ENGINEERING GEOLOGY AND
GEOTECHNICAL ENGINEERING REPORT
FOR PROPOSED REPLACEMENT VISITORS BLEACHERS,
ADOLFO CAMARILLO HIGH SCHOOL,
4660 MISSION OAKS BOULEVARD,
CAMARILLO, CALIFORNIA

PROJECT NO.: 303275-003
APRIL 9, 2020

PREPARED FOR
OXNARD UNION HIGH SCHOOL DISTRICT

BY
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April 9, 2020

Project No.: 303275-003
Report No.: 20-4-9

Attention: Poul Hanson
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Oxnard, CA 93030

Project: Camarillo High School Visitor Bleachers
4660 Mission Oaks Boulevard
Camarillo, California

As authorized, we have performed a geotechnical study for proposed replacement bleachers to be located on the campus of Camarillo High School in the City of Camarillo, California. The accompanying Engineering Geology and Geotechnical Engineering Report presents the results of our subsurface exploration and laboratory testing programs, as well as our conclusions and recommendations pertaining to geotechnical aspects of project design. This report completes the scope of services described within our Proposal No. VEN-19-12-011, dated December 19, 2019, and authorized by Purchase Order No. A20-02444 dated January 28, 2020.

We have appreciated the opportunity to be of service to you on this project. Please call if you have any questions, or if we can be of further service.

Respectfully submitted,

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INTRODUCTION

This report presents results of an Engineering Geology and Geotechnical Engineering study performed for a proposed replacement of the visitors' bleachers along the south side of the football field complex at Adolfo Camarillo High School campus in the City of Camarillo, California. Although detailed plans are not available at this time, it is our understanding that the bleachers will have a footprint of approximately 6,500 square feet.

The Adolfo Camarillo High School campus is located at 4660 Mission Oaks Boulevard (see Vicinity Map in Appendix A). The coordinates of the site are 34.2151° north latitude and -119.0085° west longitude. The proposed building area currently includes the existing visitors bleachers, but will also encompass grass field areas on three sides of the existing structure. There are no springs or seeps on the property.

Grading for the proposed project is expected to include preparing near-surface soils for the new structure after demolishing the existing bleachers and foundation system.

It is understood that bleachers of this type are generally supported by spread footings, but piers or some other structural configuration is sometimes required. According to Southern Bleachers, typical column loads are less than 50 kips, and this maximum load was used as a basis for the recommendations of this report. If actual loads vary significantly from these assumed loads, Earth Systems should be notified since reevaluation of the recommendations contained in this report may be required.

PURPOSE AND SCOPE OF WORK

The purpose of the geotechnical study that led to this report was to analyze the geology and soil conditions of the site with respect to the proposed improvements. These conditions include potential geohazards, surface and subsurface soil types, expansion potential, settlement potential, bearing capacity, and the presence or absence of subsurface water. The scope of work included:

1. Reconnaissance and geological mapping of the site.
2. Reviewing aerial photographs taken of the site on October 25, 1945 by Fairchild Aerial Surveys, Inc.

3. Reviewing pertinent geologic literature.
4. Advancing a series of 21 CPT soundings to help evaluate fault rupture hazard, and one additional CPT sounding to generate geotechnical information for use in providing foundation design parameters.
5. Drilling, sampling, and logging of two hollow-stem auger borings to study geologic, soil, and groundwater conditions.
6. Excavating and logging a trench to further evaluate fault rupture hazard within the proposed bleacher area.
7. Laboratory testing of soil samples obtained from the subsurface exploration to determine their physical and engineering properties.
8. Consulting with owner representatives and design professionals.
9. Collaborating with representatives of California geological Survey with respect to the fault rupture hazard evaluation.
10. Analyzing the geologic and geotechnical data obtained from the various aspects of the study.
11. Preparing this report.

Contained in this report are:

1. Descriptions and results of field and laboratory tests that were performed.
2. Discussions pertaining to the local geologic, soil, and groundwater conditions.
3. Conclusions pertaining to geohazards that could affect the site.
4. Conclusions and recommendations pertaining to site grading and structural design.

GEOLOGY

A. Regional Geology

The site lies within the Ventura basin in the western portion of the Transverse Ranges geologic province. Numerous east-west trending folds and reverse faults indicative of ongoing north-south transpressional tectonics characterize the region. Ongoing folding, uplift, and faulting has tilted Pleistocene to Tertiary age sedimentary rocks in the region. Recent alluvium blankets Saugus Formation bedrock units in the athletic fields areas of the campus.

The proposed building area of the Adolfo Camarillo High School campus is within the Fault Rupture Hazard Zone for the Camarillo Fault that has been delineated by the State of California. The Camarillo Fault is a north-dipping reverse fault.

Although the Camarillo Fault is considered capable of producing surface rupture, it is not generally considered capable of producing a significant seismic event. The consensus is that the nearest fault capable of producing a significant seismic event is the Simi-Santa Rosa Fault, portions of which are considered "active". It is a north dipping reverse fault interpreted to also have significant lateral displacements. At its closest position to the proposed bleachers it is approximately 1.4 miles to the northwest.

B. Stratigraphy

Bedrock was not encountered during the subsurface investigation, which included borings and CPT soundings to 50 feet below the ground surface. However, Saugus Formation bedrock was encountered at shallow depths during studies for the home bleachers in 2004. Saugus Formation is likely to be present slightly below the currently explored depths.

Soils encountered in the exploration were interpreted to be recent deltaic alluvial deposits (Qal). Units encountered within the exploratory borings consisted of interbedded lenses of clayey and silty sands, well-graded and poorly-graded sands, silty clays and sandy silts.

C. Structure

Bedding attitudes were not measured within the alluvial deposits, but observations made during the study indicate that bedding is oriented essentially parallel to the natural ground surface.

GEOLOGIC HAZARDS

Geologic hazards that may impact a site include seismic shaking, fault rupture, landsliding, liquefaction, seismic-induced settlement of dry sands, and flooding.

A. Seismic Shaking

1. Southern California is a seismically active region where the potential for significant ground shaking is universal. Earthquakes of a size large enough to cause structural damage are relatively common in the region. Per the State of California guidelines for these types of reports, when evaluating the seismicity potential of a specific site, it is general practice to look at the historical seismic record of the area and also review the site location with respect to mapped potentially active and active faults. By using this procedure, estimates of maximum ground accelerations are determined for consideration in structural design for buildings. The geotechnical community uses the method even though most are well aware of its shortcomings. The most significant shortcomings relate to the presence of unknown seismogenic faults well below the surface, and the amount of uncertainty regarding the time intervals between earthquake events on many of the recognized faults. The 1983 Coalinga and 1994 Northridge Earthquakes are examples of relatively large events that occurred on previously unrecognized faults. Man has only been using instruments to monitor earthquakes since the 1930's, which is a relatively short time span considering that the intervals between large earthquakes on some of the regional faults are on the order of thousands of years. Considering the above, an evaluation of site acceleration potential will lead to a value that must be considered an approximation. The structural designers must be aware that there are inherent uncertainties in the determined value or range.

2. The Camarillo area has not experienced any local large earthquakes since records have been kept; however, regional earthquakes have led to significant ground shaking and structural damage. Notable regional earthquakes include the 1812 Santa Barbara Channel and 1857 Fort Tejon events. The epicenter of the 1812 earthquake is thought to have been in the western part of the Santa Barbara channel. Associated with this earthquake, a tsunami with a disputed run up height of up to 15 feet impacted the Ventura coastal area. On January 9, 1857, the Fort Tejon earthquake with an estimated Richter magnitude of 8.25 impacted the region. According to C.D.M.G. (1975), the earthquake caused the roof of the Mission San Buenaventura to fall in.

3. One measure of ground shaking is intensity. The Modified Mercalli Intensity Scale of ground shaking ranges from I to XII with XII indicating the maximum possible intensity

of ground movement. Structural damage begins to occur when the intensity exceeds a value of VI. Southern Ventura County has been mapped by the California Division of Mines and Geology to delineate areas of varying predicted seismic response. The Alluvium that underlies the subject area is mapped as having a probable maximum intensity of earthquake response of approximately IX on the Modified Mercalli Scale. Historically, the highest estimated intensity in the Camarillo area has been VI (CDMG, 1975, 1994).

4. The school site, like any other site in the region, is subject to relatively severe ground shaking in the event of a maximum earthquake on a nearby fault. In Appendix C is a regional fault location map that shows the site's relationship to the identified faults in the region. Also in Appendix C is a summary table listing well-identified faults within a 54-km radius of the school, the distance between each fault and the school, and mean earthquake magnitudes that could occur on each of the listed faults. A proprietary program utilizing the State of California’s fault model (CGS and USGS, 2008) was used to prepare the list.

5. It is assumed that the 2019 CBC and ASCE 7-16 guidelines will apply for the seismic design parameters used in design. The 2019 CBC includes several seismic design parameters that are influenced by the geographic site location with respect to active and potentially active faults, and with respect to subsurface soil or rock conditions. The “general procedure” (i.e. probabilistic) seismic design parameters presented below were determined by the U.S. Seismic Design Maps "risk-targeted" calculator on the SEAOC/OSHPD website for ASCE 7-16 for the site coordinates (34.2151° North Latitude and 119.0085° West Longitude, Soil Site Class E (for soft clay soils), for Occupancy (Risk) Category III (which includes structures supporting people on public school campuses). (A listing of the calculated 2019 CBC and ASCE 7-16 Seismic Parameters is presented below and again in Appendix C.)

Summary of Seismic Parameters – 2019 CBC “General Procedure”

Site Class (ASCE 7-16)	E
Occupancy (Risk) Category	III
Seismic Design Category	D

Maximum Considered Earthquake (MCE) Ground Motion	
Spectral Response Acceleration, Short Period – S_s	1.618 g
Spectral Response Acceleration at 1 sec. – S_1	0.597 g
Site Coefficient – F_a	See CBC Section 11.4.8
Site Coefficient – F_v	See CBC Section 11.4.8
Site-Modified Spectral Response Acceleration, Short Period – S_{MS}	See CBC Section 11.4.8
Site-Modified Spectral Response Acceleration at 1 sec. – S_{M1}	See CBC Section 11.4.8
Design Earthquake Ground Motion	
Short Period Spectral Response – S_{DS}	See CBC Section 11.4.8
One Second Spectral Response – S_{D1}	See CBC Section 11.4.8
Site Modified Peak Ground Acceleration - PGA_M	0.773 g
Values appropriate for a 2% probability of exceedance in 50 years	

The seismic factor S_1 is greater than 0.2 g and the Site Class is “E”. If the structural engineer determines that ASCE 7-16, Section 11.4.8, Exception 2 does not apply, a site-specific (i.e. deterministic) ground motion hazard analysis is required. The site-specific study takes into account soil amplification effects. The United States Geological Survey (USGS, 2009) has undertaken a probabilistic earthquake analyses that covers the continental United States. A reasonable site-specific spectral response curve may be developed from USGS Unified Hazard Tool web page, which adjusts for site-specific ground factors. The interactive webpage appears to be a precise calculation based on site coordinates. For the purposes of this study, the Dynamic: Conterminous U.S. 2014 (Update) (Version 4.2.0) values have been chosen for use in the analysis.

NGA West 2014 attenuation relationships were used in the analyses. These attenuations included those of Abrahamson, Silva and Kamai, Boore and Stewart, Campbell and Bozorgnia, Chiou and Youngs, and Idriss.

Summary of Seismic Parameters – 2019 CBC “Site-Specific Procedure”

Site Class (ASCE 7-16)	E
Occupancy (Risk) Category	III
Seismic Design Category	D

Maximum Considered Earthquake (MCE) Ground Motion	
Spectral Response Acceleration, Short Period – S_s	1.618 g
Spectral Response Acceleration at 1 sec. – S_1	0.597 g
Site Coefficient – F_a	1.00
Site Coefficient – F_v	4.00
Site-Modified Spectral Response Acceleration, Short Period – S_{MS}	1.649 g
Site-Modified Spectral Response Acceleration at 1 sec. – S_{M1}	2.286 g
Design Earthquake Ground Motion	
Short Period Spectral Response – S_{DS}	1.099 g
One Second Spectral Response – S_{D1}	1.524 g
Site Modified Peak Ground Acceleration - PGA_M	0.675 g
Values appropriate for a 2% probability of exceedance in 50 years	

6. California has had several large earthquakes in this century, and studies on the structural effects of the ground shaking have led to changes in the building codes. After the 1933 Long Beach Earthquake, the State of California Field Act was written with the intention of making public schools more earthquake resistant. The intent of the act, as is the intent of the most modern codes, is as follows: "School buildings constructed pursuant to these regulations are expected to resist earthquake forces generated by major earthquakes in California without catastrophic collapse, but may experience some repairable architectural or structural damage". Following the 1971 San Fernando Earthquake, many changes were made to the public school building codes. After the 1994 Northridge Earthquake, a study of 127 public schools in the Los Angeles area by the State of California Division of the State Architect (1994a) revealed that the intent of the Field Act was being met even when buildings were subjected to horizontal accelerations approaching 0.9 g (much higher than expected) over a large area. None of the schools collapsed and most of the damage that would have caused injury to students, had school been in session, was from failures of non-structural items such as light fixtures, florescent bulbs, suspended ceilings, etc. Most of the schools that experienced these non-structural failures were built before the changes to the building code that applied to these non-structural items. The study also resulted in recommended changes to building codes regarding steel framed school buildings, (State of Calif. Div. of State Architect, 1994b).

B. <u>Fault Rupture</u>

Surficial displacement along a fault trace is known as fault rupture. Fault rupture typically occurs along previously existing fault traces. As mentioned in the "Structure" section above, much of the campus, including the proposed project area, is within the Fault Rupture Hazard Zone established by the California Division of Mines and Geology in 1998. It is also within a fault zone of required investigation specified by the City of Camarillo (Fugro, 2003).

To assess the potential hazard posed by fault rupture, a line of 21 cone penetration test soundings on 10-foot lateral spacings was advanced to obtain information pertaining to subsurface stratigraphy. The surface elevations and locations of the soundings were surveyed to within one one-hundredth of a foot. Utilizing these data, Geologic Cross-Section along A-A' was prepared. The section includes an upper section plotting soil-type interpretations for each sounding, and a lower section plotting friction ratios for each sounding. The section was geologically interpreted to identify stratigraphic horizons projecting throughout the length of the line of soundings.

Multiple parallel laterally continuous units were identified across the section. All units appeared to be oriented parallel to the ground surface. The section was presented to California Geological Survey for a preliminary review. At that time, some small bends were noted in some of the deeper units between CPT-4 and CPT-8. As a result, a trenching program in that zone was undertaken to determine if any indications of faulting might be present.

Between March 31 and April 2, an 87-foot long trench was excavated along the same line as the CPT soundings. The trench depth between CPT-3 and CPT-8 ranged from 8 to 10 feet. Detailed logging identified multiple laterally continuous interbeds of silty sands, clean sands, and clays representative of paleosols. No signs of warping or faulting were observed. These findings were verified by a representative of CGS that visited the site to observe the excavation.

Stratigraphic units exposed within the trench walls appeared to be Holocene in age, but a charcoal sample was obtained from the deepest paleosol and sent to Beta Analytical for age dating. (Results are pending.) Although these units are likely less than 11,000 years old, the lack of significant variations in the parallel units observed at much greater depths in the CPT soundings lead Earth Systems to conclude that the hazard posed by fault rupture to the proposed visitors' bleachers is low.

C. Landsliding and Rock Fall

No landslides were observed to be located on or trending into the subject property during the field study, during reviews of the referenced geologic literature, or during review of the aerial photographs taken of the site.

As mentioned previously, the subject site is relatively flat. As a result, it does not appear that landsliding and rock fall do not pose a hazard to the proposed project.

D. Liquefaction, Cyclic Softening, and Lateral Spreading

Earthquake-induced cyclic loading can be the cause of several significant phenomena, including liquefaction in fine sands and silty sands. Liquefaction results in a loss of strength and can cause structures to settle or even overturn if it occurs in the bearing zone. Cyclic softening in clays during earthquakes has resulted in buildings experiencing foundation failure and ground surface deformation similar to that resultant from liquefaction. If liquefaction or cyclic softening occurs beneath sloping ground, a phenomenon known as lateral spreading can occur. Liquefaction and cyclic softening is typically limited to the upper 50 feet of the subsurface soils. There are a number of conditions that need to be satisfied for liquefaction or cyclic softening to occur. Of primary importance is that groundwater, perched or otherwise, usually must be within the upper 50 feet of soils.

The subject site is not located within any of the Liquefaction Hazard Zones delineated by the State of California (CDMG, 2002b). Mapping of historically highest groundwater by CDMG (2002a) indicates groundwater has been deeper than 50 feet below the ground surface near the subject site, and Boring B-1 of this geotechnical investigation did not encounter groundwater to a depth of 51.5 feet.

Calculations based on the measured liquidity indices indicate that the clay layers encountered between the depths of 13.5 and 23.5 feet in Boring B-1 have sensitivities of 5 or less. As a result, these clay layers do not appear to be sensitive. Hence, cyclic softening of clays and post-liquefaction settlement from consolidation of clays disturbed by a design level earthquake do not appear to be significant at the subject site.

Based on the above, it is the opinion of this firm that a potential for liquefaction, cyclic softening, and lateral spreading does not exist at this site.

E. Seismic-Induced Settlement of Dry Sands

Sands can potentially settle and densify when subjected to earthquake shaking. The amount of settlement is a function of relative density, cyclic shear strain magnitude, and the number of strain cycles. A procedure to evaluate this type of settlement was developed by Seed and Silver (1972) and later modified by Pyke, et al (1975). Tokimatsu and Seed (1987) presented a simplified procedure that has been reduced to a series of equations by Pradel (1998).

Earth Systems utilized these methods to analyze potential dry sand settlement. The earthquake magnitude used in the analysis were a modal magnitude of 6.8 for the Simi-Santa Rosa Fault. Two-thirds of the site-modified acceleration of 0.773 g (i.e. 0.52 g) was used in the analysis. It was assumed that soils with plasticity indices greater than 7 would not be susceptible to settlement because they will exhibit clay-like behavior.

Calculations using data from Boring B-1 yielded an estimated potential settlement of 1.0 inch. Calculations using data from CPT-22 yielded an estimated potential settlement of 1.8 inches. (Printouts of the calculations are presented in Appendix D of this report.) About one-half of the total settlement (i.e. about 0.5 to 0.9 inches) could be experienced as differential settlement.

F. Flooding

Earthquake-induced flooding types include tsunamis, seiches, and reservoir failure. Due to the inland location of the site, hazards from tsunamis are considered extremely unlikely. The site is not close to any inland bodies of water; thus, seiches do not appear to pose a hazard to the project.

According to the Ventura County General Plan Hazards Appendix (2013), this site is at the outer edge of a dam failure inundation zone for Bard Reservoir. Proper maintenance of this reservoir is anticipated, and assuming the maintenance continues as planned, the hazard posed by reservoir failure appears to be low.

The site is located within an area designated by FEMA Flood Map Service Center (2020) website as Zone X with a 0.2% annual chance flood hazard, or areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile. As a result, it appears that the hazard posed by storm-induced flooding is low.

SOIL CONDITIONS

Near-surface soils underlying the proposed bleachers area are generally alluvial clayey sands and clean sands. Soils encountered at approximate bearing depths are characterized by low blow counts and in-place densities, and moderate to high compressibilities. Testing indicates that anticipated bearing soils lie in the "high" expansion range because the expansion index was measured to be 106. [A classification of soil expansion, i.e. Table 1809.7, is included in Appendix B of this report.] It appears that soils can be cut by standard grading equipment.

Groundwater was not encountered to a depth of 51.5 feet.

Samples of near-surface soils were tested for pH, resistivity, soluble sulfates, and soluble chlorides. The test results provided in Appendix B should be distributed to the design team for their interpretations pertaining to the corrosivity or reactivity of various construction materials (such as concrete and piping) with the soils. It should be noted that sulfate contents (44 mg/Kg) are in the "S0" ("negligible") exposure class of Table 19.3.1.1 of ACI 318-14; therefore, it appears that special concrete designs will not be necessary for the measured sulfate contents.

Based on criteria established by the County of Los Angeles (2013), measurements of resistivity of near-surface soils (5,600 ohms-cm) indicate that they are "moderately corrosive" to ferrous metal (i.e. cast iron, etc.) pipes.

GEOTECHNICAL ENGINEERING CONCLUSIONS AND RECOMMENDATIONS

The site is suitable for the proposed replacement bleacher project from Engineering Geology and Geotechnical Engineering standpoints provided that the recommendations contained in this report are successfully implemented into the project.

A. Grading

1. Pre-Grading Considerations

   a. Plans and specifications should be provided to Earth Systems prior to grading. Plans should include the grading plans, foundation plans, and foundation details.

   b. Final site grade should be designed so that all water is diverted away from the bleachers over paved surfaces, or over landscaped surfaces in accordance with current codes. Water should not be allowed to pond anywhere on the pad.

   c. Shrinkage of soils affected by compaction is estimated to be about 15 percent. Shrinkage from removal of the existing foundation system is not included in these figures.

   d. Compaction tests shall be made to determine the relative compaction of the fills in accordance with the following minimum guidelines: one test for each two-foot vertical lift; one test for each 1,000 cubic yards of material placed; and four tests at subgrade elevation in the final pad.

   e. It is recommended that Earth Systems be retained to provide Geotechnical Engineering services during site development and grading, and foundation construction phases of the work to observe compliance with the design concepts, specifications and recommendations, and to allow design changes in the event that subsurface conditions differ from those anticipated prior to the start of construction.

2. Rough Grading/Areas of Development

   a. Grading at a minimum should conform to the 2019 California Building Code.

   b. The existing ground surface should be initially prepared for grading by removing all vegetation, trees, large roots, debris, other organic material and non-complying fill. Organics and debris should be stockpiled away from areas to be graded, and ultimately removed from the site to prevent their inclusion in fills. Voids created by removal of such material should be properly backfilled and compacted. No compacted fill should be placed unless the underlying soil has been observed by the Geotechnical Engineer.

   c. If conventional pad footings are to be used to support the bleachers, overexcavation and recompaction of soils under footings will be necessary to decrease the potential for differential settlement and provide more uniform bearing conditions due to the presence of variable density soils at the bearing depth. Soils should be overexcavated to a depth of 2.5 feet below the bottoms of footings and to a distance of 5 feet on each side of the footings. The resulting surfaces should then be scarified an additional 6 inches, moisture conditioned, and recompacted. The intent of these recommendations is to have a minimum of 3 feet of compacted soil below the bottoms of all footings.

d. If pier footings are to be used, the overexcavation and recompaction described above will not be necessary.

e. Areas outside of the bleachers bearing zone area to receive fill, exterior slabs-on-grade, sidewalks, or paving should be overexcavated to a depth of 1.5 feet. The resulting surface should then be scarified an additional 6 inches, moisture conditioned and recompacted.

f. The bottom of all excavations should be observed by a representative of this firm prior to processing or placing fill.

g. On-site soils may be used for fill once they are cleaned of all organic material, rock, debris and irreducible material larger than 8 inches.

h. Fill and backfill placed at or slightly above optimum moisture in layers with loose thickness not greater than 8 inches should be compacted to a minimum of 90 percent of the maximum dry density obtainable by the ASTM D 1557 test method.

i. Import soils used to raise site grade should be equal to, or better than, on-site soils in strength, expansion, and compressibility characteristics. Import soil can be evaluated, but will not be prequalified by the Geotechnical Engineer. Final comments on the characteristics of the import will be given after the material is at the project site.

3. Utility Trenches

a. Utility trench backfill should be governed by the provisions of this report relating to minimum compaction standards. In general, on-site service lines may be backfilled with native soils compacted to 90 percent of the maximum dry density. Backfill of offsite service lines will be subject to the specifications of the jurisdictional agency or this report, whichever are greater.

b. Utility trenches running parallel to footings should be located at least 5 feet outside the footing line, or above a 2:1 (horizontal to vertical) projection downward from 9 inches above the bottom of the outside edge of the footing.

c. Backfill operations should be observed and tested by the Geotechnical Engineer to monitor compliance with these recommendations.

B. Structural Design

1. Conventional Spread Foundations

a. Conventional continuous footings and/or isolated pad footings may be used to support the bleachers. The anticipated bearing soils are in the "high" expansion range; therefore, pad footings must be tied together by grade beams (each way).

b. Footings should bear into firm recompacted soils as recommended elsewhere in this report. Foundation excavations should be observed by a representative of this firm after excavation, but prior to placing of reinforcing steel or concrete, to verify bearing conditions.

c. Isolated pad footings may be designed based on an allowable bearing value of 3,000 psf. This value is based on a factor of safety of at least 3.

d. Allowable bearing values are net (weight of footing and soil surcharge may be neglected) and are applicable for dead plus reasonable live loads.

e. A one-third increase is permitted for use with the alternative load combinations given in Section 1605.3.2 of the 2019 CBC.

f. Lateral loads may be resisted by soil friction on foundations and by passive resistance of the soils acting on the sides of foundations. Lateral capacity is based on the assumption that any required backfill adjacent to foundations and grade beams is properly compacted.

g. Actual footing designs should be provided by the Structural Engineer, but the dimensions and reinforcement he recommends should not be less than the criteria set forth in Table 1809.7 for the "high" expansion range.

h. Bearing soils in the "high" expansion range should be premoistened to 140 percent of optimum moisture content to a depth of 33 inches below lowest adjacent grade. Premoistening should be confirmed by testing.

2. Drilled Pier Foundations

a. As a minimum, the new piers should be at least twenty-four inches (24") in diameter and embedded a minimum of 10 feet below the existing ground surface. However, the Structural Engineer may require greater depths of penetration to achieve the design bearing and lateral capacities. The Geotechnical Engineer should be consulted during pier installation to determine compliance with the geotechnical recommendations.

b. For vertical (axial compression) and uplift capacity, the attached pile capacity graphs may be used. Drilled pier diameters of 2, 2.5, and 3 feet were analyzed, and the results are presented on the attached charts. Side resistance is not allowed to increase beyond a depth equal to 20 pile diameters. Upward resistance is taken as two-thirds of the downward resistance. The downward and upward capacity graphs for drilled piers are presented in Appendix E.

c. The load capacities shown on the attached charts are based upon skin friction with no end bearing. Therefore, it is not necessary to thoroughly clean the bottoms of the pier excavations. However, loose soils, slough, or debris should be removed. These allowable capacities include a safety factor of 2.0.

d. Reduction in axial capacity due to group effects should be considered for piers spaced at 3 diameters on-center or closer.

e. All piers should be tied together laterally (in both directions) at the top with grade beams. The size, spacing, and reinforcing of grade beams should be determined by the Structural Engineer.

f. The compressive and tensile strength of new pier designs should be checked to verify the structural capacity of the piers. Reinforcement of piers should be specified by the Structural Engineer. The specific method of pier installation will affect the performance of the piers. Earth Systems recommends a meeting with the design team and Contractor to verify that the specific method of pier installation can provide the anticipated load supporting capacity.

g. Lateral (horizontal) loads may be resisted by passive resistance of soil against the piers. An equivalent fluid weight (EFW) of 380 psf per foot of penetration in firm, native soil above the groundwater table may be used for lateral load design. This resisting pressure is an ultimate value. The maximum passive pressure used for design should not exceed 5,000 psf.

h. For piers spaced at least 3 diameters apart, an effective width of three times the actual pier diameter may be used for passive pressure calculations.

. i. Pier excavations are unlikely to encounter groundwater; however, due to the presence of relatively “clean” sands, temporary casing may be necessary to minimize bore-hole caving during pier construction. Use of special drilling mud or other methods to keep boreholes open during construction may be acceptable upon review by the Geotechnical Engineer.

j. Pier drilling operations should be observed by the Geotechnical Engineer, or his representative.

3. Frictional and Lateral Coefficients
   a. Resistance to lateral loading may be provided by friction acting on the bases of foundations. A coefficient of friction of 0.60 may be applied to dead load forces. This value does not include a factor of safety.
   b. Passive resistance acting on the sides of foundation stems equal to 380 pcf of equivalent fluid weight may be included for resistance to lateral load. This value does not include a factor of safety.
   c. A minimum factor of safety of 1.5 should be used when designing for sliding or overturning.
   d. For the foundations, passive resistance may be combined with frictional resistance provided that a one-third reduction in the coefficient of friction is used.

4. Settlement Considerations
   a. Maximum static settlements of about an inch are anticipated for foundations designed as recommended. Differential settlement between adjacent load bearing members should be less than one-half the total settlement.
   b. Maximum seismic-induced settlements of about 1.8 inches could be experienced during a significant earthquake. Differential settlement between adjacent load bearing members are estimated to be 0.9 inches, which is one-half the total settlement.

ADDITIONAL SERVICES

This report is based on the assumption that an adequate program of monitoring and testing will be performed by Earth Systems during construction to check compliance with the recommendations given in this report. The recommended tests and observations include, but are not necessarily limited to the following:

1. Review of the building and grading plans during the design phase of the project.
2. Observation and testing during site preparation, grading, placing of engineered fill, and foundation construction.
3. Consultation as required during construction.

LIMITATIONS AND UNIFORMITY OF CONDITIONS

The analysis and recommendations submitted in this report are based in part upon the data obtained from the borings and CPT soundings advanced at the site. The nature and extent of variations between and beyond the borings and soundings may not become evident until construction. If variations then appear evident, it will be necessary to reevaluate the recommendations of this report.

The scope of services did not include any environmental assessment or investigation for the presence or absence of wetlands, hazardous or toxic materials in the soil, surface water, groundwater or air, on, below, or around this site. Any statements in this report or on the soil boring logs regarding odors noted, unusual or suspicious items or conditions observed, are strictly for the information of the client.

Findings of this report are valid as of this date; however, changes in conditions of a property can occur with passage of time whether they be due to natural processes or works of man on this or adjacent properties. In addition, changes in applicable or appropriate standards may occur whether they result from legislation or broadening of knowledge. Accordingly, findings of this report may be invalidated wholly or partially by changes outside the control of this firm. Therefore, this report is subject to review and should not be relied upon after a period of one year.

In the event that any changes in the nature, design, or location of the improvements are planned, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and conclusions of this report modified or verified in writing.

This report is issued with the understanding that it is the responsibility of the Owner, or of his representative to ensure that the information and recommendations contained herein are called to the attention of the Architect and Engineers for the project and incorporated into the plan and that the necessary steps are taken to see that the Contractor and Subcontractors carry out such recommendations in the field.

As the Geotechnical Engineers for this project, Earth Systems has striven to provide services in accordance with generally accepted geotechnical engineering practices in this community at this time. No warranty or guarantee is expressed or implied. This report was prepared for the exclusive use of the Client for the purposes stated in this document for the referenced project only. No third party may use or rely on this report without express written authorization from Earth Systems for such use or reliance.

It is recommended that Earth Systems be provided the opportunity for a general review of final design and specifications in order that earthwork and foundation recommendations may be properly interpreted and implemented in the design and specifications. If Earth Systems is not accorded the privilege of making this recommended review, it can assume no responsibility for misinterpretation of the recommendations.

AERIAL PHOTOGRAPHS REVIEWED

Fairchild Aerial Surveys, October 25, 1945, Frame Nos. 9800-3-310 & 311, Scale 1:20,000.

SITE-SPECIFIC BIBLIOGRAPHY

Earth Systems Southern California, October 4, 2004, Engineering Geology and Geotechnical Engineering Report for Proposed Expansion of Football Field Bleachers at Camarillo High School, Camarillo, California (Job No. VT-23265-01).

Earth Systems Southern California, December 24, 2009, Engineering Geology and Geotechnical Engineering Feasibility Report for Proposed Pool Complex at Camarillo High School, Camarillo, California (Job No. VT-24393-01).

Earth Systems Southern California, October 27, 2011, Engineering Geology and Geotechnical Engineering Report for Proposed Aquatic Center at Camarillo High School, 4660 Mission Oaks Boulevard, Camarillo, California (Job No. VT-24393-02).

Earth Systems Pacific, August 19, 2019, Geotechnical Engineering Report, Proposed Improvements to Athletic Fields, Adolfo Camarillo High School, 4660 Mission Oaks Boulevard, Camarillo, California (Job No. 303275-001).

GENERAL BIBLIOGRAPHY

Abrahamson, N.A., and Silva, W.J., 1997, Empirical Response Spectral Attenuation Relations for Shallow Crustal Earthquakes: Seismological Research Letters.

Abrahamson, N.A., Silva, W.J, and Kamai, R., 2014, Summary of the ASK14 Ground Motion Relation for Active Crustal Regions, Bartlett & Youd, 1995, Empirical Prediction of Liquefaction-Induced Lateral Spread, Journal of Geotechnical Engineering, April, 1995.

Boatwright, John, 1994, Modeling Ground Motions in the Near-Field of Rupturing Faults.

Boore, D.M., and Joyner, W.B., 1994, Prediction of Ground Motion in North America.

Boore, D.M., Joyner, W.B., and Fumal, T.E., 1997, Equations for Estimating Horizontal Response Spectra and Peak Acceleration from Western North America Earthquakes: A Summary of Recent Work.

Boore, D.M., Stewart, J.P., Seyhand, E., and Atkinson, G., 2014, NGA-West 2 Equations for Predicting PGA, PGV, nd5% Damped PGA for Shallow Crustal Earthquakes.

Borcherdt, Roger D., 1994, Estimates of Site-Dependent Response Spectra for Design (Methodology and Justification).

California Building Standards Commission, 2019, California Building Code, California Code of Regulations Title 24.

California Division of Mines and Geology (C.D.M.G.), 1972 (Revised 1999), Fault Rupture Hazard Zones in California, Special Publication 42.

C.D.M.G., 1975, Seismic Hazards Study of Ventura County, California, Open File Report 76-5-LA.

C.D.M.G., 1995, The Northridge California Earthquake of 17 January, 1994, Special Publication 116.

C.D.M.G., 2002a, Seismic Hazard Zone Report for the Camarillo 7.5-Minute Quadrangle, Ventura County, California, Seismic Hazard Zone Report 054.

C.D.M.G., 2002b, State of California Seismic Hazard Zones, Camarillo Quadrangle, Official Map, February 7, 2002.

California Geological Survey (C.G.S.). 2008, Guidelines for Evaluating and Mitigating Seismic Hazards in California, Special Publication 117A.

Campbell, K.W., and Bozorgnia, Y., 2014, NGA-West2 Ground Motion Model for the Average Horizontal Componenets of PGA, PGV and 5% Damped Linear Acceleration Response Spectra.

Cetin, K.O., Seed, R.B., Der Kiureghian, A., Tokimatsu, K. Harder, L.F., Kayen, R.E., and Moss, R.E.S., 2004, Standard Penetration Test-Based Probabilistic and Deterministic Assessment of Seismic Soil

Liquefaction Potential: ASCE Journal of Geotechnical and Geoenvironmental Engineering, v. 130, n. 12, p. 1314-1340.

Chiou, B.S-J, and Youngs, R.R., 2014, Update of the Chiou and Youngs NGA Model for the Average Horizontal Component of Peak Ground Motion and Response Spectra.

County of Los Angeles Department of Public Works, July 2013, Manual for Preparation of Geotechnical Reports.

Crowell, John C., 1975, San Andreas Fault in Southern California, C.D.M.G. Special Report 118.

Dibblee, Jr., Thomas W., and Helmut E. Ehrenspeck, 1990, Geologic Map of the Camarillo and Newbury Park Quadrangles, Ventura County, California, Dibblee Foundation Map No. DF-28.

Donnellan, A. Hager, B.H., and King, R.W., 1993, Rapid North-South Shortening of the Ventura Basin, Southern California.

Federal Emergency Management Agency (FEMA), 2020, Flood Map Service Center Website.

Fugro West, Inc., 2003, City of Camarillo Geotechnical Guidelines.

Hauksson Egill, Jones, Lucille M., and Hutton, Kate, 1995, The 1994 Northridge Earthquake Sequence in California.

Heaton, T.H., and Hartzell, S.H., 1994, Earthquake Ground Motions in the Near Source Region.

Huftile, Gary J., and Yeats, Robert S., 1995, Convergence Rates Across a Displacement Transfer Zone in the Western Transverse Ranges, Ventura Basin, California.

Idriss, I.M., and Boulanger, R.W., 2004, Semi-empirical procedures for evaluation liquefaction potential during earthquakes: Proceedings of the 11th SDEE and 3rd ICEGE, University of California, Berkeley, January 2004, plenary session, p. 32-56.

Idriss, I.M., and Boulanger, R.W., 2008, Soil liquefaction during earthquakes, Earthquake Engineering Research Institute, MNO-12.

Idriss, I.M., 2014, An NGA-West2 Empirical Model for Estimating the Horizontal Spectral Values Generated by Shallow Crustal Earthquakes.

Ishihara, K., 1985, Stability of Natural Deposits during Earthquakes, Proceedings of the International Conference on Soil Mechanics and Foundation Engineering.

Jennings, C.W., and W.A. Bryant, 2010, Fault Activity Map of California, Scale 1:750,000, CGS Geologic Data Map No. 6.

NCEER, 1997, Proceedings of the NCEER Workshop on Evaluation of Liquefaction Resistance of Soils, Technical Report NCEER-97-0022.

Petersen, Mark D., and Wesnousky, S.D., 1994, Fault Slip Rates and Earthquake Histories for Active Faults in Southern California.

Pradel, D., 1998, Procedure to Evaluate Earthquake-Induced Settlements in Dry Sandy Soils, Journal of Geotechnical and Geoenvironmental Engineering, ASCE, Vol. 124, No. 4, April.

Pyke, R., Seed, H. B., and Chan, C. K., 1975, Settlement of Sands Under Multidirectional Shaking, ASCE, Journal of Geotechnical Engineering, Vol. 101, No. 4, April, 1975.

Seed, H. B., and Silver, M. L., 1972, Settlement of Dry Sands During Earthquakes, ASCE, Journal of Geotechnical Engineering, Vol. 98, No. 4, April, 1972.

Seed, R.B., Bray, J.D., Chang, S.W., and Dickensen, S.E., 1997, Site-Dependent Seismic Response Including Recent Strong Motion Data.

Seed, R.B., Cetin, K.O., Moss, R.E. S., Kammerer, A.M., Wu, J., Pestana, J.M., Riemer, M.F., Sancio, R.B., Bray, H.D., Kayen R.E., and Faris, A., 2003, Recent Advances in Soil Liquefaction Engineering,: A Unified and Consistent Framework: University of California, Earthquake Engineering Research Center Report 2003-06, 71p.

Shakal, A.F., Huang, M.J., Darragh, R.B., Cao, T., Sherburne, R.W., Malhotra, P., Cramer, C.H., Sydnor, R.H., Graizer V., Maldonado, G., Petersen, C., and Wampole, J., 1994, CSMIP Strong-Motion Records from the Northridge, California Earthquake of 17 January 1994.

Shaw, John H., and Suppe, John, 1994, Active Faulting and Growth Folding in the Eastern Santa Barbara Channel, California.

