGB-1

Date Drilled: 9/6-7/2017 JS

This log is a representation of subsurface conditions at the time and place of drilling. With the passage of time or at any other location, there may be consequential changes in conditions

SAMPLE 12" DROP	SAMPLE BULK	SAMPLE TUBE	BLOWS/6"	FIELD MOISTURE % DRY WEIGHT	DRY DENSITY LB./CU. FT	SHEAR RESISTANCE KIPS/SQ. FT	DEPTH FEET	SOIL/ROCK SYMBOL	SOIL/ROCK TYPE	Descriptions and Remarks
	X								ML	@ 0 feet, ARTIFICIAL FILL, (AF): SILT: medium brown, slightly
		X	8/12/13 N=25	11.7	110.0				ML	@ 3 feet, SILT: light brown, very slightly moist, stiff, some fine- to medium-grained, some iron-oxide staining, trace organics and shell fragments, mottled
		X	9/13/14 N=27	15.0	103.6		5		ML	@ 6 feet, The materials encountered are generally the same as those described above
							10		ML	@ 15 feet, SILT: light brownish-gray, moist, stiff, some iron-oxide staining and organics, mottled
									ML	@ 16 feet, CONTACT, YOUNGER ALLUVIUM, (Qyal), Clayey SILT: very dark gray to black, very moist, soft to firm, some organics including wood fragments and shell fragments
		X	8/8/9 N=17	12.9	107.4		15		ML/CL	@ 15 to 16 feet, represents the contact between artificial fill materials and estuarine, back-bay mud deposited in late Pleistocene to early Holocene inland extension of San Juan Creek Coastal Marsh Remants of which remain and can be seen south of PCH to Doheny Beach
							20			Total Depth at 16.5 feet. NOTE 1) No ground water encountered. 2) No caving experienced.
							25			

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Project No.: 7082-04

Figure No.: B-15

LOG OF BORING

Drill Rig:	Boring Diameter:	Boring Elevation:	Boring No.
Hollow Stem Auger	8 inches		SSGB-2
Date Drilled: 9/6-7/2017 JS	This log is a representation of subsurface conditions at the time and place of drilling. With the passage of time or at any other location, there may be consequential changes in conditions.		

SAMPLE 12" DROP	SAMPLE BULK	SAMPLE TUBE	BLOWS/6"	FIELD MOISTURE % DRY WEIGHT	DRY DENSITY LB./CU. FT	SHEAR RESISTANCE KIPS/SQ. FT	DEPTH FEET	SOIL/ROCK SYMBOL	SOIL/ROCK TYPE	Descriptions and Remarks
	X								CL	@ 0 feet, ARTIFICIAL FILL, (AF): Silty CLAY: light brown, moist but deep desiccation cracks at surface
							5		ML	@ 3 feet, SILT: light brown, very slightly moist, stiff, some fine- to medium-grained, some iron-oxide staining, trace organics and shell fragments, mottled
		X	7/10/15 N=25	11.9	78.5		10		ML	@ 6 feet, The materials encountered are generally the same as those described above
		X	4/11/8 N=19	23.0	85.0		15		ML/CL	@ 15 feet, SILT and Clayey SILT dark gray, moist, stiff moderately organic
							20			Total Depth at 16.5 feet. NOTE: 1) No ground water encountered. 2) No caving experienced.
							25			

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Project No.:	Figure No.:
7082-04	B-16

LOG OF BORING

Drill Rig:	Boring Diameter:	Boring Elevation:	Boring No.
Hollow Stem Auger	8 inches		SSGB-3
Date Drilled: 9/6-7/2017 JS	This log is a representation of subsurface conditions at the time and place of drilling. With the passage of time or at any other location, there may be consequential changes in conditions		

SAMPLE 12" DROP	SAMPLE BULK	SAMPLE TUBE	BLOWS/6"	FIELD MOISTURE % DRY WEIGHT	DRY DENSITY LB./CU. FT	SHEAR RESISTANCE KIPS/SQ. FT	DEPTH FEET	SOIL/ROCK SYMBOL	SOIL/ROCK TYPE	Descriptions and Remarks
							0		ML	@ 0 feet, ARTIFICIAL FILL, (AF): Silty CLAY: light brown, moist but deep desiccation cracks at surface
		X	5/8/14 N=22	19.4	105.9		5		ML/ CL	@ 7 feet, mottled dark brown to black Silty CLAY/Clayey SILT:some iron-oxide staining, very fine-grained SAND, slightly moist, very stiff, some coarse gravel-size angular fragments of asphaltic concrete and base
							10			@ 16 feet, CONTACT: YOUNGER ALLUVIUM (Qyal): Silty SAND: slightly moist, very loose, fine-grained
		X	2/3/4 N=7	5.3	84.7		15		SM	
							20			Total Depth at 16.5 feet. NOTE: 1) No ground water encountered. 2) No caving experienced.
							25			

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Project No.: 7082-04

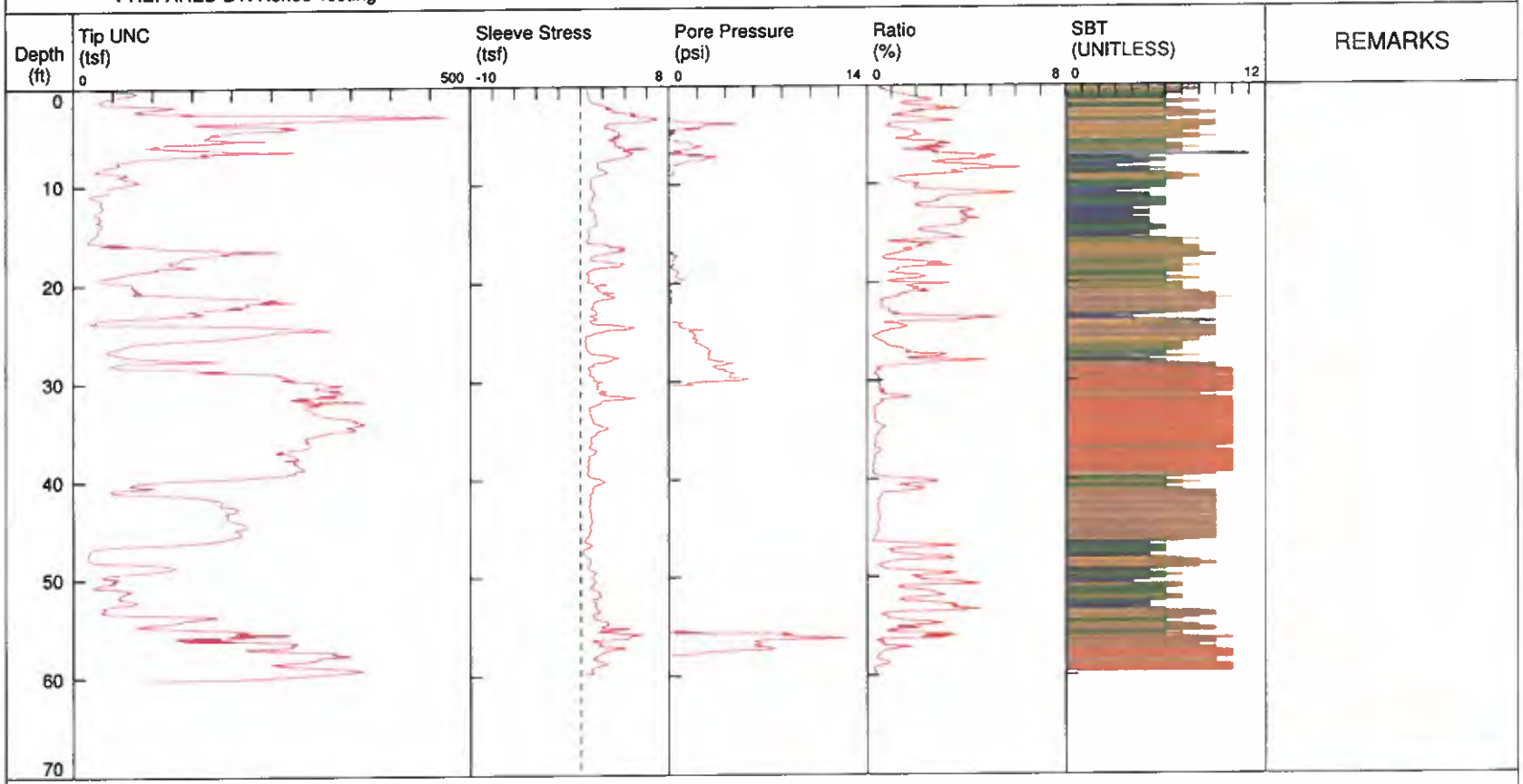
Figure No.: B-17

APPENDIX C

CPT Summary of Soundings

"Field Plots"

TEST ID: CPT-1
TEST DATE: Mon 11/Sep/2017
LOCATION: SanJuanCapistrano
CLIENT: G.A. Nicoll & Associates, Inc.
PREPARED BY: Kehoe Testing



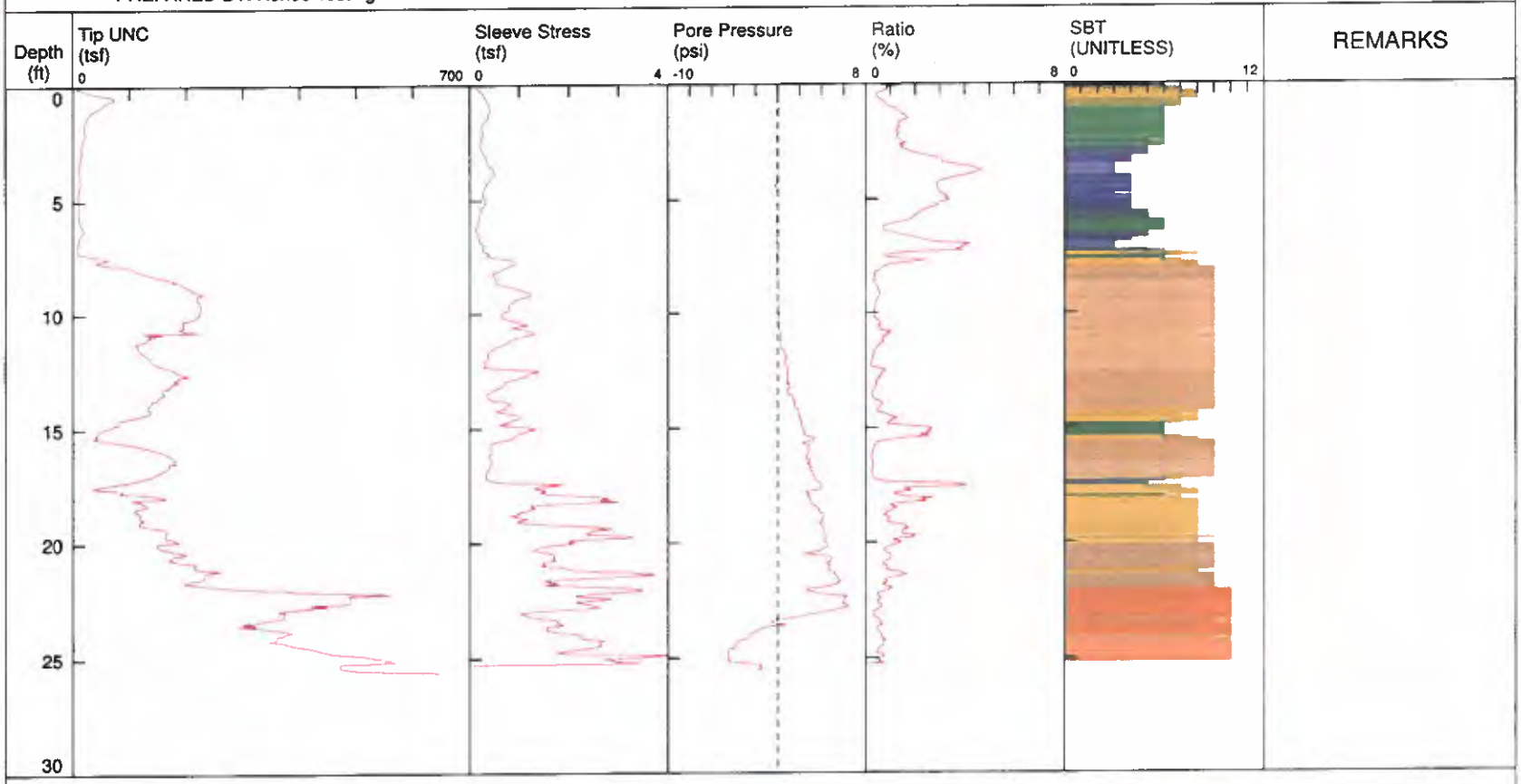
TOTAL DEPTH: 18.309 m

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 (*)

*SBT/SPT CORRELATION: UBC-1983

"Field Plots"

TEST ID: CPT-2
TEST DATE: Mon 11/Sep/2017
LOCATION: SanJuanCapistrano
CLIENT: G.A. Nicoll & Associates, Inc.
PREPARED BY: Kehoe Testing



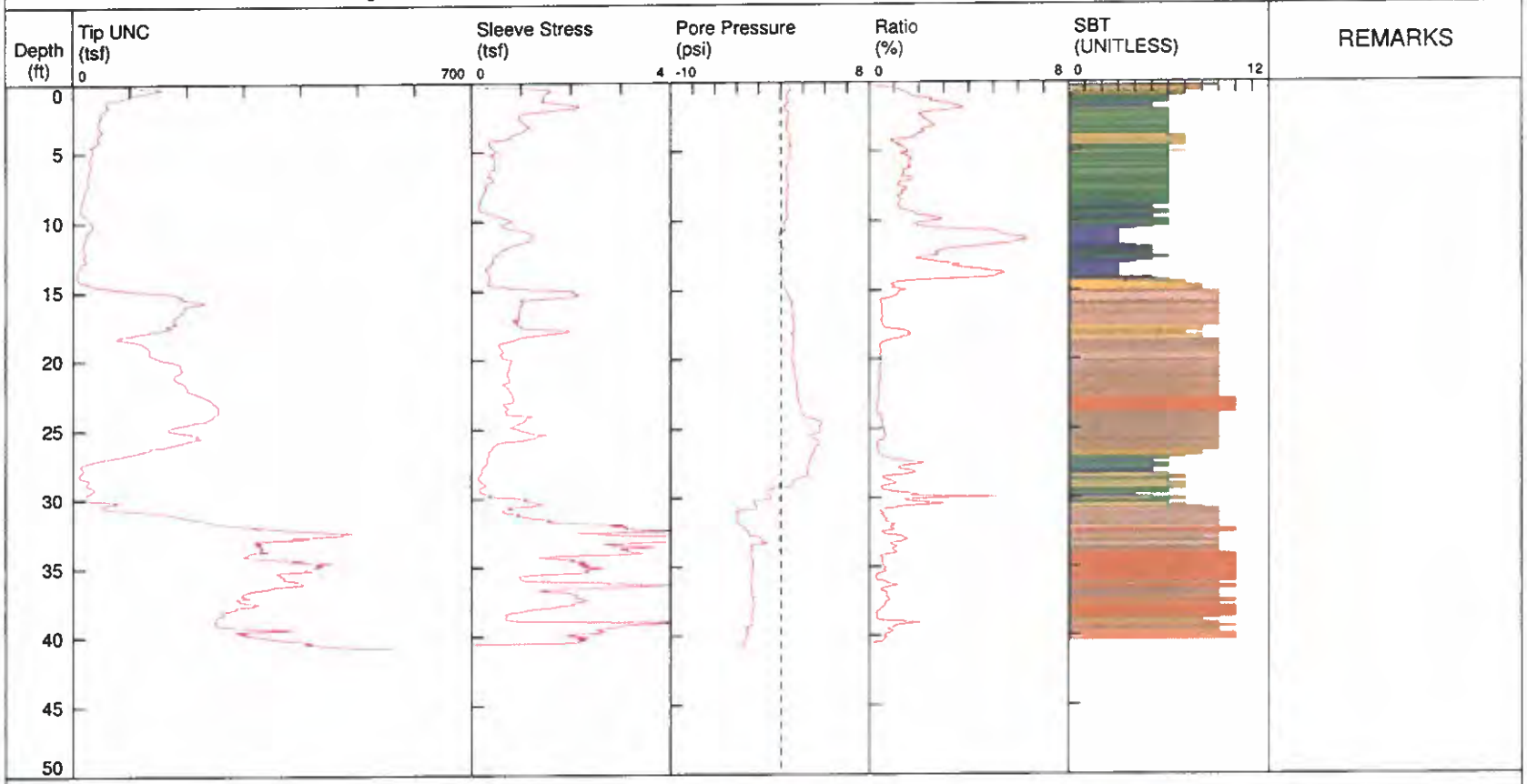
TOTAL DEPTH: 7.803 m

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 (*)

*SBT/SPT CORRELATION: UBC-1983

"Field Plots"

TEST ID: CPT-3
TEST DATE: Mon 11/Sep/2017
LOCATION: SanJuanCapistrano
CLIENT: G.A. Nicoll & Associates, Inc.
PREPARED BY: Kehoe Testing



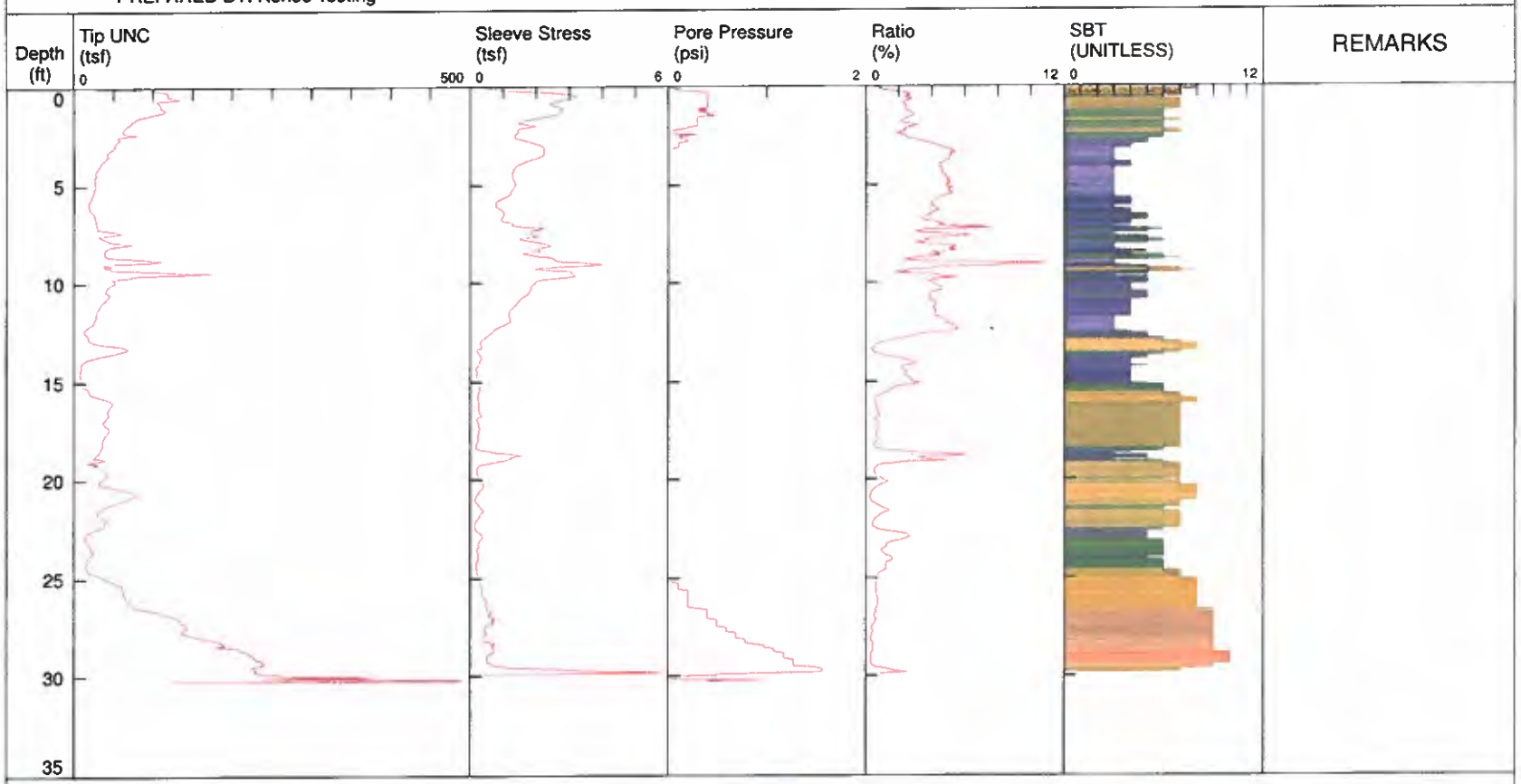
TOTAL DEPTH: 40.749 ft

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 (*)

*SBT/SPT CORRELATION: UBC-1983

"Field Plots"

TEST ID: CPT-4
TEST DATE: Mon 11/Sep/2017
LOCATION: SanJuanCapistrano
CLIENT: G.A. Nicoll & Associates, Inc.
PREPARED BY: Kehoe Testing



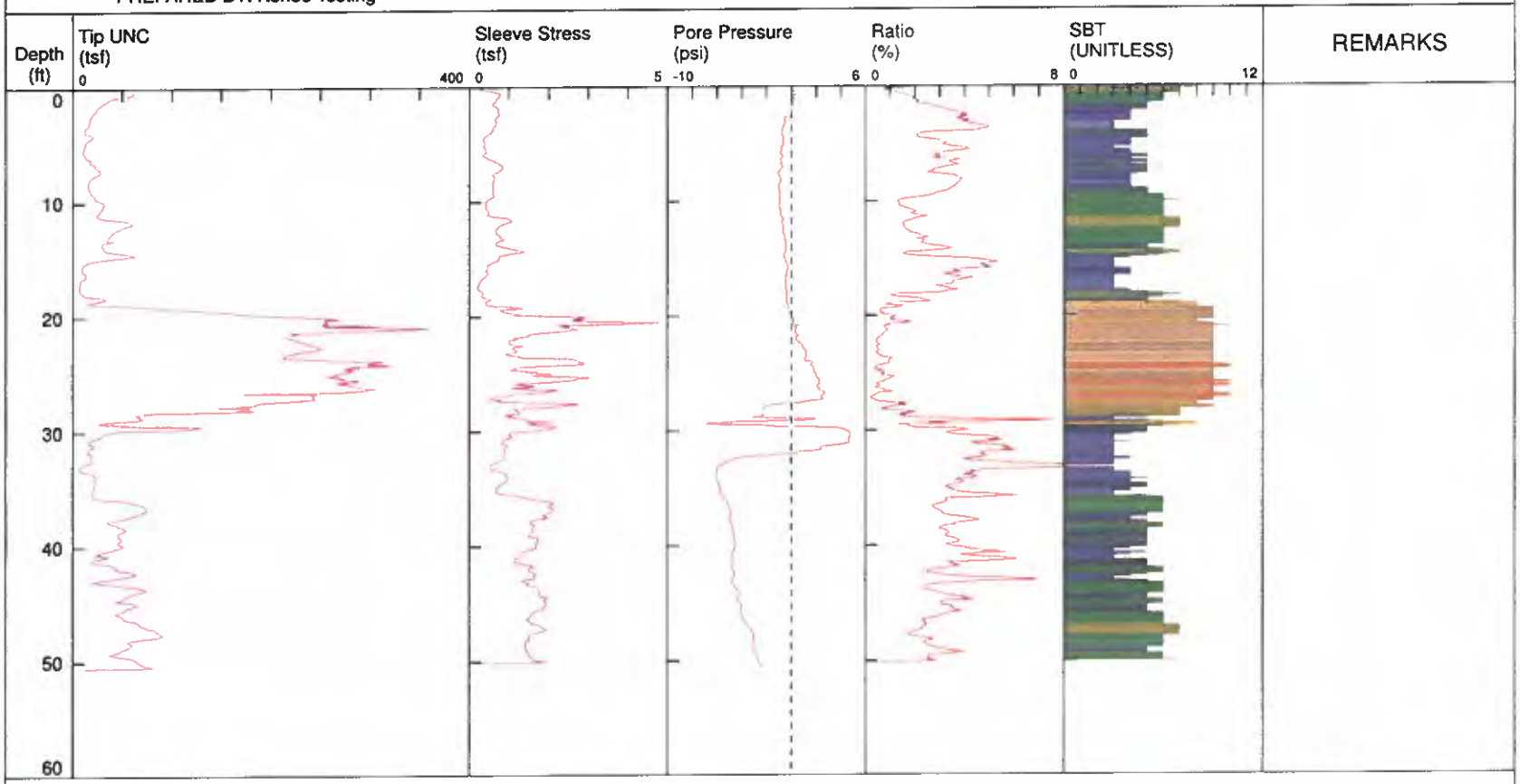
TOTAL DEPTH: 30.218 ft

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 (*)

*SBT/SPT CORRELATION: UBC-1983

"Field Plots"

TEST ID: CPT-5
TEST DATE: Mon 11/Sep/2017
LOCATION: SanJuanCapistrano
CLIENT: G.A. Nicoll & Associates, Inc.
PREPARED BY: Kehoe Testing



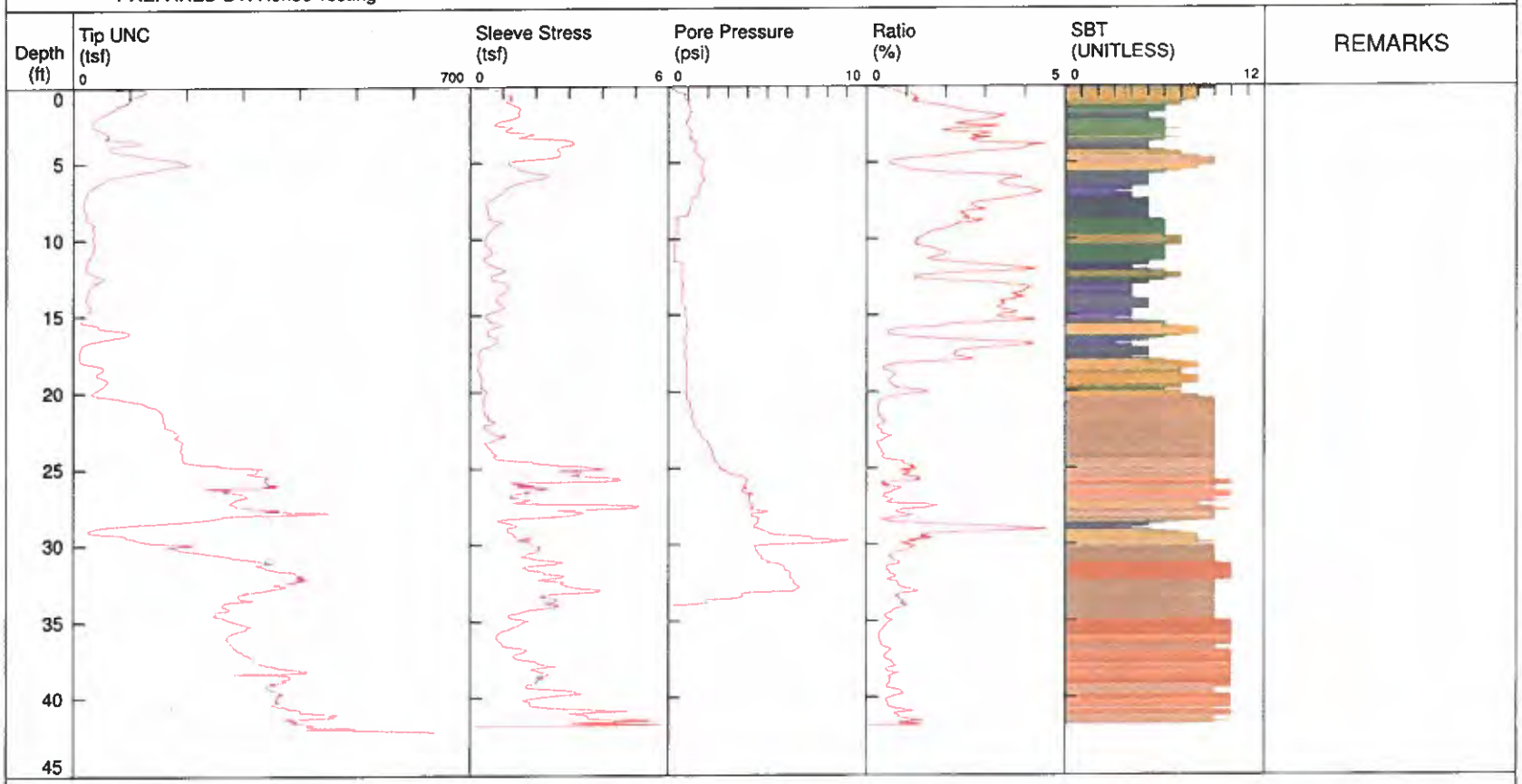
TOTAL DEPTH: 15.381 m

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 (*)

*SBT/SPT CORRELATION: UBC-1983

"Field Plots"

TEST ID: CPT-6
TEST DATE: Mon 11/Sep/2017
LOCATION: SanJuanCapistrano
CLIENT: G.A. Nicoll & Associates, Inc.
PREPARED BY: Kehoe Testing



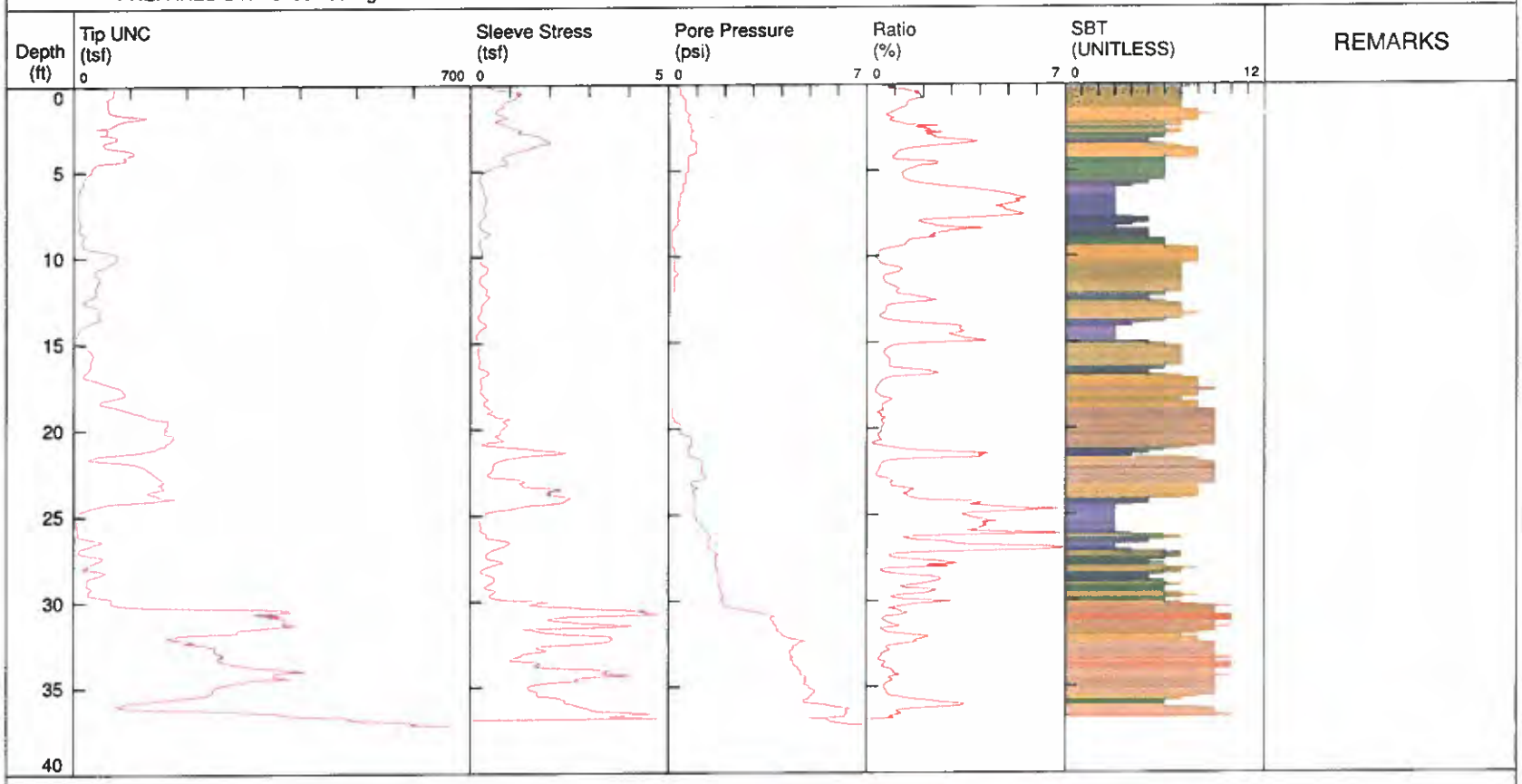
TOTAL DEPTH: 42.130 ft

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 (*)

*SBT/SPT CORRELATION: UBC-1983

"Field Plots"

TEST ID: CPT-8
TEST DATE: Mon 11/Sep/2017
LOCATION: SanJuanCapistrano
CLIENT: G.A. Nicoll & Associates, Inc.
PREPARED BY: Kehoe Testing



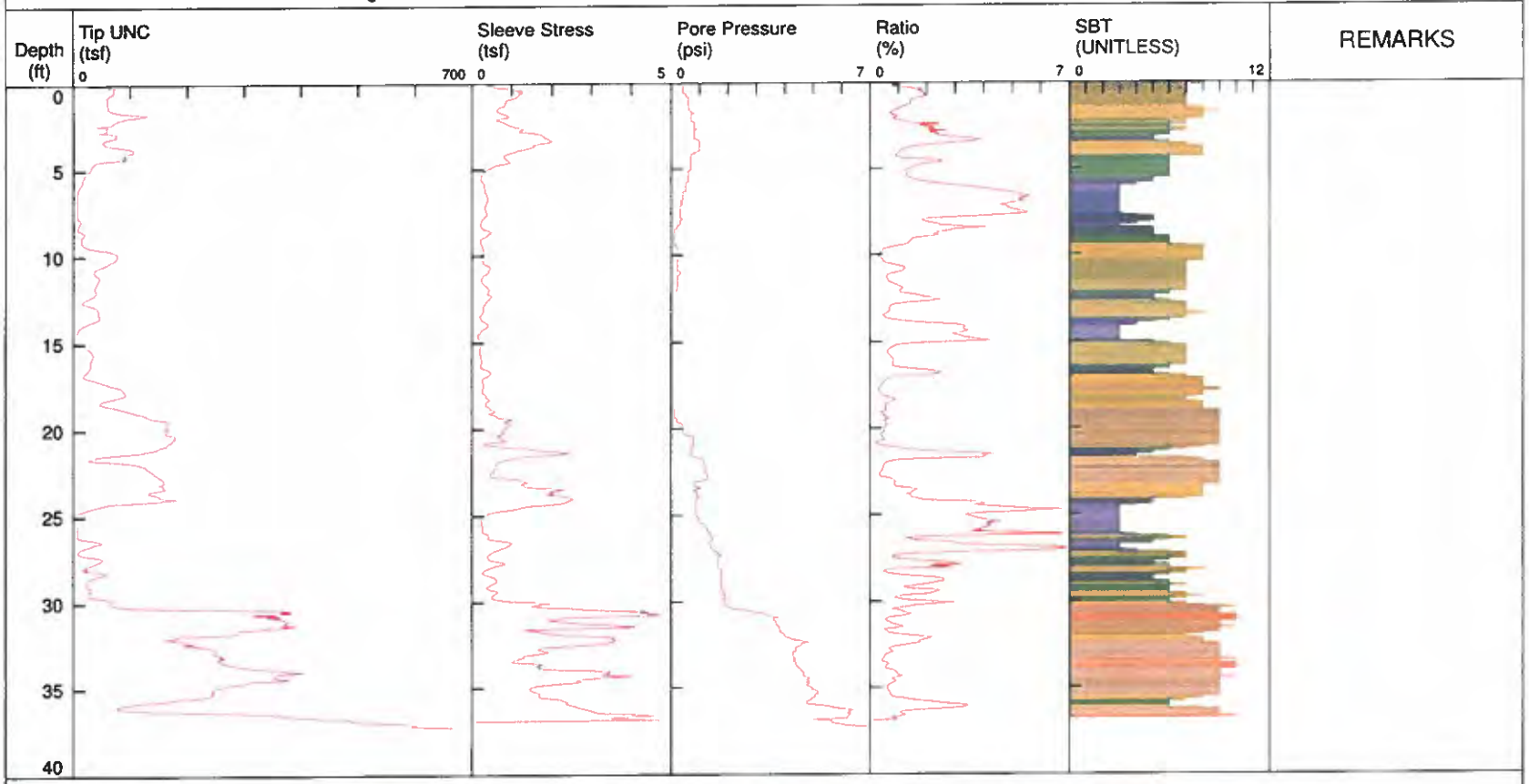
TOTAL DEPTH: 37.212 ft

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 (*)

*SBT/SPT CORRELATION: UBC-1983

"Field Plots"

TEST ID: CPT-8
TEST DATE: Mon 11/Sep/2017
LOCATION: SanJuanCapistrano
CLIENT: G.A. Nicoli & Associates, Inc.
PREPARED BY: Kehoe Testing



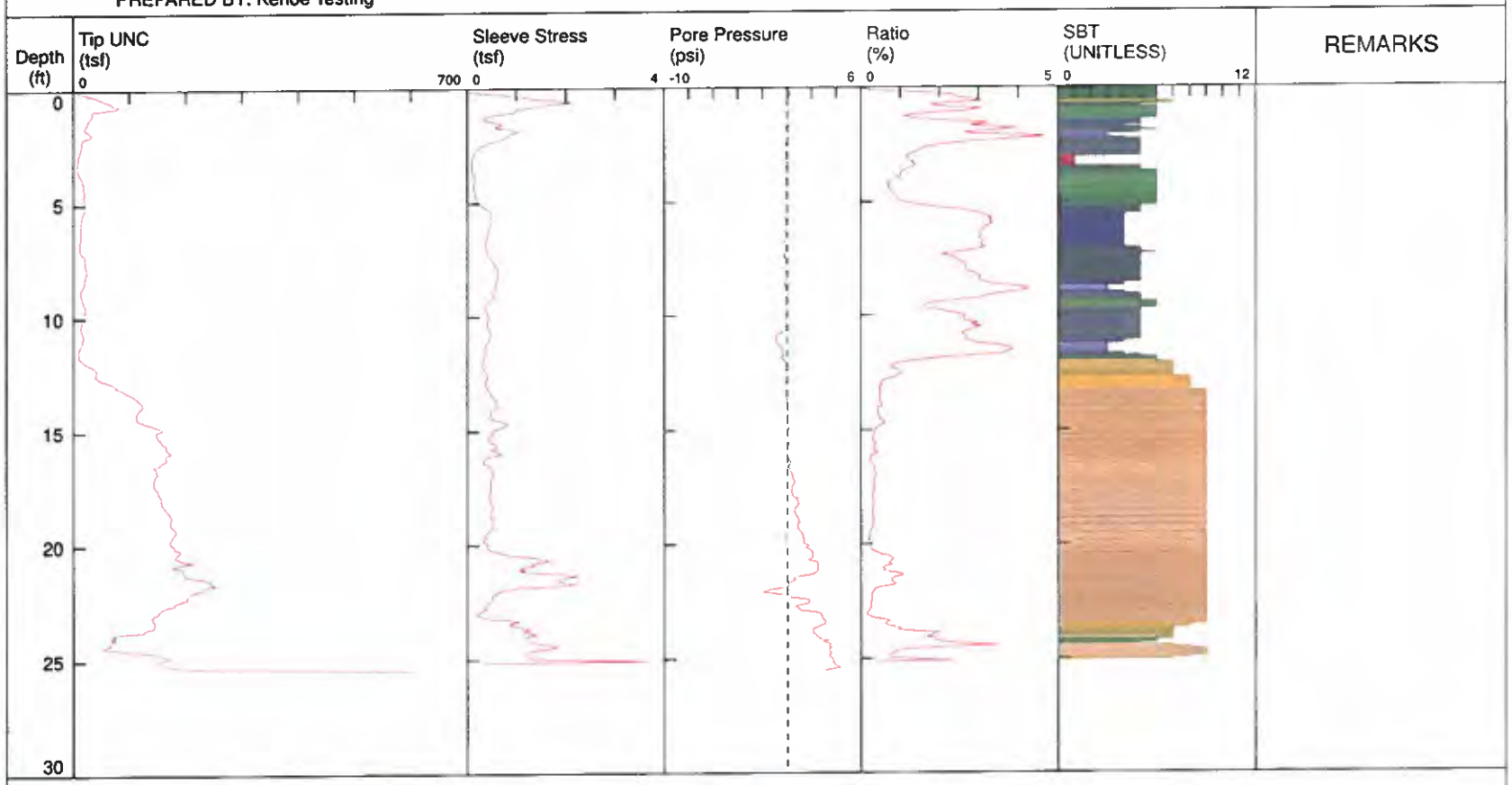
TOTAL DEPTH: 37.212 ft

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 (*)

*SBT/SPT CORRELATION: UBC-1983

"Field Plots"

TEST ID: CPT-9
TEST DATE: Mon 11/Sep/2017
LOCATION: SanJuanCapistrano
CLIENT: G.A. Nicoll & Associates, Inc.
PREPARED BY: Kehoe Testing



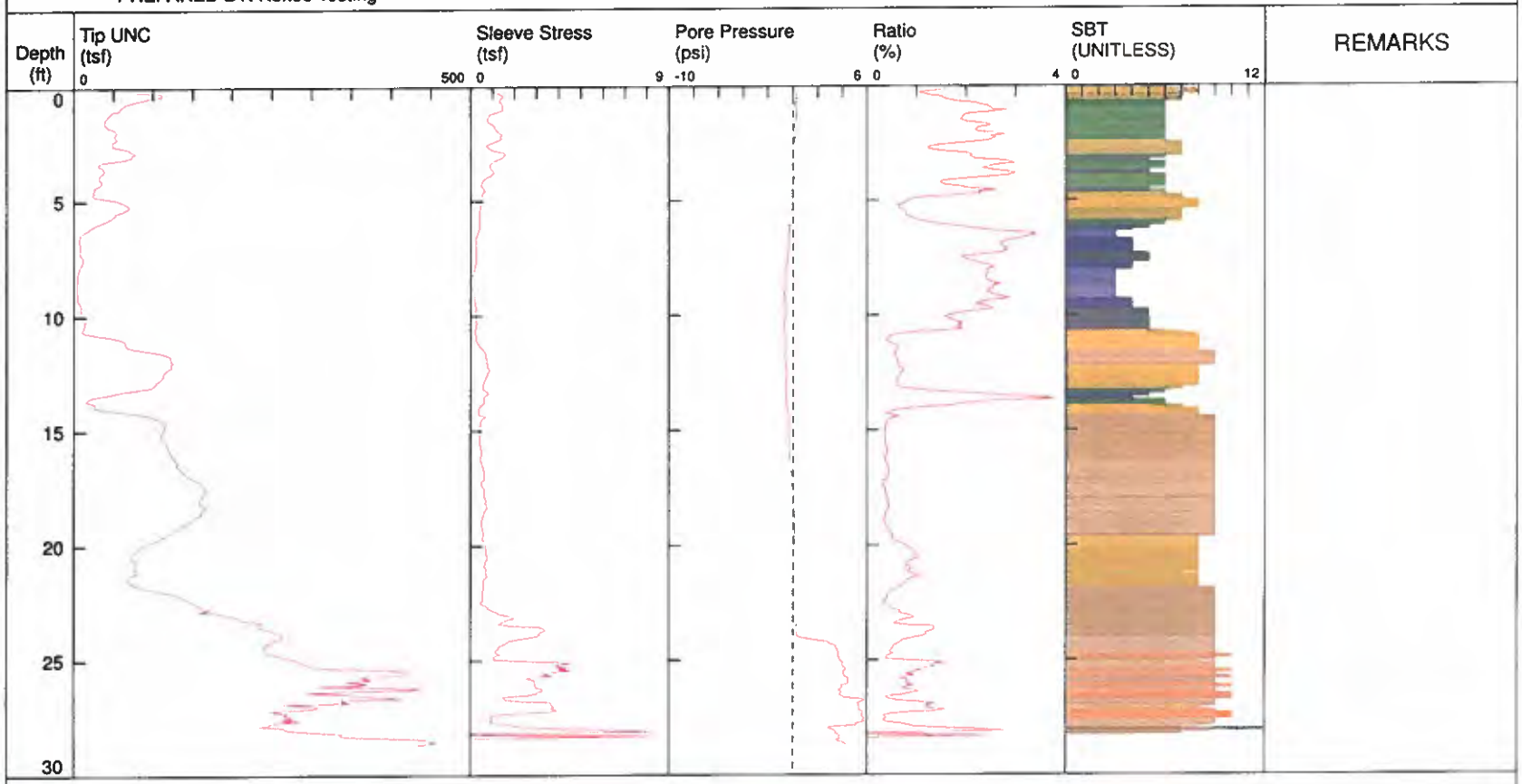
TOTAL DEPTH: 25.471 ft

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 (*)

*SBT/SPT CORRELATION: UBC-1983

"Field Plots"

TEST ID: CPT-10
TEST DATE: Mon 11/Sep/2017
LOCATION: SanJuanCapistrano
CLIENT: G.A. Nicoli & Associates, Inc.
PREPARED BY: Kehoe Testing



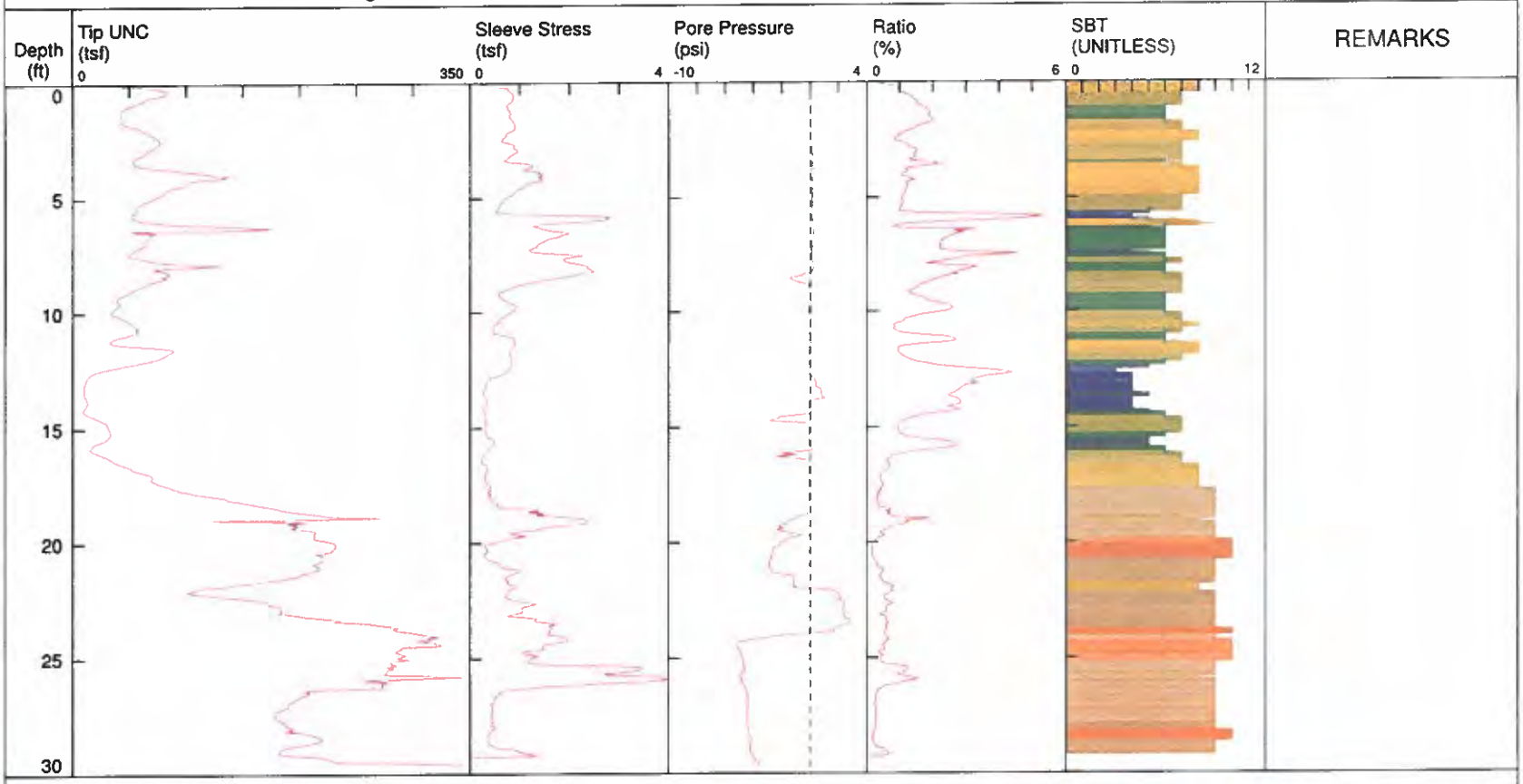
TOTAL DEPTH: 28.680 ft

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 (*)

*SBT/SPT CORRELATION: UBC-1983

"Field Plots"

TEST ID: CPT-11
TEST DATE: Mon 11/Sep/2017
LOCATION: SanJuanCapistrano
CLIENT: G.A. Nicoll & Associates, Inc.
PREPARED BY: Kehoe Testing



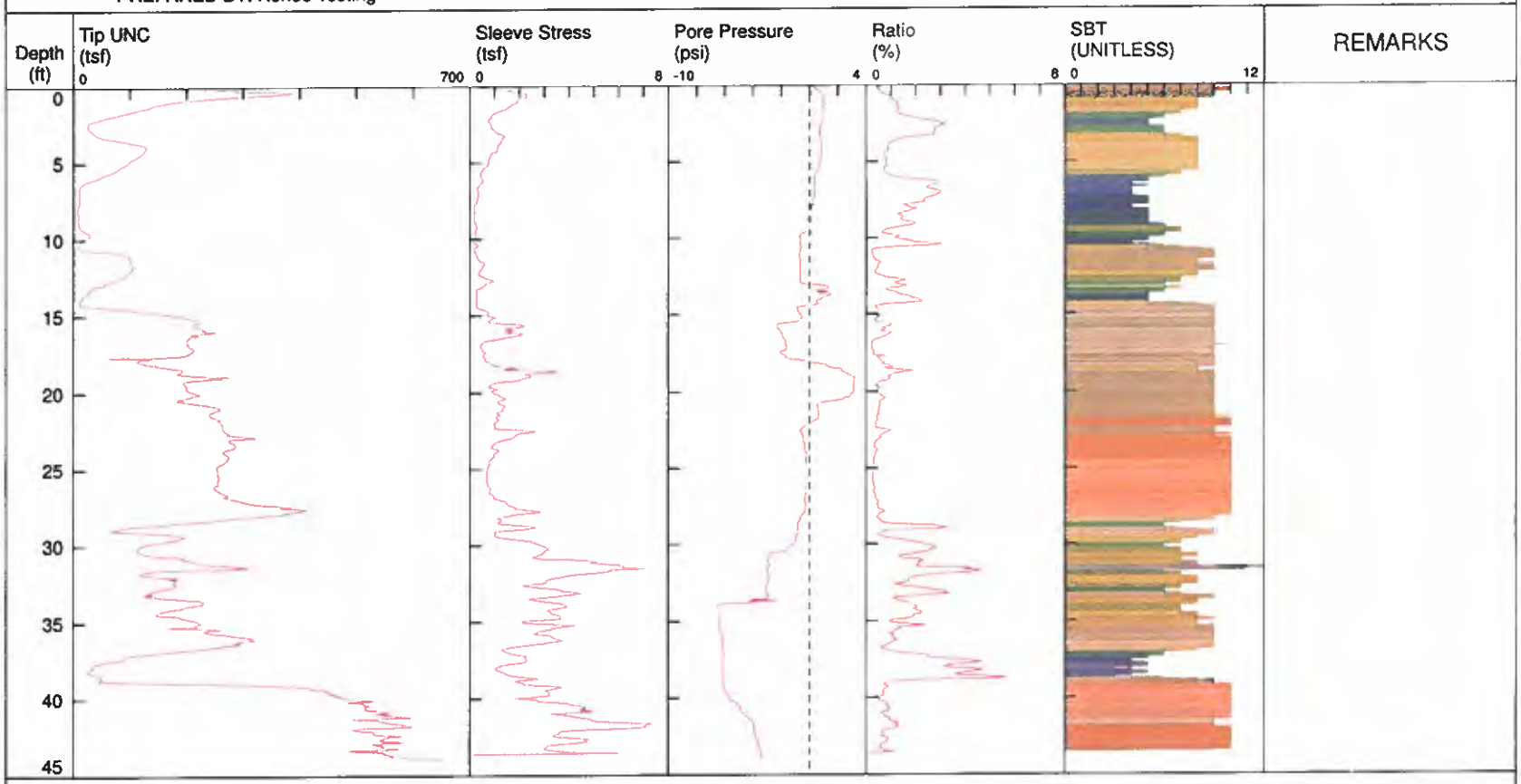
TOTAL DEPTH: 29.597 ft

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 (*)

*SBT/SPT CORRELATION: UBC-1983

"Field Plots"

TEST ID: CPT-7
TEST DATE: Mon 11/Sep/2017
LOCATION: SanJuanCapistrano
CLIENT: G.A. Nicoll & Associates, Inc.
PREPARED BY: Kehoe Testing



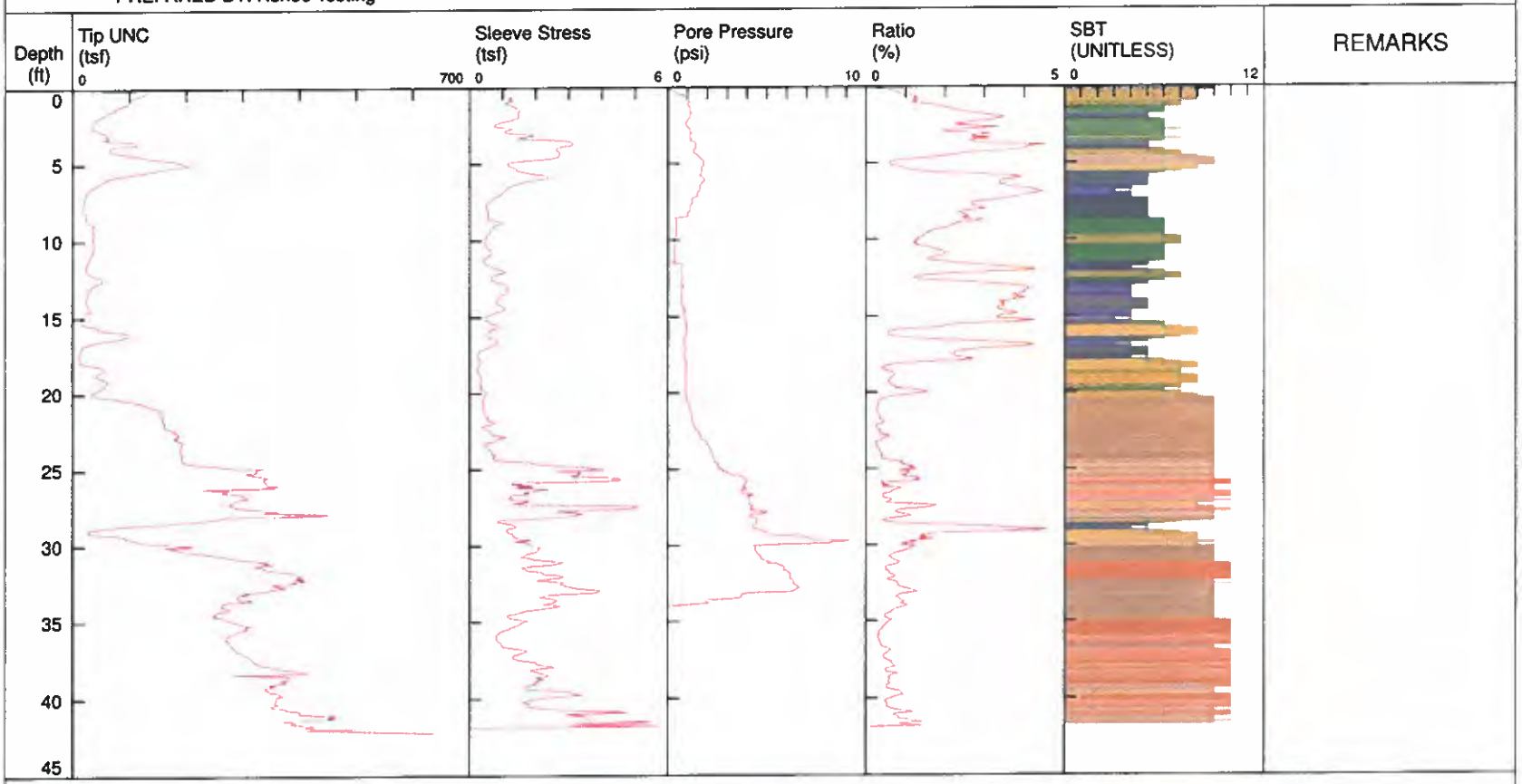
TOTAL DEPTH: 43.902 ft

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 (*)

*SBT/SPT CORRELATION: UBC-1983

"Field Plots"

TEST ID: CPT-6
TEST DATE: Mon 11/Sep/2017
LOCATION: SanJuanCapistrano
CLIENT: G.A. Nicoli & Associates, Inc.
PREPARED BY: Kehoe Testing



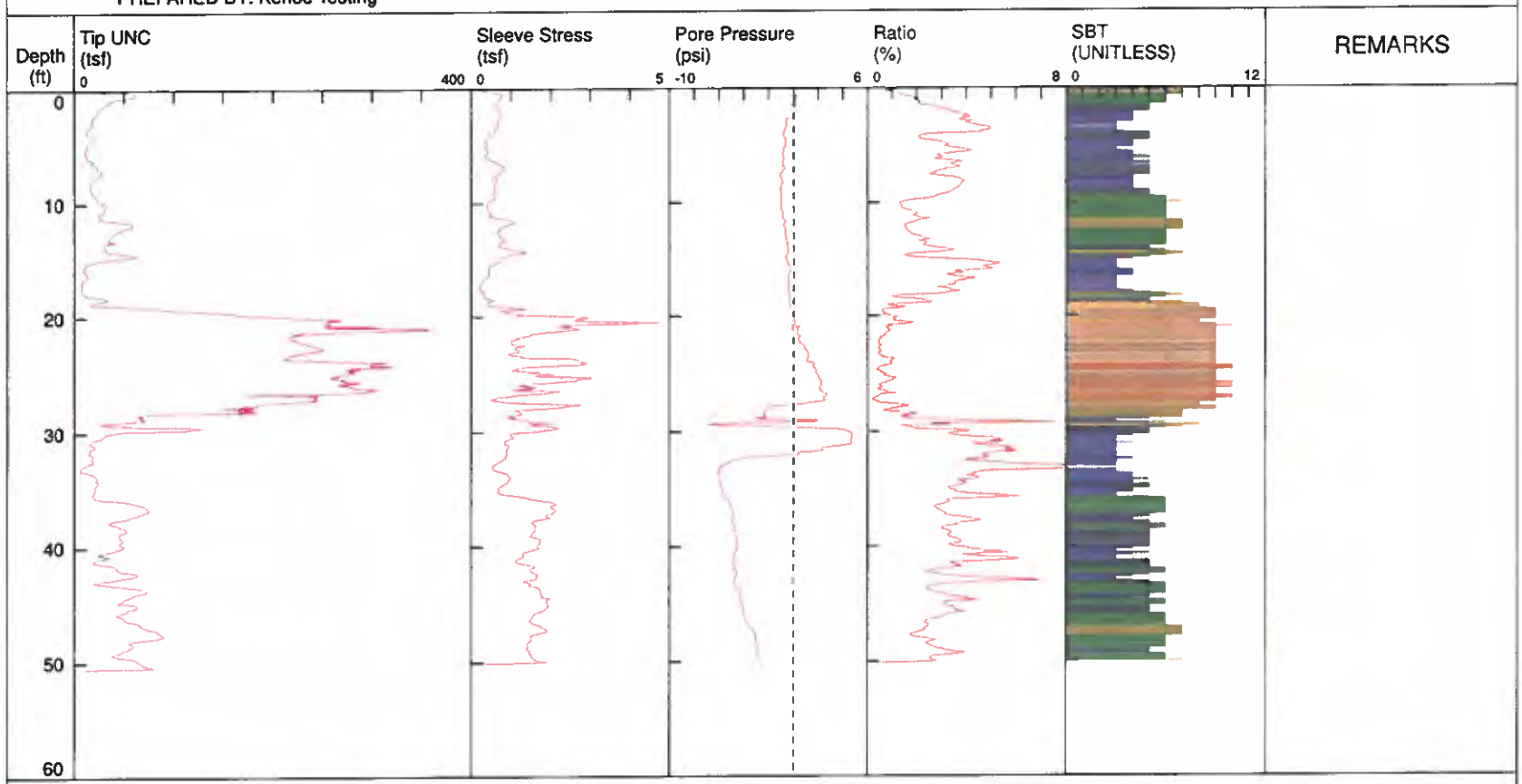
TOTAL DEPTH: 42.130 ft

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 (*)

*SBT/SPT CORRELATION: UBC-1983

"Field Plots"

TEST ID: CPT-5
TEST DATE: Mon 11/Sep/2017
LOCATION: SanJuanCapistrano
CLIENT: G.A. Nicoll & Associates, Inc.
PREPARED BY: Kehoe Testing



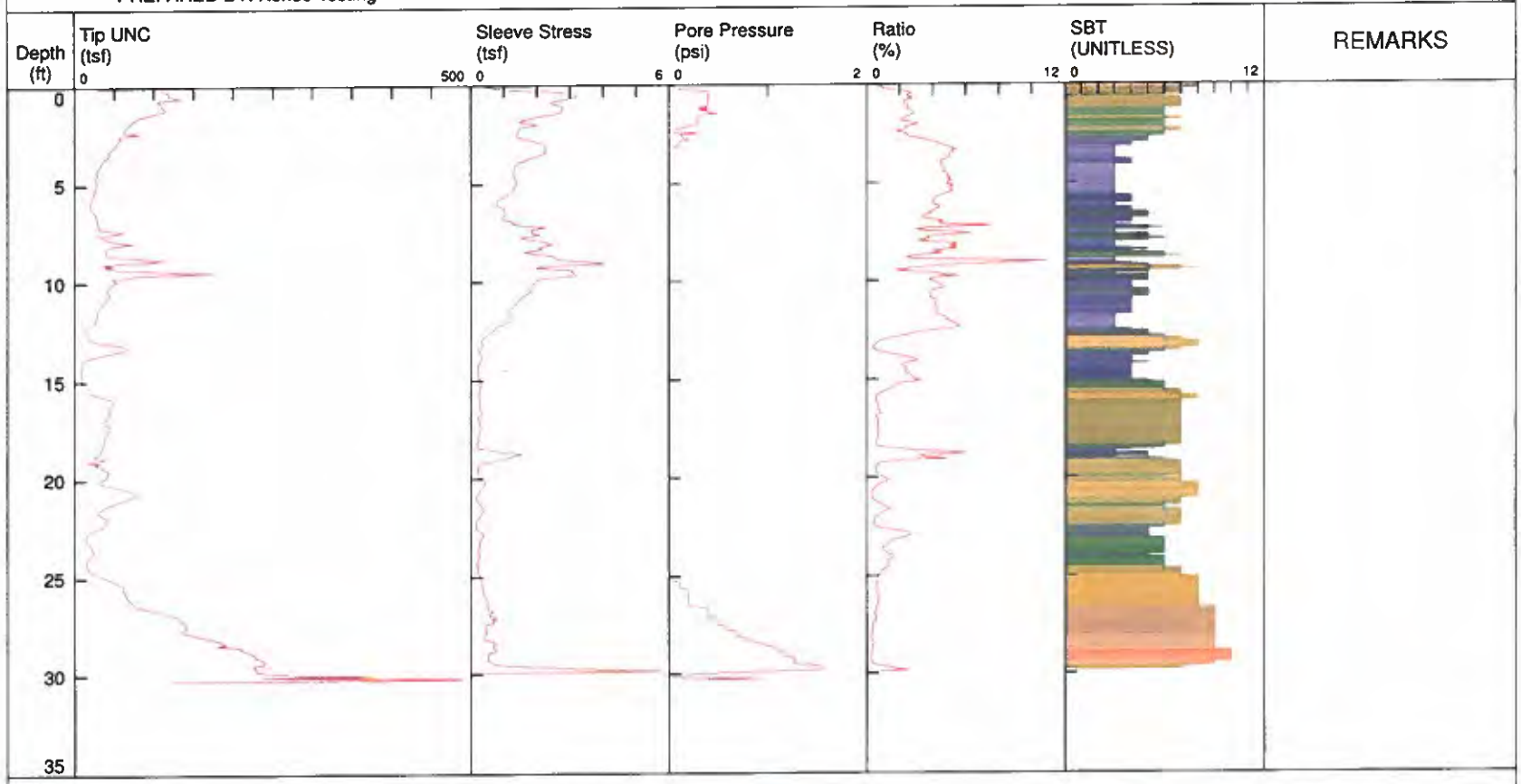
TOTAL DEPTH: 15.381 m

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 (*)

*SBT/SPT CORRELATION: UBC-1983

"Field Plots"

TEST ID: CPT-4
TEST DATE: Mon 11/Sep/2017
LOCATION: SanJuanCapistrano
CLIENT: G.A. Nicoll & Associates, Inc.
PREPARED BY: Kehoe Testing



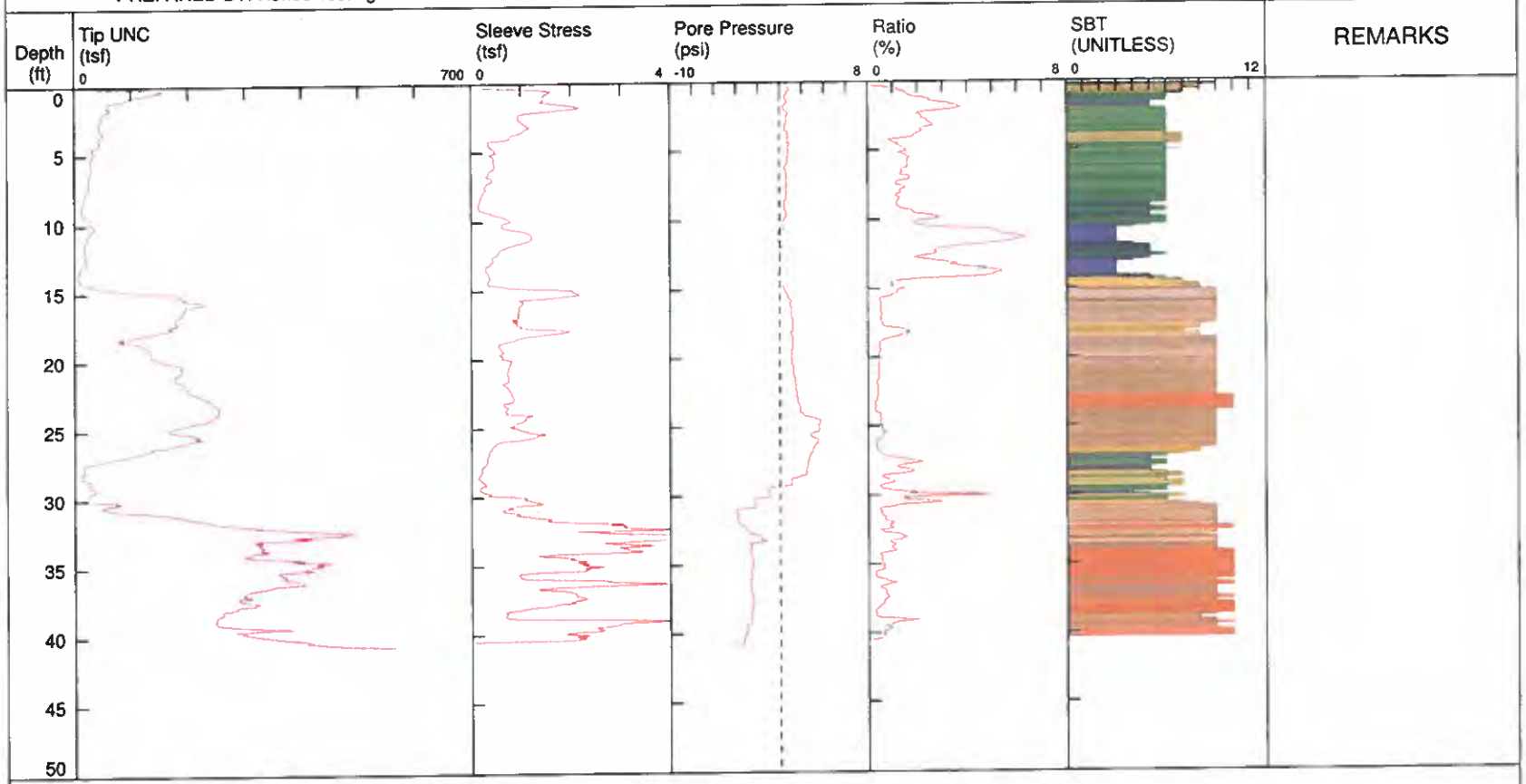
TOTAL DEPTH: 30.218 ft

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 (*)

*SBT/SPT CORRELATION: UBC-1983

"Field Plots"

TEST ID: CPT-3
TEST DATE: Mon 11/Sep/2017
LOCATION: SanJuanCapistrano
CLIENT: G.A. Nicoll & Associates, Inc.
PREPARED BY: Kehoe Testing



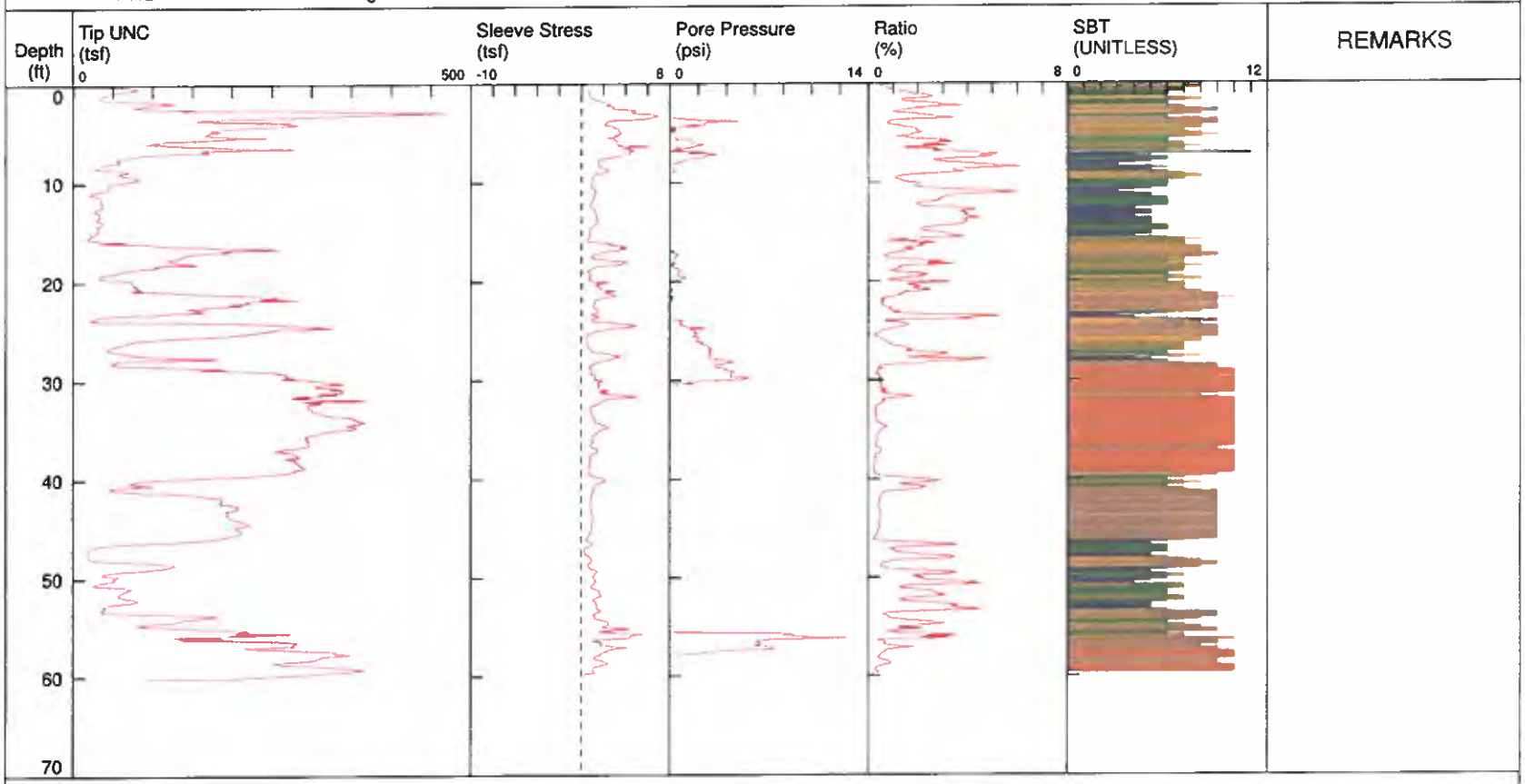
TOTAL DEPTH: 40.749 ft

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 (*)

*SBT/SPT CORRELATION: UBC-1983

"Field Plots"

TEST ID: CPT-1
TEST DATE: Mon 11/Sep/2017
LOCATION: SanJuanCapistrano
CLIENT: G.A. Nicoll & Associates, Inc.
PREPARED BY: Kehoe Testing