Sieh, Kerry E., 1978, Earthquake Intervals, San Andreas Fault, Palmdale, California, CDMG California Geology, June 1978.

Southern California Earthquake Center (SCEC), 1999, Recommended Procedures for Implementation of DMG Special Publication 117, Guidelines for Analyzing and Mitigating Liquefaction in California.

State of California Division of the State Architect Office of Regulation Services, May 1994, Northridge Earthquake (January 17, 1994) Performance of Public School Buildings.

State of California Division of the State Architect Office of Regulation Services, May 1994, Implementation of Northridge Earthquake Interim Guidelines for Steel Moment Frames.

Tokimatsu, K., and Seed, H. B., 1987, Evaluation of Settlements in Sands Due to Earthquake Shaking, Journal of Geotechnical Engineering-August 1987.

Treiman, J.A., September 23, 1997, Fault Evaluation Report FER-237, Springville, Camarillo, and Related Faults in the Camarillo and Santa Paula Quadrangles, Ventura County, California.

United States Geological Survey (U.S.G.S.) 1989, Map Showing Late Quaternary Faults and 1978-1984 Seismicity of the Los Angeles Region, California. Map MF-1964.

U.S.G.S., 2020, U.S. Unified Hazard Tool Website.

Ventura County Planning Department, October 22, 2013, Ventura County General Plan Hazards Appendix.

Ventura County Public Works Agency, Flood Control and Water Resources Agency, 1984, Report of Hydrologic Data 1981-1984.

Weber, F. Harold, Jr. and others, 1973, Geology and Mineral Resources of Southern Ventura County, California, C.D.M.G., Preliminary Report 14.

Wills, C.J., and Silva, W.S., 1998, Shear Wave Velocity Characteristics of Geologic Units in California.

Yeats, R.S., 1982 Low-Shake Faults of the Ventura Basin, California, in Cooper, J.D. compiler, Volume and Guidebook, Neotectonics in Southern California.

Yeats, Robert S., 1983, Large-Scale Quaternary Detachments in the Ventura Basin, Southern California.

Yeats, Robert S., Huftile, Gary J., and Grigsby, F.B., 1988, Oak Ridge Fault, Ventura Fold Belt, and the Sisar Decollement, Ventura Basin, California.

Yerkes, Robert F., and Lee. W.H.K., 1987, Late Quaternary Deformation in the Western Transverse Ranges.

Yerkes, R.F., Sarna-Wojcicki, A.M., and Lajoie, K.R., 1987, Geology and Quaternary Deformation of the Ventura Area, in Recent Faulting in the Transverse Ranges, California. USGS Professional Paper 1339.

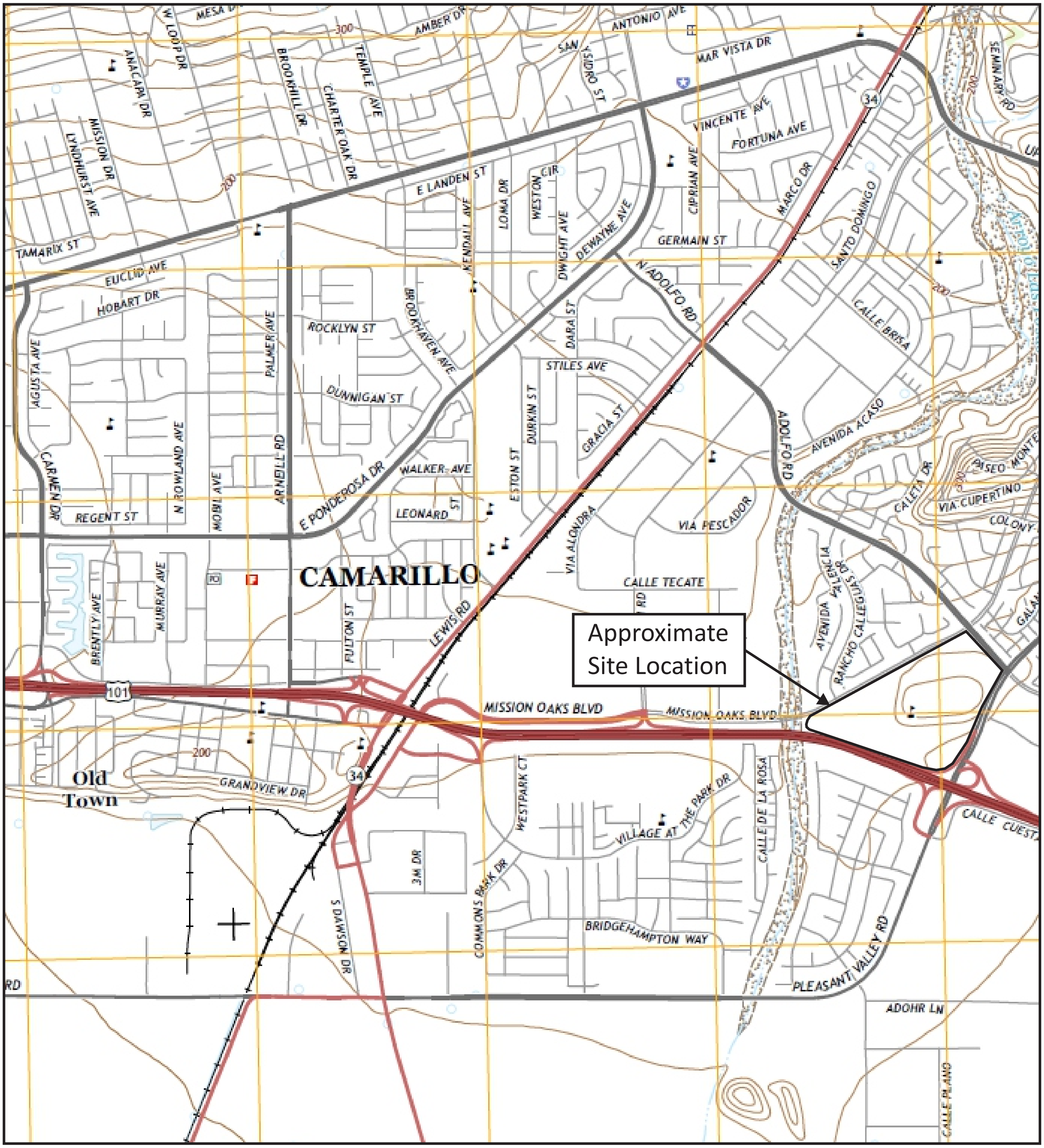
Youd, T.L. and Garris, C.T., 1995, Liquefaction-Induced Ground-Surface Disruption: ASCE Journal of Geotechnical Engineering, v 121, n. 11, p. 805-809.

Youd, T.L., and Idriss, I.M., and 19 others, 2001, Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER/NSF Workshops on Evaluation of Liquefaction Resistance of Soils: ASCE Geotechnical and Geoenvironmental Journal, v. 127, n. 10, p 817-833.

Youd, T.L., C.M. Hansen, and S.F. Bartlett, 2002, Revised Multilinear Regression Equations for Prediction of Lateral Spread Displacement, in Journal of Geotechnical and Geoenvironmental Engineering, December 2002.

APPENDIX A

Vicinity Map
Regional Fault Map
Regional Geologic Map
Seismic Hazard Zones Map
Historical High Groundwater Map
Field Study
Geologic Map
Geologic Cross-Sections
Logs and Interpretations of CPT Soundings
Log of Geologic Fault Trench
Logs of Borings
Boring Log Symbols
Unified Soil Classification System



*Taken from USGS Topo Map, Camarillo Quadrangle, California, 2015.

Approximate Scale: 1" = 2,000'

0 2,000' 4,000'

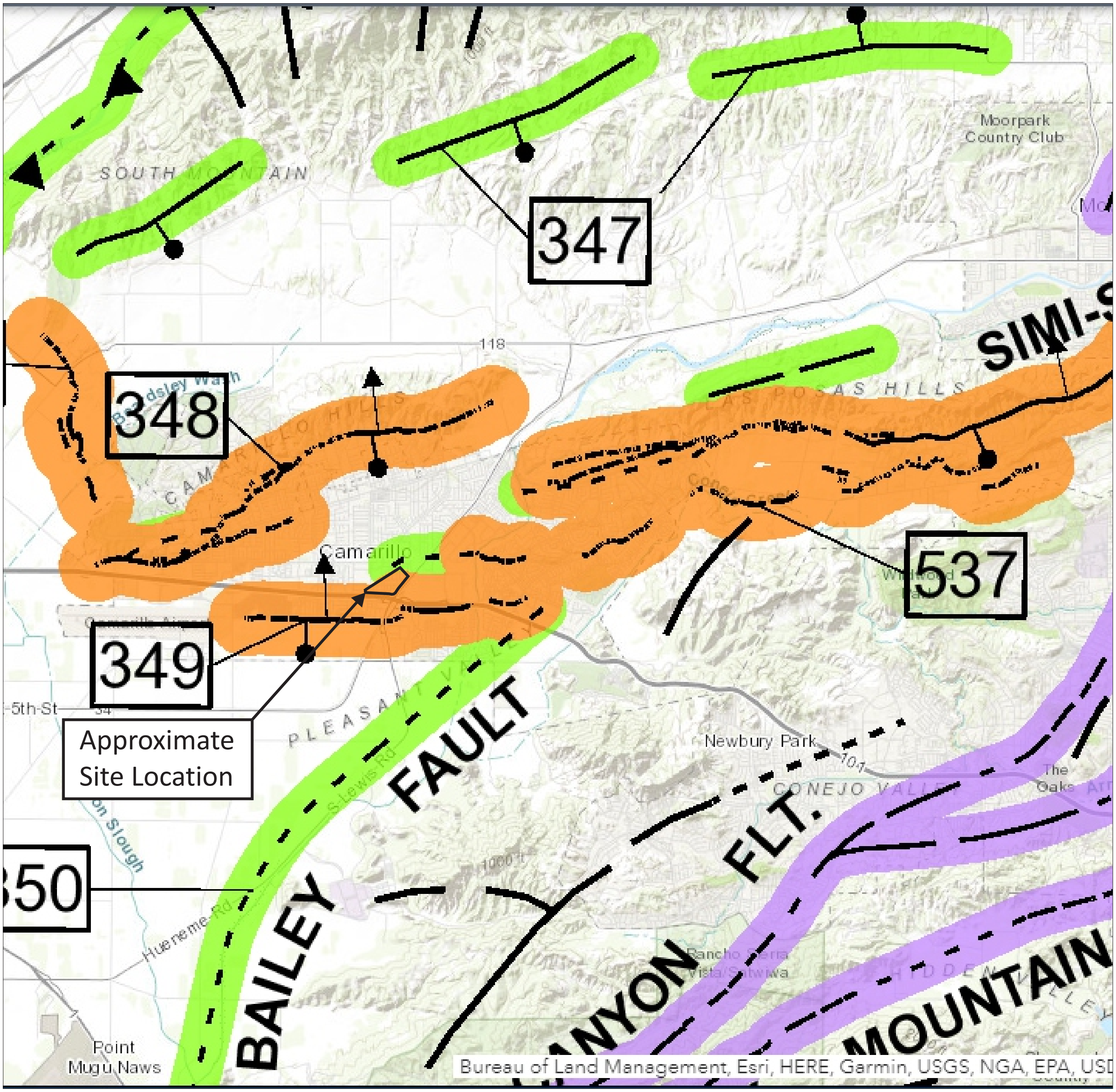
N

VICINITY MAP

Camarillo High School Visitors Bleachers
Camarillo, California

Earth Systems

April 2020	303275-003



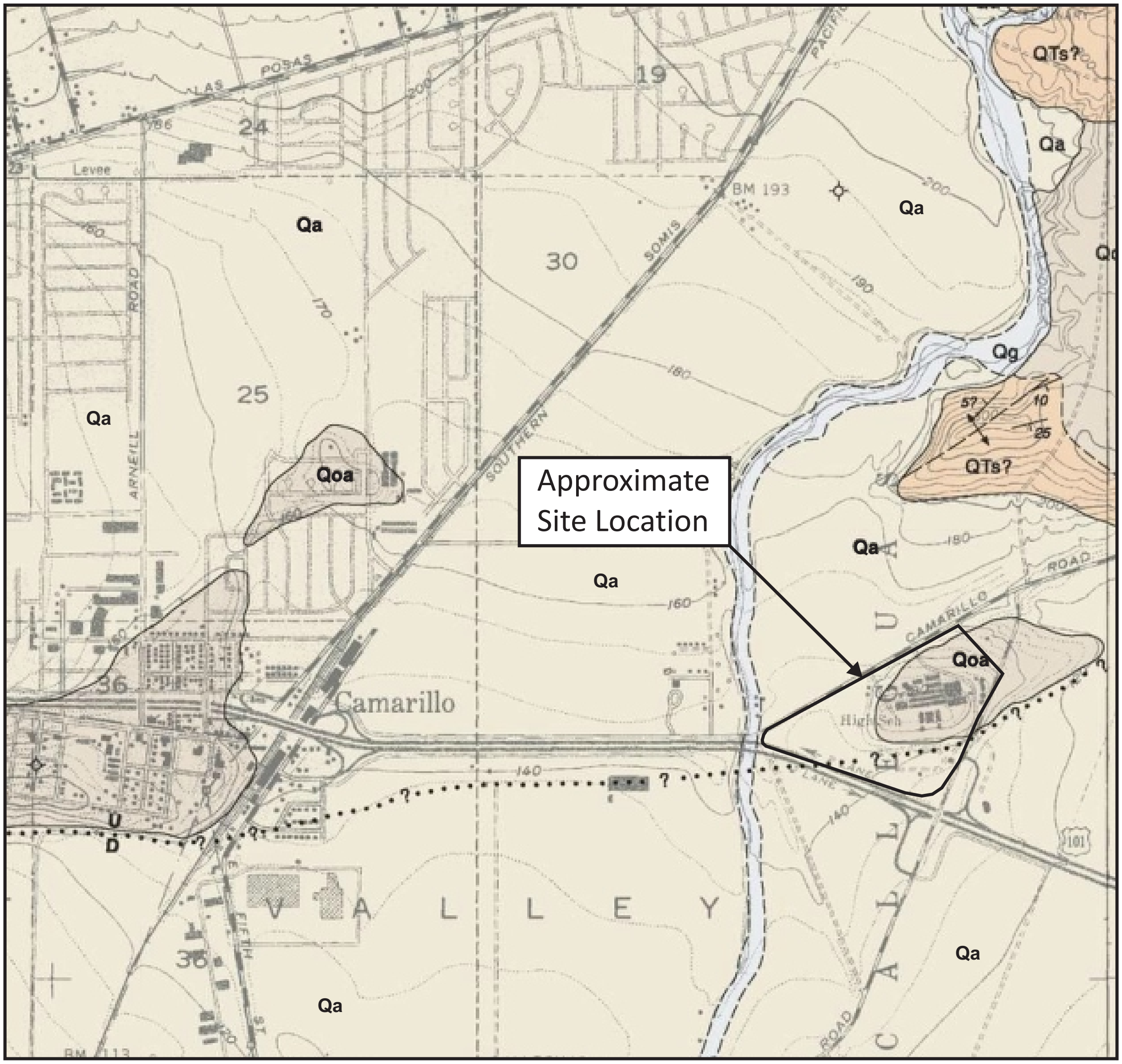
*Taken from Jennings and Bryant, Geologic Data Map No.6, 2010

Approximate Scale: 1" = 2 Miles

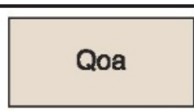
0 2 Miles 4 Miles

N

REGIONAL FAULT MAP	
Camarillo High School Visitors Bleachers Camarillo, California	
Earth Systems	
April 2020	303275-003

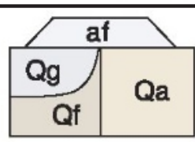


*Taken from Dibblee, Jr., Geologic Map of the Camarillo and Newbury Park Quadrangles, Ventura County, California, 1990, DF-28.



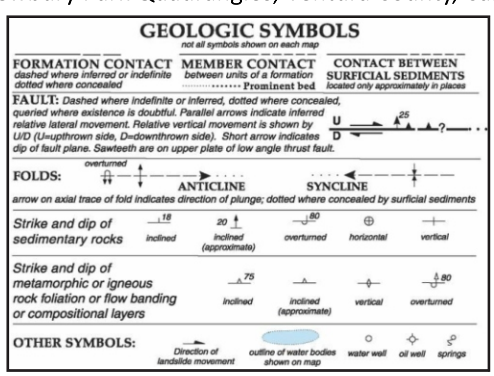
OLDER DISSECTED SURFICIAL SEDIMENTS

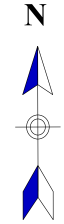
Qoa *Dissected, weakly indurated alluvial gravel, sand and clay*



SURFICIAL SEDIMENTS

af *Artificial fill*
Qg *Stream channel sand and gravel*
Qf *Alluvial fan gravel and sand, locally slightly indurated*
Qa *Alluvium: gravel, sand and clay of flatlands*





Approximate Scale: 1" = 2,000'

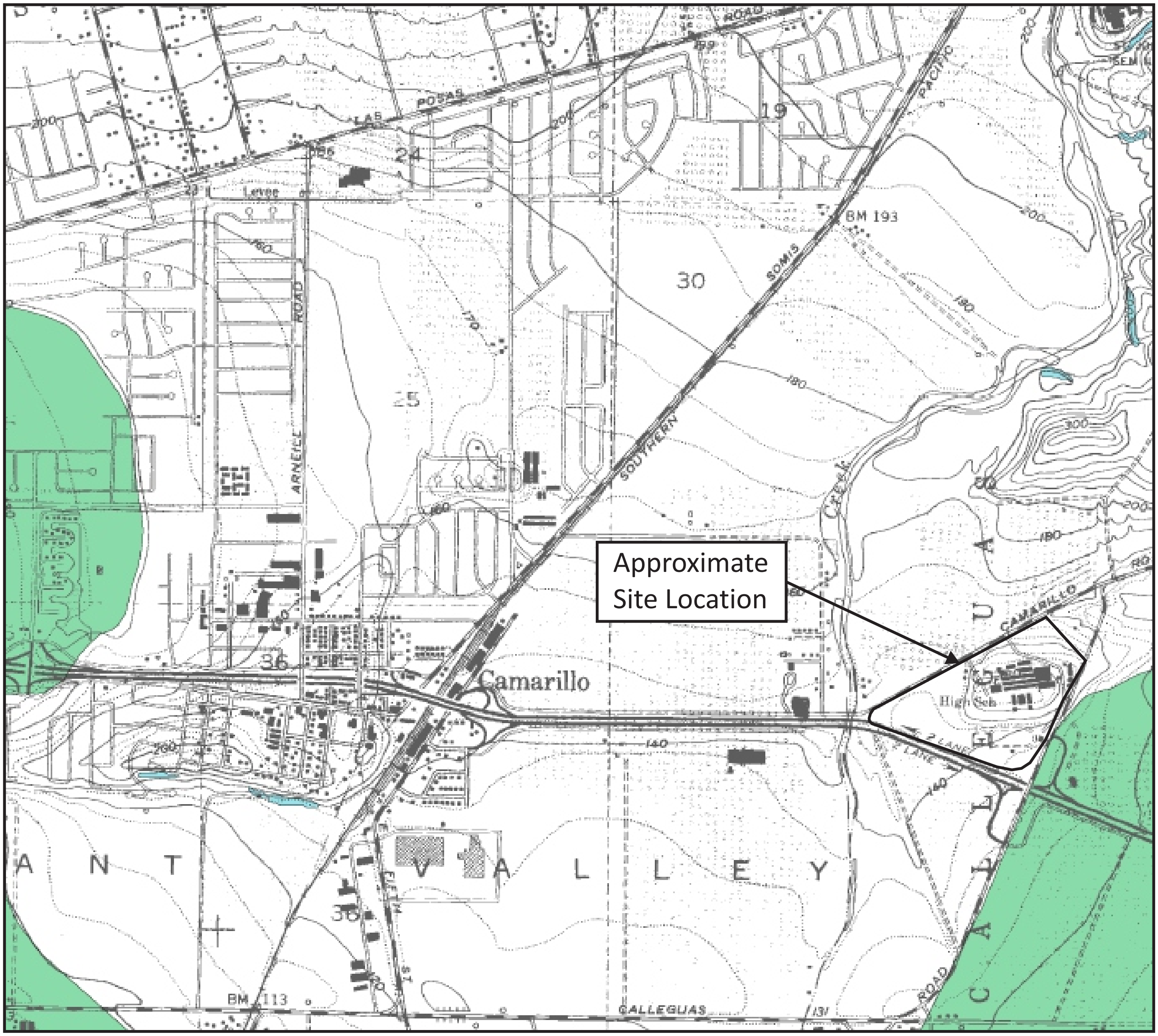
0 2,000' 4,000'

REGIONAL GEOLOGIC MAP

Camarillo High School Visitors Bleachers
Camarillo, California

Earth Systems

April 2020 | 303275-003



MAP EXPLANATION

Zones of Required Investigation:

Liquefaction

Areas where historical occurrence of liquefaction, or local geological, geotechnical and ground-water conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 2693(c) would be required.

Earthquake-Induced Landslides

Areas where previous occurrence of landslide movement, or local topographic, geological, geotechnical and subsurface water conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 2693(c) would be required.

NOTE: Seismic Hazard Zones identified on this map may include developed land where delineated hazards have already been mitigated to city or county standards. Check with your local building/planning department for information regarding the location of such mitigated areas.

Approximate Scale: 1" = 2,000'

0 2,000' 4,000'

STATE OF CALIFORNIA

SEISMIC HAZARD ZONES

Delineated in compliance with Chapter 7.8, Division 2 of the California Public Resources Code (Seismic Hazards Mapping Act)

CAMARILLO QUADRANGLE

OFFICIAL MAP

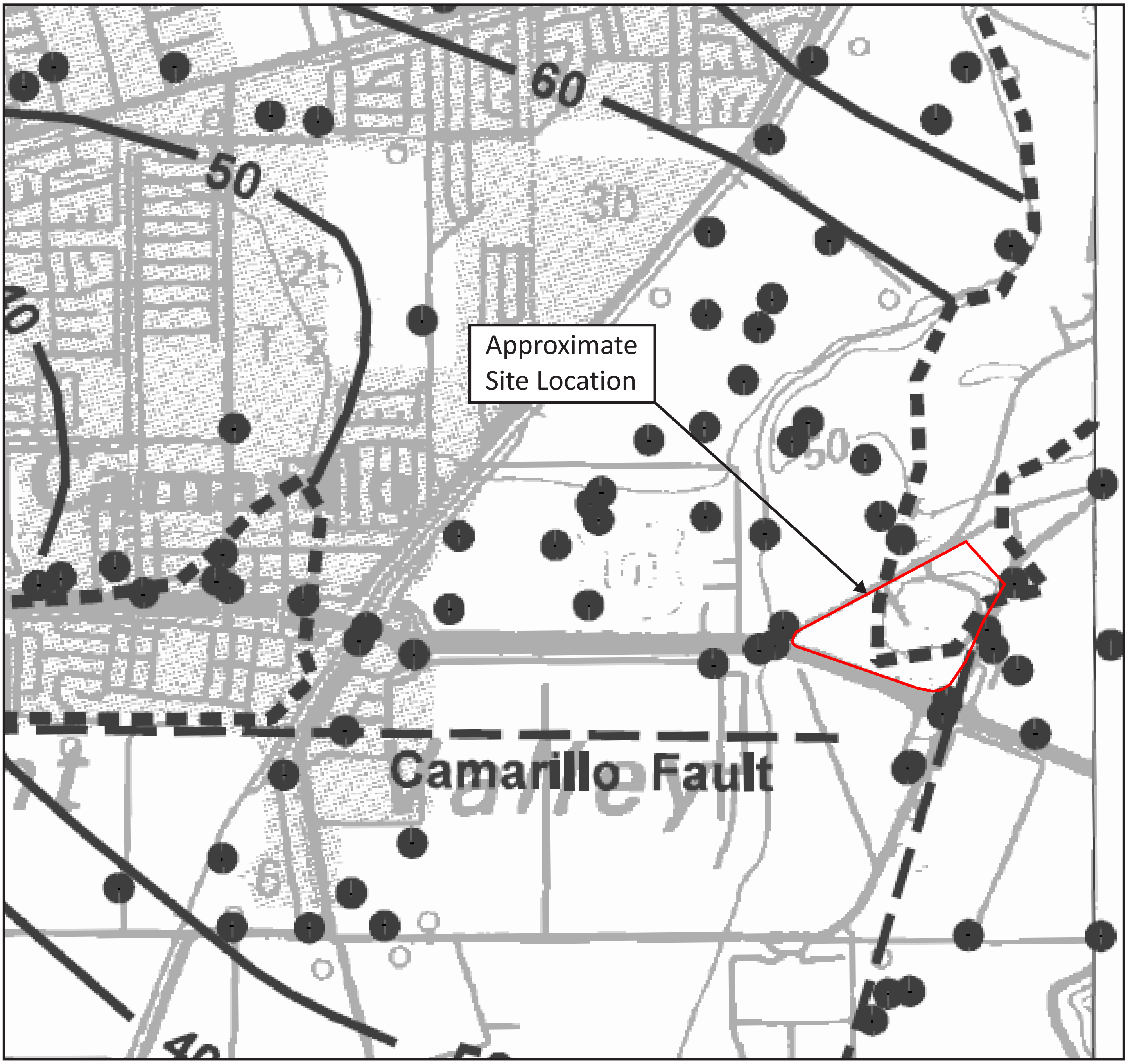
Released: February 7, 2002

SEISMIC HAZARD ZONES MAP

Camarillo High School Visitors Bleachers
Camarillo, California

Earth Systems

April 2020	303275-003



*Taken from CGS, Seismic Hazard Zone Report For The Saticoy 7.5-Minute Quadrangle, Ventura County, California, 2003.

30	Depth to historically highest ground water level in feet	Valley / Mountains Boundary	Groundwater Barrier
●	Borehole Site	▲	Approximate location of sand boils and lurch cracks observed following the Point Mugu Earthquake of February 21, 1973.

Approximate Scale: 1" = 2,000’

0 2,000’ 4,000’

N

SEISMIC HAZARD ZONES MAP

Camarillo High School Visitors Bleachers
Camarillo, California

Earth Systems

April 2020 | 303275-003

FIELD STUDY

A. Between February 4 and 6, 2020, twenty-one Cone Penetrometer Test (CPT) soundings (CPT-1 through CPT-21) were advanced on 10-foot lateral spacings along a trend of S18°E to provide data to aid in the evaluation of fault rupture potential. The soundings were advanced to depths of approximately 50 feet. One additional sounding (CPT-22) was advanced within the approximate footprint of the proposed bleachers to obtain information pertaining to the soil profile. The soundings were performed using equipment owned and operated by Kehoe Testing and Engineering. During advancement of the cone penetrometer soundings, readings of sleeve friction (in tons per square foot), tip resistance (also in tons per square foot), and friction ratio (in percent) were recorded at 0.15-meter intervals as per ASTM D 5778 and ASTM D 3441.

B. On February 7, 2020, the surface elevations and locations of the soundings used to evaluate the fault rupture hazard were surveyed by Encompass Consulting Group. The survey was accurate to one one-hundredth of a foot.

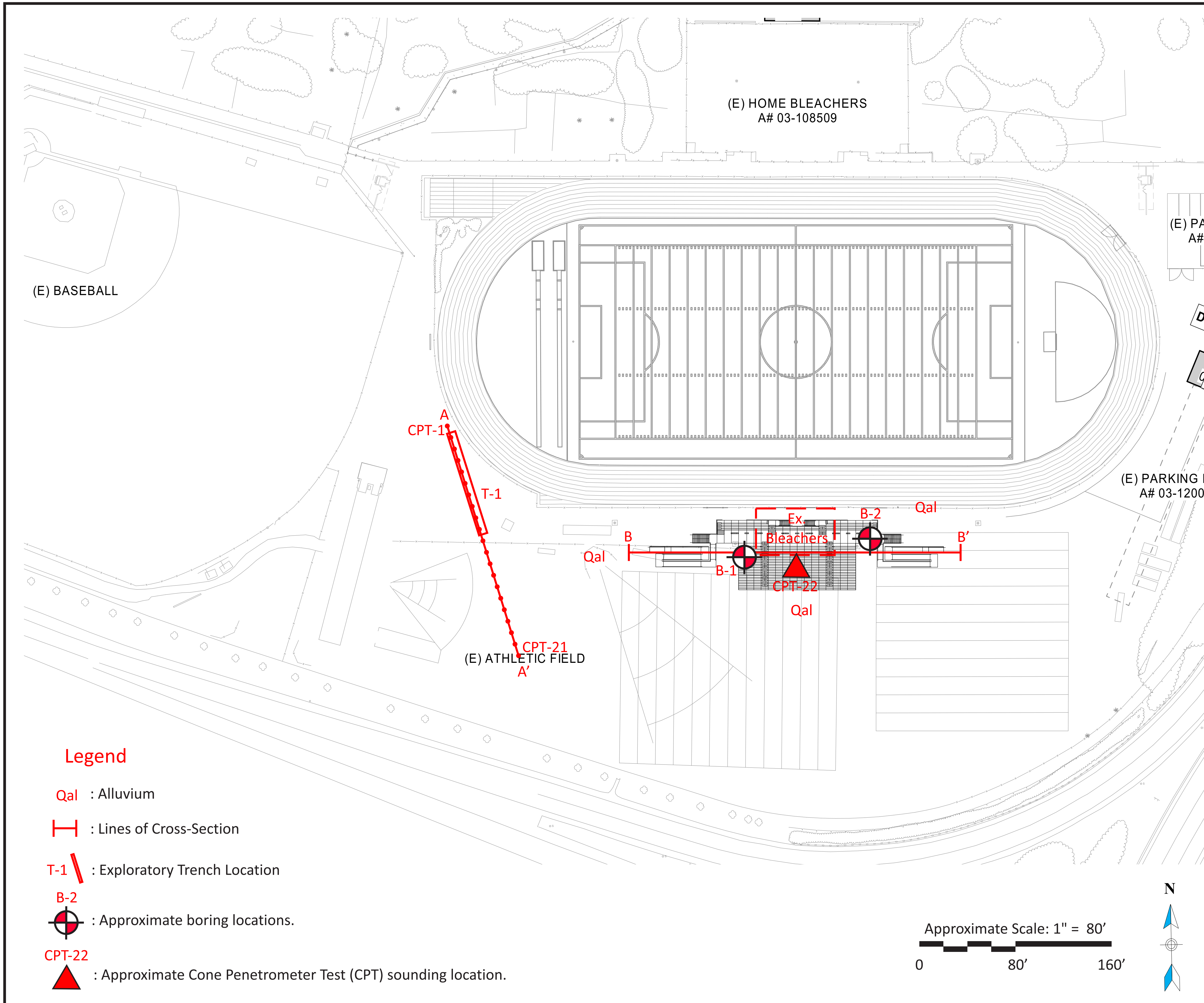
C. A trench was excavated in the area between CPT-4 and CPT-8 for the purpose of obtaining more information pertaining to the fault rupture hazard. The trench was 87 feet long and had a maximum depth of about 10 feet. Members of Earth Systems staff prepared the trench walls for observation and logging. A detailed log of the east wall of the trench was prepared, and is included within this Appendix. While the trench was open, a representative of the California Geological Survey visited the project site to observe the excavation walls with Earth Systems staff. Dr. Larry Gurrola helped log the trench and was also consulted to provide age dating estimates for the soils encountered.

D. Two borings were drilled within the proposed bleacher footprint to depths of 51.5 and 16.5 feet below the existing ground surface to observe the soil profile and to obtain samples for laboratory analysis. The borings were drilled on January 23, 2020, using an 8-inch diameter continuous flight hollow stem auger powered by a CME-75 truck mounted drilling rig owned and operated by 2R Drilling.

E. Samples were obtained within the test borings with a Modified California (M.C.) ring sampler (ASTM D 3550 with shoe similar to ASTM D 1586), and with a Standard Penetration Test (SPT) sampler (ASTM D 1586). The M.C. sampler has a 3-inch outside diameter, and a 2.42-inch inside diameter when used with brass ring liners (as it was during this study). The SPT sampler has a 2.00-inch outside diameter and a 1.37-inch inside diameter, but when used without liners, as was done for this project, the inside diameter is 1.63 inches. The samples were obtained from the borings by driving the sampler with an automatic trip hammer dropping 30 inches in accordance with ASTM D 1586.

F. Bulk samples of the soils encountered were gathered from the upper 5 feet of cuttings in Borings B-1 and B-2.

G. The final logs of the borings represent interpretations of the contents of the field logs and the results of laboratory testing performed on the samples obtained during the subsurface study. The final boring logs and the logs and interpretations of the CPT soundings are included in this Appendix. The locations of the borings and CPT-22 were determined in the field by pacing and sighting, and are shown on the Geologic Map in this Appendix.

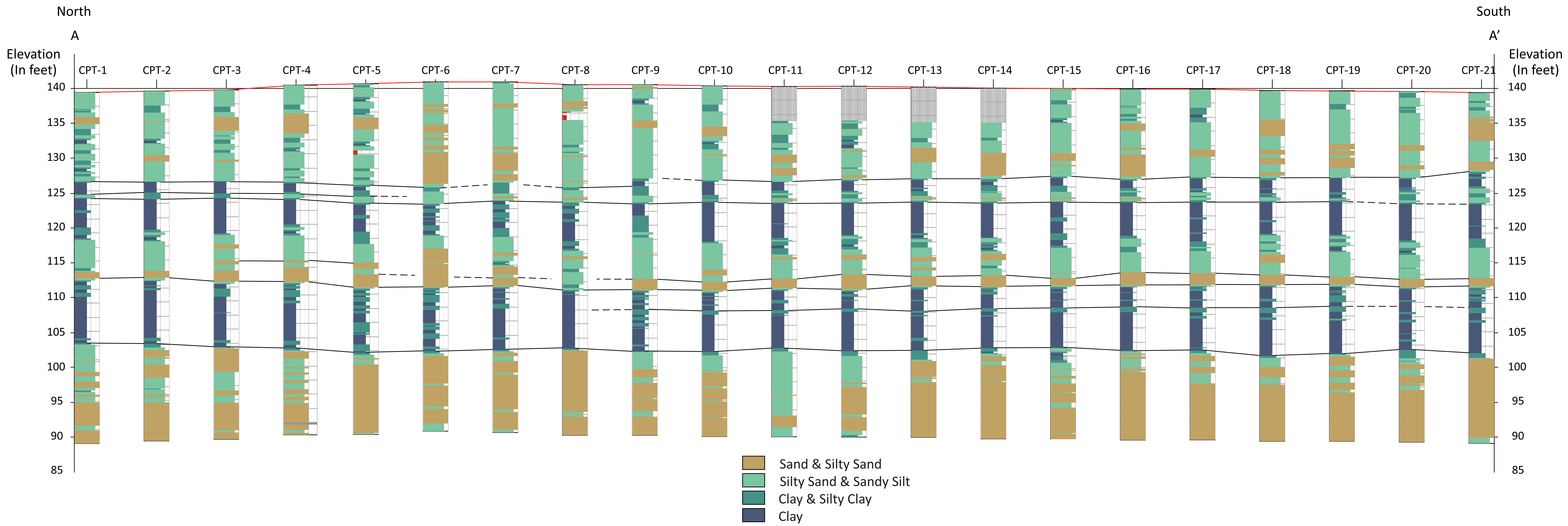


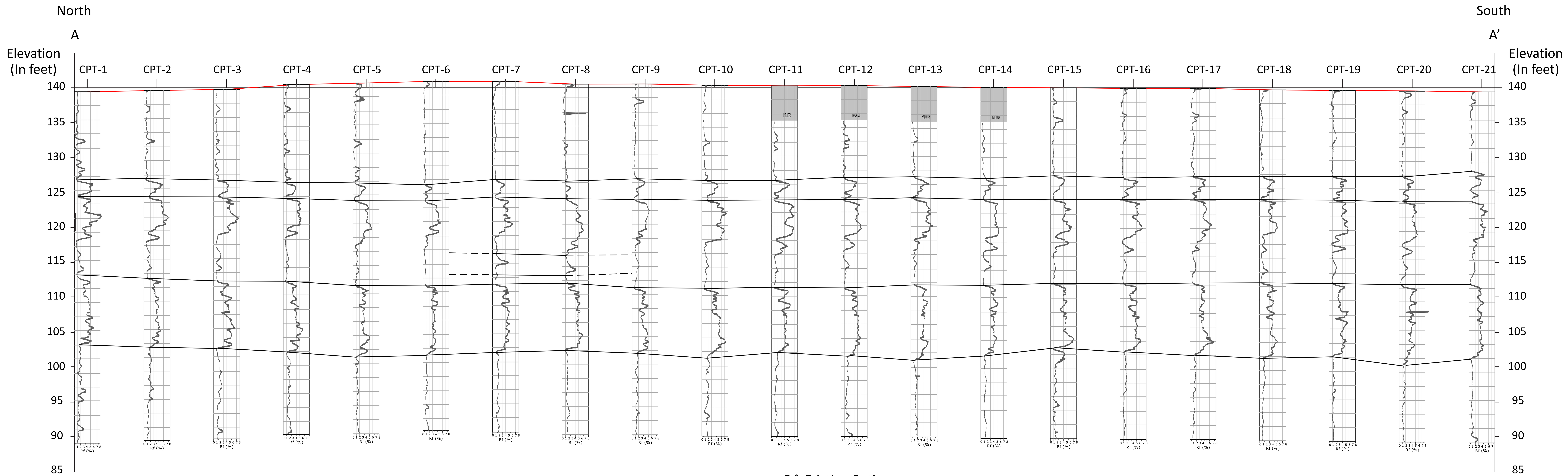
GEOLOGIC MAP

Adolfo Camarillo High School
Camarillo, California

Earth Systems

April 2020	303275-003





Rf: Friction Ratio

Scale: 1" = 5'