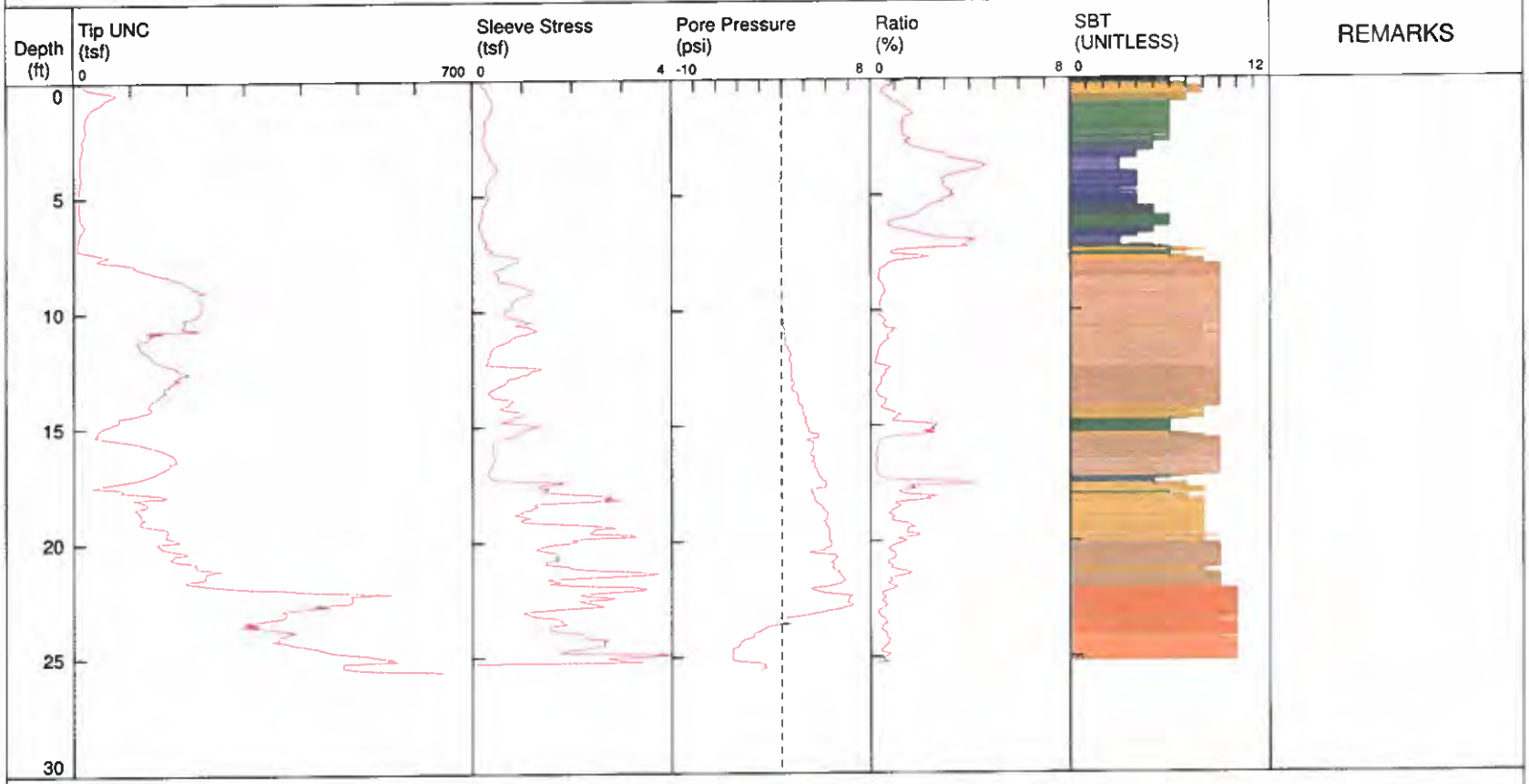
TOTAL DEPTH: 18.309 m

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 (*)

*SBT/SPT CORRELATION: UBC-1983

"Field Plots"

TEST ID: CPT-2
TEST DATE: Mon 11/Sep/2017
LOCATION: SanJuanCapistrano
CLIENT: G.A. Nicoll & Associates, Inc.
PREPARED BY: Kehoe Testing



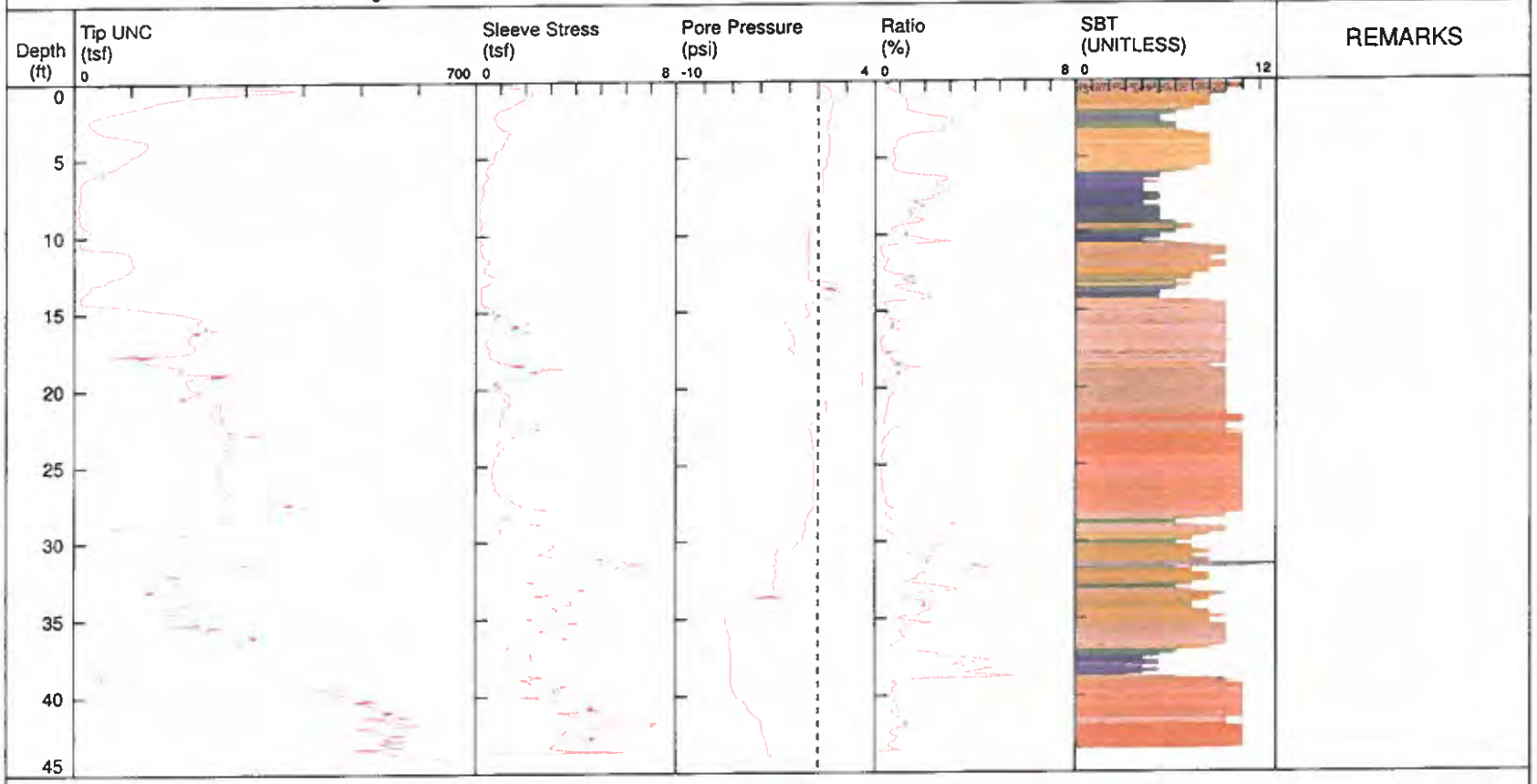
TOTAL DEPTH: 7.803 m

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 (*)

*SBT/SPT CORRELATION: UBC-1983

"Field Plots"

TEST ID: CPT-7
TEST DATE: Mon 11/Sep/2017
LOCATION: SanJuanCapistrano
CLIENT: G.A. Nicoll & Associates, Inc.
PREPARED BY: Kehoe Testing



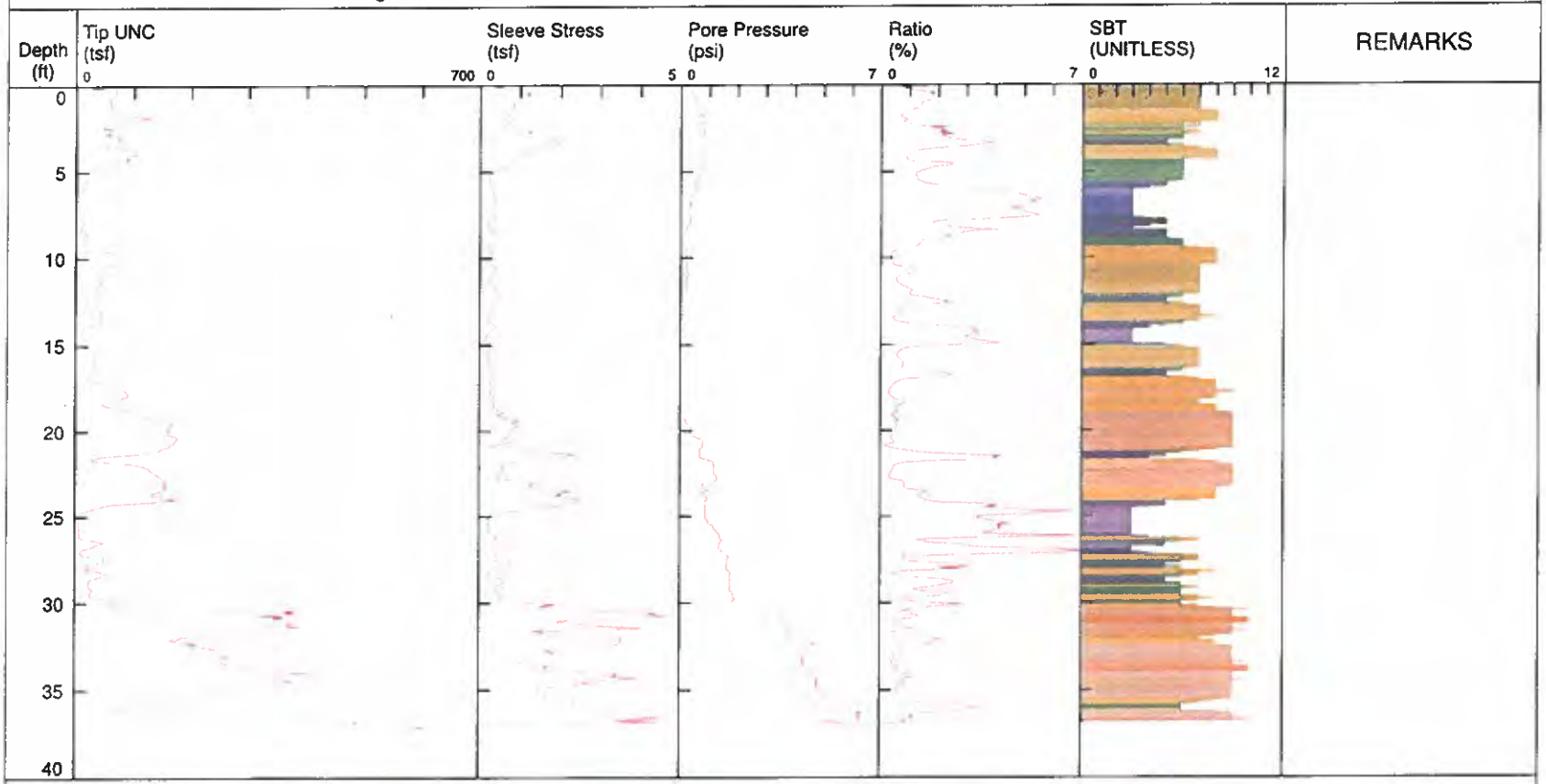
TOTAL DEPTH: 43.902 ft

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 (*)

*SBT/SPT CORRELATION: UBC-1983

"Field Plots"

TEST ID: CPT-8
TEST DATE: Mon 11/Sep/2017
LOCATION: SanJuanCapistrano
CLIENT: G.A. Nicoll & Associates, Inc.
PREPARED BY: Kehoe Testing



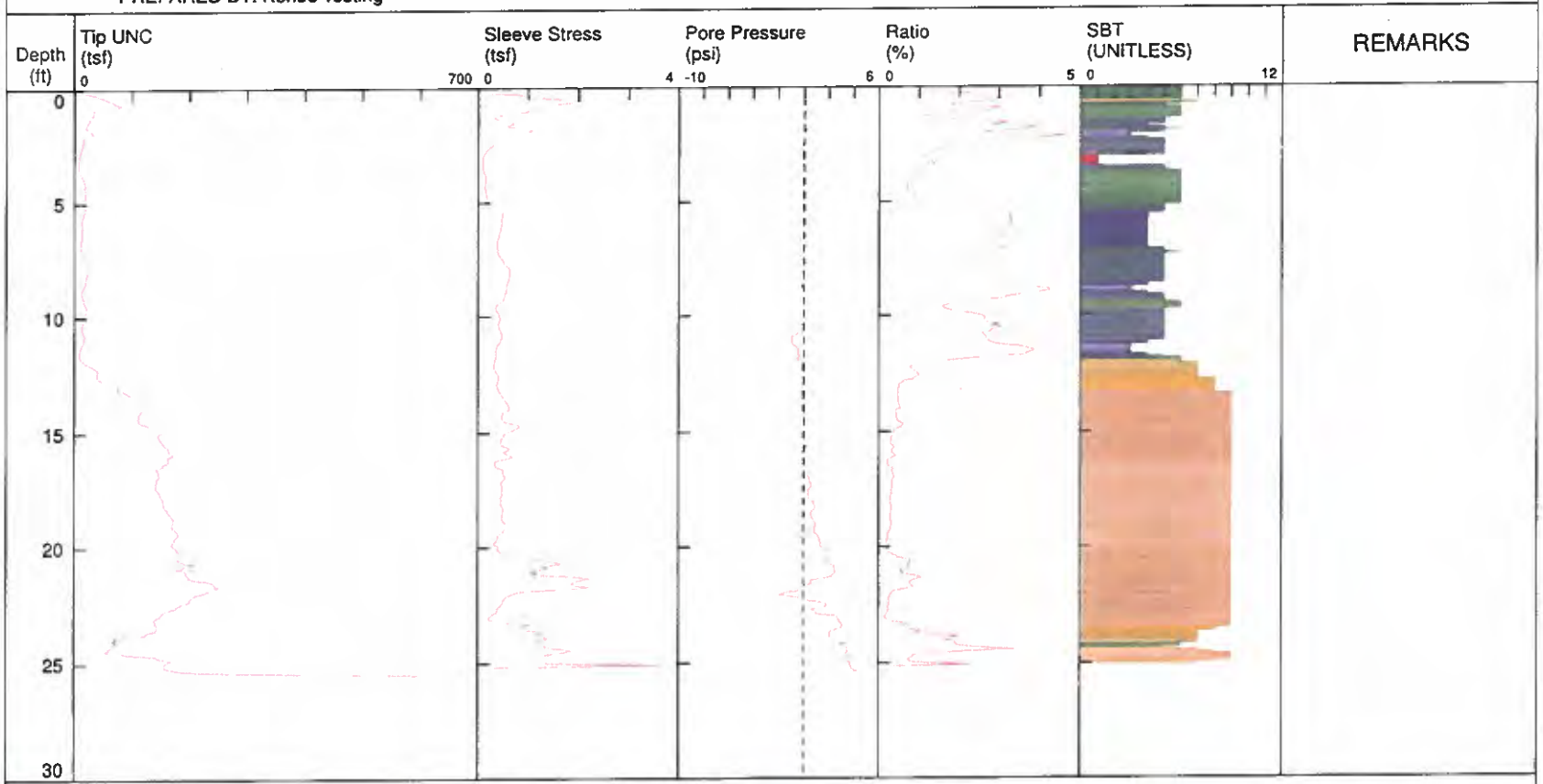
TOTAL DEPTH: 37.212 ft

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 (*)

*SBT/SPT CORRELATION: UBC-1983

"Field Plots"

TEST ID: CPT-9
TEST DATE: Mon 11/Sep/2017
LOCATION: SanJuanCapistrano
CLIENT: G.A. Nicoll & Associates, Inc.
PREPARED BY: Kehoe Testing



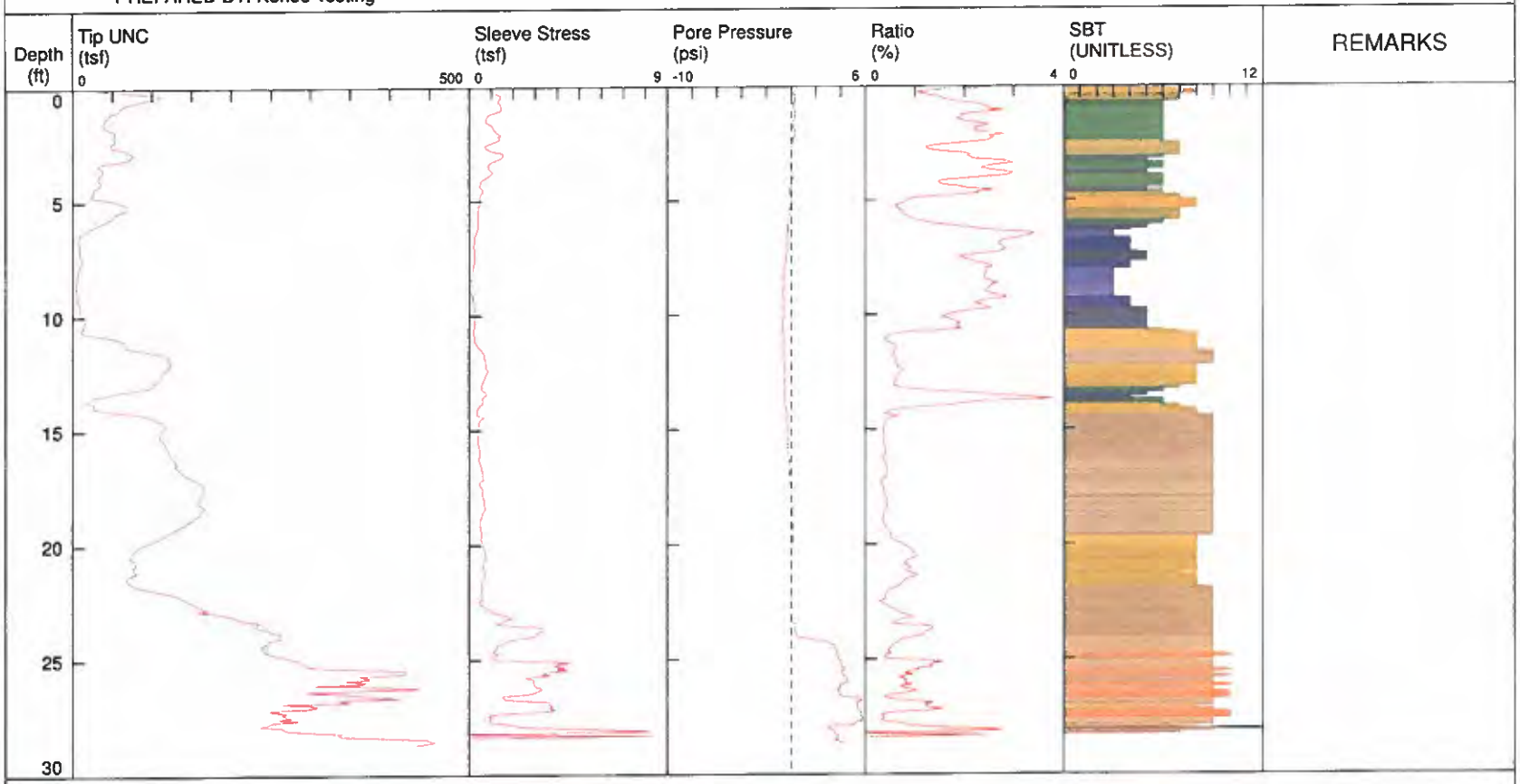
TOTAL DEPTH: 25.471 ft

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 (*)

*SBT/SPT CORRELATION: UBC-1983

"Field Plots"

TEST ID: CPT-10
TEST DATE: Mon 11/Sep/2017
LOCATION: SanJuanCapistrano
CLIENT: G.A. Nicoll & Associates, Inc.
PREPARED BY: Kehoe Testing



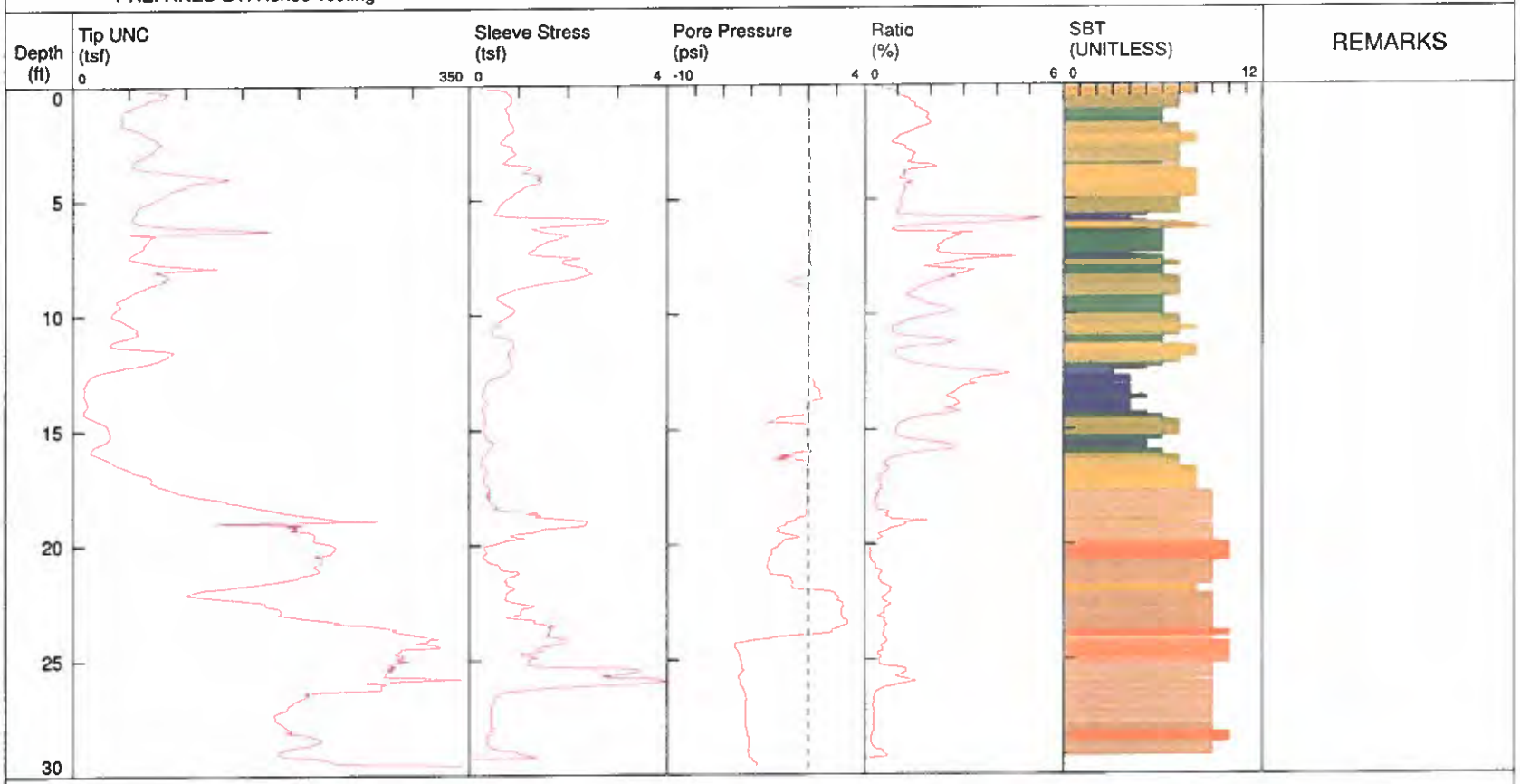
TOTAL DEPTH: 28.680 ft

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 (*)

*SBT/SPT CORRELATION: UBC-1983

"Field Plots"

TEST ID: CPT-11
TEST DATE: Mon 11/Sep/2017
LOCATION: SanJuanCapistrano
CLIENT: G.A. Nicoll & Associates, Inc.
PREPARED BY: Kehoe Testing



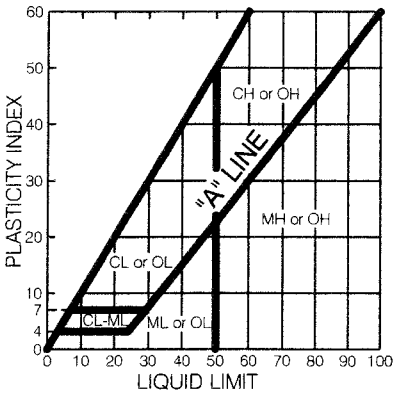
TOTAL DEPTH: 29.597 ft

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 (*)

*SBT/SPT CORRELATION: UBC-1983

UNIFIED SOIL CLASSIFICATION

PT	OH	CH	MH	OL	CL	ML	SC	SM	SP	SW	GC	GM	GP	GW
Highly organic soils	Silts and clays Liquid limit ≥50			Silts and clays Liquid limit <50			Sands with fines >12% fines		Clean sands <5% fines		Gravels with fines >12% fines		Clean gravels <5% fines	
							Sands-more than 50% of coarse fraction is smaller than No.4 sieve				Gravels-more than 50% of coarse fraction is larger than No. 4 sieve			
Fine grained soils (More than 50% is smaller than 200 sieve)							Coarse grained soils (More than 50% is larger than No. 200 sieve)							



LABORATORY CLASSIFICATION CRITERIA

$$Cu = \frac{D_{60}}{D_{10}} \qquad Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$$

GW if $Cu \geq 4$ and $1 \leq Cc \leq 3$
SW if $Cu \geq 6$ and $1 \leq Cc \leq 3$

GP and SP - Clean gravel or sand not meeting requirements for GW and SW.
GM and SM - Atterburg limits below "A" line or P.I. less than 4.
GC and SC - Atterburg limits above "A" line and P.I. greater than 7.

FINES (silt or clay)	Fine sand	Medium sand	Coarse sand	Fine gravel	Coarse gravel	Cobbles	Boulders
Sieve sizes	200	40	10	4	3/4"	3"	12"

Classification of earth materials shown on this sheet is based on field inspection and should not be construed to imply laboratory analysis unless so stated.

MATERIAL SYMBOLS

- ASPHALT
- CONCRETE
- CLAYSTONE
- CLAYEY SANDSTONE
- CLAYEY SILTSTONE
- INTERBEDDED LIMESTONE AND SHALE
- LIMESTONE
- SANDY CLAYSTONE
- SANDSTONE
- SANDY SILTSTONE
- SILTSTONE
- SILTY CLAYSTONE
- SILTY SANDSTONE
- INTRUSIVE IGNEOUS ROCK
- EXTRUSIVE IGNEOUS ROCK
- CONGLOMERATE
- BRECCIA
- METAMORPHIC ROCK

RELATIVE DENSITY AND CONSISTENCY CLASSIFICATION

(ACCORDING TO STANDARD PENETRATION TEST)

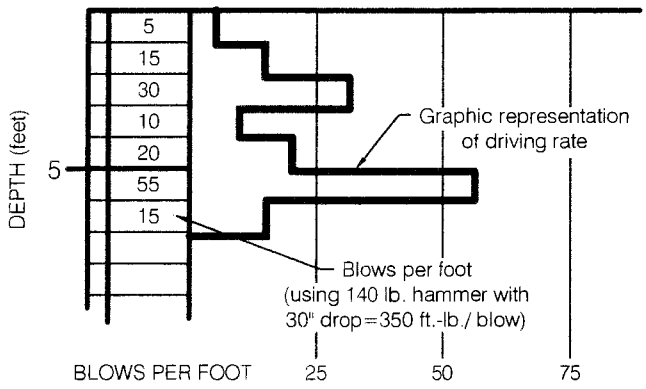
GRANULAR

Consistency	Blows/Foot
Very loose	0 - 4
Loose	5 - 10
Medium dense	11 - 30
Dense	31 - 50
Very dense	Over 50

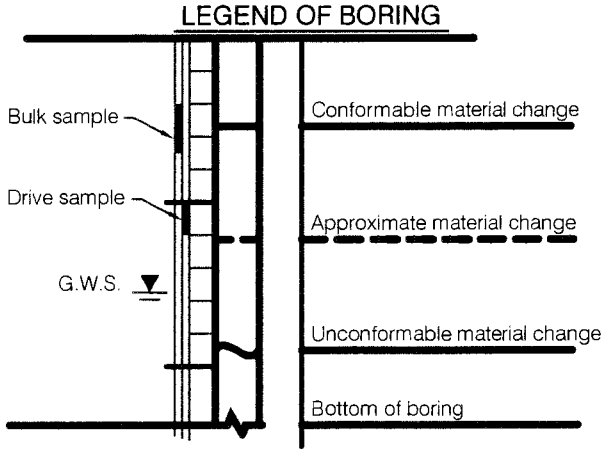
COHESIVE

Consistency	Blows/Foot
Very soft	Under 2
Soft	2 - 4
Firm	5 - 8
Stiff	9 - 15
Very stiff	16 - 30
Hard	Over 30

LEGEND OF PENETRATION INDEX



LEGEND OF BORING



AMEC Earth & Environmental, Inc.

TEST BORING LOG

TYPE **8" DIA. HOLLOW STEM AUGER** | ELEVATION **39.8 FEET** | BORING **B-01**

LAB TESTING	RELATIVE COMPACTION	DRY DENSITY (lbs/cu.ft.)	MOISTURE (%)	BLOWS/FOOT	SAMPLE SIZE (INCHES)	SAMPLE NO.	DEPTH IN FEET	MATERIAL SYMBOL	UNIFIED SOIL CLASS.	
PA, SE, SS					BAG	1		SM SP		**ARTIFICIAL FILL - LEVEE (afc):** Mottled brown and gray, poorly graded SAND with SILT and GRAVEL up to 1 inch in diameter
				45	1.4	2				. . . (2.5 feet) GRAVEL up to 3/4 inch in diameter, subrounded, dense
DS		121.8	3.3	51	2.4	3	5	SM		Gray SILTY SAND with GRAVEL up to 3 inches in diameter, subrounded
				54	1.4	4				. . . (7 feet) becoming more GRAVELLY with small COBBLES up to 4 inches
		116.2	6.5	55	2.4	5	10	SM		. . . (7.5 feet) GRAVEL up to 2 inches in diameter, subrounded, very dense
				32	1.4	6				**ALLUVIUM (Qal):** Gray, medium to coarse grained SILTY SAND
PA		111.9	14.7	27	2.4	7	15	SC		. . . (12.5 feet) mottled brown to gray, GRAVEL up to 1/2 inch in diameter, subrounded, red staining, dense
				8	1.4	8		SM		Mottled brown to dark green CLAYEY SAND, fines are medium plastic
CR, CH					BAG	9				Mottled gray to brown, fine grained SILTY SAND, vertical rootlets approximately 1/8 inch in diameter, loose
		112	3.9	32	2.4	10	20 ▼			. . . (20 feet) coarse grained
FC				17	1.4	11		SP		Gray, poorly graded, coarse grained SAND, medium dense
		119.8	13.1	51	2.4	12	25	SP SM		Gray, poorly graded, coarse grained SAND with SILT
PI			8.7	7	1.4	13		CL ML		Dark green SILTY CLAY, low plasticity, firm
		118.9	14.5	9	2.4	14	30	SM		Dark gray, fine grained SILTY SAND, nonplastic
				26	1.4	15	35	SP		Gray and brown, poorly graded SAND with GRAVEL up to 1/2 inch in diameter, subrounded, medium dense
		112.2	17.4	53	2.4	16	40			. . . (40 feet) coarse grained
				18	1.4	17	45			. . . (45 feet) medium grained, medium dense
							50			

Continued

THIS BORING LOG SUMMARY APPLIES ONLY AT THE TIME AND LOCATION INDICATED. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND TIMES.

LOGGED BY **B.J./M.V.** | DATE **12-8-09**

AMEC Earth & Environmental, Inc.

TEST BORING LOG

TYPE	8" DIA. HOLLOW STEM AUGER	ELEVATION	39.8 FEET	BORING	B-01

LAB TESTING	RELATIVE COMPACTION	DRY DENSITY (lbs/cu.ft.)	MOISTURE (%)	BLOWS/FOOT	SAMPLE SIZE (INCHES)	SAMPLE NO.	DEPTH IN FEET	MATERIAL SYMBOL	UNIFIED SOIL CLASS.	
		113.6	16.3	93/11"	2.4	18				. . . (50 feet) coarse grained, feldspar crystals
				31	1.4	19	55			. . . (55 feet) medium grained, dense
		129.4	11.9	52	2.4	20	60		SM	Gray and brown, coarse grained SILTY SAND with GRAVEL up to 1/2 inch diameter
				36	1.4	21	65		SP SM	Gray, poorly graded, fine to medium grained SAND with SILT and GRAVEL up to 1/2 inch in diameter, dense
		135.5	7.6	99/9"	2.4	22	70		SM	Gray SILTY SAND with GRAVEL up to 1-1/2 inch in diameter, angular
				50/5"	1.4	23	75		ML	Gray, very fine grained SANDY SILT, non-plastic, hard
		125.3	10.8	47	2.4	24	80		SM	. . . (80 feet) gray, coarse grained SILTY SAND with GRAVEL up to 1-1/2 inch in diameter, angular

NOTES:

1. Total depth of boring 81.5 feet.
2. Groundwater encountered at 20.5 feet during drilling.
3. Boring elevation based on plans provided by Orange County Surveyor, dated January 5, 2010.
4. Boring backfilled with cement bentonite slurry on December 8, 2009.

THIS BORING LOG SUMMARY APPLIES ONLY AT THE TIME AND LOCATION INDICATED. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND TIMES.

LOGGED BY **B.J./M.V.** DATE **12-8-09**

AMEC Earth & Environmental, Inc.

TEST BORING LOG

TYPE **8" DIA. HOLLOW STEM AUGER** | ELEVATION **41.8 FEET** | BORING **B-02**

LAB TESTING	RELATIVE COMPACTION	DRY DENSITY (lbs/cu.ft.)	MOISTURE (%)	BLOWS/FOOT	SAMPLE SIZE (INCHES)	SAMPLE NO.	DEPTH IN FEET	MATERIAL SYMBOL	UNIFIED SOIL CLASS.	
EI					BAG	1			SM	**ARTIFICIAL FILL - LEVEE (afc):** Gray SILTY SAND with GRAVEL up to 3/4 inch
		121.9	3.5	79/11"	2.4	2				. . . (2.5 feet) brown GRAVEL, subrounded
				53	1.4	3	5			. . . (5 feet) mix of angular and subrounded GRAVEL, very dense
DS		119.4	3.1	32	2.4	4			SP SM	Gray and brown, poorly graded SAND with SILT and GRAVEL up to 3/4 inch in diameter, subrounded
				15	1.4	5	10		SM	Brown, fine grained SILTY SAND, non-plastic, medium dense
		101.4	12.1	30	2.4	7			SM	**ALLUVIUM (Qal):** Mottled brown and gray, fine grained SILTY SAND, some rootlets,
					BAG	6				non-plastic, minor amount of staining
FC, PI			19.6	8	1.4	8	15		ML	
									CL	Fine grained SANDY SILT, firm
		109.1	4.4	35	2.4	9				Dark green, lean CLAY, some rootlets, firm
									SP SM	Brown, poorly graded, coarse grained SAND with SILT
				9	1.4	10	20 ▼			. . . (20 feet) loose
DS		121.9	11.2	30	2.4	11				
				9	1.4	12	25			. . . (25 feet) loose
		117.1	15.6	35	2.4	13			SM	Gray to brown, coarse grained SILTY SAND with GRAVEL up to 1-1/2 inches in diameter, subrounded
				5	1.4	14	30		SP	Gray, poorly graded, coarse grained SAND, feldspar crystals, loose
		114.2	17.1	50	2.4	15	35			. . . (35 feet) medium to coarse grained
				31	1.4	16	40		SM	Gray SILTY SAND with GRAVEL up to 1/2 inch in diameter, dense
		124.9	14.1	50/4"	2.4	17	45			. . . (45 feet) coarse grained, GRAVEL up to 1-1/2 inch in diameter, subrounded
							50			

Continued

THIS BORING LOG SUMMARY APPLIES ONLY AT THE TIME AND LOCATION INDICATED. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND TIMES.

LOGGED BY **B.J./M.V.** | DATE **12-9-09**

AMEC Earth & Environmental, Inc.

TEST BORING LOG

TYPE **8" DIA. HOLLOW STEM AUGER** | ELEVATION **41.8 FEET** | BORING **B-02**

LAB TESTING	RELATIVE COMPACTION	DRY DENSITY (lbs/cu.ft.)	MOISTURE (%)	BLOWS/FOOT	SAMPLE SIZE (INCHES)	SAMPLE NO.	DEPTH IN FEET	MATERIAL SYMBOL	UNIFIED SOIL CLASS.	
				22	1.4	18				. . . (50 feet) fine grained, non-plastic fines, medium dense
		123.9	12.9	50/6"	2.4	19	55			. . . (55 feet) medium grained, GRAVEL up to 1/2 inch in diameter, subangular
				39	1.4	20	60			. . . (60 feet) fine to medium grained, dense
		123.9	14.7	93	2.4	21	65		SP SM	Gray, poorly graded, medium to coarse grained SAND with SILT and GRAVEL up to 1 inch in diameter
				29	1.4	22	70		SM	Gray, fine grained SILTY SAND, medium dense
		98.2	28.8	41	2.4	23	75		ML	Gray, very fine grained SANDY SILT, fines are non-plastic
			14.3	35	1.4	24	80		CL	Dark green SANDY lean CLAY with GRAVEL up to 1/2 inch in diameter, medium to high plasticity, hard

NOTES:

1. Total depth of boring 81.5 feet.
2. Groundwater encountered at 20 feet during drilling.
3. Boring elevation based on plans provided by Orange County Surveyor, dated January 5, 2010.
4. Boring backfilled with cement bentonite slurry on December 9, 2009.

THIS BORING LOG SUMMARY APPLIES ONLY AT THE TIME AND LOCATION INDICATED. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND TIMES.

LOGGED BY **B.J./M.V.** | DATE **12-9-09**

AMEC Earth & Environmental, Inc.

TEST BORING LOG

TYPE	8" DIA. HOLLOW STEM AUGER	ELEVATION	44 FEET	BORING	B-03

LAB TESTING	RELATIVE COMPACTION	DRY DENSITY (lbs/cu.ft.)	MOISTURE (%)	BLOWS/FOOT	SAMPLE SIZE (INCHES)	SAMPLE NO.	DEPTH IN FEET	MATERIAL SYMBOL	UNIFIED SOIL CLASS.	
MD, SS					BAG	1			SM	**ARTIFICIAL FILL - LEVEE (afc):** Gray SILTY SAND with GRAVEL up to 3/4 inch
				36	1.4	2				. . . (2.5 feet) gray and brown, GRAVEL up to 1 inch in diameter, dense
		117.3	9.4	41	2.4	3	5			. . . (5 feet) becoming more GRAVELLY, subrounded
PA			6.7	14	1.4	4			SC	Mottled brown and dark green, CLAYEY SAND, medium plasticity, some GRAVEL, medium dense
EI					BAG	5				
		124	5.7	63	2.4	6	10		SM CL	Mottled brown and gray, SILTY SAND/SANDY CLAY, some GRAVEL, medium plasticity, some oxidation staining in the SANDY CLAY
				22	1.4	7			SM	Brown SILTY SAND with GRAVEL up to 3/4 inch, angular, medium dense
			2.3	10	2.4	8	15		SM	**ALLUVIUM (Qal):** Mottled brown and gray, SILTY SAND with GRAVEL, oxidation staining, minor amount of rootlets, slight porosity
				10	1.4	9				. . . (17.5 feet) brown, fine grained, non-plastic, loose
PA, DS		93.7	9.4	6	2.4	10	20 ▼		SP	Dark green to brown, poorly graded SAND
				9	1.4	11				. . . (22.5 feet) brown, coarse grained, loose
CR, CH					BAG	12				
		118.9	12.1	11	2.4	13	25			. . . (25 feet) dark brown, GRAVEL up to 1/2 inch in diameter
FC, PI			40.8	2	1.4	14			SM	Dark gray, fine grained SILTY SAND, low-plasticity, very loose
		121.6	16.4	24	2.4	15	30			. . . (30 feet) mottled brown and gray, fine to medium grained, GRAVEL up to 1 inch in diameter, rounded, non-plastic
PA				11	1.4	16	35		SC	Dark gray, medium to coarse grained, CLAYEY SAND, medium to highly plastic, medium dense
		130.2	9.6	47	2.4	17	40		SP SM	Gray, poorly graded, coarse grained SAND with SILT, minor amount of GRAVEL up to 1/2 inch in diameter
				29	1.4	18	45			. . . (45 feet) dark gray, GRAVEL up to 1/2 inch in diameter, subrounded, medium dense
							50			

Continued

THIS BORING LOG SUMMARY APPLIES ONLY AT THE TIME AND LOCATION INDICATED. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND TIMES.

LOGGED BY **B.J./M.V.** DATE **12-8-09**

AMEC Earth & Environmental, Inc.

TEST BORING LOG

TYPE	8" DIA. HOLLOW STEM AUGER	ELEVATION	44 FEET	BORING	B-03

LAB TESTING	RELATIVE COMPACTION	DRY DENSITY (lbs/cu.ft.)	MOISTURE (%)	BLOWS/FOOT	SAMPLE SIZE (INCHES)	SAMPLE NO.	DEPTH IN FEET	MATERIAL SYMBOL	UNIFIED SOIL CLASS.	
		101	23.8	50/4"	2.4	19			CL SP	Interbedded light gray to dark green, poorly graded SAND and lean CLAY, moderately plastic
				91/9"	1.4	20	55		SP	Light gray, poorly graded, medium grained SAND, very dense
		113.2	16.3	50/4"	2.4	21	60			. . . (60 feet) gray, fine to medium grained, minor amount of oxidation staining
				41	1.4	22	65		SM ML	Interbedded lenses of mottled gray to brown SANDY SILT/SILTY SAND, some oxidation in the SAND portion, dense
PI		108.4	20.4	50/5"	2.4	23	70			**Displaced CAPISTRANO FORMATION - Ancient Landslide Deposits (Qls):** Mottled brown and green CLAYEY SILTSTONE, some caliche stringers, oxidation staining, medium to high plasticity, massive to thinly bedded
				72/11"	1.4	24	75			. . . (75 feet) dark green
		97.8	29.5	90/11"	2.4	25	80			. . . (80 feet) dark brown, low to medium plasticity

NOTES:

1. Total depth of boring 81.5 feet.
2. Groundwater encountered at 21 feet during drilling.
3. Boring elevation based on plans provided by Orange County Surveyor, dated January 5, 2010.
4. Boring backfilled with cement bentonite slurry on December 9, 2009.

THIS BORING LOG SUMMARY APPLIES ONLY AT THE TIME AND LOCATION INDICATED. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND TIMES.

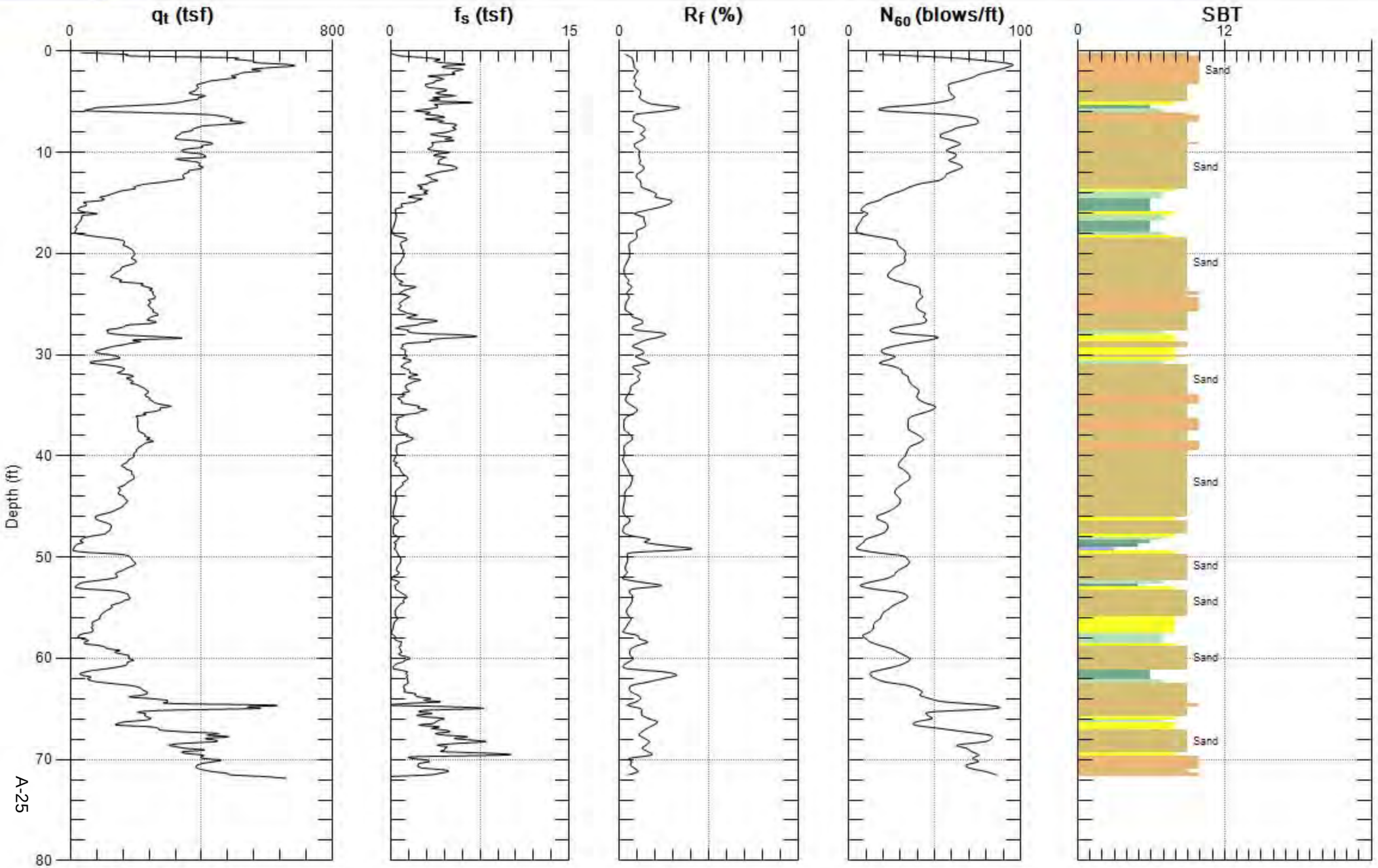
LOGGED BY **B.J./M.V.** DATE **12-8-09**

GREGG

AMEC

Site: SAN JUAN CREEK
Sounding: CPT-01

Engineer: C.SPITZER
Date: 2009-12-11 07:38



Max. Depth: 71.850 (ft)
Avg. Interval: 0.328 (ft)

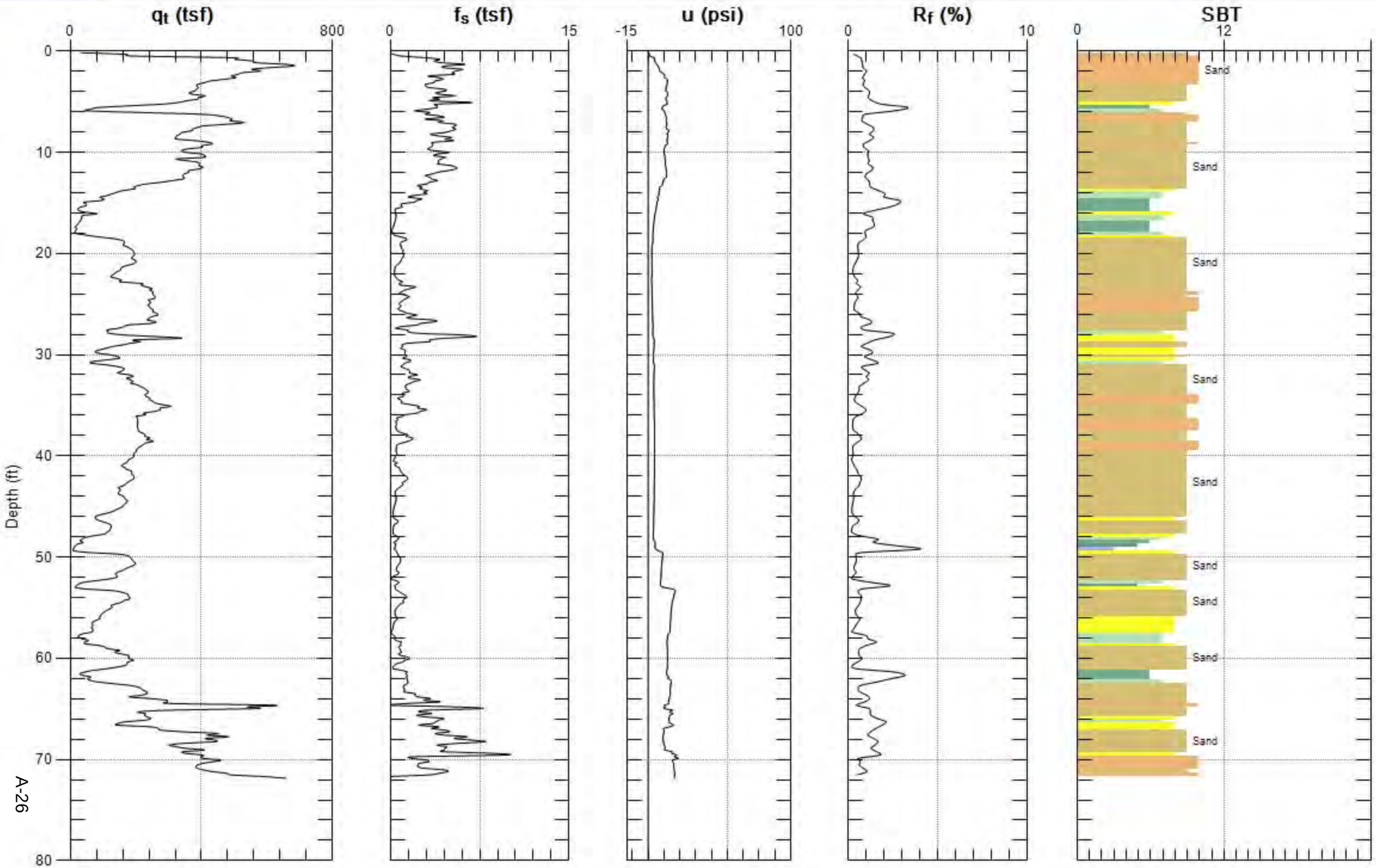
SBT: Soil Behavior Type (Robertson 1990)

GREGG

AMEC

Site: SAN JUAN CREEK
Sounding: CPT-01

Engineer: C.SPITZER
Date: 2009-12-11 07:38



Max. Depth: 71.850 (ft)
Avg. Interval: 0.328 (ft)

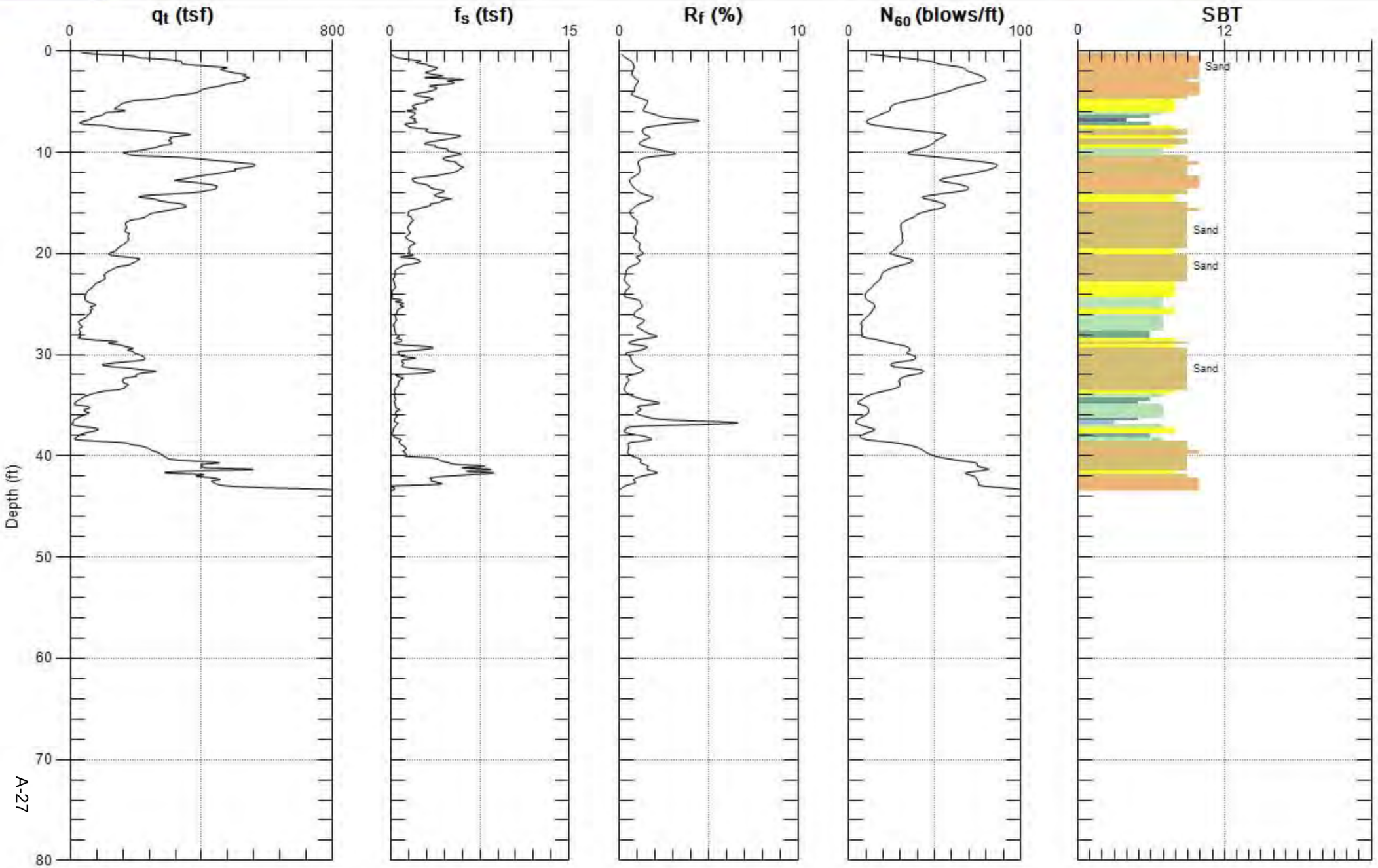
SBT: Soil Behavior Type (Robertson 1990)

GREGG

AMEC

Site: SAN JUAN CREEK
Sounding: CPT-02

Engineer: C.SPITZER
Date: 2009-12-11 08:43



Max. Depth: 43.635 (ft)
Avg. Interval: 0.328 (ft)

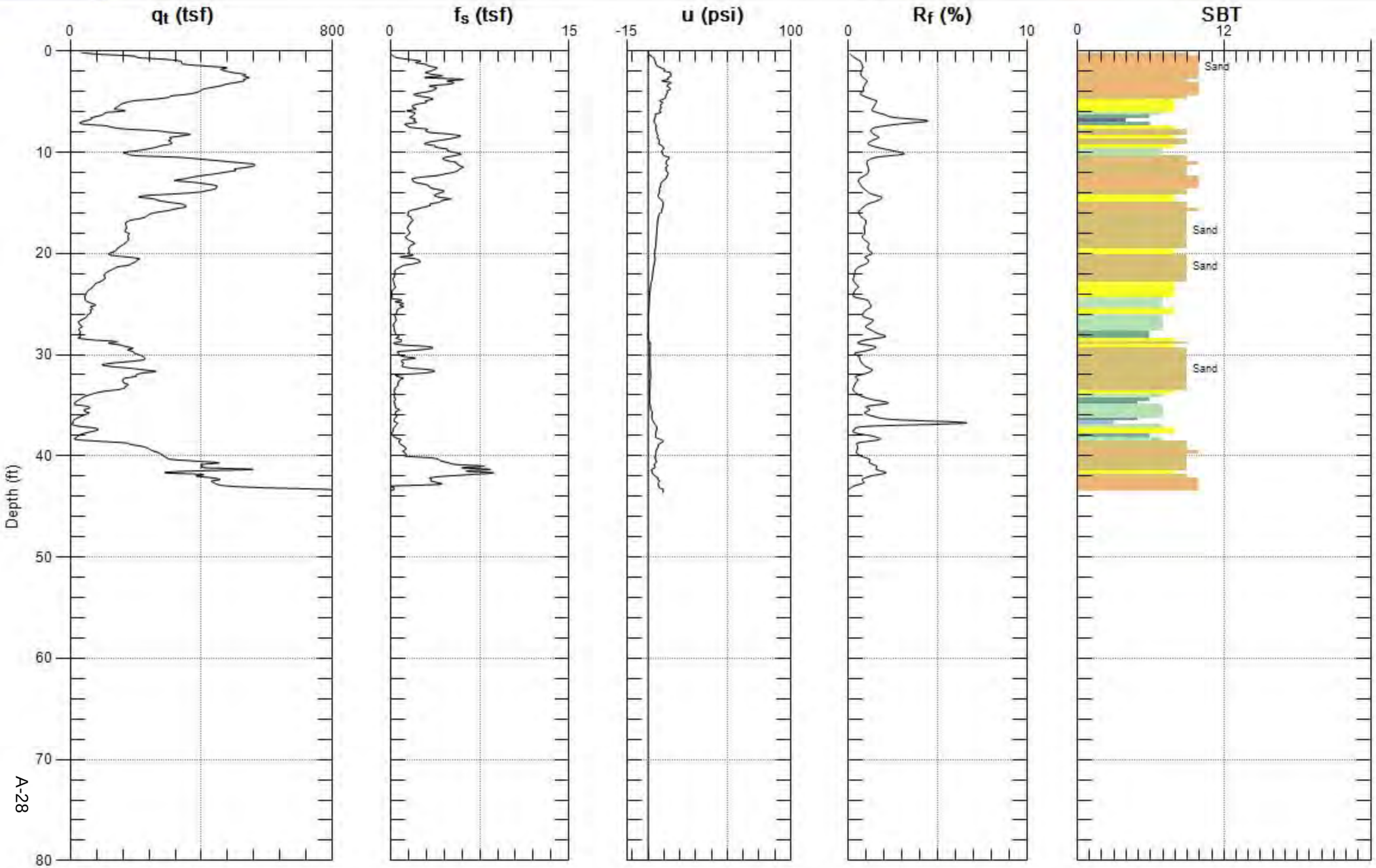
SBT: Soil Behavior Type (Robertson 1990)

GREGG

AMEC

Site: SAN JUAN CREEK
Sounding: CPT-02

Engineer: C.SPITZER
Date: 2009-12-11 08:43



Max. Depth: 43.635 (ft)
Avg. Interval: 0.328 (ft)

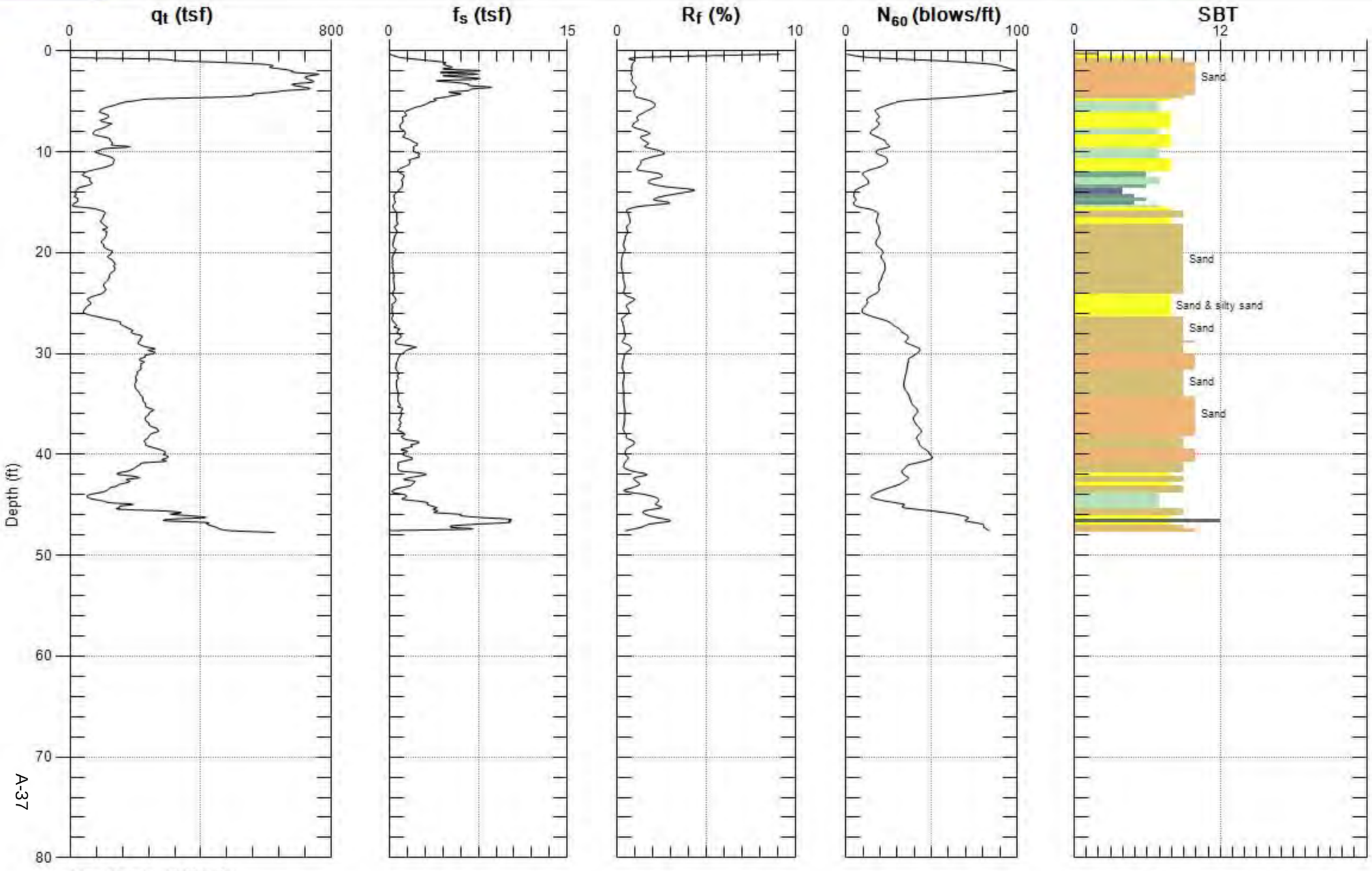
SBT: Soil Behavior Type (Robertson 1990)

GREGG

AMEC

Site: SAN JUAN CREEK
Sounding: CPT-07

Engineer: C.SPITZER
Date: 2009-12-11 12:51



Max. Depth: 47.736 (ft)
Avg. Interval: 0.328 (ft)

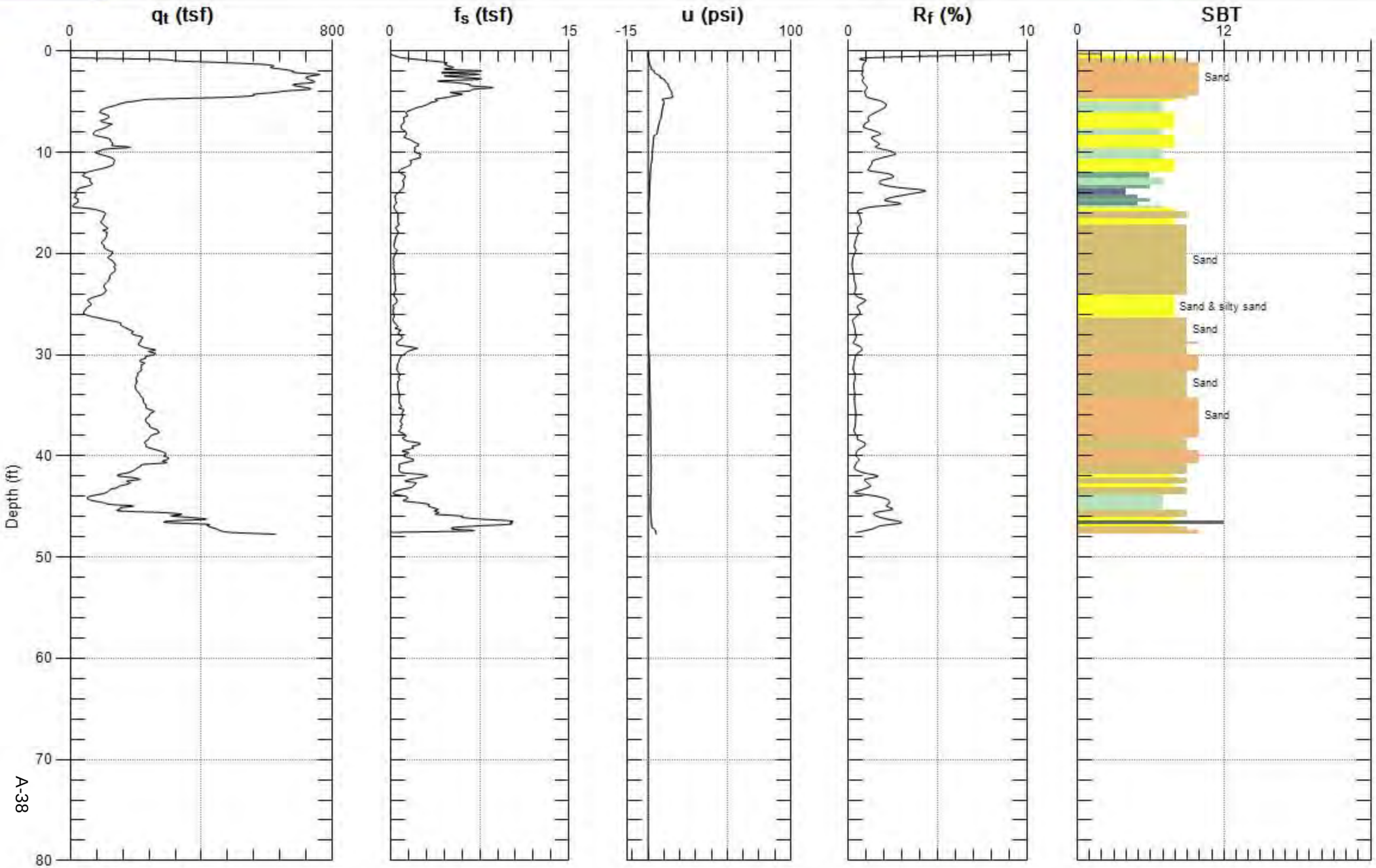
SBT: Soil Behavior Type (Robertson 1990)

GREGG

AMEC

Site: SAN JUAN CREEK
Sounding: CPT-07

Engineer: C.SPITZER
Date: 2009-12-11 12:51



Max. Depth: 47.736 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

APPENDIX C. LIQUEFACTION ANALYSES

Willdan Geotechnical
1515 S. Sunkist St., Suite E
Anaheim, CA 92806

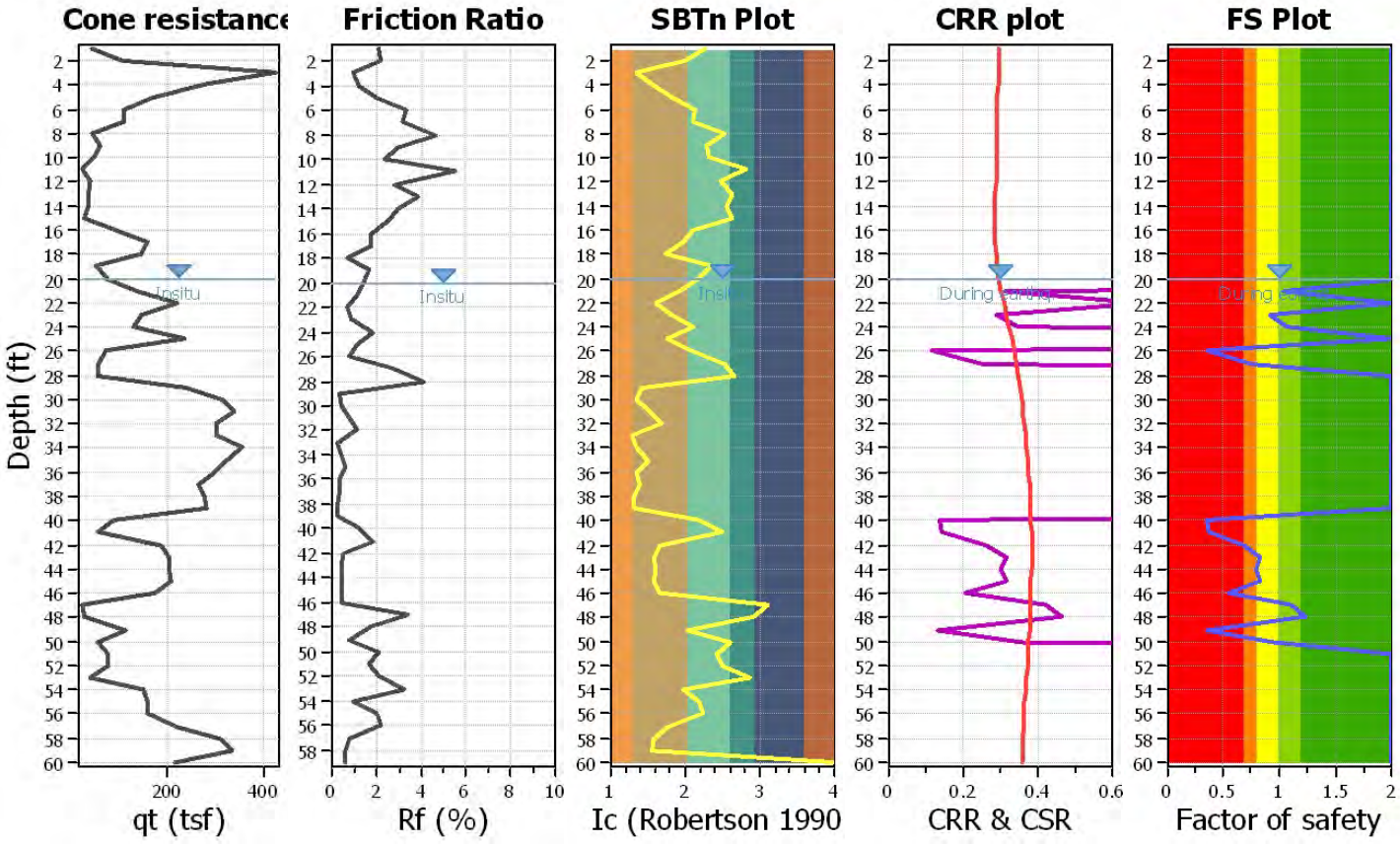
LIQUEFACTION ANALYSIS REPORT

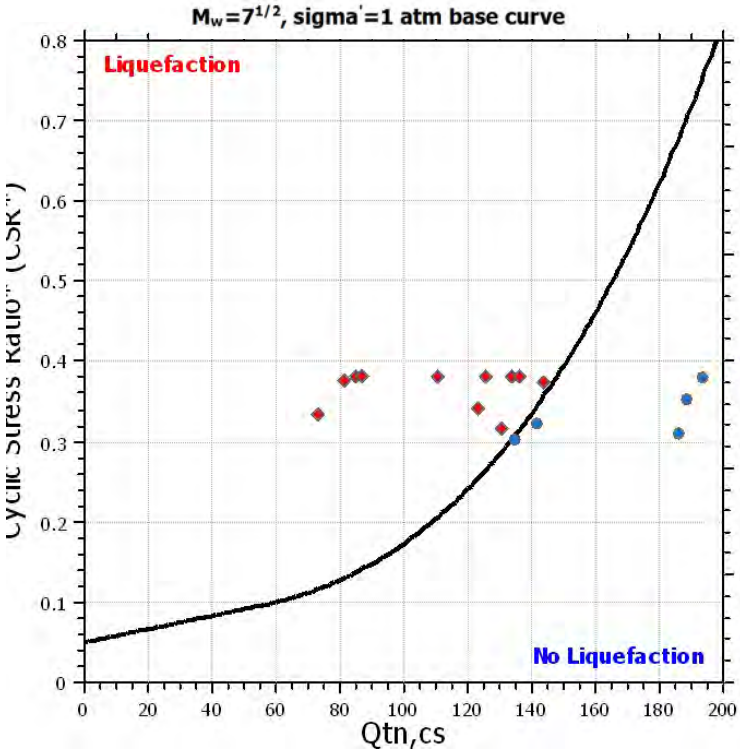
Project title : Ganahl SJC **Location :**

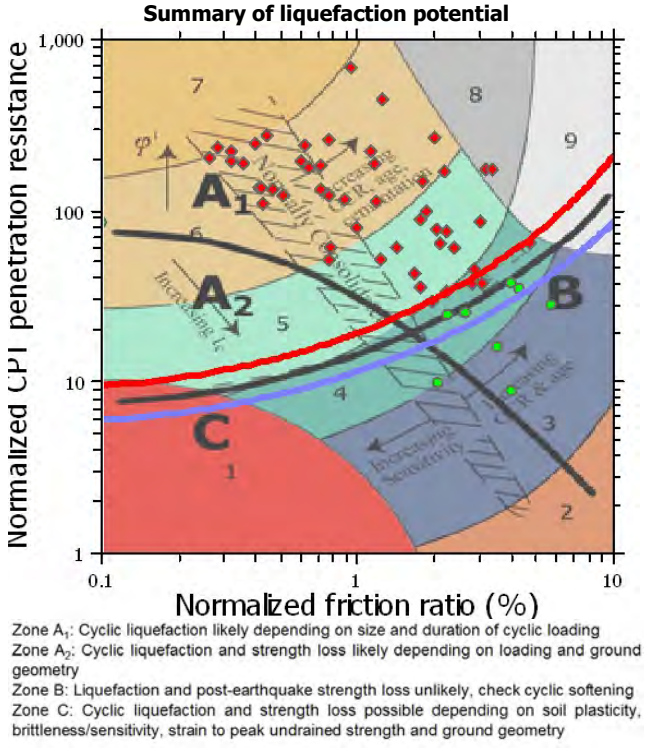
CPT file : CPT-1

Input parameters and analysis data

Analysis method:	Robertson (2009)	G.W.T. (in-situ):	20.00 ft	Use fill:	No	Clay like behavior applied:	All soils
Fines correction method:	Robertson (2009)	G.W.T. (earthq.):	20.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth:	50.00 ft
Earthquake magnitude M_w:	6.70	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.55	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

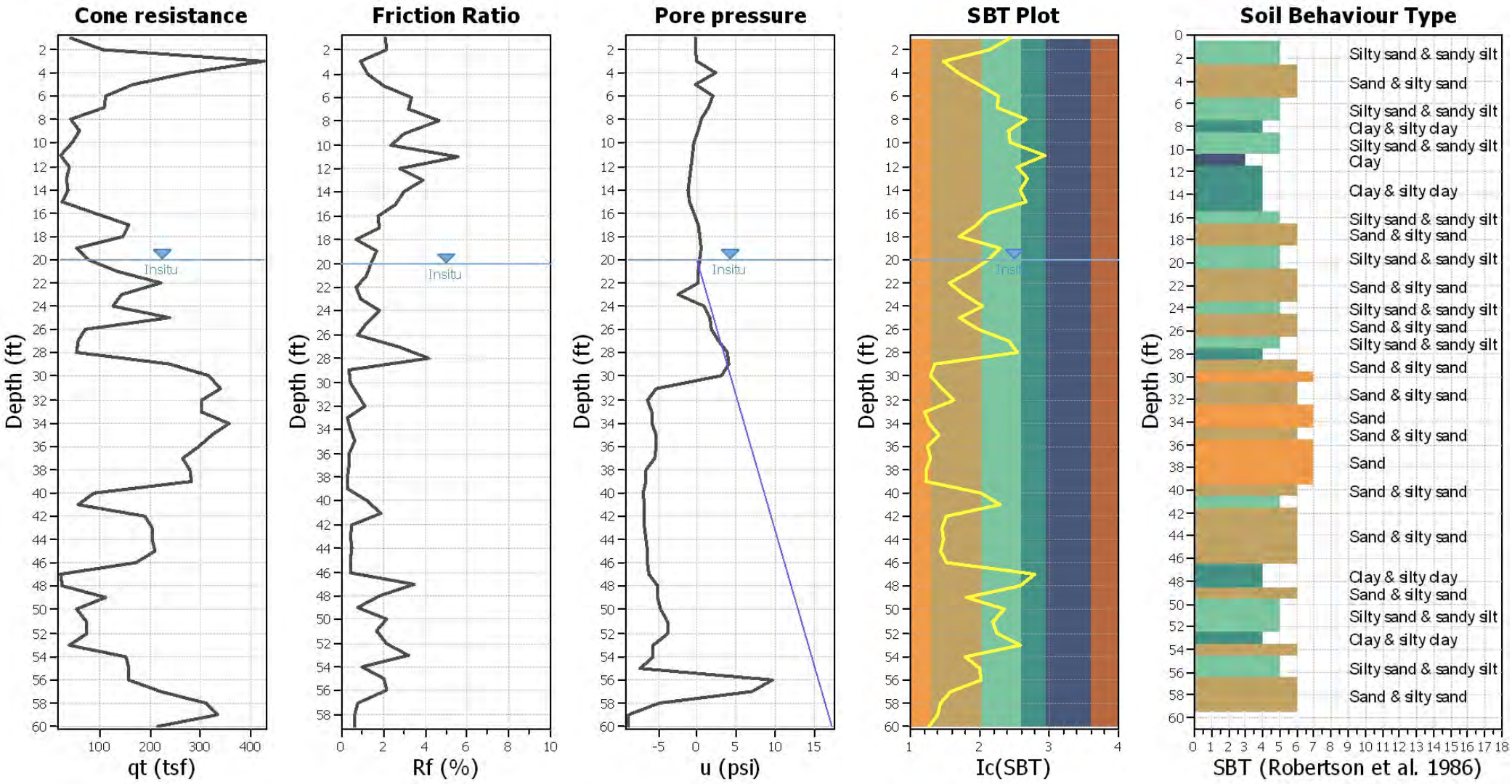






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plc



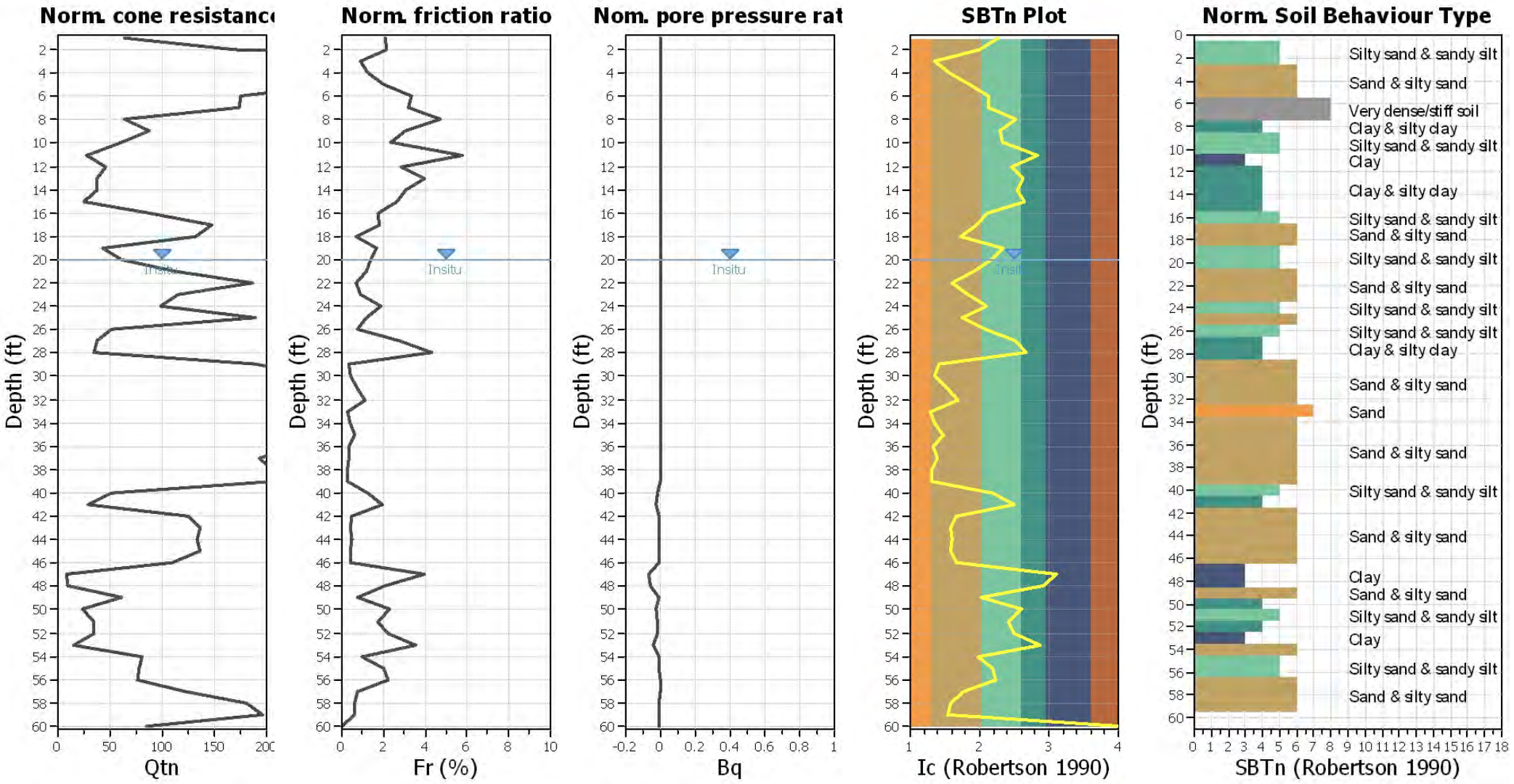
Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	All soils
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

SBT legend

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

CPT basic interpretation plots (normaliz



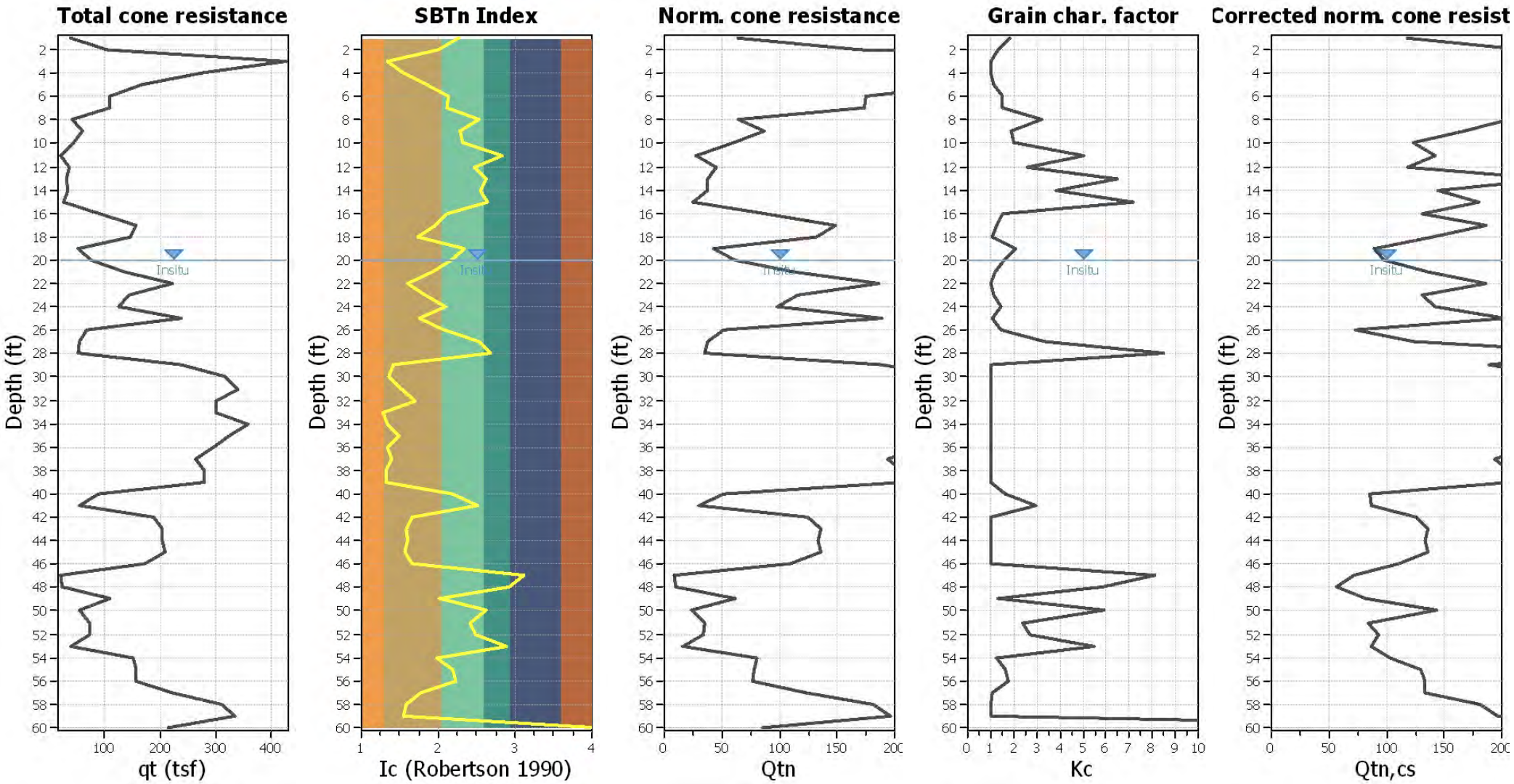
Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	All soils
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

SBTn legend

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

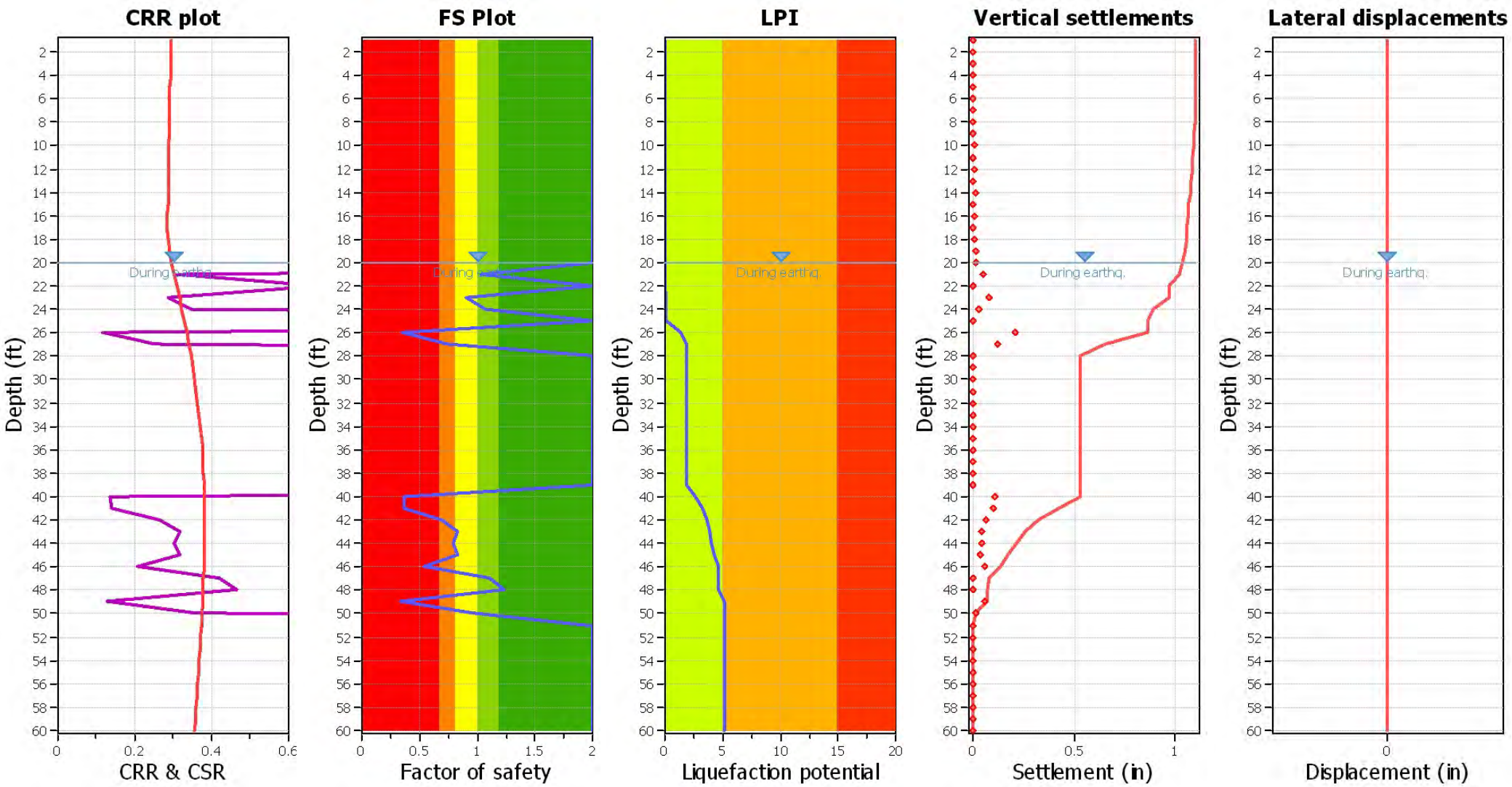
Liquefaction analysis overall plots (intermediate resi



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	All soils
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

Liquefaction analysis overall plot



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	All soils
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

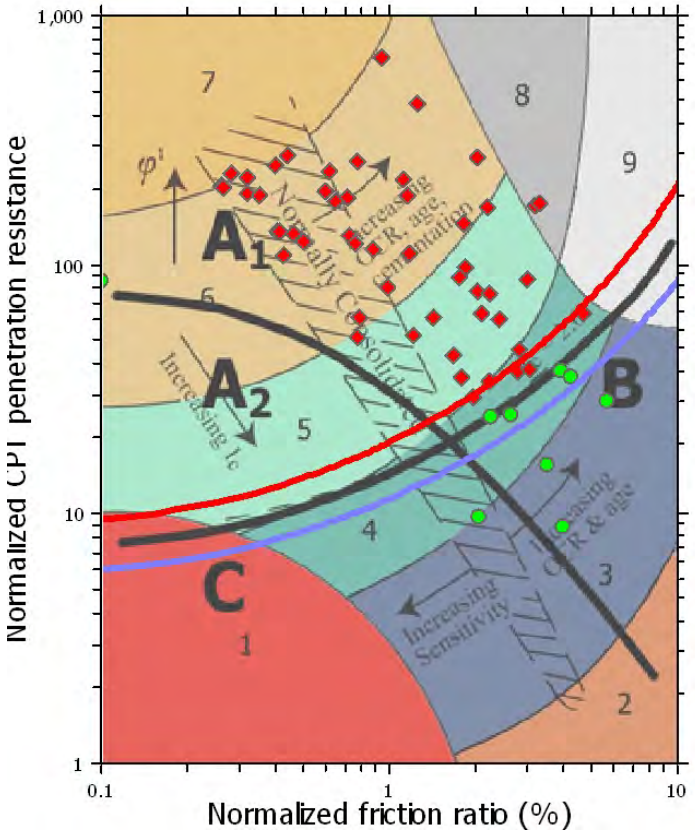
F.S. color scheme

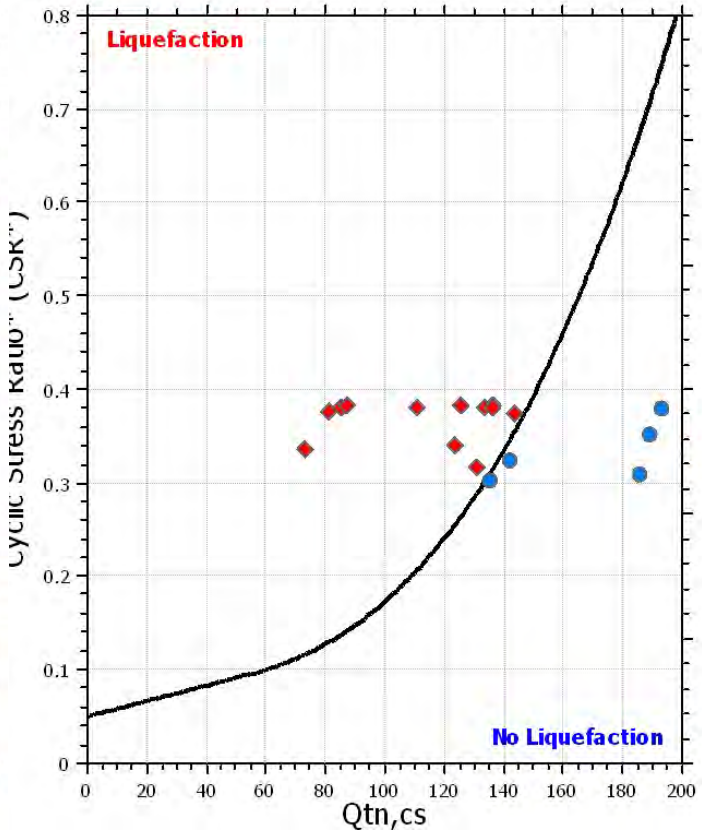
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

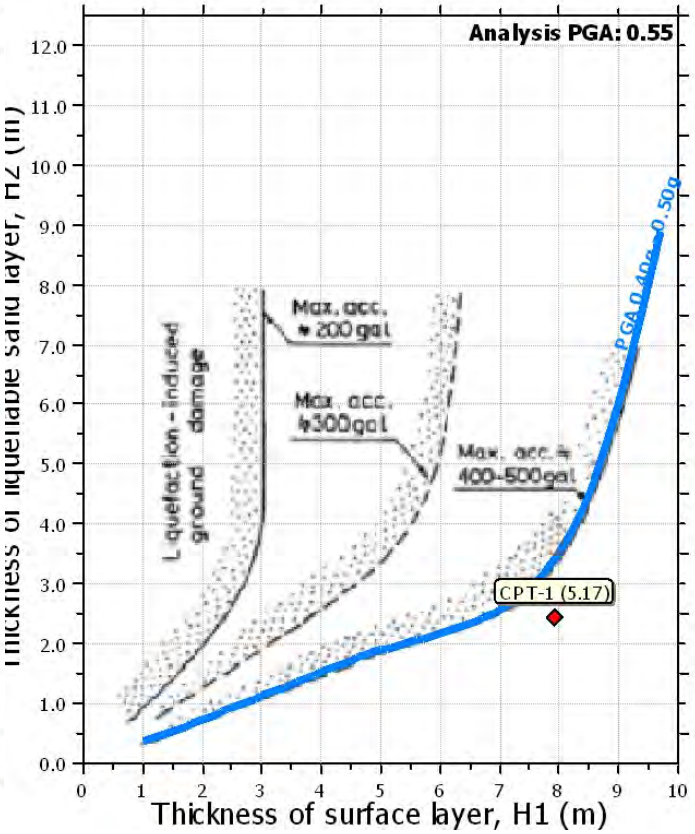
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plo



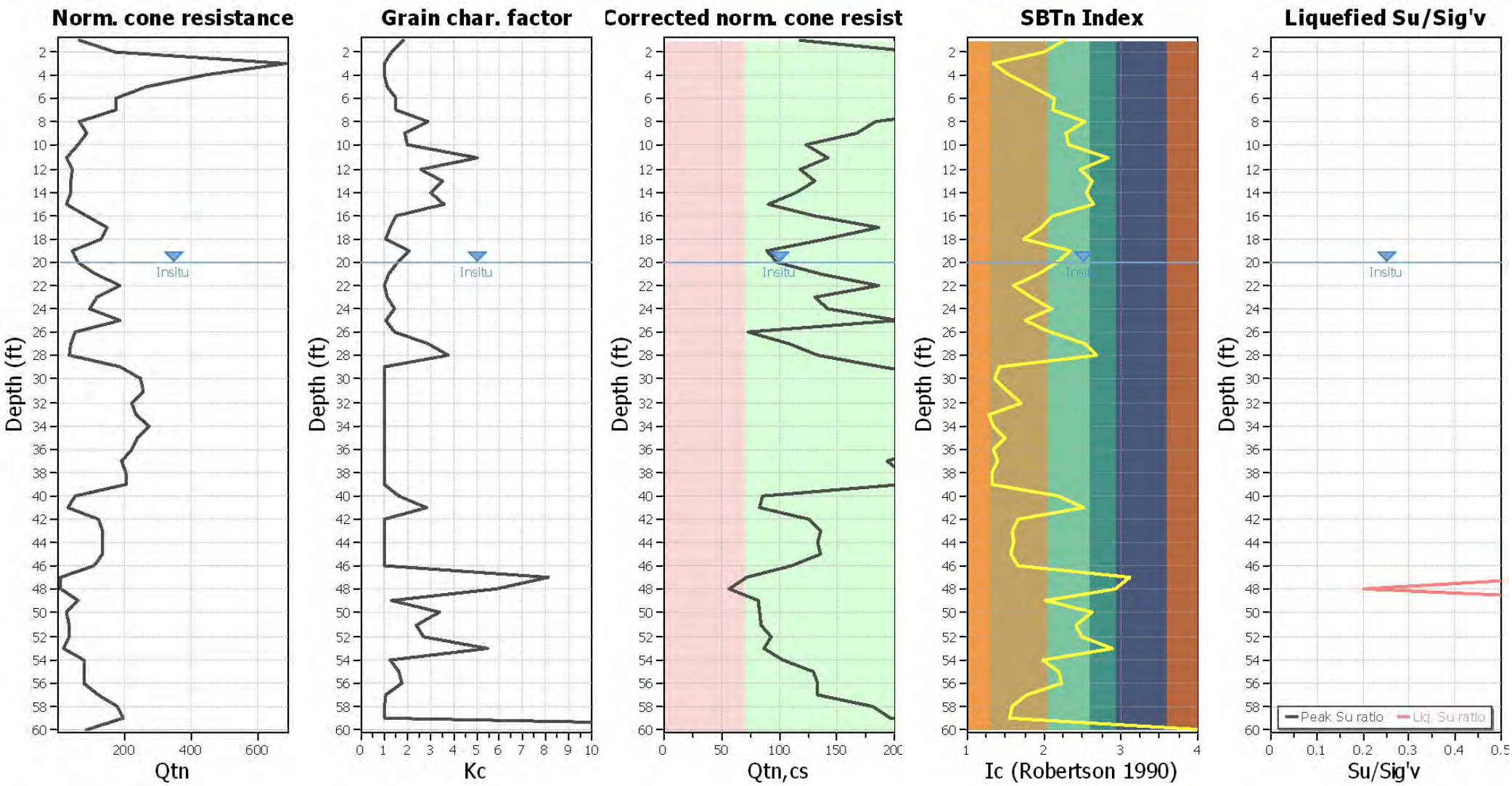




Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	All soils
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

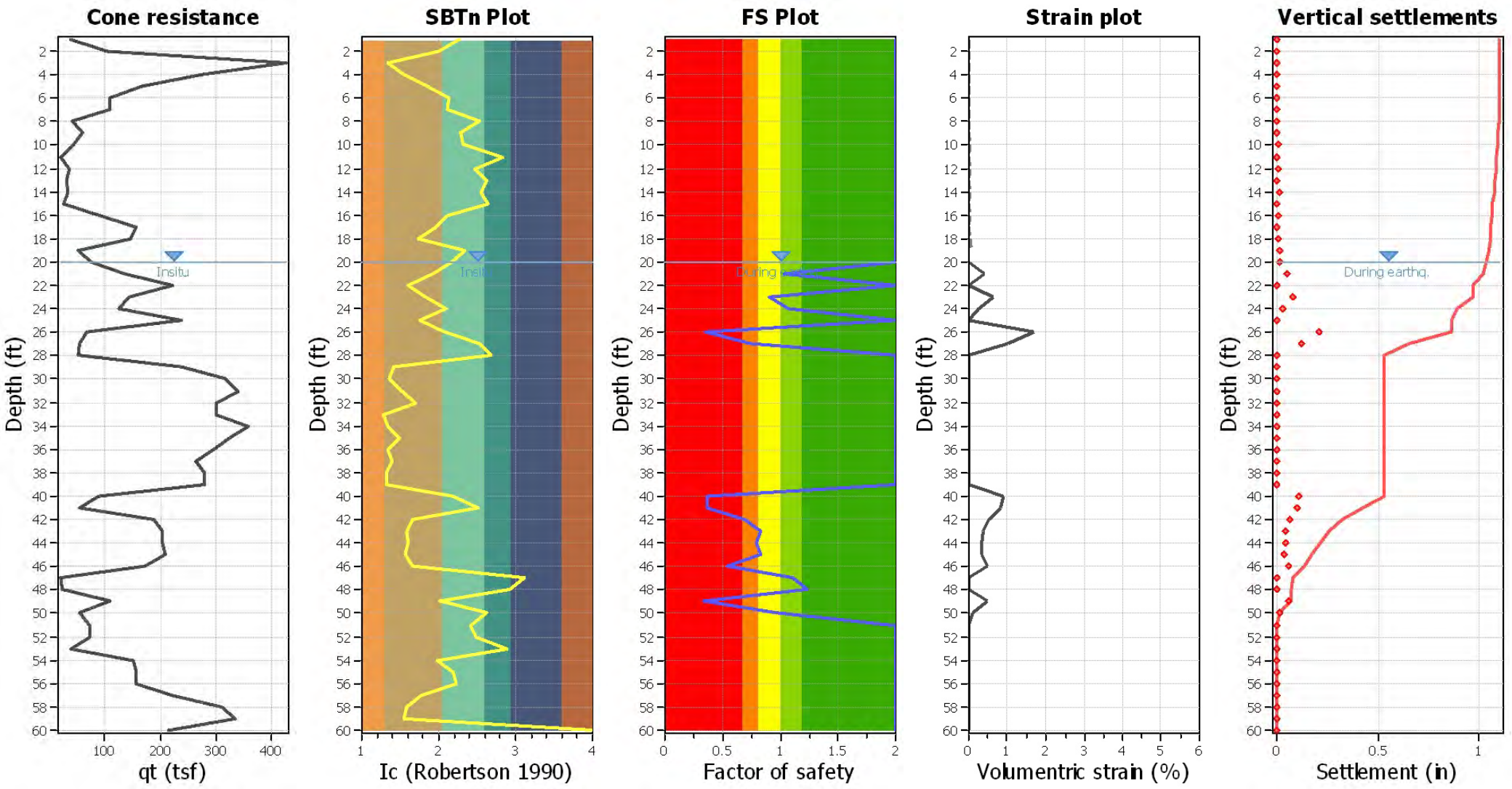
Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	All soils
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

Estimation of post-earthquake settlements



Abbreviations

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

:: Post-earthquake settlement of dry sands ::

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
1.00	2.27	64.32	1.85	118.78	28	636	0.29	0.004	0.00	8.63	0.00	0.001
2.00	1.99	169.25	1.29	218.50	45	1183	0.29	0.004	0.00	8.63	0.00	0.000
3.00	1.35	684.40	1.00	684.40	114	2114	0.29	0.003	0.00	8.63	0.00	0.000
4.00	1.55	442.06	1.00	442.06	79	1774	0.29	0.006	0.00	8.63	0.00	0.000
5.00	1.85	267.58	1.14	305.31	60	1550	0.29	0.009	0.00	8.63	0.00	0.000
6.00	2.13	175.42	1.52	265.85	58	1462	0.29	0.012	0.00	8.63	0.00	0.001
7.00	2.12	173.62	1.49	258.45	56	1422	0.29	0.014	0.00	8.63	0.00	0.001
8.00	2.52	63.95	2.88	184.12	48	873	0.29	0.038	0.01	8.63	0.01	0.002
9.00	2.29	87.21	1.91	166.76	39	957	0.29	0.037	0.02	8.63	0.01	0.003
10.00	2.33	60.48	2.03	123.00	29	743	0.29	0.078	0.05	8.63	0.03	0.008
11.00	2.83	28.19	5.03	141.88	0	0	0.29	0.000	0.00	10.85	0.00	0.000
12.00	2.47	45.63	2.60	118.66	30	748	0.29	0.104	0.06	8.63	0.04	0.010
13.00	2.63	37.40	3.51	131.14	0	0	0.29	0.000	0.00	10.85	0.00	0.000
14.00	2.55	37.88	3.01	114.15	30	771	0.29	0.124	0.08	8.63	0.05	0.011
15.00	2.64	25.06	3.61	90.50	0	0	0.29	0.000	0.00	10.85	0.00	0.000
16.00	2.11	88.28	1.48	130.59	28	1171	0.28	0.054	0.04	8.63	0.02	0.005
17.00	1.97	147.83	1.26	186.03	38	1701	0.28	0.030	0.01	8.63	0.01	0.002
18.00	1.73	131.47	1.06	139.04	26	1156	0.29	0.066	0.05	8.63	0.03	0.006
19.00	2.33	43.36	2.06	89.38	21	866	0.29	0.151	0.14	8.63	0.07	0.018

Total estimated settlement: 0.07

Abbreviations

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

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

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
20.00	98.21	2.00	0.00	0.67	0.00	21.00	135.25	1.03	0.43	0.65	0.05
22.00	185.97	2.00	0.00	0.63	0.00	23.00	130.56	0.91	0.65	0.62	0.08
24.00	141.95	1.07	0.26	0.60	0.03	25.00	202.44	2.00	0.00	0.58	0.00
26.00	72.87	0.35	1.72	0.57	0.21	27.00	123.32	0.75	1.00	0.55	0.12
28.00	296.81	2.00	0.00	0.53	0.00	29.00	188.96	2.00	0.00	0.52	0.00
30.00	250.23	2.00	0.00	0.50	0.00	31.00	259.03	2.00	0.00	0.48	0.00
32.00	229.07	2.00	0.00	0.47	0.00	33.00	234.43	2.00	0.00	0.45	0.00
34.00	273.41	2.00	0.00	0.43	0.00	35.00	238.09	2.00	0.00	0.42	0.00
36.00	222.38	2.00	0.00	0.40	0.00	37.00	193.55	2.00	0.00	0.38	0.00
38.00	206.04	2.00	0.00	0.37	0.00	39.00	206.16	2.00	0.00	0.35	0.00
40.00	84.96	0.36	0.89	0.33	0.11	41.00	86.97	0.37	0.83	0.32	0.10
42.00	125.37	0.69	0.54	0.30	0.06	43.00	136.43	0.83	0.37	0.28	0.04
44.00	133.59	0.79	0.35	0.27	0.04	45.00	136.36	0.83	0.32	0.25	0.04
46.00	110.83	0.54	0.50	0.23	0.06	47.00	71.32	1.11	0.01	0.22	0.00
48.00	57.10	1.23	0.01	0.20	0.00	49.00	81.20	0.34	0.51	0.18	0.06
50.00	143.79	0.95	0.11	0.17	0.01	51.00	84.42	2.00	0.00	0.15	0.00

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

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
52.00	93.04	2.00	0.00	0.13	0.00	53.00	86.59	2.00	0.00	0.12	0.00
54.00	102.79	2.00	0.00	0.10	0.00	55.00	129.51	2.00	0.00	0.08	0.00
56.00	133.58	2.00	0.00	0.07	0.00	57.00	133.05	2.00	0.00	0.05	0.00
58.00	180.67	2.00	0.00	0.03	0.00	59.00	195.89	2.00	0.00	0.02	0.00
60.00	2270.34	2.00	0.00	0.00	0.00						

Total estimated settlement: 1.02

Abbreviations

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

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Anaheim, CA 92806

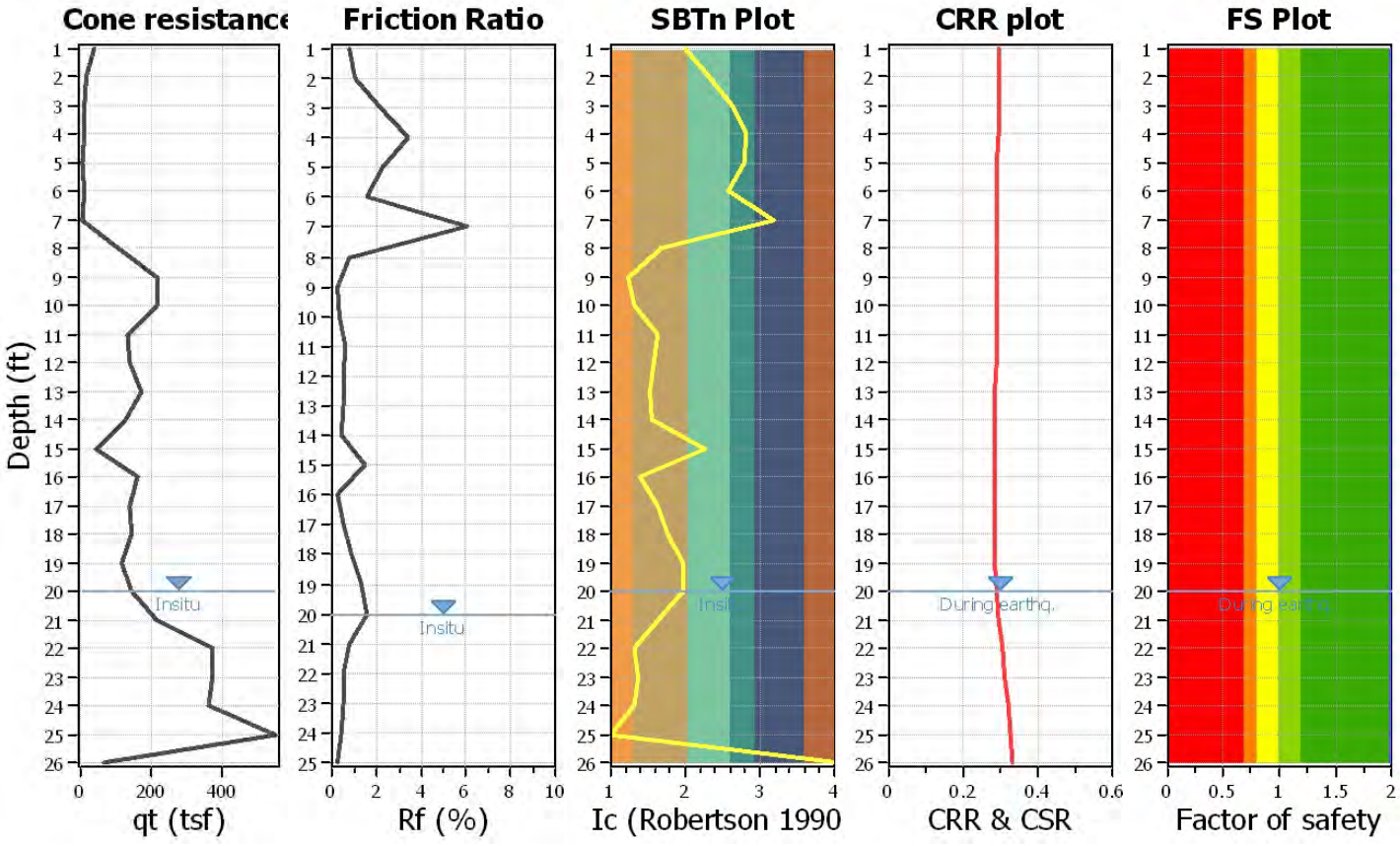
LIQUEFACTION ANALYSIS REPORT

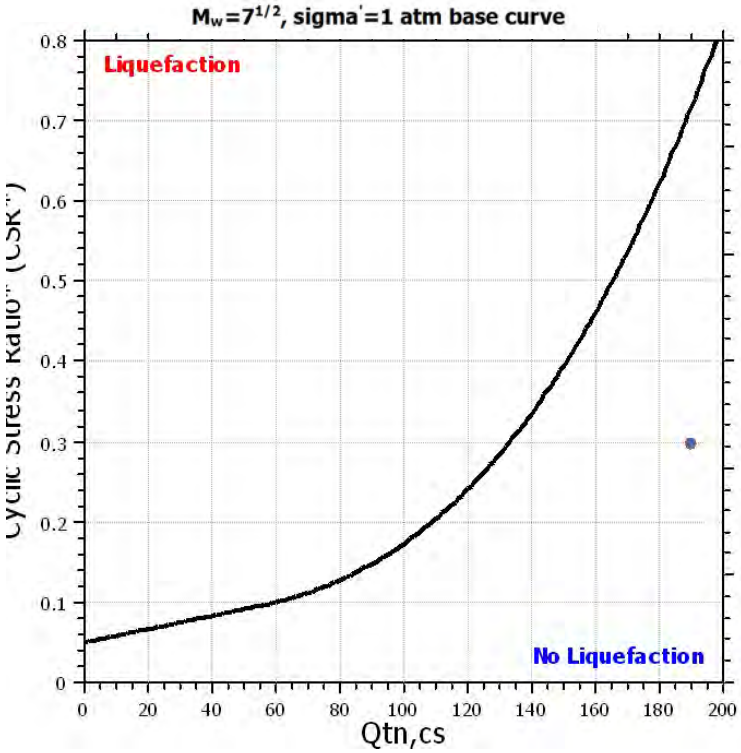
Project title : Ganahl SJC **Location :**

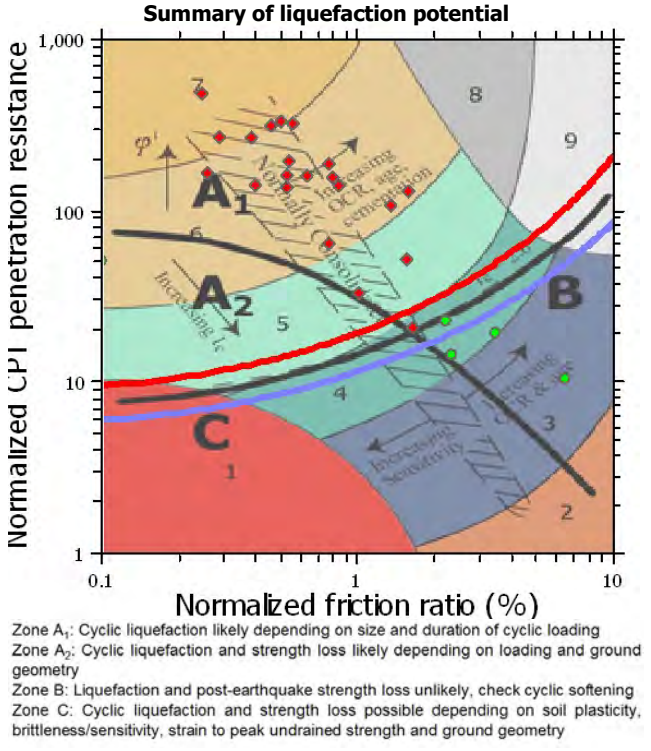
CPT file : CPT-2

Input parameters and analysis data

Analysis method:	Robertson (2009)	G.W.T. (in-situ):	20.00 ft	Use fill:	No	Clay like behavior applied:	All soils
Fines correction method:	Robertson (2009)	G.W.T. (earthq.):	20.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth:	50.00 ft
Earthquake magnitude M_w:	6.70	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.55	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

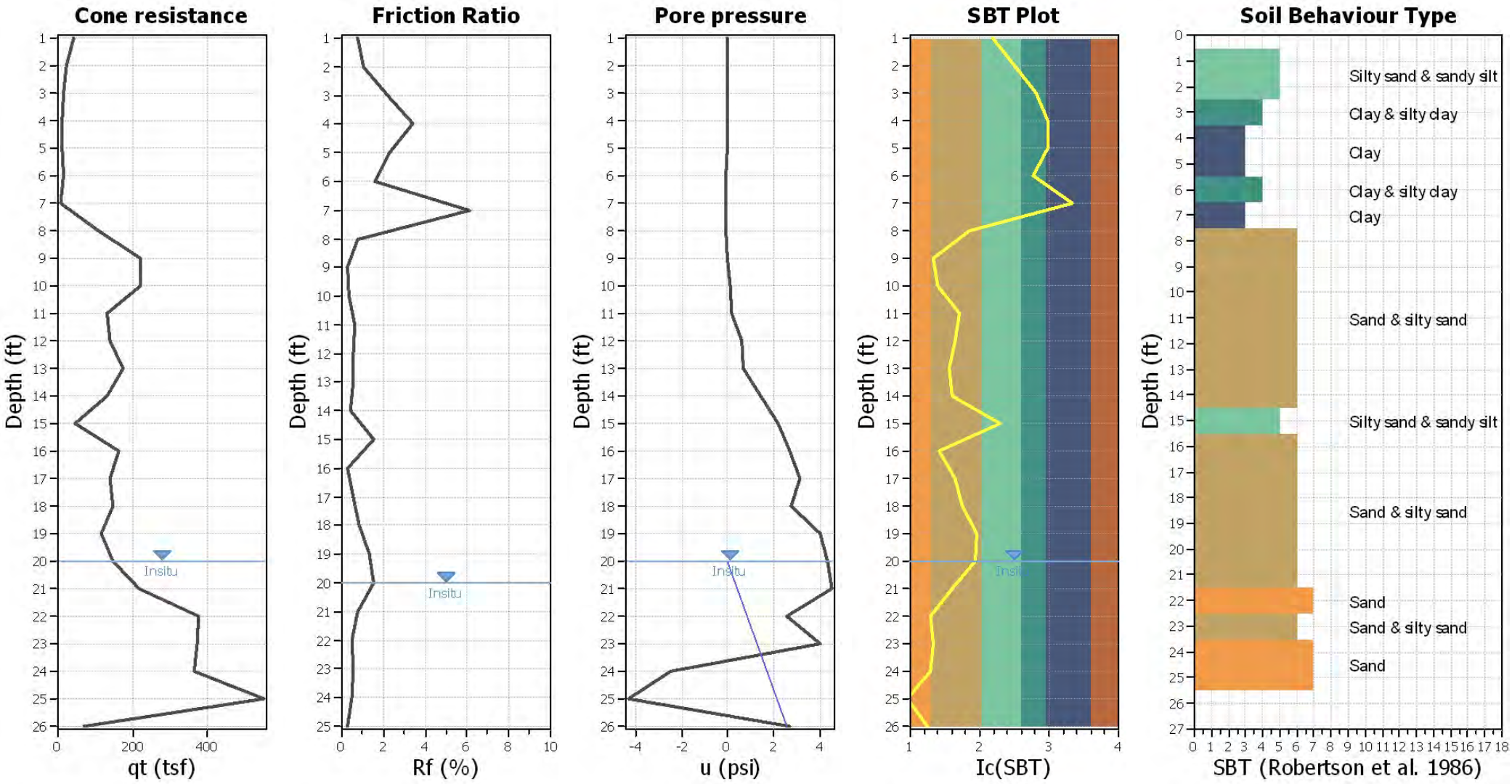






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plc



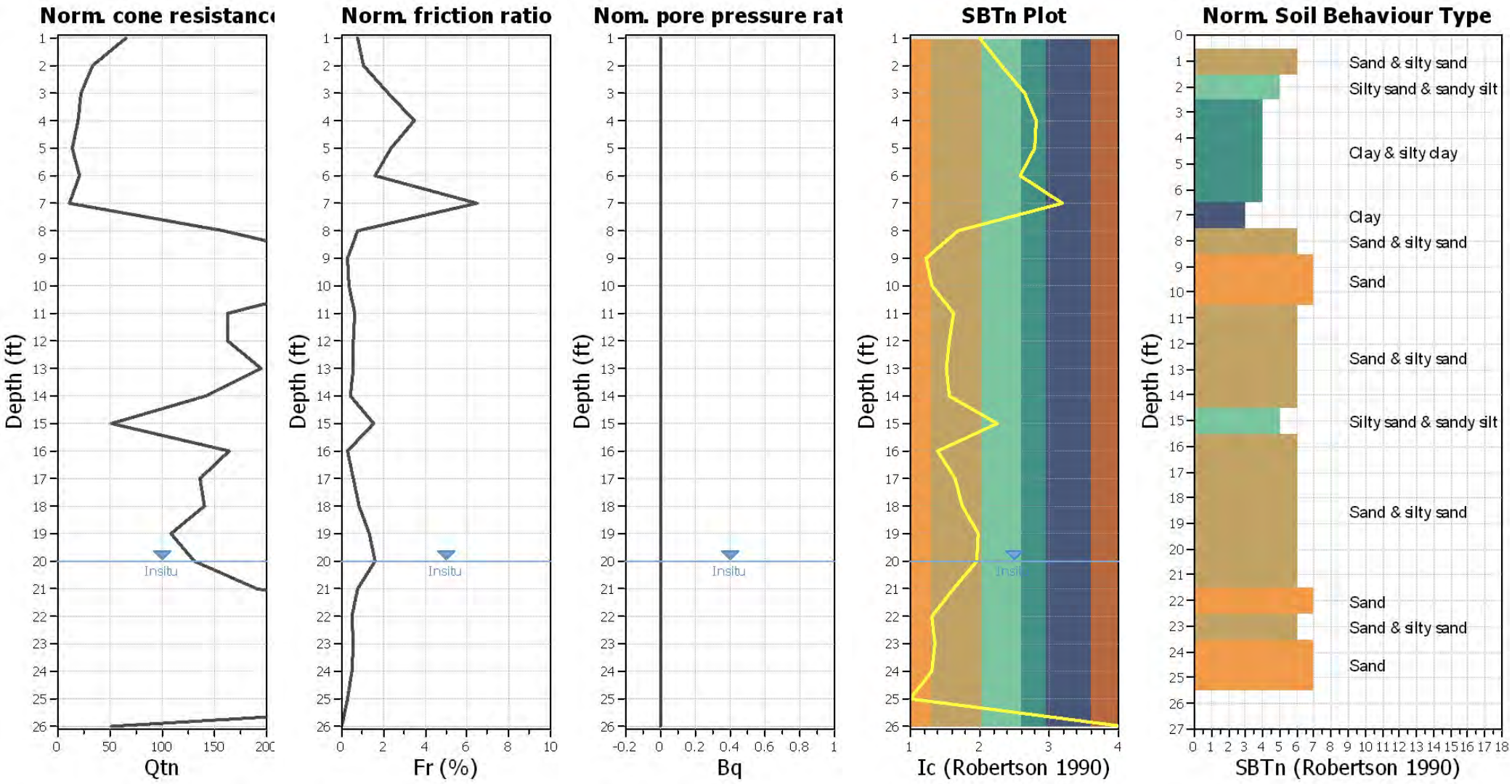
Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	All soils
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

SBT legend

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

CPT basic interpretation plots (normaliz



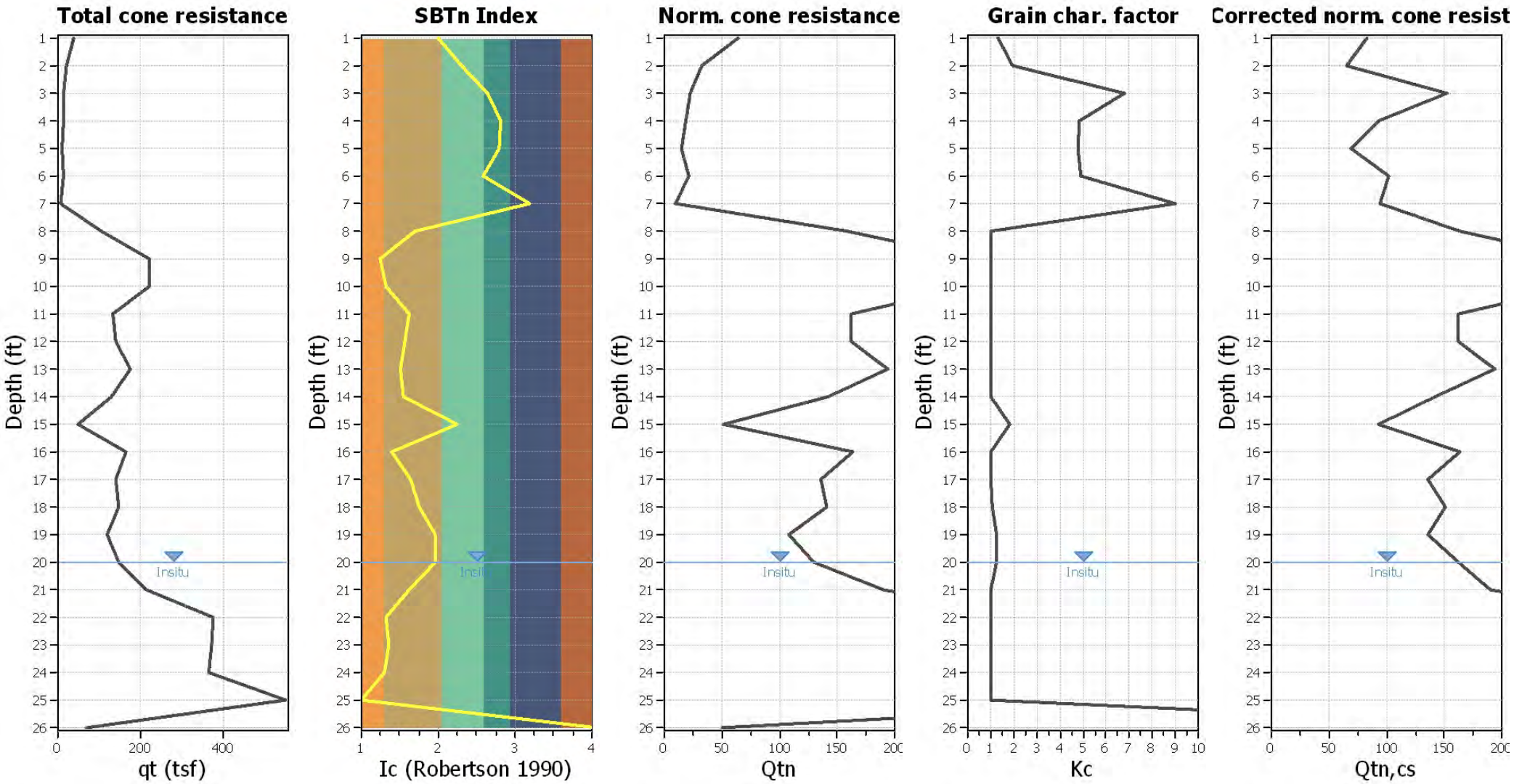
Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	All soils
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

SBTn legend

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

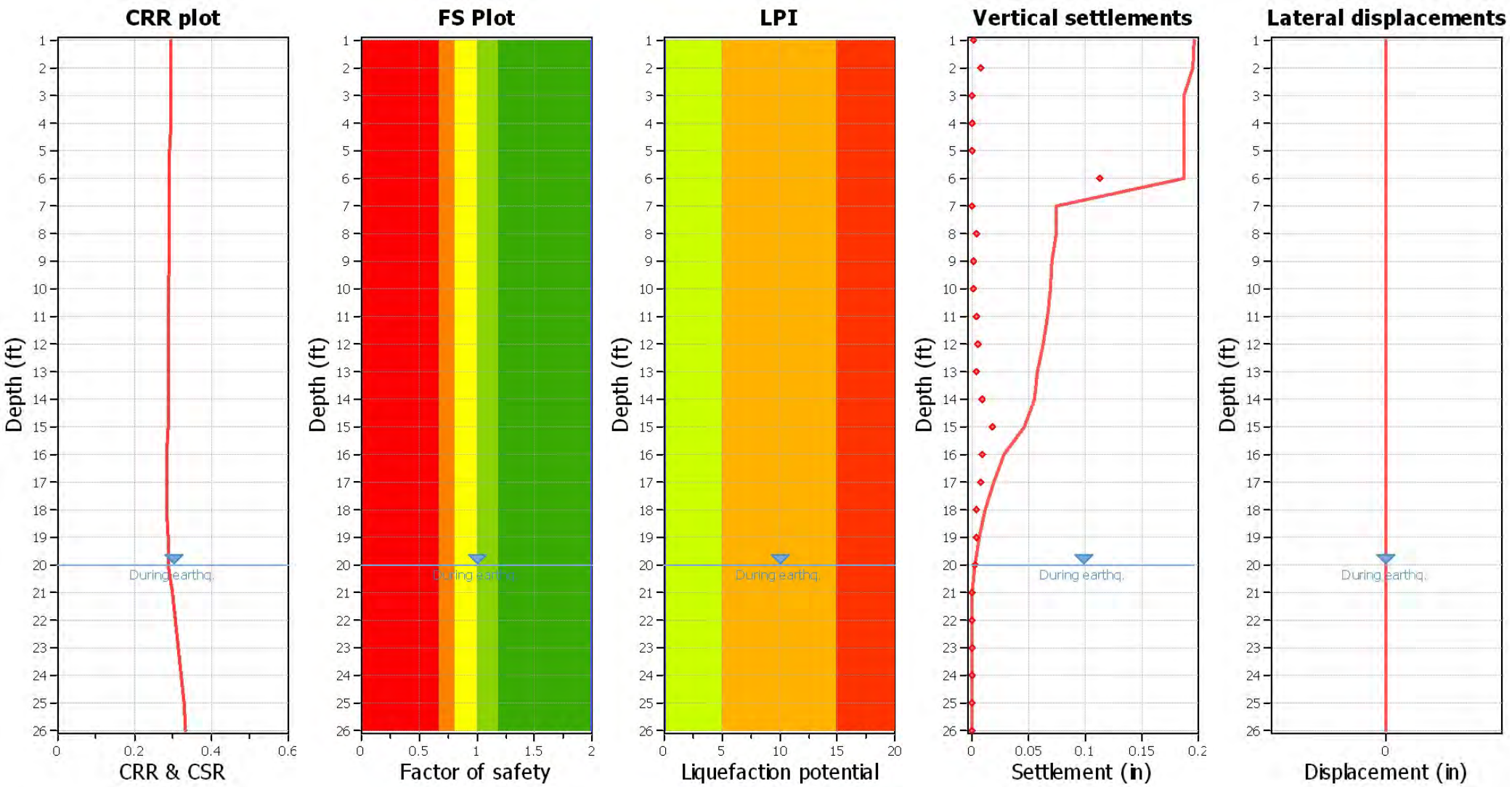
Liquefaction analysis overall plots (intermediate resi



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	All soils
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

Liquefaction analysis overall plot



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	All soils
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

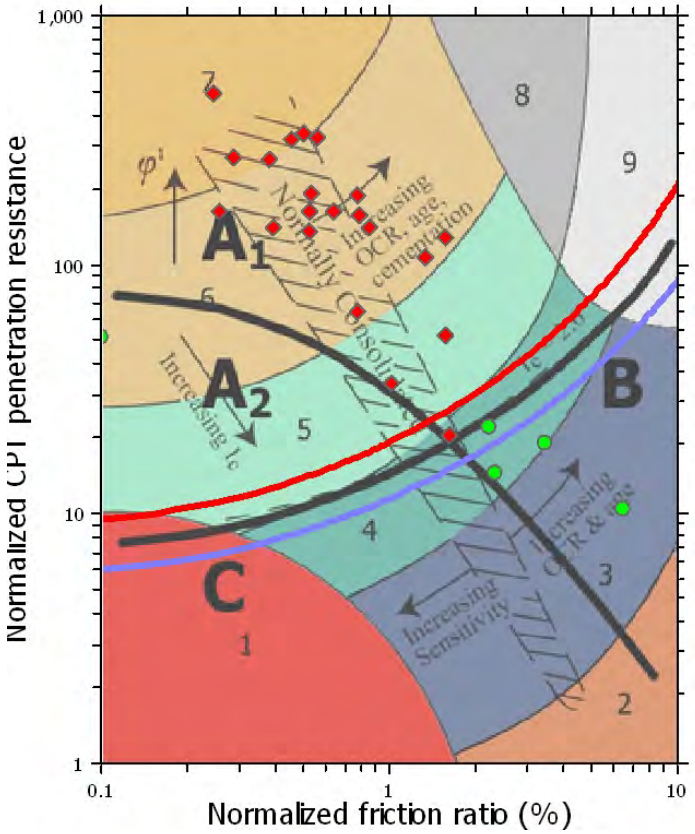
F.S. color scheme

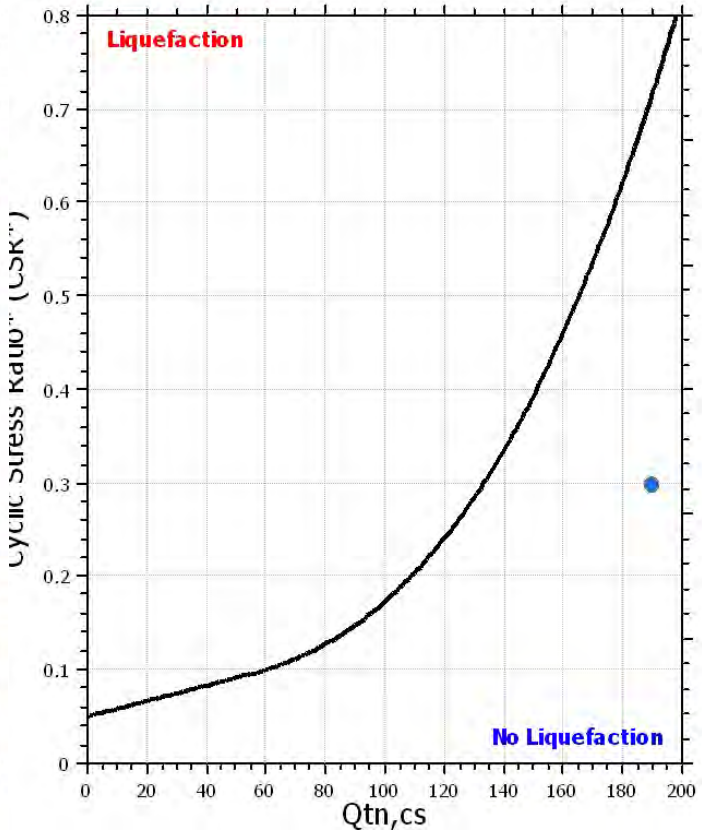
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

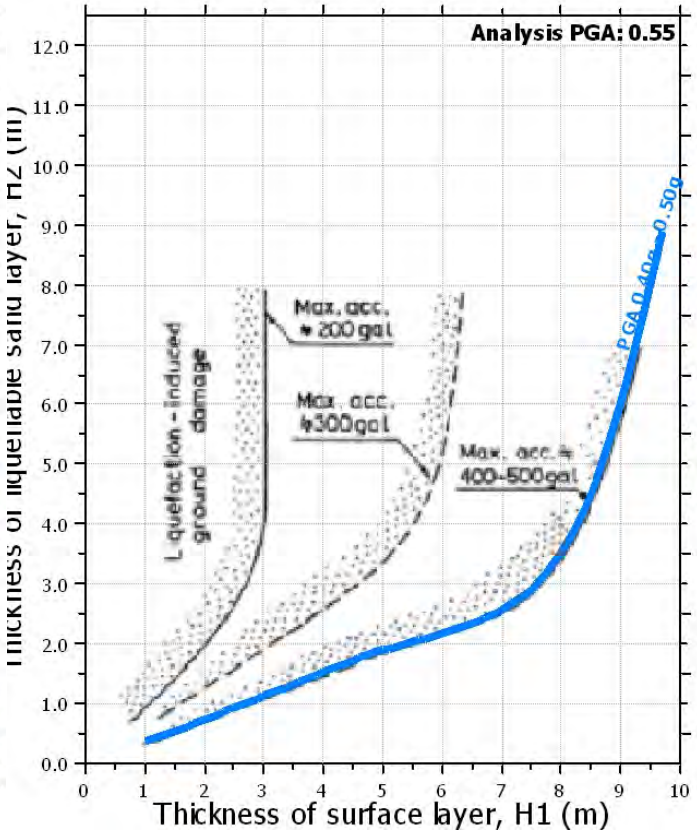
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plo



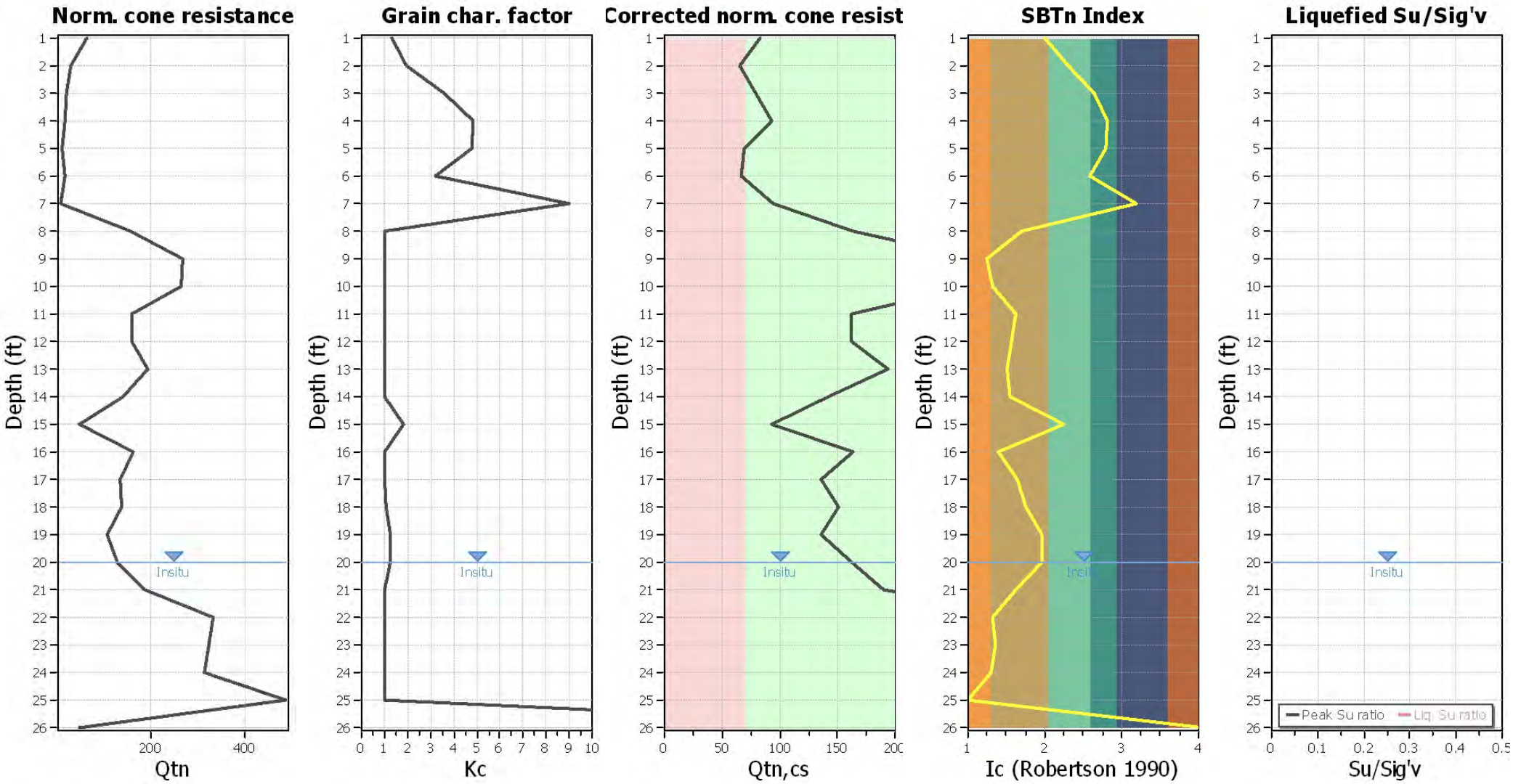




Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	All soils
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

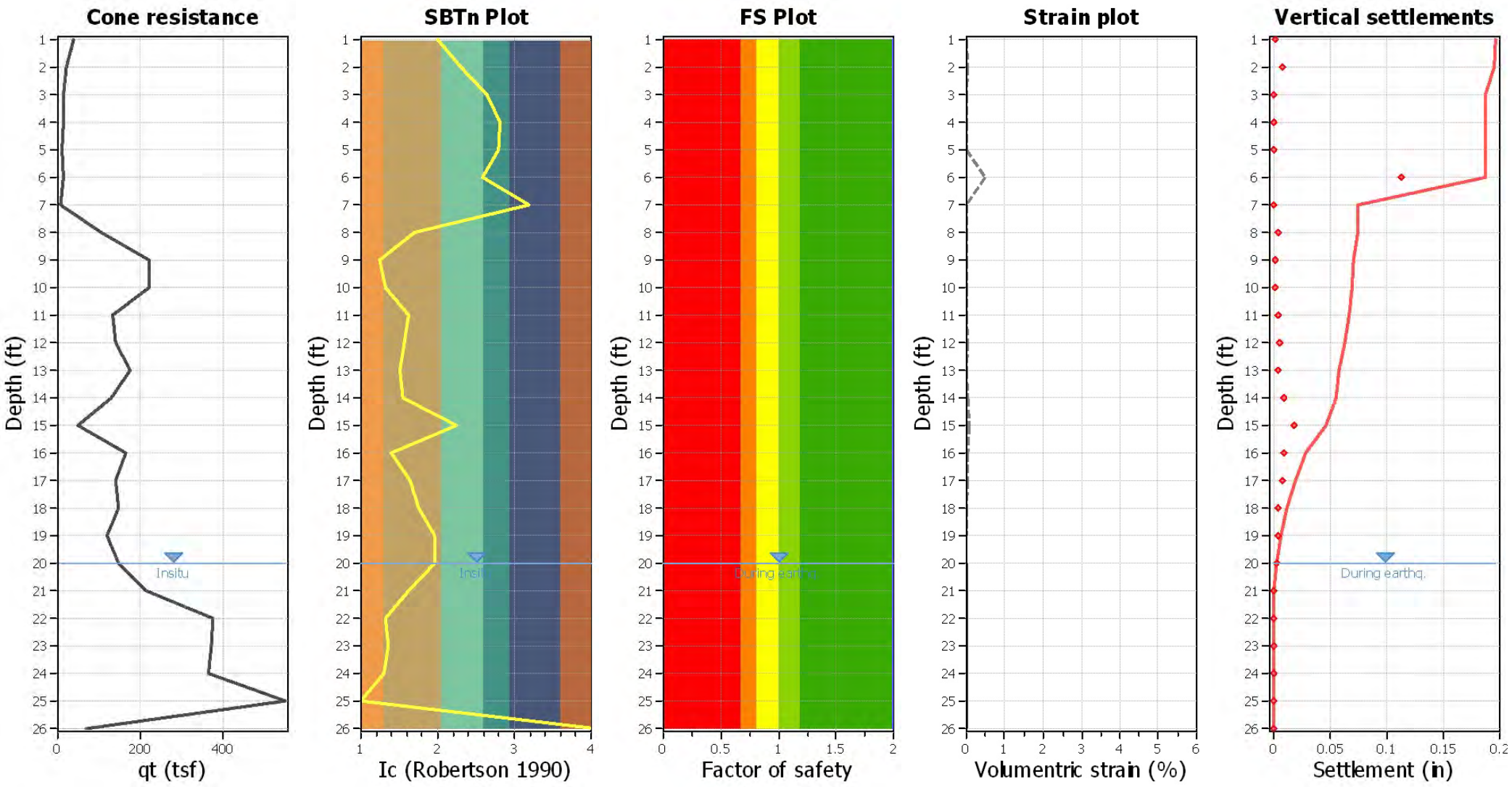
Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	All soils
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

Estimation of post-earthquake settlements



Abbreviations

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

:: Post-earthquake settlement of dry sands ::

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
1.00	1.99	64.67	1.29	83.61	17	453	0.29	0.006	0.01	8.63	0.01	0.001
2.00	2.30	33.21	1.96	65.01	15	344	0.29	0.032	0.04	8.63	0.03	0.008
3.00	2.64	22.39	3.56	79.64	0	0	0.29	0.000	0.00	12.48	0.00	0.000
4.00	2.81	19.28	4.85	93.58	0	0	0.29	0.000	0.00	0.00	0.00	0.000
5.00	2.80	14.49	4.80	69.54	0	0	0.29	0.000	0.00	0.00	0.00	0.000
6.00	2.58	20.78	3.23	67.17	18	307	0.29	0.594	0.67	8.63	0.47	0.113
7.00	3.18	10.46	9.00	94.13	0	0	0.29	0.000	0.00	10.85	0.00	0.000
8.00	1.69	158.07	1.03	163.36	30	814	0.29	0.035	0.02	8.63	0.01	0.003
9.00	1.24	270.45	1.00	270.45	44	952	0.29	0.030	0.01	8.63	0.01	0.002
10.00	1.32	265.45	1.00	265.45	44	1052	0.29	0.030	0.01	8.63	0.01	0.002
11.00	1.62	162.70	1.00	162.70	30	926	0.29	0.044	0.03	8.63	0.02	0.004
12.00	1.57	162.71	1.00	162.71	29	915	0.29	0.052	0.03	8.63	0.02	0.005
13.00	1.52	194.32	1.00	194.32	34	1071	0.29	0.042	0.02	8.63	0.01	0.003
14.00	1.55	141.60	1.00	141.60	25	841	0.29	0.082	0.06	8.63	0.04	0.009
15.00	2.25	51.79	1.81	93.69	22	731	0.29	0.139	0.13	8.63	0.07	0.018
16.00	1.40	164.01	1.00	164.01	28	869	0.28	0.094	0.06	8.63	0.04	0.009
17.00	1.64	136.13	1.00	136.13	25	986	0.28	0.076	0.06	8.63	0.03	0.008
18.00	1.75	140.88	1.07	151.02	29	1217	0.28	0.052	0.03	8.63	0.02	0.004
19.00	1.97	107.69	1.26	136.12	28	1276	0.29	0.052	0.03	8.63	0.02	0.004

Total estimated settlement: 0.19

Abbreviations

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

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

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
20.00	162.69	2.00	0.00	0.67	0.00	21.00	190.17	2.00	0.00	0.65	0.00
22.00	333.33	2.00	0.00	0.63	0.00	23.00	325.82	2.00	0.00	0.62	0.00
24.00	316.29	2.00	0.00	0.60	0.00	25.00	487.69	2.00	0.00	0.58	0.00
26.00	1351.26	2.00	0.00	0.57	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