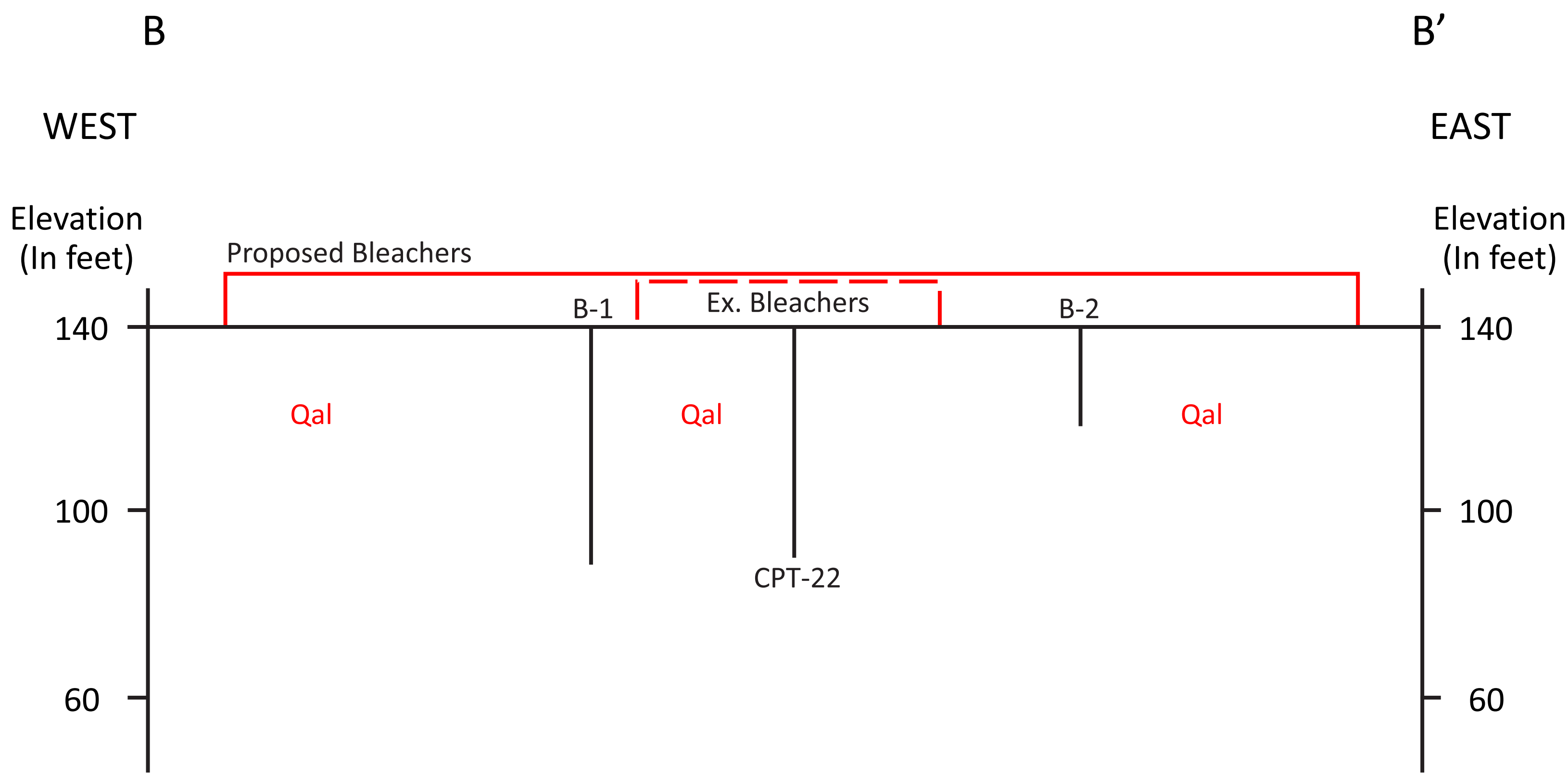
0 5' 10' 15' 20'

CPT PROFILE SECTION

Camarillo High School Visitors Bleachers
Camarillo, California

Earth Systems

March 2020 | 303275-003



Qal : Alluvium

B-2 : Approximate Boring Locations

CPT-22 : Approximate CPT Location

Approximate Scale: 1" = 40’

0 40’ 80’

GEOLOGIC CROSS-SECTION A-A’

Camarillo High School Visitors Bleachers
Camarillo, California

Earth Systems

April 2020 | 303275-003

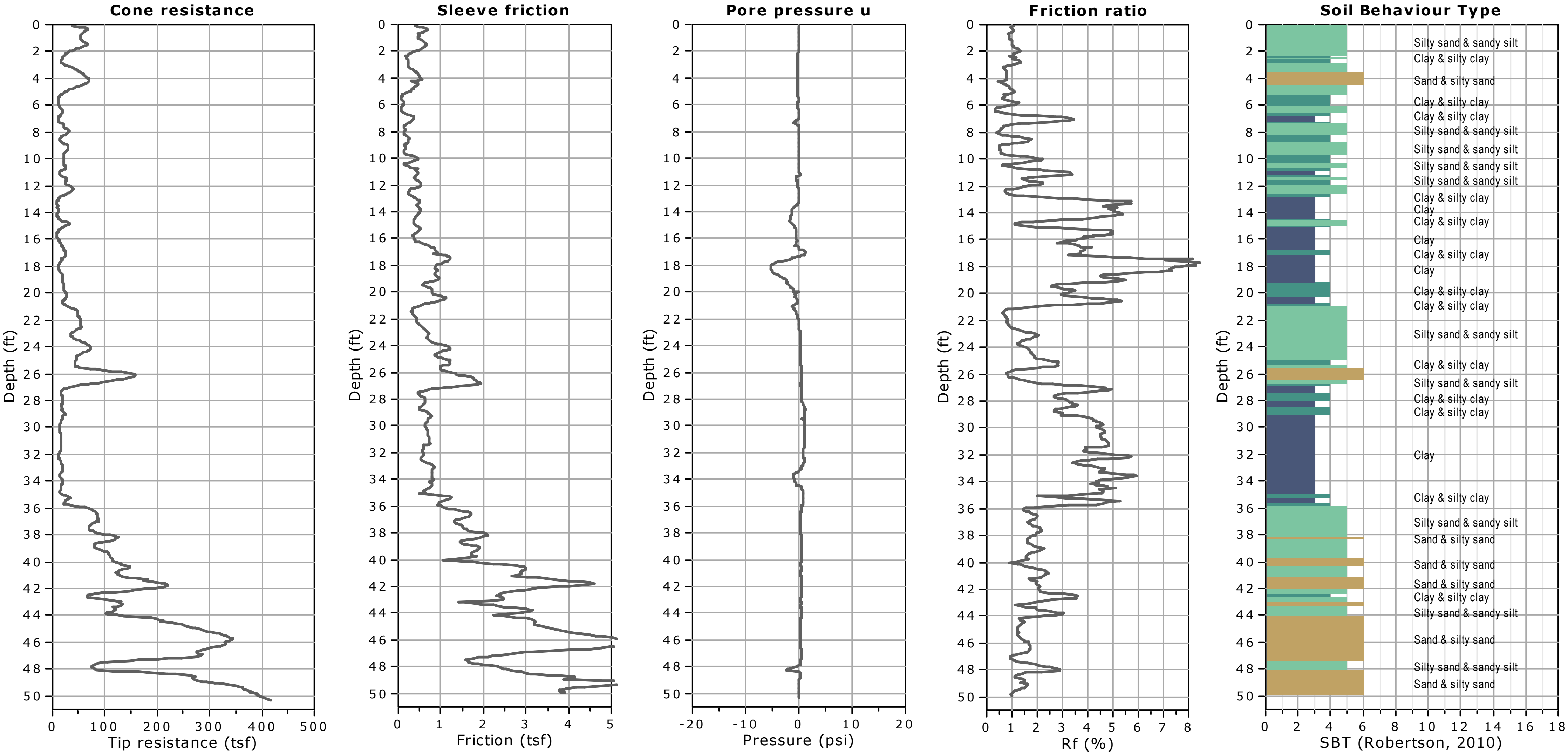
Kehoe Testing and Engineering
714-901-7270
steve@kehoetesting.com
www.kehoetesting.com

Project: Earth Systems / Adolfo Camarillo High School

Location: Camarillo, CA

CPT-1

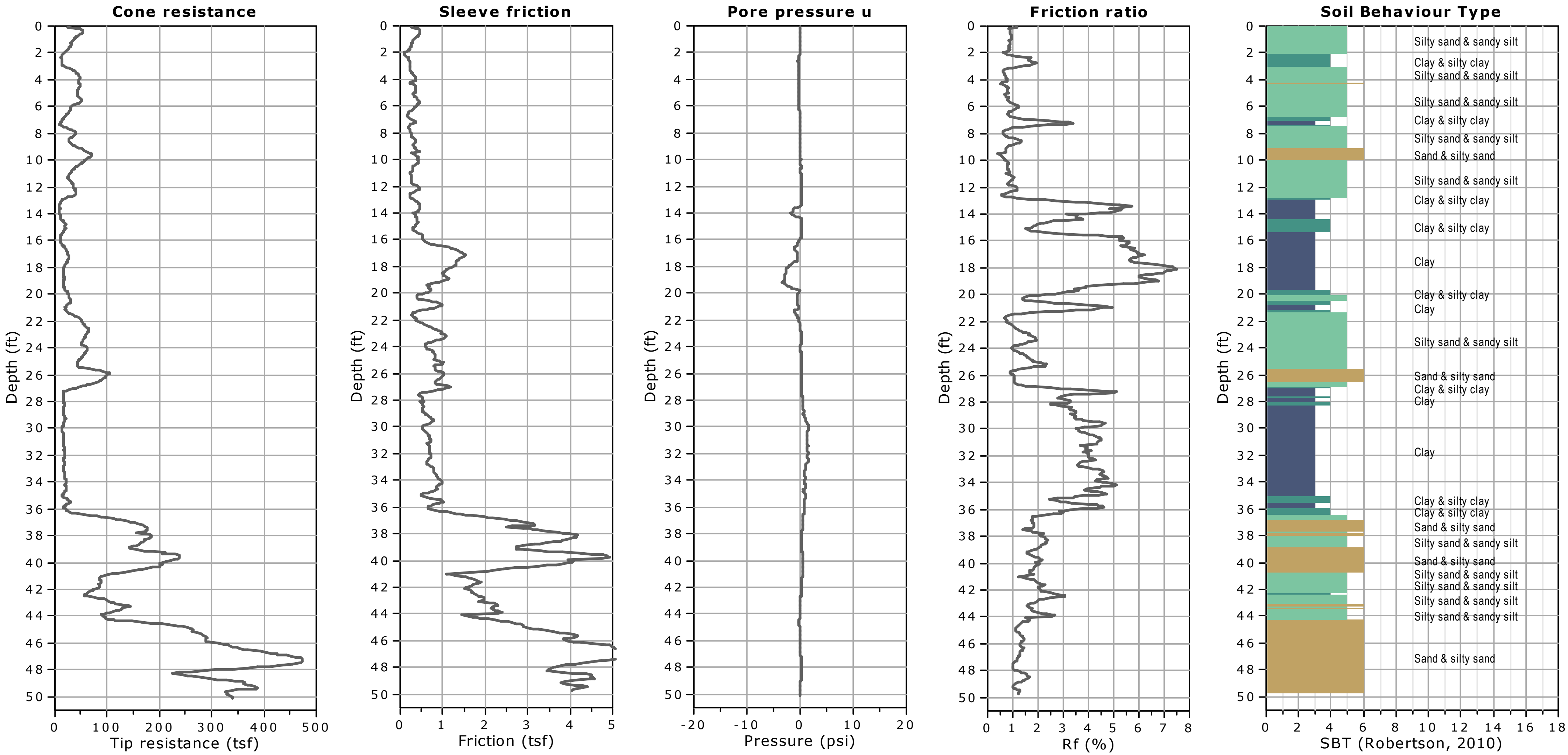
Total depth: 50.34 ft, Date: 2/6/2020



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

Project: Earth Systems / Adolfo Camarillo High School
Location: Camarillo, CA

CPT-2
Total depth: 50.16 ft, Date: 2/6/2020



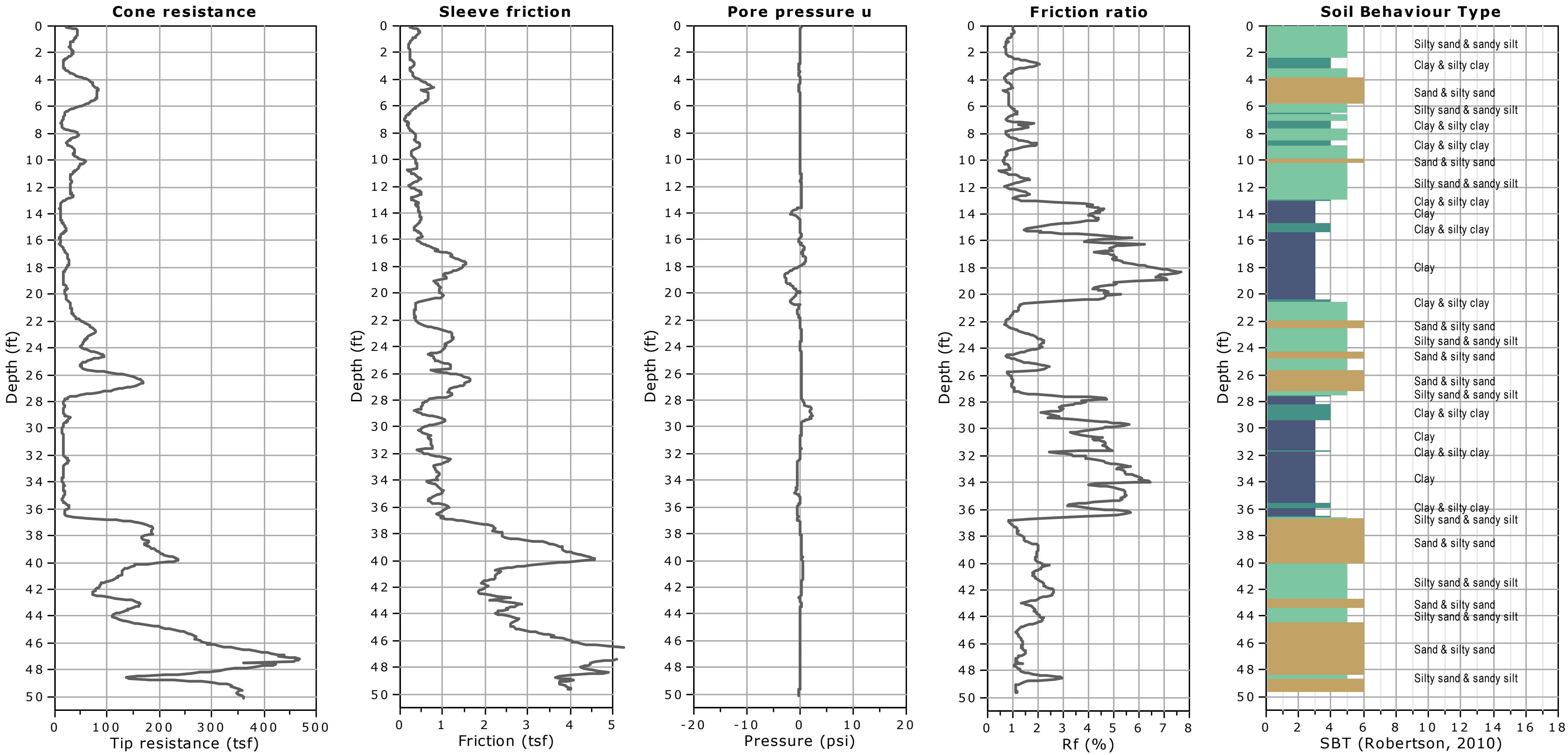
Kehoe Testing and Engineering
714-901-7270
steve@kehoetesting.com
www.kehoetesting.com

Project: Earth Systems / Adolfo Camarillo High School

Location: Camarillo, CA

CPT-3

Total depth: 50.09 ft, Date: 2/6/2020



Kehoe Testing and Engineering
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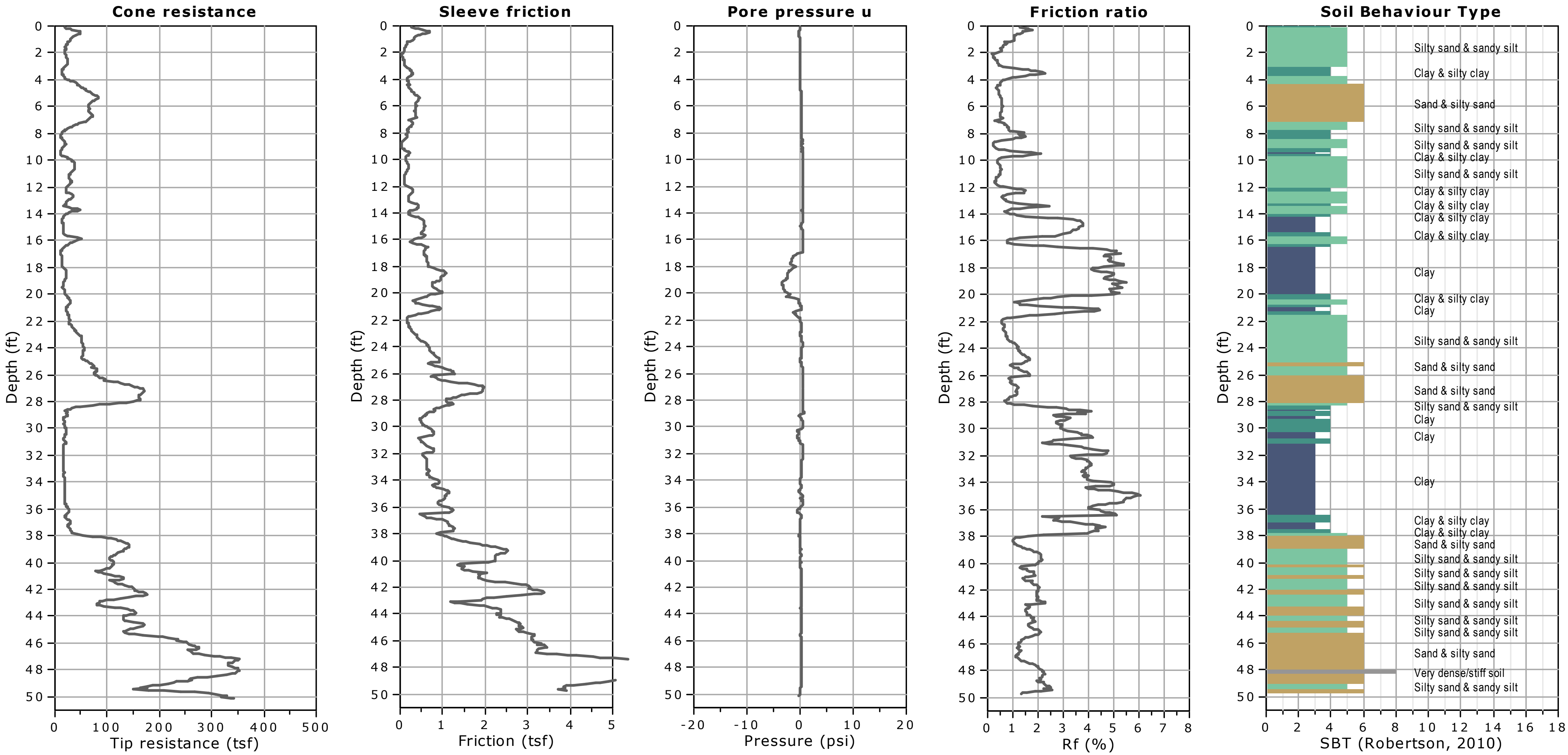
Project: Earth Systems / Adolfo Camarillo High School
Location: Camarillo, CA

CPT-4
Total depth: 50.13 ft, Date: 2/6/2020



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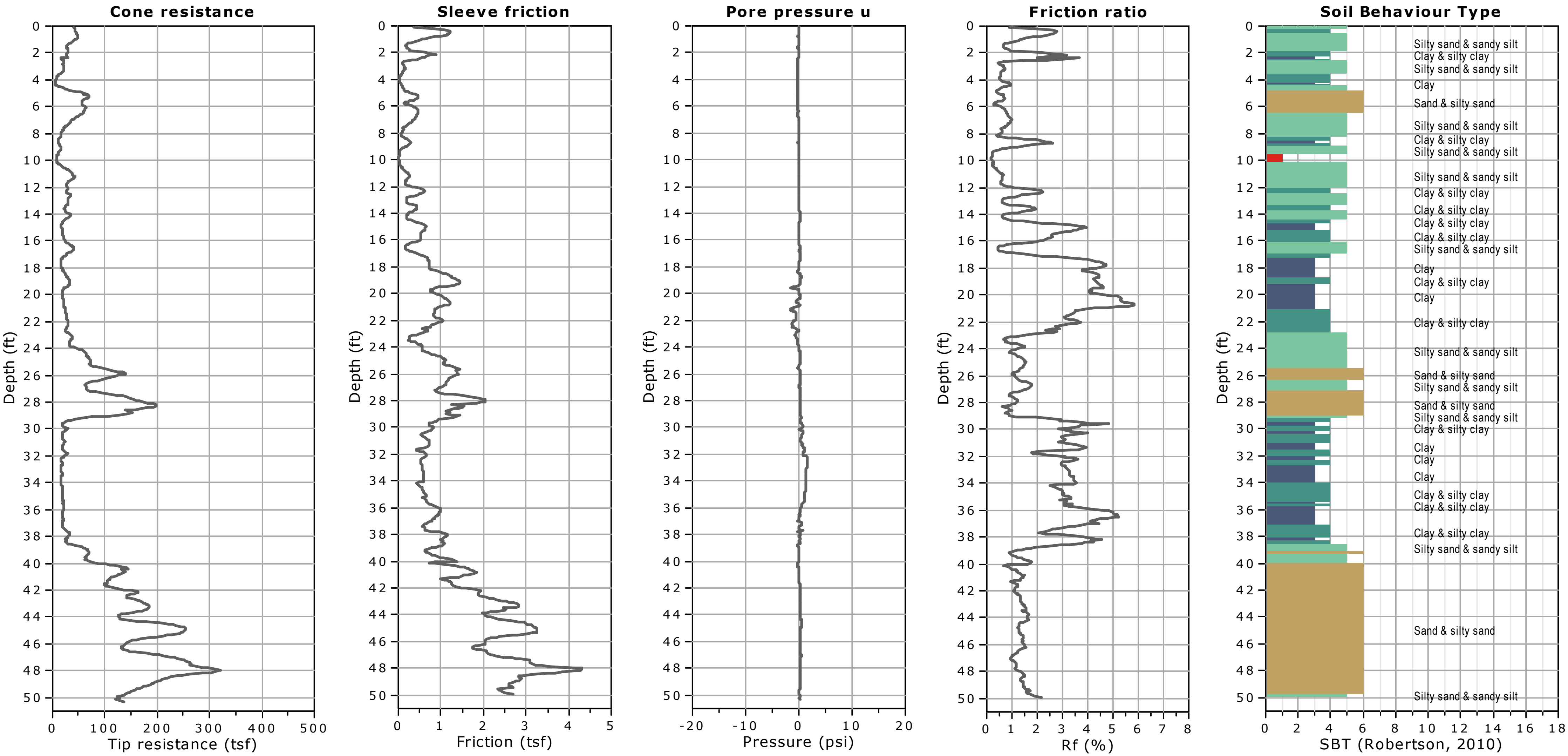
714-901-7270
steve@kehoetesting.com
www.kehoetesting.com

Project: **Earth Systems / Adolfo Camarillo High School**
Location: **Camarillo, CA**

CPT-5
Total depth: 50.28 ft, Date: 2/6/2020



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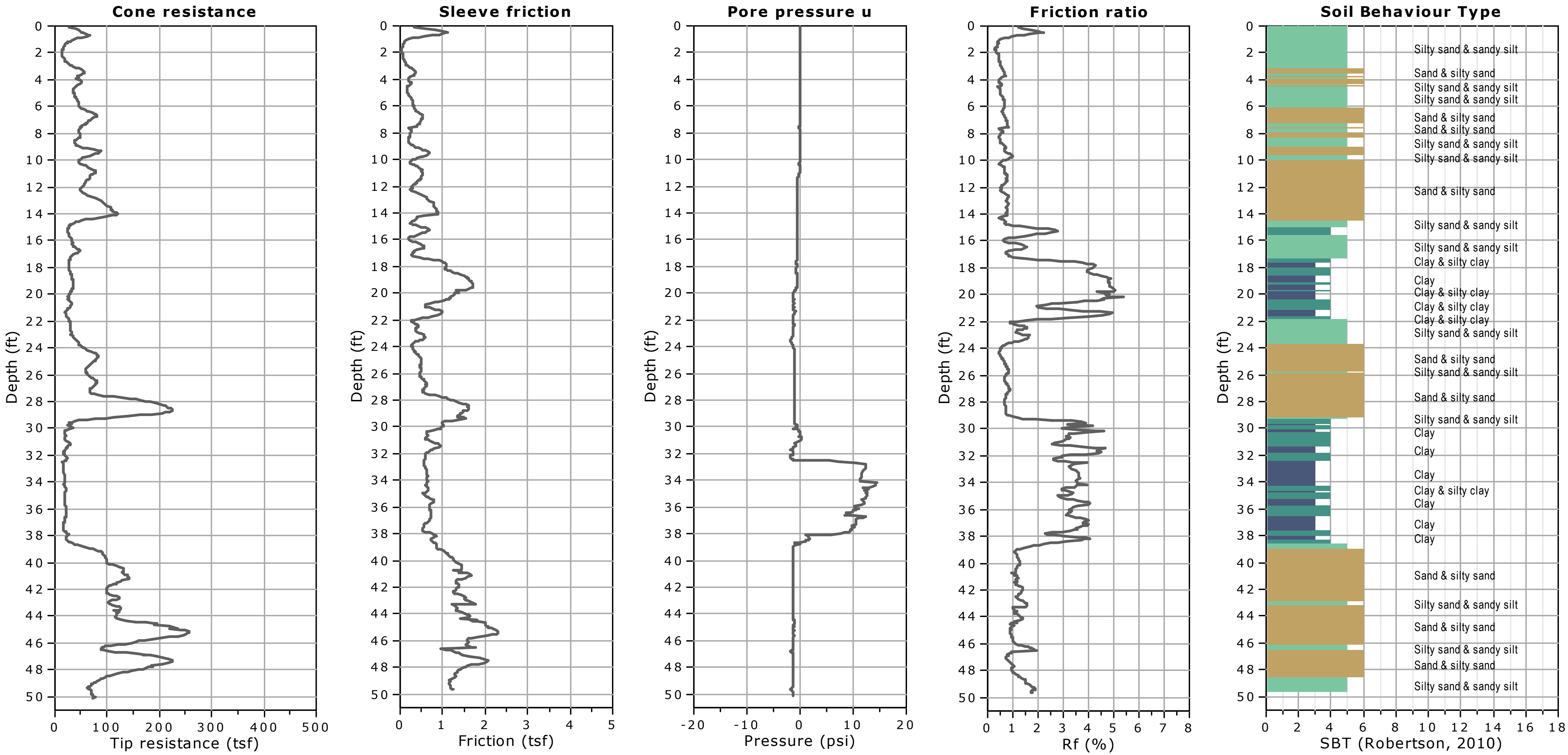
714-901-7270
steve@kehoetesting.com
www.kehoetesting.com

Project: Earth Systems / Adolfo Camarillo High School

Location: Camarillo, CA

CPT-6

Total depth: 50.08 ft, Date: 2/6/2020



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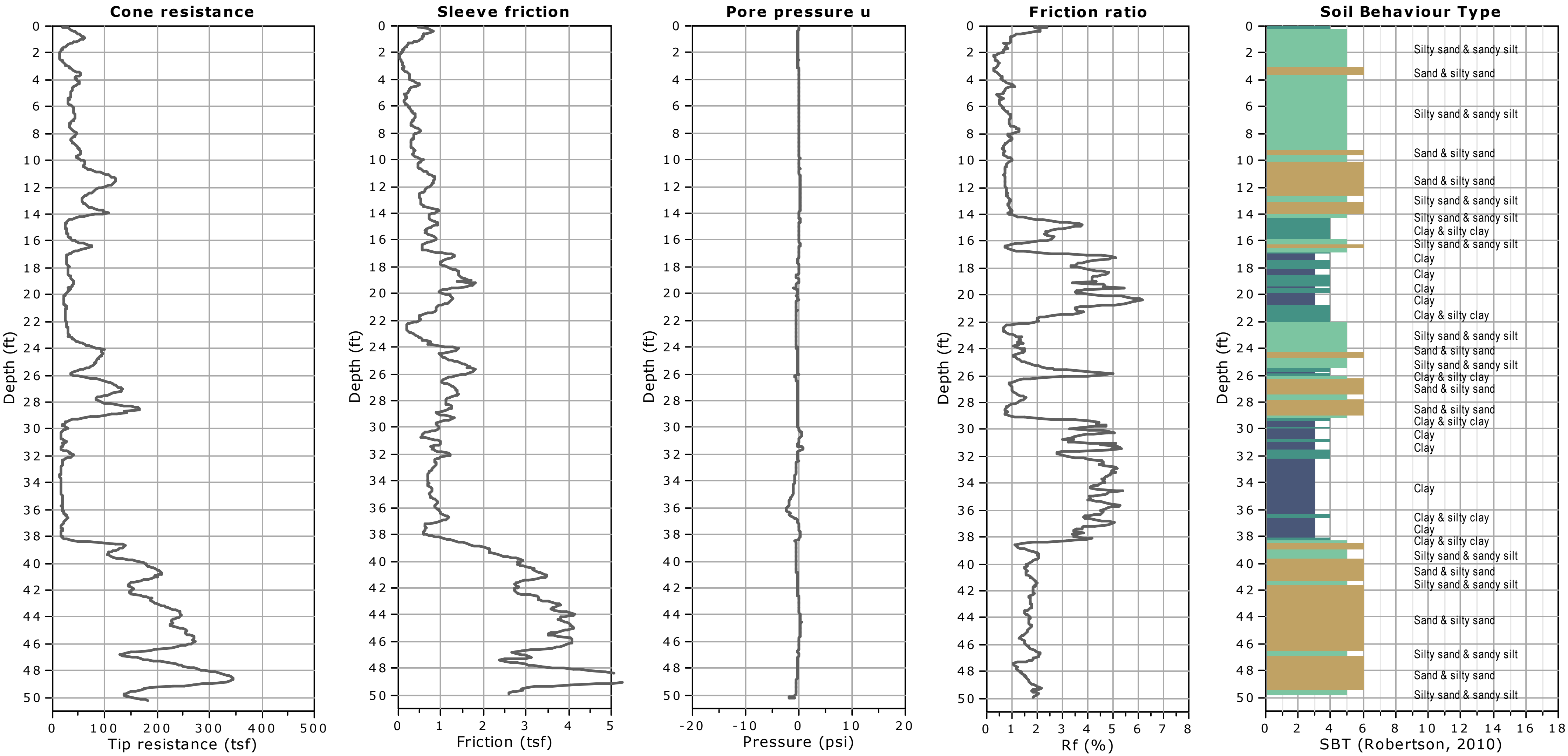
Project: **Earth Systems / Adolfo Camarillo High School** | **CPT-7**
Location: **Camarillo, CA** | Total depth: 50.27 ft, Date: 2/5/2020



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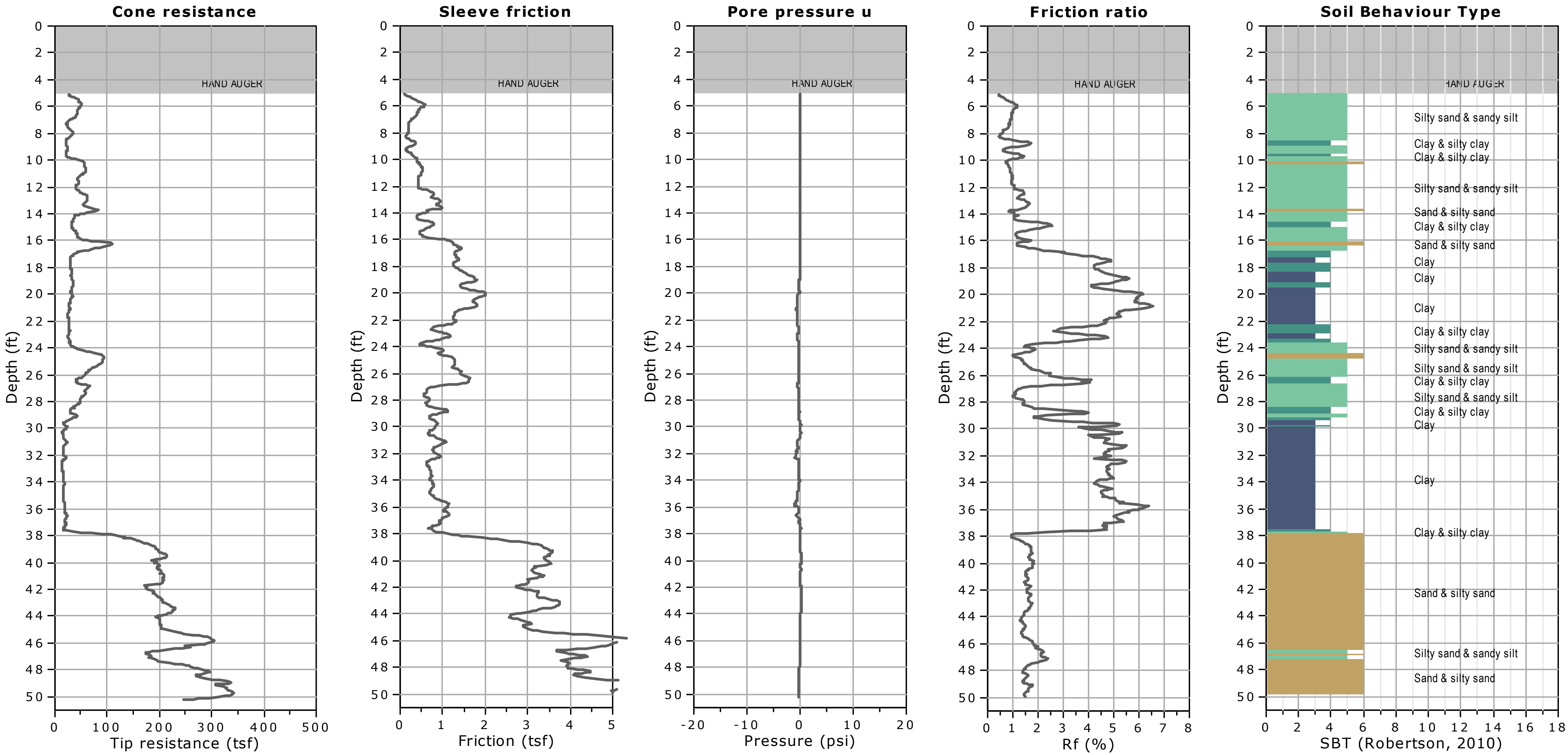
Project: Earth Systems / Adolfo Camarillo High School
Location: Camarillo, CA

CPT-8A
Total depth: 50.26 ft, Date: 2/5/2020



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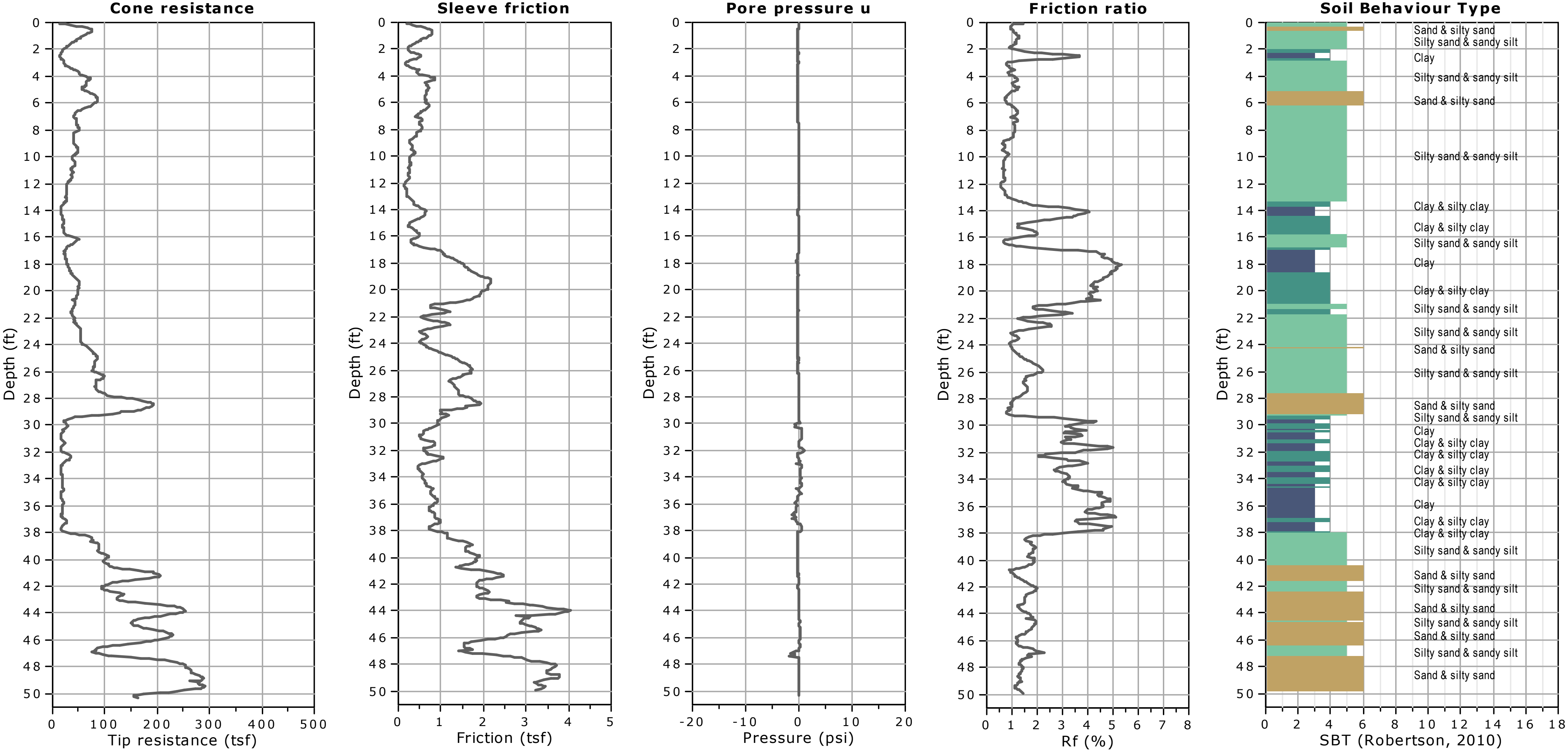
Project: Earth Systems / Adolfo Camarillo High School

Location: Camarillo, CA

CPT-9

Total depth: 50.28 ft, Date: 2/5/2020



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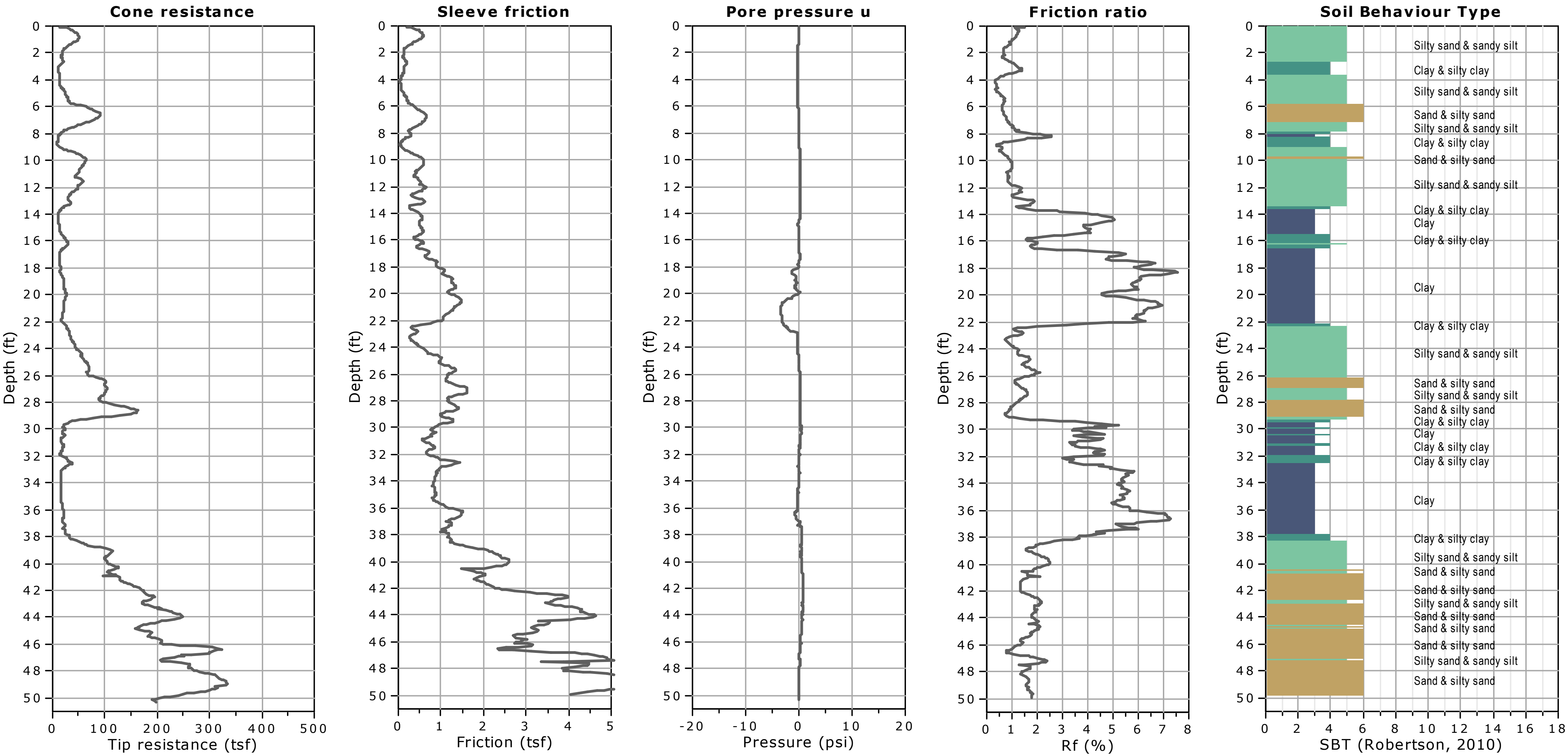
Project: Earth Systems / Adolfo Camarillo High School

Location: Camarillo, CA

CPT-10

Total depth: 50.27 ft, Date: 2/5/2020



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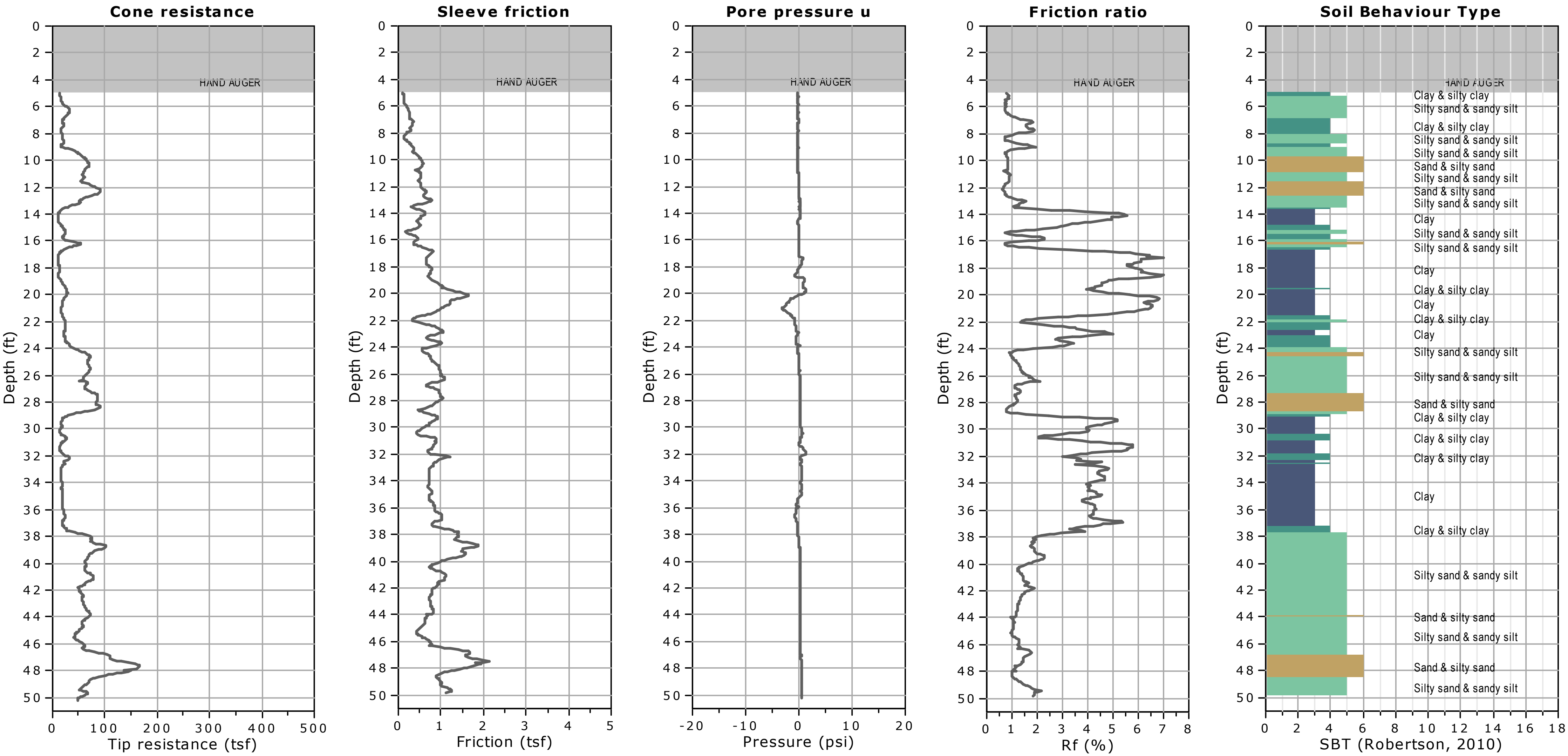
Project: Earth Systems / Adolfo Camarillo High School
Location: Camarillo, CA

CPT-11
Total depth: 50.22 ft, Date: 2/5/2020



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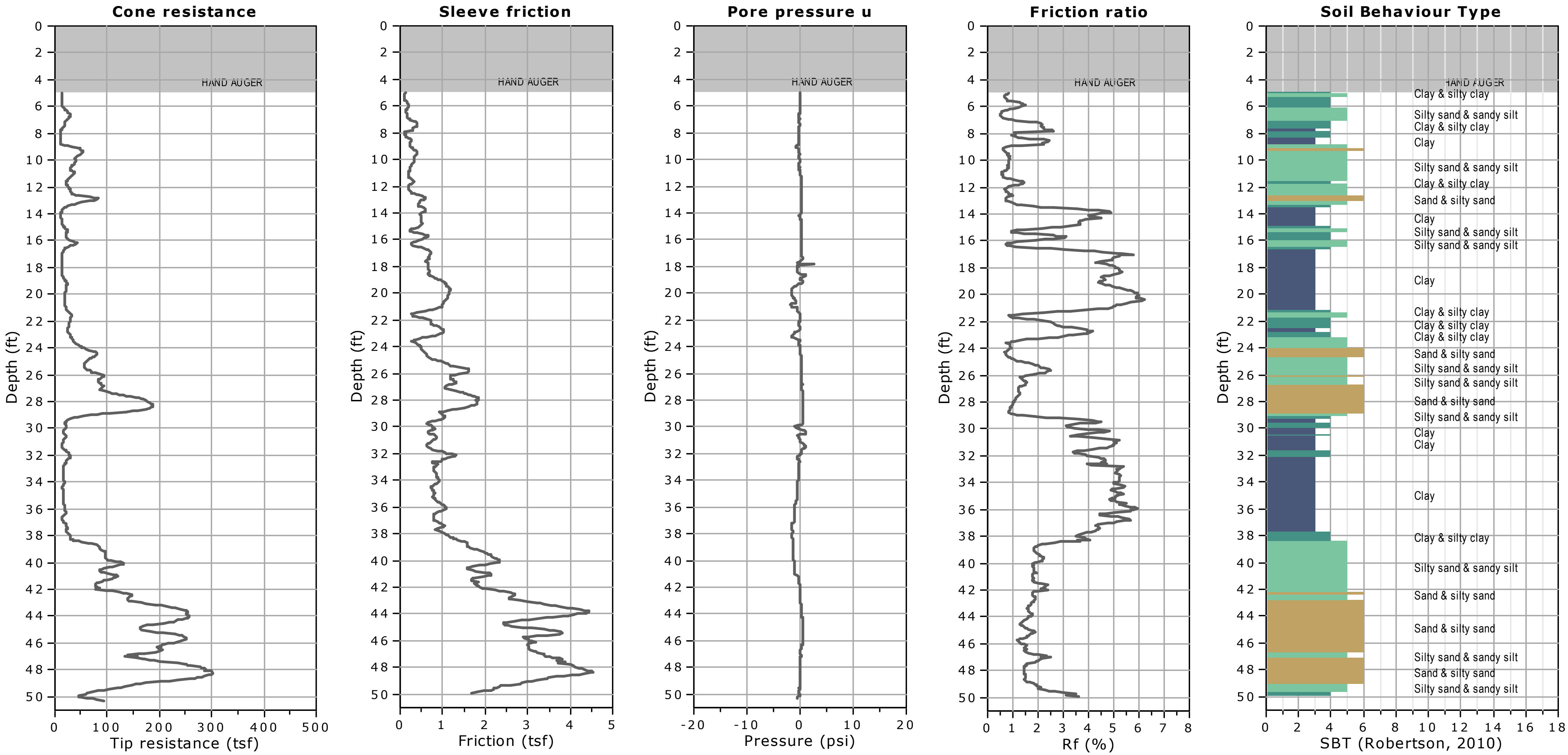
Project: Earth Systems / Adolfo Camarillo High School

Location: Camarillo, CA

CPT-12

Total depth: 50.30 ft, Date: 2/5/2020



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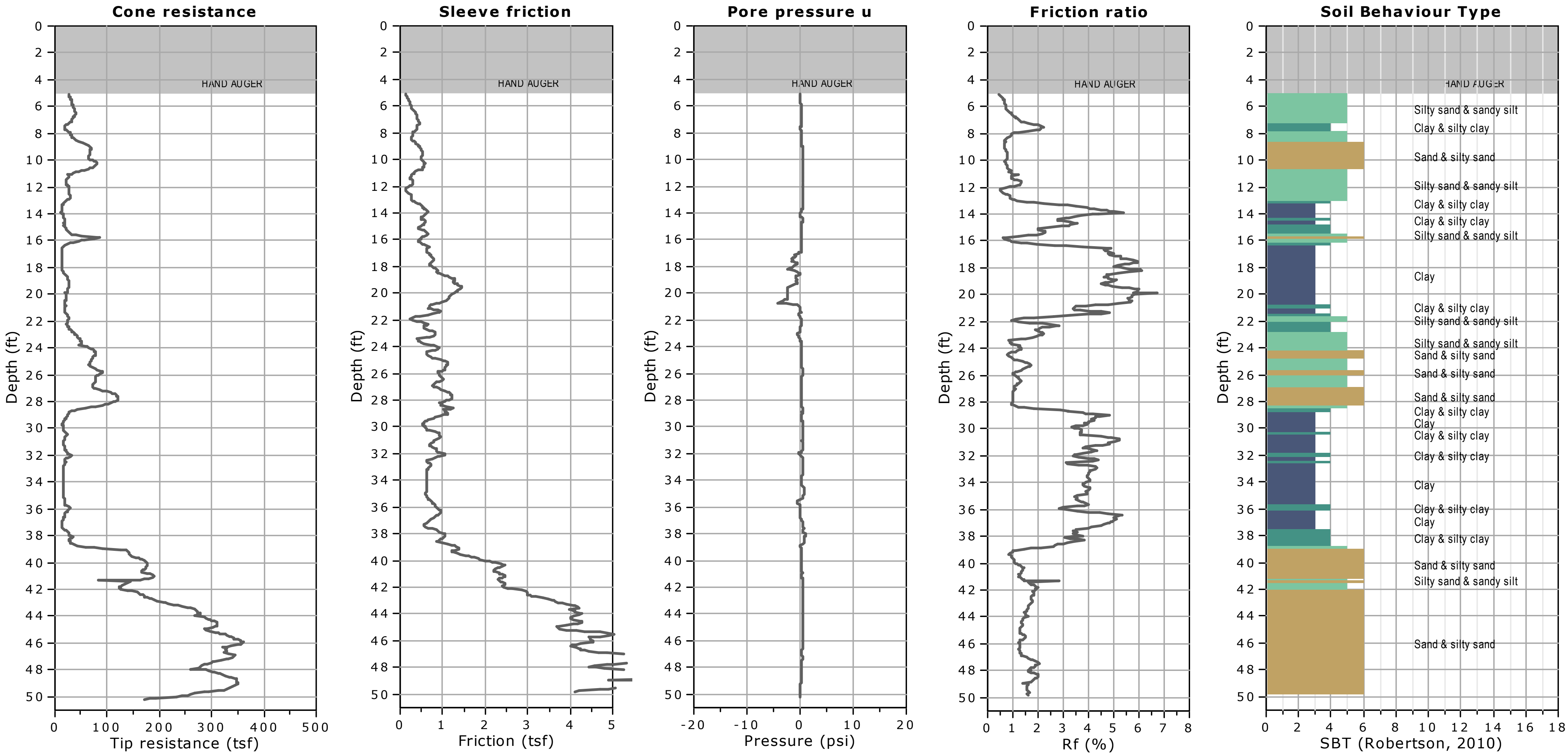
Project: Earth Systems / Adolfo Camarillo High School
Location: Camarillo, CA

CPT-13
Total depth: 50.22 ft, Date: 2/5/2020



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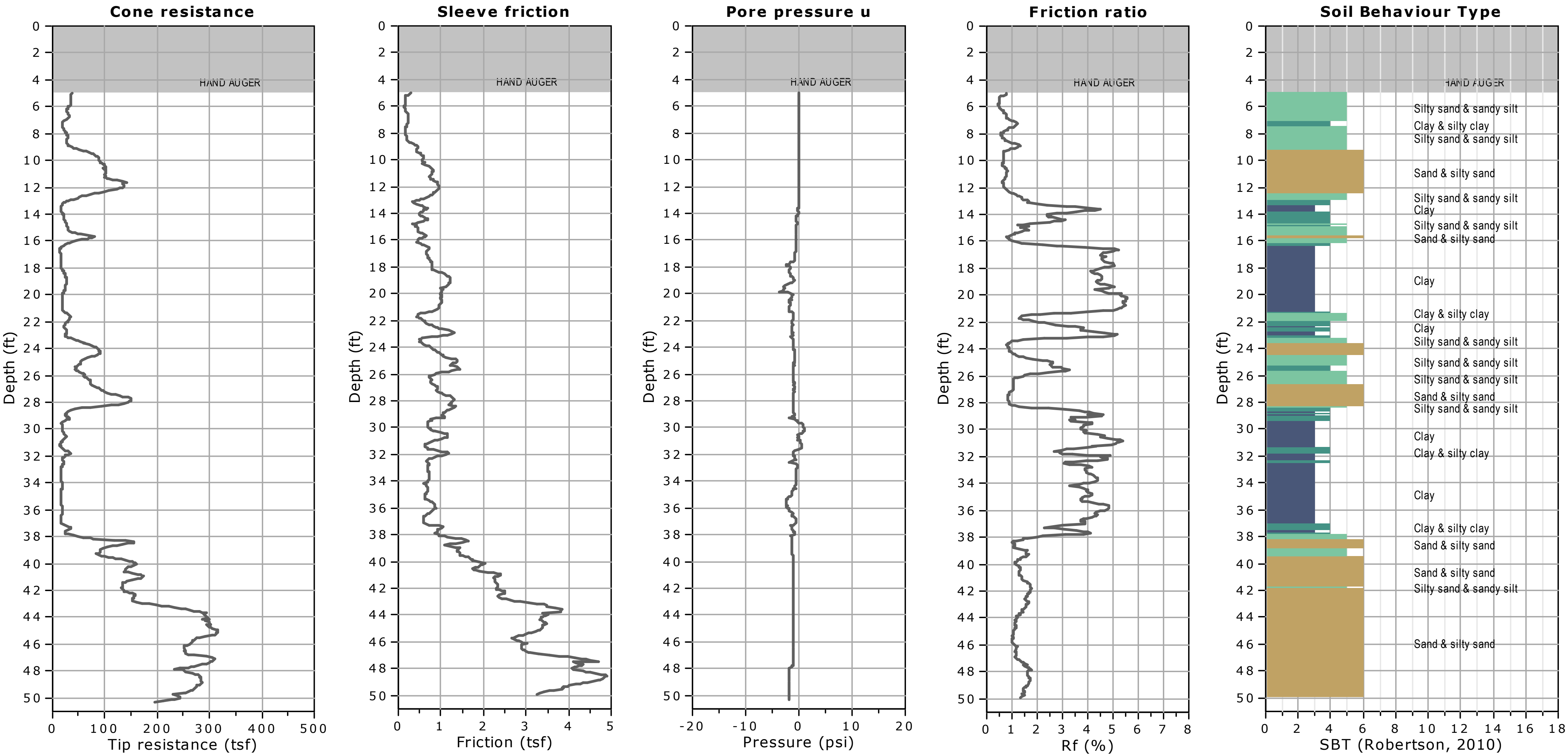
Project: Earth Systems / Adolfo Camarillo High School

Location: Camarillo, CA

CPT-14

Total depth: 50.28 ft, Date: 2/5/2020



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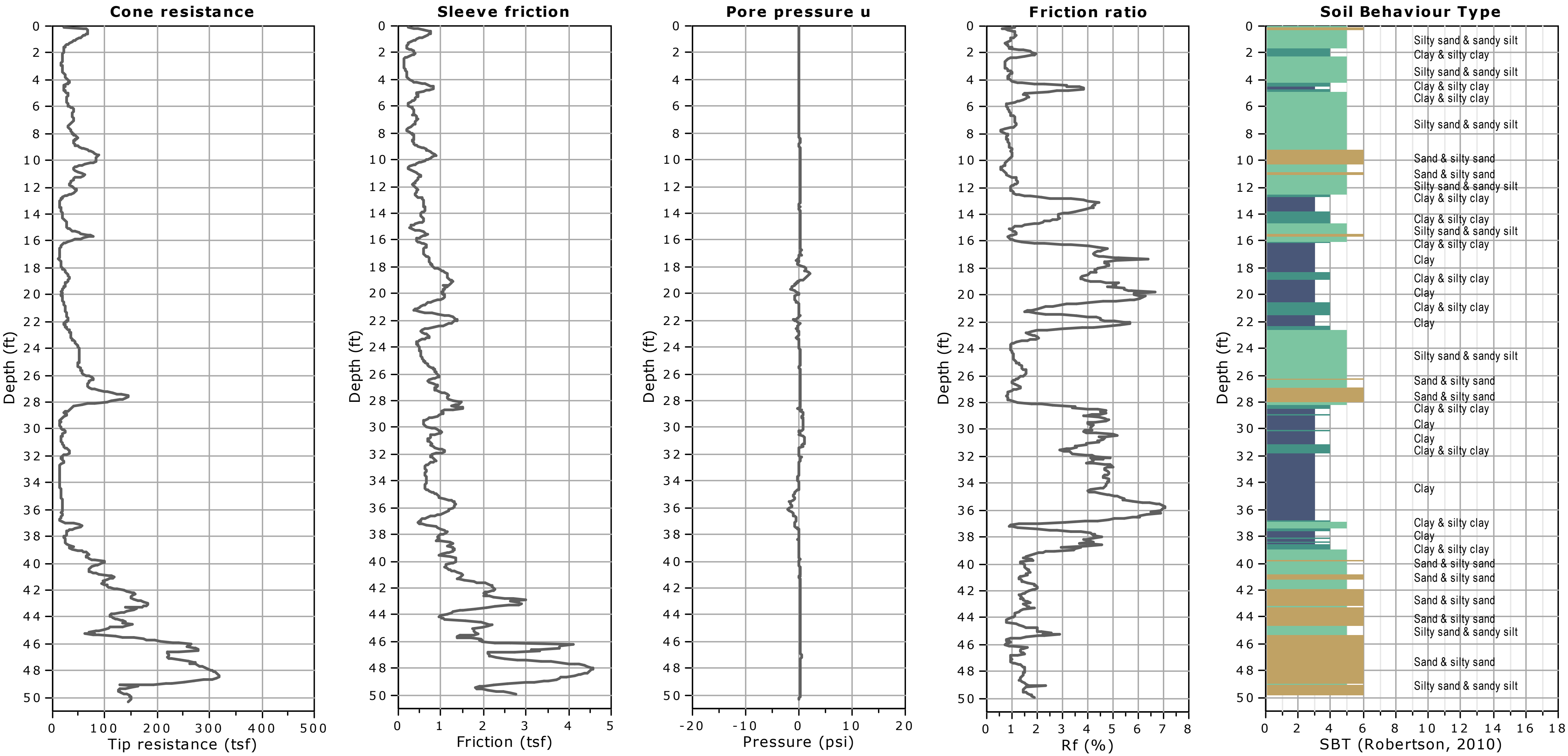
Project: Earth Systems / Adolfo Camarillo High School
Location: Camarillo, CA

CPT-15
Total depth: 50.29 ft, Date: 2/4/2020



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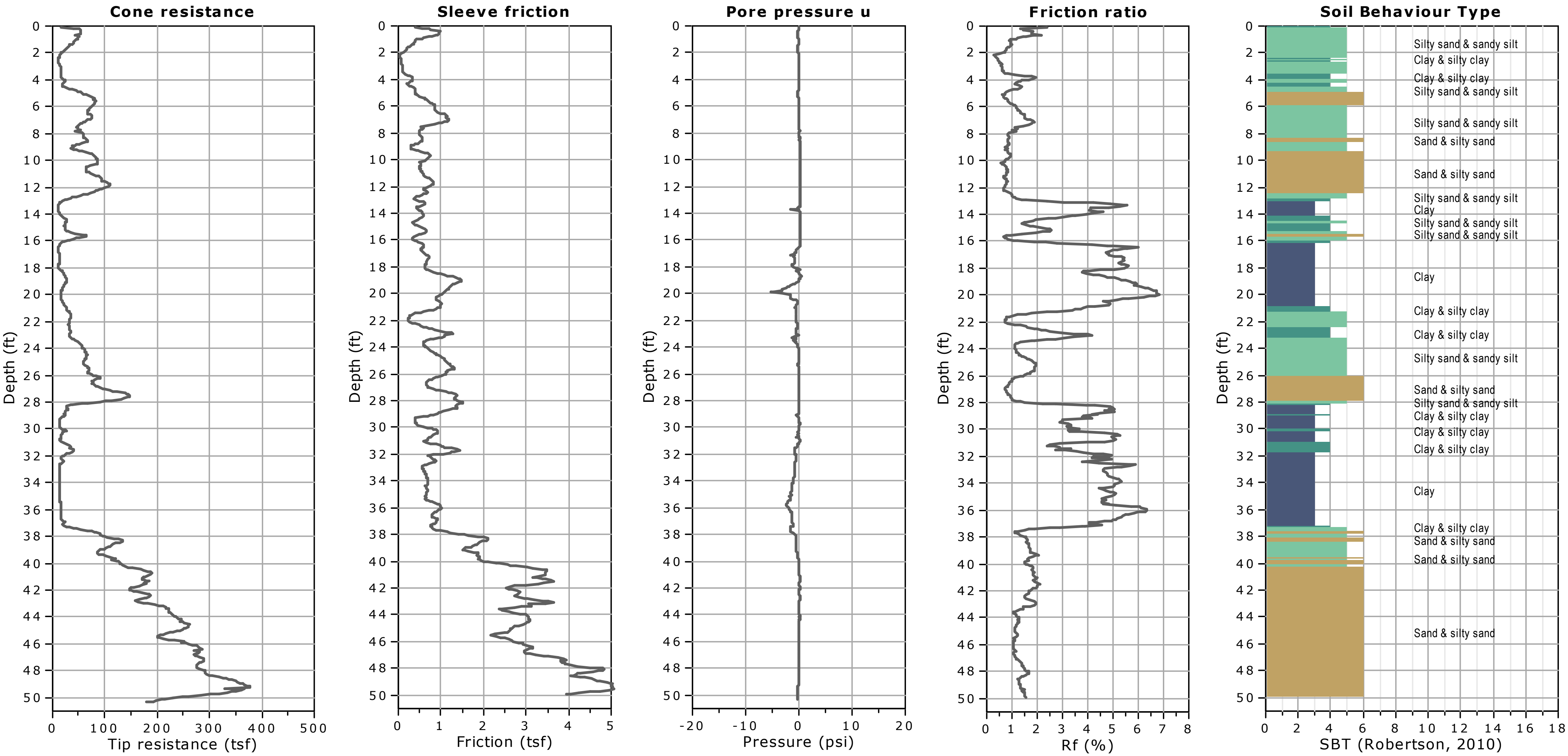
Project: **Earth Systems / Adolfo Camarillo High School**
Location: **Camarillo, CA**

CPT-16
Total depth: 50.33 ft, Date: 2/4/2020



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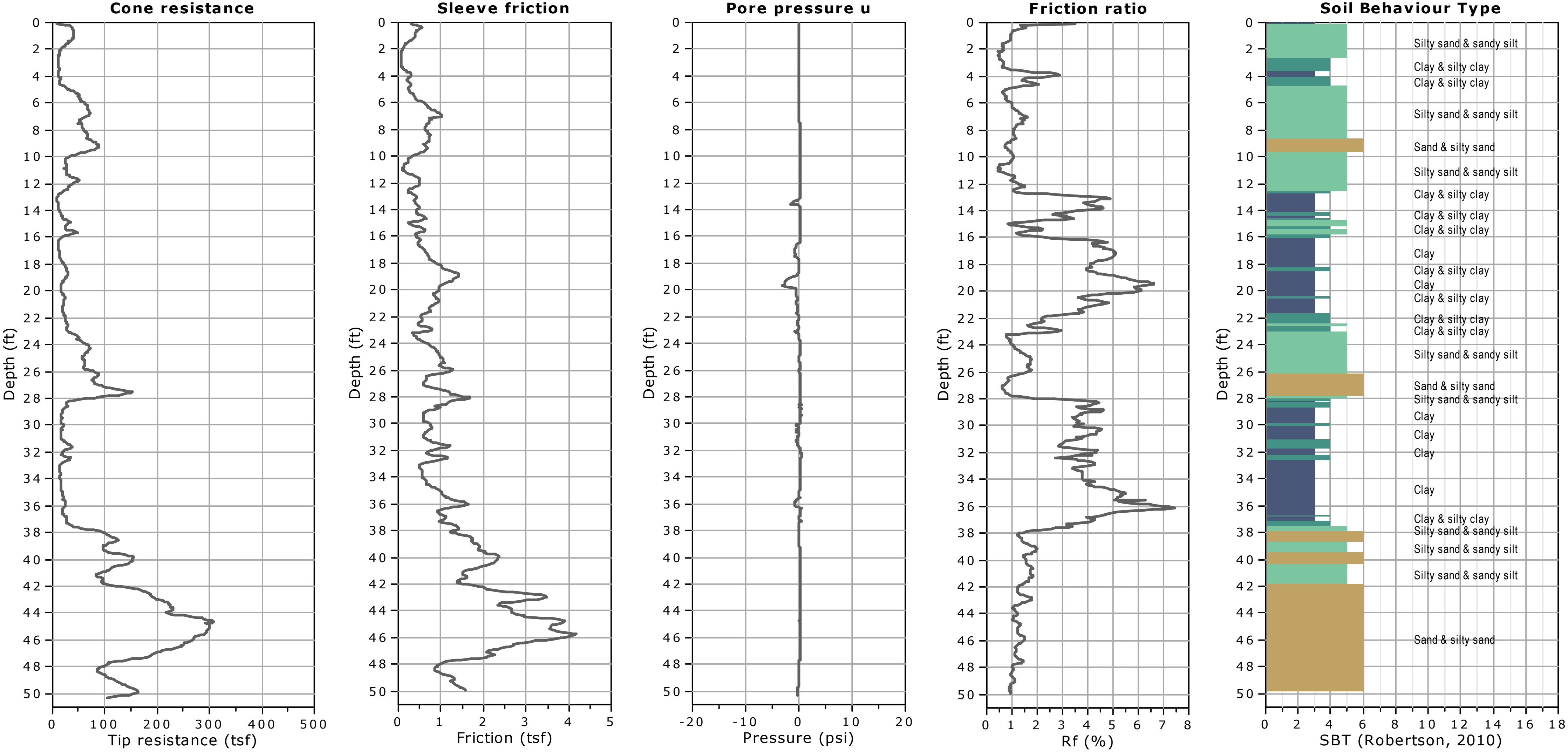
Project: Earth Systems / Adolfo Camarillo High School
Location: Camarillo, CA

CPT-17
Total depth: 50.30 ft, Date: 2/4/2020



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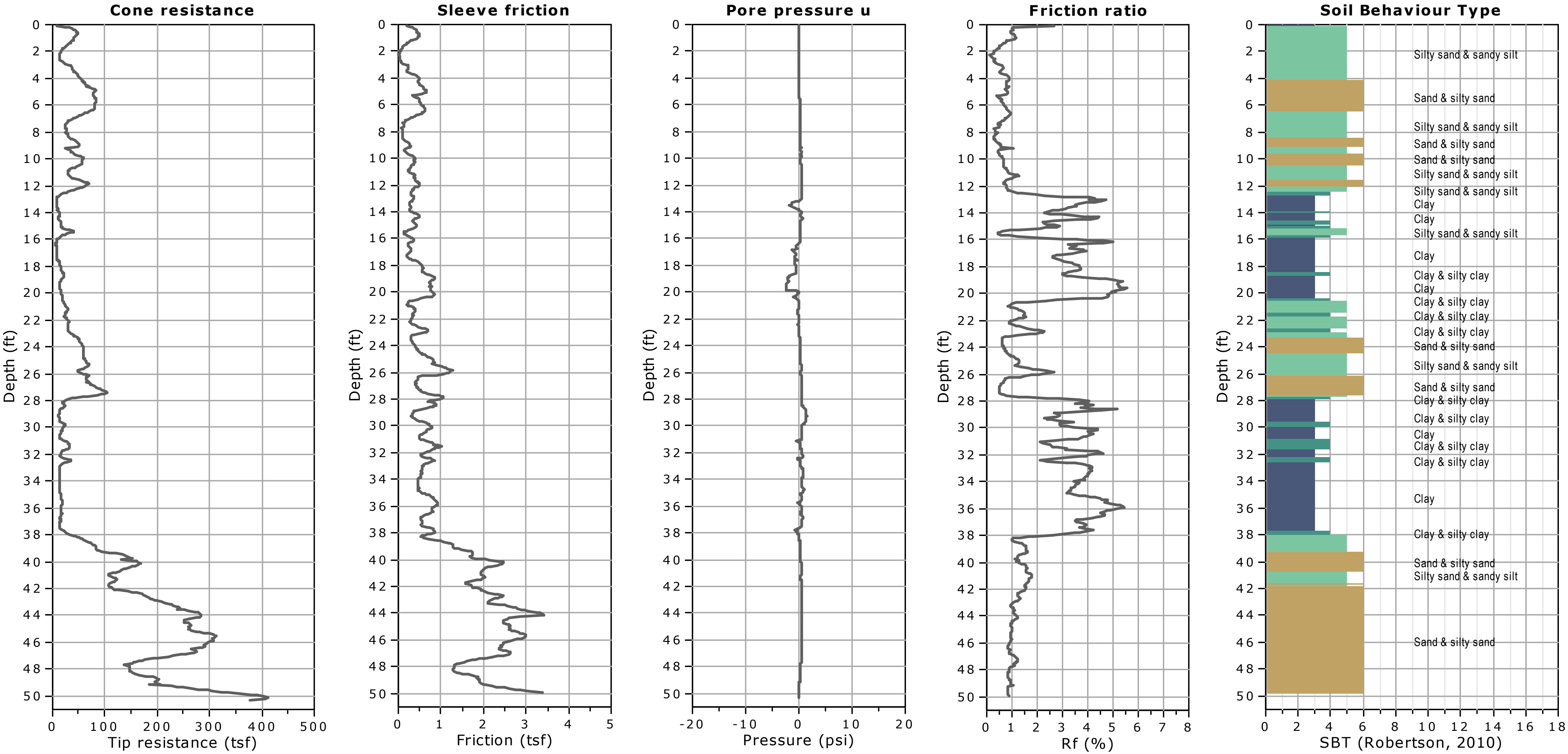
Project: Earth Systems / Adolfo Camarillo High School

Location: Camarillo, CA

CPT-18

Total depth: 50.29 ft, Date: 2/4/2020



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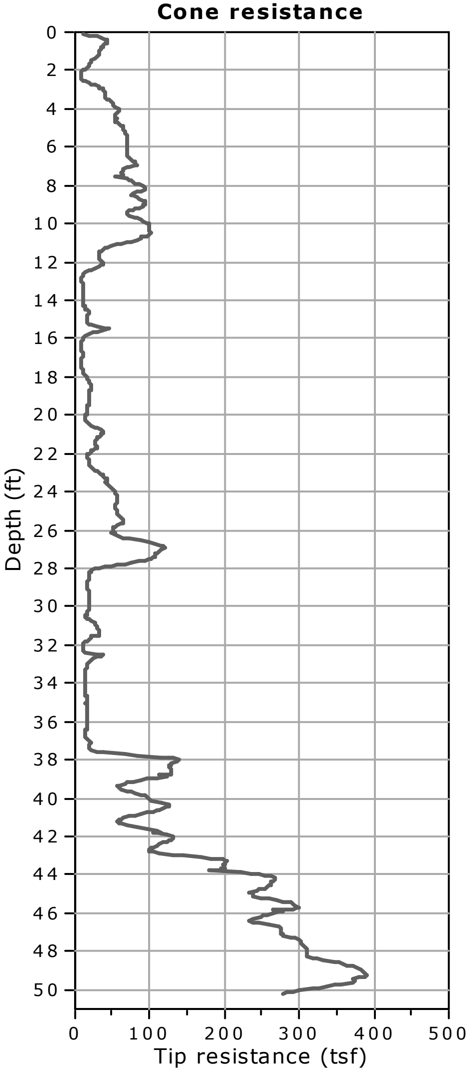
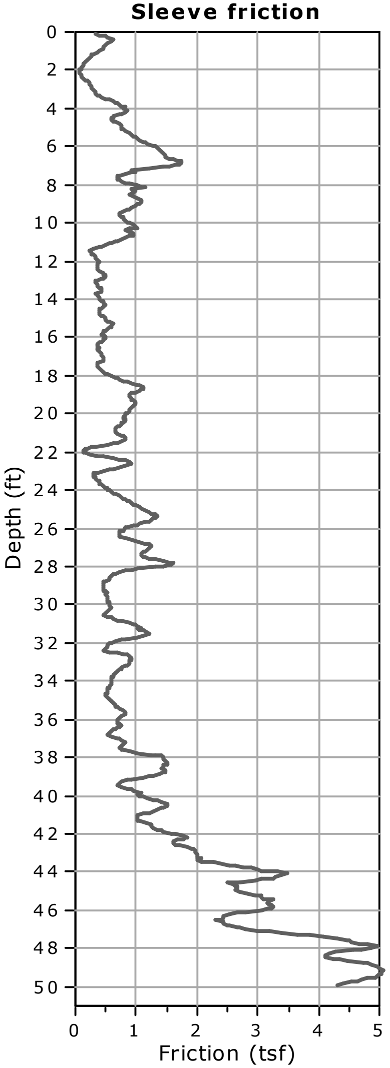
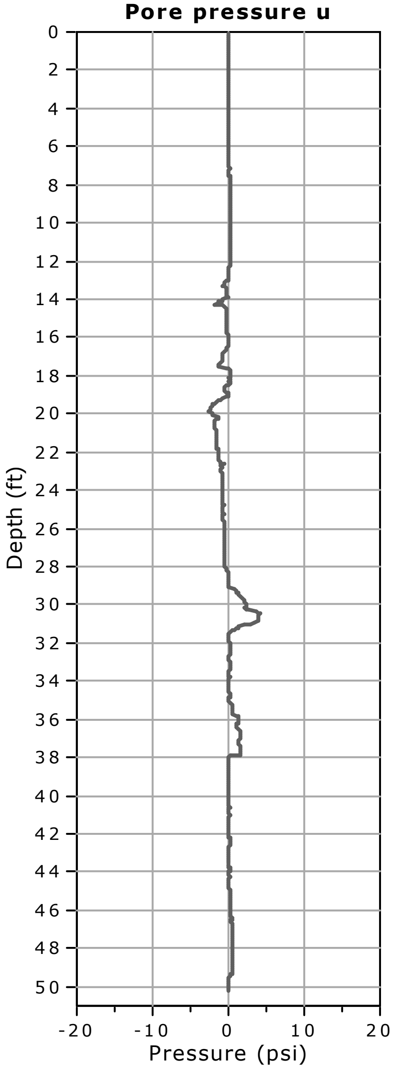
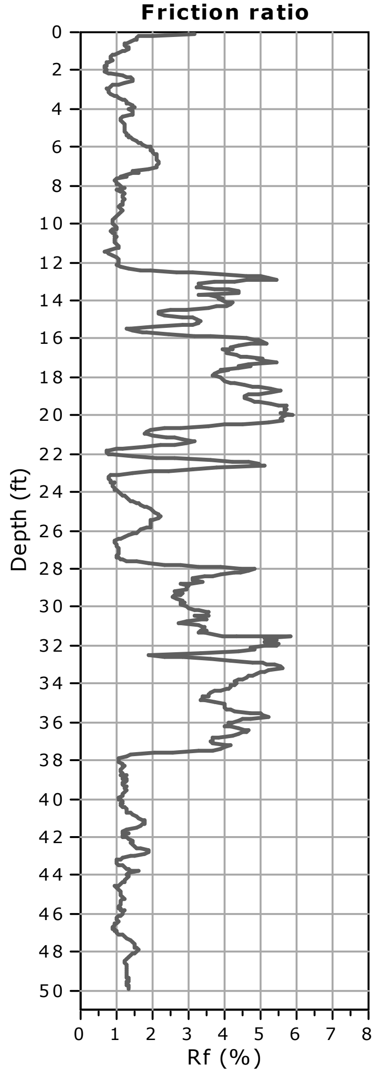
Project: Earth Systems / Adolfo Camarillo High School
Location: Camarillo, CA