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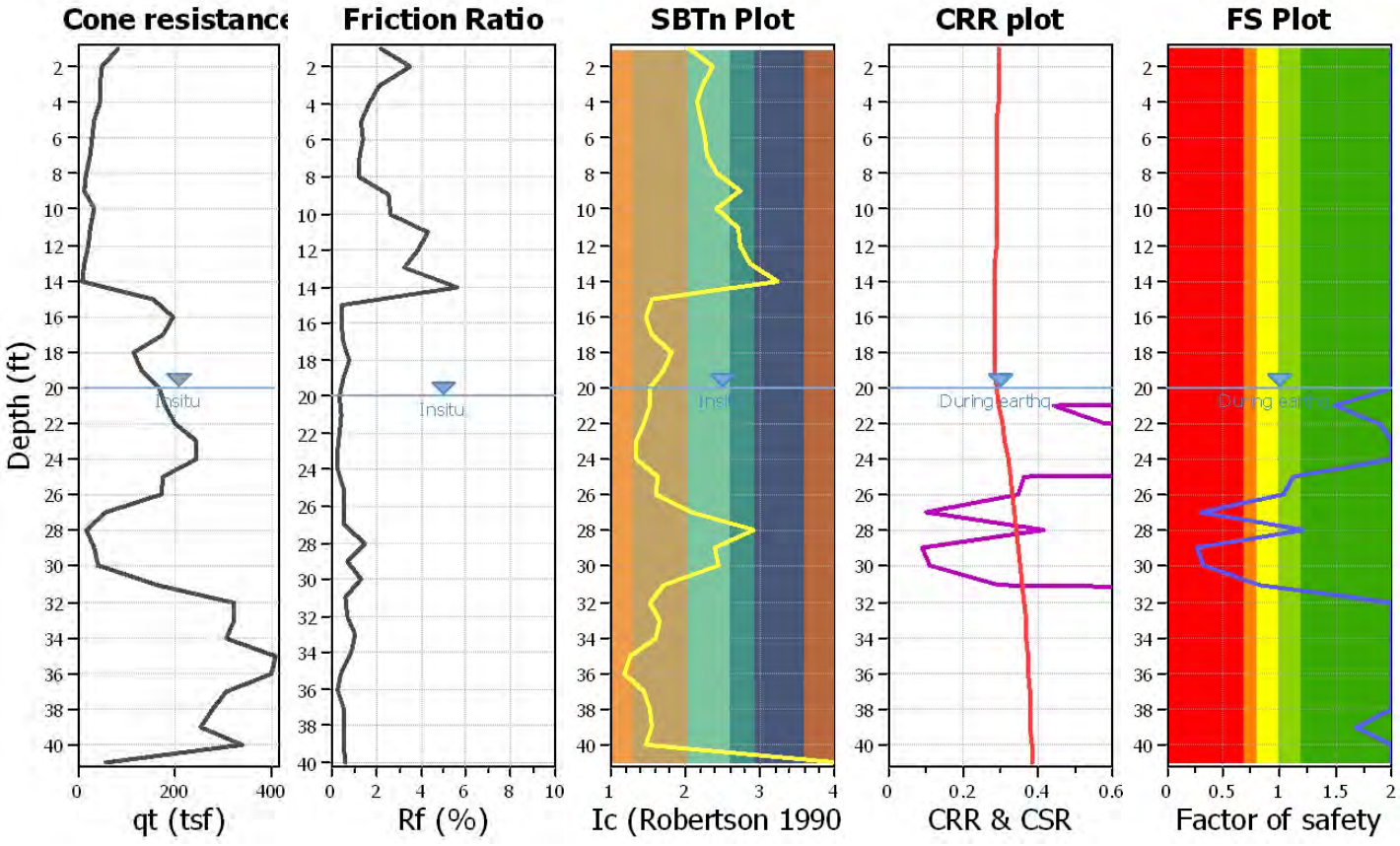
LIQUEFACTION ANALYSIS REPORT

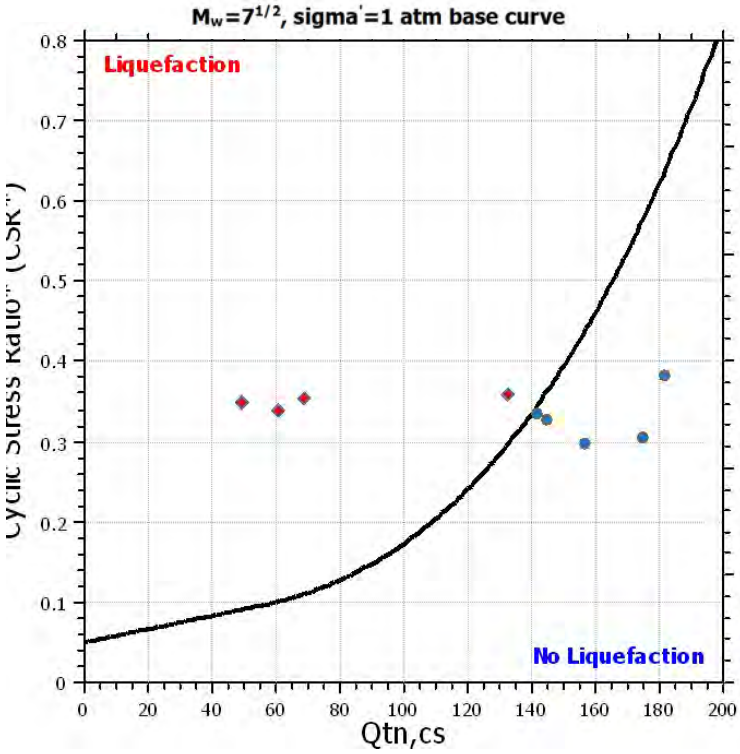
Project title : Ganahl SJC **Location :**

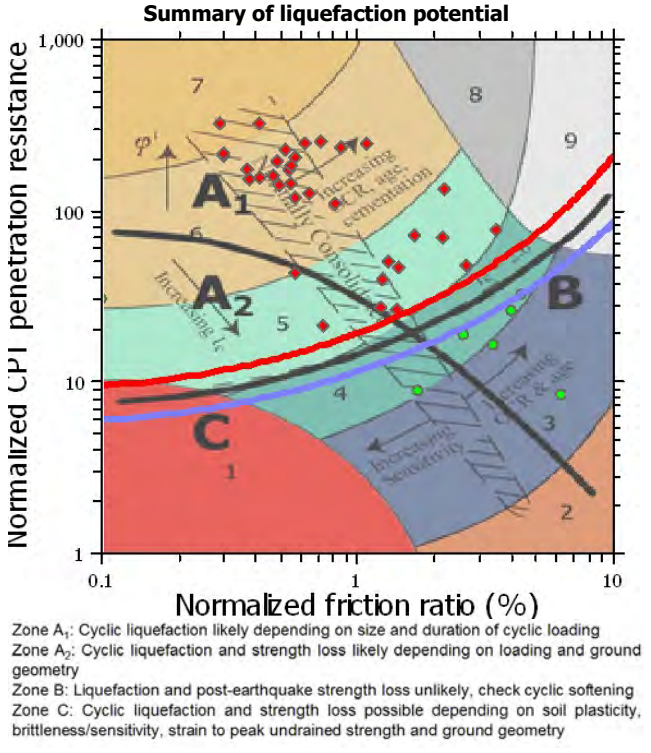
CPT file : CPT-3

Input parameters and analysis data

Analysis method:	Robertson (2009)	G.W.T. (in-situ):	20.00 ft	Use fill:	No	Clay like behavior applied:	All soils
Fines correction method:	Robertson (2009)	G.W.T. (earthq.):	20.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth:	50.00 ft
Earthquake magnitude M_w:	6.70	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.55	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

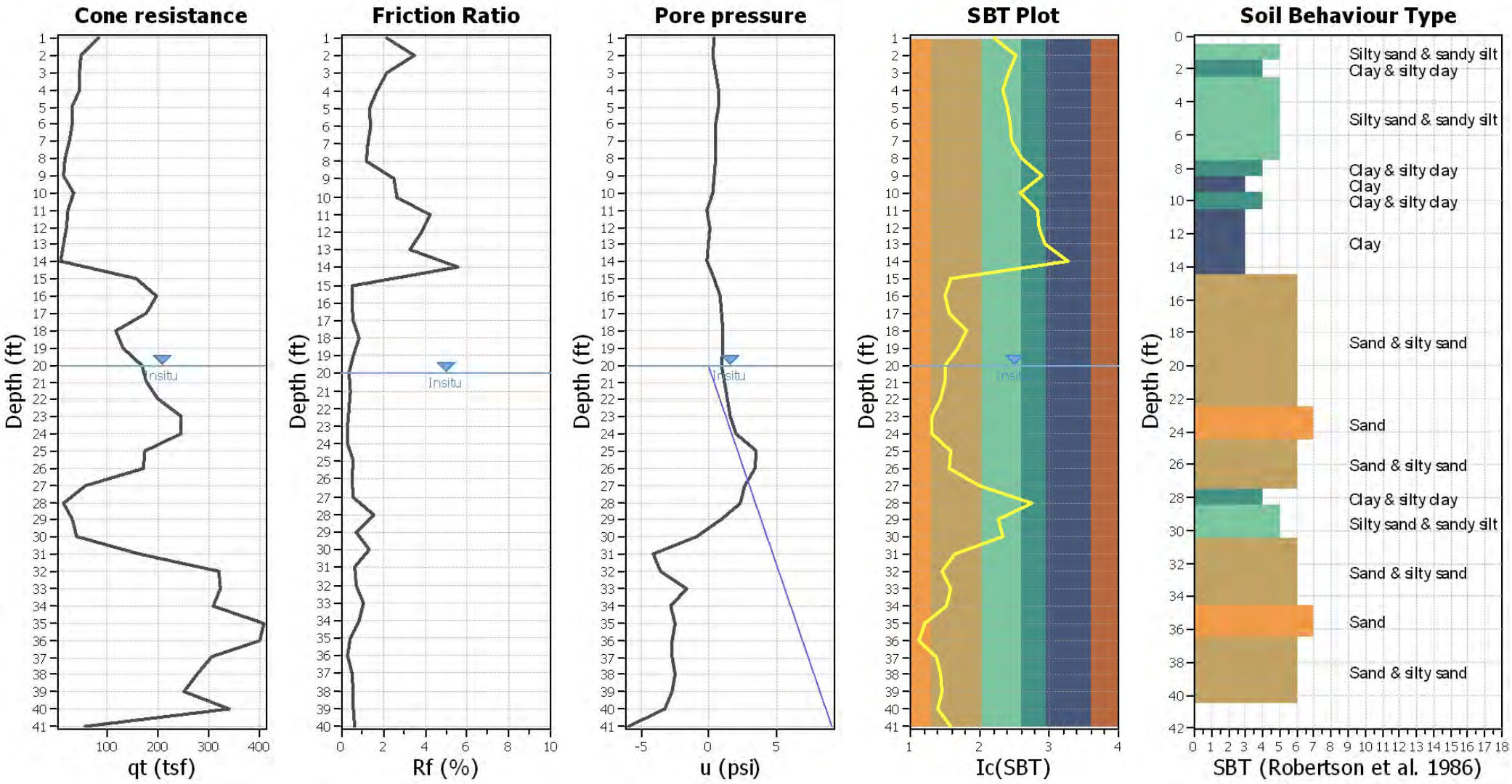






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plc



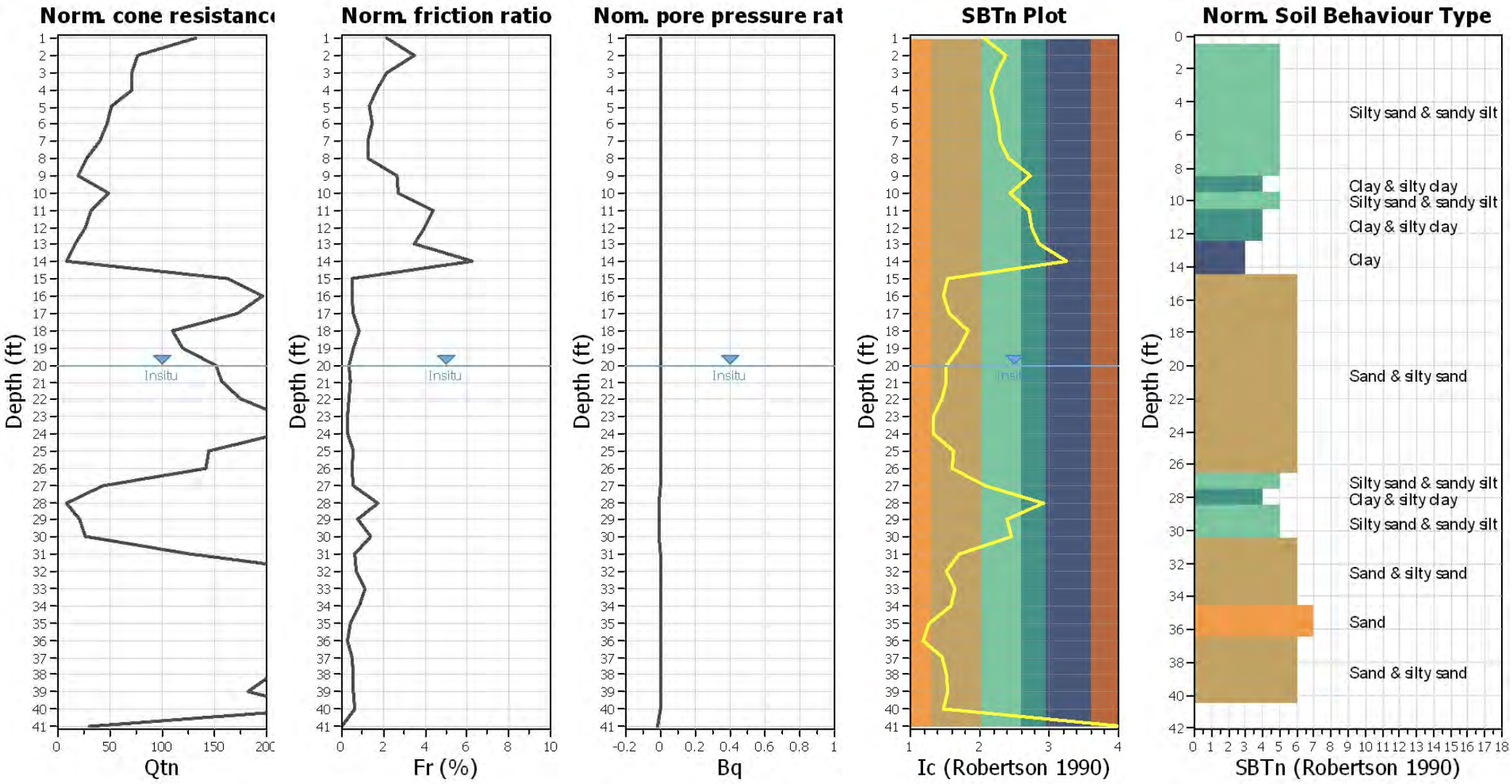
Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_o applied:	Yes
Earthquake magnitude M_w:	6.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

SBT legend

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

CPT basic interpretation plots (normaliz



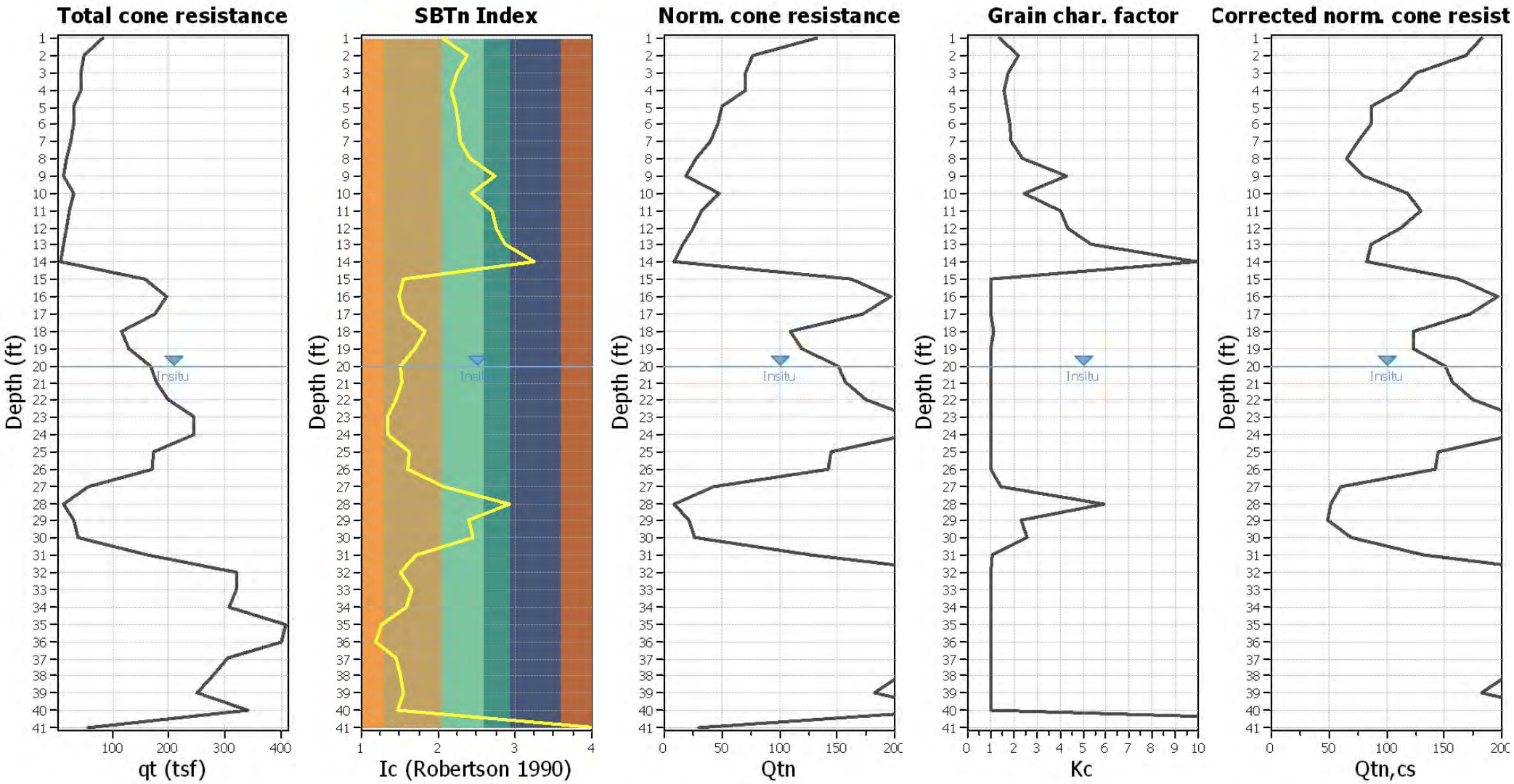
Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	All soils
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

SBTn legend

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

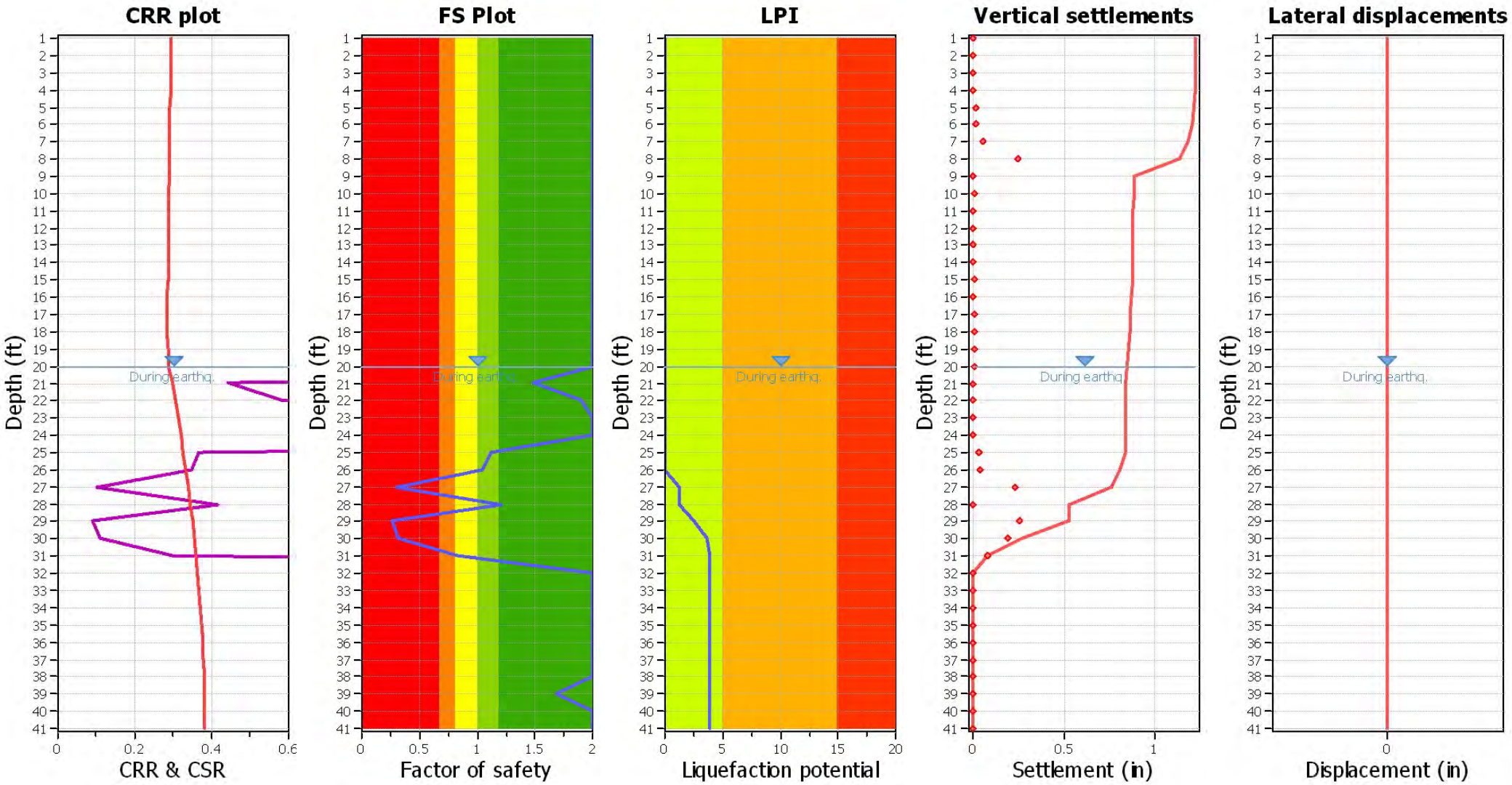
Liquefaction analysis overall plots (intermediate resi



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	All soils
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

Liquefaction analysis overall plot



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	All soils
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

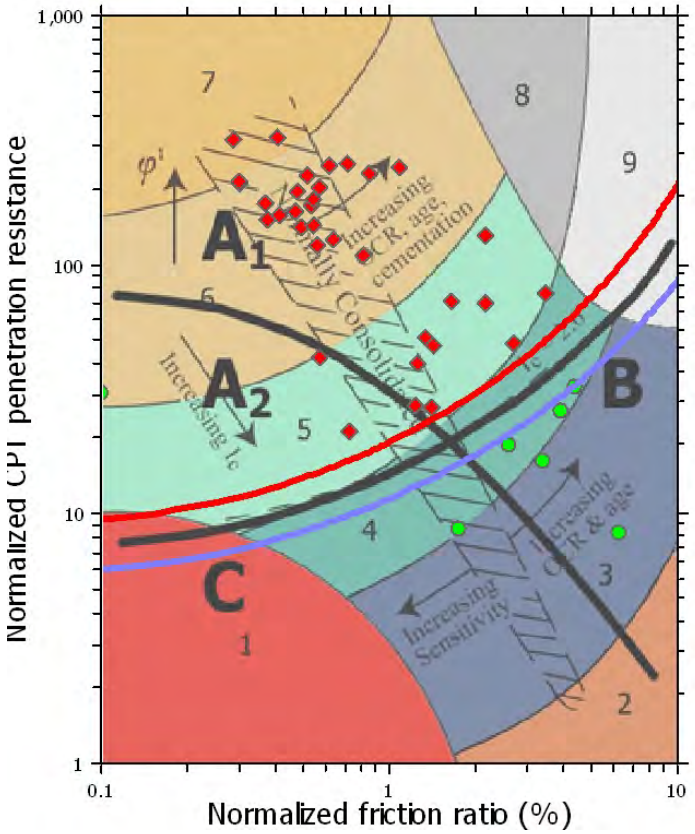
F.S. color scheme

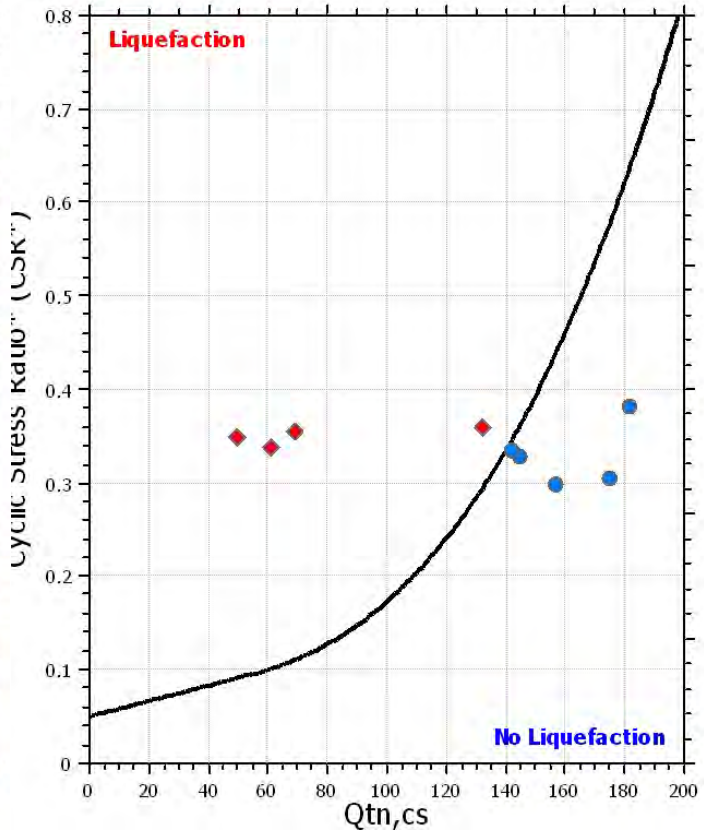
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

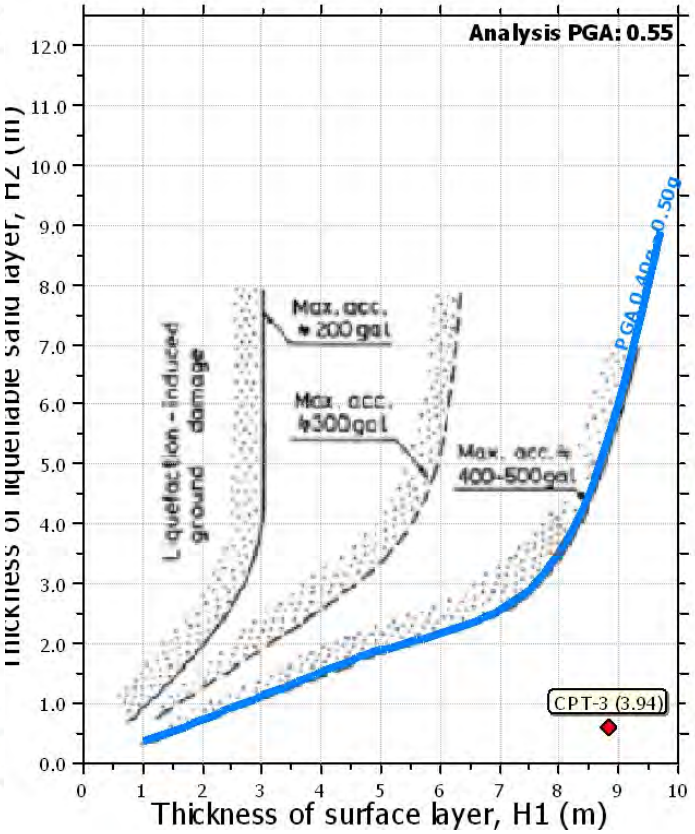
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plo



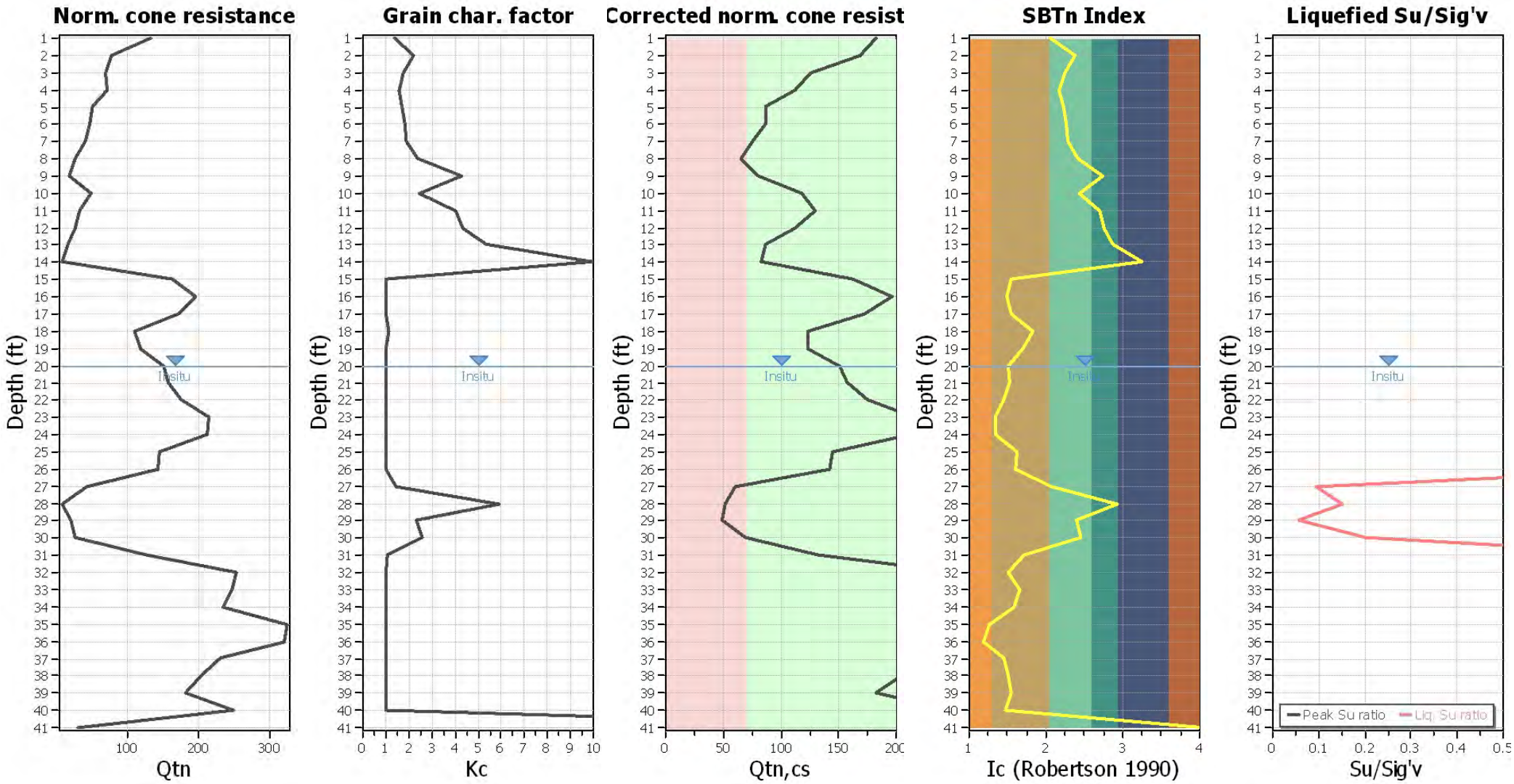




Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	All soils
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

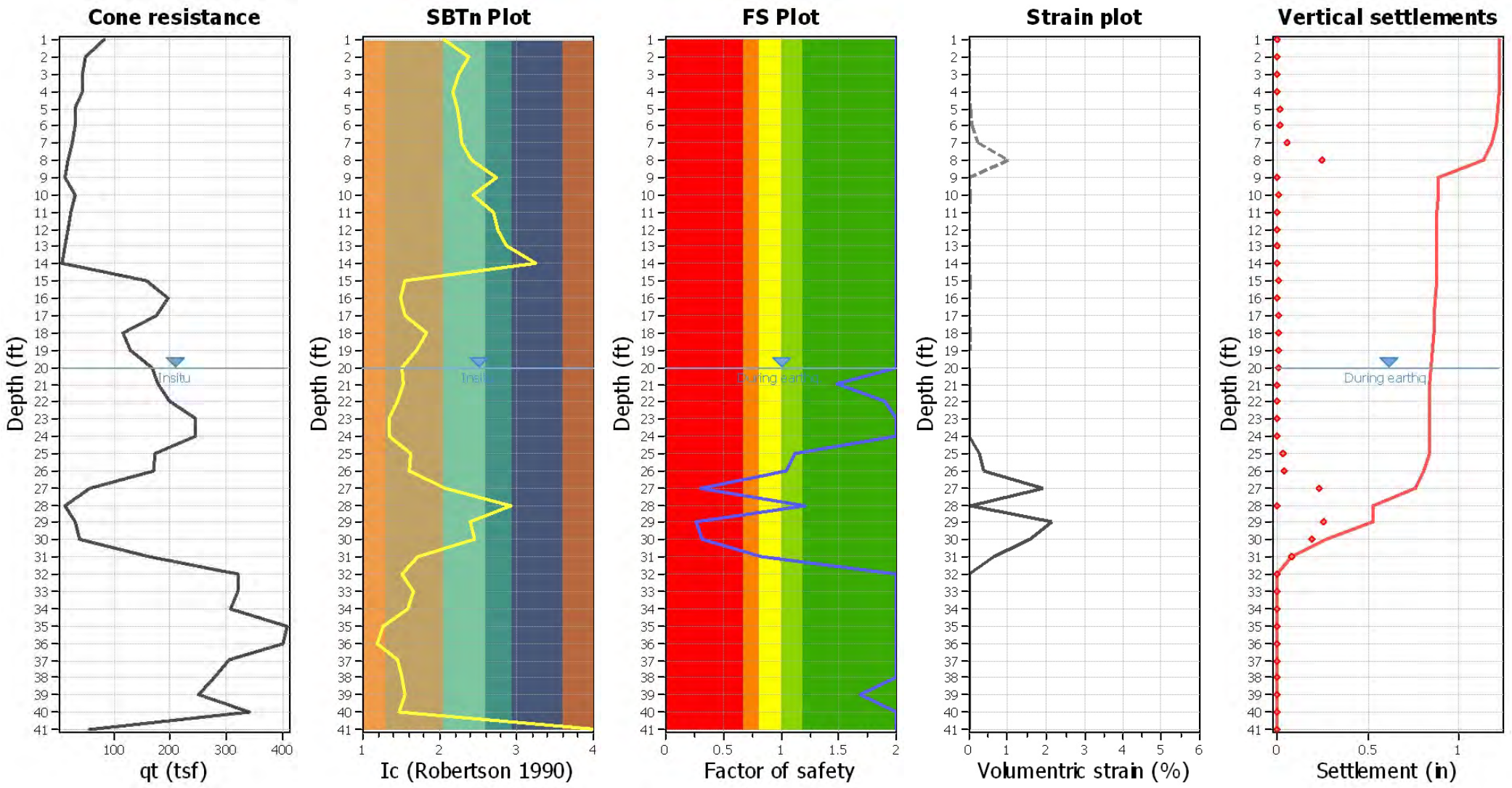
Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	All soils
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

Estimation of post-earthquake settlements



Abbreviations

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

:: Post-earthquake settlement of dry sands ::

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
1.00	2.06	132.12	1.38	182.98	39	1004	0.29	0.003	0.00	8.63	0.00	0.000
2.00	2.37	76.81	2.20	168.71	41	866	0.29	0.006	0.00	8.63	0.00	0.000
3.00	2.25	70.34	1.79	125.58	29	677	0.29	0.015	0.01	8.63	0.01	0.002
4.00	2.17	70.93	1.59	112.57	25	617	0.29	0.027	0.02	8.63	0.01	0.004
5.00	2.22	50.71	1.71	86.87	20	471	0.29	0.077	0.08	8.63	0.06	0.013
6.00	2.26	47.09	1.84	86.50	20	464	0.29	0.115	0.11	8.63	0.08	0.019
7.00	2.28	40.13	1.89	76.01	18	405	0.29	0.277	0.32	8.63	0.22	0.053
8.00	2.42	27.29	2.40	65.44	16	328	0.29	1.174	1.51	8.63	1.02	0.244
9.00	2.74	18.97	4.27	81.08	0	0	0.29	0.000	0.00	10.85	0.00	0.000
10.00	2.43	48.39	2.44	117.89	29	612	0.29	0.115	0.07	8.63	0.05	0.011
11.00	2.71	32.25	4.03	130.07	0	0	0.29	0.000	0.00	10.85	0.00	0.000
12.00	2.75	25.72	4.37	112.30	0	0	0.29	0.000	0.00	0.00	0.00	0.000
13.00	2.86	16.21	5.34	86.60	0	0	0.29	0.000	0.00	0.00	0.00	0.000
14.00	3.25	8.39	9.93	83.31	0	0	0.29	0.000	0.00	10.85	0.00	0.000
15.00	1.54	162.59	1.00	162.59	29	989	0.29	0.062	0.04	8.63	0.02	0.006
16.00	1.48	196.07	1.00	196.07	34	1148	0.28	0.050	0.03	8.63	0.02	0.004
17.00	1.56	172.32	1.00	172.32	31	1135	0.28	0.056	0.03	8.63	0.02	0.005
18.00	1.83	109.42	1.13	123.14	24	1043	0.28	0.074	0.06	8.63	0.03	0.008
19.00	1.70	119.12	1.04	123.61	23	999	0.29	0.089	0.08	8.63	0.04	0.010

Total estimated settlement: 0.38

Abbreviations

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

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

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
20.00	151.38	2.00	0.00	0.67	0.00	21.00	157.18	1.49	0.00	0.65	0.00
22.00	175.12	1.90	0.00	0.63	0.00	23.00	214.87	2.00	0.00	0.62	0.00
24.00	212.72	2.00	0.00	0.60	0.00	25.00	145.12	1.12	0.25	0.58	0.03
26.00	142.08	1.04	0.36	0.57	0.04	27.00	60.86	0.30	1.93	0.55	0.23
28.00	51.46	1.21	0.02	0.53	0.00	29.00	49.35	0.26	2.15	0.52	0.26
30.00	68.85	0.31	1.59	0.50	0.19	31.00	132.50	0.83	0.65	0.48	0.08
32.00	253.72	2.00	0.00	0.47	0.00	33.00	247.39	2.00	0.00	0.45	0.00
34.00	234.44	2.00	0.00	0.43	0.00	35.00	324.15	2.00	0.00	0.42	0.00
36.00	319.93	2.00	0.00	0.40	0.00	37.00	230.04	2.00	0.00	0.38	0.00
38.00	204.96	2.00	0.00	0.37	0.00	39.00	182.12	1.68	0.00	0.35	0.00
40.00	248.27	2.00	0.00	0.33	0.00	41.00	809.56	2.00	0.00	0.32	0.00

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

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

Total estimated settlement: 0.84

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

Willdan Geotechnical
1515 S. Sunkist St., Suite E
Anaheim, CA 92806

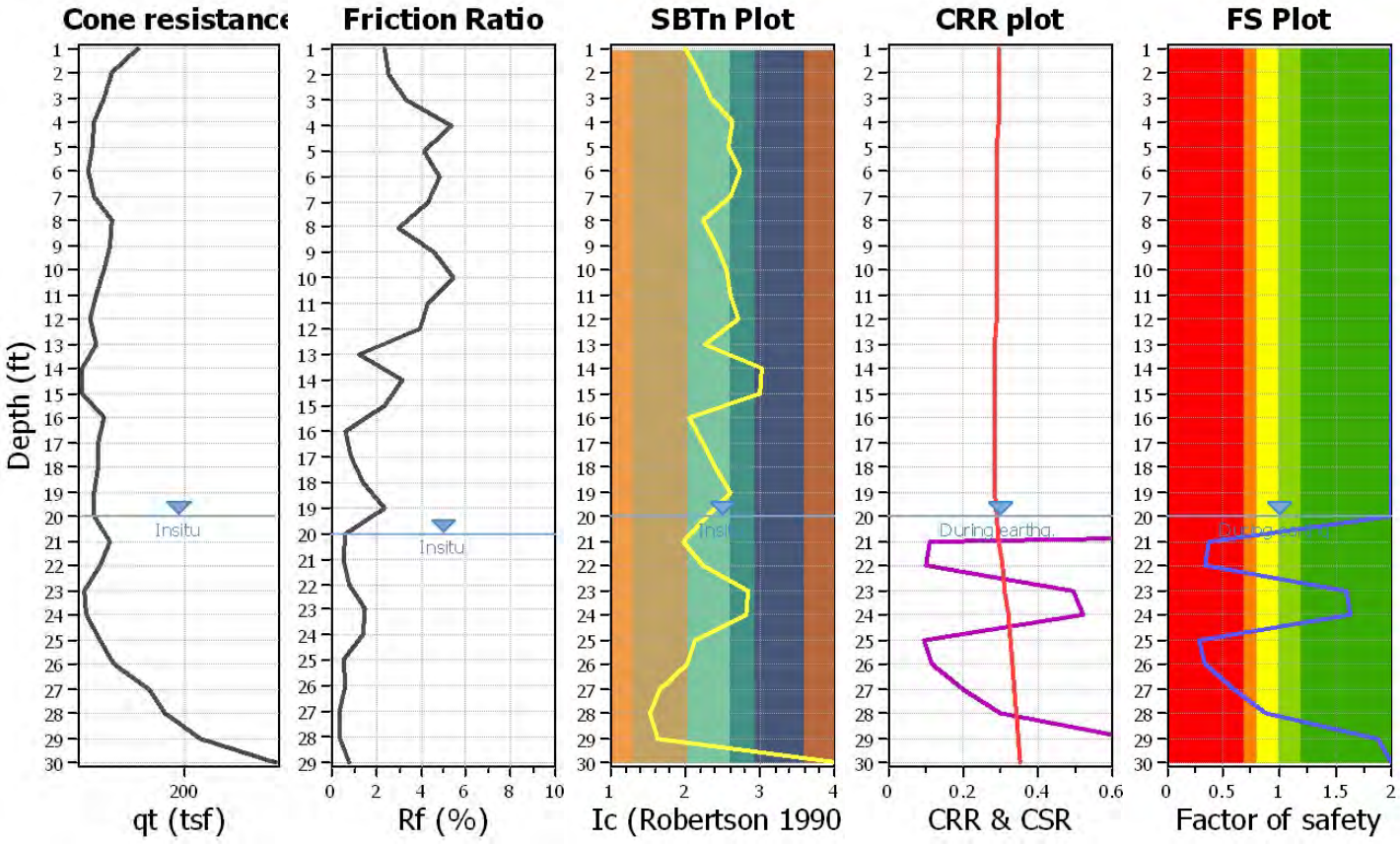
LIQUEFACTION ANALYSIS REPORT

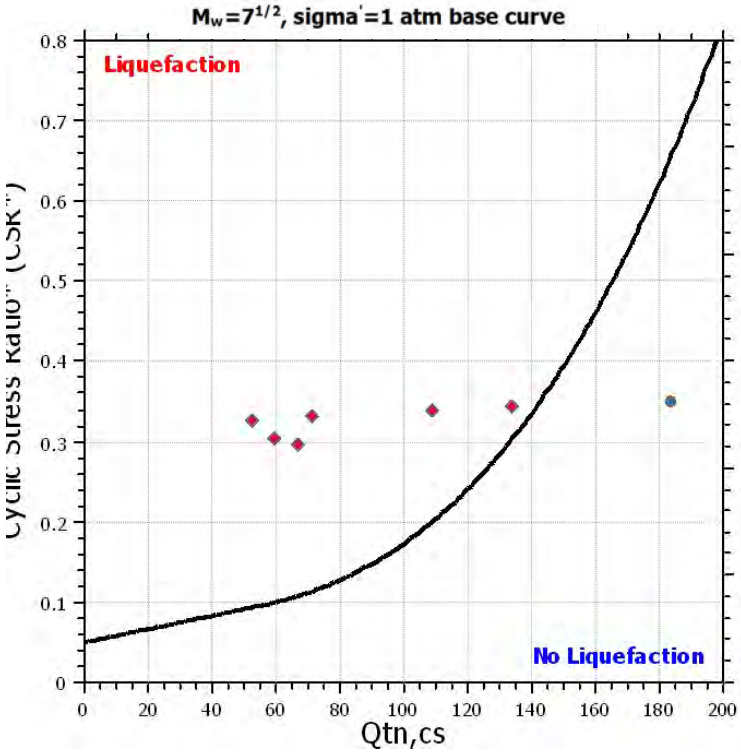
Project title : Ganahl SJC **Location :**

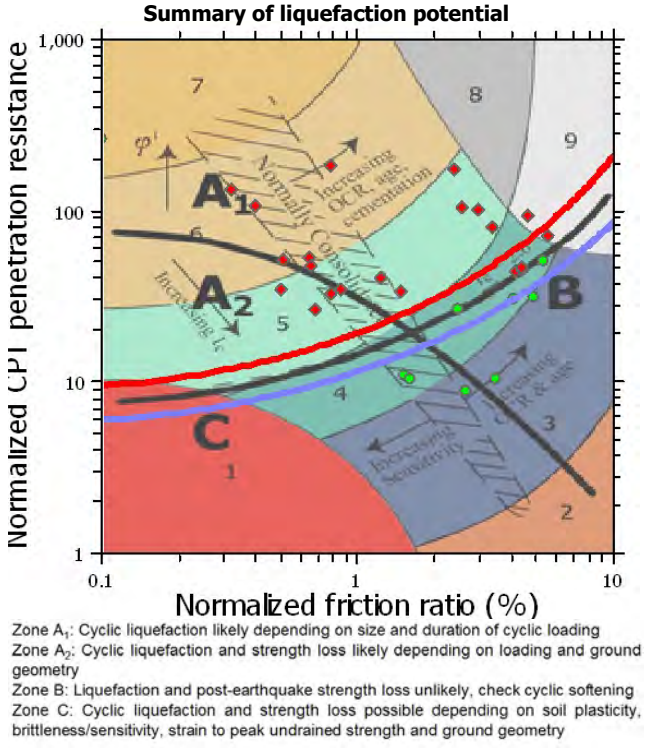
CPT file : CPT-4

Input parameters and analysis data

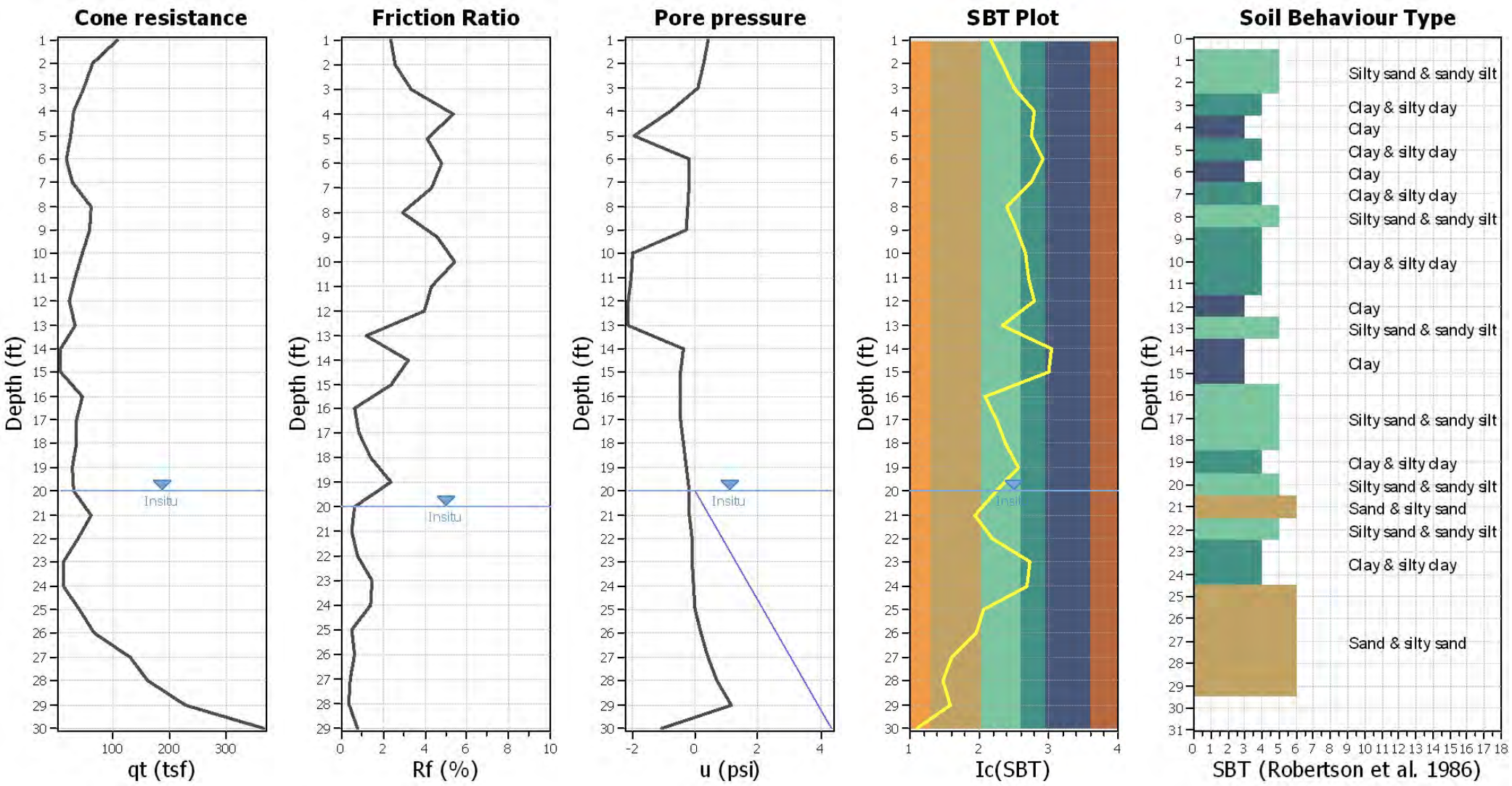
Analysis method:	Robertson (2009)	G.W.T. (in-situ):	20.00 ft	Use fill:	No	Clay like behavior applied:	All soils
Fines correction method:	Robertson (2009)	G.W.T. (earthq.):	20.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth:	50.00 ft
Earthquake magnitude M_w:	6.70	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.55	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		







CPT basic interpretation plc



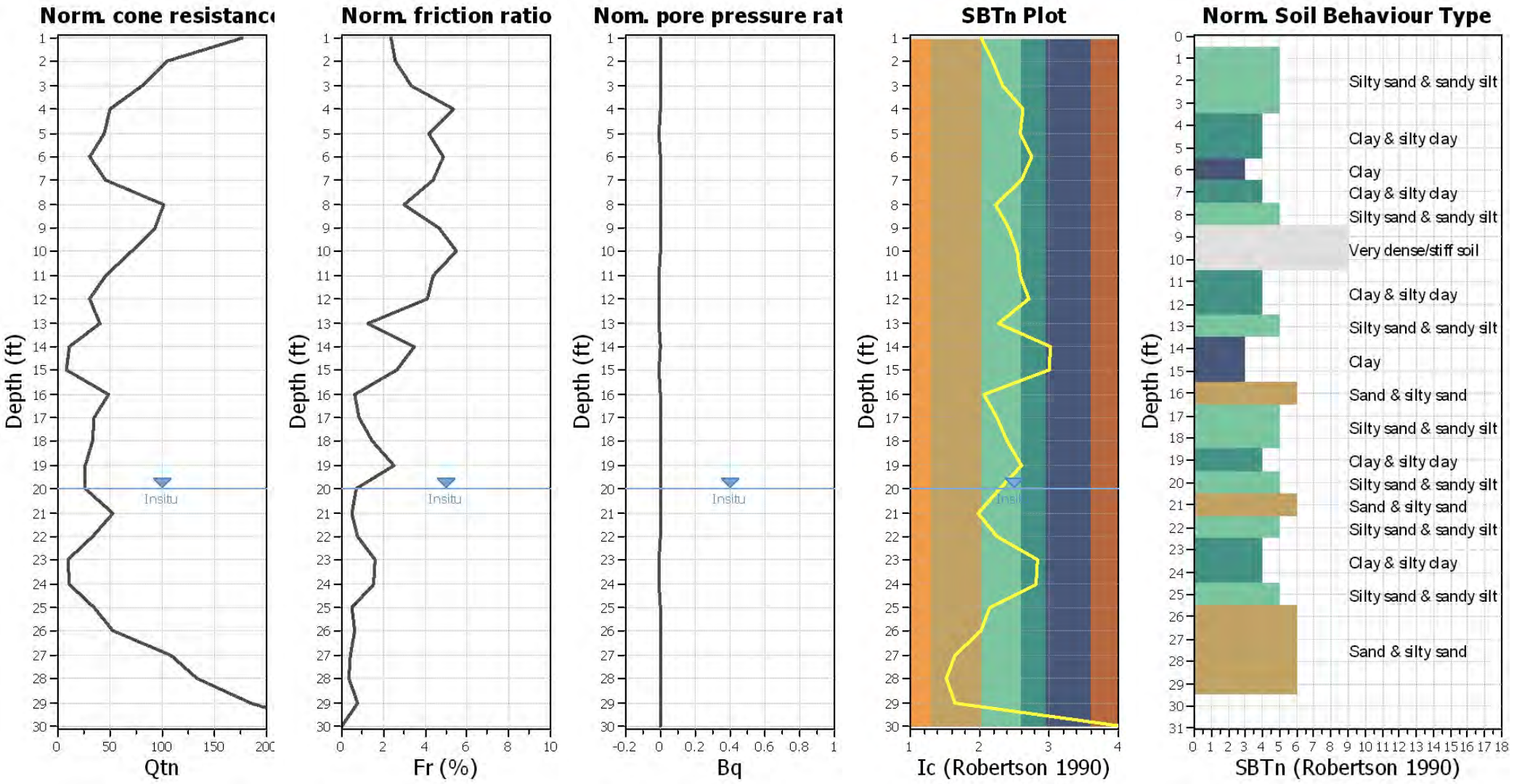
Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_o applied:	Yes
Earthquake magnitude M_w:	6.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

SBT legend

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

CPT basic interpretation plots (normaliz



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	All soils
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SBTn legend

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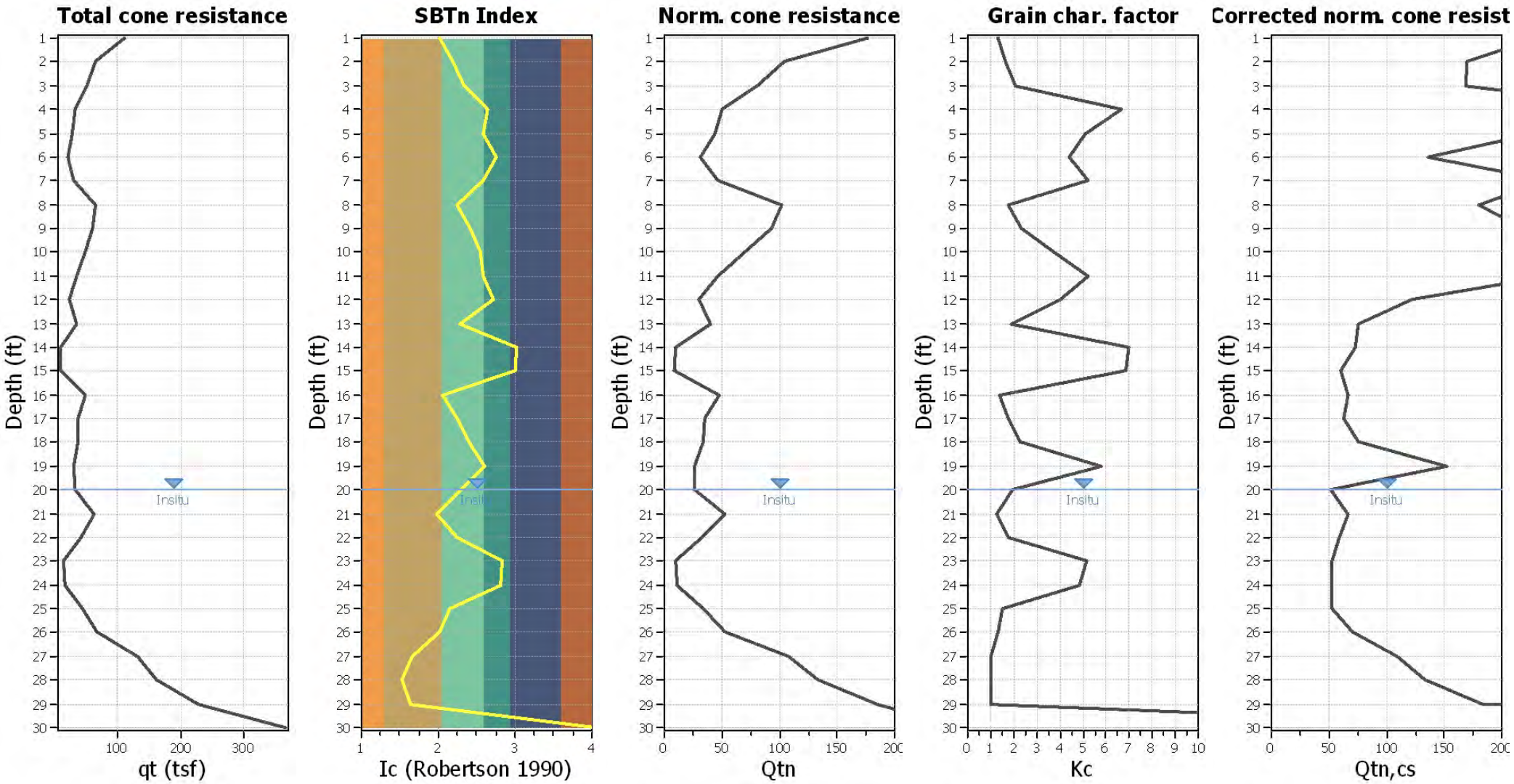
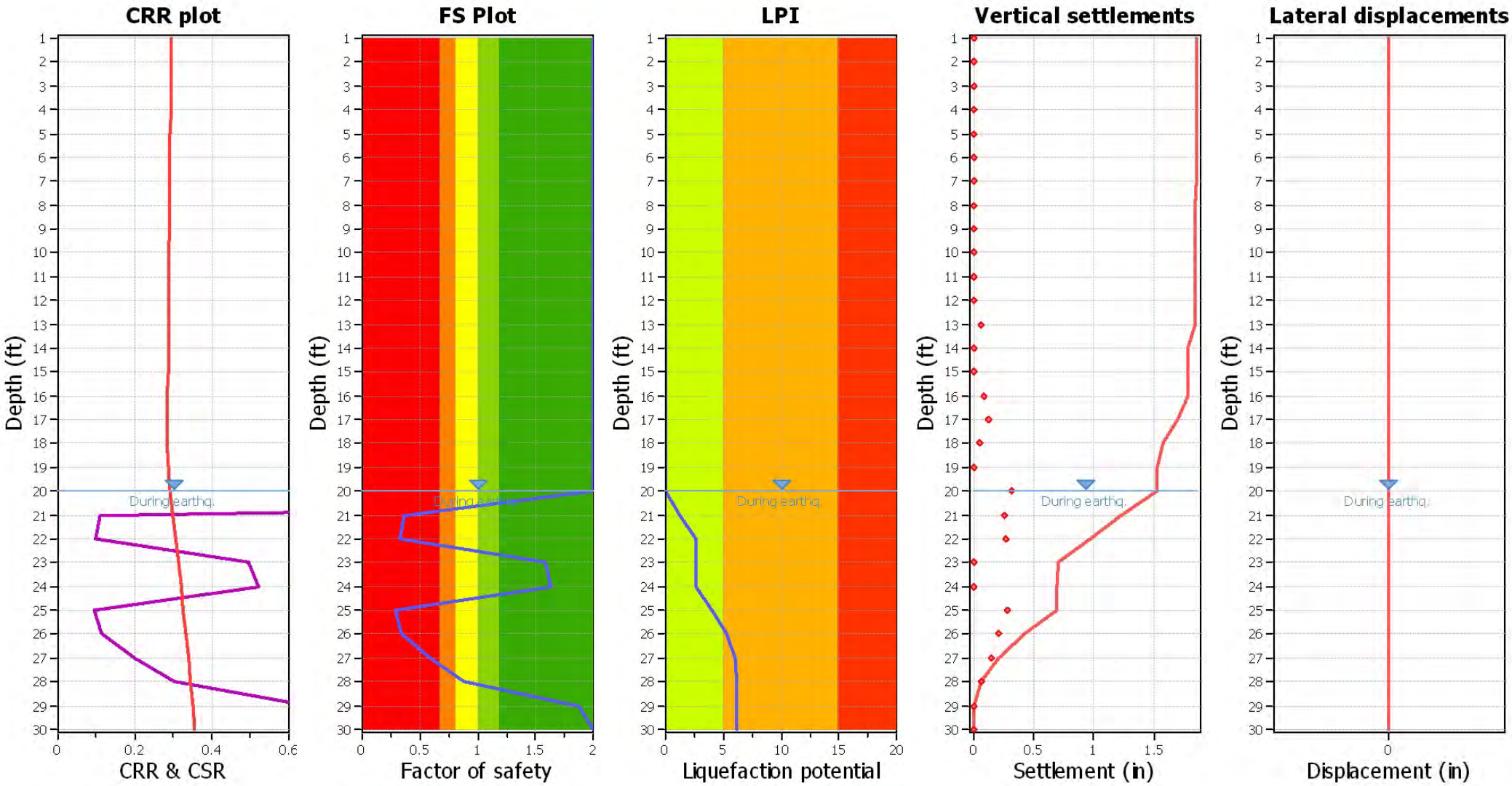
Liquefaction analysis overall plots (intermediate resi



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	All soils
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

Liquefaction analysis overall plot



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	All soils
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

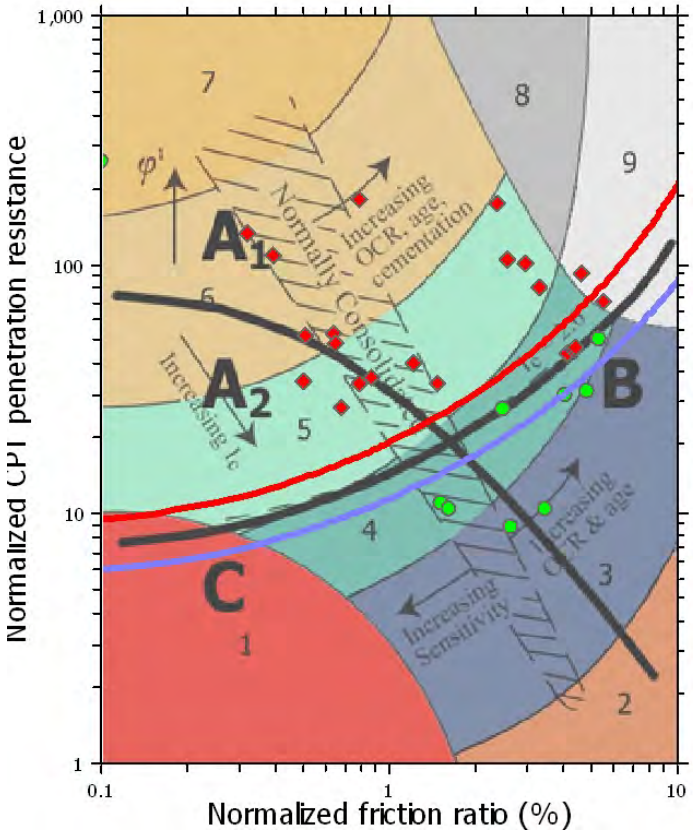
F.S. color scheme

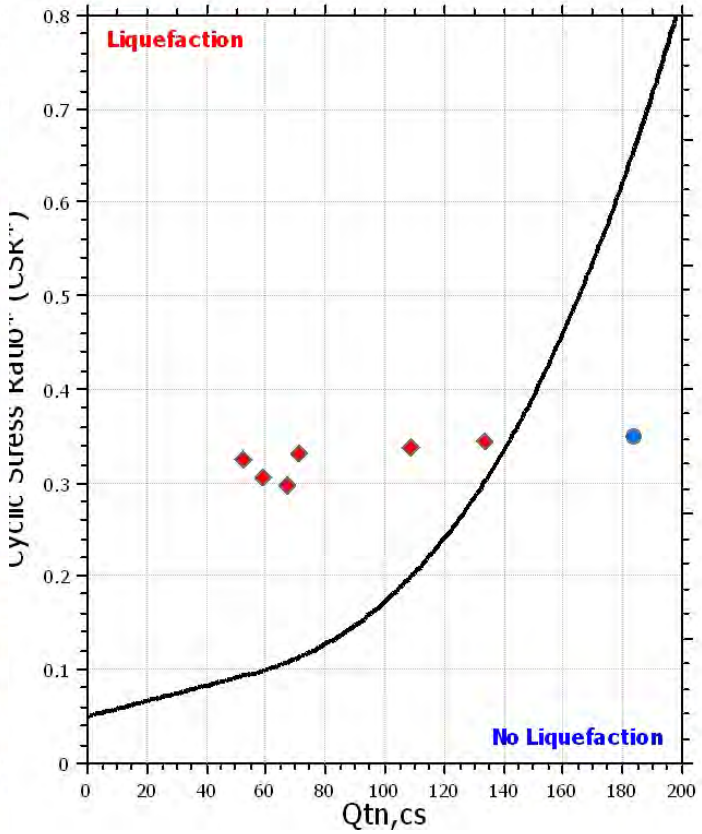
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

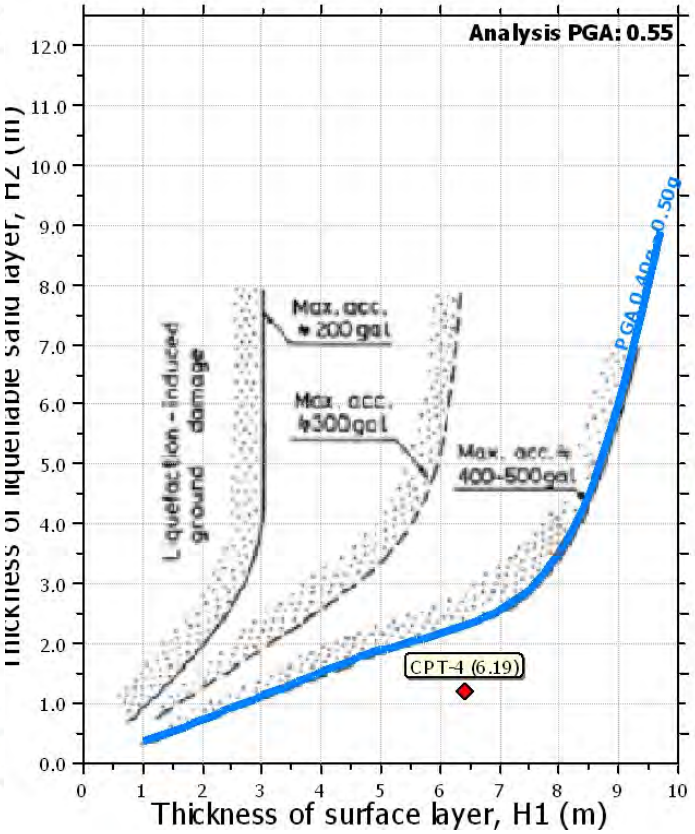
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plo







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Analysis method:	Robertson (2009)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
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Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
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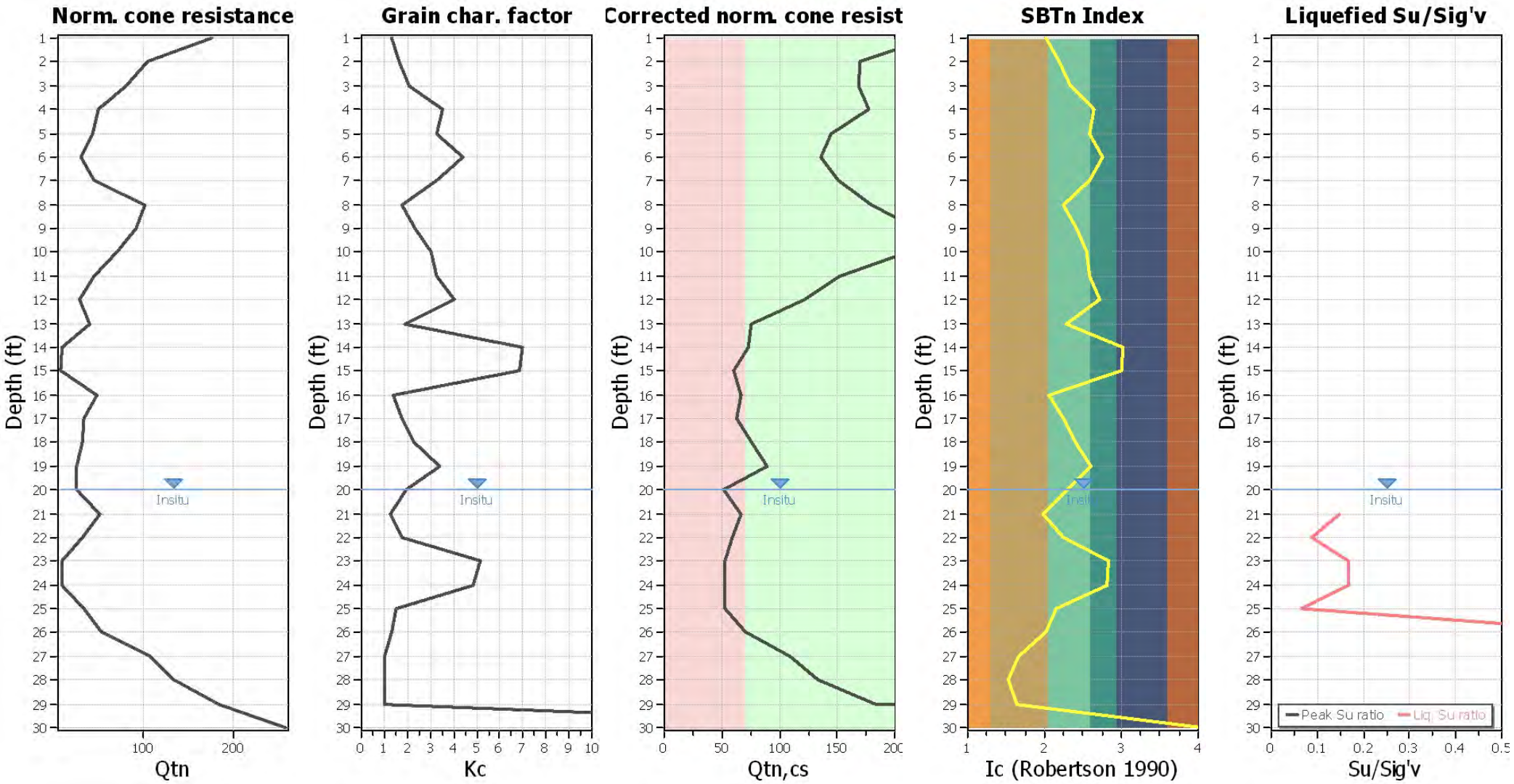
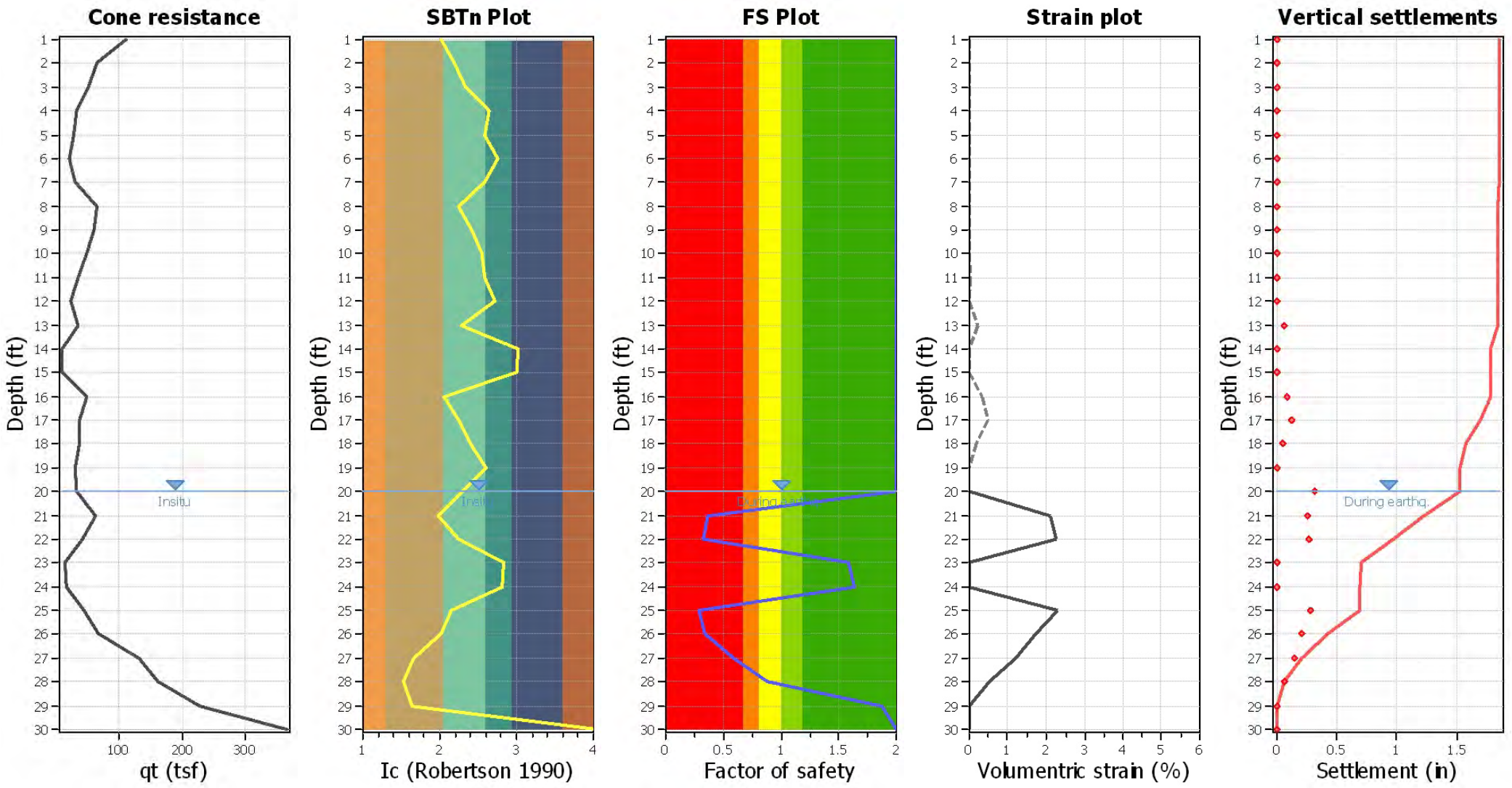
Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	All soils
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

Estimation of post-earthquake settlements



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I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