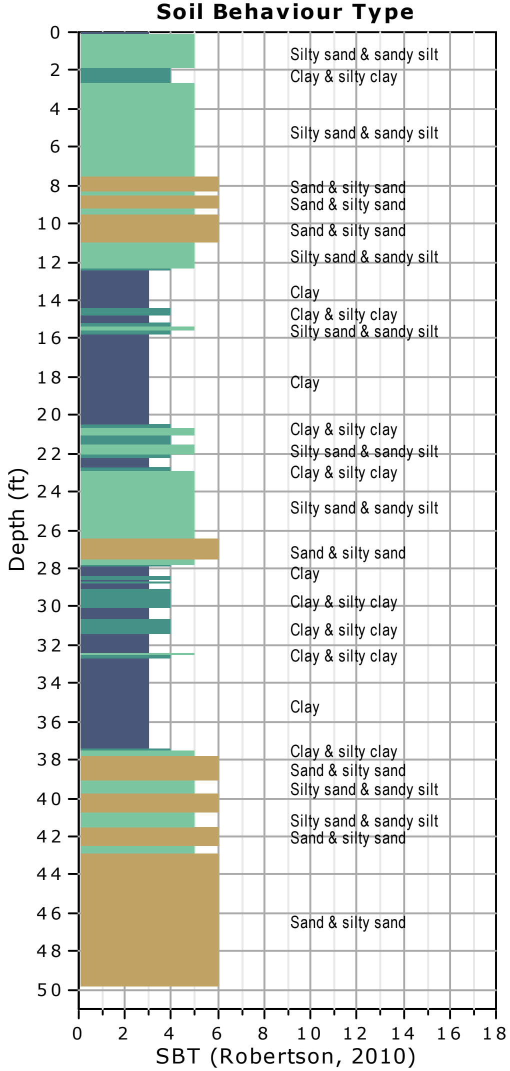
CPT-19
Total depth: 50.26 ft, Date: 2/4/2020











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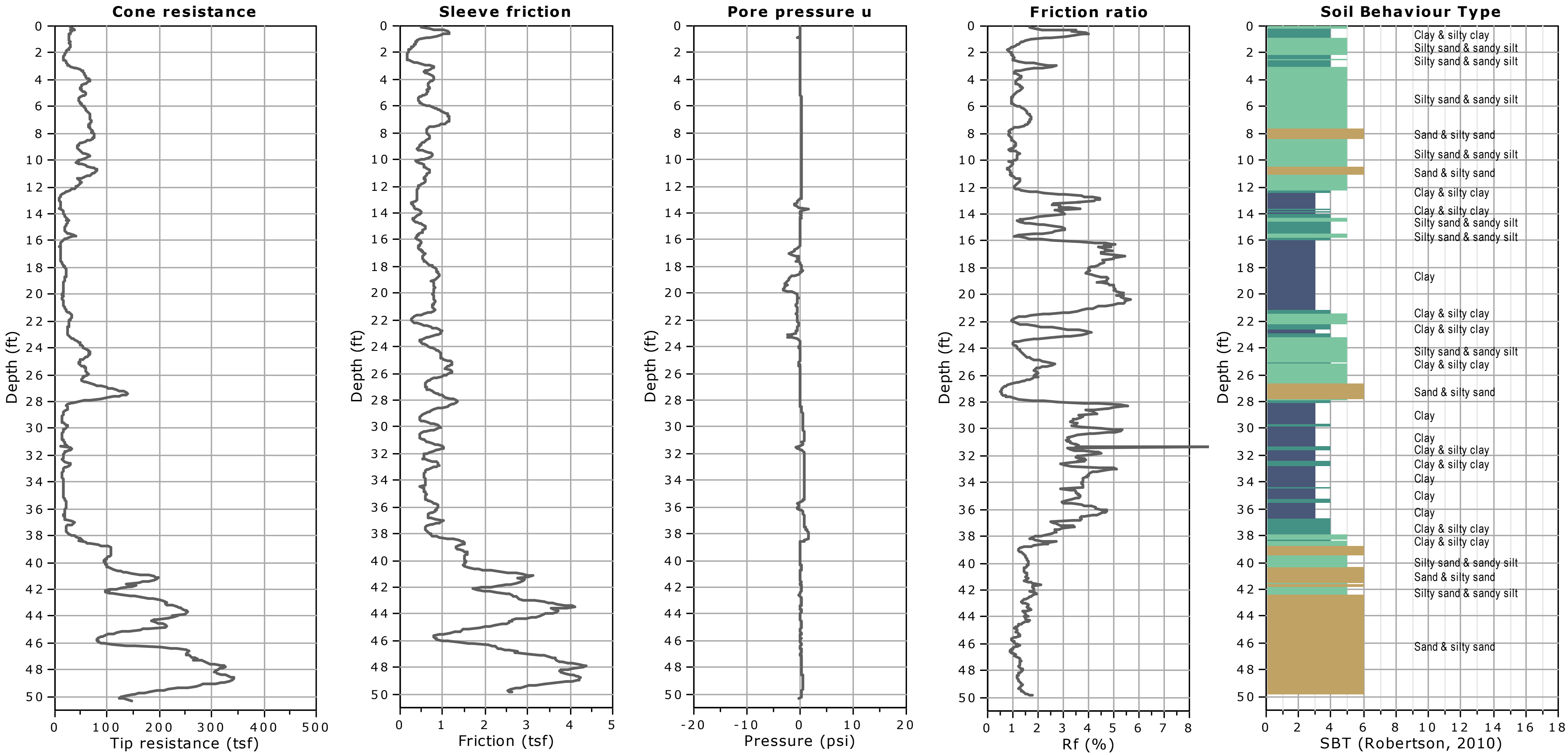
Project: Earth Systems / Adolfo Camarillo High School
Location: Camarillo, CA

CPT-20
Total depth: 50.27 ft, Date: 2/4/2020



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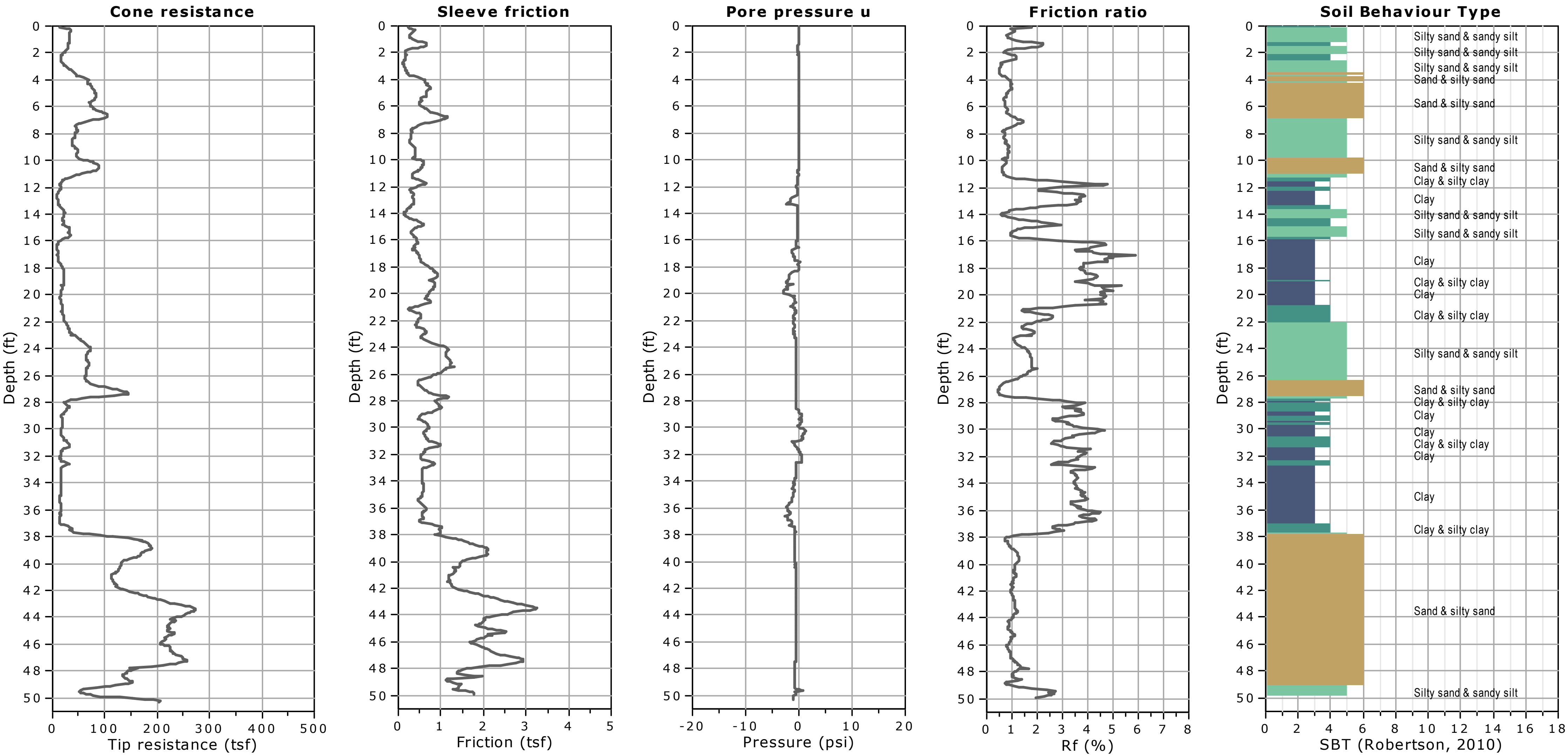
Project: Earth Systems / Adolfo Camarillo High School
Location: Camarillo, CA

CPT-21
Total depth: 50.30 ft, Date: 2/4/2020



CPT No: CPT-22

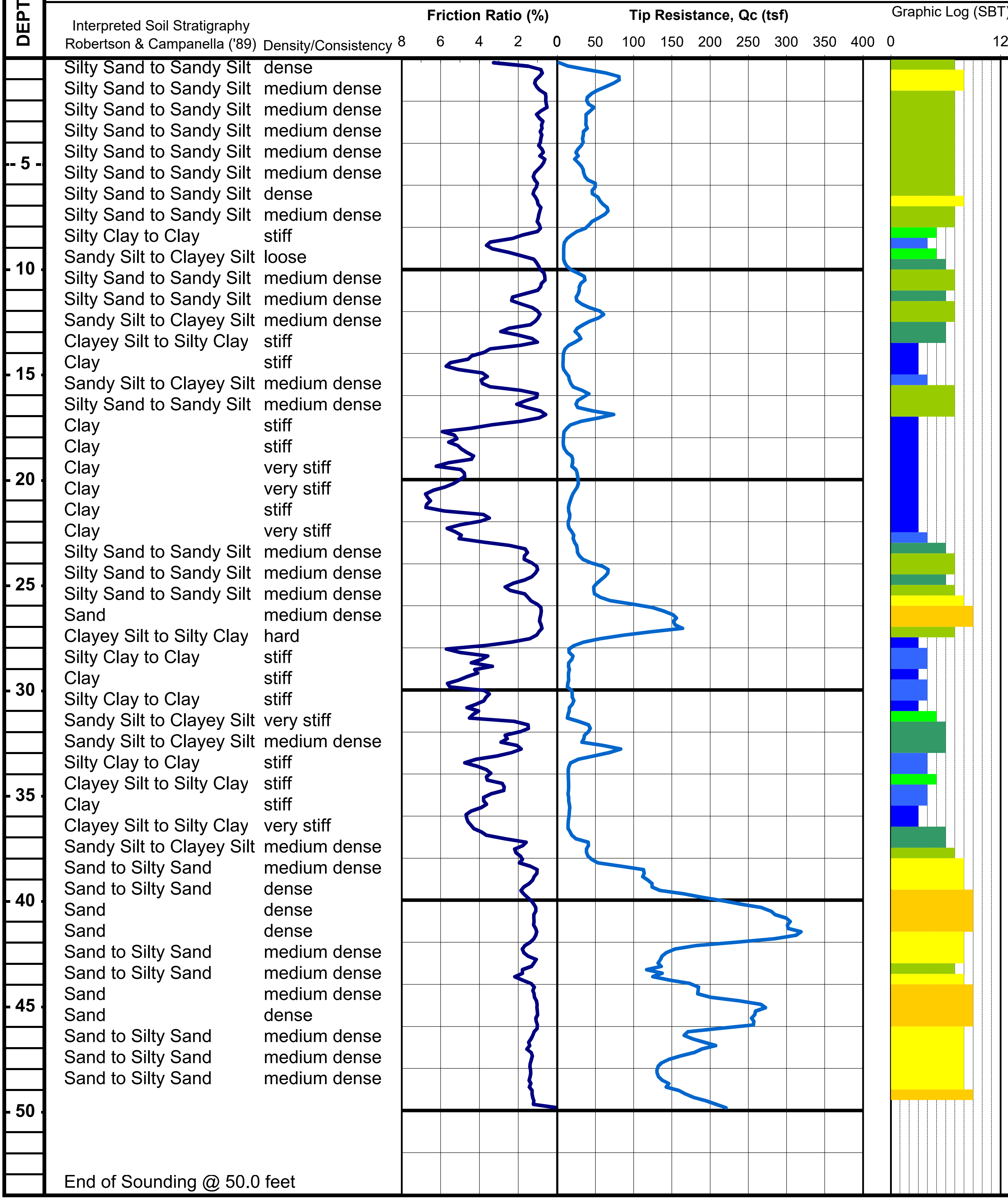
Project Name: Camarillo High School Visitors Bleachers
Project No.: 303275-003
Location: See Site Exploration Plan

CPT Vendor: **Kehoe Testing and Engineering**
Truck Mounted Electric
Cone with 23-ton reaction
Date: 2/6/2020

DEPTH (FEET)

Interpreted Soil Stratigraphy Robertson & Campanella ('89)	Density/Consistency
Silty Sand to Sandy Silt	dense
Silty Sand to Sandy Silt	medium dense
Silty Sand to Sandy Silt	medium dense
Silty Sand to Sandy Silt	medium dense
Silty Sand to Sandy Silt	medium dense
Silty Sand to Sandy Silt	medium dense
Silty Sand to Sandy Silt	dense
Silty Sand to Sandy Silt	medium dense
Silty Clay to Clay	stiff
Sandy Silt to Clayey Silt	loose
Silty Sand to Sandy Silt	medium dense
Silty Sand to Sandy Silt	medium dense
Sandy Silt to Clayey Silt	medium dense
Clayey Silt to Silty Clay	stiff
Clay	stiff
Sandy Silt to Clayey Silt	medium dense
Silty Sand to Sandy Silt	medium dense
Clay	stiff
Clay	stiff
Clay	very stiff
Clay	very stiff
Clay	stiff
Clay	very stiff
Silty Sand to Sandy Silt	medium dense
Silty Sand to Sandy Silt	medium dense
Silty Sand to Sandy Silt	medium dense
Sand	medium dense
Clayey Silt to Silty Clay	hard
Silty Clay to Clay	stiff
Clay	stiff
Silty Clay to Clay	stiff
Sandy Silt to Clayey Silt	very stiff
Sandy Silt to Clayey Silt	medium dense
Silty Clay to Clay	stiff
Clayey Silt to Silty Clay	stiff
Clay	stiff
Clayey Silt to Silty Clay	very stiff
Sandy Silt to Clayey Silt	medium dense
Sand to Silty Sand	medium dense
Sand to Silty Sand	dense
Sand	dense
Sand	dense
Sand to Silty Sand	medium dense
Sand to Silty Sand	medium dense
Sand	medium dense
Sand	dense
Sand to Silty Sand	medium dense
Sand to Silty Sand	medium dense
Sand to Silty Sand	medium dense

End of Sounding @ 50.0 feet



CONE PENETROMETER INTERPRETATION

(based on Robertson & Campanella, 1989)

Project: Camarillo High School Visitors Bleachers — Project No: 303275-003 — Date: 02/06/20

CPT SOUNDING: CPT-22 — Plot: 1 — Density: 1 SPT N — Program developed 2003 by Shelton L. Stringer, GE, Earth Systems Southwest

Est. GWT (feet): **52.0** — Dr correlation: 0 Baldi — Qc/N: 1 Robertson — Phi Correlation: 4 SPT N — Nk: 17

Base Depth meters	Base Depth feet	Avg Tip Qc, tsf	Avg Friction Ratio, %	Soil Classification	USCS	Density or Consistency	Est. Density (pcf)	Qc to N	SPT N(60)	Total po tsf	p'o tsf	F	n	Cq	Norm. Qc1n	Ic (2.6)	Clean Sand Qc1n	$N_{1(60)}$	Clean Sand $N_{1(60)}$	Rel. Dens. Dr (%)	Phi (deg.)	Su (tsf)	OCR
0.15	0.5	38.44	1.02	Silty Sand to Sandy Silt	SM/ML	medium dense	110	3.0	13	0.014	0.014	1.02	0.63	1.70	61.8	2.08	87.9	22	18	57	34		
0.30	1.0	78.45	1.05	Sand to Silty Sand	SP/SM	dense	100	4.0	20	0.040	0.040	1.05	0.56	1.70	126.0	1.85	144.2	33	29	86	37		
0.46	1.5	53.39	0.84	Sand to Silty Sand	SP/SM	medium dense	100	4.0	13	0.065	0.065	0.84	0.58	1.70	85.8	1.92	103.3	23	21	70	34		
0.61	2.0	39.67	0.57	Silty Sand to Sandy Silt	SM/ML	medium dense	110	3.0	13	0.091	0.091	0.57	0.59	1.70	63.7	1.93	77.7	22	16	58	34		
0.76	2.5	43.06	0.80	Silty Sand to Sandy Silt	SM/ML	medium dense	110	3.0	14	0.119	0.119	0.80	0.60	1.70	69.2	1.98	88.1	24	18	62	35		
0.91	3.0	37.56	0.81	Silty Sand to Sandy Silt	SM/ML	medium dense	110	3.0	13	0.146	0.146	0.82	0.62	1.70	60.3	2.03	81.3	21	16	56	34		
1.07	3.5	35.87	0.81	Silty Sand to Sandy Silt	SM/ML	medium dense	110	3.0	12	0.174	0.174	0.81	0.62	1.70	57.6	2.05	78.9	20	16	54	33		
1.22	4.0	32.96	0.88	Silty Sand to Sandy Silt	SM/ML	medium dense	110	3.0	11	0.201	0.201	0.88	0.64	1.70	53.0	2.10	77.0	19	15	50	33		
1.37	4.5	26.43	0.79	Silty Sand to Sandy Silt	SM/ML	medium dense	110	3.0	9	0.229	0.229	0.80	0.66	1.70	42.5	2.16	66.6	15	13	41	32		
1.52	5.0	27.24	0.71	Silty Sand to Sandy Silt	SM/ML	medium dense	110	3.0	9	0.256	0.256	0.72	0.65	1.70	43.8	2.12	65.5	15	13	43	32		
1.68	5.5	36.30	1.13	Silty Sand to Sandy Silt	SM/ML	medium dense	110	3.0	12	0.284	0.284	1.14	0.65	1.70	58.3	2.13	88.0	21	18	54	33		
1.83	6.0	48.45	1.08	Silty Sand to Sandy Silt	SM/ML	medium dense	110	3.0	16	0.311	0.311	1.09	0.61	1.70	77.8	2.02	103.1	27	21	66	35		
1.98	6.5	51.59	1.12	Silty Sand to Sandy Silt	SM/ML	medium dense	110	3.0	17	0.339	0.339	1.13	0.61	1.70	82.9	2.01	108.5	29	22	69	36		
2.13	7.0	63.84	0.89	Sand to Silty Sand	SP/SM	medium dense	100	4.0	16	0.365	0.365	0.90	0.57	1.70	102.6	1.87	119.4	26	24	78	35		
2.29	7.5	54.08	0.97	Silty Sand to Sandy Silt	SM/ML	medium dense	110	3.0	18	0.391	0.391	0.98	0.59	1.70	86.9	1.95	107.9	29	22	71	36		
2.44	8.0	34.62	0.93	Silty Sand to Sandy Silt	SM/ML	medium dense	110	3.0	12	0.419	0.419	0.94	0.64	1.70	55.6	2.10	80.6	18	16	52	33		
2.59	8.5	13.65	2.51	Clayey Silt to Silty Clay	ML/CL	stiff	110	2.0	7	0.446	0.446	2.60	0.82	1.70	21.9	2.68		7				0.78	8.9
2.74	9.0	8.57	3.15	Silty Clay to Clay	CL	firm	110	1.5	6	0.474	0.474	3.33	0.89	1.70	13.8	2.91		6				0.48	5.1
2.90	9.5	8.99	1.36	Clayey Silt to Silty Clay	ML/CL	firm	110	2.0	4	0.501	0.501	1.44	0.82	1.70	14.4	2.69		4				0.50	5.1
3.05	10.0	19.16	0.83	Sandy Silt to Clayey Silt	ML	medium dense	110	2.5	8	0.529	0.529	0.85	0.70	1.63	29.5	2.31	58.2	11	12	26	30		
3.20	10.5	34.17	0.68	Silty Sand to Sandy Silt	SM/ML	medium dense	110	3.0	11	0.556	0.556	0.69	0.63	1.50	48.5	2.08	68.5	15	14	47	32		
3.35	11.0	28.34	1.17	Silty Sand to Sandy Silt	SM/ML	medium dense	110	3.0	9	0.584	0.584	1.20	0.69	1.51	40.4	2.27	75.1	12	15	39	31		
3.51	11.5	27.57	2.14	Sandy Silt to Clayey Silt	ML	medium dense	110	2.5	11	0.611	0.611	2.19	0.74	1.50	39.2	2.44	97.5	14	19	38	31		
3.66	12.0	52.67	1.06	Silty Sand to Sandy Silt	SM/ML	medium dense	110	3.0	18	0.639	0.639	1.08	0.63	1.37	68.4	2.06	94.7	22	19	61	34		
3.81	12.5	43.34	1.16	Silty Sand to Sandy Silt	SM/ML	medium dense	110	3.0	14	0.666	0.666	1.18	0.66	1.35	55.5	2.15	86.8	18	17	52	33		
3.96	13.0	26.00	2.46	Sandy Silt to Clayey Silt	ML	medium dense	110	2.5	10	0.694	0.694	2.53	0.77	1.38	34.0	2.53	99.1	12	20	32	31		
4.11	13.5	22.98	1.40	Sandy Silt to Clayey Silt	ML	medium dense	110	2.5	9	0.721	0.721	1.44	0.74	1.33	28.9	2.44	71.3	11	14	25	30		
4.27	14.0	8.87	3.87	Clay	CL/CH	firm	110	1.0	9	0.749	0.749	4.22	0.93	1.38	11.5	3.03		9				0.48	3.3
4.42	14.5	7.61	5.26	Clay	CL/CH	firm	110	1.0	8	0.776	0.776	5.86	0.97	1.35	9.7	3.18		8				0.40	2.6
4.57	15.0	11.72	4.17	Clay	CL/CH	stiff	110	1.0	12	0.804	0.804	4.48	0.91	1.28	14.2	2.98		12				0.64	4.1
4.72	15.5	18.17	3.72	Silty Clay to Clay	CL	very stiff	110	1.5	12	0.831	0.831	3.90	0.86	1.23	21.1	2.81		12				1.02	6.3
4.88	16.0	33.71	1.39	Silty Sand to Sandy Silt	SM/ML	medium dense	110	3.0	11	0.859	0.859	1.42	0.71	1.16	37.0	2.35	77.8	12	16	36	31		
5.03	16.5	32.70	1.49	Silty Sand to Sandy Silt	SM/ML	medium dense	110	3.0	11	0.886	0.886	1.53	0.73	1.14	35.1	2.38	78.7	12	16	33	31		
5.18	17.0	53.13	1.13	Silty Sand to Sandy Silt	SM/ML	medium dense	110	3.0	18	0.914	0.914	1.15	0.65	1.10	55.3	2.15	85.8	19	17	52	33		
5.33	17.5	13.01	4.56	Clay	CL/CH	stiff	110	1.0	13	0.941	0.941	4.91	0.92	1.11	13.7	3.02		13				0.71	3.8
5.49	18.0	8.14	5.34	Clay	CL/CH	firm	110	1.0	8	0.969	0.969	6.07	0.99	1.09	8.4	3.24		8				0.42	2.2
5.64	18.5	10.18	4.91	Clay	CL/CH	stiff	110	1.0	10	0.996	0.996	5.44	0.96	1.06	10.2	3.14		10				0.54	2.8
5.79	19.0	19.82	4.77	Clay	CL/CH	very stiff	110	1.0	20	1.024	1.024	5.03	0.89	1.03	19.3	2.91		20				1.11	5.5
5.94	19.5	23.14	5.32	Clay	CL/CH	very stiff	110	1.0	23	1.051	1.051	5.58	0.88	1.01	22.0	2.90		23				1.30	6.3
6.10	20.0	27.32	5.04	Clay	CL/CH	very stiff	110	1.0	27	1.079	1.079	5.25	0.86	0.98	25.4	2.83		27				1.54	7.3
6.25	20.5	23.32	6.31	Clay	CL/CH	very stiff	110	1.0	23	1.106	1.106	6.63	0.90	0.96	21.2	2.96		23				1.31	6.0
6.40	21.0	17.01	6.63	Clay	CL/CH	stiff	110	1.0	17	1.134	1.134	7.11	0.94	0.94	15.1	3.09		17				0.93	4.2
6.55	21.5	15.35	5.46	Clay	CL/CH	stiff	110	1.0	15	1.161	1.161	5.90	0.94	0.92	13.3	3.08		15				0.83	3.7
6.71	22.0	15.07	4.15	Clay	CL/CH	stiff	110	1.0	15	1.189	1.189	4.51	0.92	0.90	12.8	3.02		15				0.82	3.5
6.86	22.5	18.62	5.28	Clay	CL/CH	very stiff	110	1.0	19	1.216	1.216	5.65	0.92	0.88	15.5	3.01		19				1.02	4.3
7.01	23.0	22.95	3.76	Silty Clay to Clay	CL	very stiff	110	1.5	15	1.244	1.244	3.98	0.87	0.87	18.8	2.85		15				1.28	5.2
7.16	23.5	27.30	1.61	Sandy Silt to Clayey Silt	ML	loose	110	2.5	11	1.271	1.271	1.69	0.78	0.87	22.3	2.57	70.1	10	14	15	30		
7.32	24.0	45.51	1.34	Silty Sand to Sandy Silt	SM/ML	medium dense	110	3.0	15	1.299	1.299	1.38	0.71	0.86	37.2	2.34	77.0	13	15	36	31		
7.47	24.5	64.99	1.13	Silty Sand to Sandy Silt	SM/ML	medium dense	110	3.0	22	1.326	1.326	1.16	0.66	0.86	52.9	2.17	84.1	19	17	50	33		
7.62	25.0	51.98	2.22	Sandy Silt to Clayey Silt	ML	medium dense	110	2.5	21	1.354	1.354	2.27	0.74	0.83	40.9	2.44	101.1	18	20	40	33		
7.77	25.5	51.18	1.86	Silty Sand to Sandy Silt	SM/ML	medium dense	110	3.0	17	1.381	1.381	1.91	0.73	0.82	39.8	2.40	91.6	15	18	39	32		
7.92	26.0	97.70	1.07	Sand to Silty Sand	SP/SM	medium dense	100	4.0	24	1.408	1.408	1.08	0.62	0.84	77.5	2.02	102.6	21	21	66	33		
8.08	26.5	149.44	0.85	Sand	SP	medium dense	100	5.0	30	1.433	1.433	0.86	0.55	0.85	119.5	1.81	133.0	25	27	84	35		
8.23	27.0	147.54	0.84	Sand	SP	medium dense	100	5.0	30	1.458	1.458	0.85	0.55	0.84	116.8	1.81	130.5	24	26	83	35		
8.38	27.5	59.26	1.61	Silty Sand to Sandy Silt	SM/ML	medium dense	110	3.0	20	1.484	1.484	1.65	0.71	0.79	44.1	2.32	89.3	16	18	43	32		
8.53	28.0	17.75	4.79	Clay	CL/CH	stiff	110	1.0	18	1.511	1.511	5.23	0.94	0.72	12.0	3.08		18				0.96	3.2
8.69	28.5	18.20	3.95	Silty Clay to Clay	CL	stiff	110	1.5	12	1.539	1.539	4.31	0.92	0.71	12.2	3.02		12				0.98	3.2
8.84	29.0	15.17	3.89	Silty Clay to Clay	CL	stiff	110	1.5	10	1.566	1.566	4.34	0.95	0.69	9.9	3.09		10				0.80	2.6
8.99	29.5	14.62	5.12	Clay	CL/CH	stiff	110	1.0	15	1.594	1.594	5.74	0.98	0.67	9.3	3.19		15				0.77	2.5
9.14	30.0	17.37	4.25	Silty Clay to Clay	CL	stiff	110	1.5	12	1.621	1.621	4.69	0.94	0.67	11.0	3.08		12				0.93	2.9
9.30	30.5	20.33	3.87	Silty Clay to Clay	CL	very stiff	110	1.5	14	1.649	1.649	4.21	0.92	0.67	12.8	3.00		14				1.10	3.4
9.45	31.0	15.37	4.34	Clay	CL/CH	stiff	110	1.0	15	1.676	1.676	4.87	0.96	0.64	9.3	3.14		15				0.81	2.5
9.60	31.5	27.24	2.74	Clayey Silt to Silty Clay	ML/CL	very stiff	110	2.0	14	1.704	1.704	2.92	0.86	0.67	17.1	2.80		14				1.50	4.5
9.75	32.0	39.92	2.02	Sandy Silt to Clayey Silt	ML	medium dense	110	2.5	16	1.731	1.731	2.11	0.79	0.68	25.6	2.58	81.4	12	16	20	31		
9.91	32.5	42.48	2.50	Sandy Silt to Clayey Silt	ML	hard	110	2.5	17	1.759	1.759	2.61	0.80	0.67	26.8	2.62		17				2.40	6.9
10.06	33.0	66.27	2.43	Sandy Silt to Clayey Silt	ML	medium dense	110	2.5	27	1.786	1.786	2.50	0.75	0.68	42.4	2.45	107.5	20	21	41	33		
10.21	33.5	20.01	4.34	Silty Clay to Clay	CL	very stiff	110	1.5	13	1.814	1.814	4.77	0.94	0.60	11.4	3.07		13				1.07	3.0
10.36	34.0	14.53	3.56	Silty Clay to Clay	CL	stiff	110	1.5	10	1.841	1.841	4.08	0.97	0.58	8.0	3.15		10				0.75	2.1
10.52	34.5	14.83	3.05	Clayey Silt to Silty Clay	ML/CL	stiff	110	2.0	7	1.869	1.869	3.49	0.95	0.58	8.1	3.11		7				0.76	2.1
10.67	35.0	14.65	3.31	Silty Clay to Clay	CL	stiff	110	1.5	10	1.896	1.896	3.81	0.97	0.57	7.9	3.14		10				0.75	2.0
10.82	35.5	15.89	3.78	Silty Clay to Clay	CL	stiff	110	1.5	11	1.924	1.924	4.30	0.97	0.56	8.4	3.15		11				0.82	2.2
10.97	36.0	15.55	4.59	Clay	CL/CH	stiff	110	1.0	16	1.951	1.951	5.24	0.99	0.55	8.0	3.22		16				0.80	2.1
11.13	36.5	15.02	4.31	Clay	CL/CH	stiff	110	1.0	15	1.979	1.979	4.97	0.99	0.54	7.6	3.22		15				0.77	2.0
11.28	37.0	28.06	2.64	Sandy Silt to Clayey Silt	ML	very stiff	110	2.5	11	2.006	2.006	2.85	0.87	0.57	15.2	2.83		11				1.53	3.9

Earth Systems

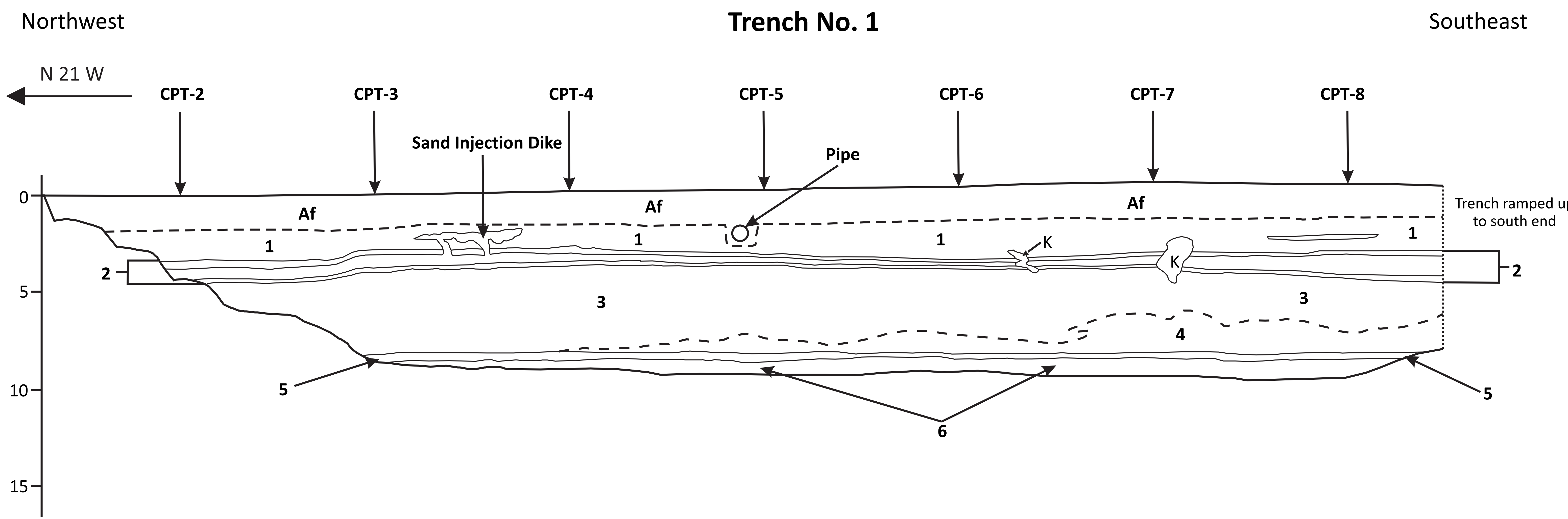
CONE PENETROMETER INTERPRETATION (based on Robertson & Campanella, 1989)

Project: Camarillo High School Visitors Bleachers Project No: 303275-003 Date: 02/06/20

CPT SOUNDING: CPT-22 Plot: 1 Density: 1 SPT N Program developed 2003 by Shelton L. Stringer, GE, Earth Systems Southwest

Est. GWT (feet): **52.0** Dr correlation: 0 Baldi Qc/N: 1 Robertson Phi Correlation: 4 SPT N

Base Depth meters	Base Depth feet	Avg Tip Qc, tsf	Avg Friction Ratio, %	Soil Classification	USCS	Density or Consistency	Est. Density (pcf)	Qc to N	SPT N(60)	Total po tsf	p'o tsf	F	n	Cq	Norm. Qc1n	2.6 Ic	Clean Sand Qc1n	$N_{1(60)}$	Clean Sand $N_{1(60)}$	Rel. Dens. Dr (%)	Phi (deg.)	Su (tsf)	Nk: 17 OCR
11.43	37.5	39.13	2.02	Sandy Silt to Clayey Silt	ML	hard	110	2.5	16	2.034	2.034	2.13	0.80	0.59	21.9	2.63		16				2.18	5.5
11.58	38.0	46.03	1.86	Silty Sand to Sandy Silt	SM/ML	medium dense	110	3.0	15	2.061	2.061	1.95	0.78	0.59	25.9	2.55	78.8	11	16	21	30		
11.73	38.5	103.80	1.14	Sand to Silty Sand	SP/SM	medium dense	100	4.0	26	2.088	2.088	1.17	0.64	0.65	63.3	2.11	93.0	18	19	58	33		
11.89	39.0	118.22	1.29	Sand to Silty Sand	SP/SM	medium dense	100	4.0	30	2.113	2.113	1.31	0.64	0.64	71.8	2.10	104.0	20	21	63	33		
12.04	39.5	141.43	1.76	Sand to Silty Sand	SP/SM	medium dense	100	4.0	35	2.138	2.138	1.79	0.65	0.63	84.6	2.13	128.3	24	26	70	34		
12.19	40.0	215.69	1.35	Sand	SP	medium dense	100	5.0	43	2.163	2.163	1.37	0.58	0.66	134.4	1.91	160.7	29	32	89	36		
12.34	40.5	277.27	1.12	Sand	SP	dense	100	5.0	55	2.188	2.188	1.13	0.54	0.68	177.0	1.77	191.5	37	38	100	38		
12.50	41.0	301.93	1.19	Sand	SP	dense	100	5.0	60	2.213	2.213	1.20	0.54	0.67	191.8	1.76	206.8	41	41	100	39		
12.65	41.5	311.04	1.08	Sand	SP	dense	100	5.0	62	2.238	2.238	1.09	0.53	0.67	198.2	1.72	208.2	42	42	100	39		
12.80	42.0	233.10	1.41	Sand to Silty Sand	SP/SM	dense	100	4.0	58	2.263	2.263	1.42	0.58	0.64	141.5	1.90	168.9	39	34	91	38		
12.95	42.5	144.49	1.66	Sand to Silty Sand	SP/SM	medium dense	100	4.0	36	2.288	2.288	1.69	0.65	0.61	82.9	2.12	124.0	24	25	69	34		
13.11	43.0	134.23	1.19	Sand to Silty Sand	SP/SM	medium dense	100	4.0	34	2.313	2.313	1.21	0.63	0.61	77.7	2.05	106.3	22	21	66	34		
13.26	43.5	126.27	1.91	Silty Sand to Sandy Silt	SM/ML	medium dense	110	3.0	42	2.339	2.339	1.95	0.68	0.58	69.7	2.22	119.7	28	24	62	35		
13.41	44.0	168.71	1.42	Sand to Silty Sand	SP/SM	medium dense	100	4.0	42	2.365	2.365	1.44	0.62	0.61	96.9	2.02	129.3	27	26	76	35		
13.56	44.5	189.73	1.20	Sand	SP	medium dense	100	5.0	38	2.390	2.390	1.21	0.59	0.62	110.8	1.93	135.2	25	27	81	35		
13.72	45.0	258.94	1.04	Sand	SP	dense	100	5.0	52	2.415	2.415	1.05	0.55	0.64	156.0	1.78	170.4	33	34	95	37		
13.87	45.5	257.35	1.03	Sand	SP	dense	100	5.0	51	2.440	2.440	1.04	0.55	0.63	154.1	1.78	168.6	33	34	95	37		
14.02	46.0	241.80	1.03	Sand	SP	dense	100	5.0	48	2.465	2.465	1.04	0.55	0.63	143.1	1.81	159.0	31	32	92	36		
14.17	46.5	171.37	1.26	Sand to Silty Sand	SP/SM	medium dense	100	4.0	43	2.490	2.490	1.27	0.61	0.59	96.1	1.99	124.0	27	25	75	35		
14.33	47.0	191.79	1.44	Sand to Silty Sand	SP/SM	dense	100	4.0	48	2.515	2.515	1.46	0.61	0.59	106.8	2.00	138.6	30	28	80	36		
14.48	47.5	147.61	1.32	Sand to Silty Sand	SP/SM	medium dense	100	4.0	37	2.540	2.540	1.34	0.63	0.57	80.2	2.07	112.0	23	22	68	34		
14.63	48.0	130.90	1.37	Sand to Silty Sand	SP/SM	medium dense	100	4.0	33	2.565	2.565	1.40	0.65	0.56	69.6	2.12	104.4	20	21	62	33		
14.78	48.5	138.55	1.39	Sand to Silty Sand	SP/SM	medium dense	100	4.0	35	2.590	2.590	1.42	0.65	0.56	73.5	2.11	108.4	22	22	64	34		
14.94	49.0	156.35	1.33	Sand to Silty Sand	SP/SM	medium dense	120	4.0	39	2.618	2.618	1.36	0.63	0.57	83.6	2.06	115.3	24	23	69	34		
15.09	49.5	193.69	1.22	Sand	SP	medium dense	120	5.0	39	2.648	2.648	1.24	0.60	0.58	105.8	1.95	131.4	24	26	79	34		



Artificial Fill: Af
Medium Brown Silty Sand with little fine Gravel, fine roots, medium dense, trace Clay, utility conduits, with minor Sandy and Clayey Silt in upper 6 inches

Unit 1
Pale Gray fine to very coarse Sand, well graded, little Silt, damp, moderately loose, thinly bedded with some cross bedding to massive, thin Clayey Silt to Silty Clay interbeds

Unit 2
Two Clayey Silt beds with intervening Sand bed, dark Olive Clayey Silt beds, little very fine Sand, soft with locally thin decaying organic layer, intervening pale Brown very fine to fine Sand with little Silt, moderately loose

Unit 3
Pale Gray Brown fine to very coarse Sand, thinly laminated to massive to cross bedded, erosional basal contact with local troughs, little fine Gravel in troughs, occasional Gravel in massive units

Unit 4
Dark Olive Brown very fine Sandy Silt to Silt with little Sand, massive to locally thin laminated to cross laminated, few fine roots, moist, moderately firm

Unit 5
Dark Olive Brown Silty Clay to Clayey Silt, moist, soft, laminated to massive

Unit 6
Pale Brown fine to very coarse Sand, damp, little silt, moderately loose, laminated to cross laminated

K = Krotovina

Approximate Scale: 1" = 5'

0 5' 10'

Fault Trench Log	
Adolfo Camarillo High School Bleachers Camarillo, California	
Earth Systems	
April 2020	303275-003

Earth Systems
1731-A Walter Street, Ventura, California 93003
PHONE: (805) 642-6727 FAX: (805) 642-1325

BORING NO: B-1	DRILLING DATE: January 23, 2020
PROJECT NAME: Camarillo High School Bleachers	DRILL RIG: CME-75
PROJECT NUMBER: 303275-003	DRILLING METHOD: 8" Hollow-Stem Auger
BORING LOCATION: Per Plan	LOGGED BY: A. Luna

Vertical Depth	Sample Type: Bulk	Sample Type: SPT	Sample Type: Mod. Calif.	PENETRATION RESISTANCE (BLOWS/6")	SYMBOL	USCS CLASS	UNIT DRY WT. (pcf)	MOISTURE CONTENT (%)	DESCRIPTION OF UNITS
0	X		■	4/2/4		SC	88.5	21.3	**ALLUVIUM:** Brown Clayey fine to medium Sand, loose, damp
5			■	4/4/5		SM	90.9	11.4	**ALLUVIUM:** Light Yellow Brown Silty fine Sand, trace medium Sand, loose, dry to damp
			■	6/8/7		SW	104.2	3.0	**ALLUVIUM:** Light Yellow Brown fine to medium Sand, looose to medium dense, dry to damp
10			■	4/4/5		SM	102.4	5.9	**ALLUVIUM:** Light Brown Silty fine Sand, loose, damp
15			■	3/5/7		CL	88.7	30.2	**ALLUVIUM:** Brown Silty Clay, stiff, moist
20			■	5/11/15		CL	100.9	23.9	**ALLUVIUM:** Dark Brown Silty Clay, very stiff, moist
25		■		4/4/4		SM			**ALLUVIUM:** Light Brown Silty fine Sand, loose, damp
30		■		3/6/4		ML			**ALLUVIUM:** Light Brown fine Sandy Silt, trace Clay, loose, damp
35		■		4/5/7		ML			**ALLUVIUM:** Light Brown fine Sandy Silt, trace Clay, medium dense, damp

Note: The stratification lines shown represent the approximate boundaries between soil and/or rock types and the transitions may be gradual.

Earth Systems
1731-A Walter Street, Ventura, California 93003
PHONE: (805) 642-6727 FAX: (805) 642-1325

BORING NO: B-1	DRILLING DATE: January 23, 2020
PROJECT NAME: Camarillo High School Bleachers	DRILL RIG: CME-75
PROJECT NUMBER: 303277-002	DRILLING METHOD: 8" Hollow-Stem Auger
BORING LOCATION: Per Plan	LOGGED BY: A. Luna

Vertical Depth	Sample Type: Bulk	Sample Type: SPT	Sample Type: Mod. Calif.	PENETRATION RESISTANCE (BLOWS/6")	SYMBOL	USCS CLASS	UNIT DRY WT. (pcf)	MOISTURE CONTENT (%)	DESCRIPTION OF UNITS
40		■		3/8/10		SP			**ALLUVIUM:** Light Brown fine Sand, trace medium Sand, medium dense, dry to damp
45		■		4/16/23		SP			**ALLUVIUM:** Light Brown fine Sand, trace medium Sand, dense, dry to damp
50		■		3/5/12		ML			**ALLUVIUM:** Brown fine Sandy Silt, little Clay, very stiff, moist to very moist
									Total Depth: 51.5 feet **No Groundwater Encountered**
55									
60									
65									
70									
75									

Note: The stratification lines shown represent the approximate boundaries between soil and/or rock types and the transitions may be gradual.

Earth Systems
1731-A Walter Street, Ventura, California 93003
PHONE: (805) 642-6727 FAX: (805) 642-1325

BORING NO: B-2
PROJECT NAME: Camarillo High School Bleachers
PROJECT NUMBER: 303275-003
BORING LOCATION: Per Plan

DRILLING DATE: January 23, 2020
DRILL RIG: CME-75
DRILLING METHOD: 8" Hollow-Stem Auger
LOGGED BY: A. Luna

Vertical Depth	Sample Type: Bulk	Sample Type: SPT	Sample Type: Mod. Calif.	PENETRATION RESISTANCE (BLOWS/6")	SYMBOL	USCS CLASS	UNIT DRY WT. (pcf)	MOISTURE CONTENT (%)	DESCRIPTION OF UNITS
0–5	X		■	4/6/6		SC	101.9	8.6	**ALLUVIUM:** Brown Clayey fine Sand, loose, damp
5			■	4/6/6		SW	103.5	2.9	**ALLUVIUM:** Light Brown fine to medium Sand, trace Silt, loose, damp
			■	3/3/5		SM	106.2	14.2	**ALLUVIUM:** Brown Silty fine to medium Sand, loose, damp
10			■	5/5/4		SM	101.4	2.7	**ALLUVIUM:** Brown Silty fine Sand with some Silty Clay Lenses, loose, moist
15			■	4/4/6		SM	102.4	11.1	**ALLUVIUM:** Brown Silty fine to medium Sand with scattered thin Silt lenses, loose, moist
20			■	6/10/10		CL	99.8	22.9	**ALLUVIUM:** Brown Silty Clay, very stiff, moist
25									**Total Depth: 21.5 feet**
30									**No Groundwater Encountered**
35									

Note: The stratification lines shown represent the approximate boundaries between soil and/or rock types and the transitions may be gradual.

BORING LOG SYMBOLS

 Modified California Split Barrel Sampler

 Modified California Split Barrel Sampler - No Recovery

 Standard Penetration Test (SPT) Sampler

 Standard Penetration Test (SPT) Sampler - No Recovery

 Perched Water Level

 Water Level First Encountered

 Water Level After Drilling

 Pocket Penetrometer (tsf)

 Vane Shear (ksf)

1. The location of borings were approximately determined by pacing and/or siting from visible features. Elevations of borings are approximately determined by interpolating between plan contours. The location and elevation of the borings should be considered.

2. The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

3. Water level readings have been made in the drill holes at times and under conditions stated on the boring logs. This data has been reviewed and interpretations made in the text of this report. However, it must be noted that fluctuations in the level of the groundwater may occur due to variations in rainfall, tides, temperature, and other factors at the time measurements were made.

BORING LOG SYMBOLS

Earth Systems

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			*GRAPH SYMBOL*	*LETTER SYMBOL*	*TYPICAL DESCRIPTIONS*
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, 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
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING NO. 4 SIEVE	CLEAN SAND (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNTOF 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 SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENT

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

UNIFIED SOIL CLASSIFICATION SYSTEM

Earth Systems

APPENDIX B

Laboratory Testing
Tabulated Laboratory Test Results
Individual Laboratory Test Results
Table 1809.7

LABORATORY TESTING

A. Samples were reviewed along with field logs to determine which would be analyzed further. Those chosen for laboratory analysis were considered representative of soils that would be exposed and/or used during grading, and those deemed to be within the influence of proposed structures. Test results are presented in graphic and tabular form in this Appendix.

B. In-situ Moisture Content and Unit Dry Weight for the ring samples were determined in general accordance with ASTM D 2937.

C. The relative strength characteristics of soils were determined from the results of Direct Shear tests on remolded and relatively undisturbed samples. Specimens were placed in contact with water at least 24 hours before testing, and were then sheared under normal loads ranging from 1 to 3 ksf in general accordance with ASTM D 3080.

D. Settlement characteristics were developed from the results of one-dimensional Consolidation tests performed in general accordance with ASTM D 2435. The samples were typically loaded to 0.5 ksf, flooded with water, and then incrementally loaded to 1.0, 2.0, 4.0, 8.0, and 16.0 ksf. The samples were allowed to consolidate under each load increment. Rebound was measured under reverse alternate loading. Compression was measured by dial gauges accurate to 0.0001 inch. Results of the consolidation tests are presented in this Appendix as curves plotting percent consolidation versus log of pressure, and curves plotting void ratio versus log of normal pressure.

E. An expansion index test was performed on a bulk soil sample in accordance with ASTM D 4829. The sample was surcharged under 144 pounds per square foot at moisture content of near 50% saturation. The sample was then submerged in water for 24 hours, and the amount of expansion was recorded with a dial indicator.

F. A maximum density test was performed to estimate the moisture-density relationship of typical soil materials. The test was performed in accordance with ASTM D 1557.

G. The gradation characteristics of selected samples were evaluated by hydrometer (in accordance with ASTM D 422) and sieve analysis procedures. Selected samples were soaked in water until individual soil particles were separated, then washed on the No. 200 mesh sieve, oven dried, weighed to calculate the percent passing the No. 200 sieve, and mechanically sieved. Additionally, hydrometer analyses were performed to assess the distribution of the minus No. 200 mesh material of the samples. The hydrometer portions of the tests were run using sodium hexametaphosphate as a dispersing agent.

H. A portion of the bulk sample was sent to another laboratory for analyses of soil pH, resistivity, chloride contents, and sulfate contents. Soluble chloride and sulfate contents were determined on a dry weight basis. Resistivity testing was performed in accordance with California Test Method 424, wherein the ratio of soil to water was 1:3.

LABORATORY TESTING (Continued)

I. The Plasticity Indices of selected samples were evaluated in accordance with ASTM D 4318.

TABULATED LABORATORY TEST RESULTS

REMOLDED SAMPLES

BORING AND DEPTH	B-1 @ 0-5’	
USCS	SC	
MAXIMUM DENSITY (pcf)	123.5	
OPTIMUM MOISTURE (%)	10.0	
COHESION (psf)	420*	160**
ANGLE OF INTERNAL FRICTION	31°*	33°**
EXPANSION INDEX	106	
pH	9.1	
SOLUBLE CHLORIDES (mg/Kg)	18	
RESISTIVITY (OHMs-cm)	5,600	
SOLUBLE SULFATES (mg/Kg)	44	

BORING AND DEPTH	B-1 @ 15’	B-1 @ 20’	B-1 @ 30’
USCS	CL	CL	ML
IN-PLACE MOISTURE (%)	30.2	23.9	--
LIQUID LIMIT	44	47	--
PLASTIC LIMIT	23	18	--
PLASTICITY INDEX	21	29	Non-Plastic
GRAIN SIZE DISTRIBUTION (%)			
GRAVEL	0.0	0.0	0.0
SAND	19.9	17.0	13.1
SILT	35.6	37.4	67.9
CLAY (2ųm to 5ųm)	11.9	7.8	5.1
CLAY (≤2ųm)	32.6	37.8	13.9

RELATIVELY UNDISTURBED SAMPLES

BORING AND DEPTH	B-1 @ 7.5’		B-2 @ 5’	
USCS	SM		SW	
IN-PLACE DENSITY (pcf)	104.3		103.4	
IN-PLACE MOISTURE (%)	3.0		2.9	
COHESION (psf)	80*	0**	0*	0**
ANGLE OF INTERNAL FRICTION	35°*	34°**	37°*	32°**

^ * = Peak Strength Parameters; ** = Ultimate Strength Parameters

File Number: 303275-001 Lab Number: 098371

MAXIMUM DENSITY / OPTIMUM MOISTURE

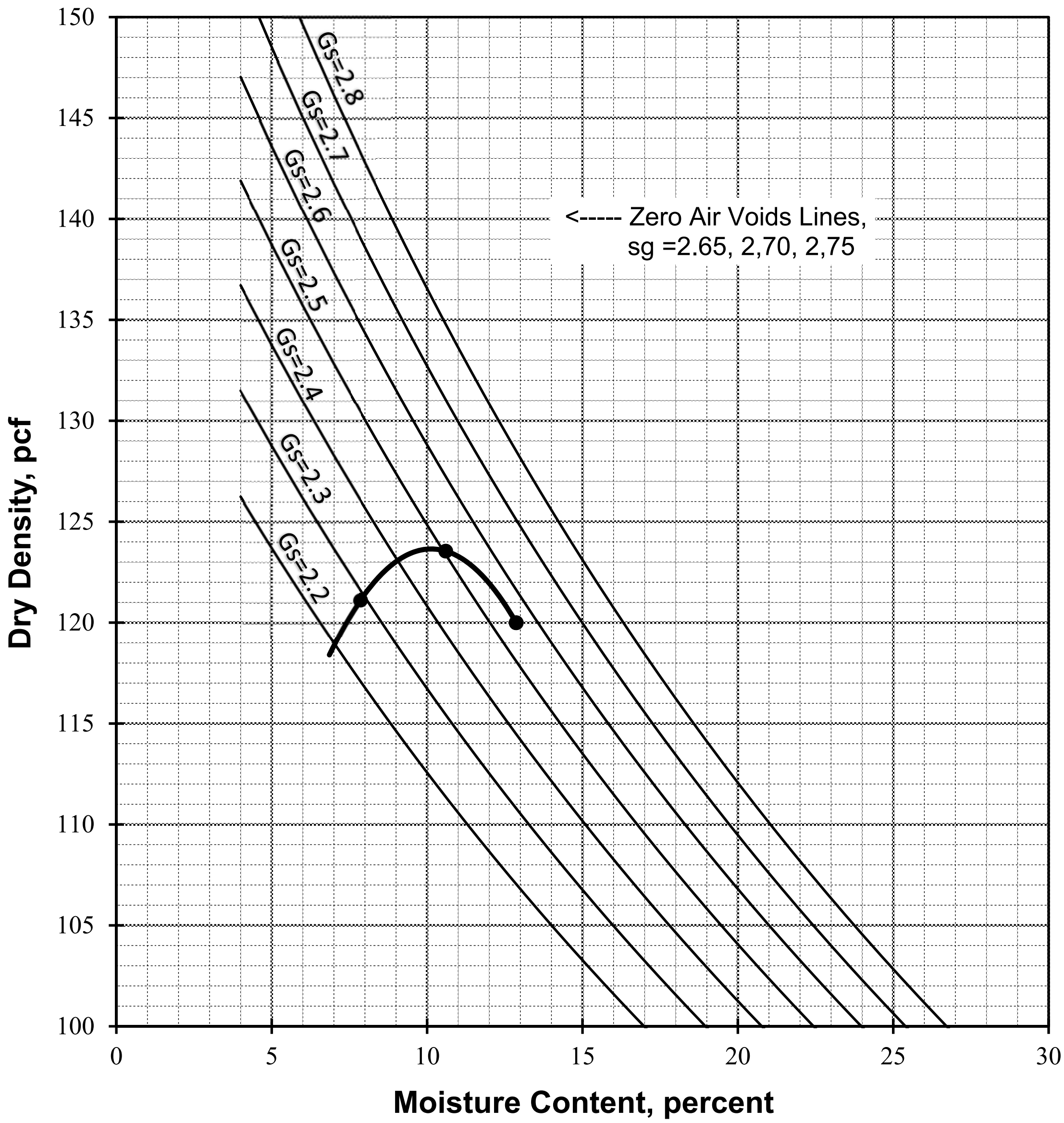
ASTM D 1557-12 (Modified)

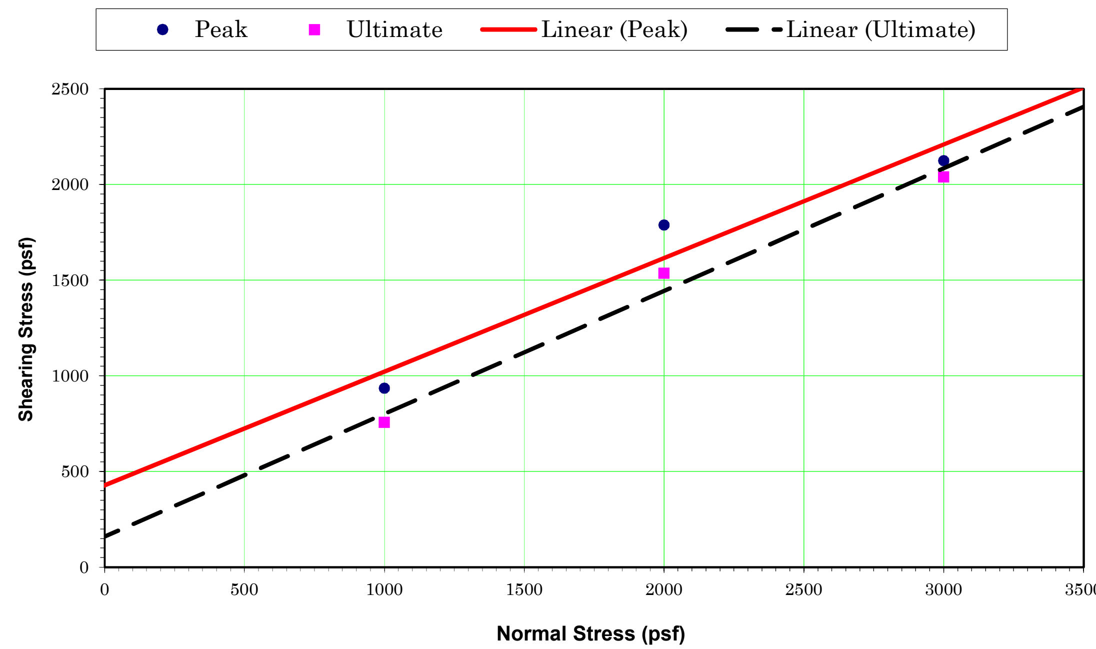
Job Name: Camarillo High School Bleachers
Sample ID: B 1 @ 0-5'
Date: B 1 @ 0-5'
Description: Brown Clayey Sand
SG: 2.48

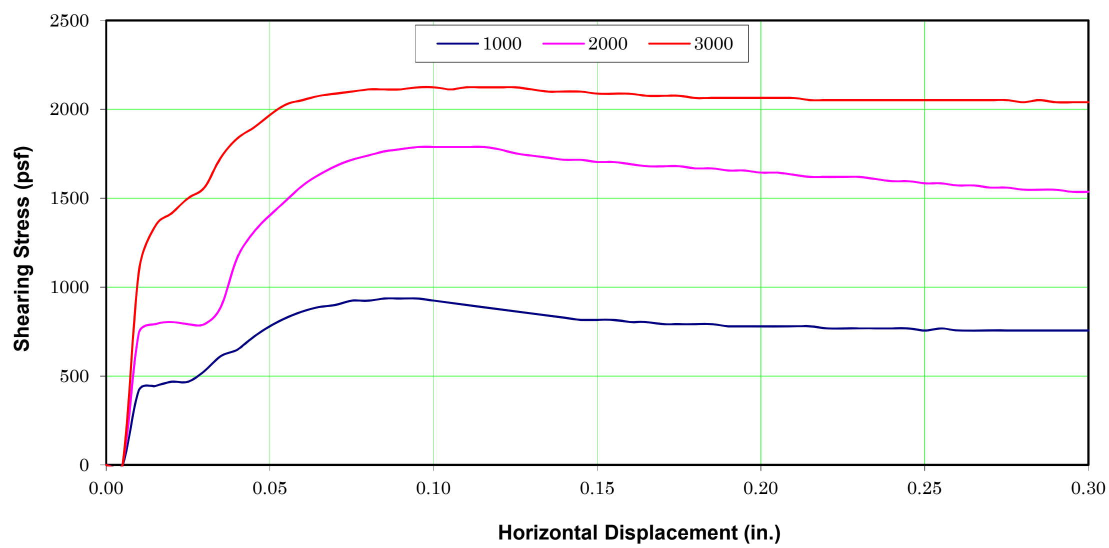
Procedure Used: A
Prep. Method: Moist
Rammer Type: Automatic

Maximum Density: **123.5 pcf**
Optimum Moisture: **10%**

Sieve Size	% Retained
3/4"	0.0
3/8"	0.0
#4	1.0







DIRECT SHEAR DATA*

Sample Location: B 1 @ 0-5'
Sample Description: Clayey Sand
Dry Density (pcf): 111.4
Intial % Moisture: 10.1
Average Degree of Saturation: 97.5
Shear Rate (in/min): 0.005 in/min

Normal stress (psf)	1000	2000	3000
Peak stress (psf)	936	1788	2124
Ultimate stress (psf)	756	1536	2040

	Peak	Ultimate
ϕ Angle of Friction (degrees):	31	33
c Cohesive Strength (psf):	420	160

Test Type: Peak & Ultimate

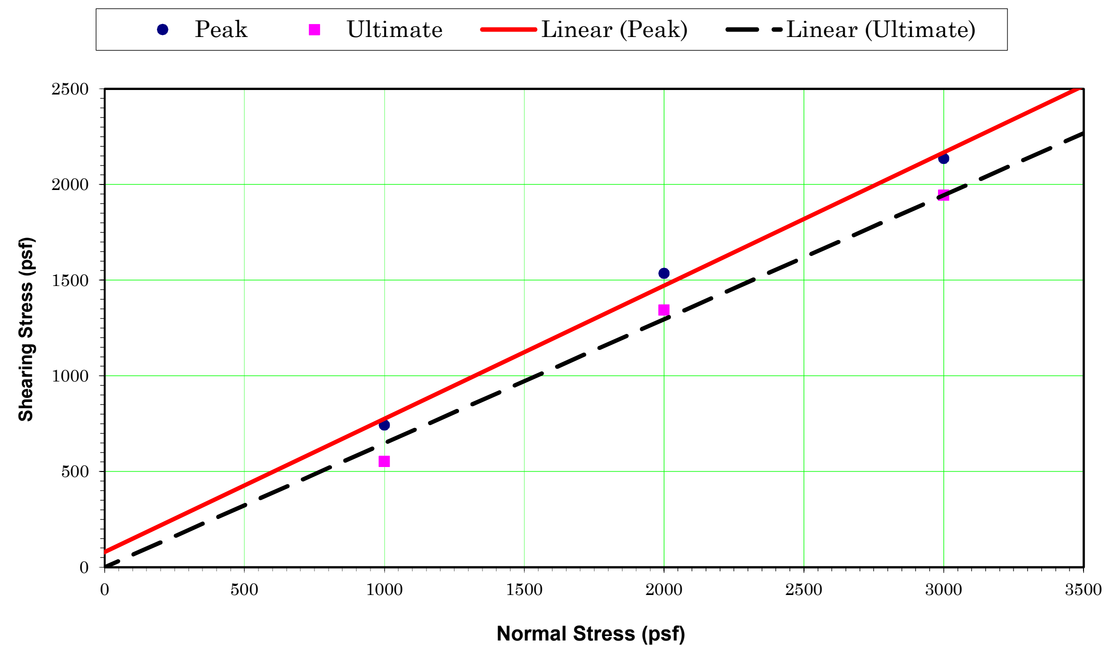
* Test Method: ASTM D-3080

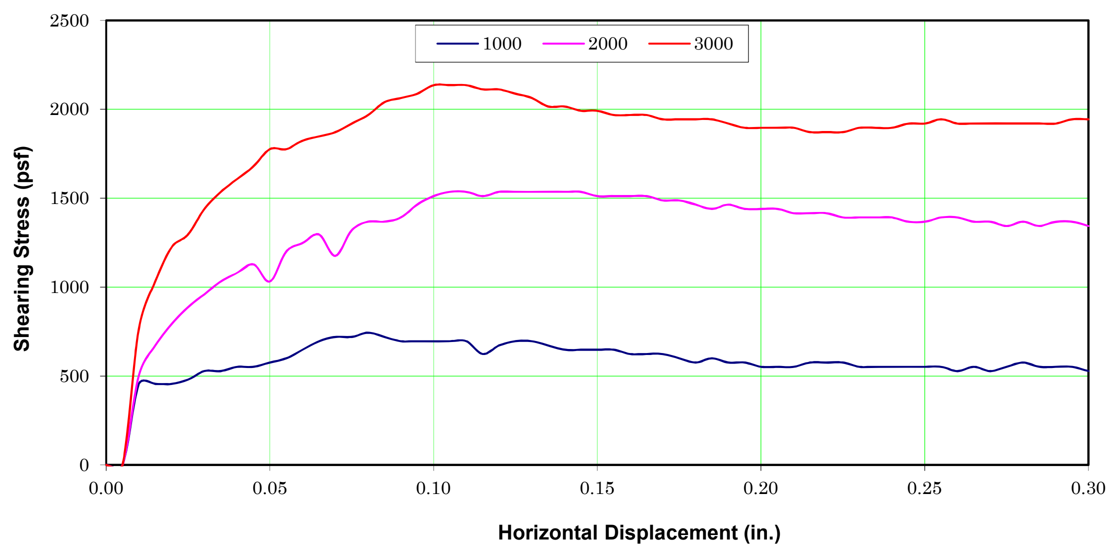
DIRECT SHEAR TEST

Camarillo High School Bleachers

Earth Systems

3/3/2020 303275-001





DIRECT SHEAR DATA*

Sample Location: B 1 @ 7.5'
Sample Description: Sand
Dry Density (pcf): 104.3
Intial % Moisture: 3
Average Degree of Saturation: 84.9
Shear Rate (in/min): 0.005 in/min

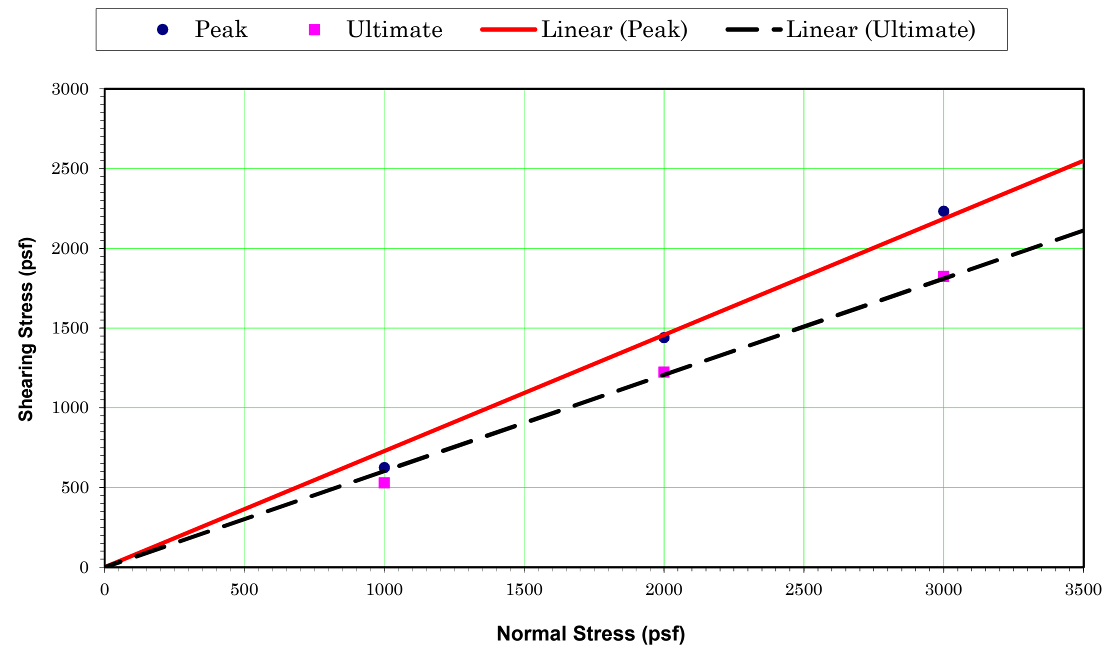
Normal stress (psf)	1000	2000	3000
Peak stress (psf)	744	1536	2136
Ultimate stress (psf)	552	1344	1944

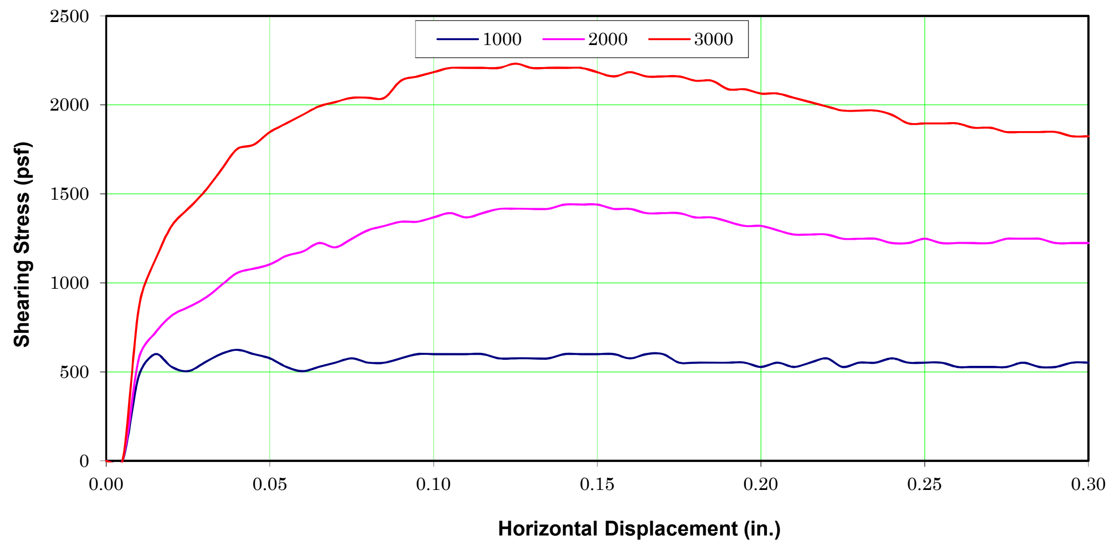
	Peak	Ultimate
ϕ Angle of Friction (degrees):	35	34
c Cohesive Strength (psf):	80	0

Test Type: Peak & Ultimate

* Test Method: ASTM D-3080

DIRECT SHEAR TEST	
Camarillo High School Bleachers	
Earth Systems	
3/3/2020	303275-001





DIRECT SHEAR DATA*

Sample Location: B 2 @ 5'
Sample Description: Sand
Dry Density (pcf): 103.4
Intial % Moisture: 2.9
Average Degree of Saturation: 83.1
Shear Rate (in/min): 0.005 in/min

Normal stress (psf)	1000	2000	3000
Peak stress (psf)	624	1440	2232
Ultimate stress (psf)	528	1224	1824

	Peak	Ultimate
ϕ Angle of Friction (degrees):	37	32
c Cohesive Strength (psf):	0	0

Test Type: Peak & Ultimate

* Test Method: ASTM D-3080

DIRECT SHEAR TEST

Camarillo High School Bleachers

Earth Systems

3/3/2020 | 303275-001

File No.: 303275-001

EXPANSION INDEX

ASTM D-4829, UBC 18-2

Job Name: Camarillo High School Bleachers
Sample ID: B 1 @ 0-5'
Soil Description: SC

Initial Moisture, %:	9.0
Initial Compacted Dry Density, pcf:	112.6
Initial Saturation, %:	49
Final Moisture, %:	18.3
Volumetric Swell, %:	10.6

Expansion Index: 106 High

EI	UBC Classification
0-20	Very Low
21-50	Low
51-90	Medium
91-130	High
130+	Very High

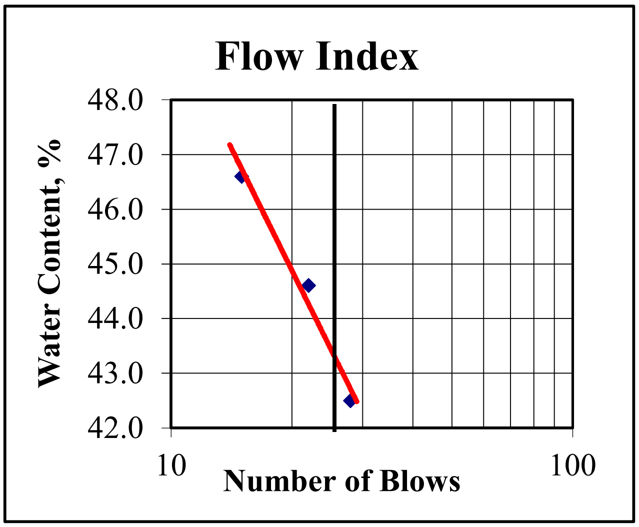
PLASTICITY INDEX

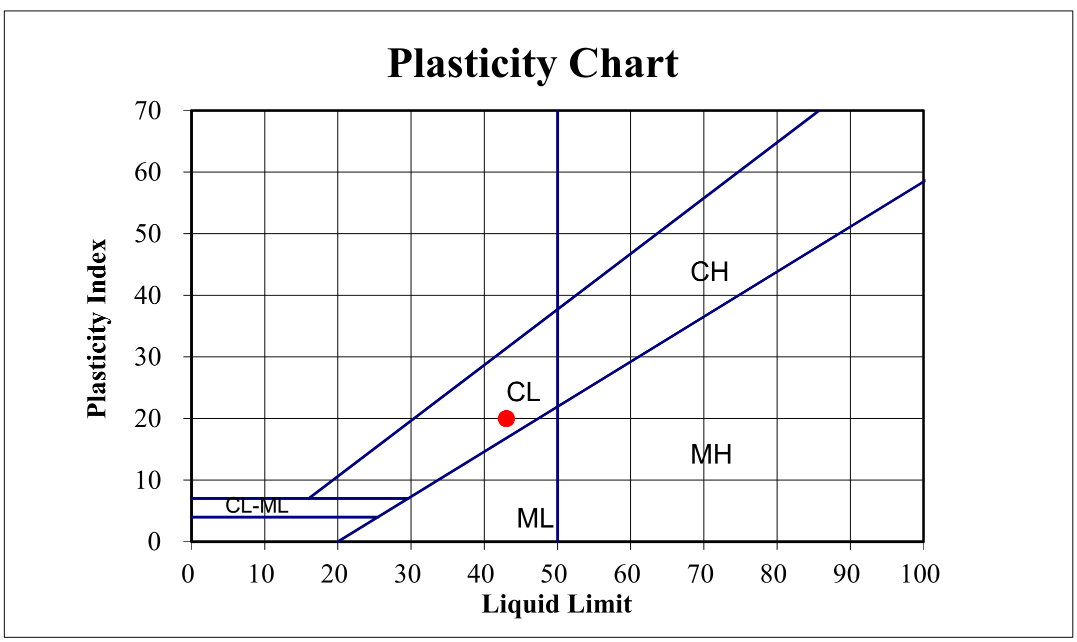
ASTM D-4318

Job Name: Camarillo High School Bleachers
Sample ID: B 1 @ 15'
Soil Description: CL

DATA SUMMARY **TEST RESULTS**

Number of Blows:	15	22	28	**LIQUID LIMIT**	**44**
Water Content, %	46.6	44.6	42.5	**PLASTIC LIMIT**	**23**
Plastic Limit:	22.4	22.7		**PLASTICITY INDEX**	**20**



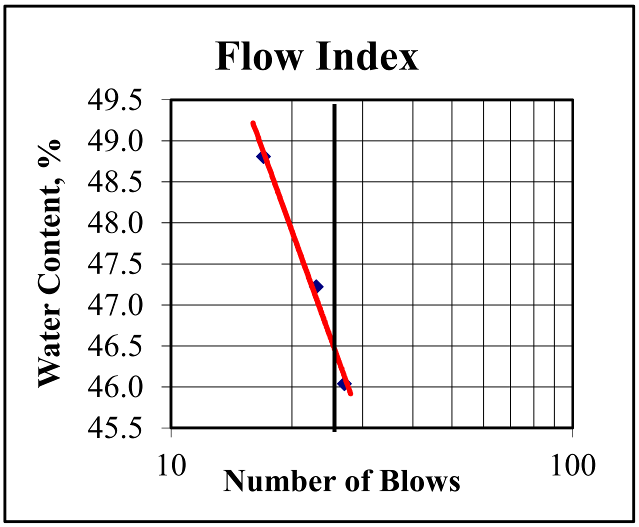


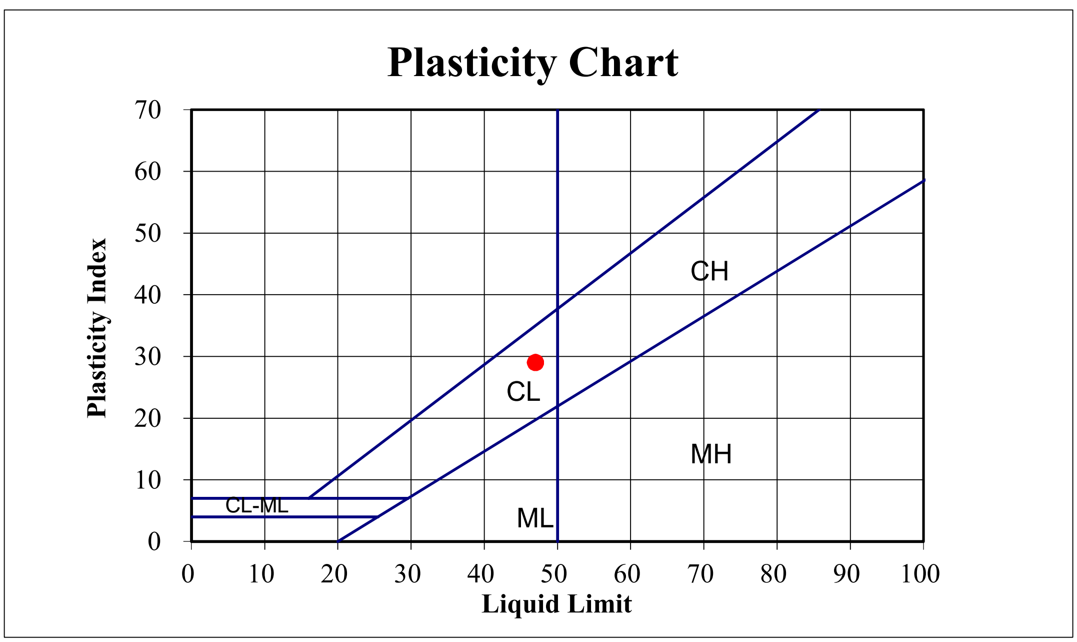
PLASTICITY INDEX

ASTM D-4318

Job Name: Camarillo High School Bleachers
Sample ID: B 1 @ 20'
Soil Description: CL