:: Post-earthquake settlement of dry sands ::

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
1.00	2.01	176.57	1.31	232.00	48	1262	0.29	0.002	0.00	8.63	0.00	0.000
2.00	2.18	104.83	1.62	169.71	38	928	0.29	0.006	0.00	8.63	0.00	0.001
3.00	2.34	80.56	2.09	168.26	40	875	0.29	0.010	0.00	8.63	0.00	0.001
4.00	2.63	50.08	3.53	177.02	0	0	0.29	0.000	0.00	12.48	0.00	0.000
5.00	2.59	44.25	3.27	144.90	39	660	0.29	0.033	0.01	8.63	0.01	0.003
6.00	2.75	30.94	4.37	135.28	0	0	0.29	0.000	0.00	0.00	0.00	0.000
7.00	2.59	45.95	3.29	151.22	41	688	0.29	0.049	0.02	8.63	0.01	0.003
8.00	2.24	101.89	1.76	179.29	41	969	0.29	0.029	0.01	8.63	0.01	0.002
9.00	2.41	93.00	2.35	218.79	54	1120	0.29	0.026	0.01	8.63	0.01	0.001
10.00	2.54	70.88	2.99	212.13	56	1069	0.29	0.033	0.01	8.63	0.01	0.002
11.00	2.59	46.26	3.29	152.11	41	798	0.29	0.072	0.03	8.63	0.02	0.005
12.00	2.71	30.06	4.06	121.90	0	0	0.29	0.000	0.00	10.85	0.00	0.000
13.00	2.27	40.49	1.87	75.73	18	553	0.29	0.338	0.39	8.63	0.24	0.058
14.00	3.02	10.46	6.96	72.82	0	0	0.29	0.000	0.00	10.85	0.00	0.000
15.00	3.01	8.87	6.84	60.68	0	0	0.29	0.000	0.00	10.85	0.00	0.000
16.00	2.06	48.25	1.39	67.22	14	585	0.28	0.409	0.61	8.63	0.35	0.084
17.00	2.24	35.19	1.78	62.70	14	555	0.28	0.595	0.88	8.63	0.49	0.118
18.00	2.39	33.50	2.26	75.69	19	660	0.28	0.317	0.35	8.63	0.19	0.046
19.00	2.61	26.26	3.39	89.08	0	0	0.29	0.000	0.00	10.85	0.00	0.000

Total estimated settlement: 0.32

Abbreviations

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

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

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
20.00	52.00	2.00	0.00	0.67	0.00	21.00	66.96	0.36	2.11	0.65	0.25
22.00	59.32	0.33	2.27	0.63	0.27	23.00	53.30	1.59	0.01	0.62	0.00
24.00	52.87	1.64	0.01	0.60	0.00	25.00	52.67	0.29	2.31	0.58	0.28
26.00	70.99	0.34	1.75	0.57	0.21	27.00	108.89	0.59	1.20	0.55	0.14
28.00	133.47	0.88	0.55	0.53	0.07	29.00	183.60	1.88	0.00	0.52	0.00
30.00	6861.19	2.00	0.00	0.50	0.00						

Total estimated settlement: 1.22

Abbreviations

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

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Anaheim, CA 92806

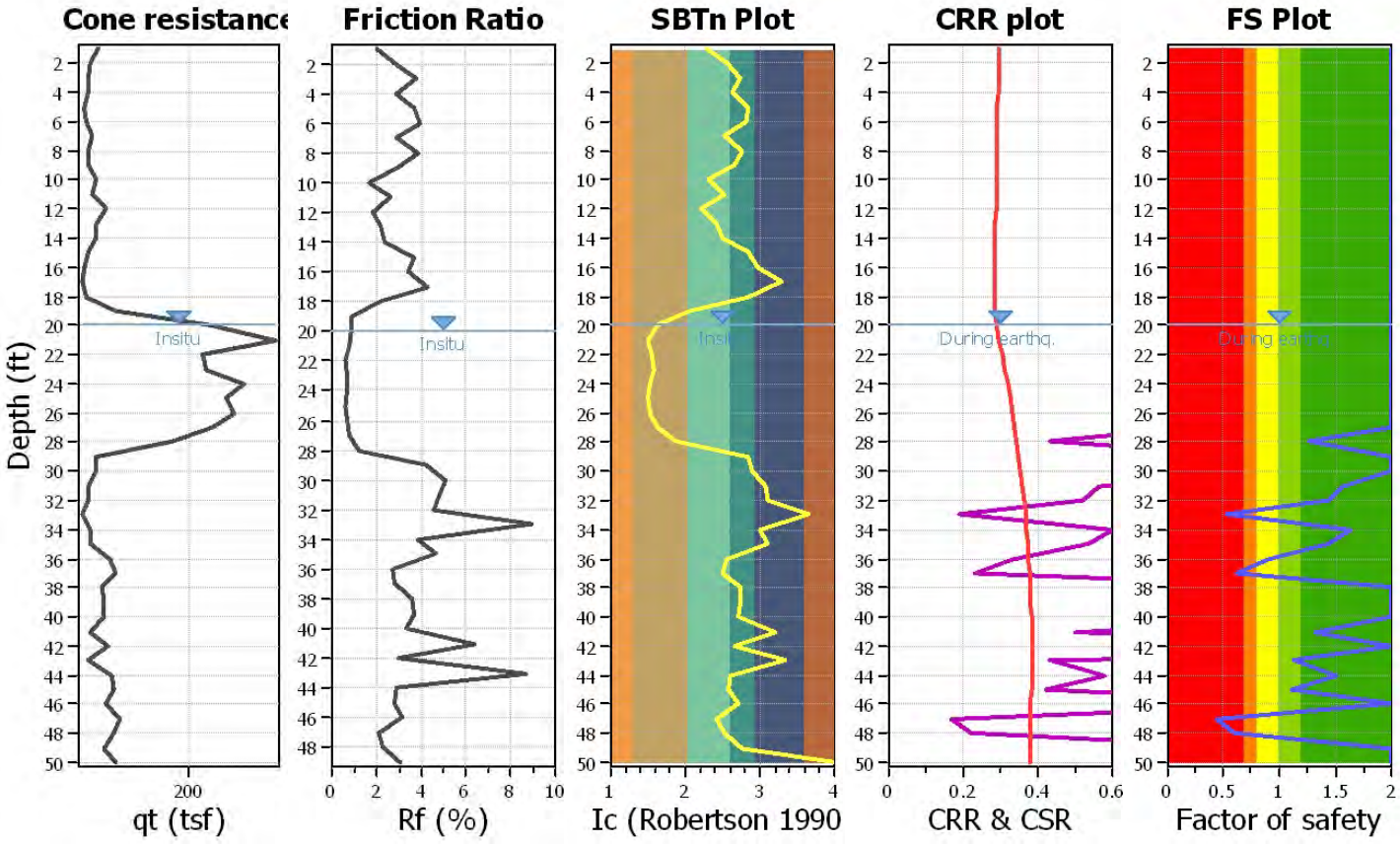
LIQUEFACTION ANALYSIS REPORT

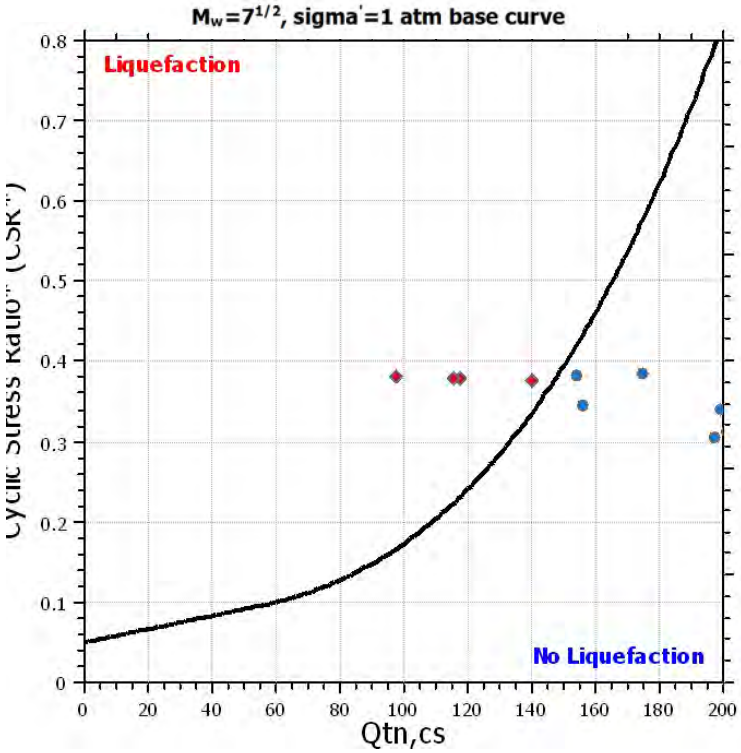
Project title : Ganahl SJC **Location :**

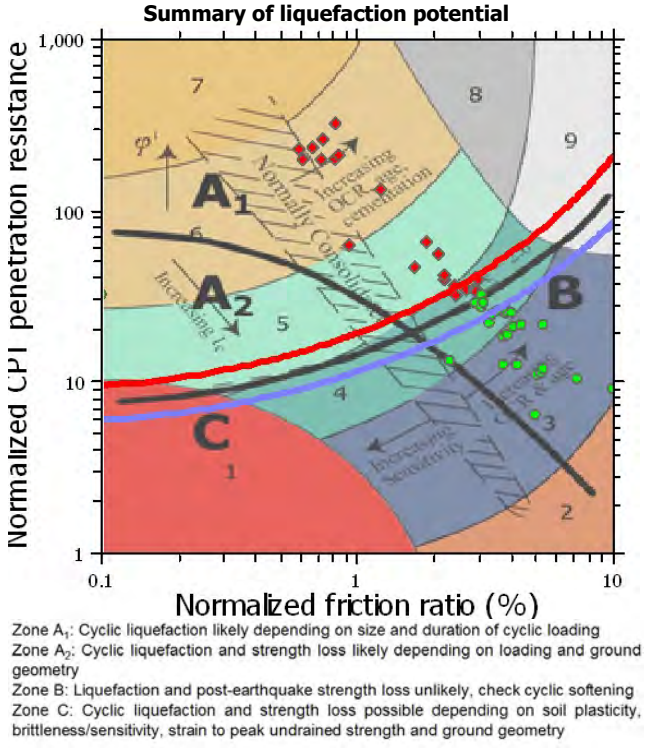
CPT file : CPT-5

Input parameters and analysis data

Analysis method:	Robertson (2009)	G.W.T. (in-situ):	20.00 ft	Use fill:	No	Clay like behavior applied:	All soils
Fines correction method:	Robertson (2009)	G.W.T. (earthq.):	20.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth:	50.00 ft
Earthquake magnitude M_w:	6.70	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.55	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

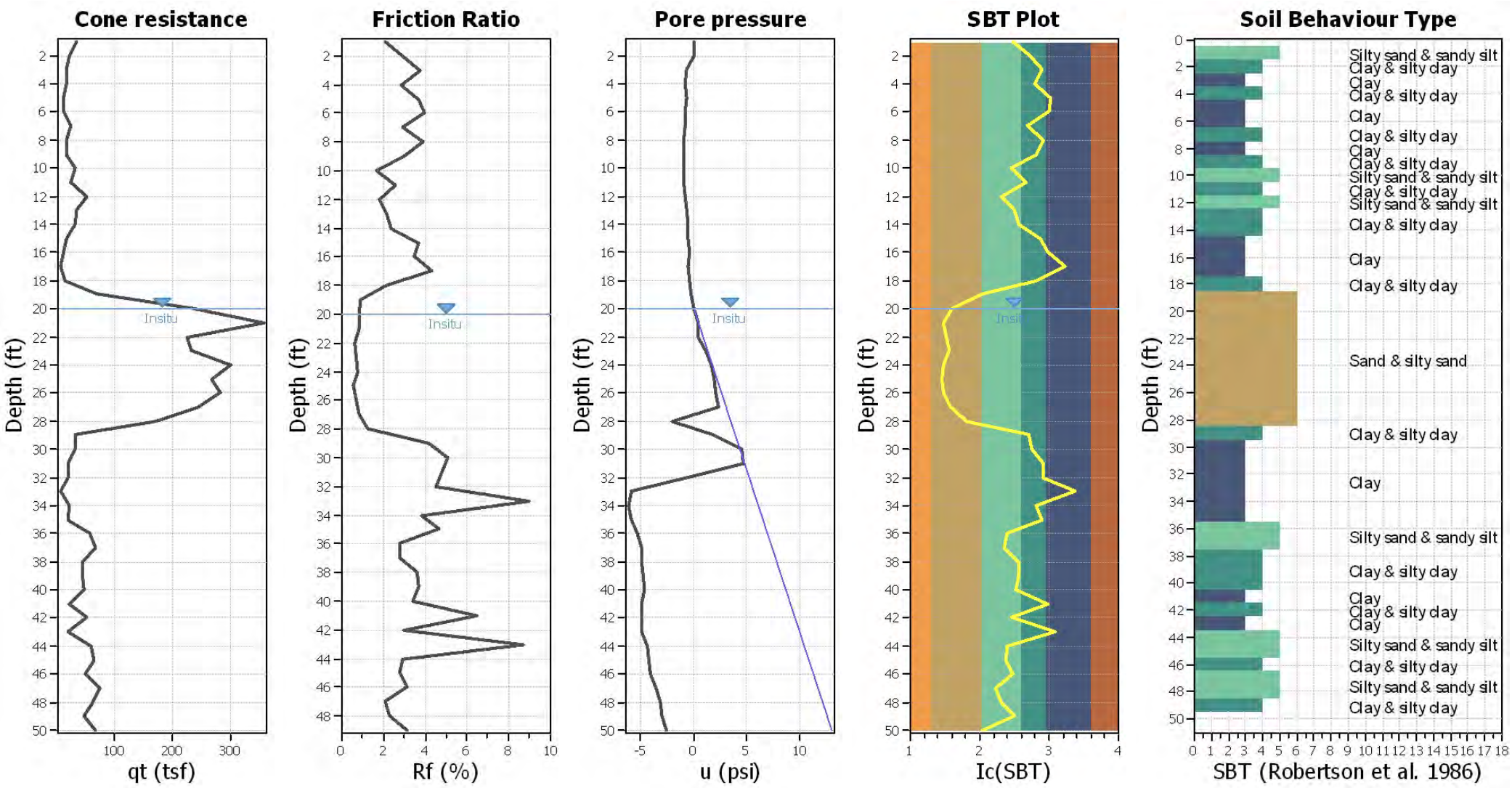






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plc



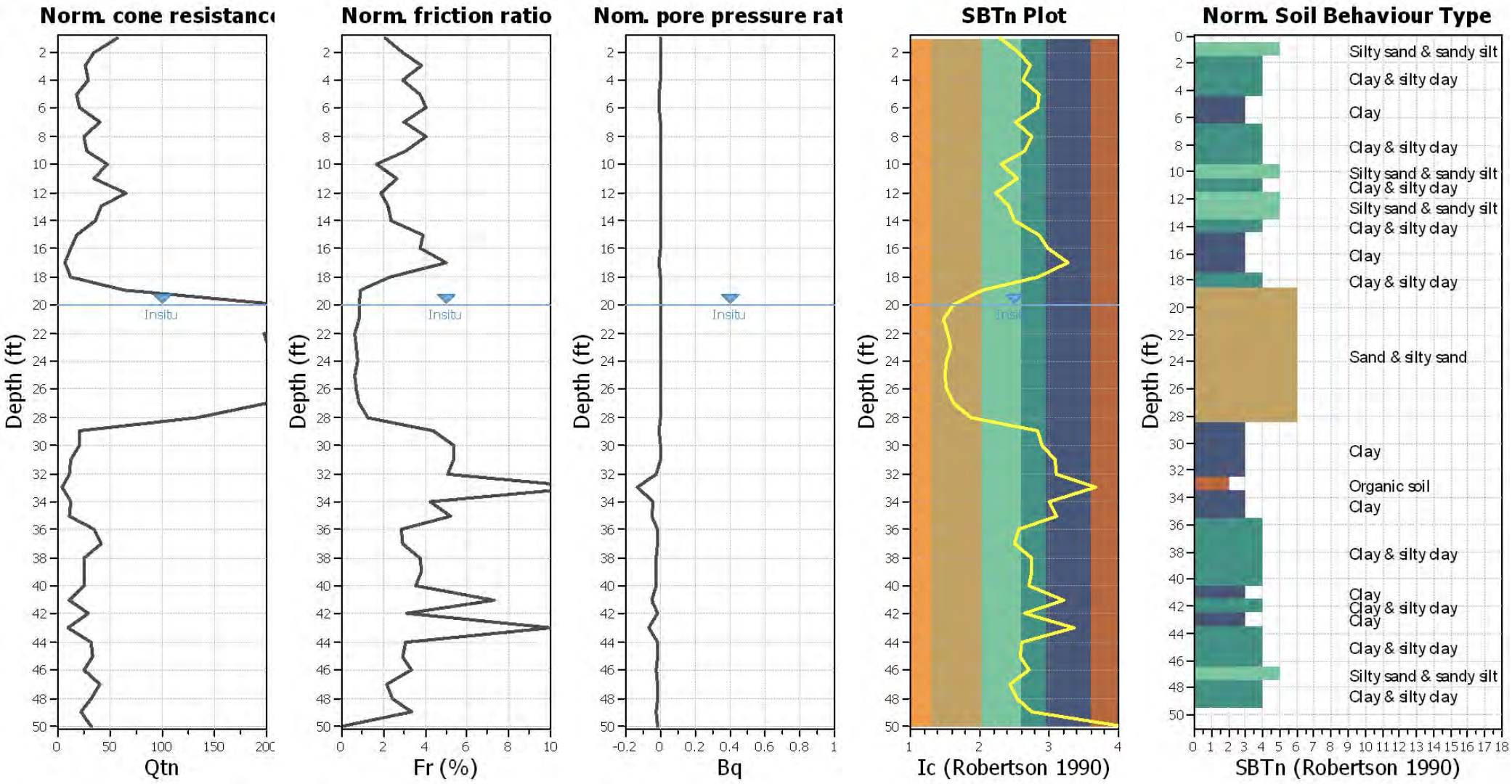
Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	All soils
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

SBT legend

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

CPT basic interpretation plots (normaliz



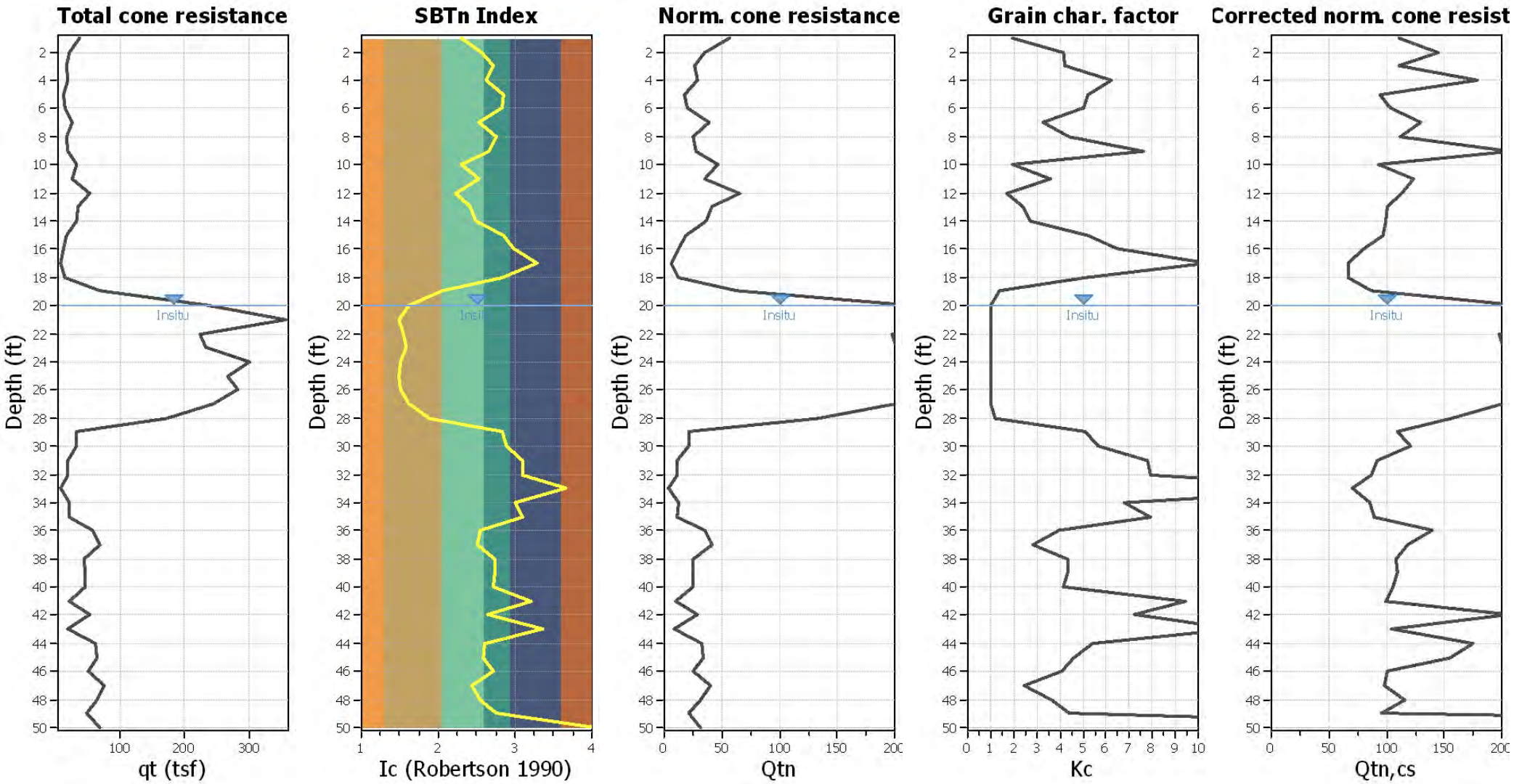
Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	All soils
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

SBTn legend

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

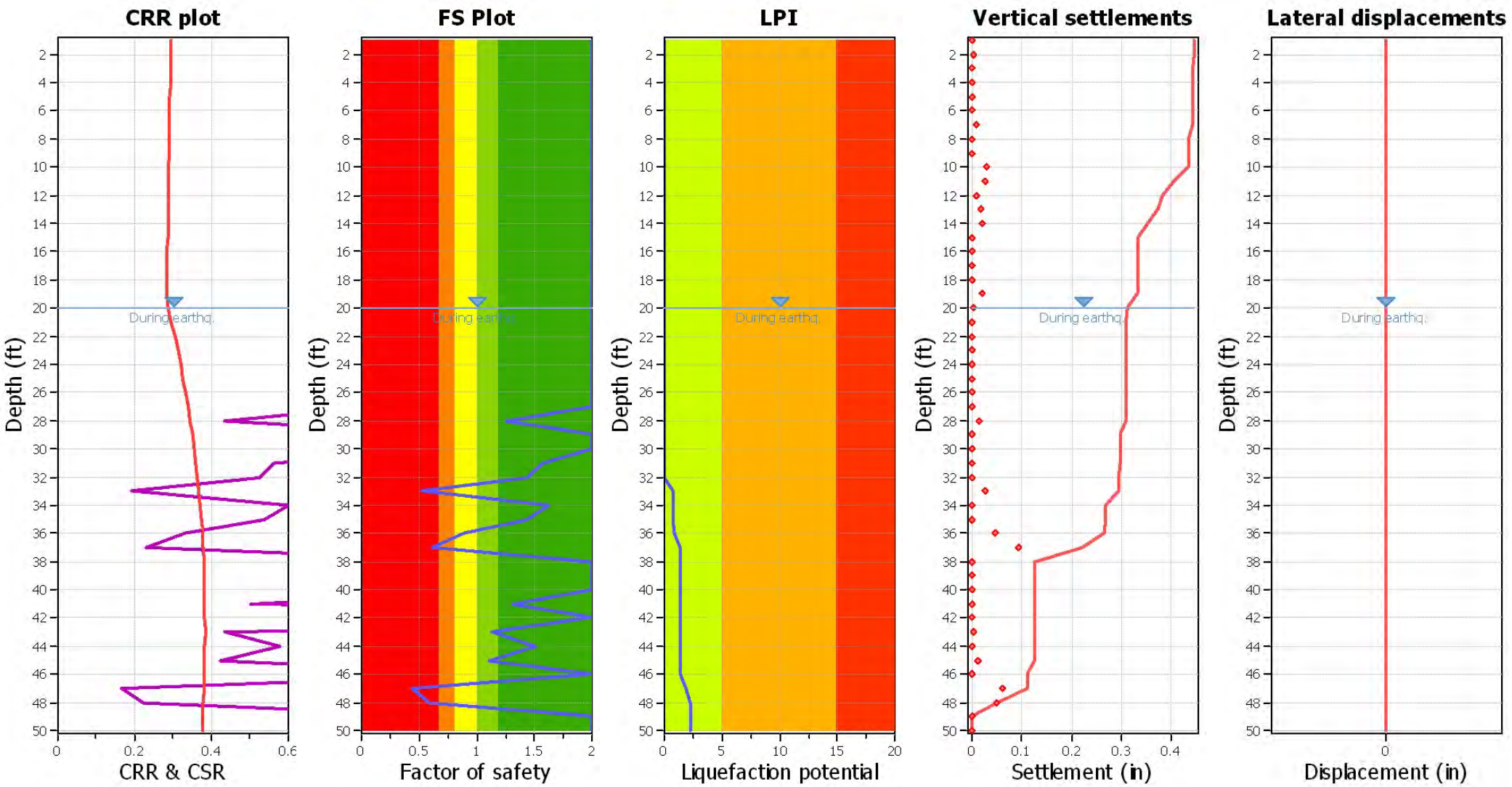
Liquefaction analysis overall plots (intermediate resi



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	All soils
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

Liquefaction analysis overall plot



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	All soils
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

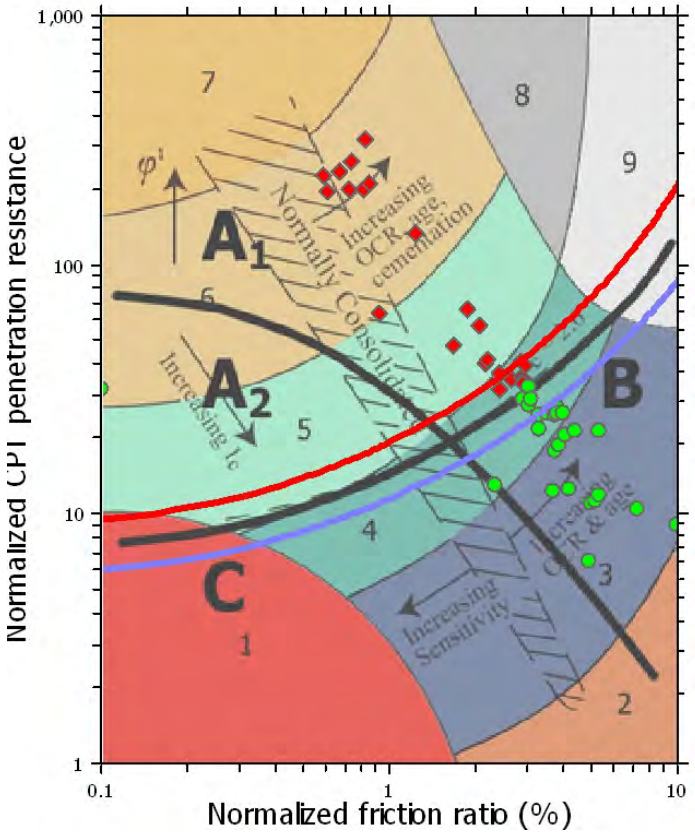
F.S. color scheme

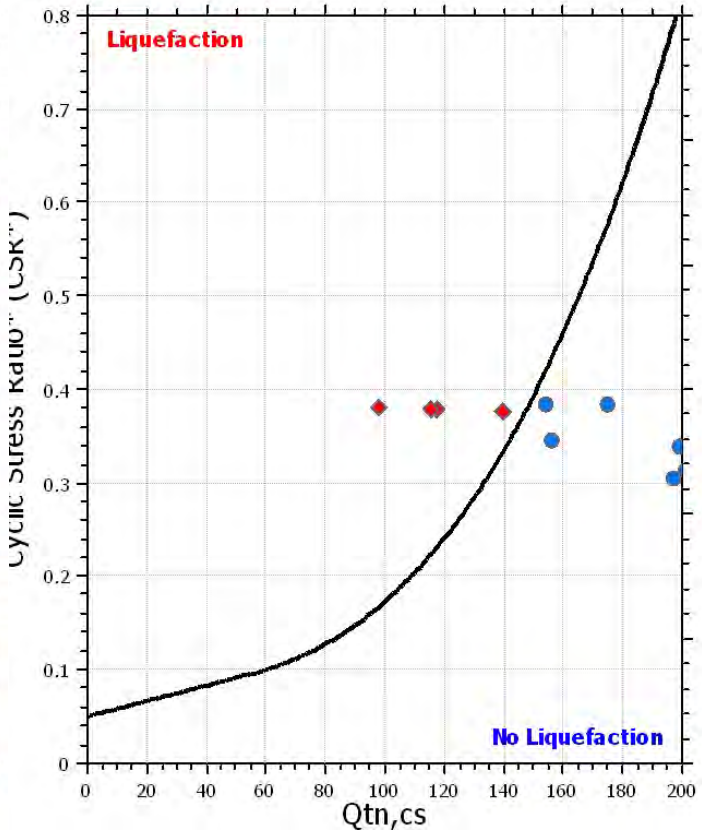
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

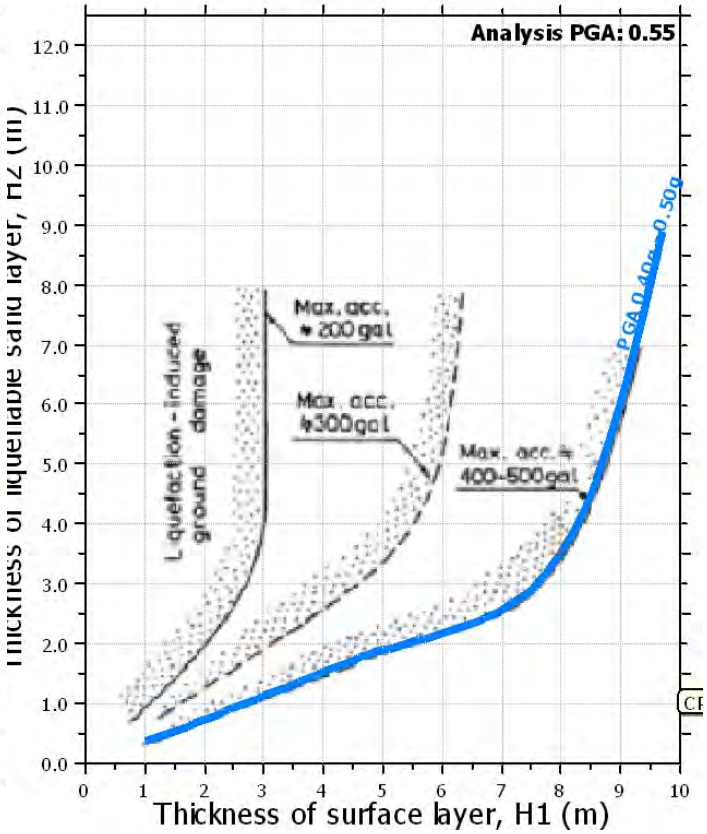
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plo



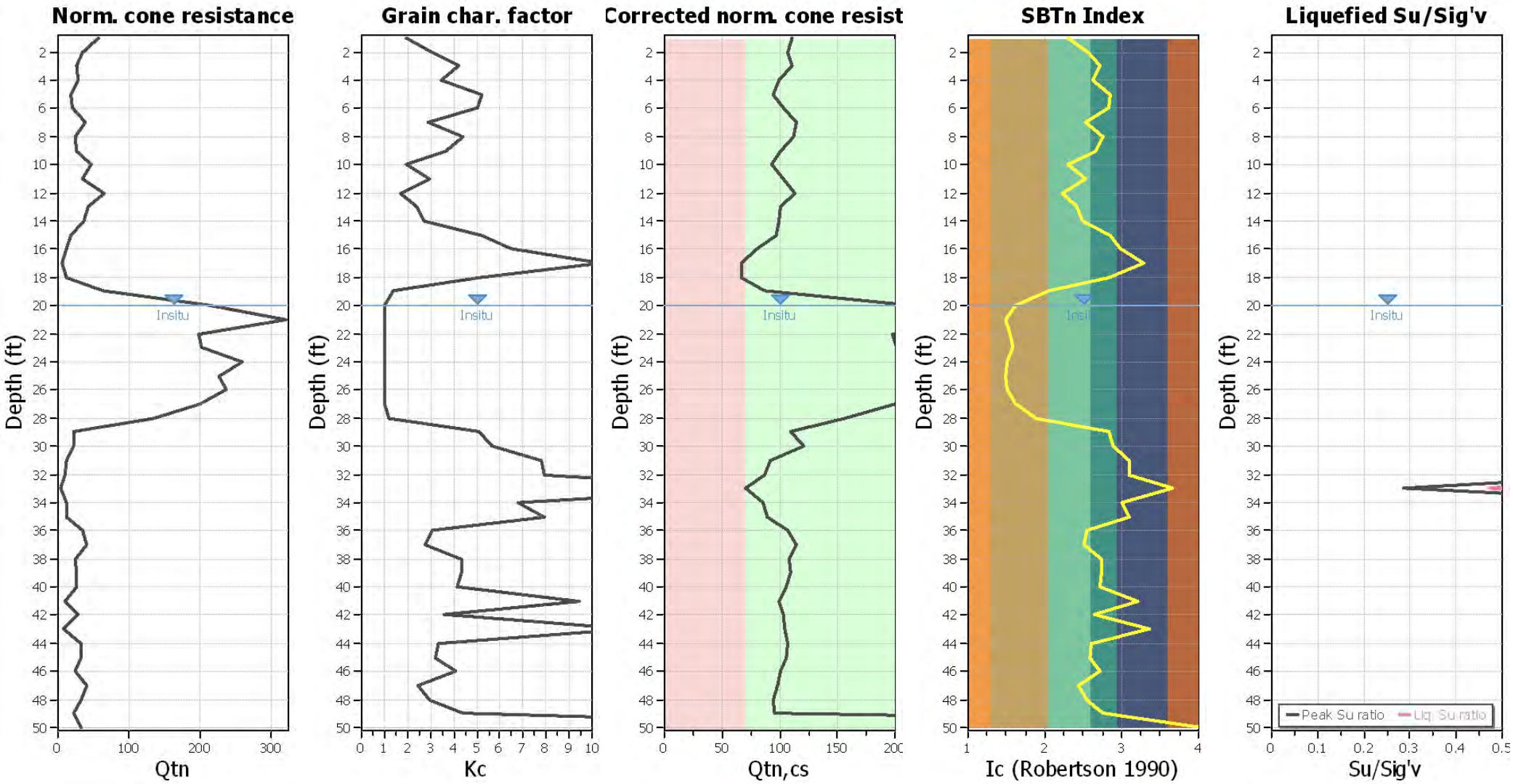




Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	All soils
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

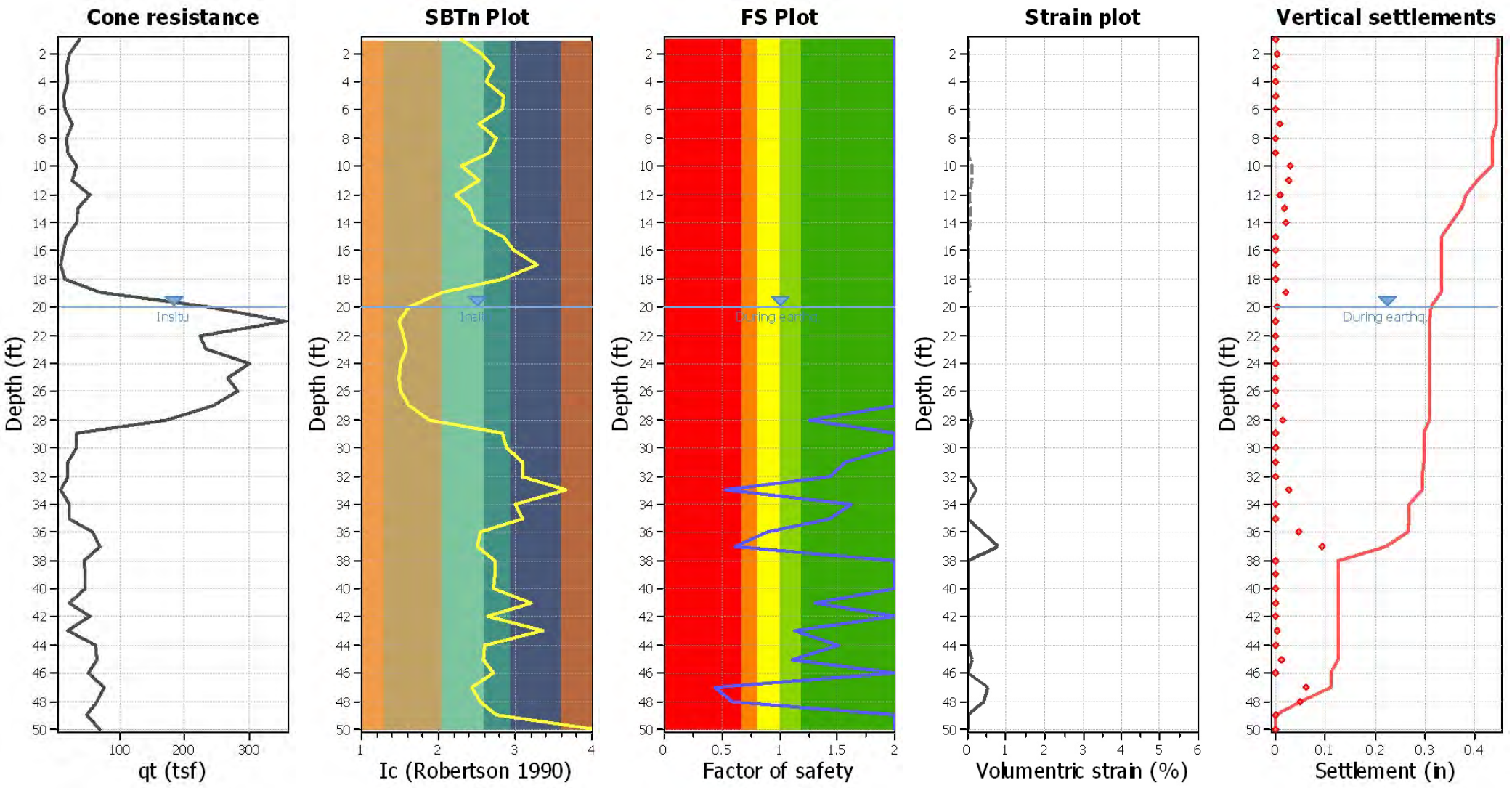
Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	All soils
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

Estimation of post-earthquake settlements



Abbreviations

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

:: Post-earthquake settlement of dry sands ::

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
1.00	2.30	57.12	1.94	111.05	26	588	0.29	0.005	0.00	8.63	0.00	0.001
2.00	2.56	34.89	3.08	107.52	29	499	0.29	0.014	0.01	8.63	0.01	0.002
3.00	2.73	26.56	4.19	111.19	0	0	0.29	0.000	0.00	0.00	0.00	0.000
4.00	2.62	28.81	3.46	99.71	0	0	0.29	0.000	0.00	12.48	0.00	0.000
5.00	2.85	17.99	5.23	94.07	0	0	0.29	0.000	0.00	0.00	0.00	0.000
6.00	2.83	20.58	5.02	103.35	0	0	0.29	0.000	0.00	0.00	0.00	0.000
7.00	2.52	39.61	2.89	114.40	30	542	0.29	0.085	0.05	8.63	0.04	0.009
8.00	2.76	25.26	4.42	111.78	0	0	0.29	0.000	0.00	0.00	0.00	0.000
9.00	2.65	27.34	3.67	100.36	0	0	0.29	0.000	0.00	10.85	0.00	0.000
10.00	2.30	47.16	1.96	92.47	22	519	0.29	0.204	0.18	8.63	0.12	0.029
11.00	2.54	34.81	2.96	102.87	27	527	0.29	0.238	0.17	8.63	0.11	0.025
12.00	2.22	65.81	1.73	113.57	26	762	0.29	0.082	0.06	8.63	0.04	0.009
13.00	2.42	41.74	2.40	100.19	25	641	0.29	0.164	0.13	8.63	0.08	0.018
14.00	2.49	36.41	2.72	98.95	25	643	0.29	0.189	0.14	8.63	0.08	0.020
15.00	2.85	18.73	5.20	97.46	0	0	0.29	0.000	0.00	0.00	0.00	0.000
16.00	2.98	12.38	6.48	80.22	0	0	0.28	0.000	0.00	0.00	0.00	0.000
17.00	3.28	6.46	10.39	67.06	0	0	0.28	0.000	0.00	0.00	0.00	0.000
18.00	2.84	13.11	5.10	66.89	0	0	0.28	0.000	0.00	10.85	0.00	0.000
19.00	2.05	63.37	1.37	86.63	18	817	0.28	0.151	0.17	8.63	0.09	0.021

Total estimated settlement: 0.13

Abbreviations

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

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

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
20.00	212.53	2.00	0.00	0.67	0.00	21.00	319.51	2.00	0.00	0.65	0.00
22.00	197.61	2.00	0.00	0.63	0.00	23.00	201.23	2.00	0.00	0.62	0.00
24.00	257.59	2.00	0.00	0.60	0.00	25.00	226.57	2.00	0.00	0.58	0.00
26.00	235.89	2.00	0.00	0.57	0.00	27.00	199.47	2.00	0.00	0.55	0.00
28.00	156.06	1.26	0.11	0.53	0.01	29.00	109.62	2.00	0.00	0.52	0.00
30.00	120.32	2.00	0.00	0.50	0.00	31.00	91.90	1.57	0.01	0.48	0.00
32.00	86.68	1.44	0.01	0.47	0.00	33.00	69.85	0.52	0.23	0.45	0.03
34.00	85.60	1.62	0.00	0.43	0.00	35.00	89.06	1.44	0.01	0.42	0.00
36.00	139.73	0.89	0.38	0.40	0.05	37.00	117.68	0.61	0.78	0.38	0.09
38.00	107.66	2.00	0.00	0.37	0.00	39.00	109.86	2.00	0.00	0.35	0.00
40.00	105.65	2.00	0.00	0.33	0.00	41.00	99.14	1.31	0.01	0.32	0.00
42.00	206.01	2.00	0.00	0.30	0.00	43.00	104.69	1.13	0.01	0.28	0.00
44.00	174.95	1.51	0.00	0.27	0.00	45.00	154.24	1.10	0.10	0.25	0.01
46.00	100.83	2.00	0.00	0.23	0.00	47.00	97.69	0.44	0.52	0.22	0.06
48.00	115.41	0.59	0.42	0.20	0.05	49.00	95.72	2.00	0.00	0.18	0.00
50.00	843.81	2.00	0.00	0.17	0.00						

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

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

Total estimated settlement: 0.31

Abbreviations

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

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Anaheim, CA 92806

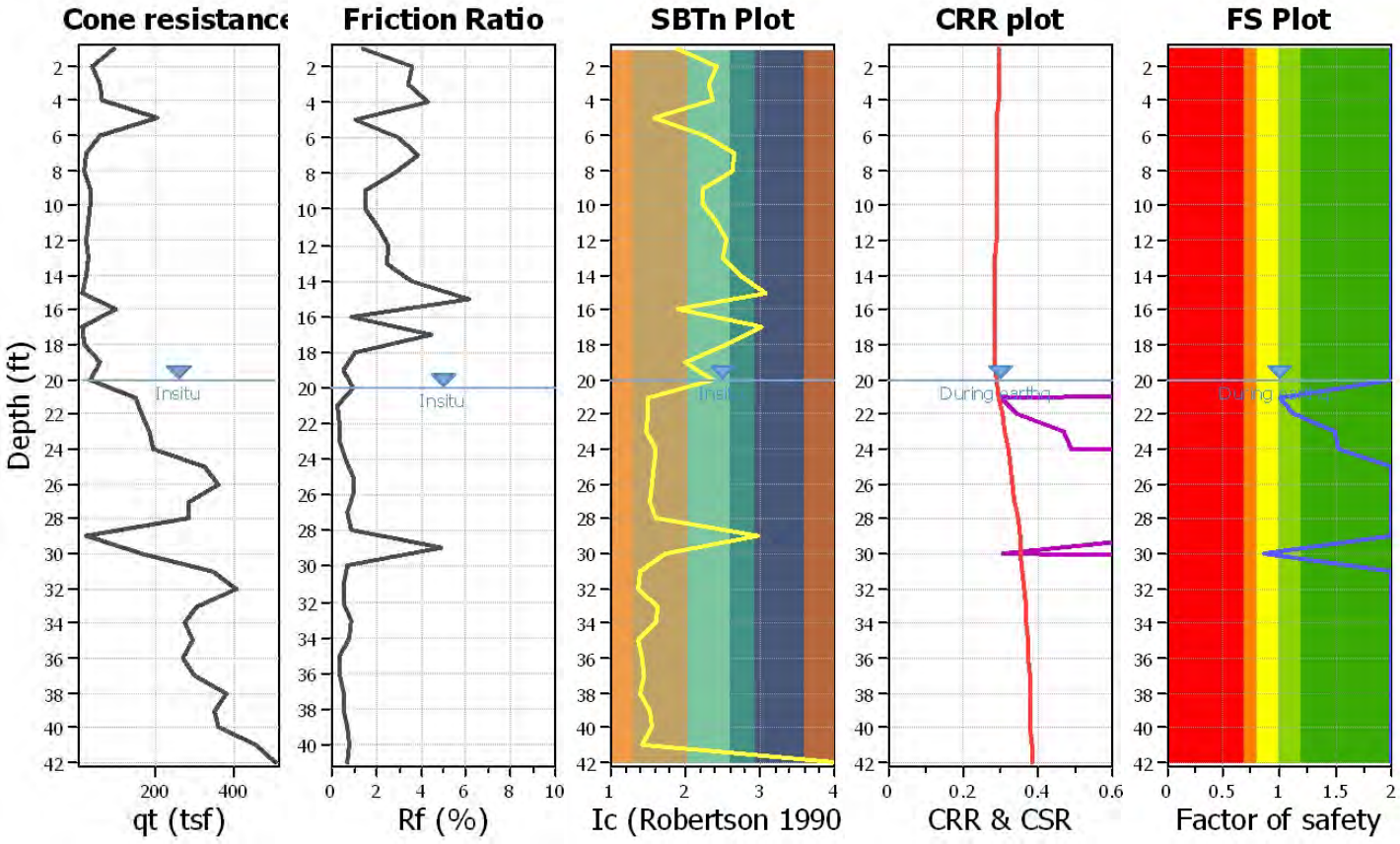
LIQUEFACTION ANALYSIS REPORT

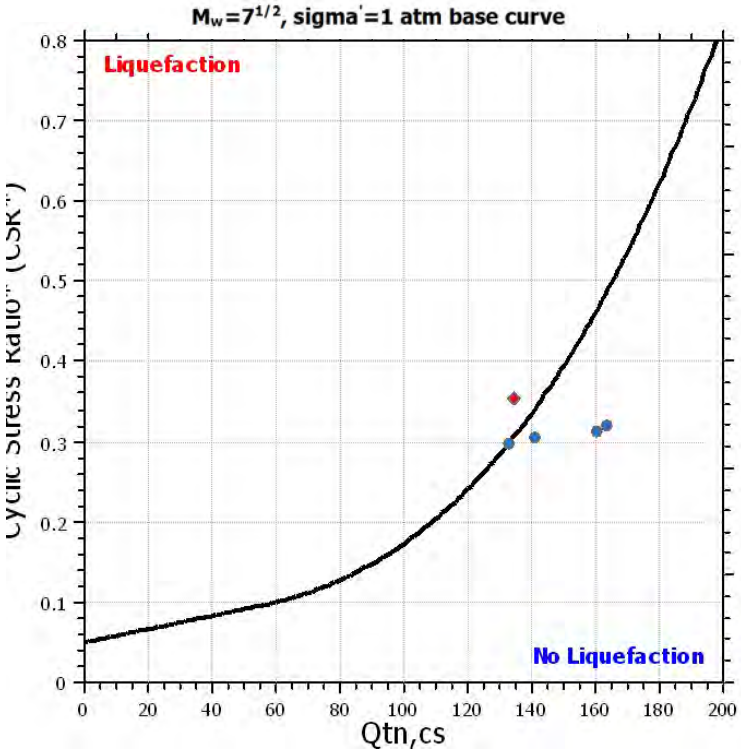
Project title : Ganahl SJC **Location :**

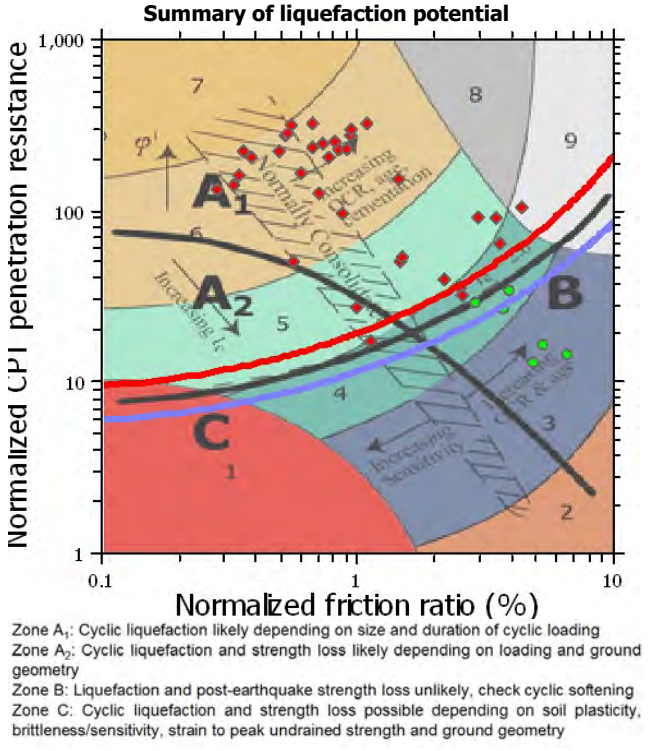
CPT file : CPT-6

Input parameters and analysis data

Analysis method:	Robertson (2009)	G.W.T. (in-situ):	20.00 ft	Use fill:	No	Clay like behavior applied:	All soils
Fines correction method:	Robertson (2009)	G.W.T. (earthq.):	20.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth:	50.00 ft
Earthquake magnitude M_w:	6.70	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.55	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

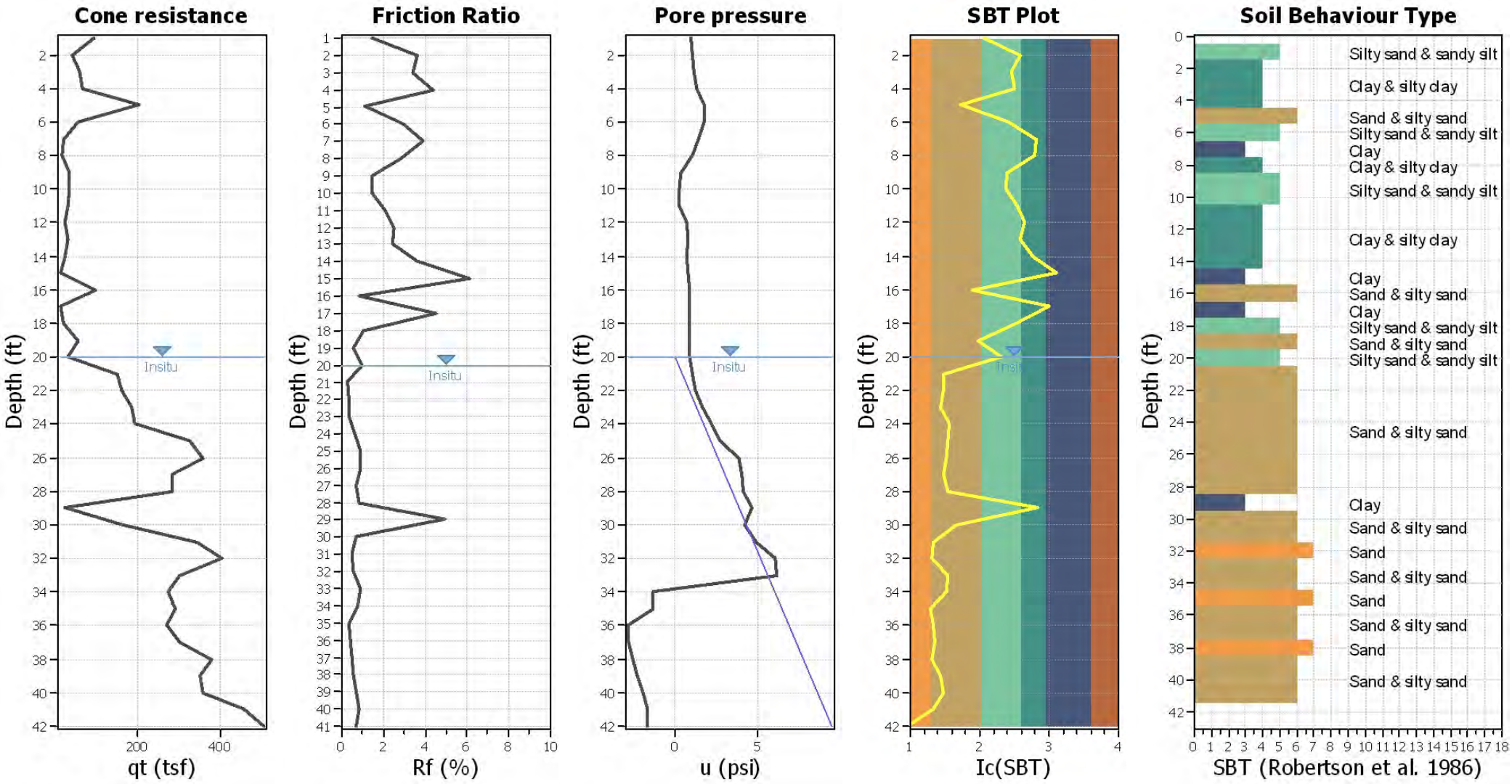






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plc



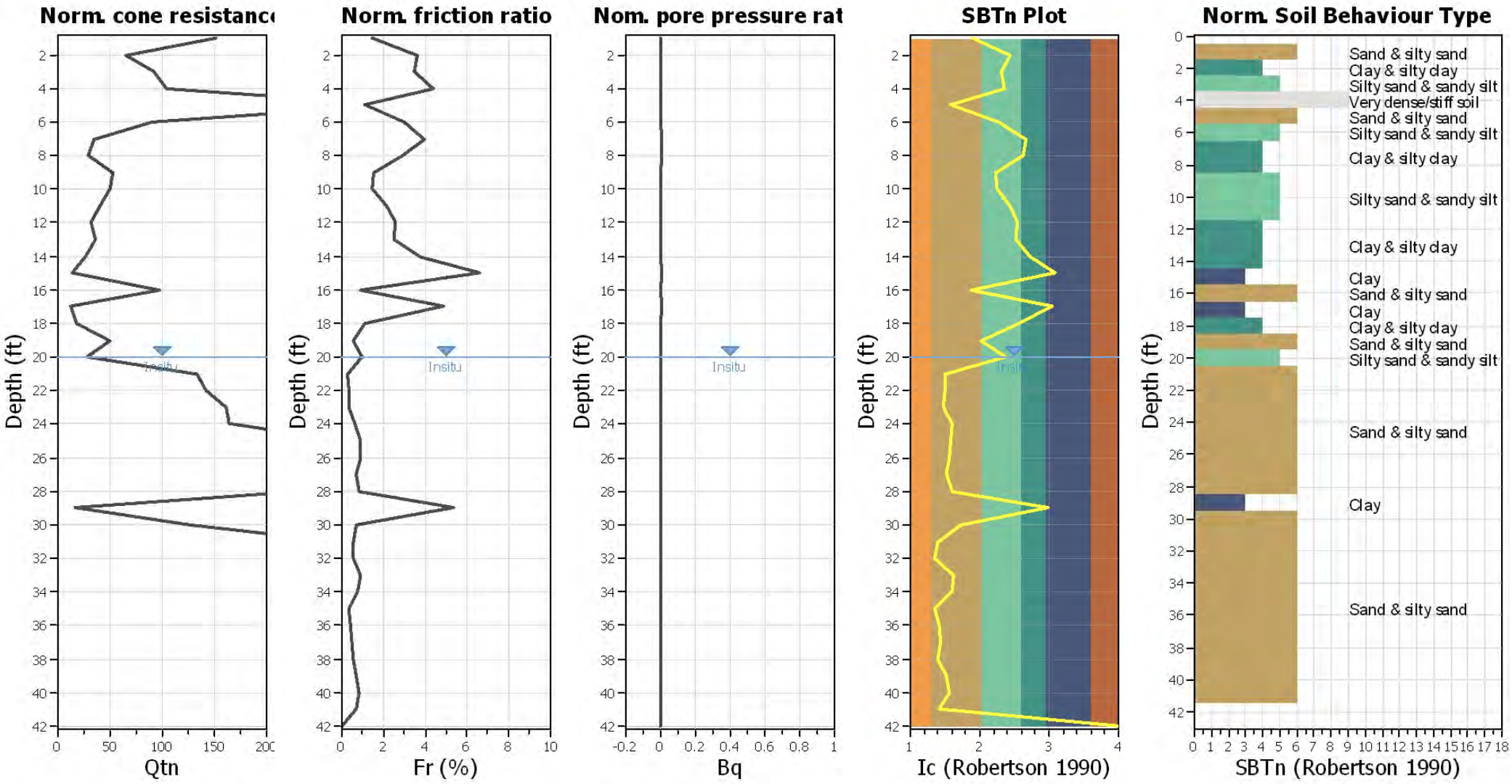
Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	All soils
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

SBT legend

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

CPT basic interpretation plots (normaliz



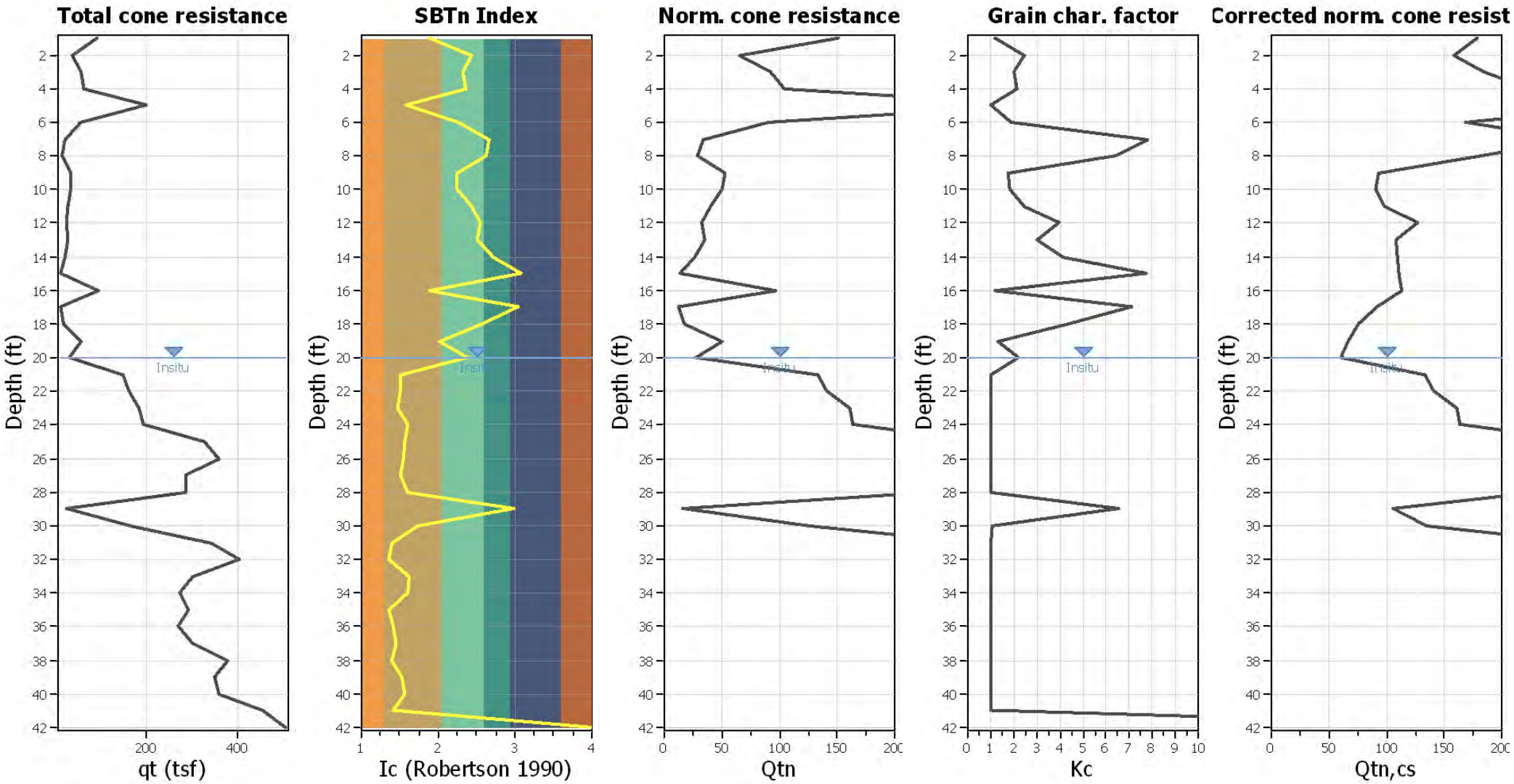
Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	All soils
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

SBTn legend

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

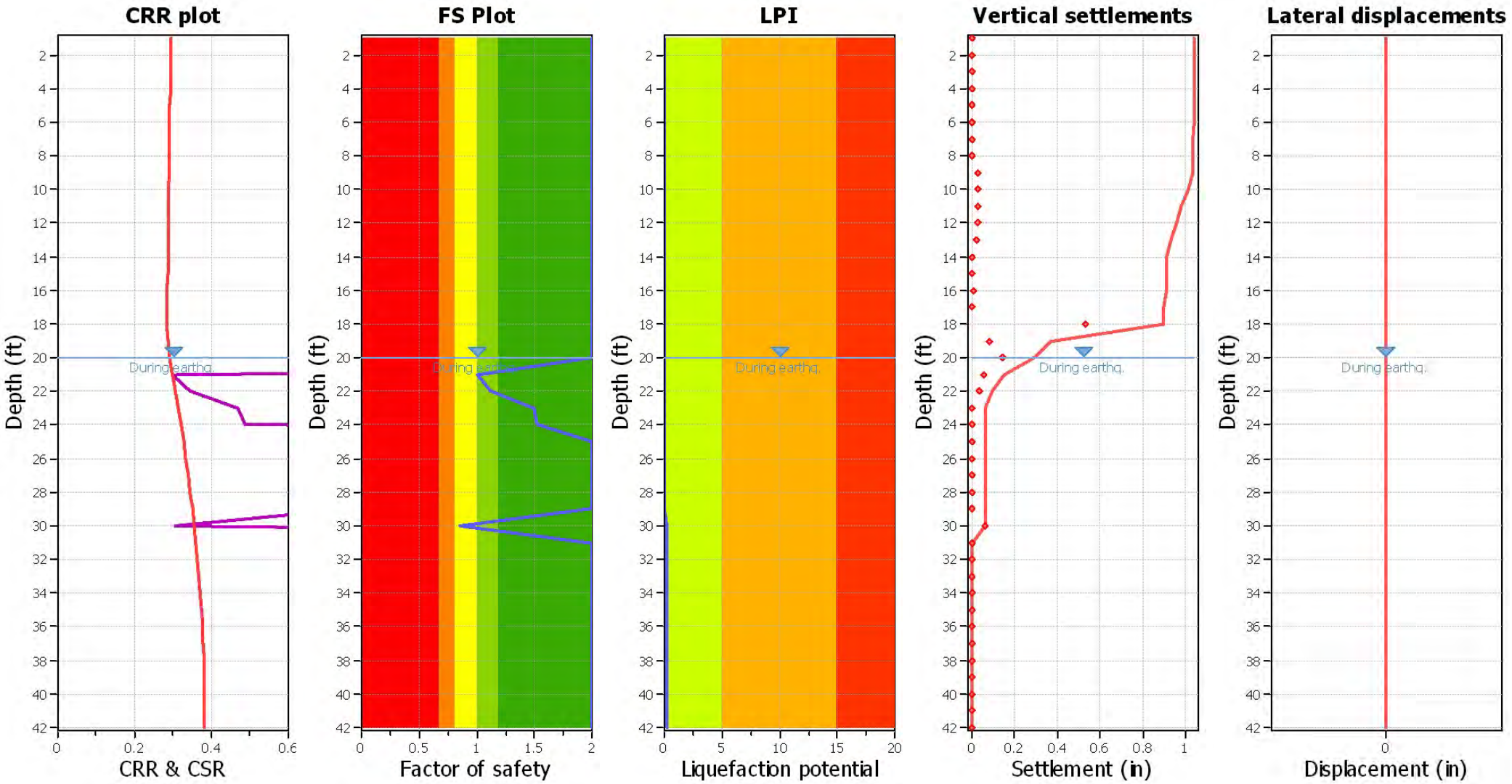
Liquefaction analysis overall plots (intermediate resi



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	All soils
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

Liquefaction analysis overall plot



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	All soils
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

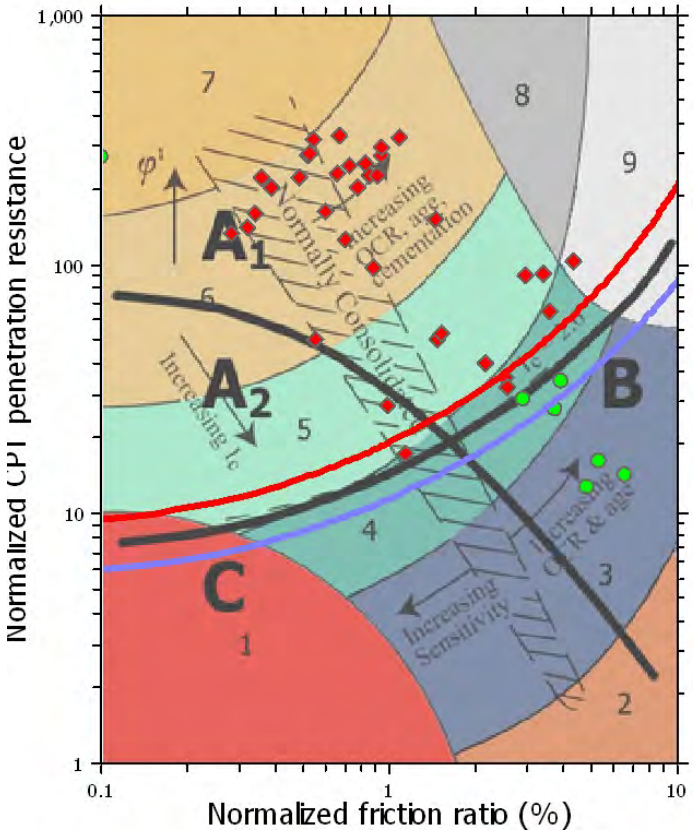
F.S. color scheme

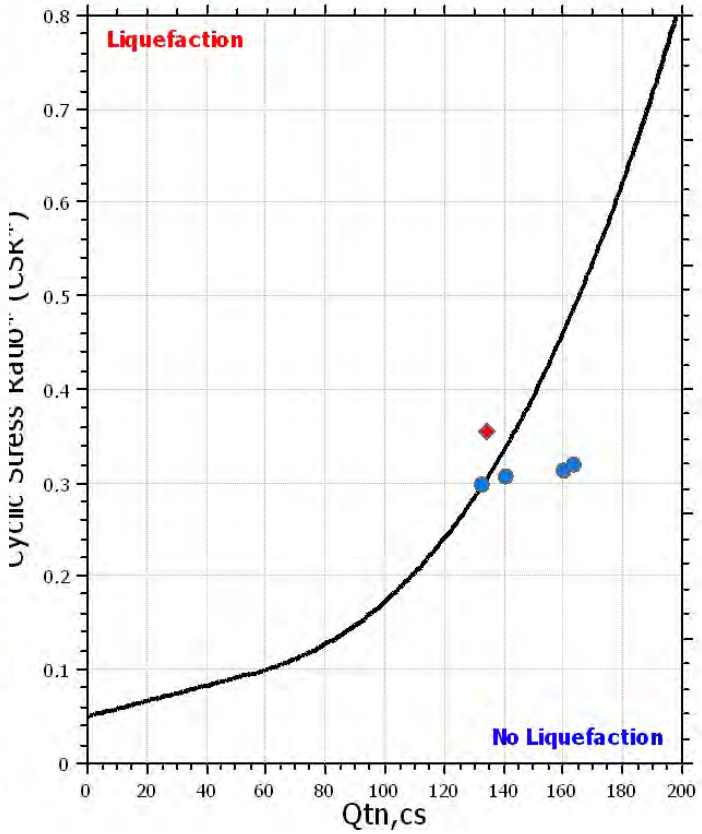
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

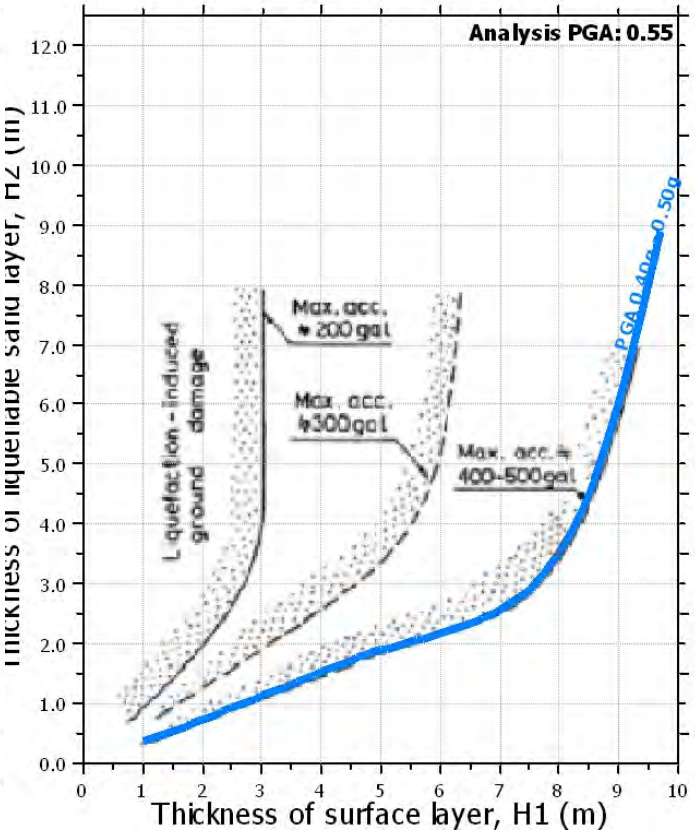
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plo



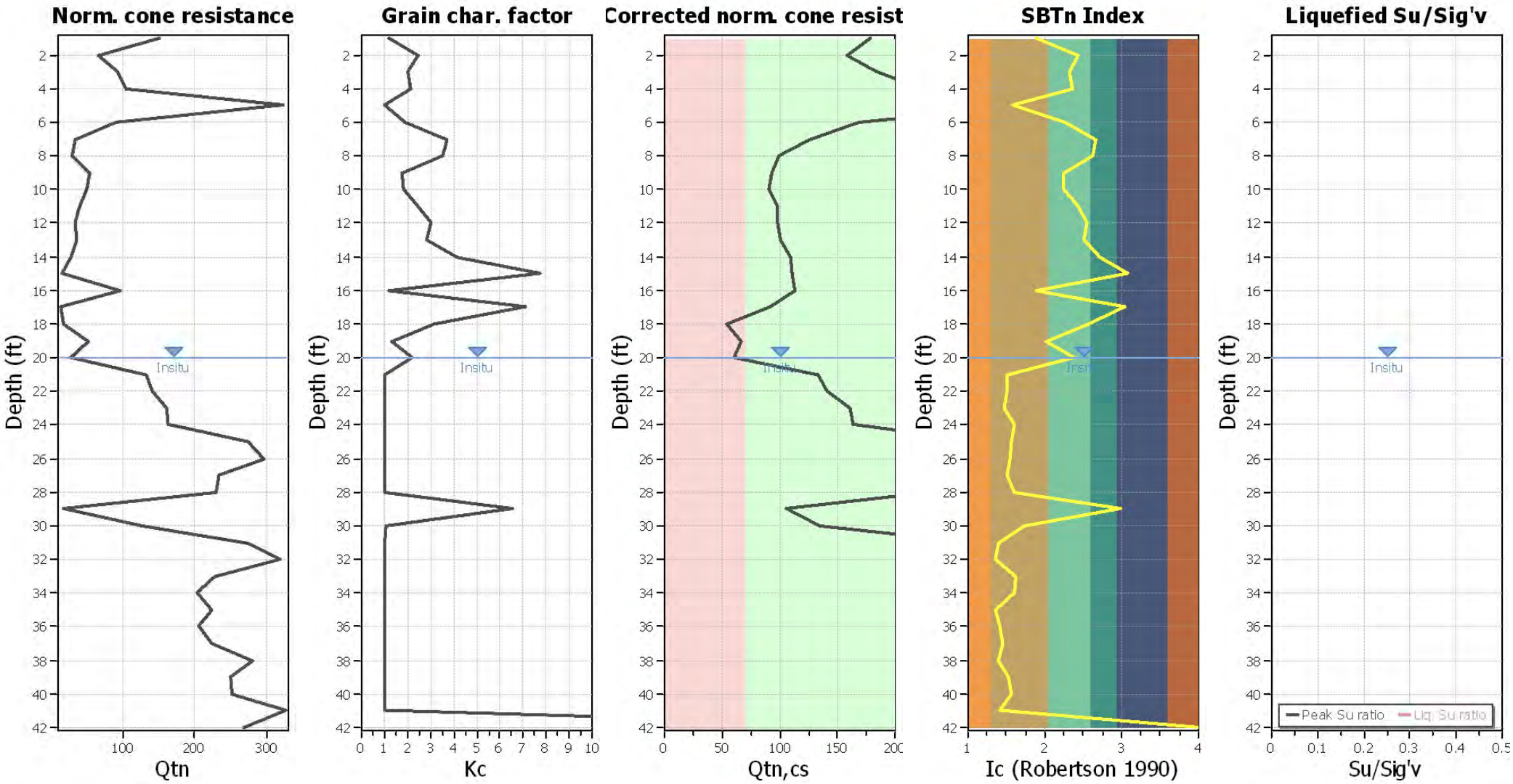




Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	All soils
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

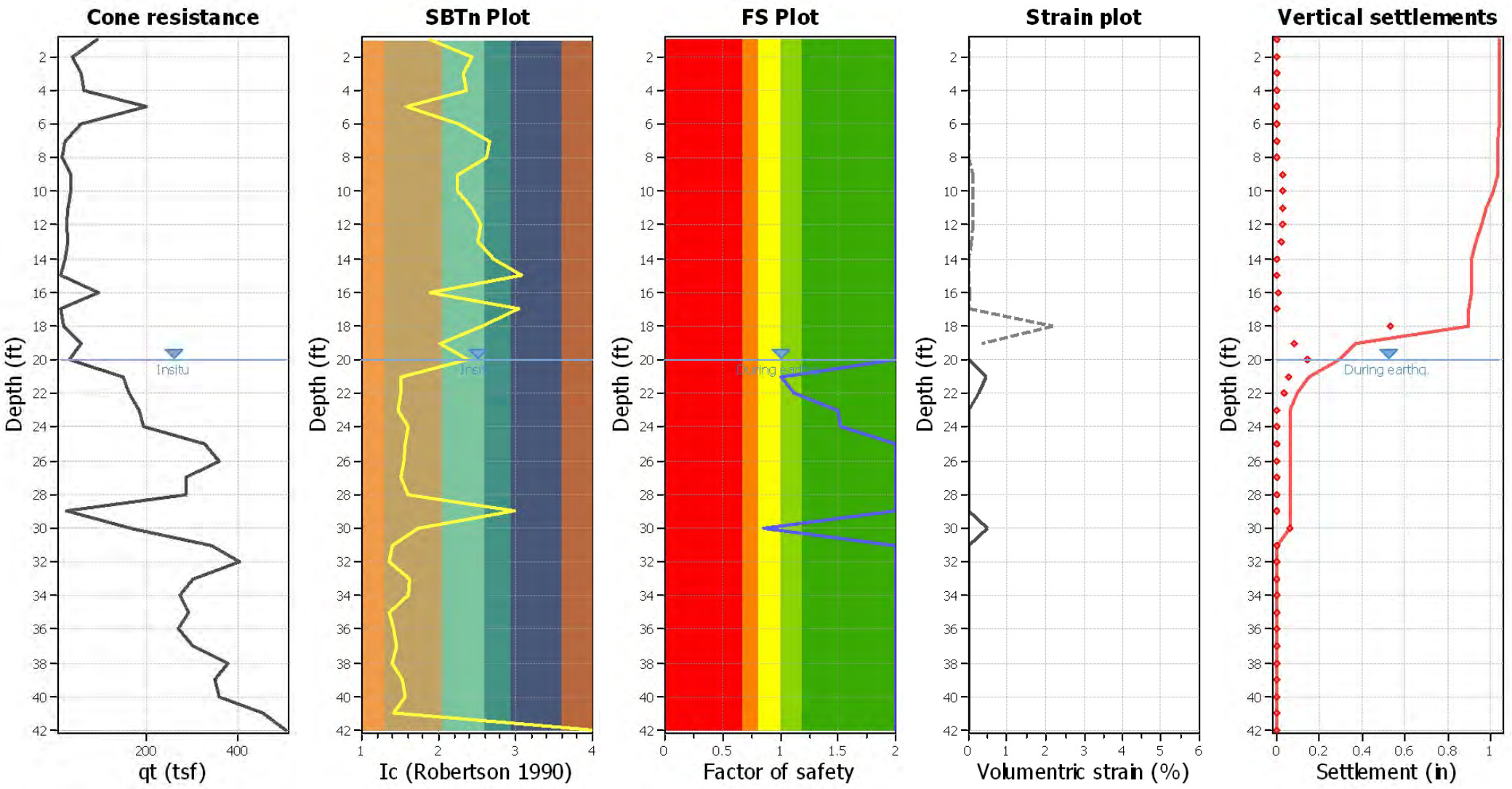
Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	All soils
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

Estimation of post-earthquake settlements



Abbreviations

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

:: Post-earthquake settlement of dry sands ::

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
1.00	1.89	151.09	1.18	178.19	36	926	0.29	0.003	0.00	8.63	0.00	0.000
2.00	2.43	64.93	2.44	158.56	40	790	0.29	0.007	0.00	8.63	0.00	0.001
3.00	2.31	92.33	1.99	183.97	44	968	0.29	0.009	0.00	8.63	0.00	0.001
4.00	2.36	103.98	2.16	224.10	54	1156	0.29	0.010	0.00	8.63	0.00	0.001
5.00	1.58	323.34	1.00	323.34	58	1342	0.29	0.010	0.00	8.63	0.00	0.000
6.00	2.27	90.37	1.86	167.98	39	898	0.29	0.023	0.01	8.63	0.01	0.002
7.00	2.66	34.07	3.69	125.82	0	0	0.29	0.000	0.00	10.85	0.00	0.000
8.00	2.63	28.59	3.49	99.81	0	0	0.29	0.000	0.00	12.48	0.00	0.000
9.00	2.24	52.79	1.76	93.11	21	529	0.29	0.176	0.16	8.63	0.11	0.026
10.00	2.25	50.24	1.80	90.24	21	547	0.29	0.191	0.18	8.63	0.12	0.029
11.00	2.43	40.15	2.44	97.84	24	568	0.29	0.202	0.16	8.63	0.10	0.024
12.00	2.55	32.17	3.04	97.92	26	557	0.29	0.261	0.19	8.63	0.12	0.029
13.00	2.51	35.54	2.83	100.61	26	628	0.29	0.194	0.14	8.63	0.09	0.021
14.00	2.72	26.29	4.18	109.91	0	0	0.29	0.000	0.00	0.00	0.00	0.000
15.00	3.08	14.32	7.72	110.49	0	0	0.29	0.000	0.00	10.85	0.00	0.000
16.00	1.88	96.87	1.17	113.75	23	941	0.28	0.082	0.07	8.63	0.04	0.010
17.00	3.03	12.86	7.13	91.68	0	0	0.28	0.000	0.00	10.85	0.00	0.000
18.00	2.57	17.48	3.12	54.59	15	431	0.28	2.751	4.04	8.63	2.20	0.529
19.00	2.01	50.60	1.32	66.66	14	640	0.29	0.399	0.61	8.63	0.33	0.079

Total estimated settlement: 0.75

Abbreviations

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

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

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
20.00	59.76	2.00	0.00	0.67	0.00	21.00	132.82	1.00	0.44	0.65	0.05
22.00	141.18	1.12	0.28	0.63	0.03	23.00	160.73	1.49	0.00	0.62	0.00
24.00	163.56	1.52	0.00	0.60	0.00	25.00	273.76	2.00	0.00	0.58	0.00
26.00	297.45	2.00	0.00	0.57	0.00	27.00	233.59	2.00	0.00	0.55	0.00
28.00	228.99	2.00	0.00	0.53	0.00	29.00	106.01	2.00	0.00	0.52	0.00
30.00	134.16	0.86	0.51	0.50	0.06	31.00	273.89	2.00	0.00	0.48	0.00
32.00	318.99	2.00	0.00	0.47	0.00	33.00	228.14	2.00	0.00	0.45	0.00
34.00	203.09	2.00	0.00	0.43	0.00	35.00	224.59	2.00	0.00	0.42	0.00
36.00	204.61	2.00	0.00	0.40	0.00	37.00	223.16	2.00	0.00	0.38	0.00
38.00	281.17	2.00	0.00	0.37	0.00	39.00	249.99	2.00	0.00	0.35	0.00
40.00	252.72	2.00	0.00	0.33	0.00	41.00	327.20	2.00	0.00	0.32	0.00
42.00	7152.81	2.00	0.00	0.30	0.00						

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

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

Total estimated settlement: 0.15

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

Willdan Geotechnical
1515 S. Sunkist St., Suite E
Anaheim, CA 92806

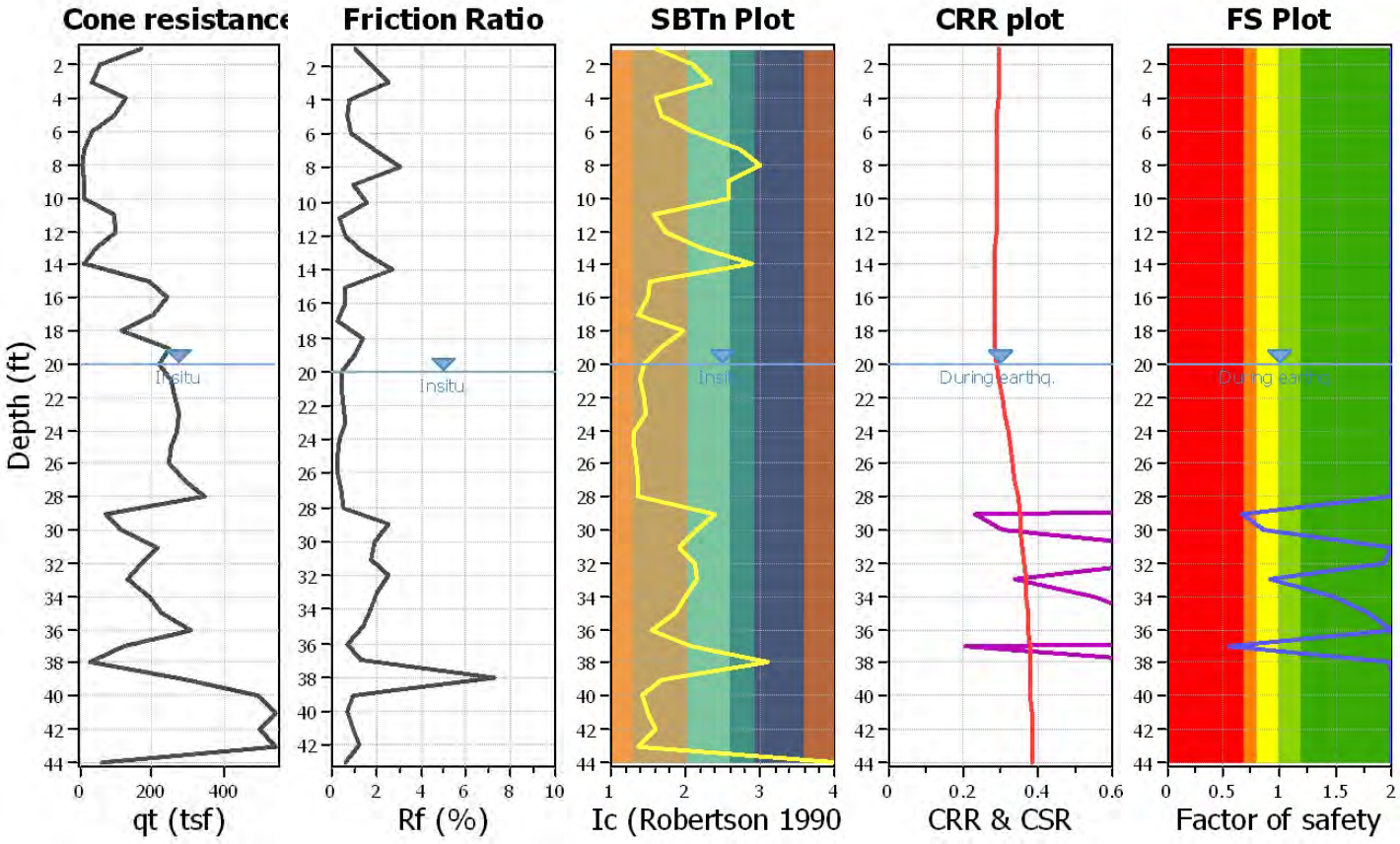
LIQUEFACTION ANALYSIS REPORT

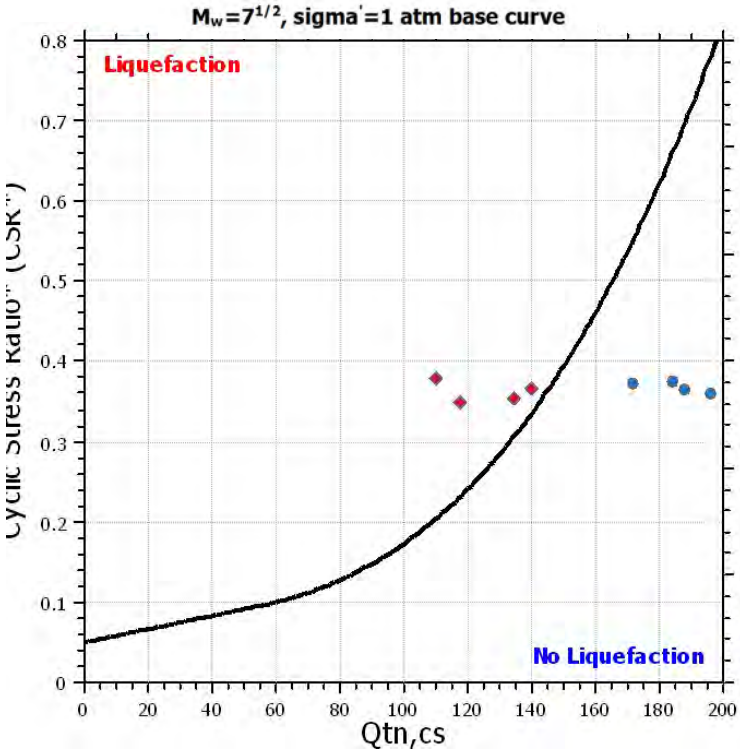
Project title : Ganahl SJC **Location :**

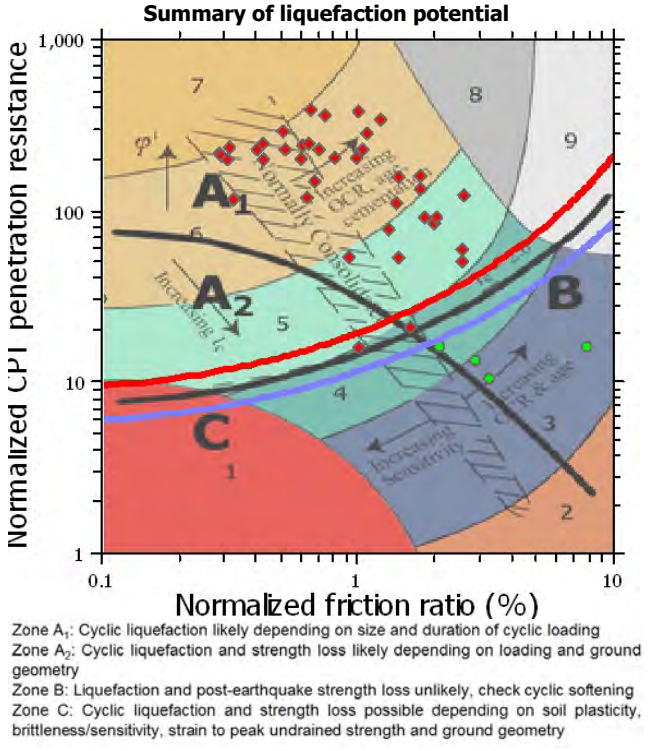
CPT file : CPT-7

Input parameters and analysis data

Analysis method:	Robertson (2009)	G.W.T. (in-situ):	20.00 ft	Use fill:	No	Clay like behavior applied:	All soils
Fines correction method:	Robertson (2009)	G.W.T. (earthq.):	20.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth:	50.00 ft
Earthquake magnitude M_w:	6.70	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.55	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

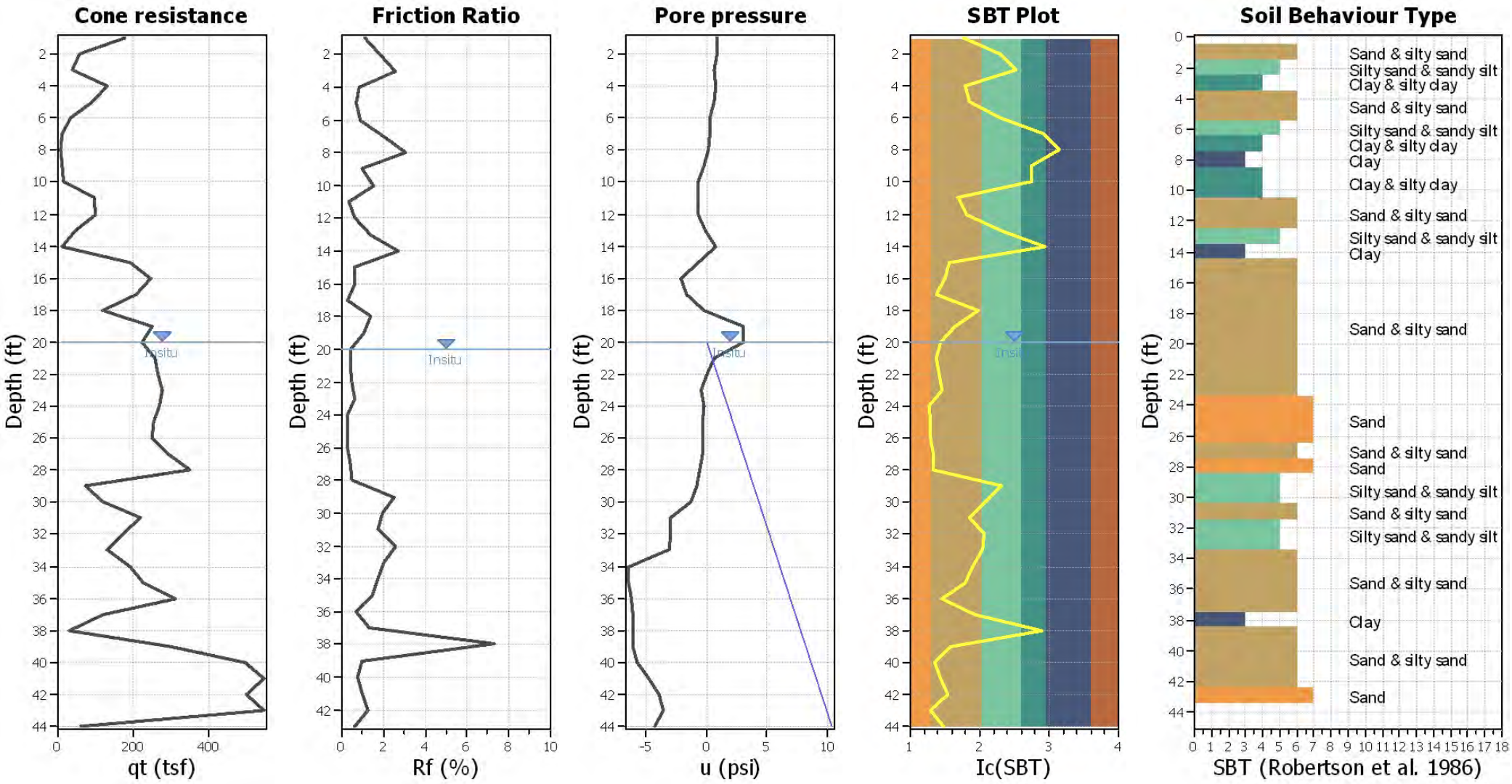






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plc



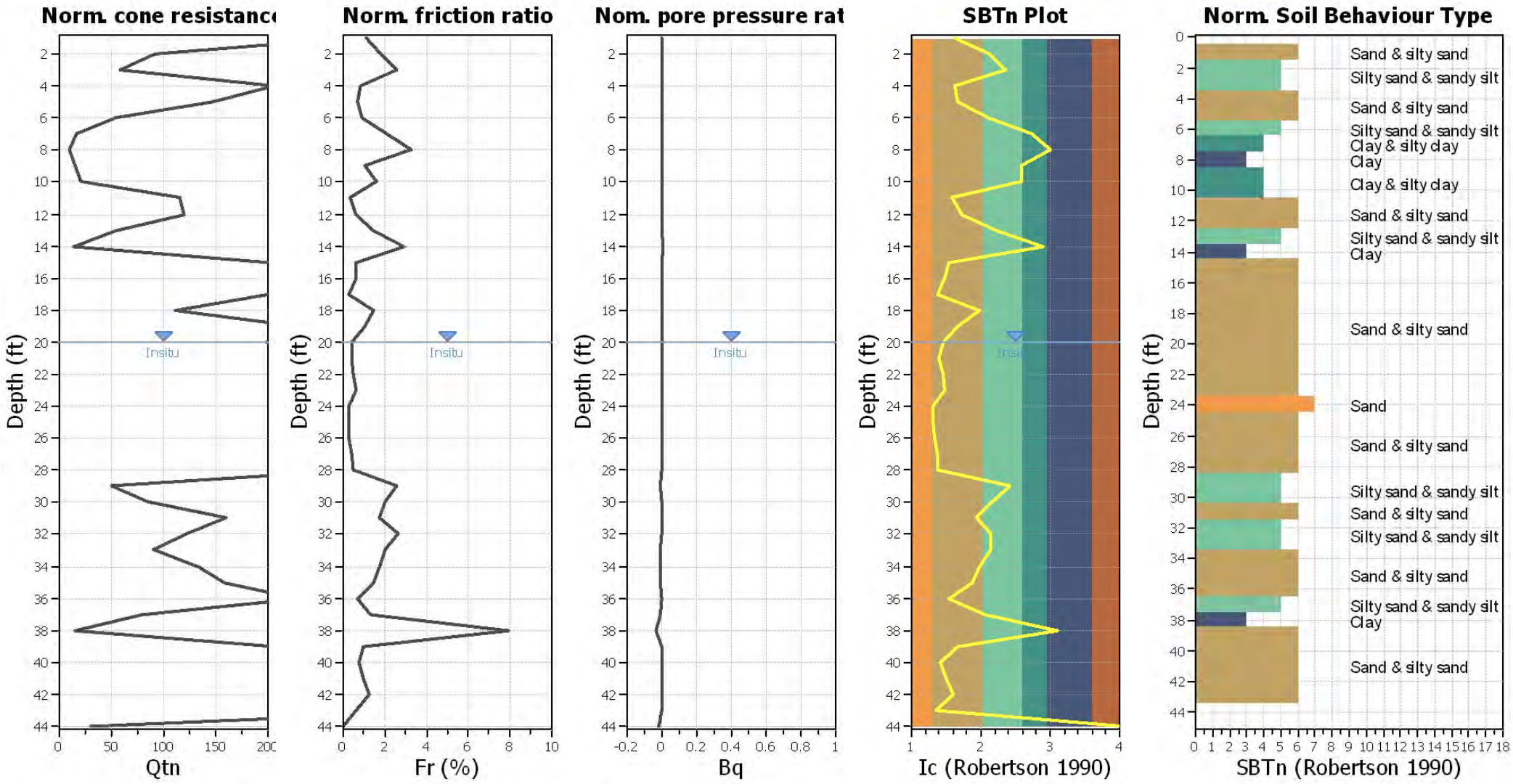
Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	All soils
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

SBT legend

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

CPT basic interpretation plots (normaliz



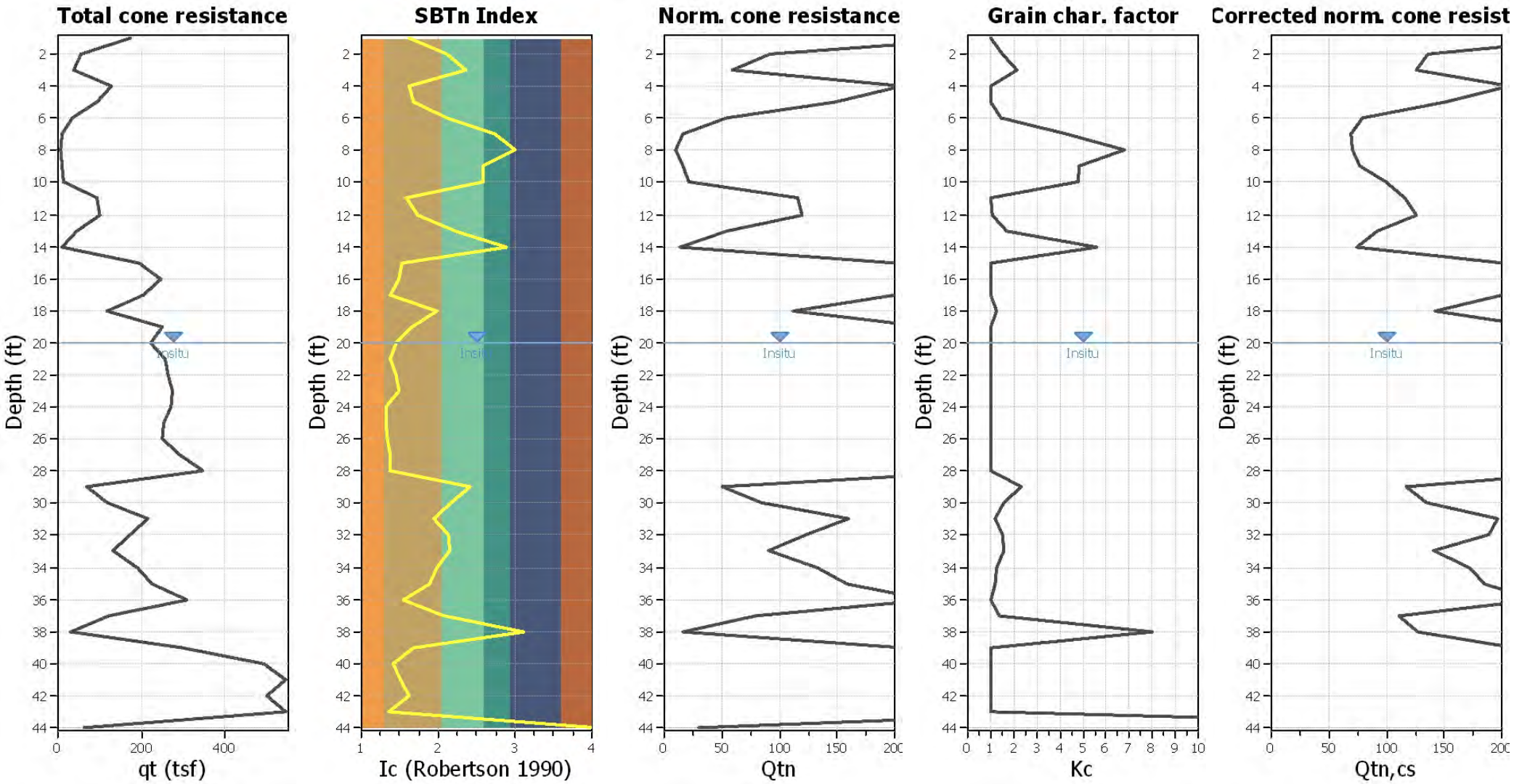
Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	All soils
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

SBTn legend

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

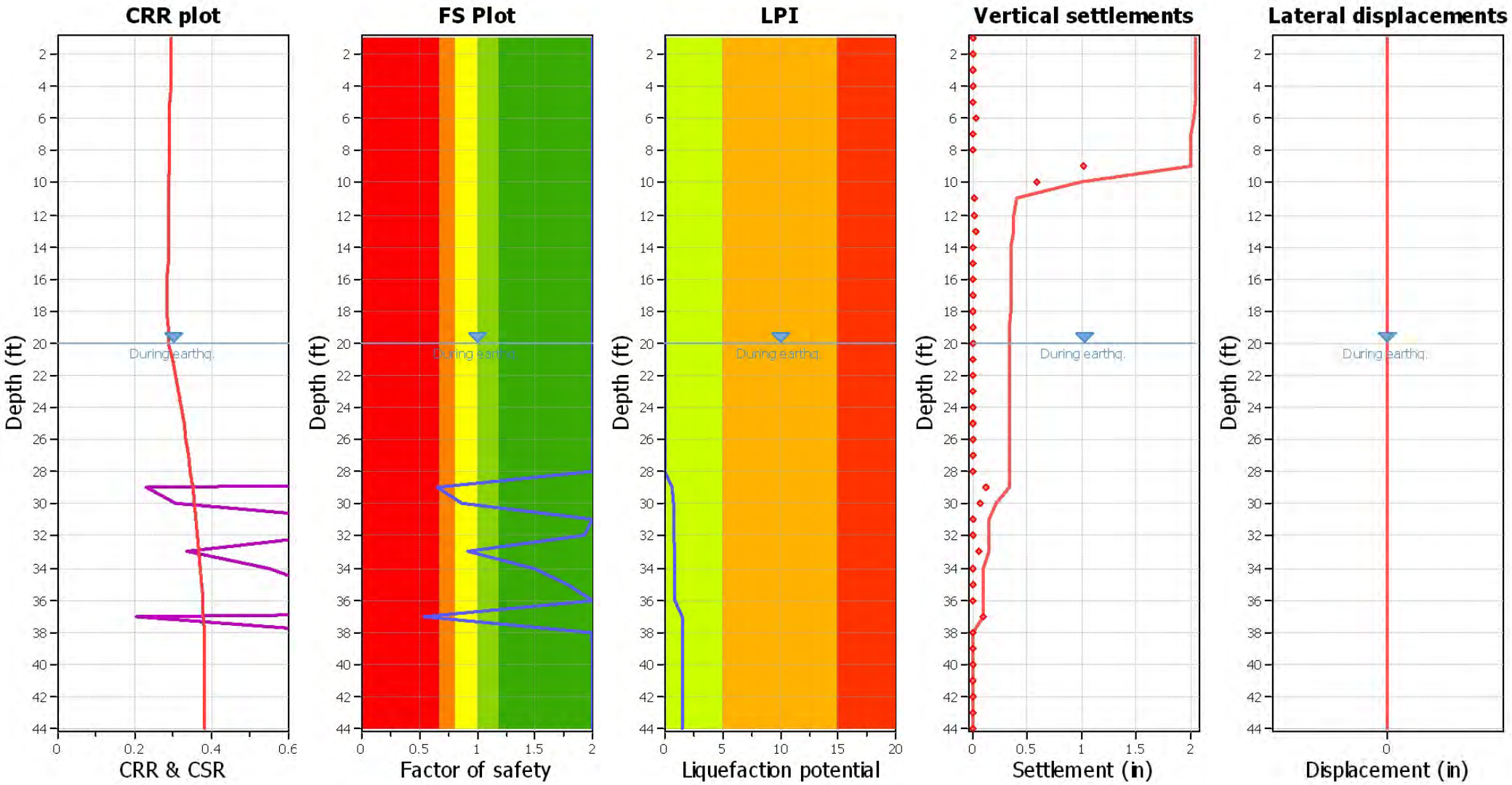
Liquefaction analysis overall plots (intermediate resi



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	All soils
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

Liquefaction analysis overall plot



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	All soils
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

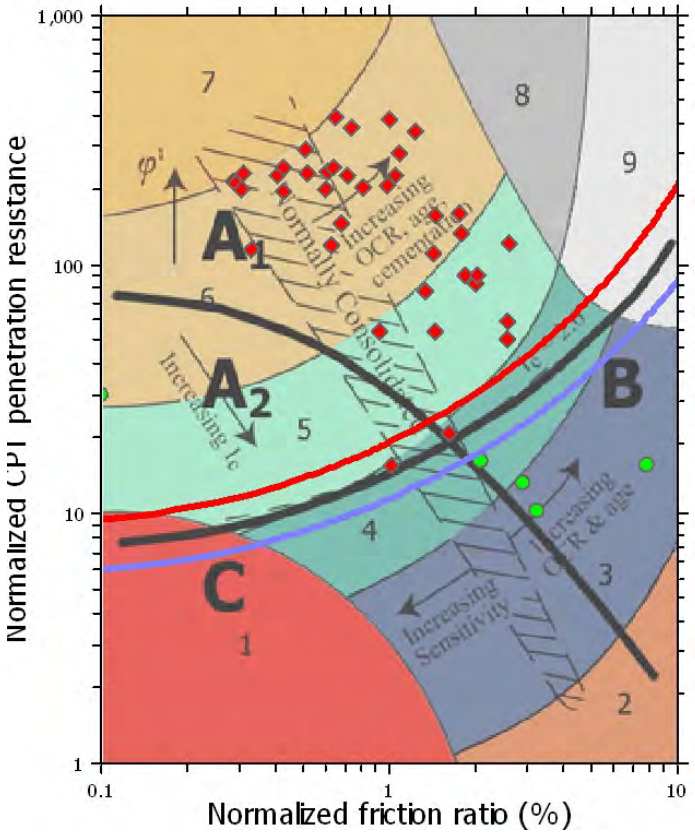
F.S. color scheme

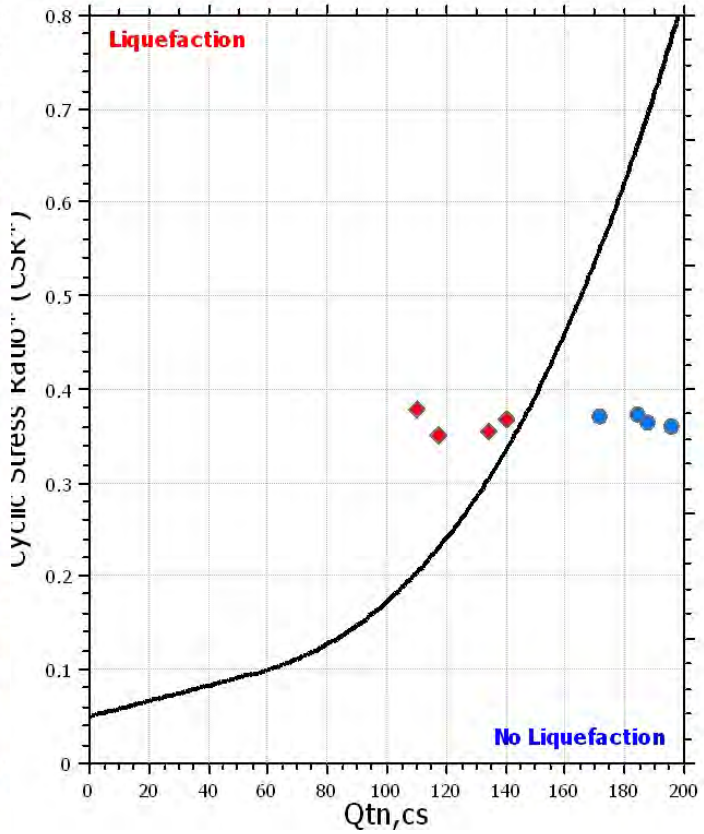
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

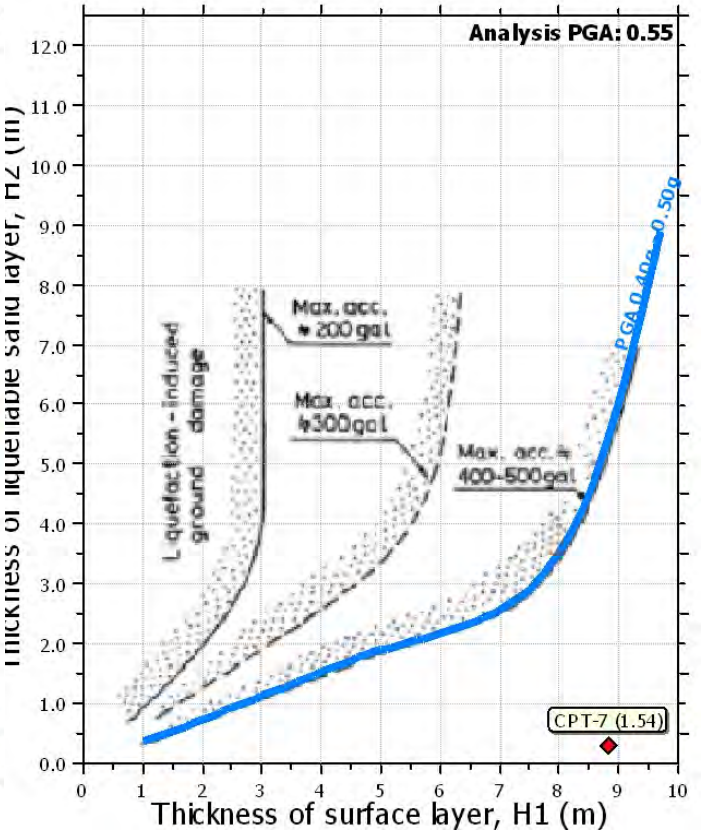
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plo



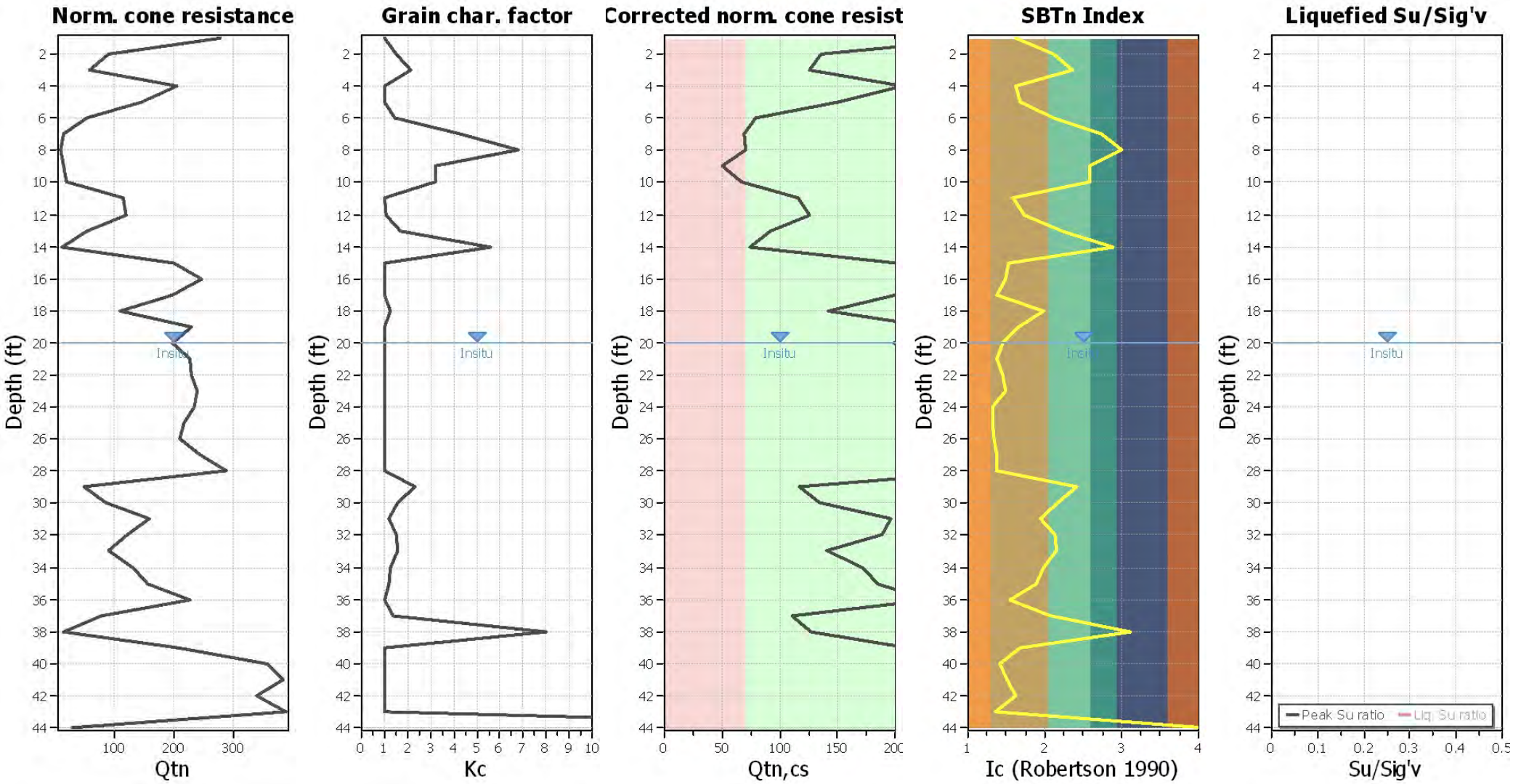




Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	All soils
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

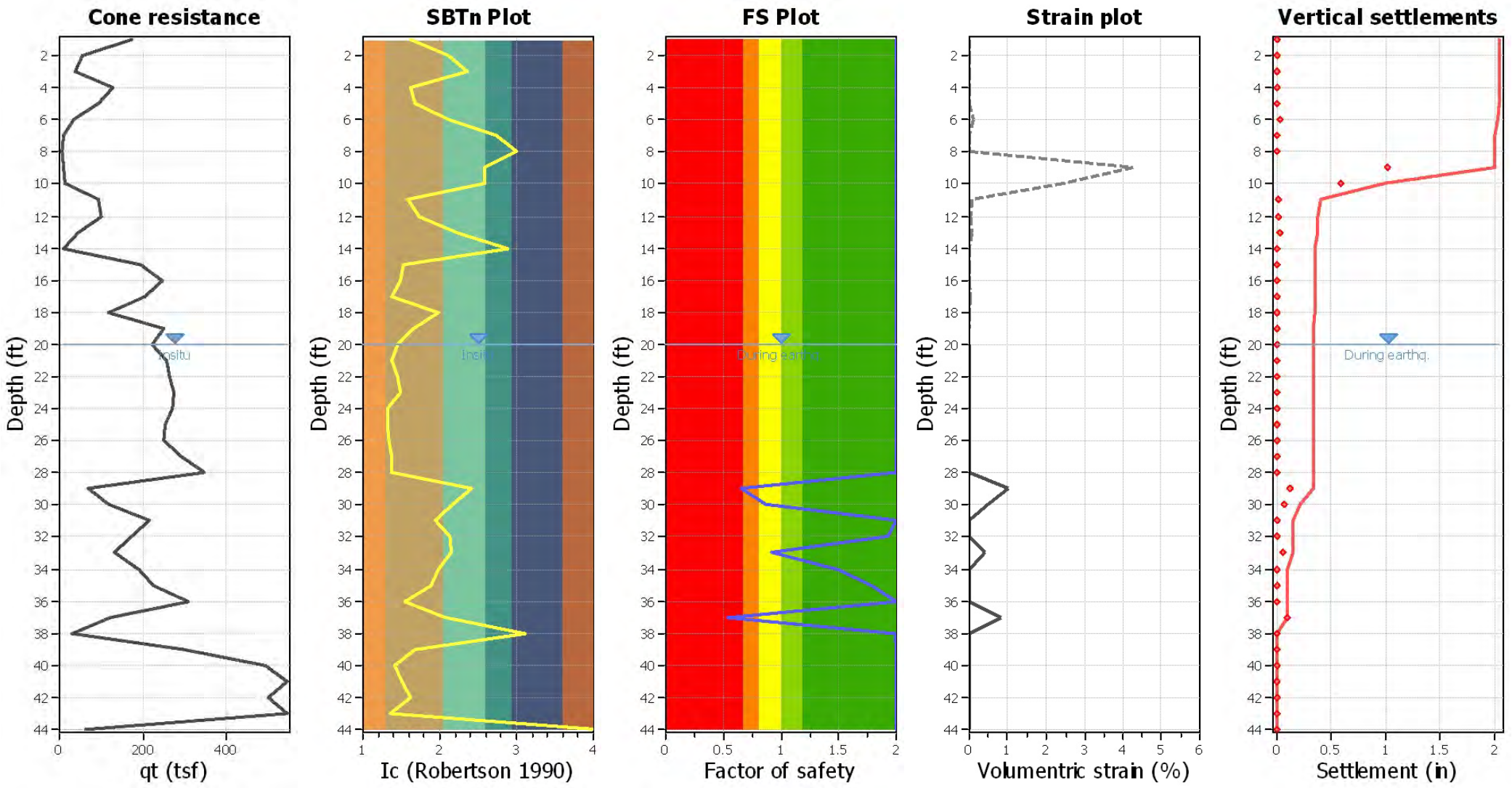
Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	All soils
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

Estimation of post-earthquake settlements



Abbreviations

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

:: Post-earthquake settlement of dry sands ::

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
1.00	1.62	280.28	1.00	280.28	51	1216	0.29	0.002	0.00	8.63	0.00	0.000
2.00	2.11	91.43	1.48	135.53	30	746	0.29	0.008	0.00	8.63	0.00	0.001
3.00	2.35	58.94	2.13	125.78	30	651	0.29	0.016	0.01	8.63	0.01	0.002
4.00	1.62	205.82	1.00	205.82	37	893	0.29	0.014	0.01	8.63	0.00	0.001
5.00	1.67	147.84	1.02	150.88	28	690	0.29	0.029	0.02	8.63	0.01	0.003
6.00	2.11	53.62	1.47	78.73	17	433	0.29	0.152	0.18	8.63	0.13	0.031
7.00	2.74	16.12	4.28	68.94	0	0	0.29	0.000	0.00	10.85	0.00	0.000
8.00	3.01	10.33	6.82	70.40	0	0	0.29	0.000	0.00	0.00	0.00	0.000
9.00	2.58	15.79	3.22	50.82	14	233	0.29	20.113	31.86	8.63	4.25	1.020
10.00	2.58	20.90	3.21	67.13	18	308	0.29	3.326	3.78	8.63	2.45	0.589
11.00	1.59	115.24	1.00	115.24	21	635	0.29	0.119	0.11	8.63	0.07	0.017
12.00	1.73	119.45	1.06	126.15	24	798	0.29	0.072	0.06	8.63	0.04	0.009
13.00	2.22	53.54	1.72	92.23	21	653	0.29	0.151	0.14	8.63	0.09	0.021
14.00	2.89	13.33	5.58	74.46	0	0	0.29	0.000	0.00	10.85	0.00	0.000
15.00	1.54	200.90	1.00	200.90	35	1207	0.29	0.041	0.02	8.63	0.01	0.003
16.00	1.49	247.21	1.00	247.21	43	1451	0.28	0.033	0.01	8.63	0.01	0.002
17.00	1.37	199.56	1.00	199.56	33	1040	0.28	0.067	0.04	8.63	0.02	0.005
18.00	1.98	111.55	1.27	142.03	29	1287	0.28	0.047	0.03	8.63	0.02	0.004
19.00	1.67	229.28	1.01	232.48	43	1841	0.29	0.028	0.01	8.63	0.01	0.001

Total estimated settlement: 1.71

Abbreviations

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

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

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
20.00	198.35	2.00	0.00	0.67	0.00	21.00	228.63	2.00	0.00	0.65	0.00
22.00	230.63	2.00	0.00	0.63	0.00	23.00	238.84	2.00	0.00	0.62	0.00
24.00	233.98	2.00	0.00	0.60	0.00	25.00	217.77	2.00	0.00	0.58	0.00
26.00	211.80	2.00	0.00	0.57	0.00	27.00	244.01	2.00	0.00	0.55	0.00
28.00	287.77	2.00	0.00	0.53	0.00	29.00	117.45	0.66	1.01	0.52	0.12
30.00	134.44	0.86	0.51	0.50	0.06	31.00	195.96	2.00	0.00	0.48	0.00
32.00	188.23	1.93	0.00	0.47	0.00	33.00	140.28	0.92	0.43	0.45	0.05
34.00	171.91	1.49	0.00	0.43	0.00	35.00	184.61	1.78	0.00	0.42	0.00
36.00	228.55	2.00	0.00	0.40	0.00	37.00	110.31	0.54	0.83	0.38	0.10
38.00	126.42	1.99	0.00	0.37	0.00	39.00	211.52	2.00	0.00	0.35	0.00
40.00	358.25	2.00	0.00	0.33	0.00	41.00	383.99	2.00	0.00	0.32	0.00
42.00	339.72	2.00	0.00	0.30	0.00	43.00	389.14	2.00	0.00	0.28	0.00
44.00	800.55	2.00	0.00	0.27	0.00						

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

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

Total estimated settlement: 0.33

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

Willdan Geotechnical
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Anaheim, CA 92806

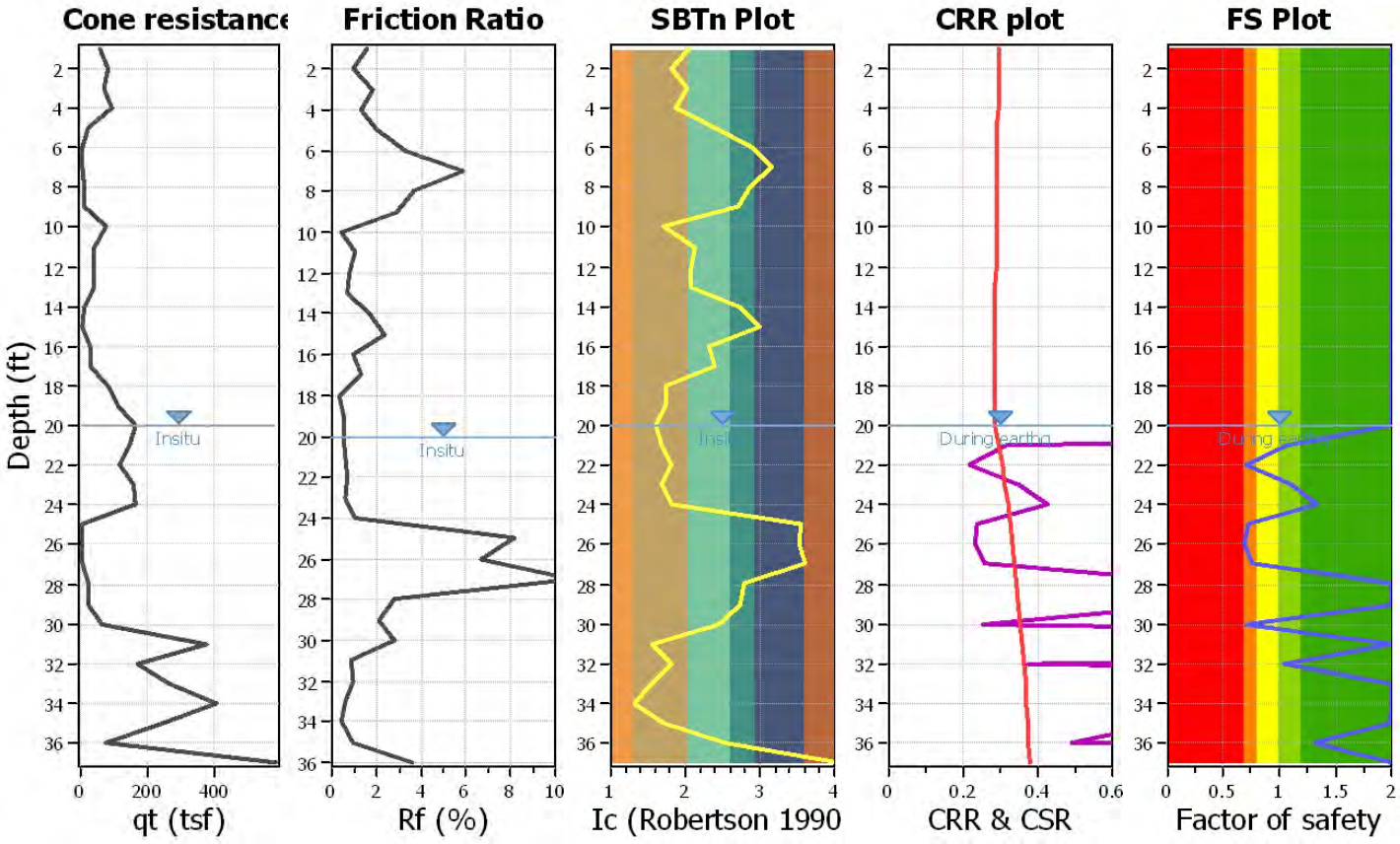
LIQUEFACTION ANALYSIS REPORT

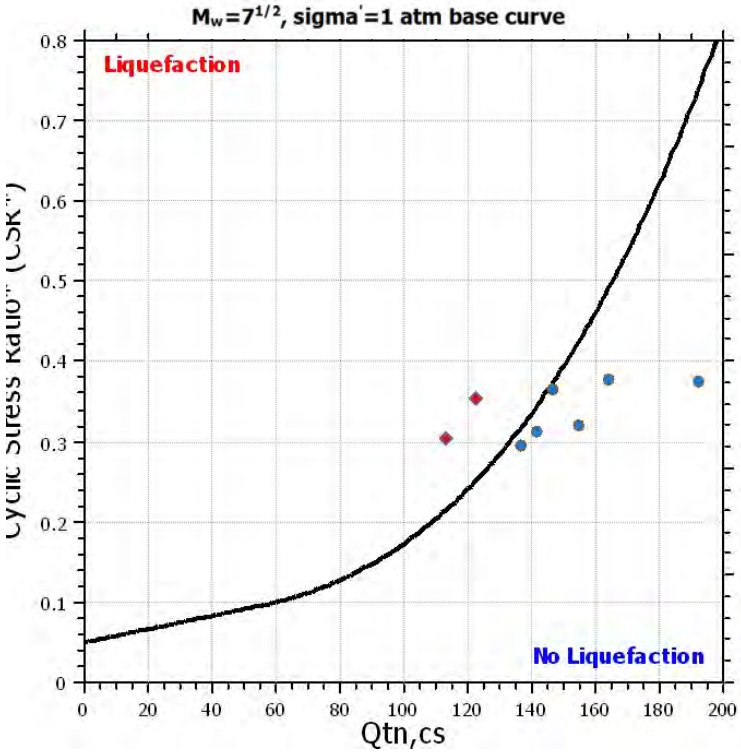
Project title : Ganahl SJC **Location :**

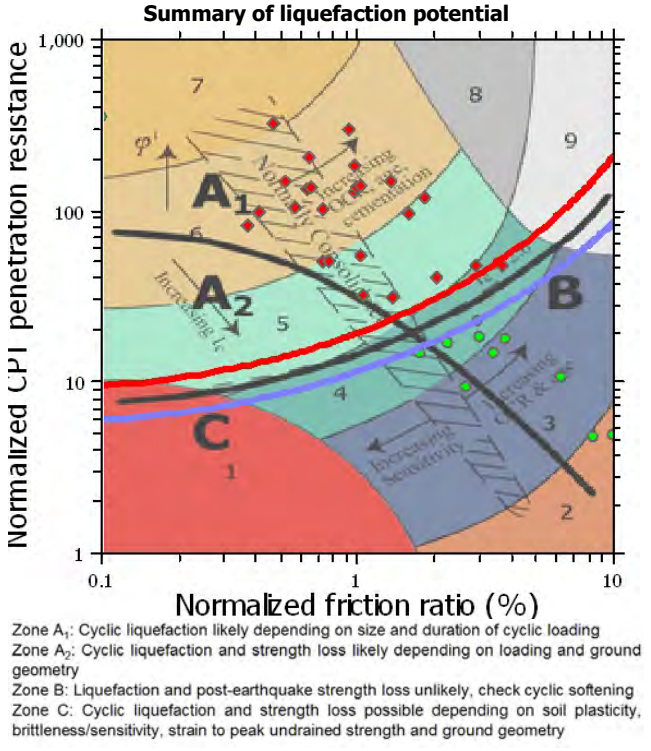
CPT file : CPT-8

Input parameters and analysis data

Analysis method:	Robertson (2009)	G.W.T. (in-situ):	20.00 ft	Use fill:	No	Clay like behavior applied:	All soils
Fines correction method:	Robertson (2009)	G.W.T. (earthq.):	20.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth:	50.00 ft
Earthquake magnitude M_w:	6.70	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.55	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

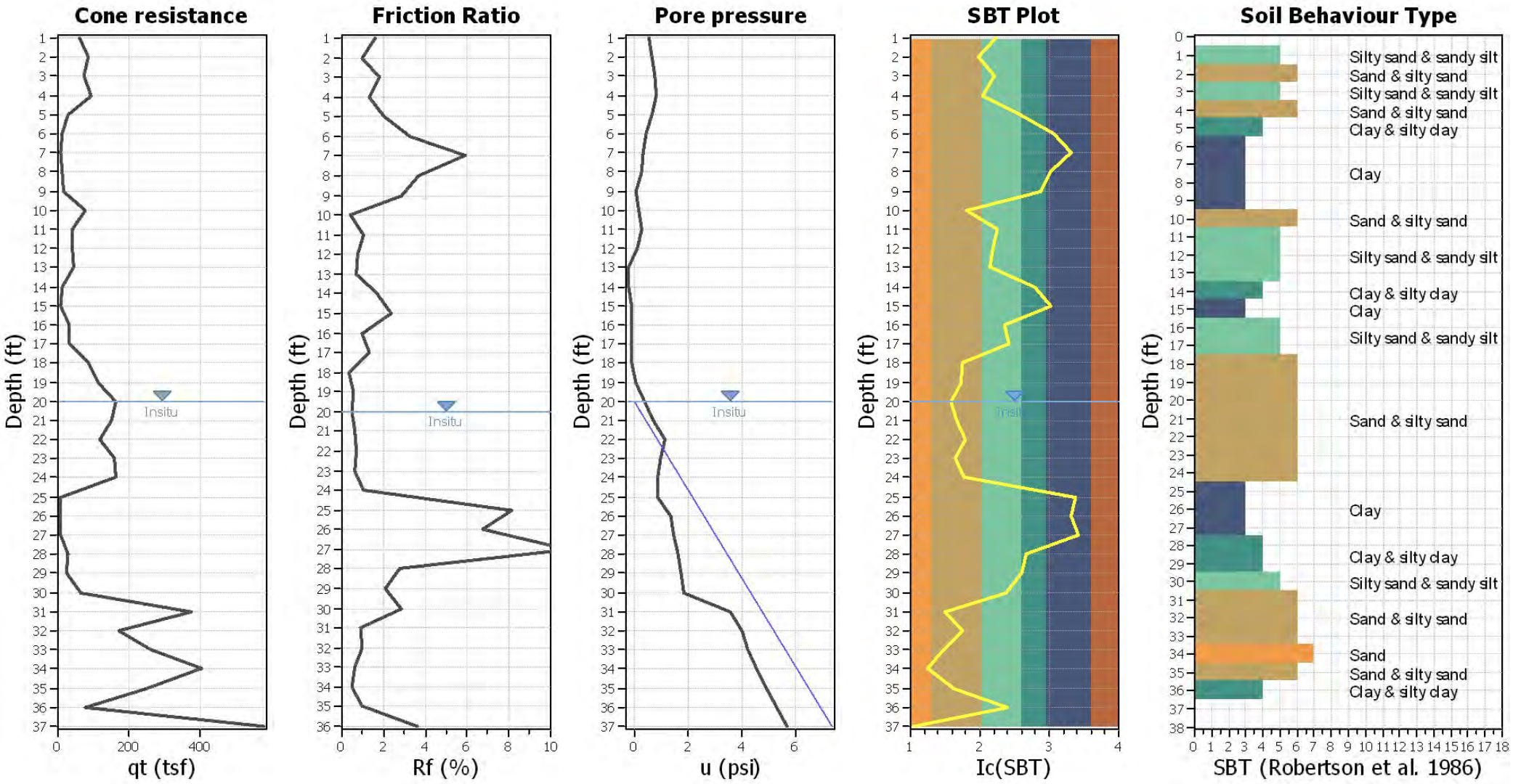






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plc



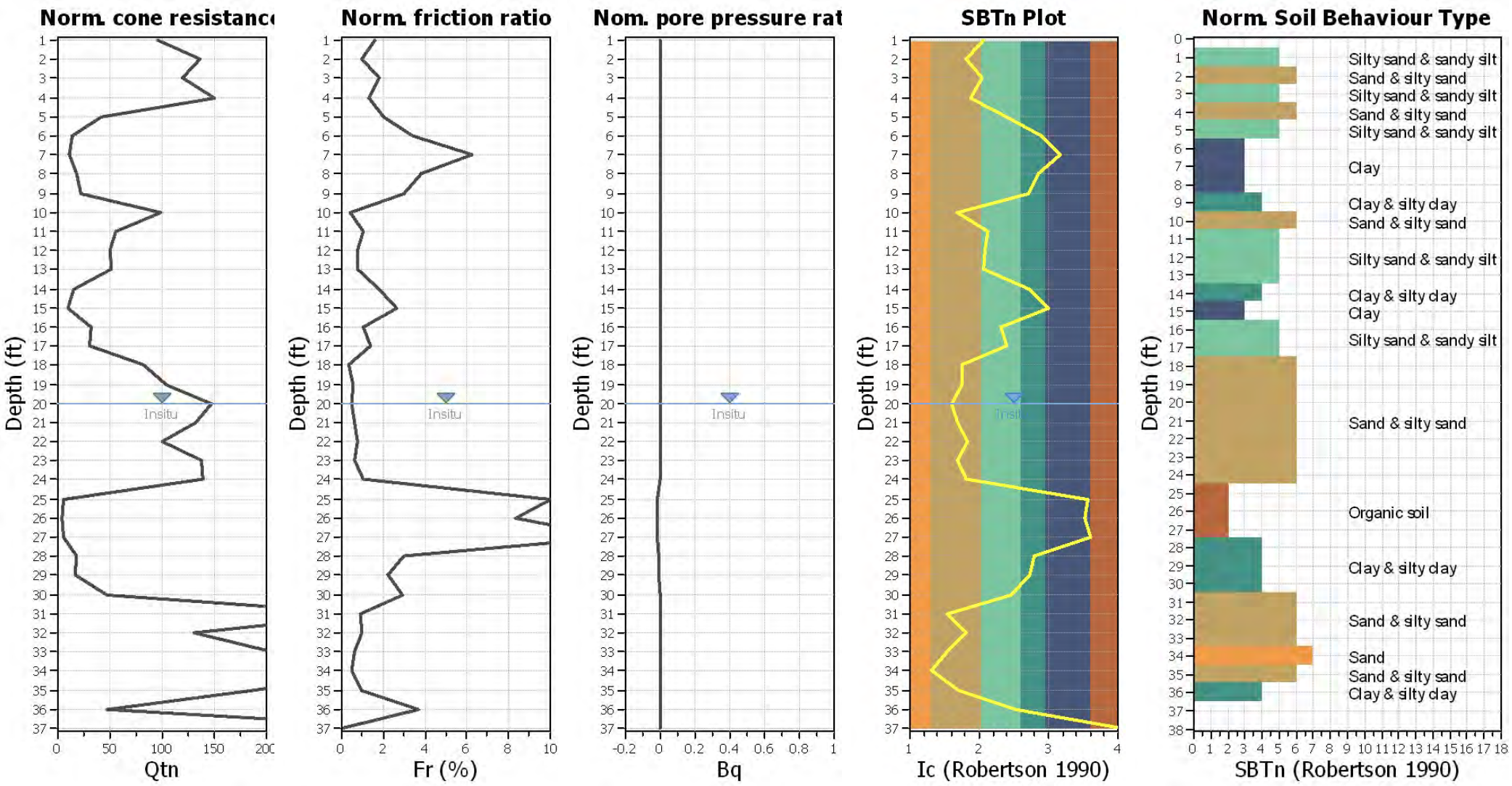
Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	All soils
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

SBT legend

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

CPT basic interpretation plots (normaliz



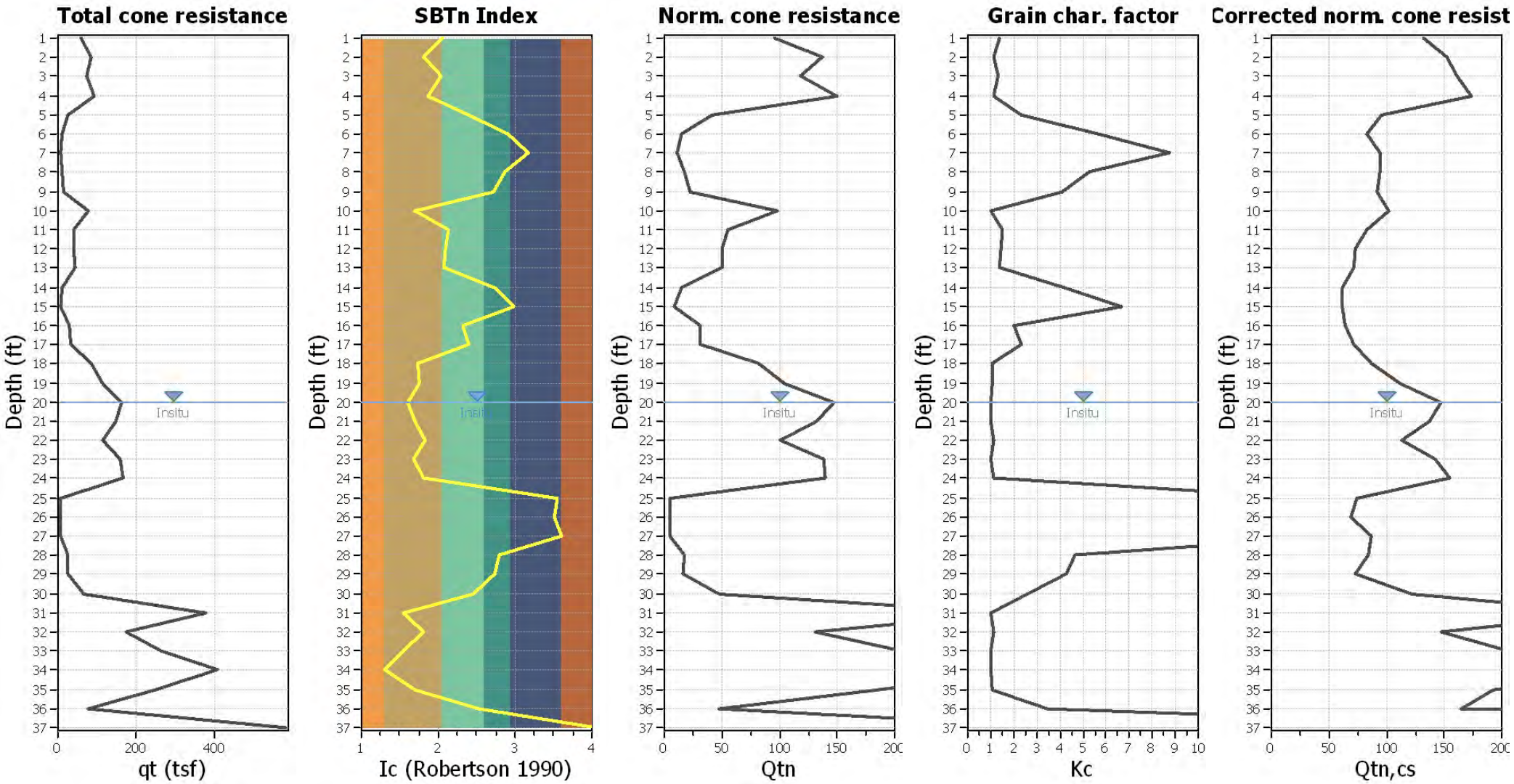
Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	All soils
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

SBTn legend

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

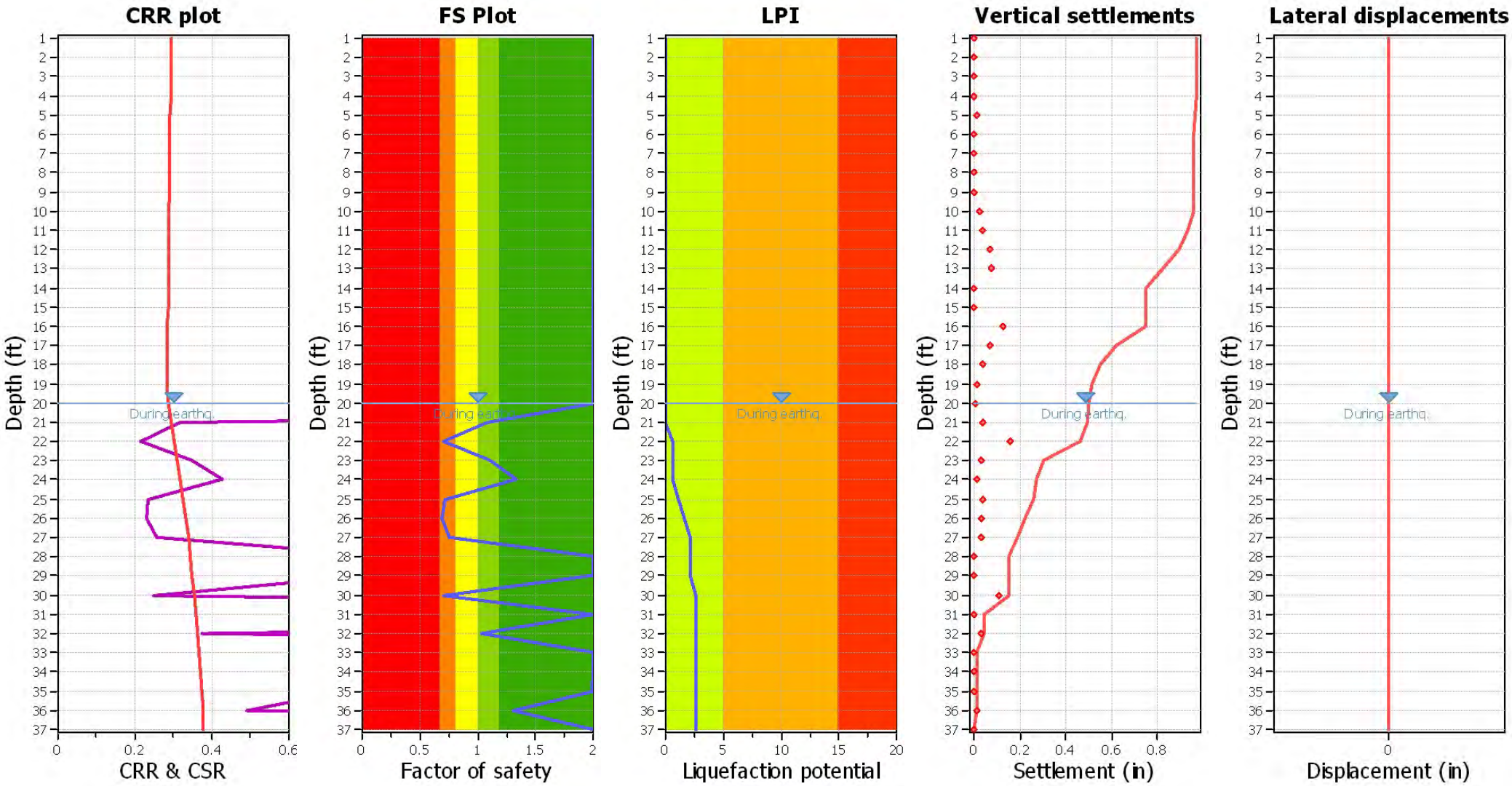
Liquefaction analysis overall plots (intermediate resi



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	All soils
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

Liquefaction analysis overall plot



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	All soils
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

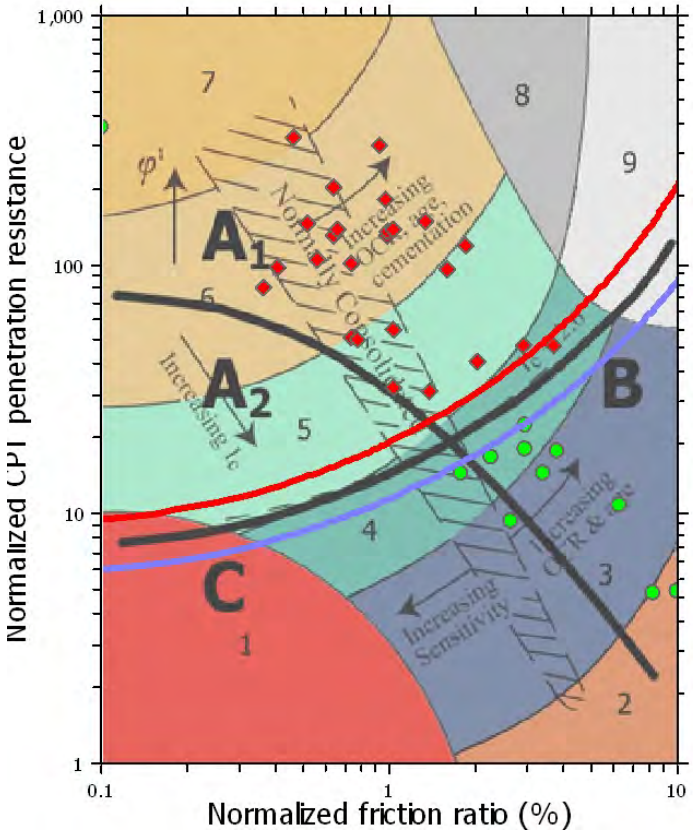
F.S. color scheme

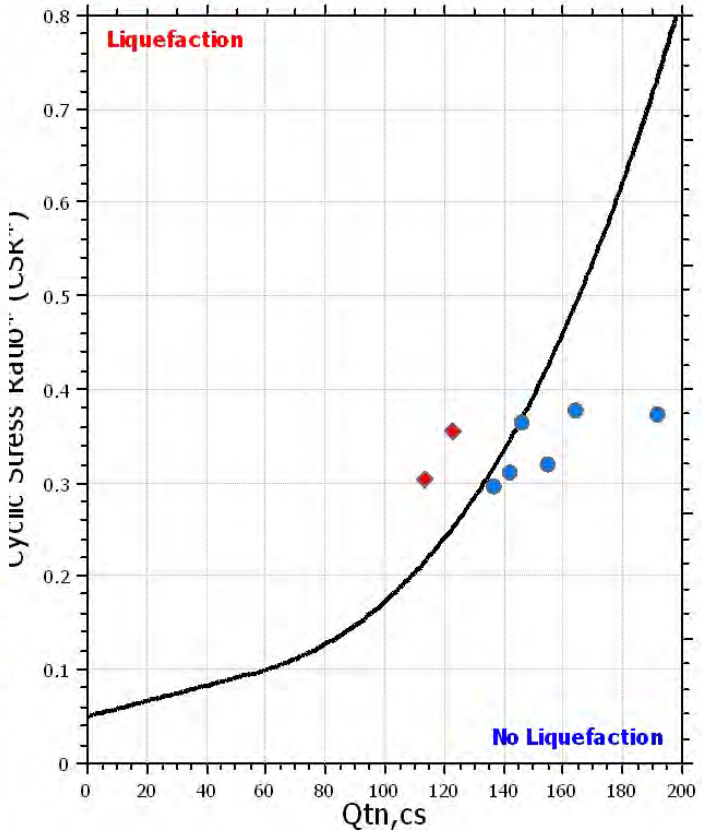
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