DATA SUMMARY				TEST RESULTS	
Number of Blows:	17	23	27	**LIQUID LIMIT**	**47**
Water Content, %	48.8	47.2	46.0	**PLASTIC LIMIT**	**18**
Plastic Limit:	17.8	17.7		**PLASTICITY INDEX**	**29**





MECHANICAL ANALYSIS

CTM 203-08

Job Name:	Camarillo High School Bleachers
Job No.:	303275-001
Sample ID:	**B 1 @ 15'**
Soil Description:	**CL**
Hydrometer ID:	504229

Hydroscopic Moisture

Air Dry Wt, g:	100.0
Oven Dry Wt, g	100.0
% Moisture:	0.0

Air Dry Sample Wt., g:	654.4
Corrected Wt., g:	654.4

Sieve Analysis for +#10 Material

Sieve Size	Wt Ret	% Ret	% Passing
1/2 inch	0.0	0.00	100.00
3/8 inch	0.0	0.00	100.00
#4	0.0	0.00	100.00
#8	0.0	0.00	100.00
#10	0.0	0.00	100.00

Air Dry Hydro Sample Wt., g:	58.9
Corrected Wt., g:	58.9
Calculation Factor	0.5890

Hydrometer Analysis for <#10 Material

Start time: 1:57:00 AM

Short Hydro	Time of Reading	Hydro Reading	Temp. at Reading, °C	Correction Factor	Corrected Hydro Reading
20 sec	1:57:20 AM	53	16	5.8	47.2
1 hour	2:57:00 AM	32	16	5.8	26.2
6 hour	7:57:00 AM	25	16	5.8	19.2

% Gravel:	0.0
% Sand(2mm - 74µm):	19.9
% Silt(74µm- 5µm):	35.6
% Clay(5µm - 2µm):	11.9
% Clay(≤2µm):	32.6

MECHANICAL ANALYSIS

CTM 203-08

Job Name:	Camarillo High School Bleachers
Job No.:	303275-001
Sample ID:	**B 1 @ 20'**
Soil Description:	**CL**
Hydrometer ID:	504229

Hydroscopic Moisture

Air Dry Wt, g:	100.0
Oven Dry Wt, g	100.0
% Moisture:	0.0

Air Dry Sample Wt., g:	741
Corrected Wt., g:	741.0

Sieve Analysis for +#10 Material

Sieve Size	Wt Ret	% Ret	% Passing
1/2 inch	0.0	0.00	100.00
3/8 inch	0.0	0.00	100.00
#4	0.0	0.00	100.00
#8	0.0	0.00	100.00
#10	0.0	0.00	100.00

Air Dry Hydro Sample Wt., g:	64.1
Corrected Wt., g:	64.1
Calculation Factor	0.6410

Hydrometer Analysis for <#10 Material

Start time: 1:55:00 AM

Short Hydro	Time of Reading	Hydro Reading	Temp. at Reading, °C	Correction Factor	Corrected Hydro Reading
20 sec	1:55:20 AM	59	16	5.8	53.2
1 hour	2:55:00 AM	35	16	5.8	29.2
6 hour	7:55:00 AM	30	16	5.8	24.2

% Gravel:	0.0
% Sand(2mm - 74µm):	17.0
% Silt(74µm- 5µm):	37.4
% Clay(5µm - 2µm):	7.8
% Clay(≤2µm):	37.8

MECHANICAL ANALYSIS

CTM 203-08

Job Name:	Camarillo High School Bleachers
Job No.:	303275-001
Sample ID:	**B 1 @ 30'**
Soil Description:	**ML**
Hydrometer ID:	504229

Hydroscopic Moisture

Air Dry Wt, g:	100.0
Oven Dry Wt, g	100.0
% Moisture:	0.0
Air Dry Sample Wt., g:	372
Corrected Wt., g:	372.0

Sieve Analysis for +#10 Material

Sieve Size	Wt Ret	% Ret	% Passing
1/2 inch	0.0	0.00	100.00
3/8 inch	0.0	0.00	100.00
#4	0.0	0.00	100.00
#8	0.0	0.00	100.00
#10	0.0	0.00	100.00

Air Dry Hydro Sample Wt., g:	58.9
Corrected Wt., g:	58.9
Calculation Factor	0.5890

Hydrometer Analysis for <#10 Material

Start time: 1:59:00 AM

Short Hydro	Time of Reading	Hydro Reading	Temp. at Reading, °C	Correction Factor	Corrected Hydro Reading
20 sec	1:59:20 AM	57	16	5.8	51.2
1 hour	2:59:00 AM	17	16	5.8	11.2
6 hour	7:59:00 AM	14	16	5.8	8.2

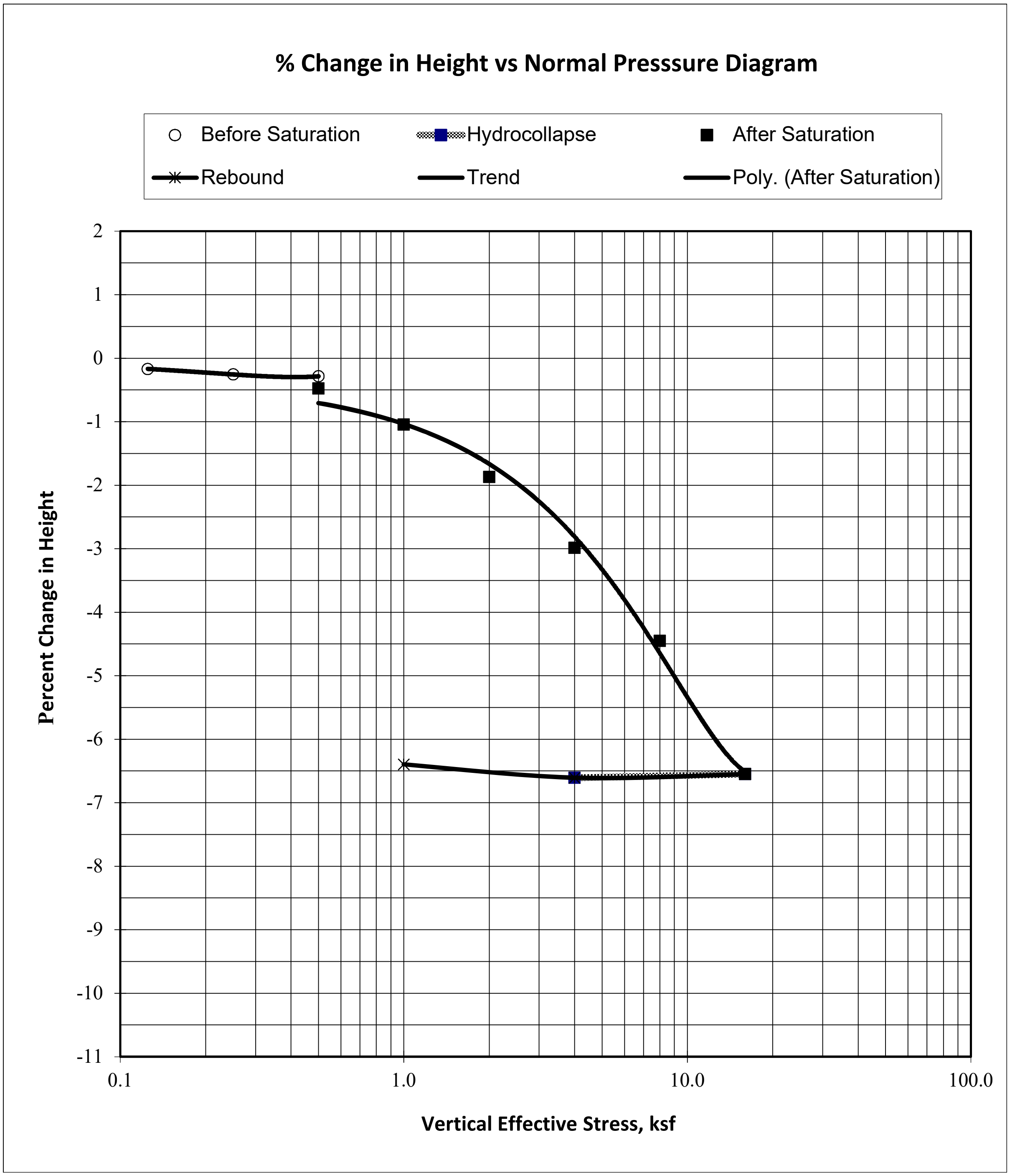
% Gravel:	0.0
% Sand(2mm - 74µm):	13.1
% Silt(74µm- 5µm):	67.9
% Clay(5µm - 2µm):	5.1
% Clay(≤2µm):	13.9

CONSOLIDATION TEST

ASTM D 2435-90 & D5333

Camarillo High School Bleachers
B 1 @ 5'
SM
Ring Sample

Initial Dry Density: 90.9 pcf
Initial Moisture, %: 11.4%
Specific Gravity: 2.67 (assume
Initial Void Ratio: 0.833

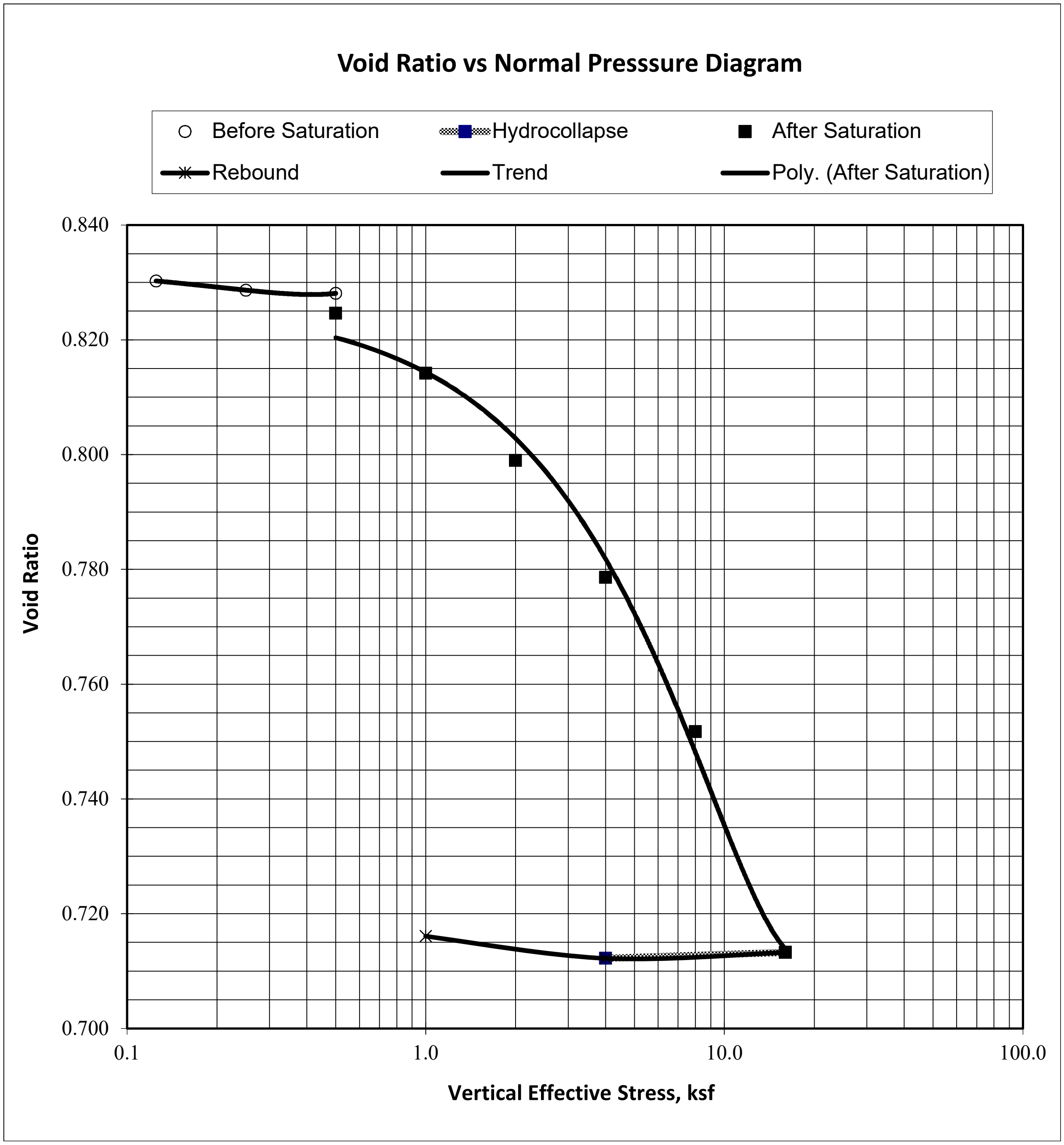


CONSOLIDATION TEST

ASTM D 2435-90

Camarillo High School Bleachers
B 1 @ 5'
SM
Ring Sample

Initial Dry Density: 90.9
Initial Moisture, %: 11.4
Specific Gravity: 2.67 (assume
Initial Void Ratio: 0.833

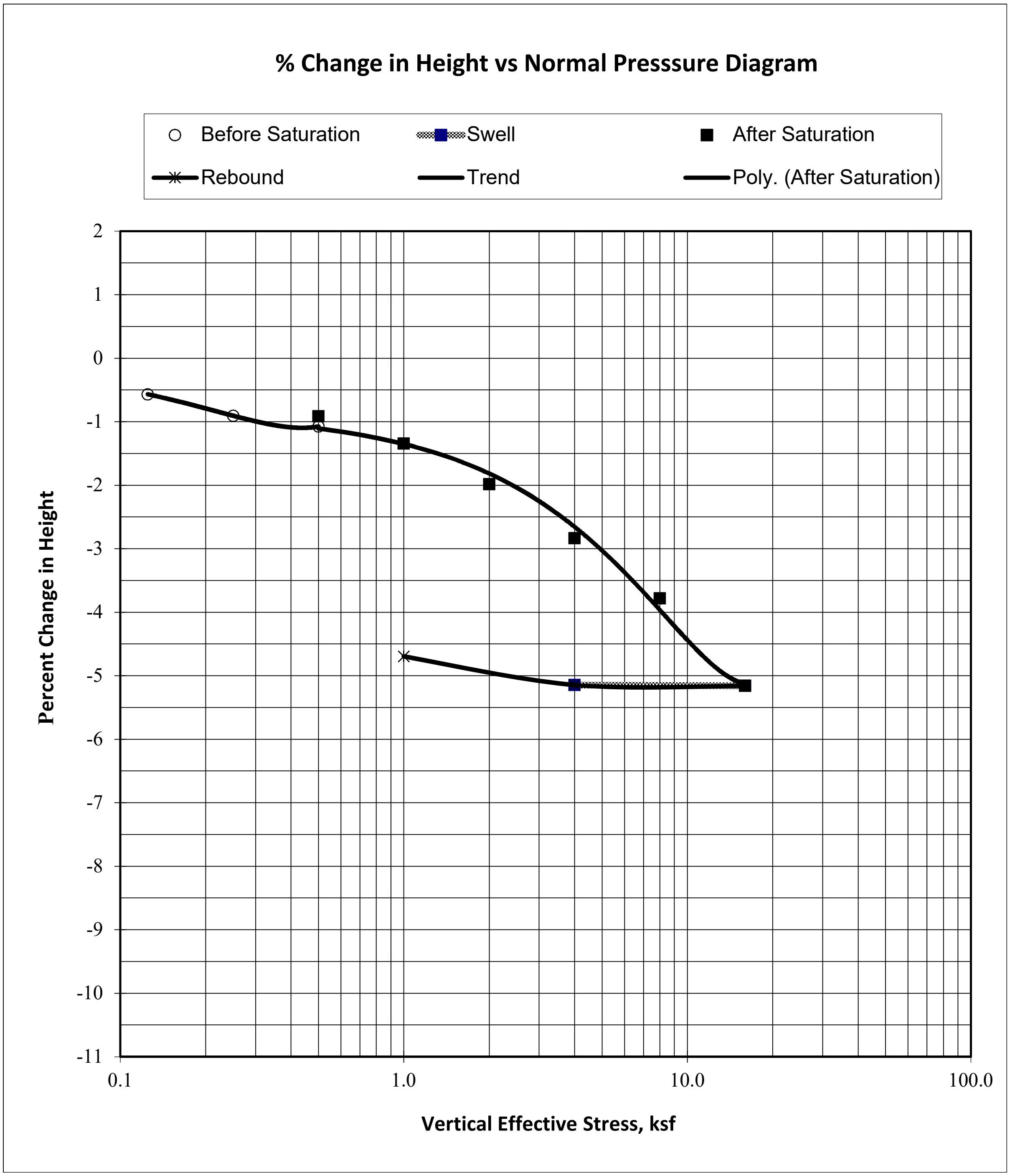


CONSOLIDATION TEST

ASTM D 2435-90

Camarillo High School Bleachers
B 2 @ 7.5'
SM
Ring Sample

Initial Dry Density: 106.2 pcf
Initial Moisture, %: 14.2%
Specific Gravity: 2.67 (assume
Initial Void Ratio: 0.570

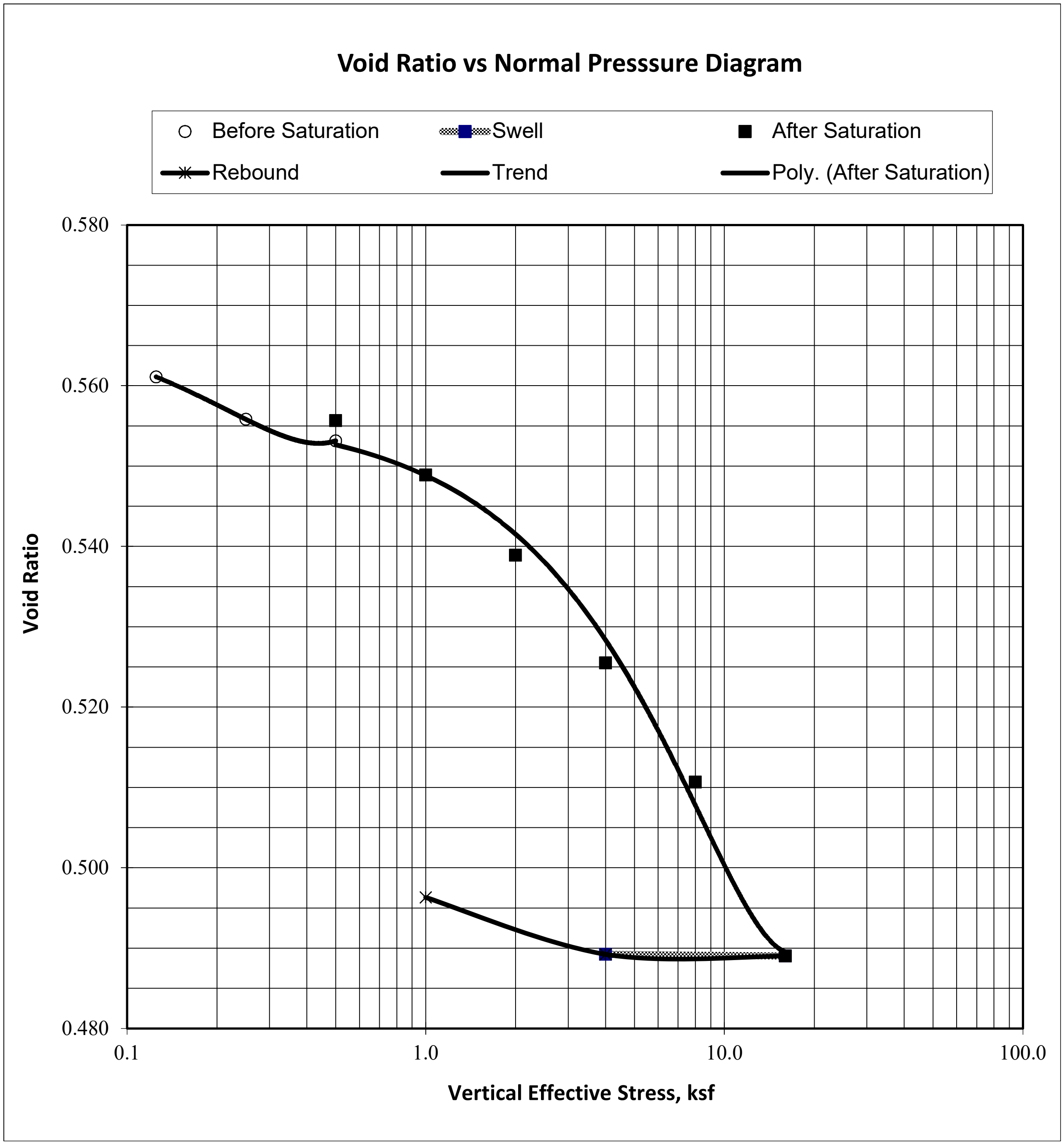


CONSOLIDATION TEST

ASTM D 2435-90

Camarillo High School Bleachers
B 2 @ 7.5'
SM
Ring Sample

Initial Dry Density: 106.2
Initial Moisture, %: 14.2
Specific Gravity: 2.67 (assume
Initial Void Ratio: 0.570



CERTIFICATE OF ANALYSIS

Client: Earth Systems Pacific
CAS LAB NO: 200246-01
Sample ID: B1@0-5'
Analyst: GP

Date Sampled: 01/28/20
Date Received: 02/10/20
Sample Matrix: Soil

WET CHEMISTRY SUMMARY

COMPOUND	RESULTS	UNITS	DF	PQL	METHOD	ANALYZED
pH (Corrosivity)	9.1	S.U.	1	---	9045	02/12/20
Resistivity*	5600	Ohms-cm	1	---	SM 120.1M	02/12/20
Chloride	18	mg/Kg	1	0.3	300.0M	02/14/20
Sulfate	44	mg/Kg	1	0.3	300.0M	02/14/20

*Sample was extracted using a 1:3 ratio of soil and DI water.

DF: Dilution Factor
PQL: Practical Quantitation Limit
BQL: Below Quantitation Limit
mg/Kg: Milligrams/Kilograms(ppm)

TABLE 1809.7
PRESCRIPTIVE FOOTINGS FOR SUPPORTING WALLS OF LIGHT FRAME CONSTRUCTION*

WEIGHTED EXPANSION INDEX (13)	FOUNDATION FOR SLAB & RAISED FLOOR SYSTEM (4) (8)							CONCRETE SLABS (8) (12)		PREMOISTENING OF SOILS UNDER FOOTINGS, PIERS AND SLABS (4) (5)	RESTRICTION ON PIERS UNDER RAISED FLOORS
	NUMBER OF STORIES	STEM THICKNESS	FOOTING WIDTH	FOOTING THICKNESS	ALL PERIMETER FOOTINGS (5)	INTERIOR FOOTINGS FOR SLAB AND RAISED FLOORS (5)	REINFORCEMENT FOR CONTINUOUS FOUNDATIONS (2) (6)	3-1/2" MINIMUM THICKNESS			
					DEPTH BELOW NATURAL SURFACE OF GROUND AND FINISH GRADE			REINFORCEMENT (3)	TOTAL THICKNESS OF SAND (10)		
		(INCHES)									
0 - 20 Very Low (non-expansive)	1 2 3	6 8 10	12 15 18	6 6 8	12 18 24	12 18 24	1-#4 top and bottom	#4 @ 48" o.c. each way, or #3 @ 36" o.c. each way	2"	Moistening of ground recommended prior to placing concrete	Piers allowed for single floor loads only
21-50 Low	1 2 3	6 8 10	12 15 18	6 6 8	15 18 24	12 18 24	1-#4 top and bottom	#4 @ 48" o.c. each way, or #3 @ 36" o.c. each way	4"	120% of optimum moisture required to a depth of 21" below lowest adjacent grade. Testing required.	Piers allowed for single floor loads only
51-90 Medium	1 2	6 8	12 15	6 6	21 21	12 18	1-#4 top and bottom	#3 @ 24" o.c. each way	4"	130% of optimum moisture required to a depth of 27" below lowest adjacent grade. Testing required	Piers not allowed
	3	10	18	8	24	24	#3 bars @ 24" in ext. footing Bend 3' into slab (7)				
91-130 High	1 2	6 8	12 15	6 6	27 27	12 18	2-#4 Top and Bottom	#3 @ 24" o.c. each way	4"	140% of optimum moisture required to a depth of 33" below lowest adjacent grade. Testing required.	Piers not allowed
	3	10	18	8	27	24	#3 bars @ 24" in ext. footing Bend 3' into slab (7)				
Above 130 Very High	Special design by licensed engineer/architect										

*Refer to next page for footnotes (1) through (14).

FOOTNOTES TO TABLE 1809.7

APPENDIX C

Site Class Determination Calculations

2019 CBC & ASCE 7-16 Seismic Parameters

US Seismic Design Maps

Spectral Response Values Table

Fault Parameters

Earth Systems	
Job Number:	303275-003
Job Name:	Camarillo HS Visitors Bleachers
Calc Date:	3/3/2020
CPT/Boring ID:	B-1

Use "SPT N_{60}" if correlated from CPT.
Use "Raw SPT blow/ft" if from SPT/ModCal.
Input Number Max Limit = 100.

Depth (ft)	SPT N	Sublayer Thick (ft)	Sublayer Thick/N
4.5	3.8	4.5	1.184
7.0	5.7	2.5	0.439
9.5	9.5	2.5	0.263
13.5	5.7	4.0	0.702
18.5	7.6	5.0	0.658
23.5	16.4	5.0	0.305
28.5	8.0	5.0	0.625
34.0	10.0	5.5	0.550
40.0	12.0	6.0	0.500
43.5	18.0	3.5	0.194
48.5	39.0	5.0	0.128
51.5	17.0	3.0	0.176
100.0	15.0	48.5	3.233

Total Thickness of Soil =	100.00	ft
N-bar Value =	11.2	*
Site Classification =	Class E	

*Equation 20.4-2 of ASCE 7-16

2019 California Building Code (CBC) (ASCE 7-16) Seismic Design Parameters

(Values presented should only be used by a Structural Engineer to determine if the exception in 11.4.8 (ASCE 7-16) can be used)

			CBC Reference	ASCE 7-16 Reference
Seismic Design Category		**D**	Table 1613.5.6	Table 11.6-1
Site Class		**E**	Table 1613.5.2	Table 20.3-1
Latitude:		34.215 N		
Longitude:		-119.009 W		
Maximum Considered Earthquake (MCE) Ground Motion				
Short Period Spectral Reponse	S_S	**1.618 g**	Figure 1613.5	Figure 22-1
1 second Spectral Response	S_1	**0.597 g**	Figure 1613.5	Figure 22-2
Site Coefficient	F_a	0.90 **	Table 1613.5.3(1)	Table 11.4-1
Site Coefficient	F_v	2.01	Table 1613.5.3(2)	Table 11-4.2
	S_{MS}	1.456 g **	$= F_a * S_S$	
	S_{M1}	1.198 g	$= F_v * S_1$	

**Exception of ASCE7-16, Section 11.4.8, Exception Note 1 Applied as Site Class is E, Ss >= 1.0, and therefore Fa was taken to be equal to that of Site Class C.

Design Earthquake Ground Motion			
Short Period Spectral Reponse	S_{DS}	**0.971 g** **	$= 2/3 * S_{MS}$
1 second Spectral Response	S_{D1}	**0.798 g**	$= 2/3 * S_{M1}$

Site Specific Evaluation May Be Required Due to Site Class = D or E and S1>=0.2. The Presented SDS and SD1 are NOT Valid Unless the Exception of ASCE7-16, Section 11.4.8 Applies

Site Specific Evaluation May Be Required Due to Site Class = E and Ss>=1.0. The Presented SDS and SD1 are NOT Valid Unless the Exception of ASCE7-16, Section 11.4.8 Applies

To	0.16 sec	$= 0.2 * S_{D1} / S_{DS}$
Ts (11.4.8 ASCE 7-16 Exception Assumed)	0.82 sec	$= S_{D1} / S_{DS}$
Risk Category	III	Table 1604.5
Seismic Importance Factor	1.25	
F_{PGA}	1.10	
PGA_M	**0.77**	
Vertical Coefficient (C_V)	1.42	Table 11.9-1

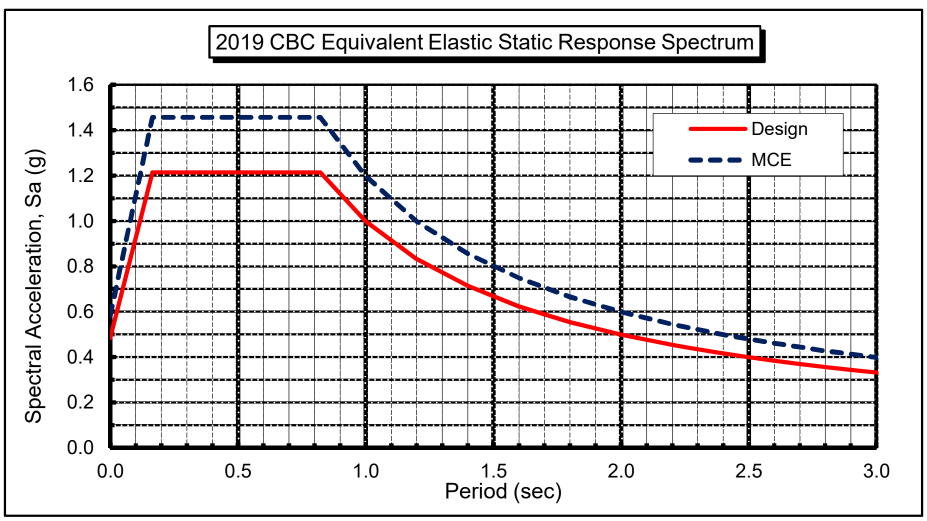


Table 11.5-1 Period T (sec)	Design Sa (g)
0.00	0.485
0.05	0.707
0.16	1.214
0.82	1.214
1.00	0.998
1.20	0.832
1.40	0.713
1.60	0.624
1.80	0.554
2.00	0.499
2.20	0.454
2.40	0.416
2.60	0.384
2.80	0.356
3.00	0.333
3.20	0.312

Adolfo Camarillo High School Visitors Bleachers

Latitude, Longitude: 34.2151, -119.0085

Date	3/3/2020, 2:37:43 PM
Design Code Reference Document	ASCE7-16
Risk Category	III
Site Class	E - Soft Clay Soil

Type	Value	Description
S_S	1.618	MCE_R ground motion. (for 0.2 second period)
S_1	0.597	MCE_R ground motion. (for 1.0s period)
S_{MS}	null -See Section 11.4.8	Site-modified spectral acceleration value
S_{M1}	null -See Section 11.4.8	Site-modified spectral acceleration value
S_{DS}	null -See Section 11.4.8	Numeric seismic design value at 0.2 second SA
S_{D1}	null -See Section 11.4.8	Numeric seismic design value at 1.0 second SA

Type	Value	Description
SDC	null -See Section 11.4.8	Seismic design category
F_a	null -See Section 11.4.8	Site amplification factor at 0.2 second
F_v	null -See Section 11.4.8	Site amplification factor at 1.0 second
PGA	0.703	MCE_G peak ground acceleration
F_{PGA}	1.1	Site amplification factor at PGA
PGA_M	0.773	Site modified peak ground acceleration
T_L	8	Long-period transition period in seconds
SsRT	1.618	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	1.801	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	2.164	Factored deterministic acceleration value. (0.2 second)
S1RT	0.597	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.667	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	0.66	Factored deterministic acceleration value. (1.0 second)
PGAd	0.859	Factored deterministic acceleration value. (Peak Ground Acceleration)
C_{RS}	0.898	Mapped value of the risk coefficient at short periods
C_{R1}	0.894	Mapped value of the risk coefficient at a period of 1 s

34.2151 -119.0085 Lat/Long

Spectral Response Values
Probabilistic and Deterministic Response Spectra for MCE compared to Code Spectra
for 5% Viscous Damping Ratio

	GeoMean Probab. 2% in 50 year MCE Spectrum	Max Rotated Probab. 2% in 50 year MCEr Spectrum	Max 84th Percentile Determ. MCE Spectrum	Determ. Lower Limit MCE Spectrum	Determ. MCE Spectrum	Site Specific MCE Ground Response	Site Specific MCE Spectrum Comparator	2019 CBC MCE Spectrum	Site Specific Design Spectrum	2019 CBC Design Spectrum
Natural Period T (seconds)	(1) 2475-year (ASCE 21.2.1)	(2) 2475-year (ASCE 21.2.1.1)	(3) 1.5*Fa = 1.500 (ASCE 21.2.2)	(4) (3) * 1.00=Scaling (ASCE 21.2.2)	(5) Max (3),(4) (ASCE 21.2.2)	(6) Min (2),(5) (ASCE 21.2.3)	(6b) Max (6),1.5*(8) (ASCE 21.2.3)	(7)	(8) (ASCE 21.3)	(9) 2/3*(7)
0.00	0.675	0.667	0.705	0.705	0.705	0.667	0.667	0.647	0.445	0.431
0.05	0.875	0.865	0.675	0.675	0.675	0.675	0.675	0.812	0.450	0.541
0.10	1.076	1.062	0.879	0.879	0.879	0.879	0.879	0.976	0.586	0.651
0.15	1.255	1.240	1.062	1.062	1.062	1.062	1.062	1.141	0.708	0.760
0.20	1.435	1.417	1.228	1.228	1.228	1.228	1.228	1.305	0.819	0.870
0.30	1.686	1.703	1.550	1.550	1.550	1.550	1.550	1.618	1.034	1.079
0.40	1.741	1.757	1.746	1.746	1.746	1.746	1.746	1.618	1.164	1.079
0.50	1.795	1.891	1.832	1.832	1.832	1.832	1.832	1.618	1.222	1.079
0.75	1.616	1.700	1.764	1.764	1.764	1.700	1.700	1.618	1.133	1.079
1.00	1.437	1.670	1.732	1.732	1.732	1.670	1.670	1.618	1.113	1.079
1.50	1.192	1.385	1.538	1.538	1.538	1.385	1.385	1.592	0.923	1.061
2.00	0.947	1.143	1.351	1.351	1.351	1.143	1.143	1.194	0.762	0.796
3.00	-	-	-	-	-	-	-	-	-	-
4.00	-	-	-	-	-	-	-	-	-	-
5.00	-	-	-	-	-	-	-	-	-	-
8.00	-	-	-	-	-	-	-	-	-	-
10.00	-	-	-	-	-	-	-	-	-	-

C_{RS}:	0.898	
C_{R1}:	0.894	
Site Specific To:	0.277	$= 0.2*S_{D1}/S_{DS}$
Site Specific Ts:	1.386	$= S_{D1}/S_{DS}$

The value of Fa used in Column (3) is defined within ASCE 21.2.2 Supplement 1. This Fa value only applies within Column (3).

Probabilistic Spectrum from 2014 USGS Ground Motion Mapping Program adjusted for site conditions and maximum rotated component of ground motion using NGA, Column 2 has risk coefficients C_R applied if ASCE7-16 Section 21.2.1.1 - Method 1 is used.