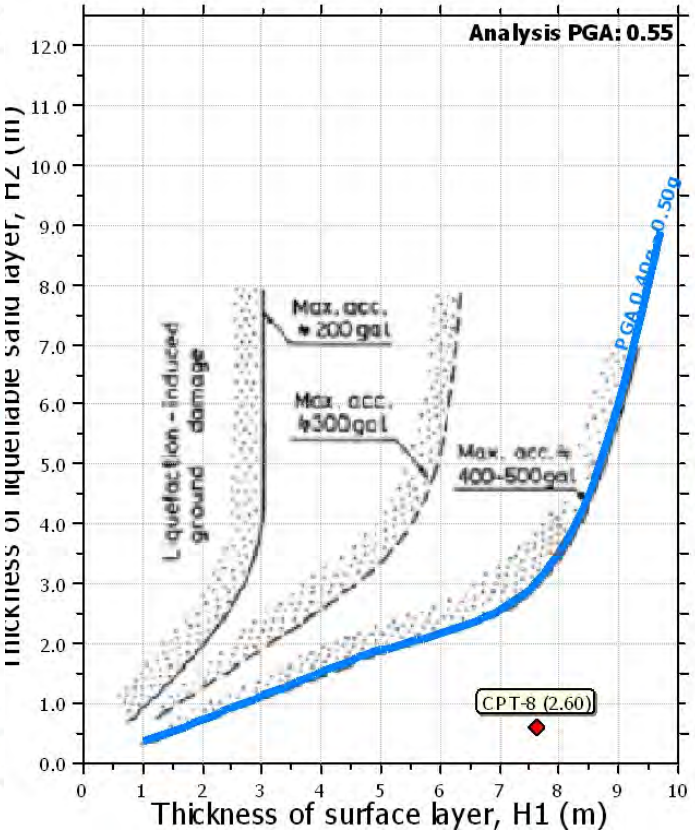
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plo



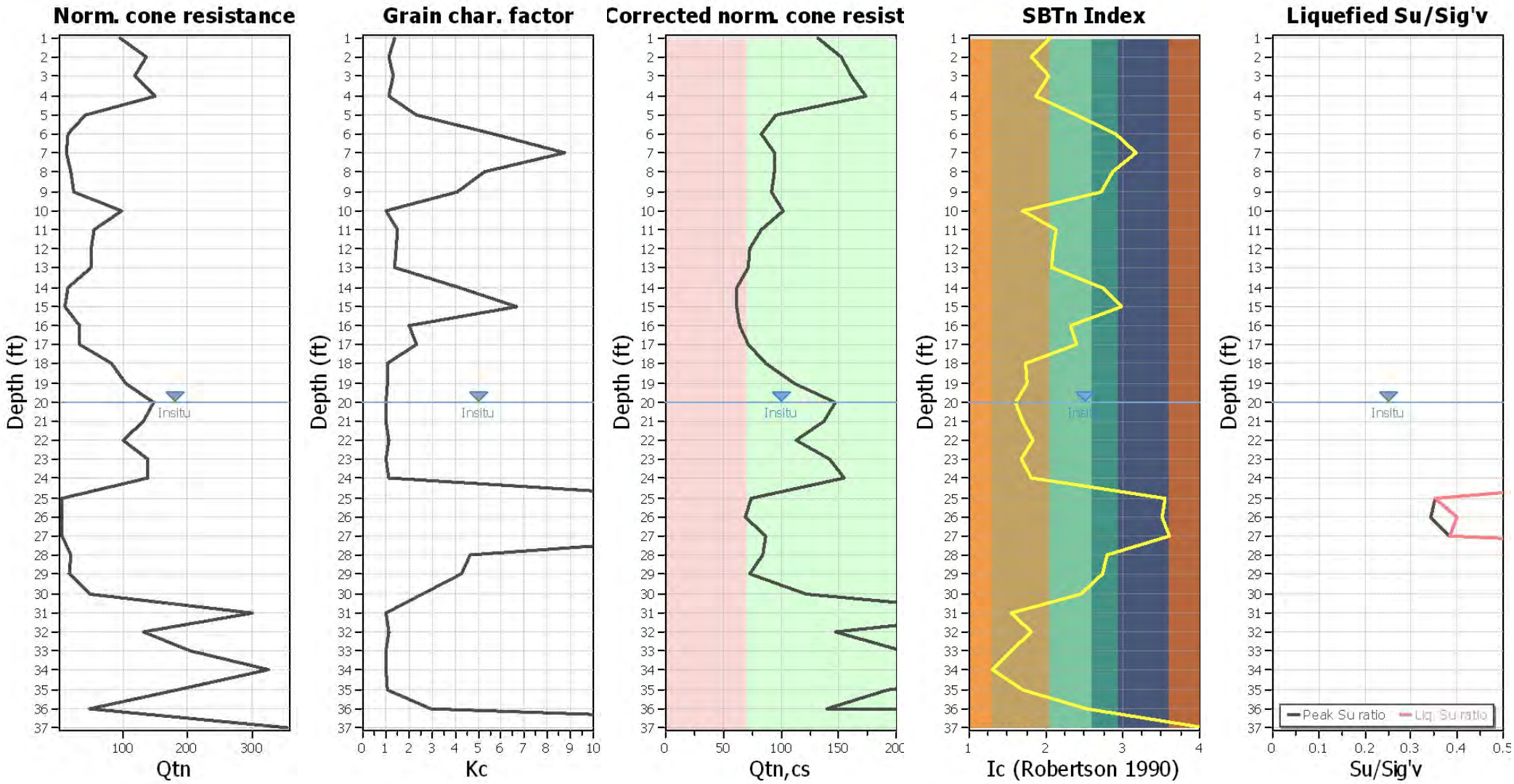




Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	All soils
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

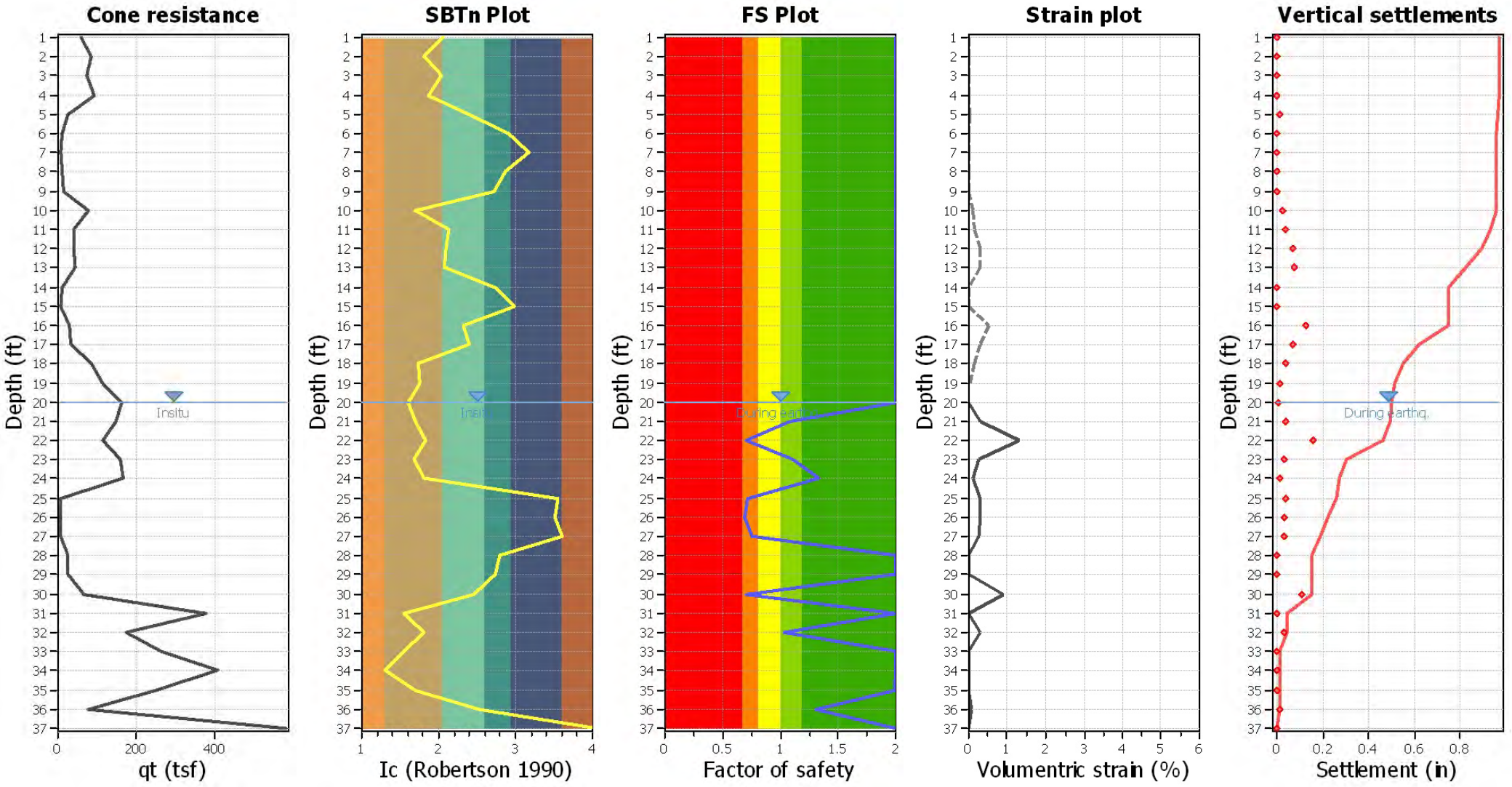
Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	All soils
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

Estimation of post-earthquake settlements



Abbreviations

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

:: Post-earthquake settlement of dry sands ::

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
1.00	2.06	95.72	1.38	132.16	28	725	0.29	0.004	0.00	8.63	0.00	0.000
2.00	1.80	136.73	1.11	151.71	29	752	0.29	0.008	0.00	8.63	0.00	0.001
3.00	2.04	118.84	1.35	160.63	34	878	0.29	0.010	0.01	8.63	0.00	0.001
4.00	1.87	149.79	1.16	173.83	34	894	0.29	0.014	0.01	8.63	0.01	0.001
5.00	2.40	41.31	2.32	95.71	24	484	0.29	0.071	0.06	8.63	0.04	0.010
6.00	2.90	14.55	5.68	82.69	0	0	0.29	0.000	0.00	0.00	0.00	0.000
7.00	3.16	10.76	8.76	94.30	0	0	0.29	0.000	0.00	0.00	0.00	0.000
8.00	2.86	17.72	5.31	94.17	0	0	0.29	0.000	0.00	0.00	0.00	0.000
9.00	2.71	22.66	4.07	92.13	0	0	0.29	0.000	0.00	10.85	0.00	0.000
10.00	1.70	98.11	1.04	101.66	19	582	0.29	0.136	0.15	8.63	0.09	0.023
11.00	2.12	55.00	1.50	82.53	18	540	0.29	0.219	0.25	8.63	0.16	0.038
12.00	2.09	50.63	1.43	72.35	16	504	0.29	0.356	0.48	8.63	0.30	0.072
13.00	2.07	50.80	1.40	71.37	15	524	0.29	0.361	0.50	8.63	0.30	0.073
14.00	2.73	14.62	4.24	62.05	0	0	0.29	0.000	0.00	10.85	0.00	0.000
15.00	2.99	9.37	6.64	62.18	0	0	0.29	0.000	0.00	10.85	0.00	0.000
16.00	2.32	32.03	2.02	64.61	15	509	0.28	0.674	0.93	8.63	0.53	0.127
17.00	2.40	31.24	2.30	71.96	18	571	0.28	0.451	0.52	8.63	0.29	0.070
18.00	1.74	81.74	1.07	87.27	17	692	0.28	0.235	0.29	8.63	0.16	0.039
19.00	1.75	104.58	1.07	111.79	21	916	0.28	0.107	0.10	8.63	0.05	0.013

Total estimated settlement: 0.47

Abbreviations

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

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

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
20.00	147.71	2.00	0.00	0.67	0.00	21.00	136.70	1.08	0.29	0.65	0.04
22.00	113.19	0.71	1.31	0.63	0.16	23.00	141.96	1.11	0.27	0.62	0.03
24.00	154.94	1.34	0.13	0.60	0.02	25.00	74.55	0.72	0.29	0.58	0.04
26.00	68.97	0.69	0.28	0.57	0.03	27.00	86.21	0.76	0.28	0.55	0.03
28.00	84.69	2.00	0.00	0.53	0.00	29.00	72.42	2.00	0.00	0.52	0.00
30.00	122.49	0.71	0.92	0.50	0.11	31.00	300.96	2.00	0.00	0.48	0.00
32.00	146.60	1.03	0.29	0.47	0.03	33.00	204.55	2.00	0.00	0.45	0.00
34.00	324.69	2.00	0.00	0.43	0.00	35.00	192.27	1.99	0.00	0.42	0.00
36.00	164.17	1.31	0.08	0.40	0.01	37.00	9446.94	2.00	0.00	0.38	0.00

Total estimated settlement: 0.50

Abbreviations

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

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Anaheim, CA 92806

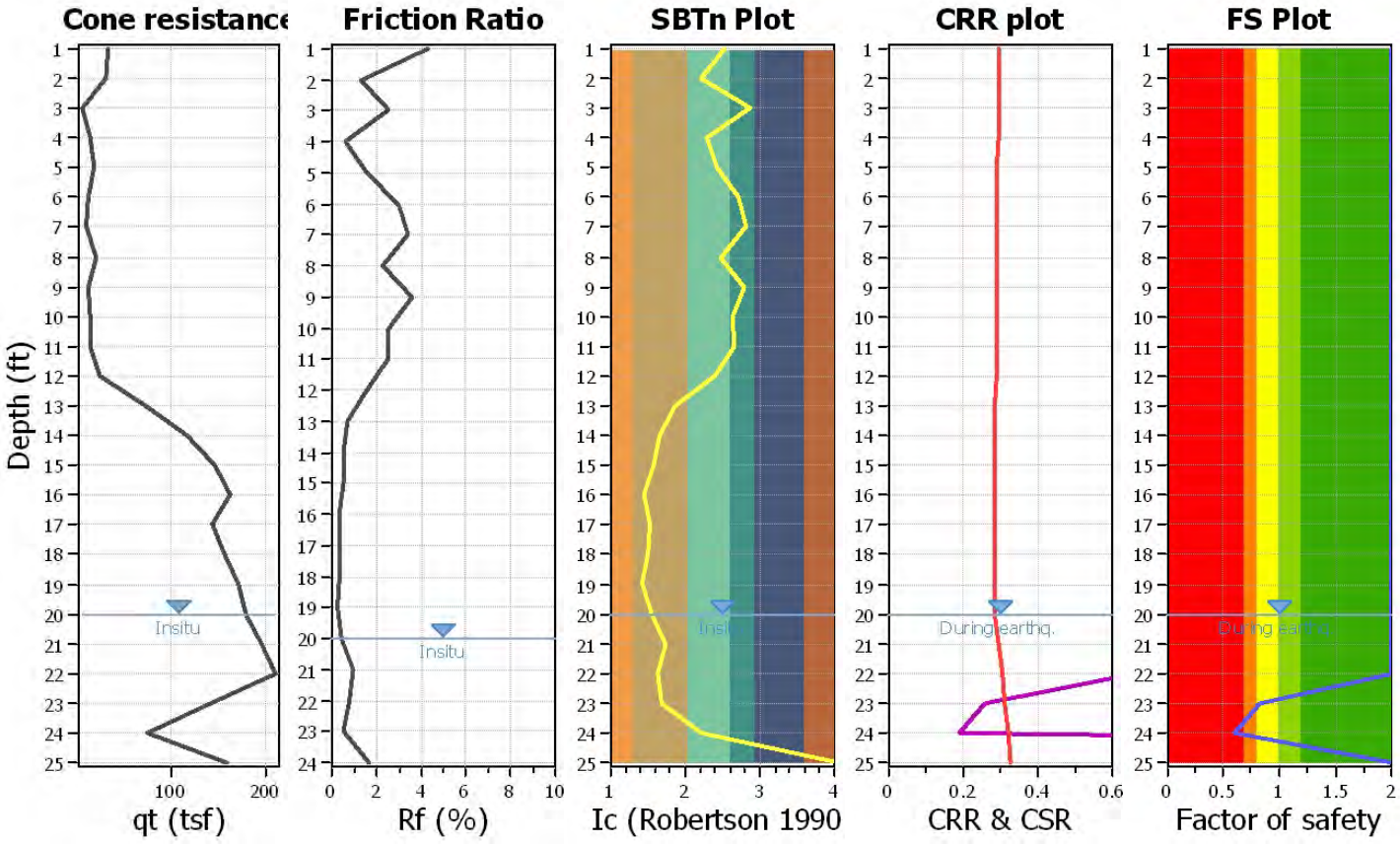
LIQUEFACTION ANALYSIS REPORT

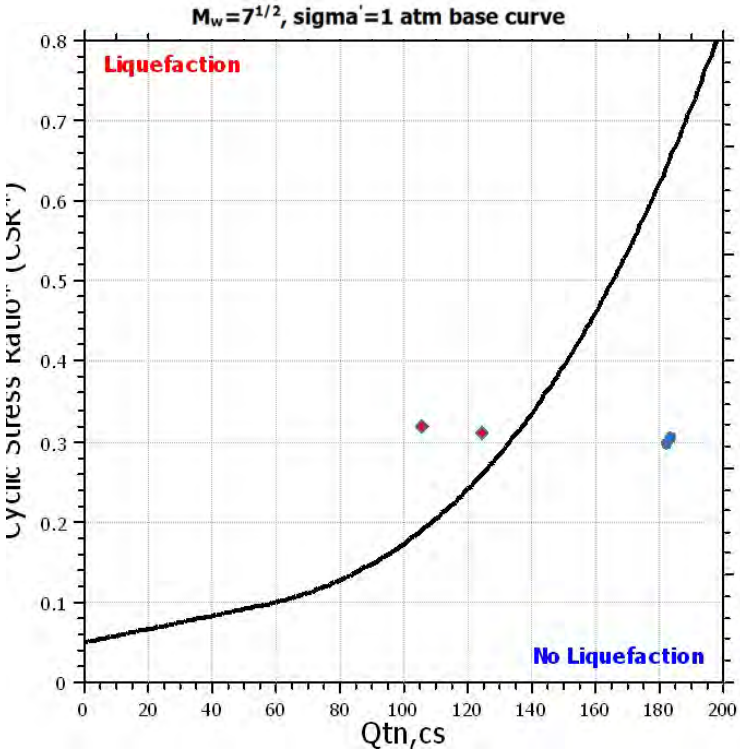
Project title : Ganahl SJC **Location :**

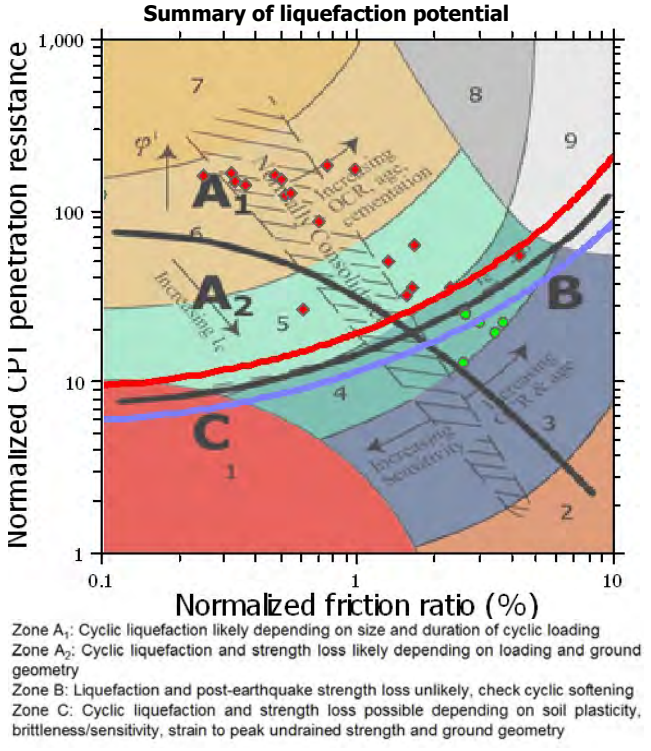
CPT file : CPT-9

Input parameters and analysis data

Analysis method:	Robertson (2009)	G.W.T. (in-situ):	20.00 ft	Use fill:	No	Clay like behavior applied:	All soils
Fines correction method:	Robertson (2009)	G.W.T. (earthq.):	20.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth:	50.00 ft
Earthquake magnitude M_w:	6.70	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.55	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

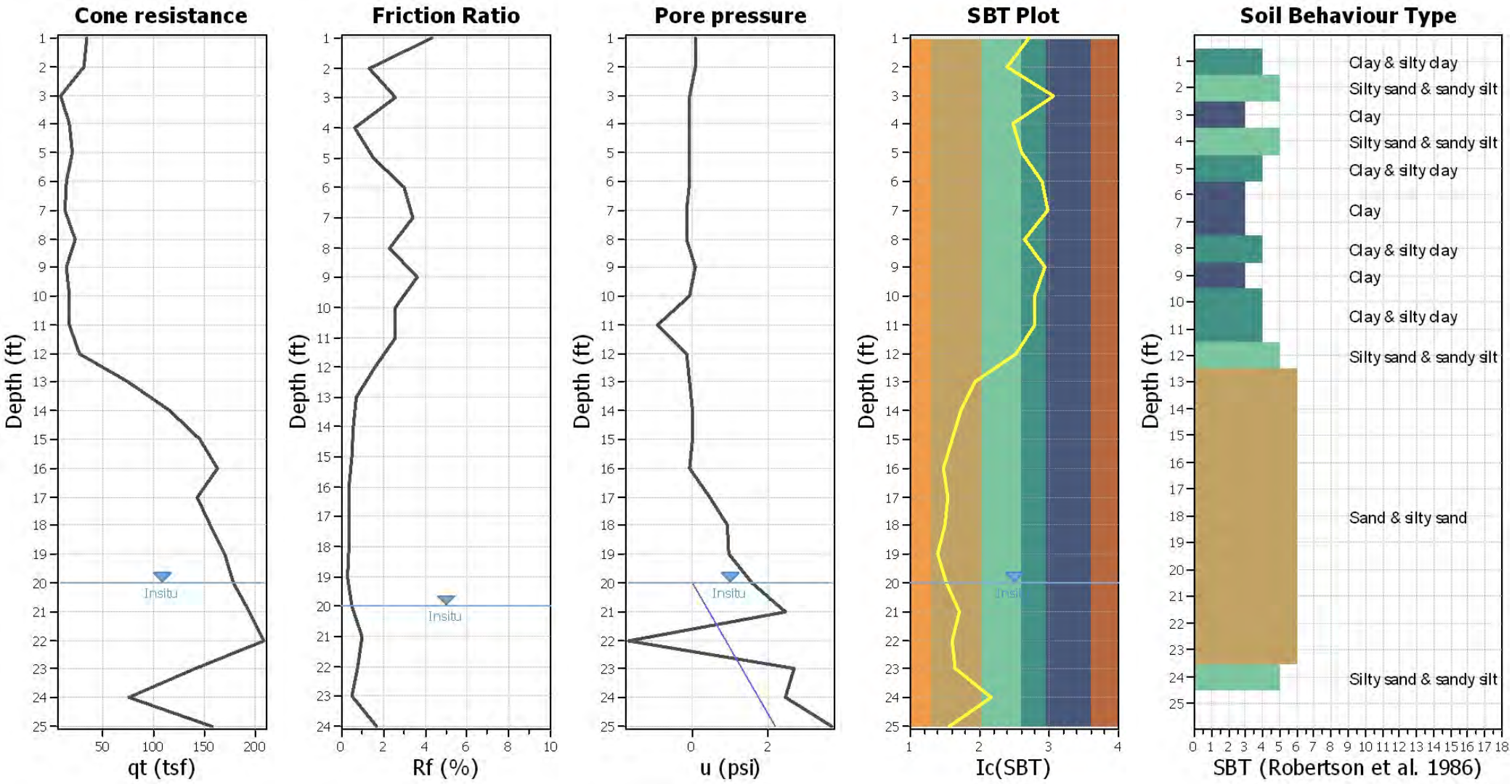






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plc



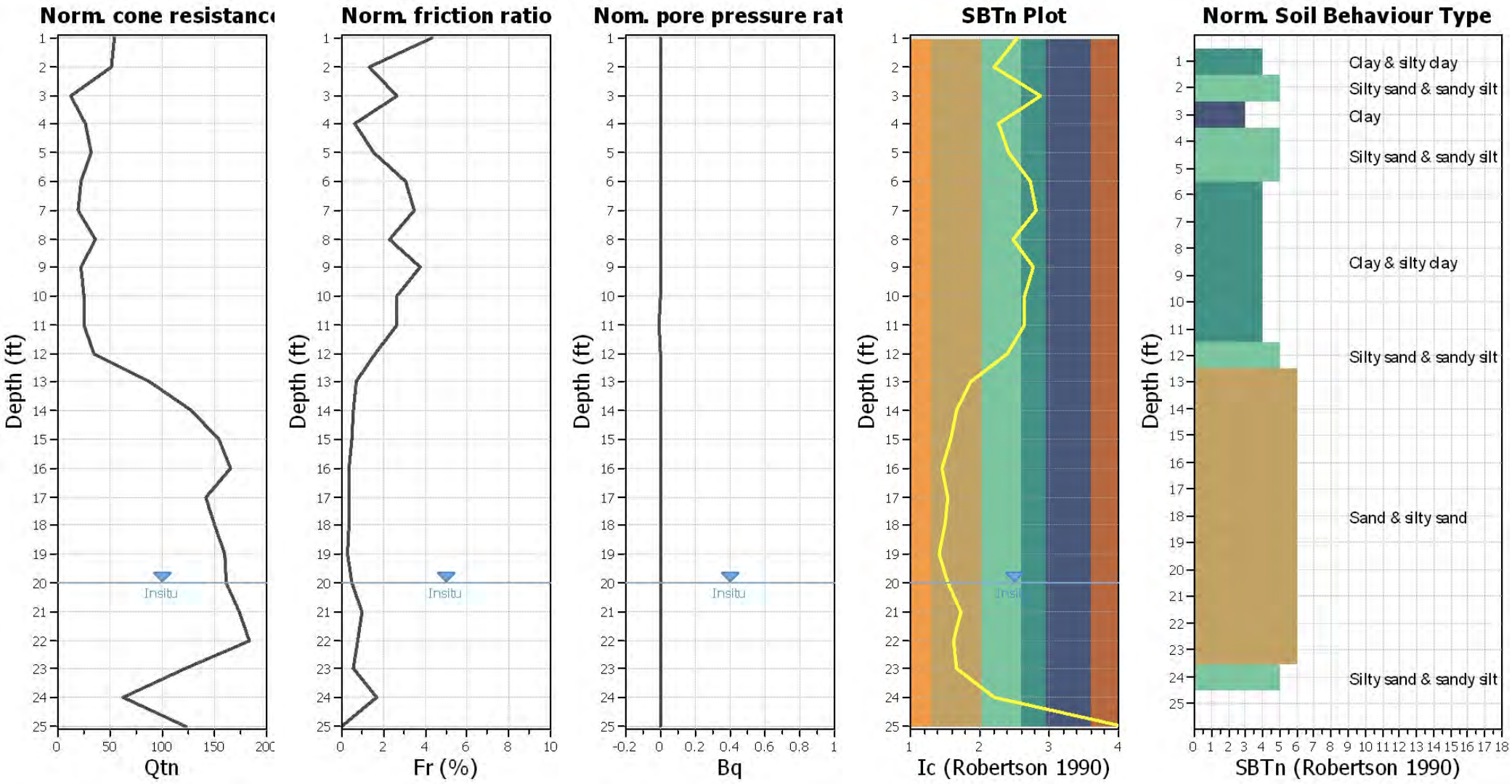
Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	All soils
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

SBT legend

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

CPT basic interpretation plots (normaliz



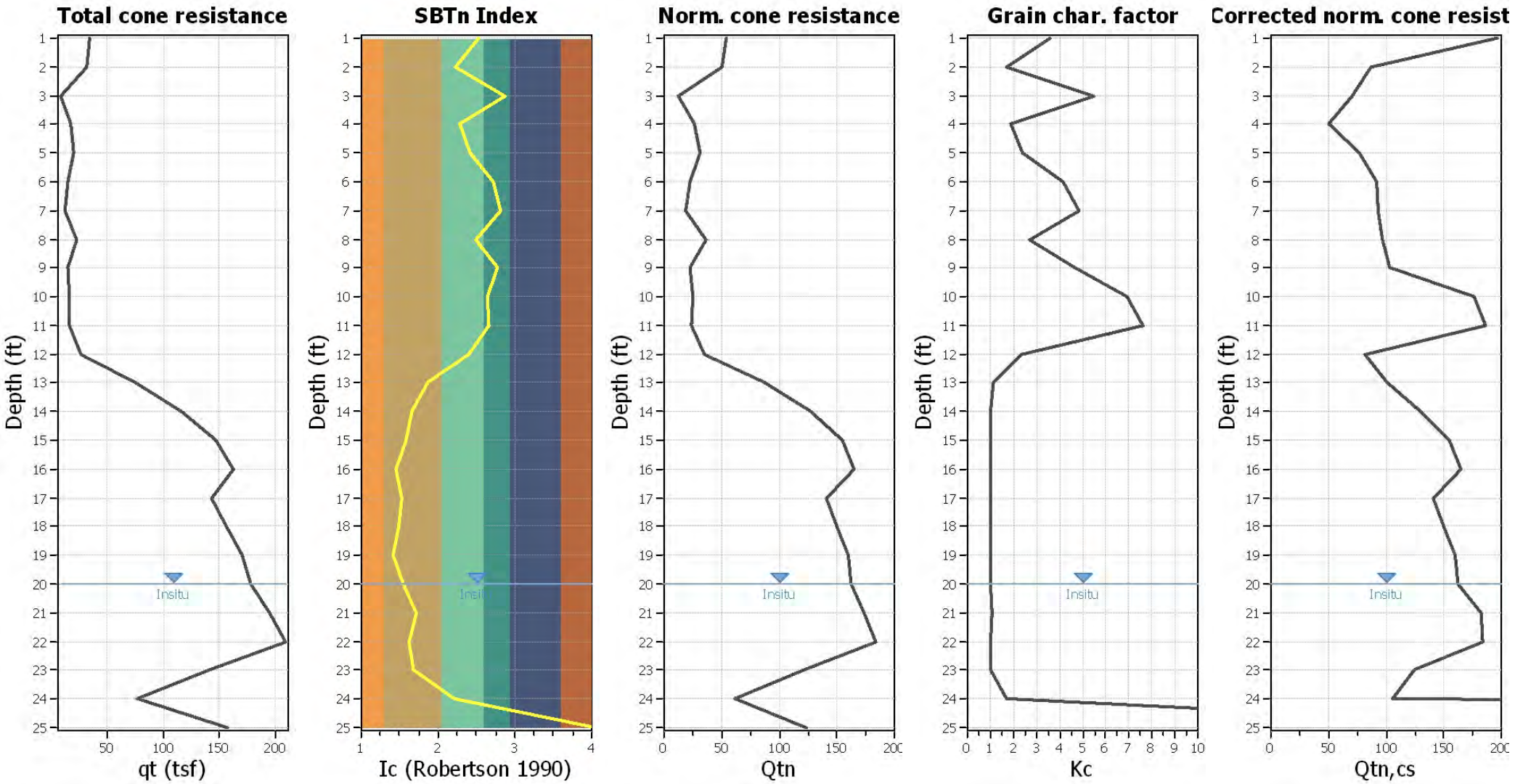
Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	All soils
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

SBTn legend

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

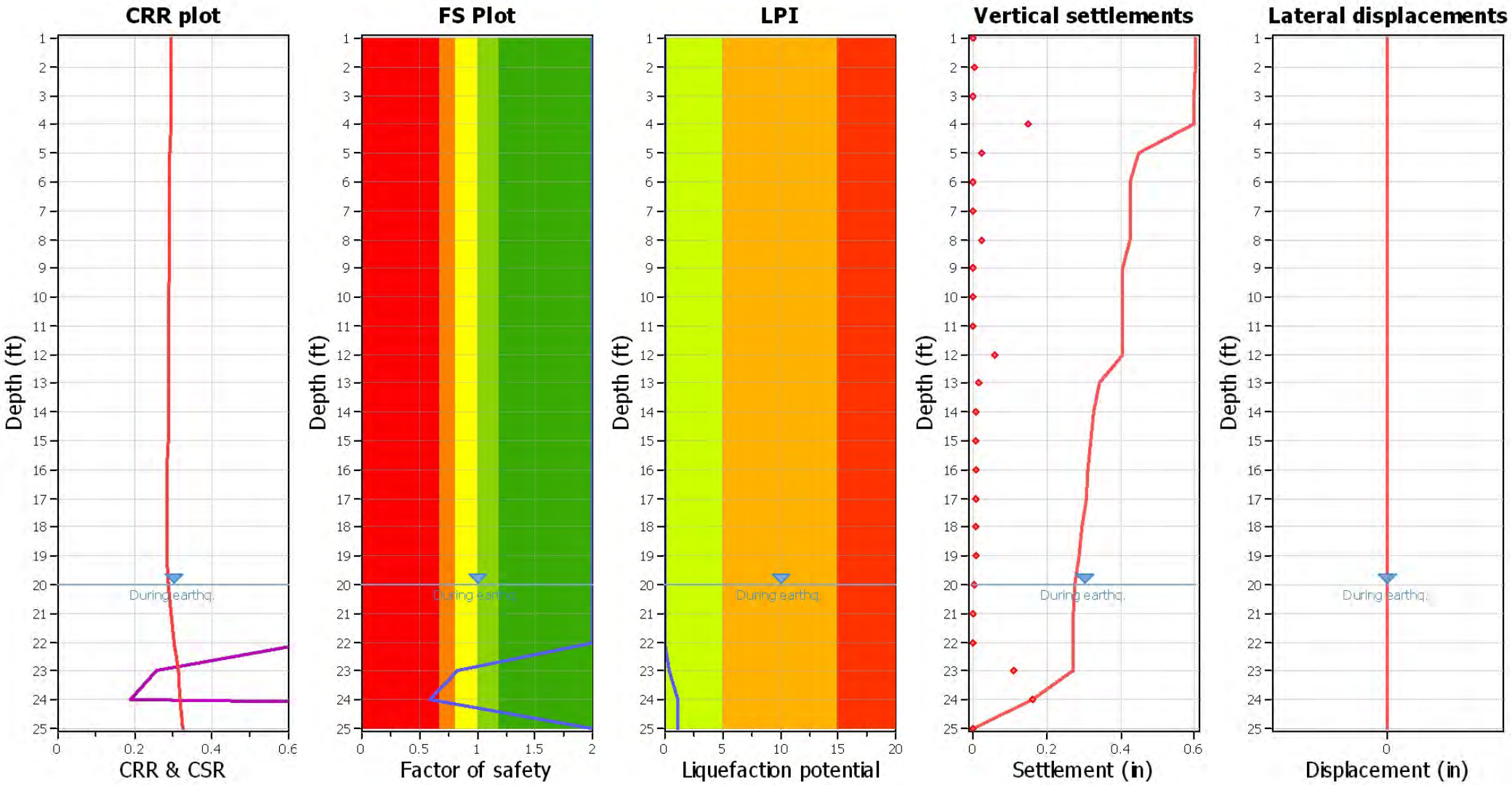
Liquefaction analysis overall plots (intermediate resi



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	All soils
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

Liquefaction analysis overall plot



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	All soils
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

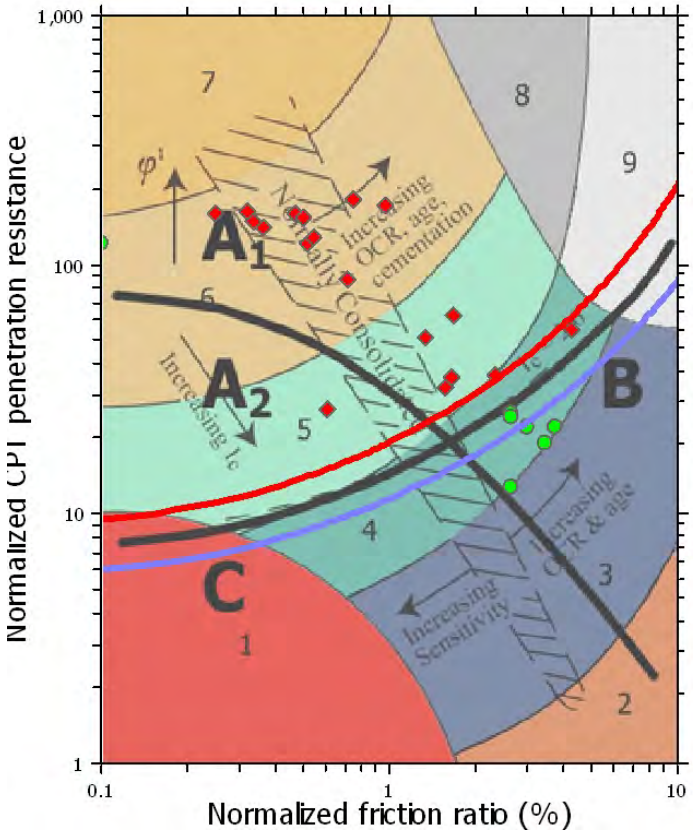
F.S. color scheme

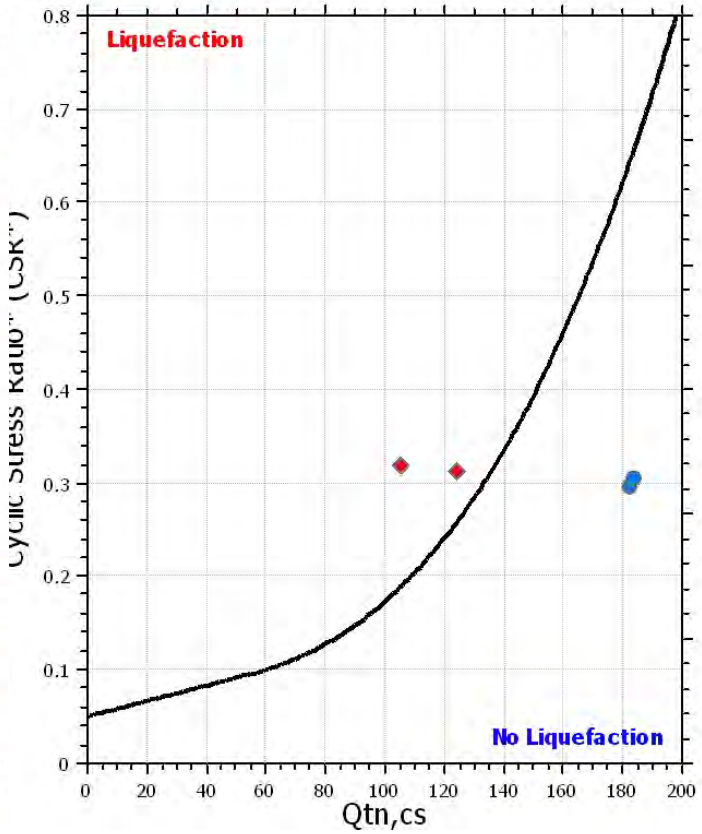
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

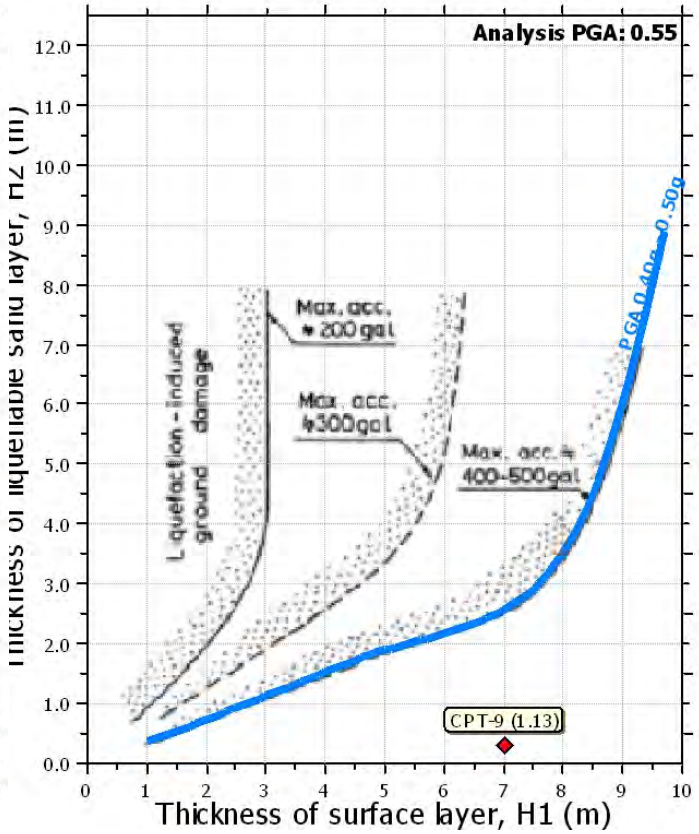
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plo



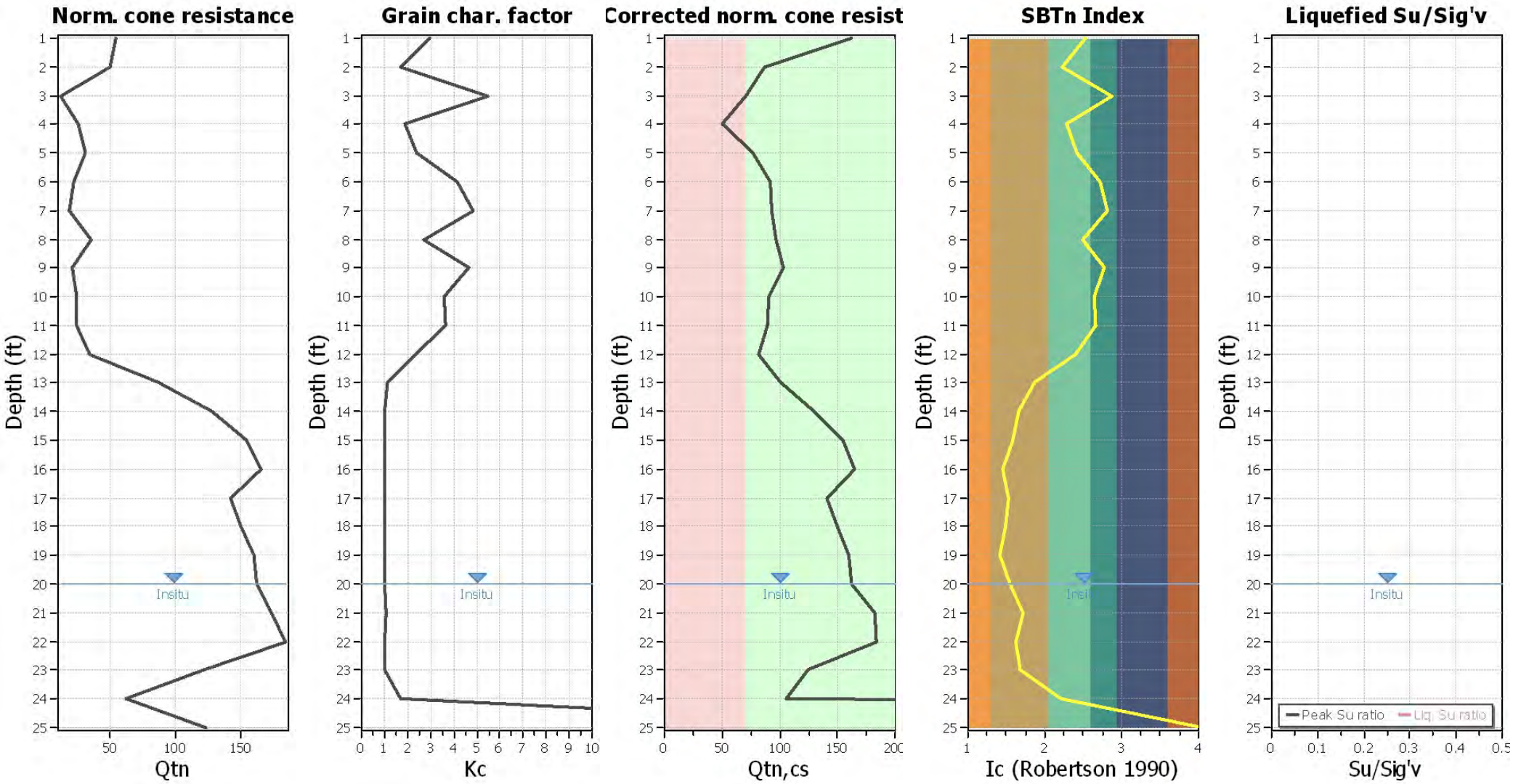




Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	All soils
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

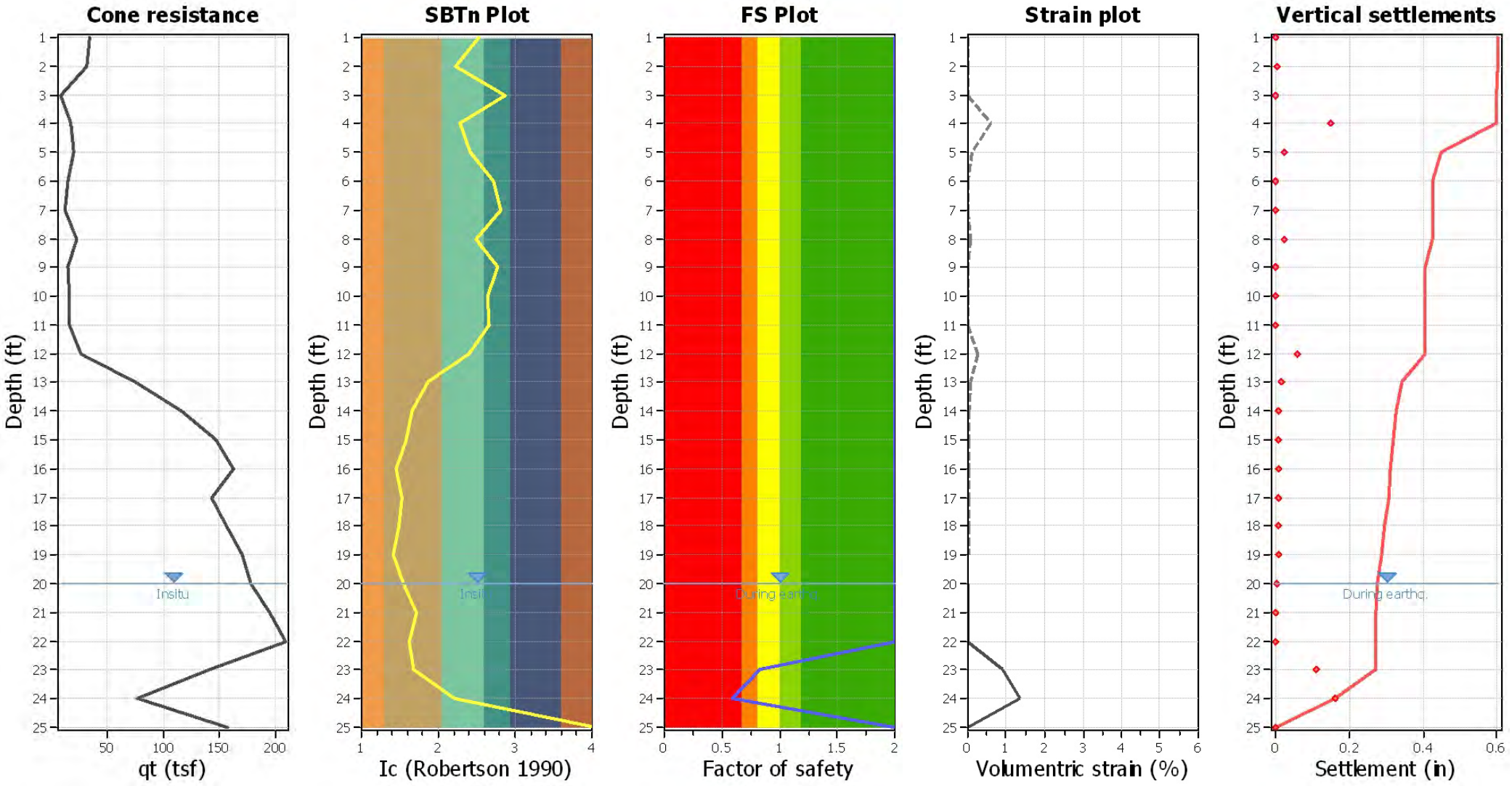
Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	All soils
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

Estimation of post-earthquake settlements



Abbreviations

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

:: Post-earthquake settlement of dry sands ::

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
1.00	2.54	54.59	2.96	161.77	42	760	0.29	0.003	0.00	8.63	0.00	0.000
2.00	2.22	50.82	1.71	86.89	20	472	0.29	0.016	0.02	8.63	0.01	0.003
3.00	2.88	12.82	5.46	70.06	0	0	0.29	0.000	0.00	10.85	0.00	0.000
4.00	2.28	26.49	1.88	49.91	12	266	0.29	0.445	0.85	8.63	0.62	0.149
5.00	2.42	31.93	2.40	76.63	19	384	0.29	0.136	0.14	8.63	0.10	0.025
6.00	2.72	22.28	4.14	92.30	0	0	0.29	0.000	0.00	0.00	0.00	0.000
7.00	2.81	19.35	4.83	93.56	0	0	0.29	0.000	0.00	0.00	0.00	0.000
8.00	2.48	36.03	2.69	97.01	25	469	0.29	0.173	0.13	8.63	0.09	0.022
9.00	2.78	22.20	4.63	102.68	0	0	0.29	0.000	0.00	0.00	0.00	0.000
10.00	2.64	25.46	3.57	90.90	0	0	0.29	0.000	0.00	0.00	0.00	0.000
11.00	2.65	24.45	3.67	89.71	0	0	0.29	0.000	0.00	10.85	0.00	0.000
12.00	2.40	35.29	2.30	81.22	20	483	0.29	0.399	0.40	8.63	0.25	0.060
13.00	1.87	86.95	1.16	100.90	20	702	0.29	0.114	0.11	8.63	0.07	0.017
14.00	1.67	127.67	1.02	129.58	24	856	0.29	0.075	0.06	8.63	0.04	0.009
15.00	1.58	154.26	1.00	154.26	28	967	0.29	0.063	0.04	8.63	0.02	0.006
16.00	1.45	164.58	1.00	164.58	28	913	0.28	0.080	0.05	8.63	0.03	0.007
17.00	1.53	141.38	1.00	141.38	25	895	0.28	0.094	0.07	8.63	0.04	0.010
18.00	1.49	149.43	1.00	149.43	26	927	0.28	0.095	0.07	8.63	0.04	0.009
19.00	1.41	159.33	1.00	159.33	27	909	0.28	0.109	0.08	8.63	0.04	0.010

Total estimated settlement: 0.33

Abbreviations

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

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

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
20.00	161.74	2.00	0.00	0.67	0.00	21.00	182.58	2.00	0.00	0.65	0.00
22.00	183.85	2.00	0.00	0.63	0.00	23.00	124.15	0.83	0.91	0.62	0.11
24.00	105.33	0.59	1.34	0.60	0.16	25.00	3264.49	2.00	0.00	0.58	0.00

Total estimated settlement: 0.27

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

Willdan Geotechnical
1515 S. Sunkist St., Suite E
Anaheim, CA 92806

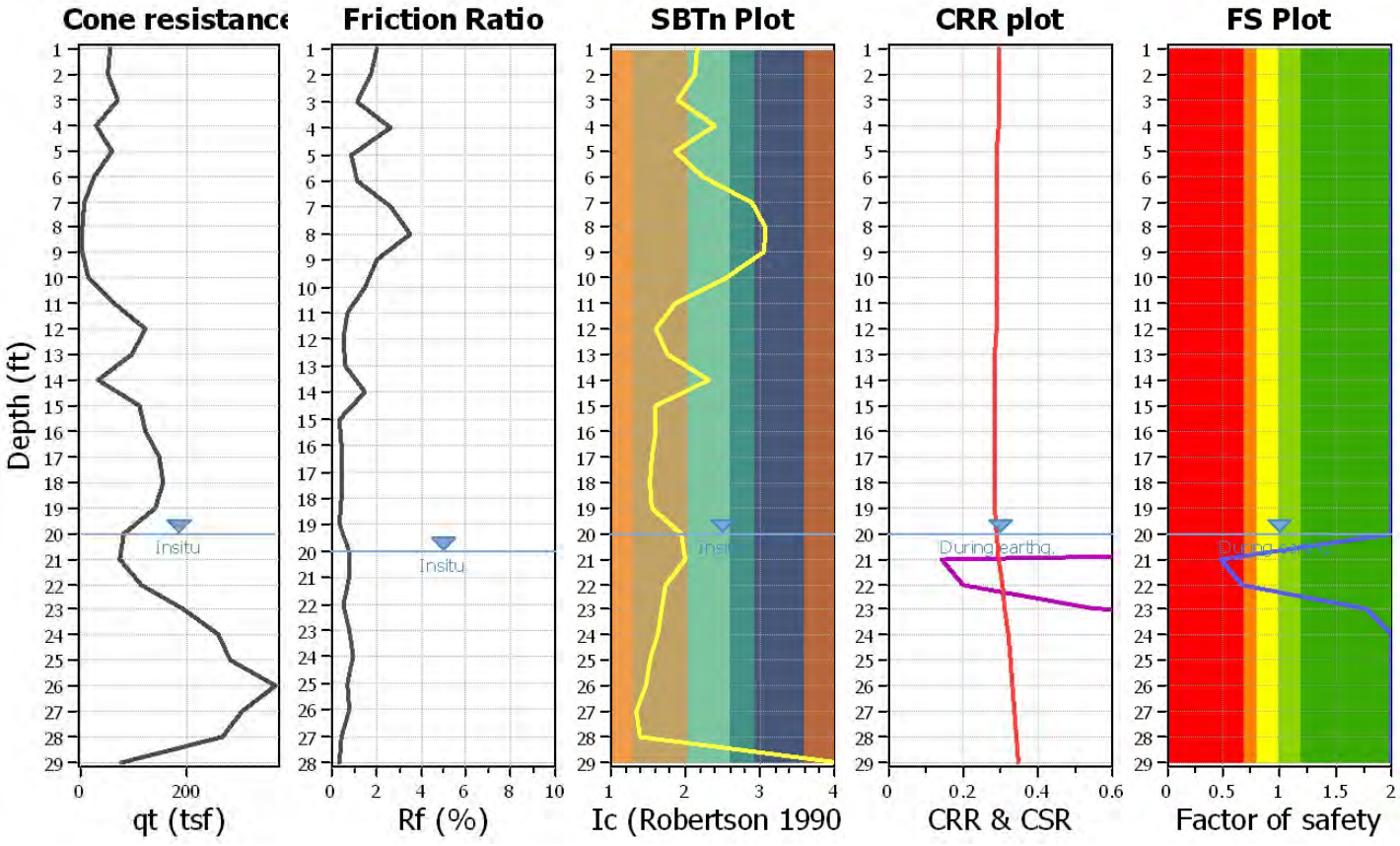
LIQUEFACTION ANALYSIS REPORT

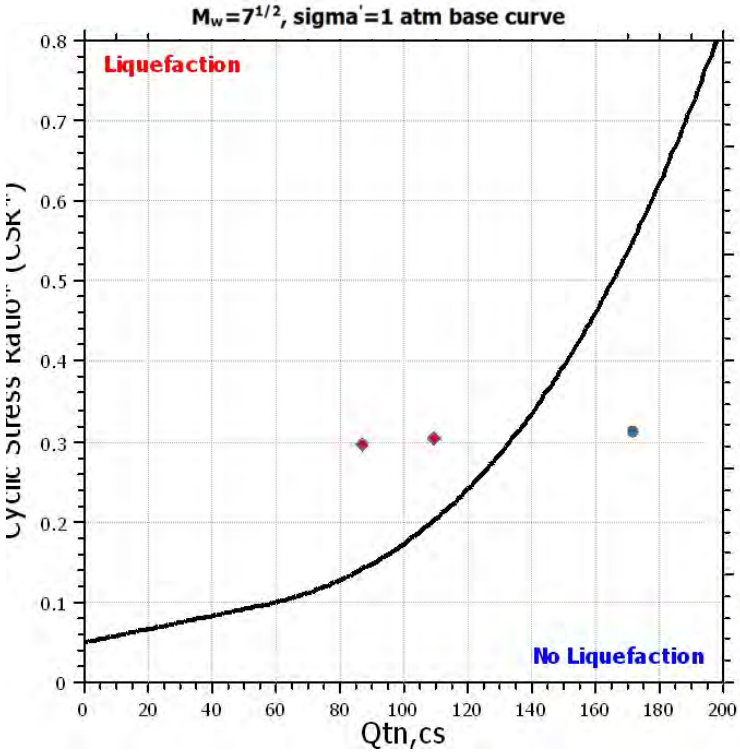
Project title : Ganahl SJC **Location :**

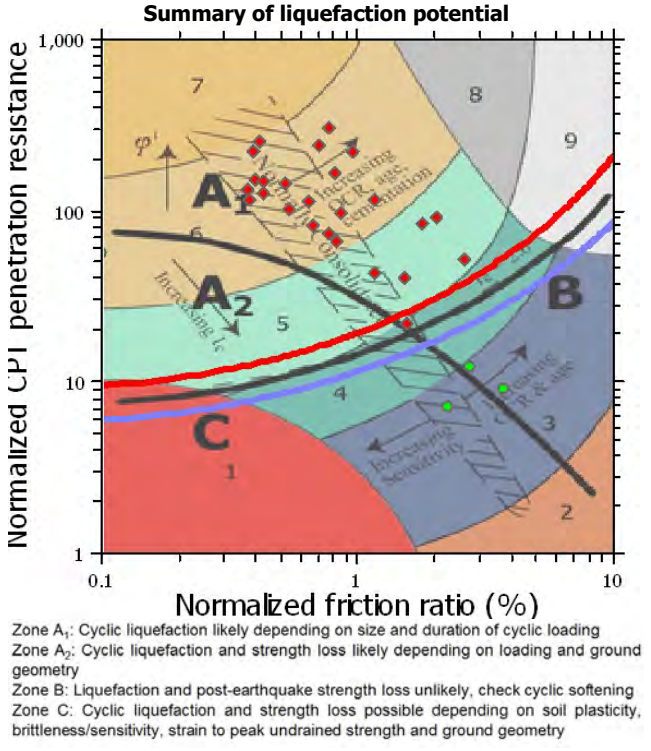
CPT file : CPT-10

Input parameters and analysis data

Analysis method:	Robertson (2009)	G.W.T. (in-situ):	20.00 ft	Use fill:	No	Clay like behavior applied:	All soils
Fines correction method:	Robertson (2009)	G.W.T. (earthq.):	20.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth:	50.00 ft
Earthquake magnitude M_w:	6.70	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.55	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

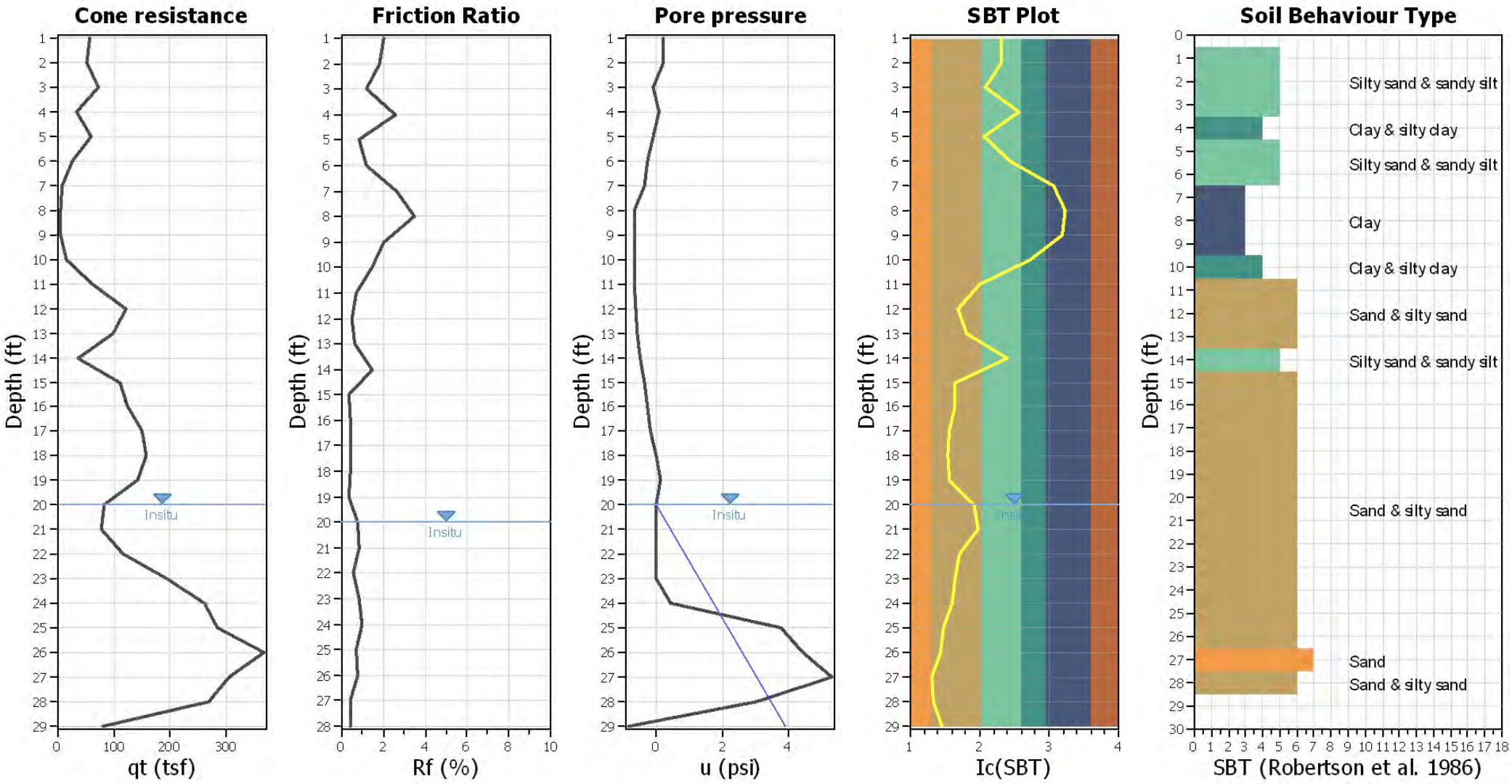






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plc



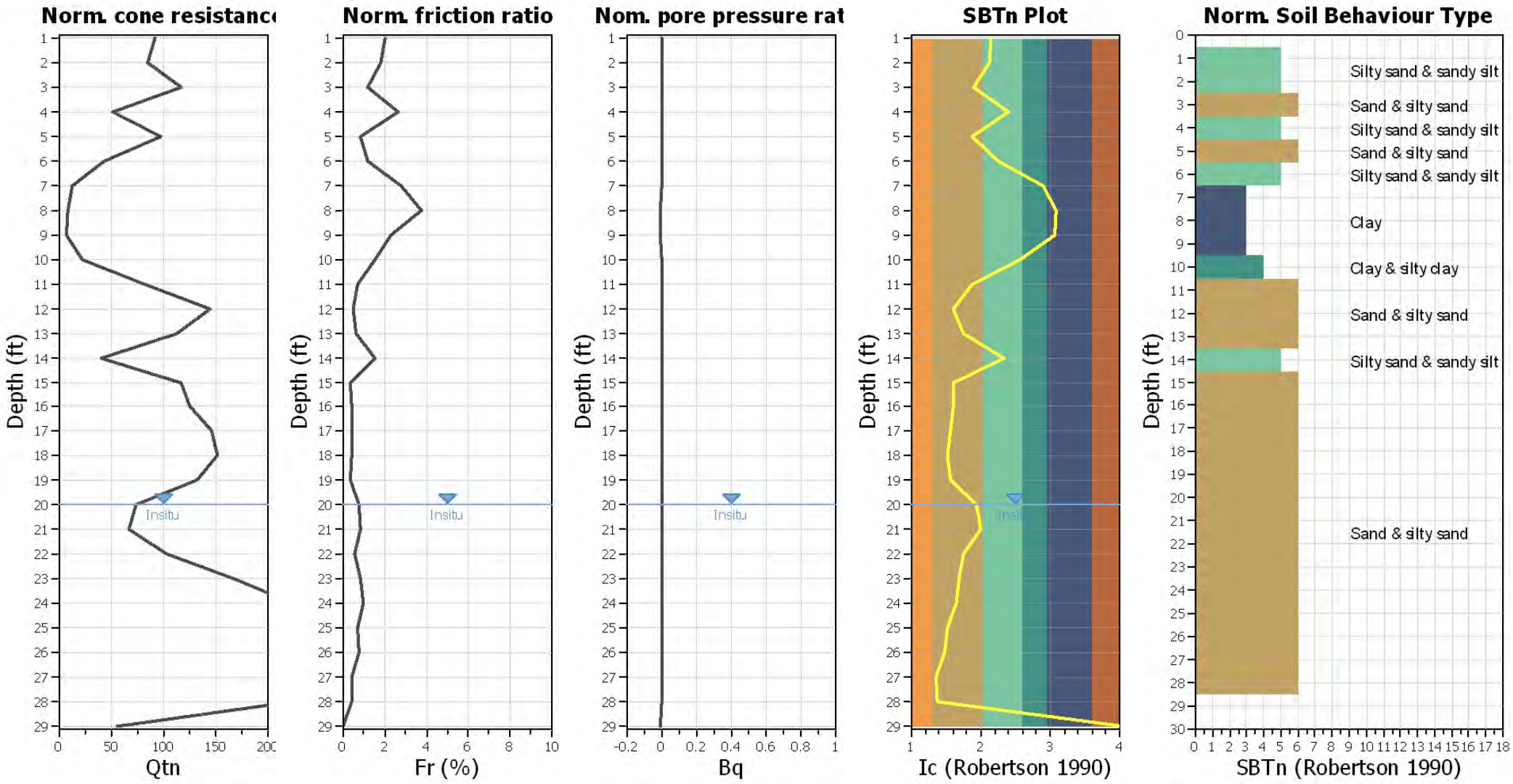
Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	All soils
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

SBT legend

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

CPT basic interpretation plots (normaliz



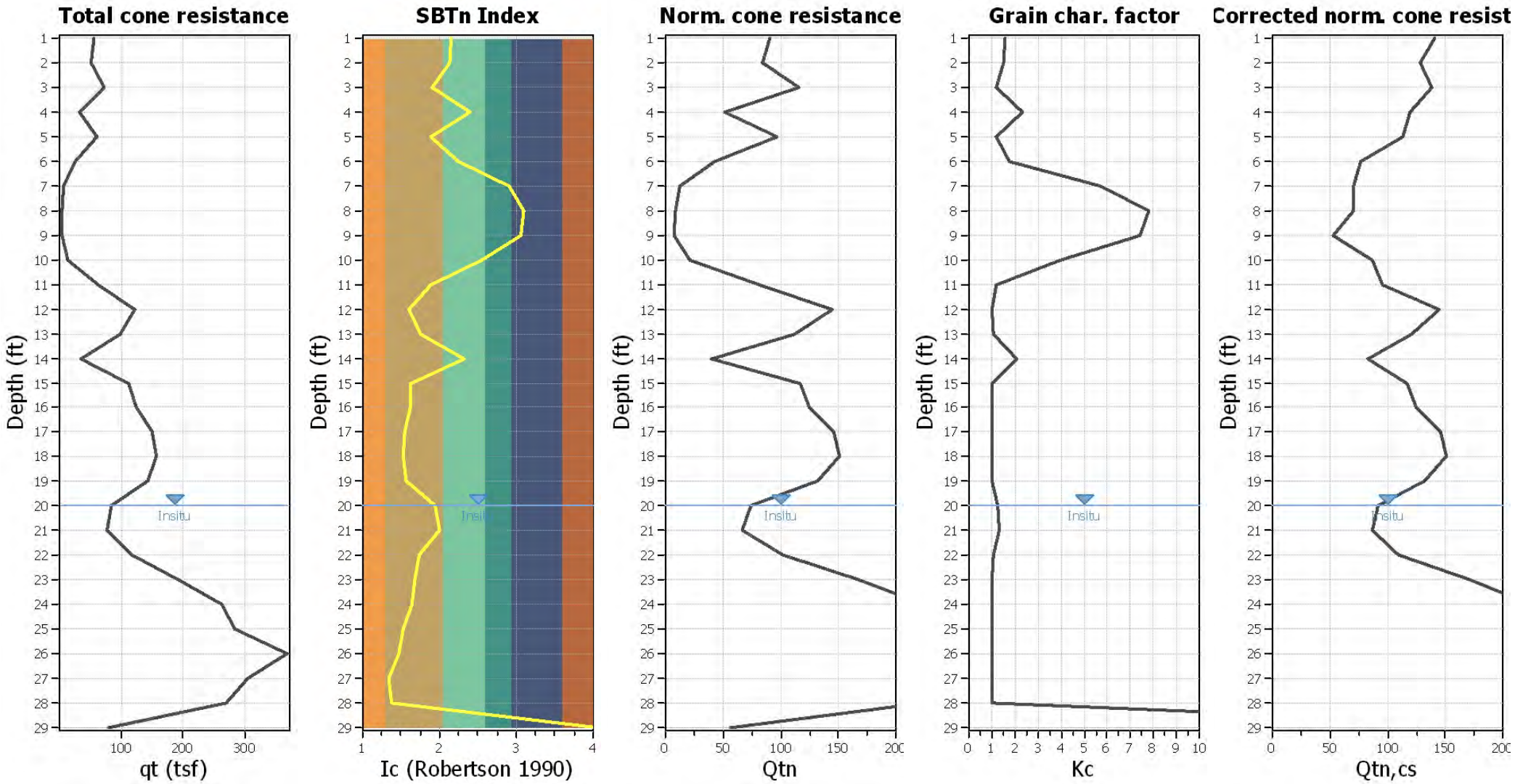
Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	All soils
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

SBTn legend

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

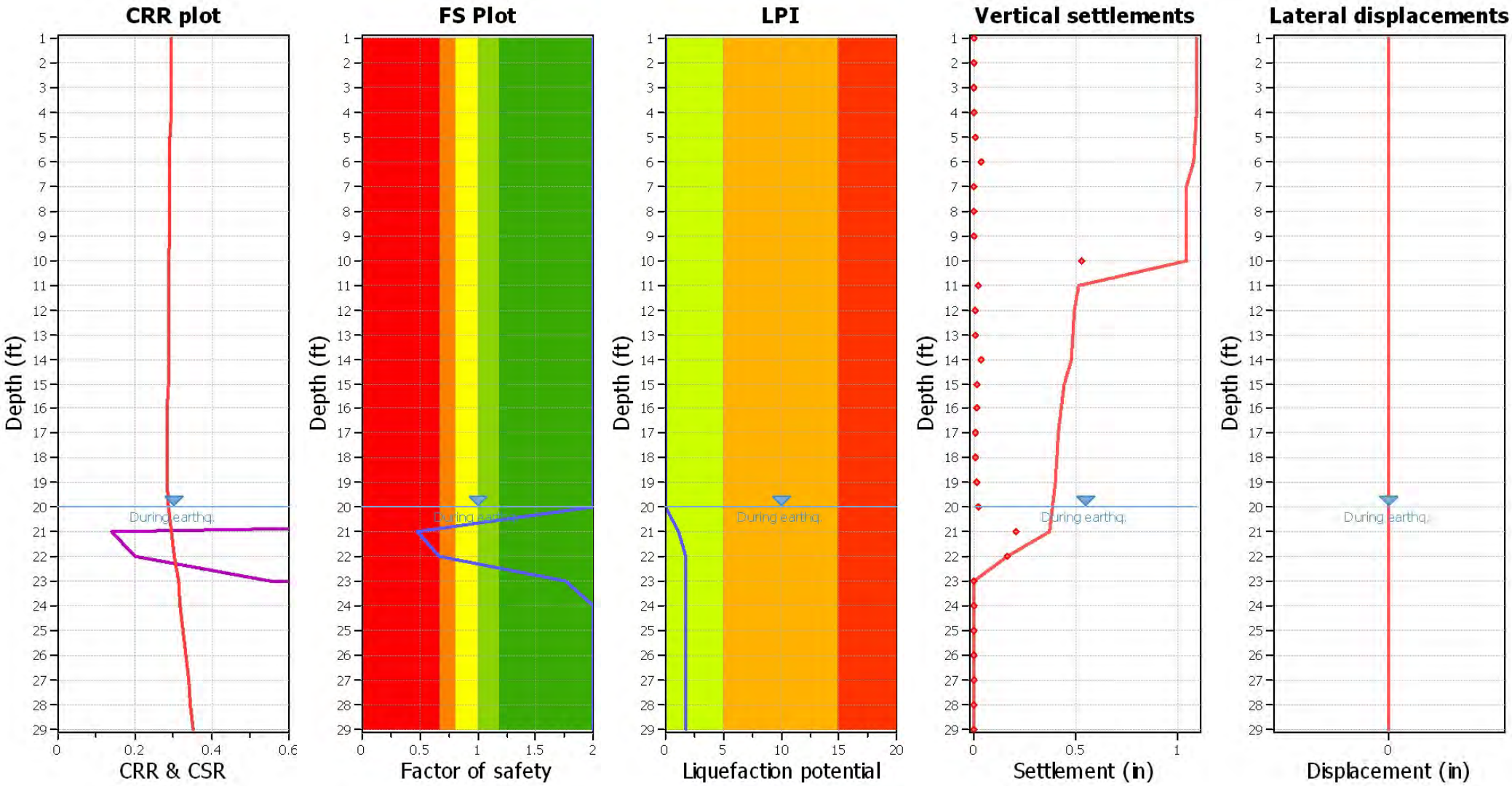
Liquefaction analysis overall plots (intermediate resi



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	All soils
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

Liquefaction analysis overall plot



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	All soils
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

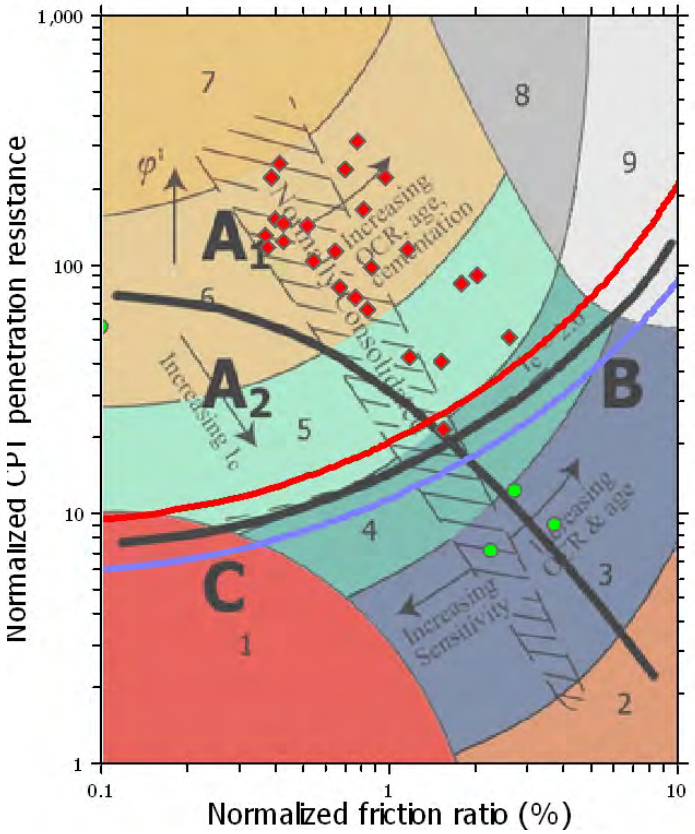
F.S. color scheme

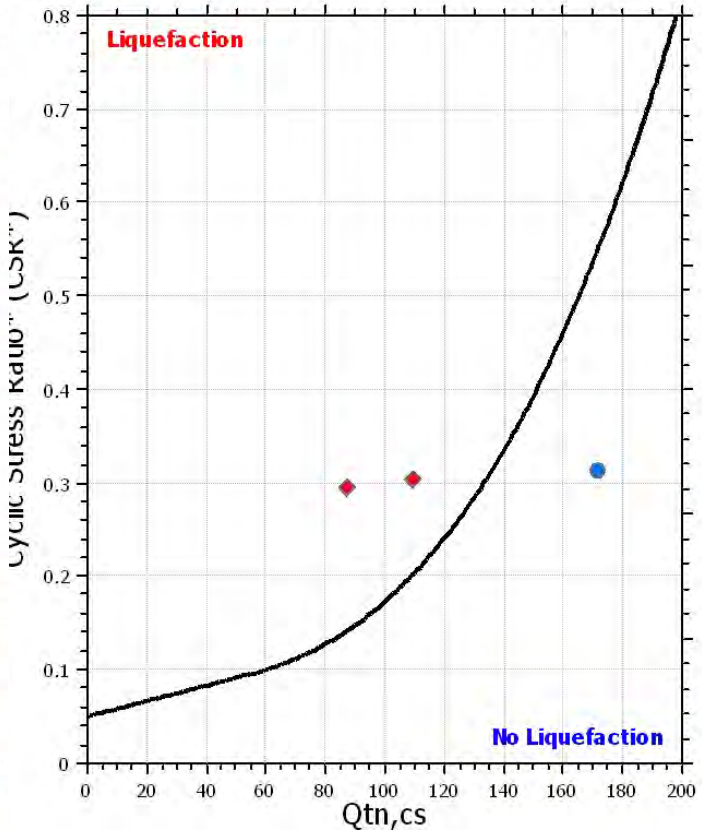
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

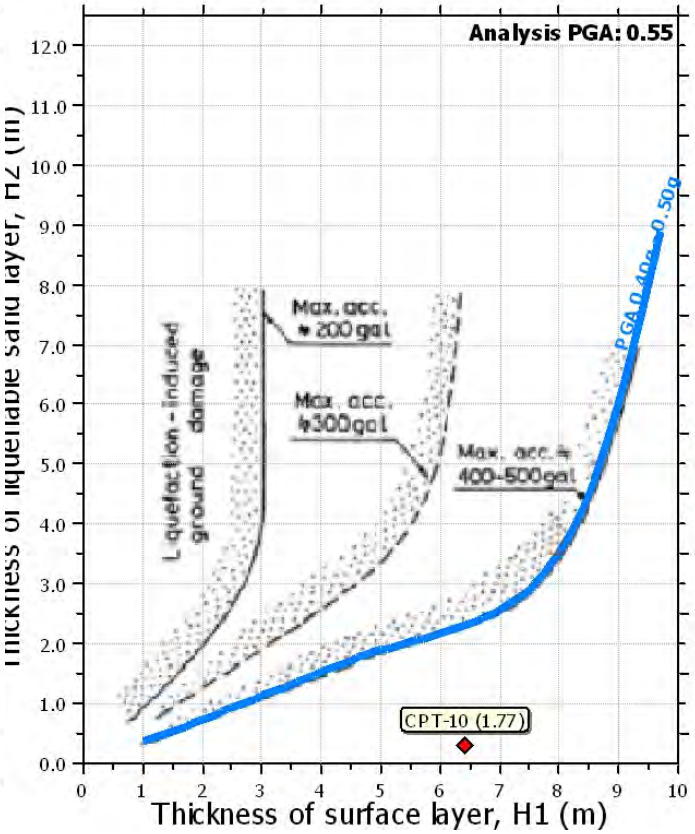
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plo



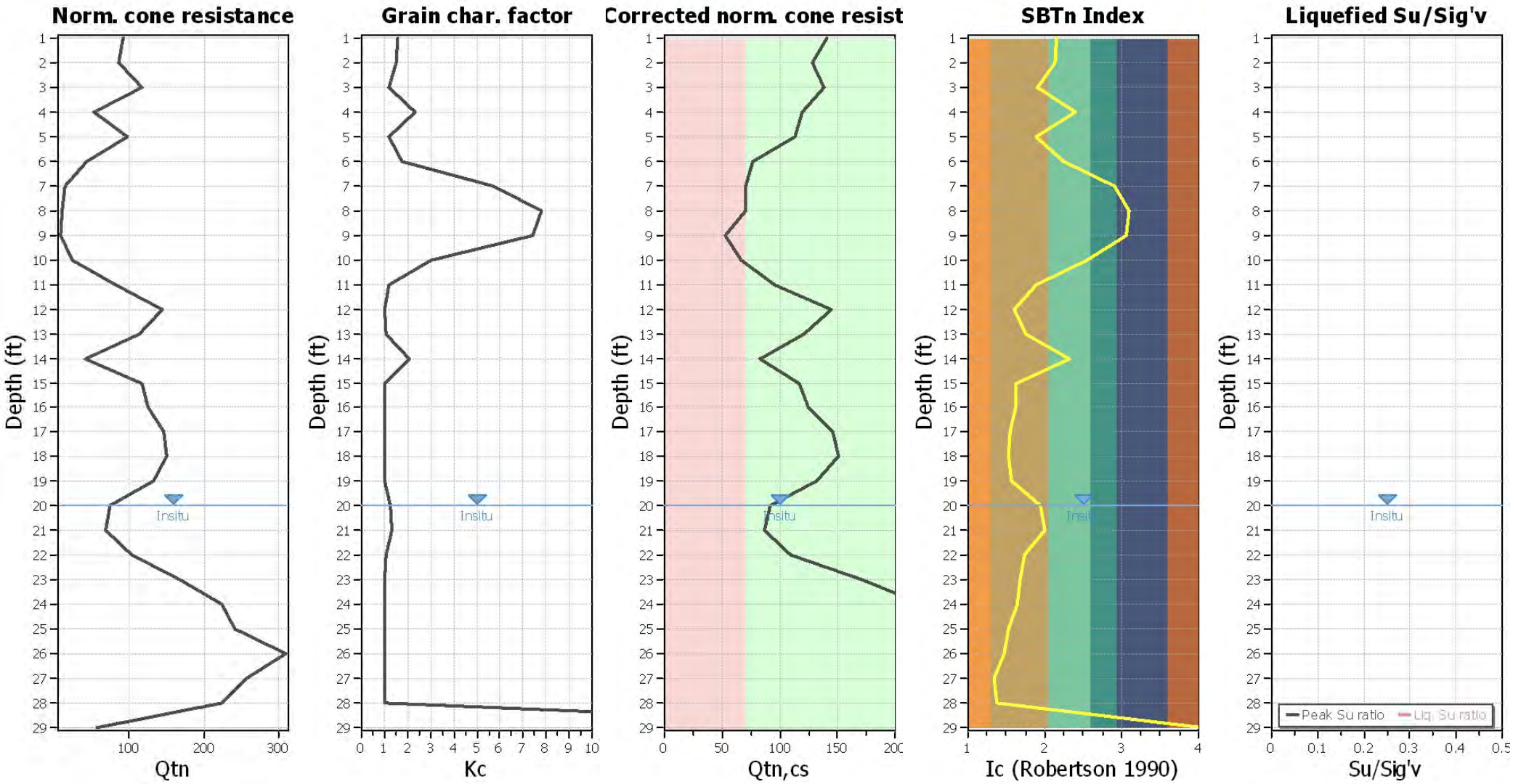




Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	All soils
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

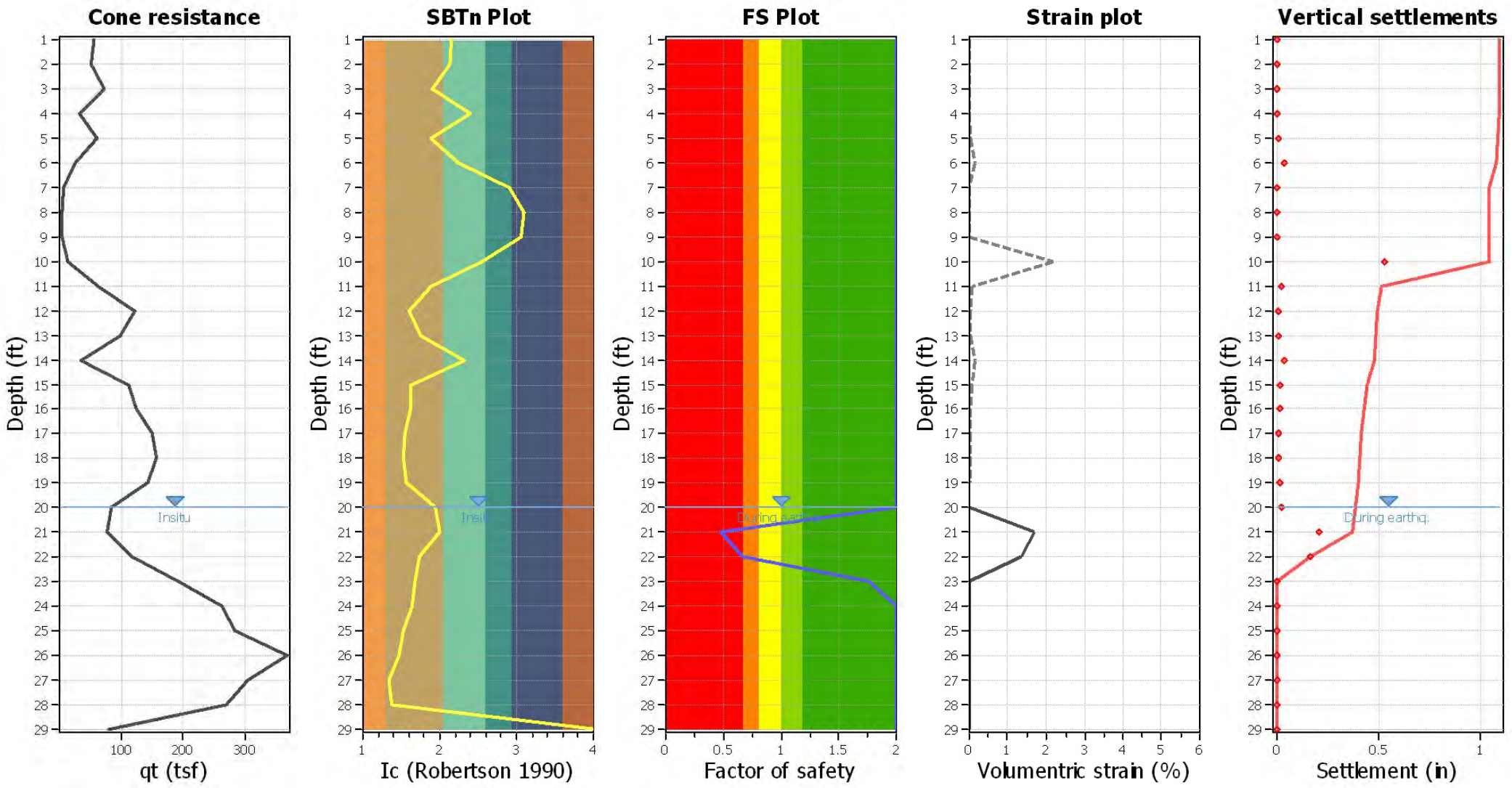
Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	All soils
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

Estimation of post-earthquake settlements



Abbreviations

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

:: Post-earthquake settlement of dry sands ::

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
1.00	2.15	91.18	1.55	141.08	31	775	0.29	0.003	0.00	8.63	0.00	0.000
2.00	2.13	84.55	1.52	128.22	28	705	0.29	0.008	0.01	8.63	0.00	0.001
3.00	1.91	115.98	1.19	138.43	28	725	0.29	0.013	0.01	8.63	0.01	0.002
4.00	2.40	51.46	2.33	119.78	30	605	0.29	0.027	0.02	8.63	0.01	0.003
5.00	1.88	96.84	1.17	113.44	23	587	0.29	0.040	0.03	8.63	0.03	0.006
6.00	2.25	42.55	1.79	76.17	18	410	0.29	0.182	0.21	8.63	0.15	0.036
7.00	2.90	12.26	5.73	70.19	0	0	0.29	0.000	0.00	0.00	0.00	0.000
8.00	3.09	8.99	7.81	70.20	0	0	0.29	0.000	0.00	0.00	0.00	0.000
9.00	3.06	7.06	7.42	52.43	0	0	0.29	0.000	0.00	0.00	0.00	0.000
10.00	2.55	21.90	3.05	66.79	18	311	0.29	2.923	3.39	8.63	2.21	0.529
11.00	1.88	81.49	1.17	95.30	19	606	0.29	0.135	0.14	8.63	0.09	0.022
12.00	1.61	144.06	1.00	144.06	26	842	0.29	0.062	0.04	8.63	0.03	0.007
13.00	1.75	112.55	1.07	120.94	23	806	0.29	0.079	0.07	8.63	0.04	0.010
14.00	2.33	40.70	2.04	83.21	20	589	0.29	0.254	0.26	8.63	0.15	0.037
15.00	1.61	117.07	1.00	117.07	21	768	0.29	0.116	0.11	8.63	0.06	0.015
16.00	1.61	125.14	1.00	125.14	23	850	0.28	0.098	0.08	8.63	0.05	0.012
17.00	1.56	146.49	1.00	146.49	26	956	0.28	0.080	0.06	8.63	0.03	0.008
18.00	1.53	150.90	1.00	150.90	27	983	0.28	0.082	0.06	8.63	0.03	0.008
19.00	1.56	131.87	1.00	131.87	23	918	0.28	0.108	0.09	8.63	0.05	0.011

Total estimated settlement: 0.71

Abbreviations

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

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

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
20.00	91.40	2.00	0.00	0.67	0.00	21.00	87.02	0.48	1.70	0.65	0.20
22.00	109.20	0.66	1.38	0.63	0.17	23.00	171.64	1.77	0.00	0.62	0.00
24.00	223.75	2.00	0.00	0.60	0.00	25.00	242.09	2.00	0.00	0.58	0.00
26.00	310.43	2.00	0.00	0.57	0.00	27.00	257.24	2.00	0.00	0.55	0.00
28.00	223.56	2.00	0.00	0.53	0.00	29.00	1496.40	2.00	0.00	0.52	0.00

Total estimated settlement: 0.37

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

Willdan Geotechnical
1515 S. Sunkist St., Suite E
Anaheim, CA 92806

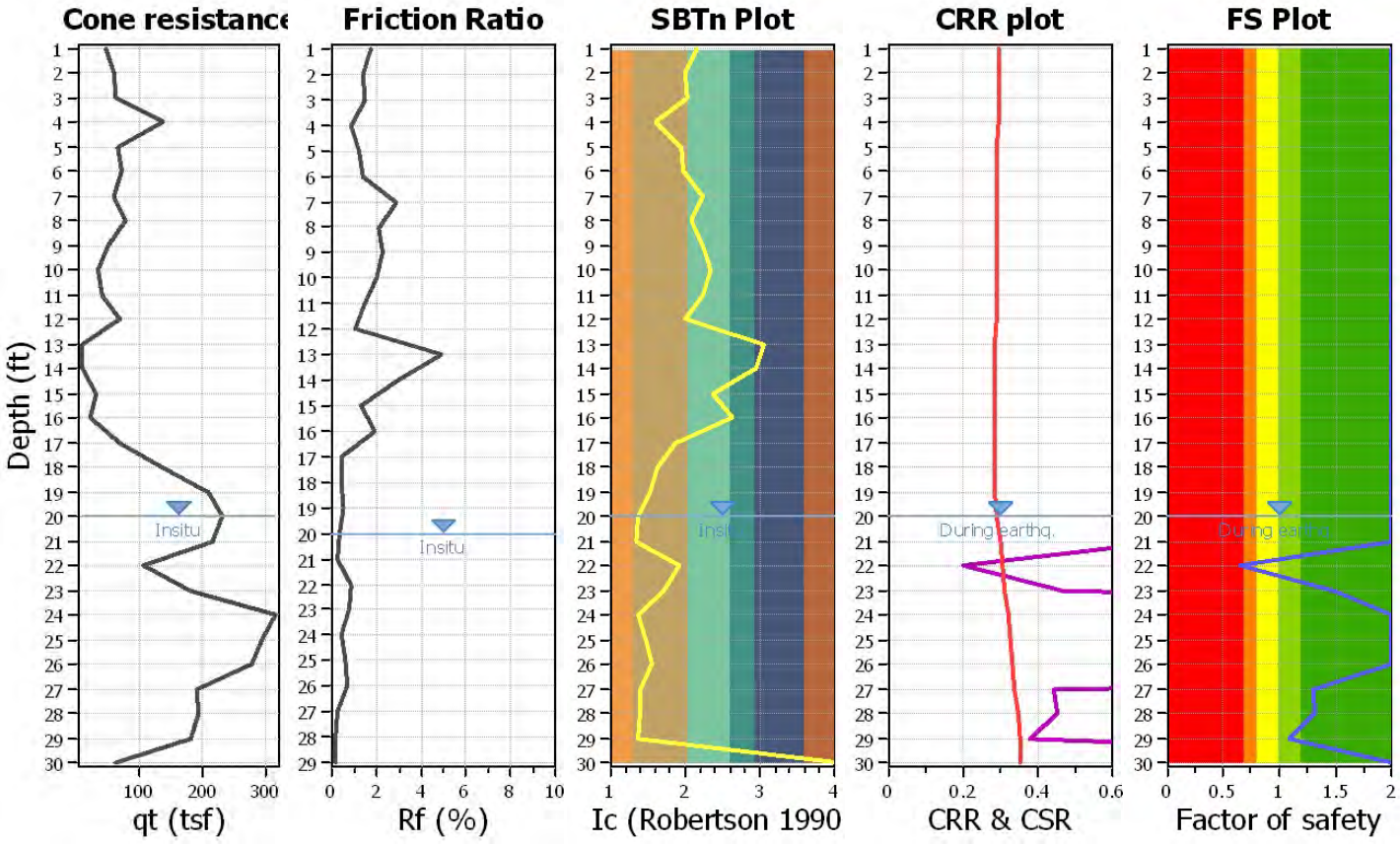
LIQUEFACTION ANALYSIS REPORT

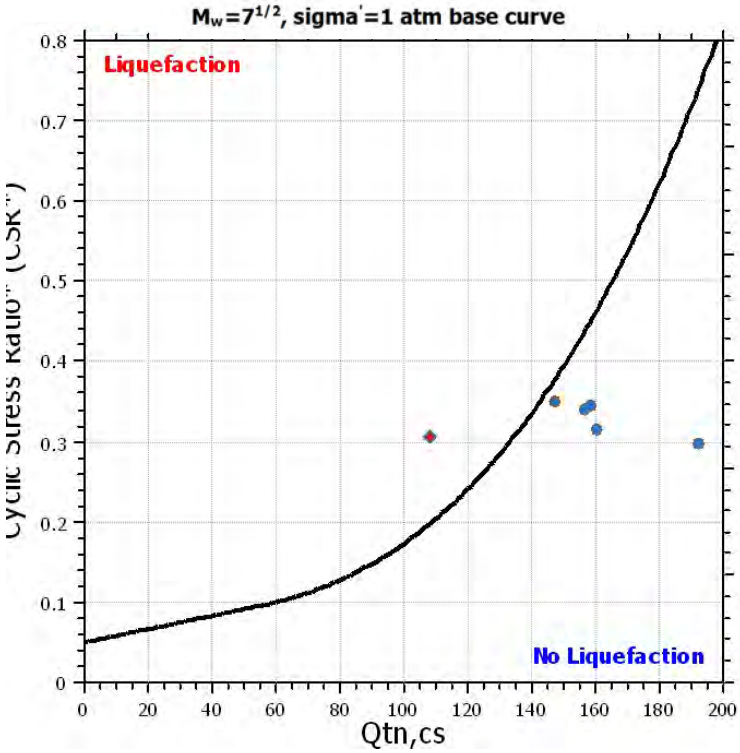
Project title : Ganahl SJC **Location :**

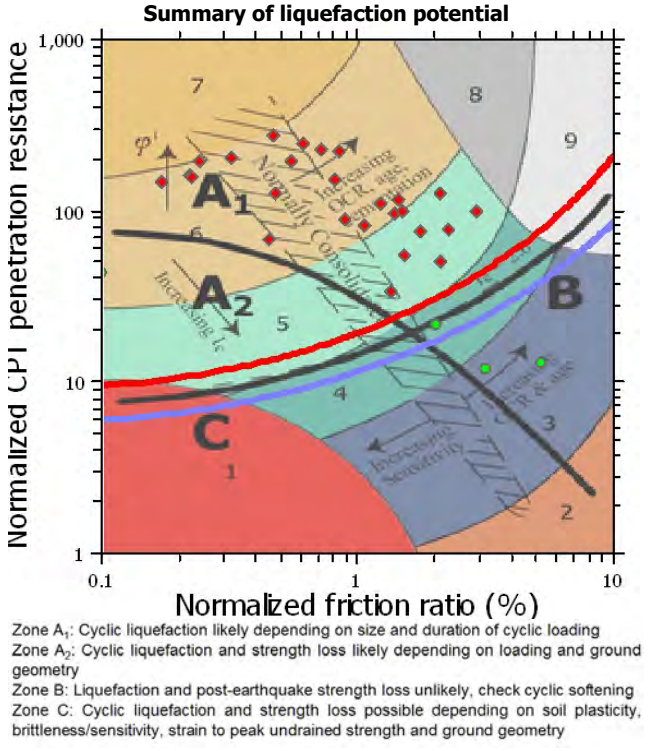
CPT file : CPT-11

Input parameters and analysis data

Analysis method:	Robertson (2009)	G.W.T. (in-situ):	20.00 ft	Use fill:	No	Clay like behavior applied:	All soils
Fines correction method:	Robertson (2009)	G.W.T. (earthq.):	20.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth:	50.00 ft
Earthquake magnitude M_w:	6.70	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.55	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

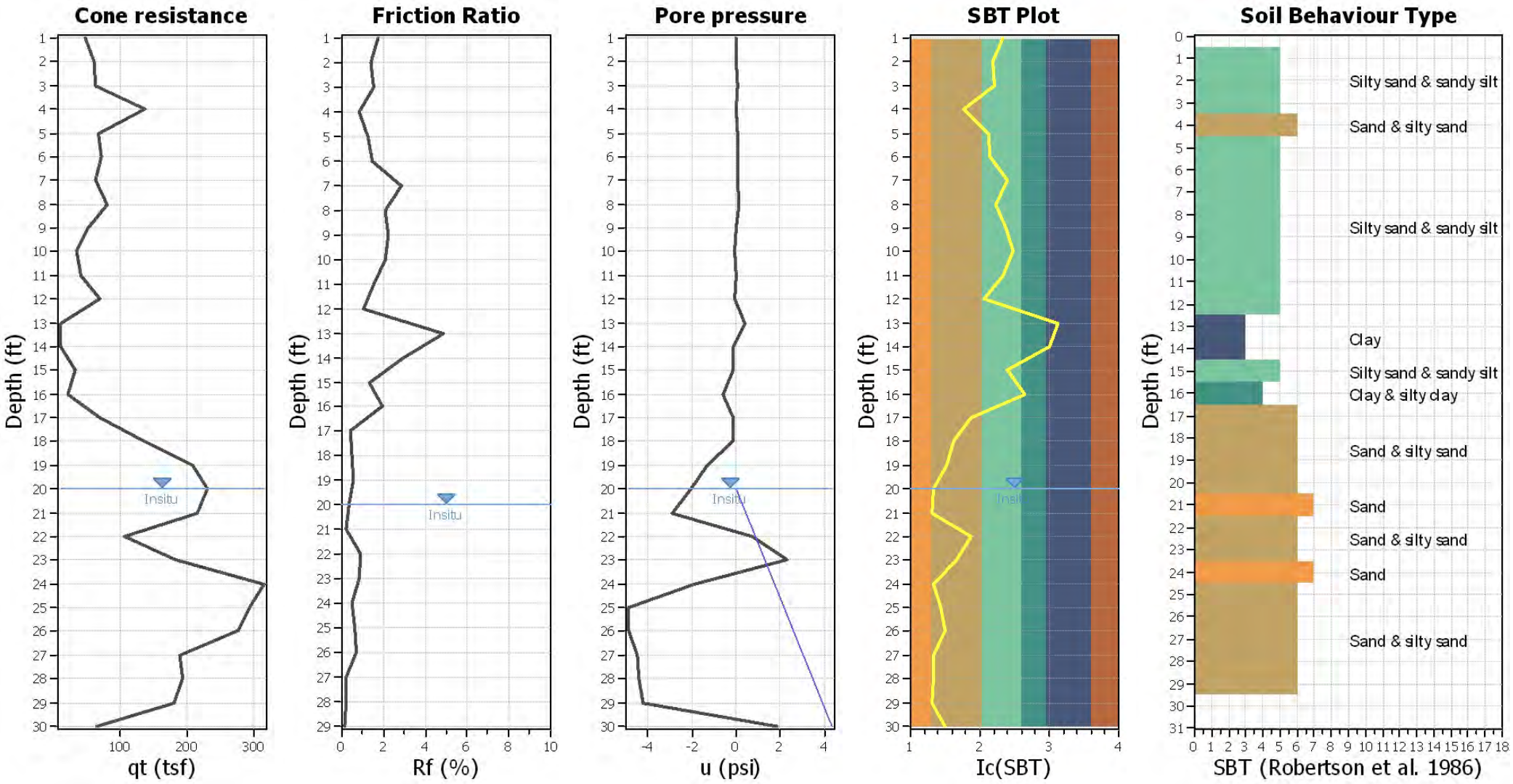






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plc



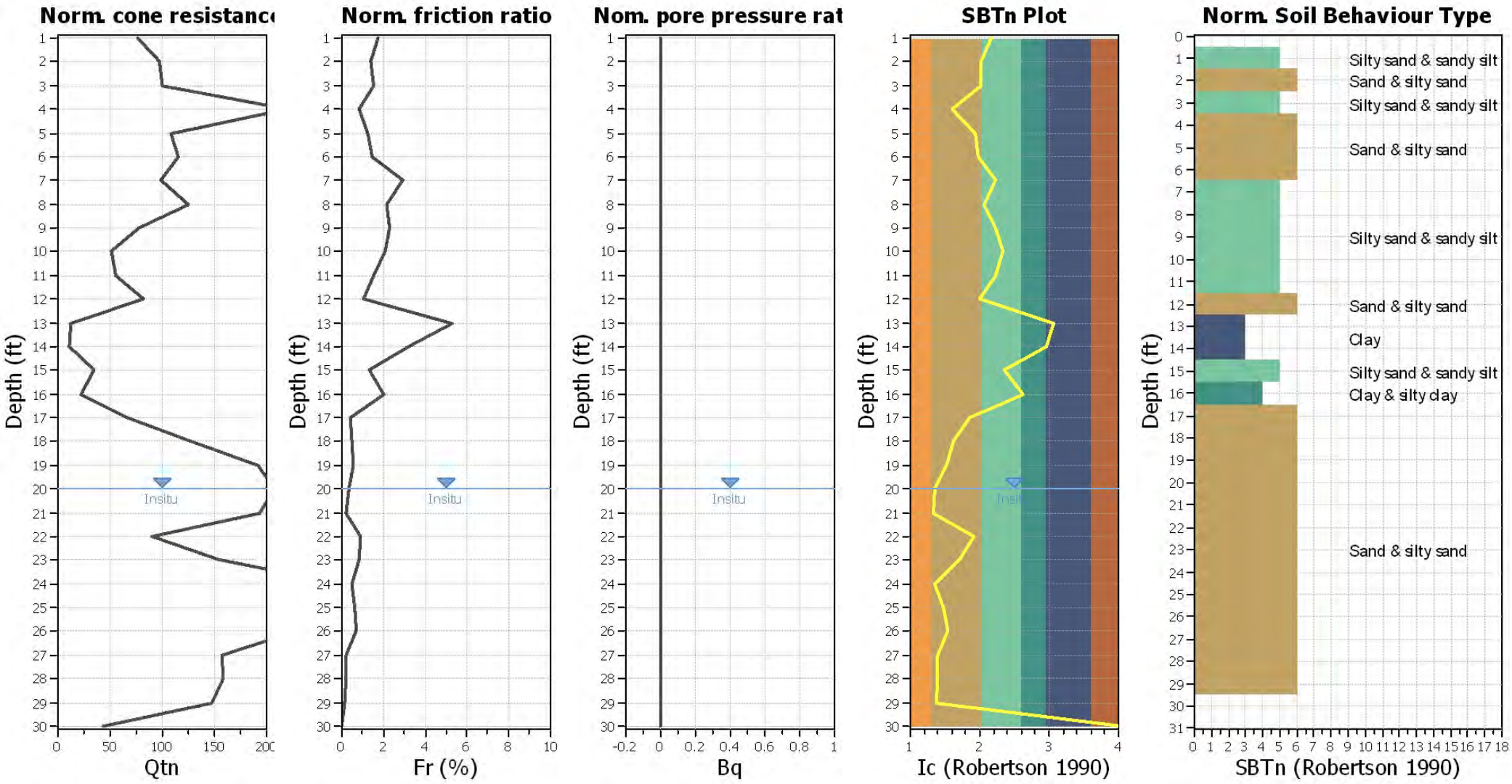
Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	All soils
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

SBT legend

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

CPT basic interpretation plots (normaliz



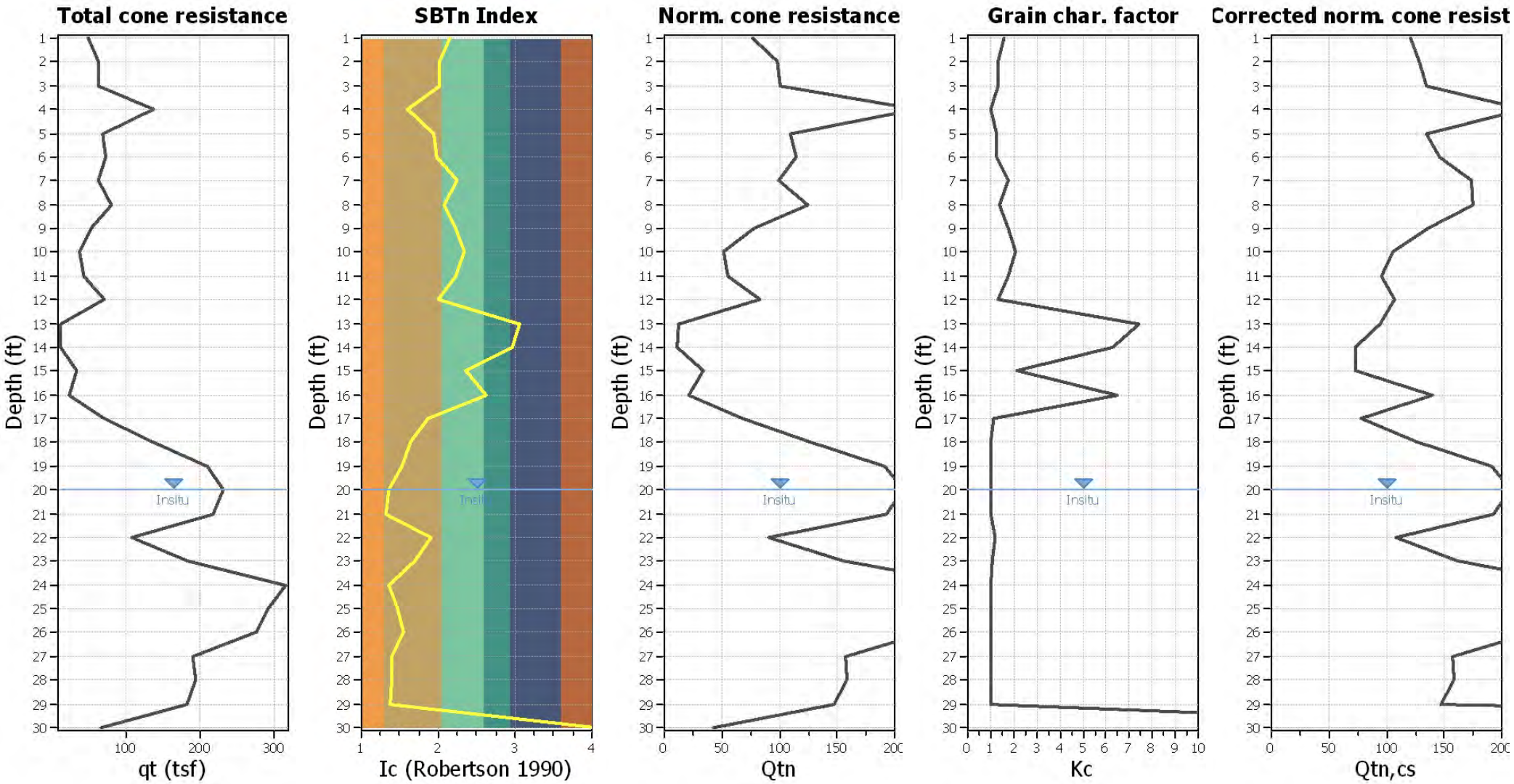
Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	All soils
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

SBTn legend

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

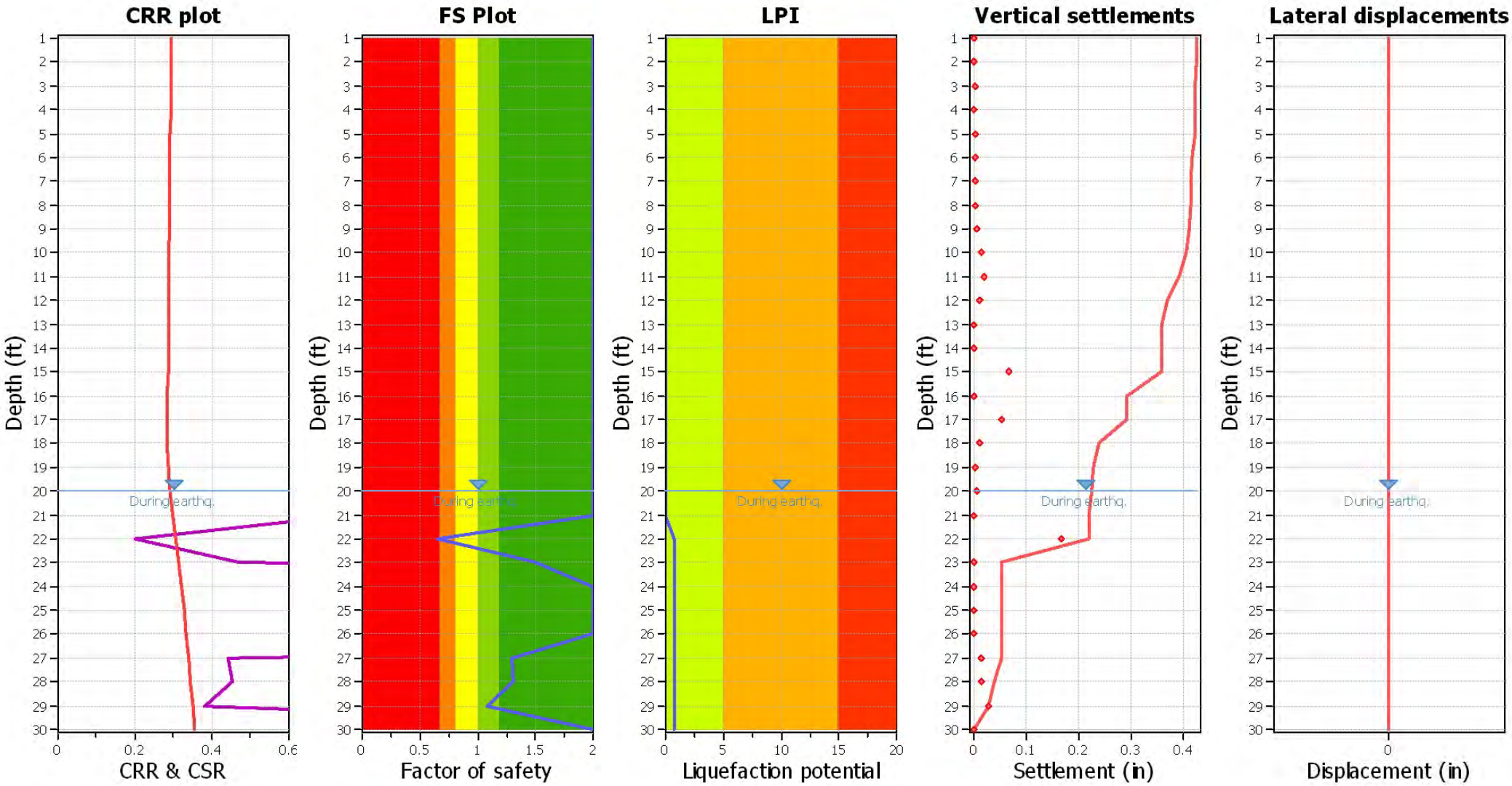
Liquefaction analysis overall plots (intermediate resi



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	All soils
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

Liquefaction analysis overall plot



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	All soils
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

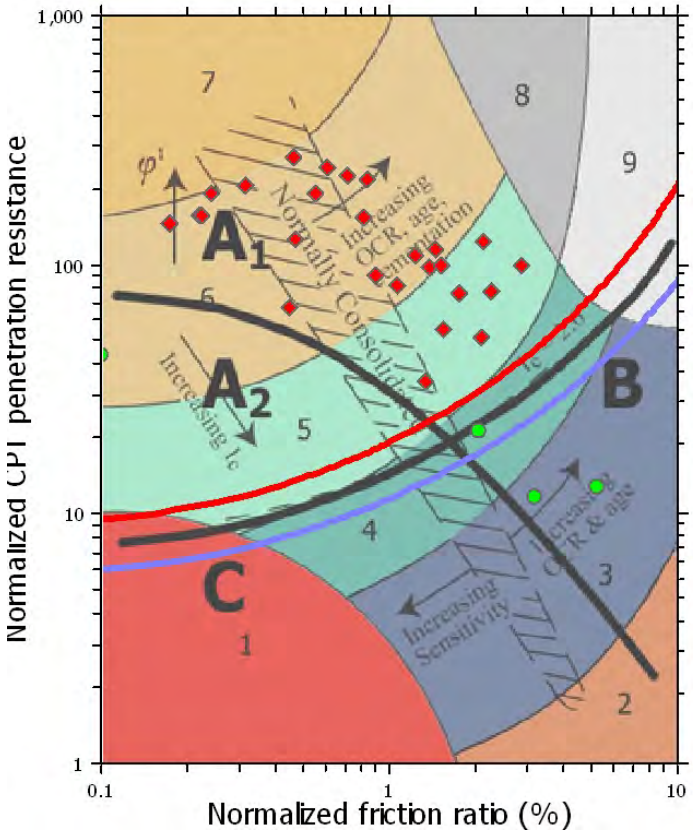
F.S. color scheme

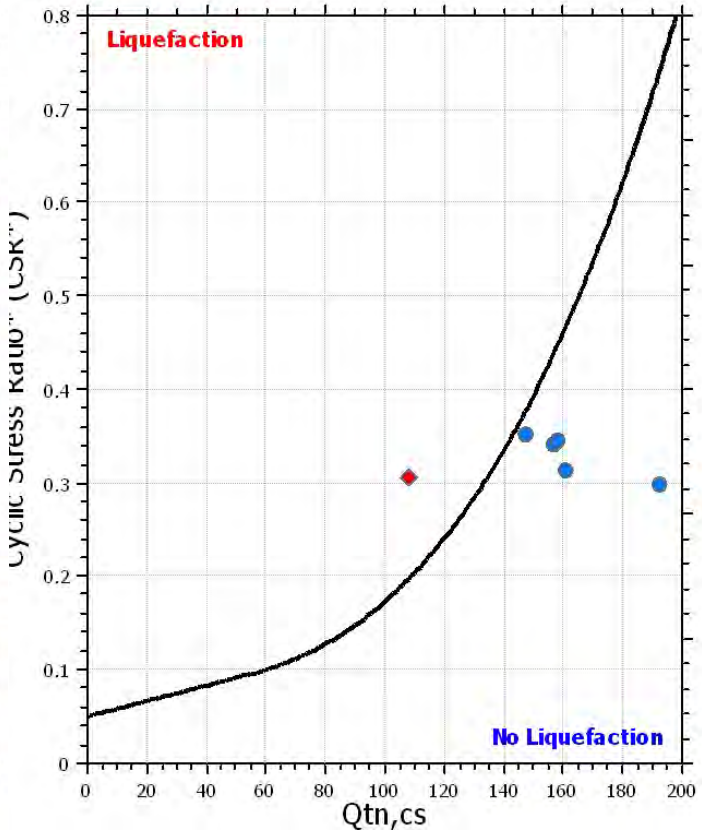
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

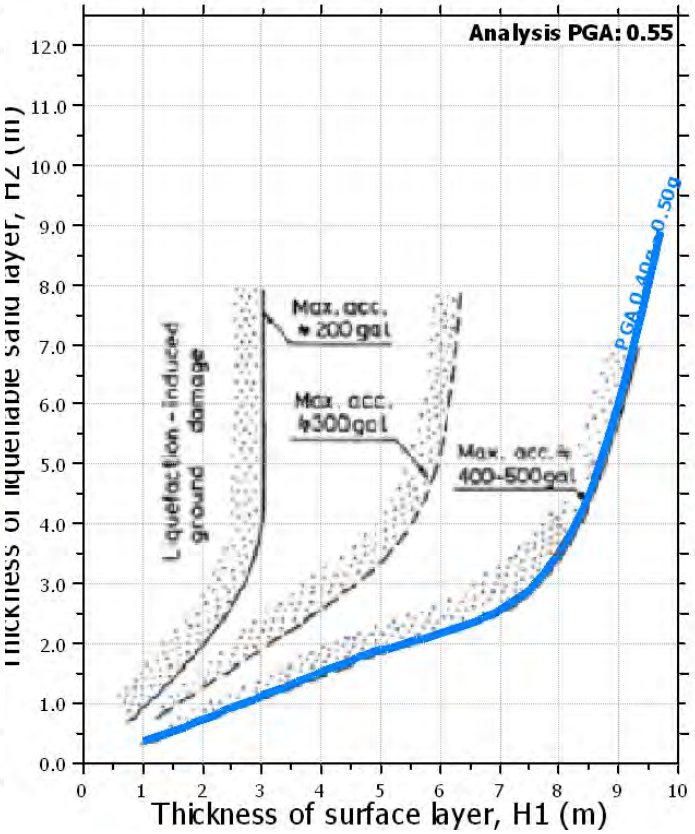
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plo



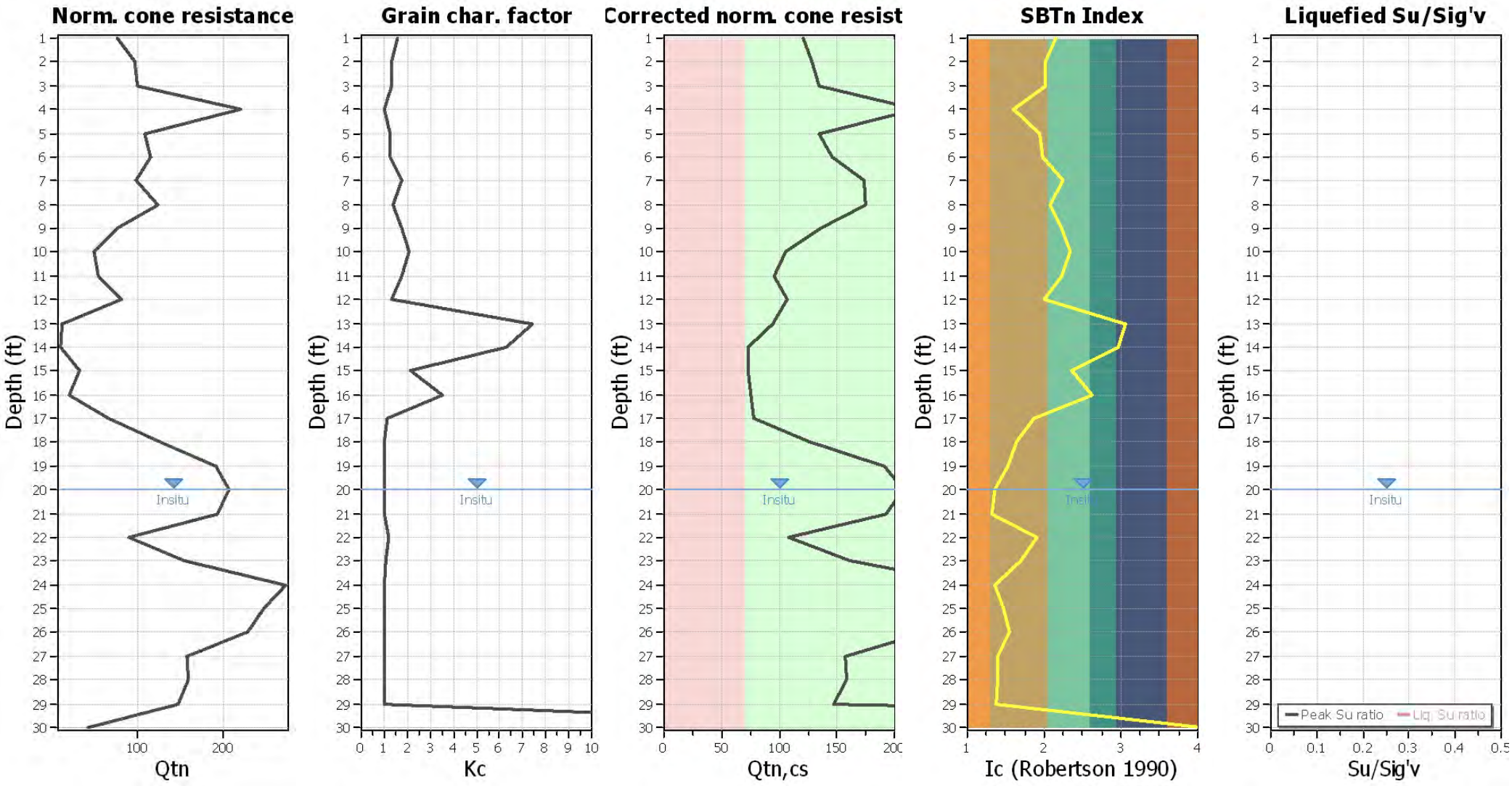




Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	All soils
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

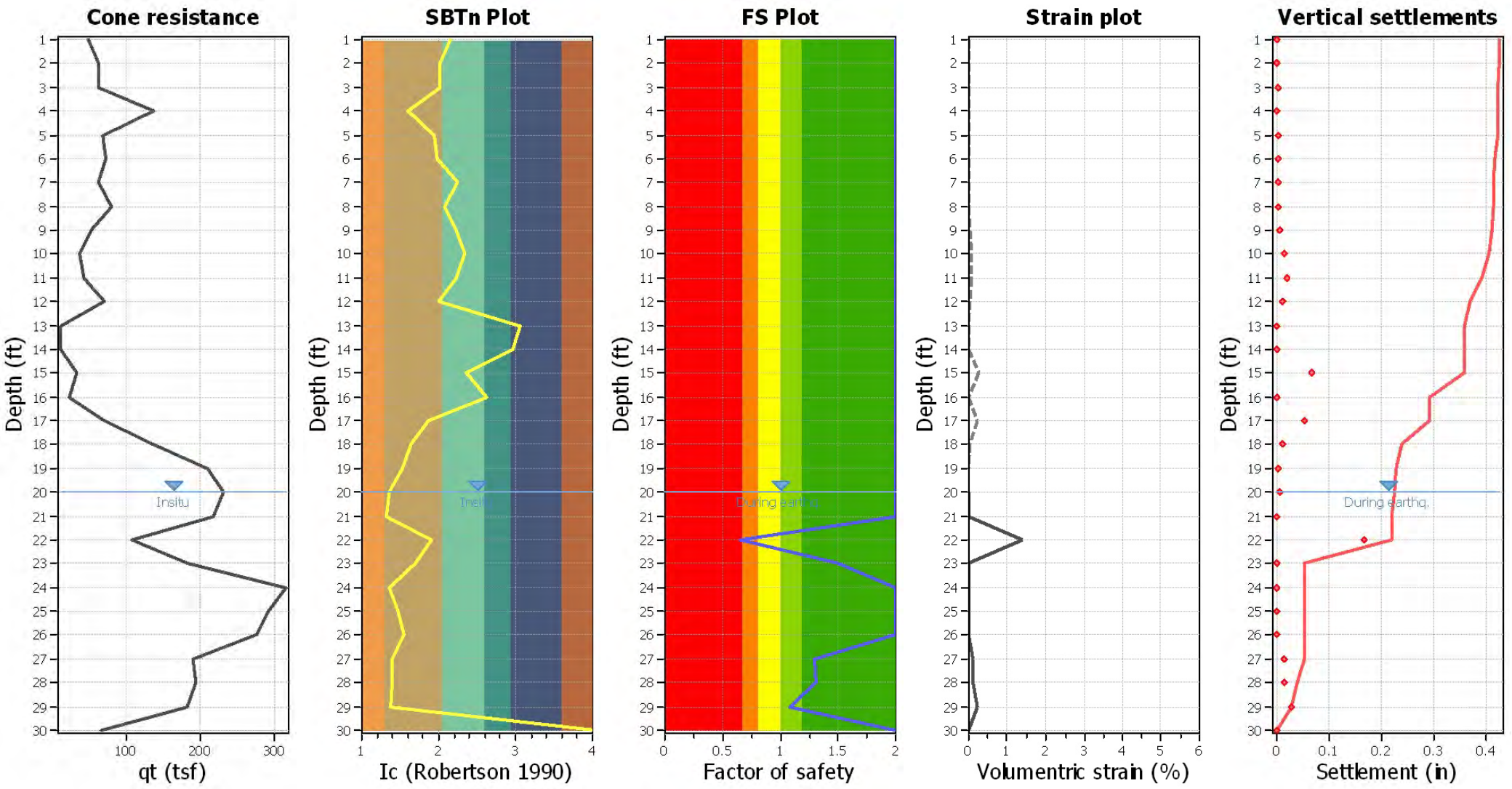
Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	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:	All soils
Peak ground acceleration:	0.55	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	50.00 ft

Estimation of post-earthquake settlements



Abbreviations

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

:: Post-earthquake settlement of dry sands ::

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
1.00	2.16	76.57	1.57	120.51	27	661	0.29	0.004	0.00	8.63	0.00	0.001
2.00	2.01	97.62	1.31	128.30	27	698	0.29	0.008	0.01	8.63	0.00	0.001
3.00	2.03	100.21	1.34	134.12	28	732	0.29	0.013	0.01	8.63	0.01	0.001
4.00	1.61	219.40	1.00	219.40	40	942	0.29	0.012	0.01	8.63	0.00	0.001
5.00	1.94	108.92	1.23	134.28	27	715	0.29	0.026	0.02	8.63	0.01	0.003
6.00	1.97	115.02	1.27	145.77	30	785	0.29	0.028	0.02	8.63	0.01	0.003
7.00	2.24	98.82	1.76	174.11	40	940	0.29	0.025	0.01	8.63	0.01	0.002
8.00	2.07	124.69	1.40	174.66	37	973	0.29	0.028	0.01	8.63	0.01	0.002
9.00	2.23	77.57	1.75	135.55	31	770	0.29	0.055	0.03	8.63	0.02	0.005
10.00	2.34	50.95	2.08	106.22	25	610	0.29	0.129	0.10	8.63	0.06	0.015
11.00	2.23	54.87	1.74	95.48	22	624	0.29	0.143	0.13	8.63	0.08	0.020
12.00	1.99	82.50	1.29	106.58	22	766	0.29	0.089	0.08	8.63	0.05	0.012
13.00	3.06	12.72	7.44	94.61	0	0	0.29	0.000	0.00	10.85	0.00	0.000
14.00	2.96	11.70	6.27	73.38	0	0	0.29	0.000	0.00	10.85	0.00	0.000
15.00	2.36	34.22	2.15	73.44	18	561	0.29	0.412	0.48	8.63	0.28	0.067
16.00	2.63	21.56	3.50	75.49	0	0	0.28	0.000	0.00	10.85	0.00	0.000
17.00	1.86	67.32	1.15	77.64	15	652	0.28	0.286	0.39	8.63	0.22	0.053
18.00	1.63	126.33	1.00	126.33	23	953	0.28	0.094	0.08	8.63	0.04	0.010
19.00	1.53	191.65	1.00	191.65	34	1299	0.29	0.051	0.03	8.63	0.01	0.004

Total estimated settlement: 0.20

Abbreviations

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

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

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
20.00	206.93	2.00	0.00	0.67	0.00	21.00	192.58	2.00	0.00	0.65	0.00
22.00	108.36	0.65	1.39	0.63	0.17	23.00	160.82	1.49	0.00	0.62	0.00
24.00	271.66	2.00	0.00	0.60	0.00	25.00	246.77	2.00	0.00	0.58	0.00
26.00	228.84	2.00	0.00	0.57	0.00	27.00	157.13	1.30	0.12	0.55	0.01
28.00	158.64	1.31	0.11	0.53	0.01	29.00	147.65	1.08	0.22	0.52	0.03
30.00	1149.07	2.00	0.00	0.50	0.00						

Total estimated settlement: 0.22

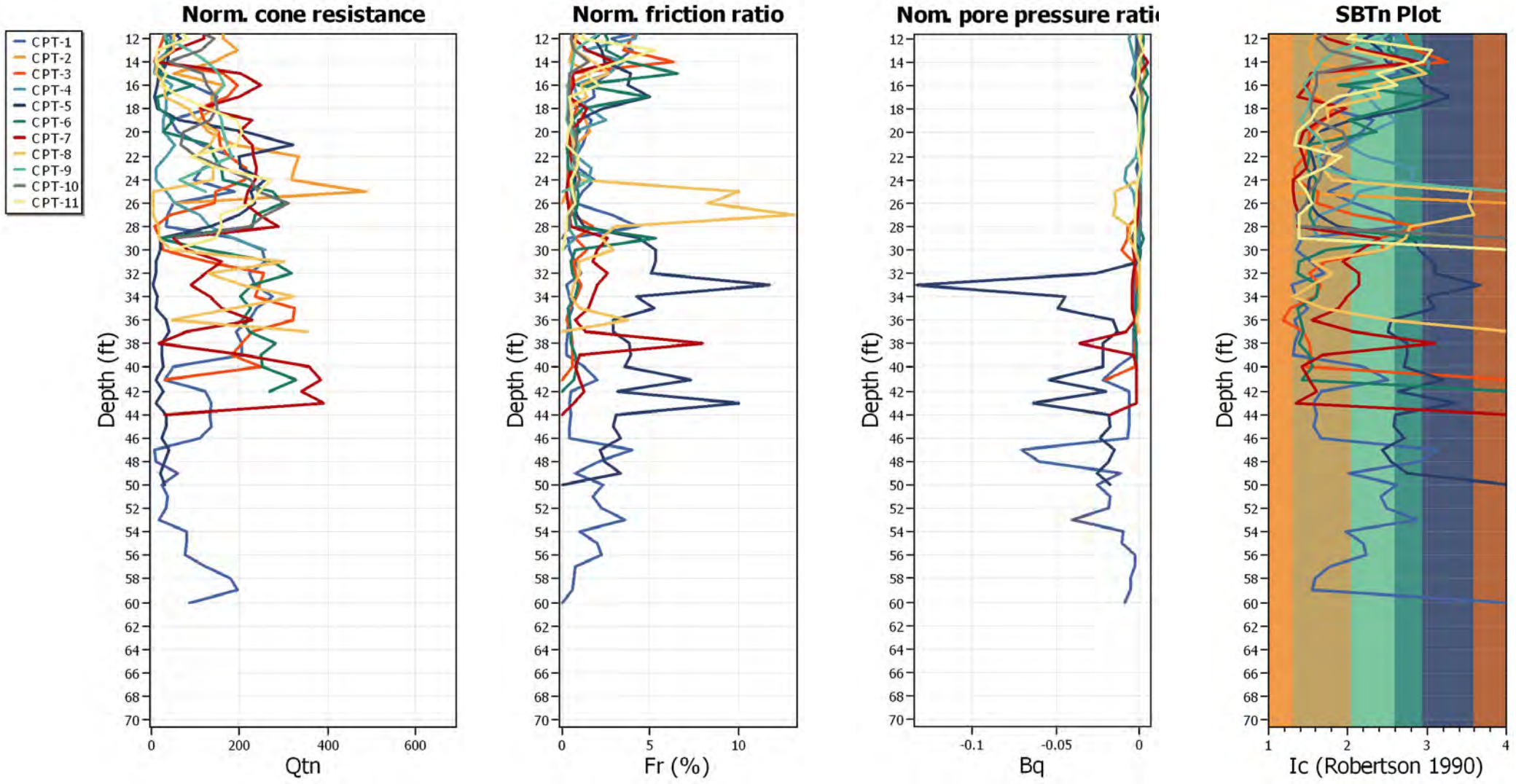
Abbreviations

$Q_{tn,cs}$: 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

Willdan Geotechnical
1515 S. Sunkist St., Suite E
Anaheim, CA 92806

Project: Ganahl SJC

Overlay Normalized Plots



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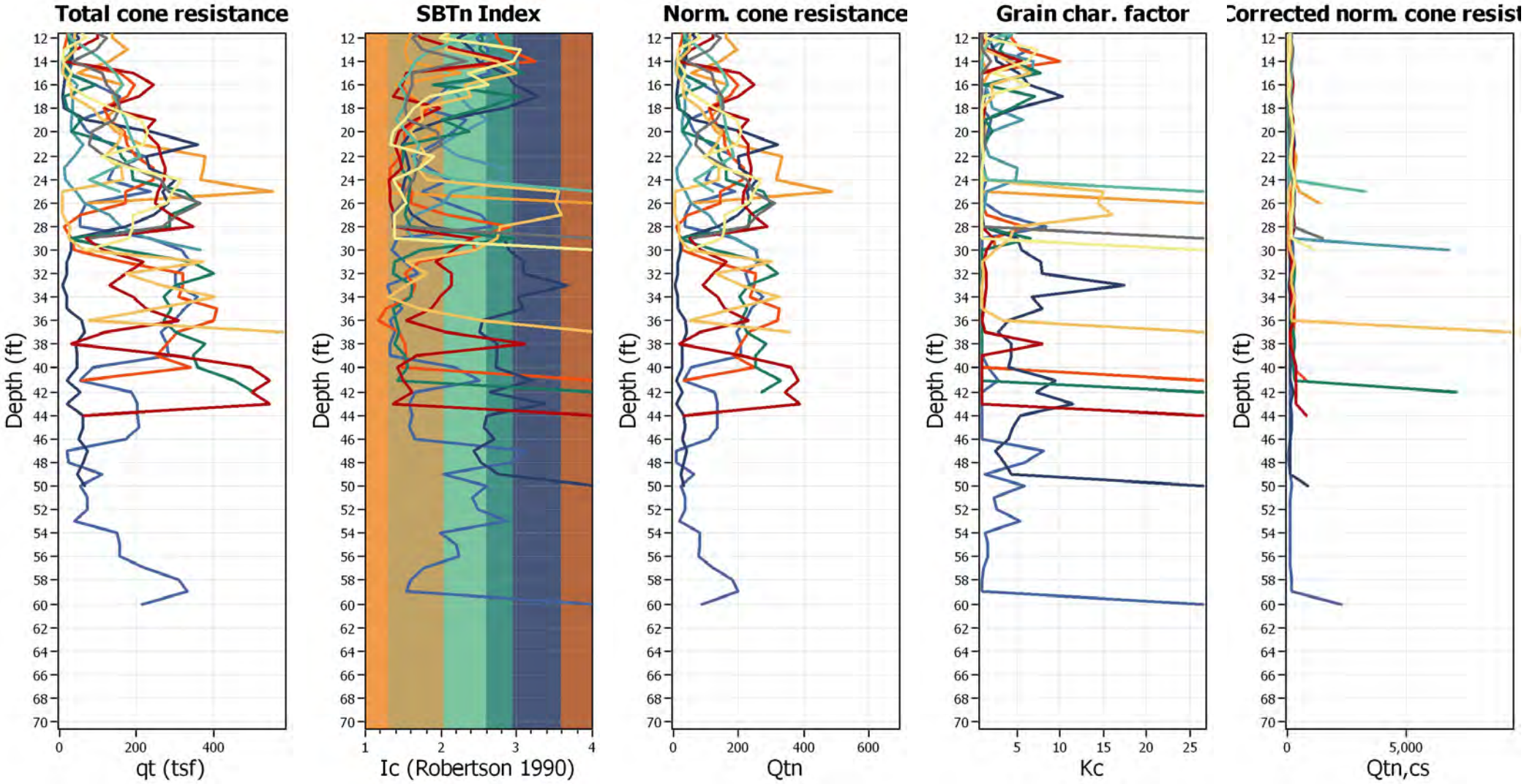
1515 S. Sunkist St., Suite E
Anaheim, CA 92806

Project: Ganahl SJC

Overlay Intermediate Results



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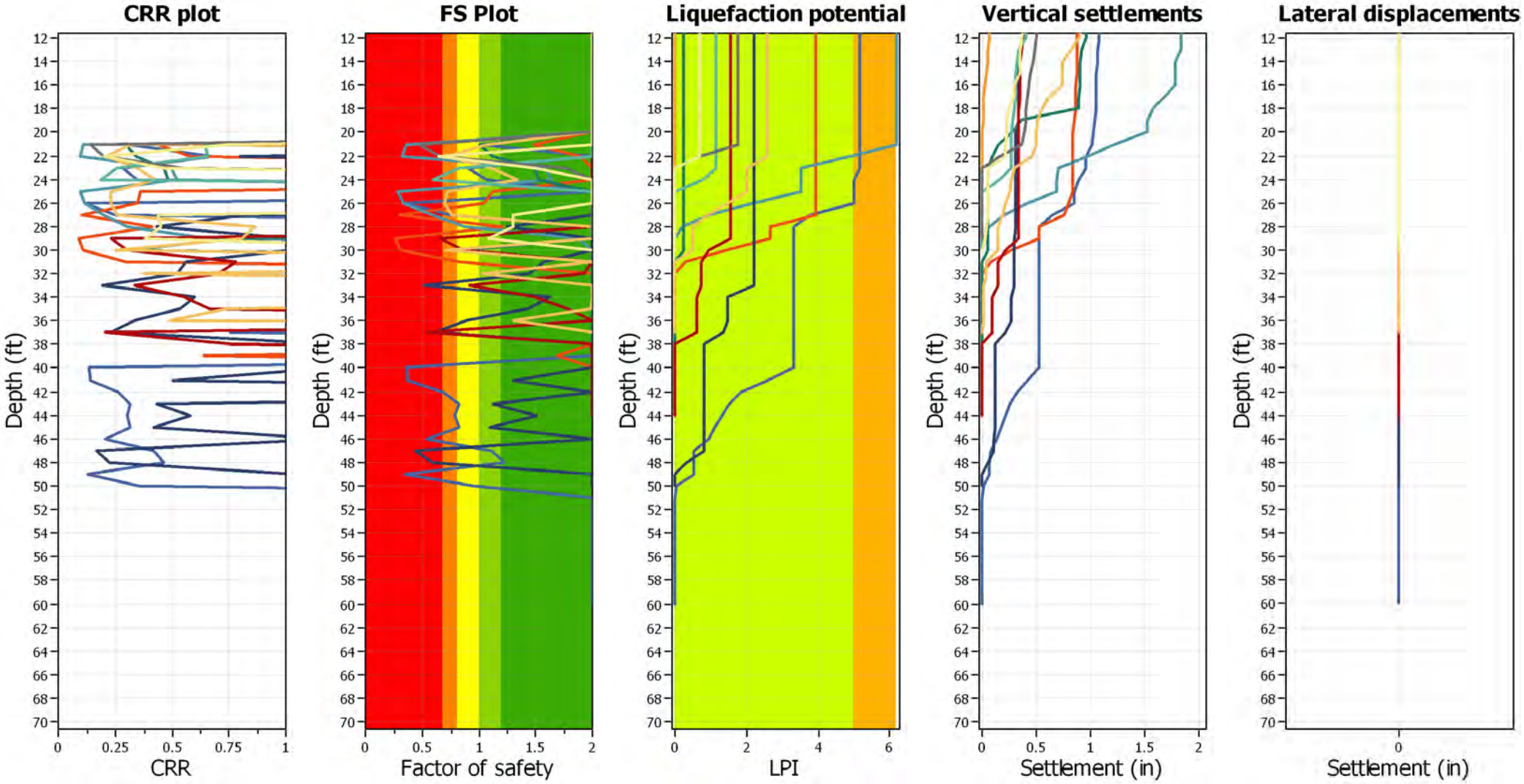
1515 S. Sunkist St., Suite E
Anaheim, CA 92806

Project: Ganahl SJC

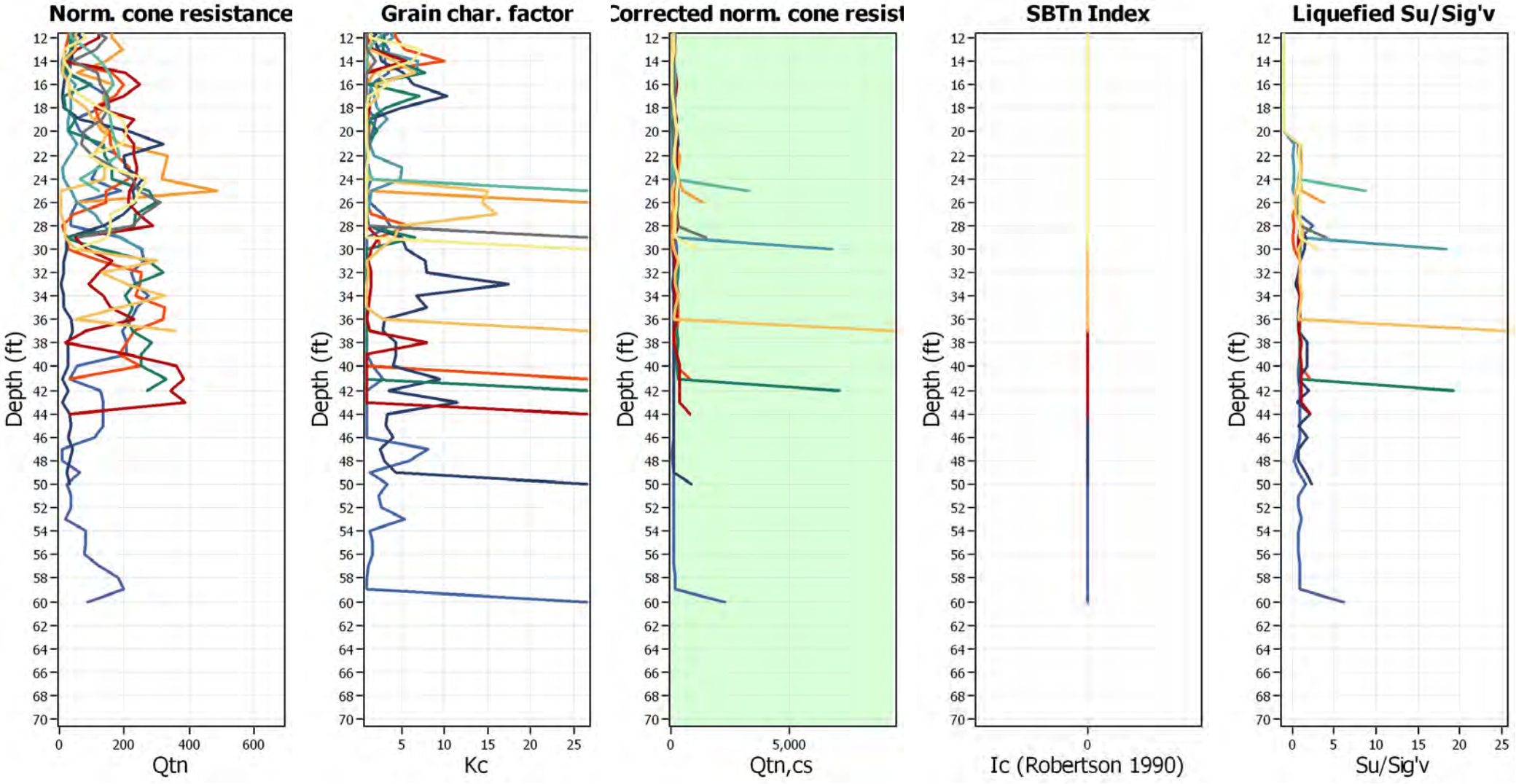
Overlay Cyclic Liquefaction Plots



Willdan Geotechnical
1515 S. Sunkist St., Suite E
Anaheim, CA 92806

Project: Ganahl SJC

Overlay Strength Loss Plots



18

Ganahl Lumber Co.

Stonehill Drive

San Juan Capistrano, CA

PALEONTOLOGICAL RESOURCES ASSESSMENT

Entitlement Submittal

Issued June 04, 2018

City of San Juan Capistrano

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

tel 213.763.DINO
www.nhm.org

NATURAL HISTORY MUSEUM
LOS ANGELES COUNTY

Vertebrate Paleontology Section
Telephone: (213) 763-3325

e-mail: smcleod@nhm.org

11 October 2017

ECORP Consulting, Inc.
1801 Park Court Place, B-103
Santa Ana, CA 92701

Attn: Roger D. Mason, Ph.D., Director Emeritus of Cultural Resources

re: Paleontological resources for the proposed Ganahl Lumber Project, ECORP Project # 2017-208, in the City of San Juan Capistrano, Orange County, project area

Dear Roger:

I have conducted a thorough search of our paleontology collection records for the locality and specimen data for the proposed Ganahl Lumber Project, ECORP Project # 2017-208, in the City of San Juan Capistrano, Orange County, project area as outlined on the portion of the Dana Point USGS topographic quadrangle map that you sent to me via e-mail on 27 September 2017. We do not have any vertebrate fossil localities that lie within the proposed project area boundaries, but we do have localities nearby from sedimentary deposits similar to those that probably occur at depth in the proposed project area.

Surface deposits throughout the proposed project area consist of younger Quaternary Alluvium, derived as fluvial deposits from the San Juan Creek that currently flows adjacent to the proposed project area. These deposits typically do not contain significant vertebrate fossils, at least in the uppermost layers, but they are usually underlain by older sedimentary deposits that may well contain significant vertebrate fossil remains. From somewhat similar older Quaternary deposits we have one general Doheny State Beach locality just to the south, LACM 2028, that produced a fossil specimen of bison, *Bison*. Our next closest vertebrate fossil locality from similar deposits is LACM 1115, situated west-northwest of the proposed project area in Salt Creek, that produced fossil specimens of imperial mammoth, *Mammuthus imperator*.

Shallow excavations in the younger Quaternary Alluvium exposed throughout the proposed project area probably will not uncover any significant vertebrate fossils. Deeper excavations that extend down into the older Quaternary deposits, however, may well encounter significant fossil vertebrate remains. Any substantial excavations below the very uppermost layers in the proposed project area, therefore, should be monitored closely to quickly and professionally recover any fossil remains discovered while not impeding development. Also, sediment samples should be collected and processed to determine the small fossil potential in the proposed project area. Any fossils recovered during mitigation should be deposited in an accredited and permanent scientific institution for the benefit of current and future generations.

This records search covers only the vertebrate paleontology records of the Natural History Museum of Los Angeles County. It is not intended to be a thorough paleontological survey of the proposed project area covering other institutional records, a literature survey, or any potential on-site survey.

Sincerely,

Samuel A. McLeod

Samuel A. McLeod, Ph.D.
Vertebrate Paleontology

enclosure: invoice