Reference: ASCE 7-16, Chapters 21.2, 21.3, 21.4, 21.5, 11.4, and 11.8

Calculation Utilized ASCE7-16, Section 21.2.1.1 - Method 1

Short-Period Seismic Design Category:	**1-Second Period Seismic Design Category:**
D	D

Vertical Coefficient (C_V)
1.42

1 g = 980.6 cm/sec² =32.2 ft/sec²

PSV (ft/sec) = $32.2(S_a)T/(2p)$

Site Coefficients	
F_{PGA}	1.10
F_a	1.00
F_v	4.00

Mapped MCE Acceleration Values		
PGA	0.703	g
S_S	1.618	g
S_1	0.597	g

Site Class	**E**
Risk Category	**III**

Site-Specific Design Acceleration Values		
PGA_M	**0.675**	**g**
S_{DS}	**1.099**	**g**
S_{D1}	**1.524**	**g**

Site-Specific MCE_R, 5% damped, Spectral Response Acceleration Parameter		
S_{MS}	**1.649**	**g**
S_{M1}	**2.286**	**g**

Key: Probab. = Probabilistic, Determ. = Deterministic, MCE = Maximum Considered Earthquake

Table 1
Fault Parameters

Fault Section Name	**Distance** (miles)	(km)	Upper Seis. Depth (km)	Lower Seis. Depth (km)	Avg Dip Angle (deg.)	Avg Dip Direction (deg.)	Avg Rake (deg.)	Trace Length (km)	Fault Type	**Mean Mag**	Mean Return Interval (years)	Slip Rate (mm/yr)
Simi-Santa Rosa	1.4	2.3	1.0	12.1	60	346	30	39	B	**6.8**		1
Oak Ridge (Onshore)	8.6	13.9	1.0	19.4	65	159	90	49	B	**7.2**		4
Malibu Coast (Extension), alt 1	11.1	17.9	0.0	7.8	74	4	30	35	B'	**6.5**		
Malibu Coast (Extension), alt 2	11.1	17.9	0.0	16.6	74	4	30	35	B'	**6.9**		
Ventura-Pitas Point	11.7	18.8	1.0	15.0	64	353	60	44	B	**6.9**		1
Malibu Coast, alt 1	12.4	20.0	0.0	7.8	75	3	30	38	B	**6.6**		0.3
Malibu Coast, alt 2	12.4	20.0	0.0	16.6	74	3	30	38	B	**6.9**		0.3
San Cayetano	14.3	23.0	0.0	16.0	42	3	90	42	B	**7.2**		6
Oak Ridge (Offshore)	15.3	24.6	0.0	7.9	32	180	90	38	B	**6.9**		3
Sisar	15.7	25.3	0.0	17.4	29	168	na	20	B'	**7.0**		
Anacapa-Dume, alt 1	16.9	27.3	0.0	15.5	45	354	60	51	B	**7.2**		3
Anacapa-Dume, alt 2	16.9	27.3	1.2	11.4	41	352	60	65	B	**7.2**		3
Santa Susana, alt 1	17.0	27.4	0.0	16.3	55	9	90	27	B	**6.8**		5
Santa Susana, alt 2	17.3	27.9	0.0	10.6	53	10	90	43	B'	**6.8**		
Northridge Hills	18.3	29.4	0.0	14.9	31	19	90	25	B'	**7.0**		
Red Mountain	18.9	30.4	0.0	14.1	56	2	90	101	B	**7.4**		2
Channel Islands Thrust	19.6	31.5	5.0	12.3	20	354	90	59	B	**7.3**		1.5
Mission Ridge-Arroyo Parida-Santa Ana	19.6	31.6	0.0	7.6	70	176	90	69	B	**6.8**		0.4
Del Valle	20.8	33.4	0.0	18.8	73	195	90	9	B'	**6.3**		
Holser, alt 1	21.2	34.1	0.0	18.6	58	187	90	20	B	**6.7**		0.4
Holser, alt 2	21.2	34.1	0.0	18.5	58	182	90	17	B'	**6.7**		
Santa Cruz Island	21.5	34.7	0.0	13.3	90	188	30	69	B	**7.1**		1
Shelf (Projection)	21.8	35.1	2.0	18.1	17	21	na	70	B'	**7.8**		
Northridge	21.9	35.3	7.4	16.8	35	201	90	33	B	**6.8**		1.5
San Pedro Basin	22.5	36.2	0.8	12.3	88	51	na	69	B'	**7.0**		
Santa Ynez (East)	23.3	37.5	0.0	13.3	70	172	0	68	B	**7.2**		2
Santa Monica Bay	24.2	38.9	2.3	18.0	20	44	na	17	B'	**7.0**		
North Channel	24.8	40.0	1.1	4.5	26	10	90	51	B	**6.7**		1
Channel Islands Western Deep Ramp	24.9	40.1	4.8	12.5	21	204	90	62	B'	**7.3**		
Pine Mtn	25.1	40.4	0.0	16.3	45	5	na	62	B'	**7.3**		
Compton	26.4	42.5	5.2	15.6	20	34	90	65	B'	**7.5**		
Pitas Point (Lower)-Montalvo	27.0	43.4	0.4	12.7	16	359	90	30	B	**7.3**		2.5
Santa Monica, alt 1	28.9	46.4	0.0	17.9	75	343	30	14	B	**6.5**		1
San Gabriel	29.3	47.1	0.0	14.7	61	39	180	71	B	**7.3**		1
Santa Monica, alt 2	29.4	47.3	0.0	11.6	50	338	30	28	B	**6.7**		1
San Pedro Escarpment	29.5	47.5	1.0	16.0	17	38	na	27	B'	**7.3**		
Santa Cruz Catalina Ridge	30.0	48.3	0.0	11.0	90	38	na	137	B'	**7.3**		
Palos Verdes	30.9	49.7	0.0	13.6	90	53	180	99	B	**7.3**		3
Sierra Madre (San Fernando)	30.9	49.7	0.0	13.0	45	9	90	18	B	**6.6**		2
Pitas Point (Upper)	33.6	54.0	1.4	10.0	42	15	90	35	B	**6.8**		1

Reference: USGS OFR 2007-1437 (CGS SP 203)

Based on Site Coordinates of 34.2151 Latitude, -119.0085 Longitude

Mean Magnitude for Type A Faults based on 0.1 weight for unsegmented section, 0.9 weight for segmented model (weighted by probability of each scenario with section listed as given on Table 3 of Appendix G in OFR 2007-1437). Mean magntude is average of Ellworths-B and Hanks & Bakun moment area relationship.

APPENDIX D

Seismic Settlement Analysis Calculations
Seismic Settlement Analysis Curves

LIQUEFY-v 2.3.XLS - A SPREADSHEET FOR EMPIRICAL ANALYSIS OF LIQUEFACTION POTENTIAL AND INDUCED GROUND SUBSIDENCE

Developed 2006 by Shelton L. Stringer, PE, GE, PG - Earth Systems Southwest

Project: **Camarillo High School Visitors Bleachers**
Job No: **303275-003**
Date: **4/9/2020**
Boring: **B-1** Data Set: 1

Methods: **Liquefaction Analysis using 1996 & 1998 NCEER workshop method (Youd & Idriss, editors)**
Journal of Geotechnical and Enviromental Engineering (JGEE), October 2001, Vol 127, No. 10, ASCE
Settlement Analysis from Tokimatsu and Seed (1987), JGEE,Vol 113, No.8, ASCE
Modified by Pradel, JGEE, Vol 124, No. 4, ASCE

EARTHQUAKE INFORMATION:

Magnitude: **6.8** 7.5
PGA, g: **0.77** 0.60
MSF: 1.28
GWT: **52.0** feet
Calc GWT: **52.0** feet
Remediate to: **0.0** **feet**

SPT N VALUE CORRECTIONS:

Energy Correction to N60 (C_E): 1.33 Automatic Hammer
Drive Rod Corr. (C_R): 1 Default
Rod Length above ground (feet): 3.0
Borehole Dia. Corr. (C_B): 1.00
Sampler Liner Correction for SPT?: 1 Yes
Cal Mod/ SPT Ratio: 0.63

Threshold Acceler., g: #N/A

Total (ft) Liquefied Thickness	**Total (in.) Induced Subsidence**
0	**1.0**

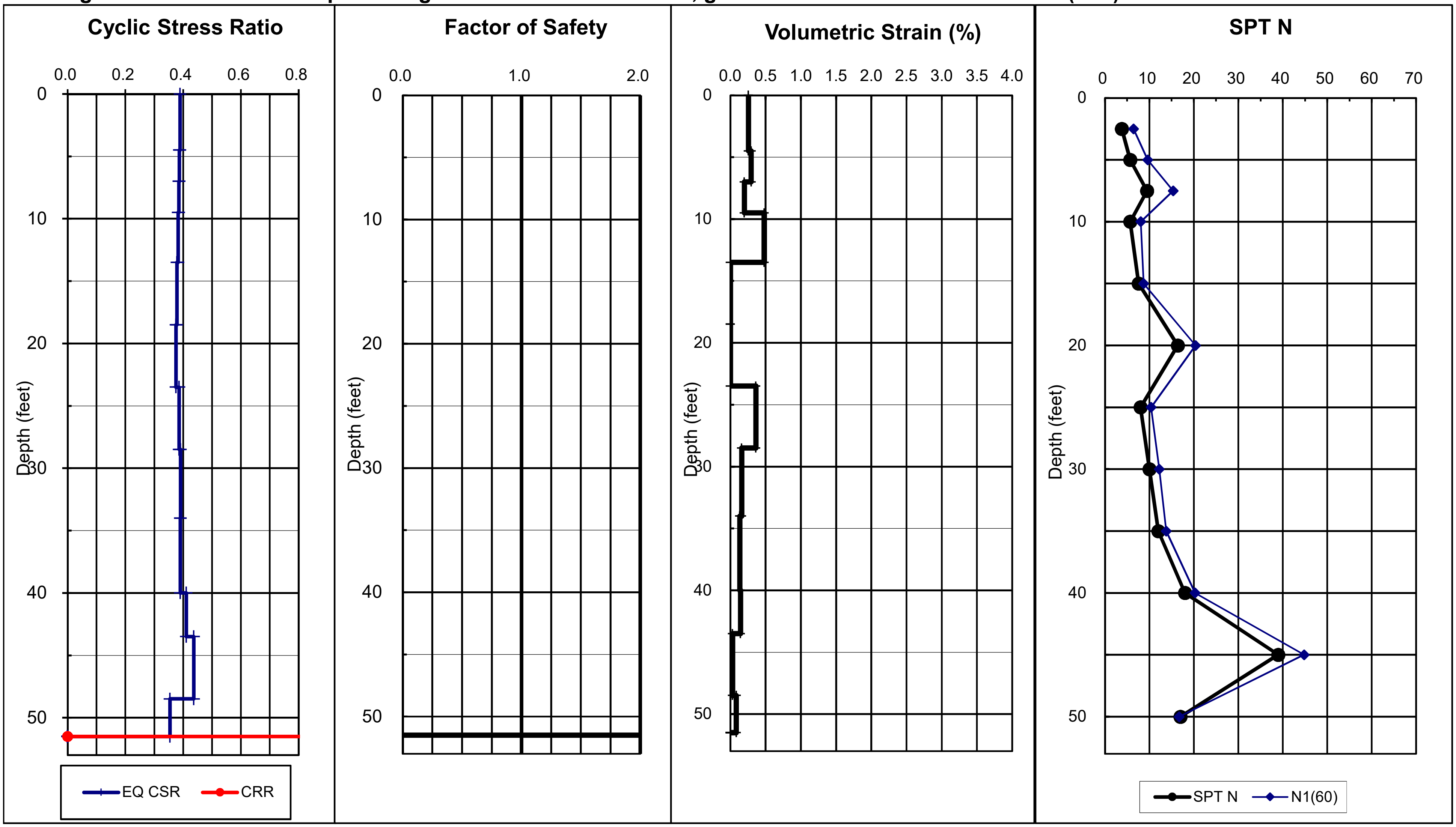
Required SF: 1.30
Minimum Calculated SF: #N/A

Base Depth (feet)	Cal Mod N	SPT N	Liquef. Suscept. (0 or 1)	Total Unit Wt. (pcf)	Fines Content (%)	Depth of SPT (feet)	Rod Length (feet)	Tot.Stress at SPT po (tsf)	Eff.Stress at SPT p'o (tsf)	rd	C_N	C_R	C_S	$N_{1(60)}$	Rel. Dens. Dr (%)	*Trigger FC Adj.* $\Delta N_{1(60)}$	*Equiv. Sand* $N_{1(60)CS}$	Kσ	M = 7.5 Available CRR	M =7.5 Induced CSR*	**Liquefac. Safety Factor**	*Post FC Adj.* $\Delta N_{1(60)}$	$N_{1(60)CS}$	Volumetric *Strain (%)*	**Induced Subsidence (in.)**
0.0				0				0.000																	
4.5	6	**4**	1	107	35	2.5	5.5	0.134	0.134	1.00	1.70	0.75	1.00	6.4	30	6.3	12.7	1.00	0.138	0.390	**Non-Liq.**	6.3	12.7	0.26	**0.14**
7.0	9	**6**	1	107	15	5.0	8.0	0.268	0.268	0.99	1.70	0.75	1.00	9.6	37	3.0	12.6	1.00	0.136	0.387	**Non-Liq.**	3.0	12.6	0.29	**0.09**
9.5	15	9	1	107	5	7.5	10.5	0.401	0.401	0.98	1.62	0.75	1.00	15.3	47	0.0	15.3	1.00	0.166	0.385	**Non-Liq.**	0.0	15.3	0.20	**0.06**
13.5	9	6	1	107	15	10.0	13.0	0.535	0.535	0.98	1.41	0.76	1.00	8.1	34	2.9	10.9	1.00	0.118	0.383	**Non-Liq.**	2.9	10.9	0.48	**0.23**
18.5	12	8	0	107	80	15.0	18.0	0.803	0.803	0.97	1.00	0.86	1.00	8.7				1.00	Infin.	0.379	**Non-Liq.**		8.7	0.00	**0.00**
23.5	26	16	0	107	83	20.0	23.0	1.070	1.070	0.96	1.00	0.93	1.00	20.4				1.00	Infin.	0.375	**Non-Liq.**		20.4	0.00	**0.00**
28.5	0	8	1	107	15	25.0	28.0	1.338	1.338	0.94	0.89	0.98	1.11	10.4	38	3.0	13.4	0.95	0.145	0.386	**Non-Liq.**	3.0	13.4	0.36	**0.22**
34.0	0	10	1	107	87	30.0	33.0	1.605	1.605	0.92	0.81	1.00	1.13	12.2	42	7.4	19.7	0.92	0.213	0.391	**Non-Liq.**	7.4	19.7	0.16	**0.11**
40.0	0	12	1	107	87	35.0	38.0	1.873	1.873	0.89	0.75	1.00	1.14	13.8	44	7.8	21.5	0.89	0.234	0.390	**Non-Liq.**	7.8	21.5	0.13	**0.10**
43.5	0	18	1	107	5	40.0	43.0	2.140	2.140	0.85	0.70	1.00	1.20	20.3	54	0.0	20.3	0.81	0.220	0.411	**Non-Liq.**	0.0	20.3	0.14	**0.06**
48.5	0	39	1	107	5	45.0	48.0	2.408	2.408	0.80	0.66	1.00	1.30	44.8	80	0.0	44.8	0.72	1.200	0.437	**Non-Liq.**	0.0	44.8	0.03	**0.02**
51.5	0	17	1	107	60	50.0	53.0	2.675	2.675	0.75	0.63	1.00	1.17	16.7	49	8.3	25.0	0.83	0.283	0.354	**Non-Liq.**	8.3	25.0	0.08	**0.03**
0.0	0	0	0	0	0	0.0																			
0.0	0	0	0	0	0	0.0																			
0.0	0	0	0	0	0	0.0																			
0.0	0	0	0	0	0	0.0																			
0.0	0	0	0	0	0	0.0																			

EARTH SYSTEMS - EVALUATION OF LIQUEFACTION POTENTIAL AND INDUCED SUBSIDENCE

Camarillo High School Visitors Bleachers **Project No: 303275-003** 1996/1998 NCEER Method

Boring: B-1 **Earthquake Magnitude: 6.8** **PGA, g: 0.77** **Calc GWT (feet): 52**



Total Thickness of Liquefiable Layers: 0.0 feet **Estimated Total Ground Subsidence: 1.0 inches**

CPT-LIQUEFY.XLS - A SPREADSHEET FOR EMPIRICAL ESTIMATION OF LIQUEFACTION POTENTIAL USING CPT DATA

Project: Camarillo High School Visitors Bleachers
Job No: 303275-003
Date: 3/3/2020
Sounding: CPT-22

Liquefaction Analysis using 1998 NCEER (Robertson & Wride) method
Settlement Analysis using Tokimatsu & Seed (1987) using clean sand Qc1n/N1(60) ratio =5

EARTHQUAKE INFORMATION:

Magnitude:	6.8	7.5
PGA, g:	0.77	0.60
MSF:	1.28	
GWT, feet:	52.0	
Calc GWT, feet:	52.0	

Plot: 1
Method Used: 1 — 1998 NCEER (Robertson & Wride)
Averaging Increment: 3 — 0.15 m
Induced CSR (M=7.5) = 0.65*PGA*(po/p'o)*rd/MSF
Clean Sand Qc1n = C_Q*K_C*K_H*Qc
SF = $CRR_{7.5}$*Kσ/CSR

Ignore 1st/last increment into sand/silt soils: 0 no
Ignore/remediate upper: 1.3 m
Unit Weight of unsaturated soils: 100 pcf
Unit Weight of saturated soils: 120 pcf
Limiting Ic for liquefiable soils: 2.60
Limiting Ic for K_H: 2.6

Use which FC adjustment: 1 — Based on Clean Sand Qc1n
Use which Apparent FC Curve: 0 — Robertson Lower Bound
Use Moss @ P_L: 15%
Use Tokimatsu & Seed (1) or Ishihara &Yoshmine (2), Wu (3): 1 — **Tokimatsu & Seed**
Required SF: 1.30
Max $\Delta N_{1(60)}$ - post liquefied: 5.0
Max $\Delta N_{1(60)}$ - non liquefied: 10.0
Min SF of Liquefiable Layers: 0.00
Avg SF of Liquefiable Layers: #DIV/0!

Total Liquefied Thickness (feet)	Total Induced Subsidence (inches)
0.0	1.8

Depth (feet)	(m)	Tip Qc (tsf)	Friction Fs (tsf)	Friction Ratio Rf %	qc MPa	Total Unit Wt. (pcf)	Total Stress po (tsf)	Eff. Stress p'o (tsf)	rd	F %	n	Max 1.70 Cq	Q	Moss qc1 MPa	Moss Δqc MPa	Moss qc_{1mod} MPa	Moss eff K_C	Qc1n	Ic	Override	Liquef. Suscept. (0 or 1)	Rel. Dens. Dr (%)	K_C	K_H	Clean Sand Qc1n	Idriss Kσ	1.0 Kσ	CRR	Induced M=7.5 CSR	Liquefac. Safety Factor	Qc1n $N_{1(60)}$ Ratio	Equiv. $N_{1(60)}$	Apparent FC %	FC Adj. $\Delta N_{1(60)}$	Equiv. $N_{1(60)cs}$	*Volumetric Strain (%)*
0.49	0.15	18.16	0.20	1.12	1.74	100	0.025	0.025	1.000	1.12	0.72	1.70	29.14	2.96	0.68	3.64		29.18	2.37		0			1.00		1.00	1.00		0.391	Non-Liq.	4.4	6.7	56			0.00
0.98	0.30	75.01	0.27	0.36	7.18	100	0.049	0.049	1.000	0.36	0.50	1.70	120.45	12.21	0.00	12.21		120.53	1.59		0			1.00		1.00	1.00		0.391	Non-Liq.	5.9	20.5	11			0.00
1.48	0.45	63.06	0.68	1.08	6.04	100	0.074	0.074	0.999	1.08	0.59	1.70	101.20	10.27	0.64	10.90		101.32	1.93		0			1.00		1.00	1.00		0.391	Non-Liq.	5.2	19.4	26			0.00
1.97	0.60	40.94	0.45	1.09	3.92	100	0.098	0.098	0.997	1.09	0.63	1.70	65.62	6.66	0.65	7.32		65.78	2.08		0			1.00		1.00	1.00		0.390	Non-Liq.	4.9	13.3	35			0.00
2.46	0.75	44.09	0.26	0.58	4.22	100	0.123	0.123	0.996	0.58	0.58	1.70	70.65	7.18	0.09	7.27		70.85	1.90		0			1.00		1.00	1.00		0.390	Non-Liq.	5.3	13.4	25			0.00
2.95	0.90	37.67	0.31	0.82	3.61	100	0.148	0.148	0.995	0.82	0.62	1.70	60.29	6.13	0.35	6.48		60.52	2.03		0			1.00		1.00	1.00		0.389	Non-Liq.	5.0	12.1	32			0.00
3.44	1.05	36.97	0.32	0.87	3.54	100	0.172	0.172	0.994	0.87	0.62	1.70	59.12	6.02	0.40	6.42		59.40	2.06		0			1.00		1.00	1.00		0.389	Non-Liq.	5.0	11.9	34			0.00
3.94	1.20	33.77	0.29	0.86	3.23	100	0.197	0.197	0.993	0.86	0.63	1.70	53.95	5.50	0.39	5.89		54.27	2.09		0			1.00		1.00	1.00		0.388	Non-Liq.	4.9	11.0	36			0.00
4.43	1.35	27.87	0.25	0.91	2.67	100	0.221	0.221	0.992	0.92	0.66	1.70	44.43	4.54	0.45	4.99	1.10	44.78	2.17		1	43	1.60	1.00	71.7	1.00	1.00	0.114	0.388	Non-Liq.	4.7	9.4	41	4.9	14.3	1.52
4.92	1.50	25.80	0.21	0.81	2.47	100	0.246	0.246	0.990	0.82	0.66	1.70	41.06	4.20	0.35	4.55	1.08	41.46	2.18		1	40	1.61	1.00	66.8	1.00	1.00	0.108	0.387	Non-Liq.	4.7	8.7	41	4.6	13.4	1.91
5.41	1.65	33.41	0.26	0.78	3.20	100	0.271	0.271	0.989	0.79	0.63	1.70	53.25	5.44	0.31	5.75	1.06	53.69	2.07		1	51	1.40	1.00	75.4	1.00	1.00	0.120	0.387	Non-Liq.	4.9	10.9	35	4.2	15.1	1.29
5.91	1.80	42.11	0.40	0.95	4.03	100	0.295	0.295	0.988	0.96	0.62	1.70	67.19	6.86	0.50	7.35	1.07	67.66	2.03		1	61	1.35	1.00	91.2	1.00	1.00	0.151	0.386	Non-Liq.	5.0	13.5	32	4.8	18.2	0.72
6.40	1.95	47.23	0.51	1.08	4.52	100	0.320	0.320	0.987	1.08	0.62	1.70	75.37	7.69	0.63	8.32	1.08	75.88	2.03		1	65	1.34	1.00	101.5	1.00	1.00	0.177	0.386	Non-Liq.	5.0	15.1	32	5.2	20.3	0.52
6.89	2.10	56.21	0.56	1.00	5.38	100	0.344	0.344	0.986	1.01	0.59	1.70	89.76	9.15	0.55	9.70	1.06	90.31	1.95		1	73	1.24	1.00	111.8	1.00	1.00	0.210	0.386	Non-Liq.	5.2	17.4	28	4.9	22.4	0.40
7.38	2.25	64.63	0.57	0.89	6.19	100	0.369	0.369	0.985	0.89	0.57	1.70	103.26	10.24	0.42	10.67	1.04	103.85	1.87		1	78	1.16	1.00	120.5	1.00	1.00	0.243	0.385	Non-Liq.	5.3	19.4	23	4.7	24.1	0.32
7.87	2.40	47.22	0.51	1.08	4.52	100	0.394	0.394	0.984	1.09	0.62	1.70	75.25	7.33	0.64	7.97	1.09	75.88	2.03		1	65	1.34	1.00	101.9	1.00	1.00	0.178	0.385	Non-Liq.	5.0	15.1	32	5.3	20.4	0.53
8.37	2.55	26.88	0.38	1.41	2.57	100	0.418	0.418	0.983	1.43	0.70	1.70	42.52	4.24	0.99	5.24	1.23	43.20	2.30		1	42	1.94	1.00	83.9	1.00	1.00	0.135	0.384	Non-Liq.	4.5	9.6	50	7.2	16.8	0.93
8.86	2.70	10.39	0.31	2.96	0.99	100	0.443	0.443	0.982	3.09	0.87	1.70	15.98	1.69	2.70	4.39		16.69	2.84		0			1.00		1.00	1.00		0.384	Non-Liq.	3.4	4.8	100			0.00
9.35	2.85	8.51	0.27	3.13	0.81	100	0.468	0.468	0.981	3.31	0.90	1.70	12.92	1.38	2.88	4.26		13.67	2.93		0			1.00		1.00	1.00		0.384	Non-Liq.	3.3	4.2	100			0.00
9.84	3.00	10.46	0.16	1.56	1.00	100	0.492	0.492	0.979	1.64	0.83	1.70	16.01	1.70	1.16	2.87		16.80	2.68		0			1.00		1.00	1.00		0.383	Non-Liq.	3.8	4.5	85			0.00
10.33	3.15	26.65	0.15	0.55	2.55	100	0.517	0.517	0.978	0.56	0.65	1.60	39.47	4.19	0.06	4.25	1.01	40.40	2.11		1	39	1.47	1.00	59.6	1.00	1.00	0.100	0.383	Non-Liq.	4.9	8.3	37	3.6	11.9	2.67
10.83	3.30	32.01	0.21	0.66	3.07	100	0.541	0.541	0.977	0.67	0.65	1.54	45.86	4.66	0.18	4.84	1.04	46.65	2.09		1	45	1.44	1.00	67.0	1.00	1.00	0.108	0.382	Non-Liq.	4.9	9.5	36	3.9	13.4	1.85
11.32	3.45	27.04	0.34	1.25	2.59	100	0.566	0.566	0.976	1.28	0.71	1.56	39.06	3.66	0.82	4.48	1.22	39.90	2.30		1	39	1.95	1.00	77.7	1.00	1.00	0.124	0.382	Non-Liq.	4.5	8.9	50	6.7	15.5	1.18
11.81	3.60	33.15	0.51	1.53	3.17	100	0.591	0.591	0.975	1.55	0.71	1.51	46.49	4.23	1.12	5.35	1.27	47.33	2.29		1	46	1.92	1.00	90.7	1.00	1.00	0.149	0.381	Non-Liq.	4.5	10.5	50	7.7	18.1	0.75
12.30	3.75	56.70	0.56	0.98	5.43	100	0.615	0.615	0.974	0.99	0.62	1.40	74.10	7.04	0.53	7.57	1.08	74.91	2.01		1	65	1.31	1.00	98.4	1.00	1.00	0.169	0.381	Non-Liq.	5.1	14.8	31	4.9	19.7	0.60
12.80	3.90	34.15	0.54	1.57	3.27	100	0.640	0.640	0.973	1.60	0.71	1.43	45.29	4.17	1.17	5.34	1.28	46.15	2.31		1	45	1.97	1.00	90.8	1.00	1.00	0.150	0.381	Non-Liq.	4.5	10.3	51	7.9	18.2	0.75
13.29	4.05	27.51	0.54	1.96	2.63	100	0.664	0.664	0.972	2.00	0.75	1.42	36.03	3.31	1.59	4.90	1.48	36.92	2.44		1	35	2.50	1.00	92.5	1.00	1.00	0.154	0.380	Non-Liq.	4.2	8.8	62	9.7	18.5	0.72
13.78	4.20	16.11	0.42	2.59	1.54	100	0.689	0.689	0.971	2.71	0.84	1.43	20.87	1.96	2.29	4.25		21.80	2.71		0			1.00		1.00	1.00		0.380	Non-Liq.	3.7	5.9	88			0.00
14.27	4.35	8.07	0.32	3.91	0.77	100	0.714	0.714	0.970	4.28	0.95	1.45	10.12	1.02	3.72	4.74		11.10	3.08		0			1.00		1.00	1.00		0.379	Non-Liq.	3.0	3.7	100			0.00
14.76	4.50	7.81	0.38	4.90	0.75	100	0.738	0.738	0.969	5.41	0.98	1.42	9.50	0.96	4.80	5.76		10.49	3.17		0			1.00		1.00	1.00		0.379	Non-Liq.	2.8	3.7	100			0.00
15.26	4.65	14.26	0.48	3.37	1.37	100	0.763	0.763	0.968	3.56	0.88	1.33	16.99	1.64	3.14	4.77		17.96	2.86		0			1.00		1.00	1.00		0.379	Non-Liq.	3.4	5.3	100			0.00
15.75	4.80	23.76	0.60	2.54	2.28	100	0.787	0.787	0.967	2.63	0.80	1.27	27.50	2.62	2.22	4.85		28.44	2.61		0			1.00		1.00	1.00		0.378	Non-Liq.	3.9	7.3	77			0.00
16.24	4.95	34.03	0.54	1.57	3.26	100	0.812	0.812	0.966	1.61	0.72	1.21	38.03	4.68	1.17	5.85	1.25	49.26	2.37		1	47	2.19	1.26	107.7	1.00	1.00	0.196	0.378	Non-Liq.	4.4	11.3	56	10.0	21.3	0.49
16.73	5.10	32.70	0.42	1.29	3.13	100	0.837	0.837	0.965	1.32	0.72	1.18	35.63	4.47	0.86	5.33	1.19	46.23	2.34		1	45	2.08	1.26	96.4	1.00	1.00	0.163	0.377	Non-Liq.	4.4	10.5	54	8.8	19.3	0.65
17.22	5.25	53.13	0.47	0.89	5.09	100	0.861	0.861	0.964	0.91	0.64	1.14	56.31	7.13	0.43	7.56	1.06	72.38	2.08		1	63	1.43	1.26	103.2	1.00	1.00	0.182	0.377	Non-Liq.	4.9	14.7	35	5.9	20.6	0.54
17.72	5.40	13.01	0.53	4.09	1.25	100	0.886	0.886	0.962	4.39	0.91	1.18	13.48	1.38	3.91	5.29		14.46	2.99		0			1.00		1.00	1.00		0.376	Non-Liq.	3.1	4.6	100			0.00
18.21	5.55	8.14	0.50	6.09	0.78	100	0.910	0.910	0.961	6.86	1.00	1.16	7.94	0.86	4.90	5.76		8.94	3.29		0			1.00		1.00	1.00		0.376	Non-Liq.	2.6	3.5	100			0.00
18.70	5.70	10.18	0.47	4.57	0.98	100	0.935	0.935	0.960	5.03	0.95	1.13	9.84	1.05	4.43	5.48		10.83	3.14		0			1.00		1.00	1.00		0.376	Non-Liq.	2.9	3.8	100			0.00
19.19	5.85	19.82	0.72	3.64	1.90	100	0.960	0.960	0.959	3.83	0.86	1.09	19.39	1.99	3.42	5.40		20.37	2.83		0			1.00		1.00	1.00		0.375	Non-Liq.	3.5	5.9	100			0.00
19.69	6.00	23.14	1.08	4.67	2.22	100	0.984	0.984	0.958	4.88	0.87	1.06	22.29	2.28	4.53	6.82		23.28	2.85		0			1.00		1.00	1.00		0.375	Non-Liq.	3.4	6.8	100			0.00
20.18	6.15	27.32	1.30	4.74	2.62	100	1.009	1.009	0.956	4.93	0.85	1.04	25.89	2.66	4.61	7.28		26.89	2.81		0			1.00		1.00	1.00		0.374	Non-Liq.	3.5	7.7	98			0.00
20.67	6.30	23.32	1.42	6.09	2.23	100	1.033	1.033	0.955	6.37	0.89	1.02	21.51	2.25	4.89	7.14		22.51	2.94		0			1.00		1.00	1.00		0.374	Non-Liq.	3.2	7.0	100			0.00
21.16	6.45	17.01	1.30	7.62	1.63	100	1.058	1.058	0.954	8.12	0.95	1.00	15.07	1.63	4.88	6.51		16.07	3.13		0			1.00		1.00	1.00		0.373	Non-Liq.	2.9	5.6	100			0.00
21.65	6.60	15.35	0.98	6.37	1.47	100	1.083	1.083	0.952	6.86	0.94	0.98	13.19	1.45	4.88	6.34		14.20	3.12		0			1.00		1.00	1.00		0.373	Non-Liq.	2.9	4.9	100			0.00
22.15	6.75	15.07	0.73	4.81	1.44	100	1.107	1.107	0.951	5.19	0.92	0.96	12.65	1.41	4.67	6.08		13.66	3.06		0			1.00		1.00	0.99		0.372	Non-Liq.	3.0	4.5	100			0.00
22.64	6.90	18.62	0.80	4.29	1.78	100	1.132	1.132	0.950	4.57	0.89	0.94	15.56	1.73	4.11	5.83		16.57	2.95		0			1.00		1.00	0.99		0.371	Non-Liq.	3.2	5.1	100			0.00
23.13	7.05	22.95	0.91	3.96	2.20	100	1.156	1.156	0.948	4.17	0.86	0.93	19.08	2.11	3.75	5.86		20.09	2.86		0			1.00		1.00	0.98		0.371	Non-Liq.	3.4	5.9	100			0.00
23.62	7.20	27.30	0.64	2.35	2.61	100	1.181	1.181	0.946	2.46	0.80	0.92	22.60	2.48	2.00	4.49		23.62	2.66		0			1.00		0.99	0.98		0.370	Non-Liq.	3.8	6.2	82			0.00
24.11	7.35	45.51	0.51	1.13	4.36	100	1.206	1.206	0.945	1.16	0.69	0.91	38.27	4.10	0.68	4.78	1.16	39.46	2.28		1	38	1.89	1.00	74.7	0.99	0.97	0.119	0.370	Non-Liq.	4.5	8.7	49	6.2	14.9	1.32

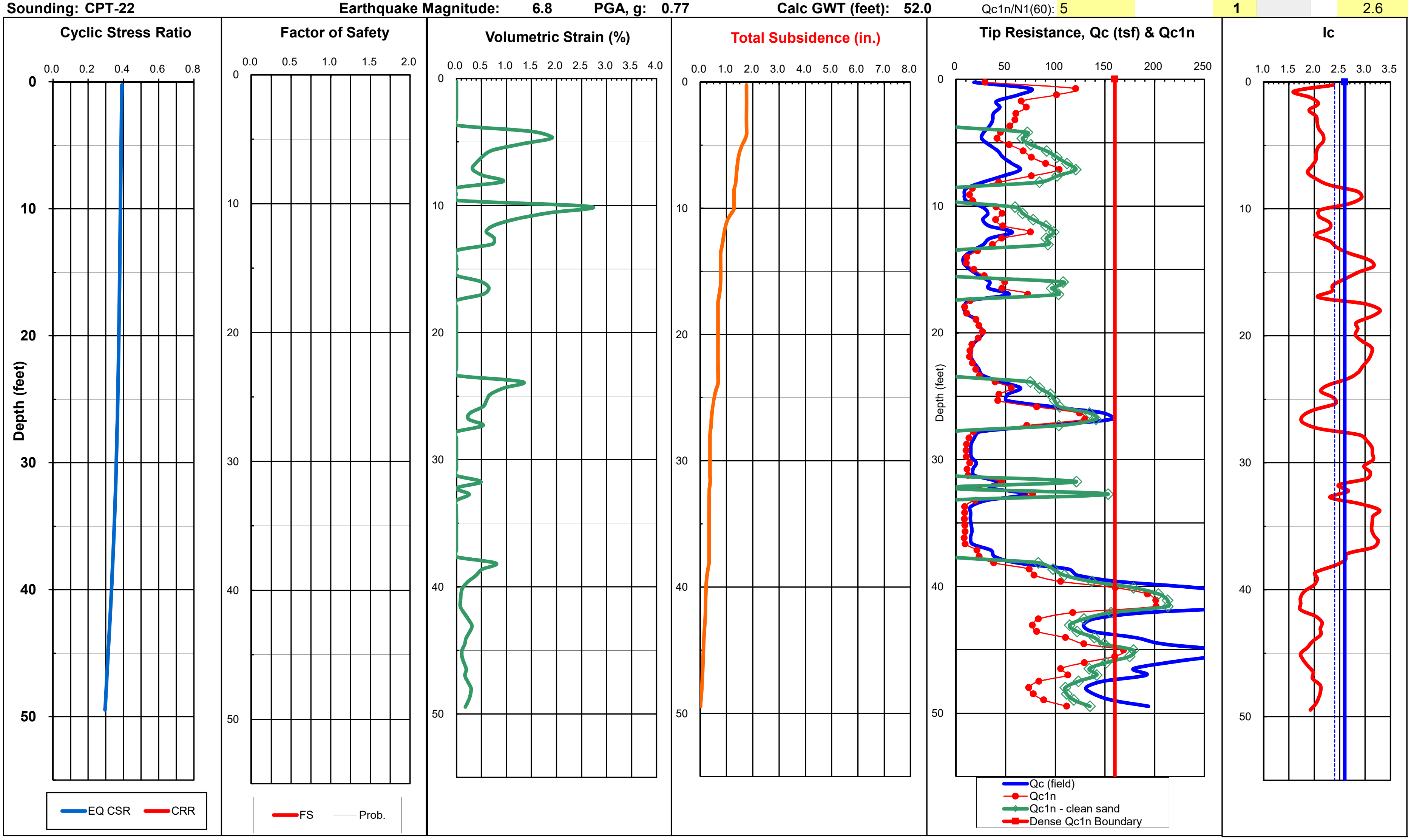
Depth (feet)	(m)	Tip Qc (tsf)	Friction Fs (tsf)	Friction Ratio Rf %	qc MPa	Total Unit Wt. (pcf)	Total Stress po (tsf)	Eff. Stress p'o (tsf)	rd	F %	n	Max 1.70 Cq	Q	Moss qc1 MPa	Moss Δqc MPa	Moss qc_{1mod} MPa	Moss eff K_C	Qc1n	Ic	Overide	Liquef. Suscept. (0 or 1)	Rel. Dens. Dr (%)	K_C	K_H	Clean Sand Qc1n	Idriss Kσ	1.0 Kσ	CRR	Induced M=7.5 CSR	Liquefac. Safety Factor	Qc1n $N_{1(60)}$ Ratio	Equiv. $N_{1(60)}$	FC %	FC Adj. $\Delta N_{1(60)}$	Equiv. $N_{1(60)cs}$	***Volumetric Strain (%)***
24.61	7.50	64.99	0.66	1.01	6.22	100	1.230	1.230	0.943	1.03	0.64	0.91	54.68	5.81	0.56	6.36	1.10	55.74	2.13		1	53	1.51	1.00	83.9	0.99	0.96	0.135	0.369	**Non-Liq.**	4.8	11.5	38	5.3	16.8	**0.95**
25.10	7.65	51.98	0.94	1.80	4.98	100	1.255	1.255	0.941	1.84	0.71	0.89	42.44	4.64	1.40	6.05	1.30	43.49	2.37		1	42	2.18	1.00	94.9	0.99	0.97	0.159	0.368	**Non-Liq.**	4.4	10.0	56	9.0	19.0	**0.68**
25.59	7.80	51.18	1.04	2.03	4.90	100	1.280	1.280	0.940	2.08	0.73	0.87	41.08	4.55	1.65	6.20	1.36	42.13	2.41		1	41	2.36	1.00	99.3	0.99	0.96	0.171	0.368	**Non-Liq.**	4.3	9.8	59	10.0	19.8	**0.60**
26.08	7.95	97.70	0.97	0.99	9.36	100	1.304	1.304	0.938	1.00	0.60	0.88	80.34	8.58	0.53	9.11	1.06	81.43	1.99		1	68	1.28	1.00	104.3	0.98	0.94	0.186	0.367	**Non-Liq.**	5.1	15.9	30	4.9	20.9	**0.53**
26.57	8.10	148.65	1.12	0.75	14.24	100	1.329	1.329	0.936	0.76	0.54	0.88	123.22	12.95	0.27	13.22	1.02	124.34	1.76		1	86	1.08	1.00	134.5	0.97	0.91	0.306	0.366	**Non-Liq.**	5.5	22.4	18	4.5	26.9	**0.28**
27.07	8.25	156.71	1.27	0.81	15.01	100	1.353	1.353	0.934	0.82	0.54	0.88	128.62	13.60	0.34	13.94	1.02	129.74	1.77		1	88	1.09	1.00	140.9	0.97	0.91	0.340	0.365	**Non-Liq.**	5.5	23.5	19	4.7	28.2	**0.25**
27.56	8.40	89.30	1.13	1.26	8.55	100	1.378	1.378	0.932	1.28	0.63	0.85	70.29	7.71	0.82	8.53	1.11	71.39	2.10		1	63	1.45	1.00	103.5	0.98	0.92	0.183	0.364	**Non-Liq.**	4.9	14.6	36	6.1	20.7	**0.53**
28.05	8.55	23.95	0.90	3.74	2.29	100	1.403	1.403	0.930	3.97	0.87	0.78	16.70	2.03	3.49	5.51		17.74	2.89		0			1.00		0.99	0.95		0.364	**Non-Liq.**	3.3	5.3	100			**0.00**
28.54	8.70	18.34	0.79	4.31	1.76	100	1.427	1.427	0.928	4.67	0.91	0.76	12.18	1.52	4.09	5.62		13.21	3.04		0			1.00		0.99	0.94		0.363	**Non-Liq.**	3.0	4.3	100			**0.00**
29.04	8.85	15.27	0.68	4.45	1.46	100	1.452	1.452	0.925	4.92	0.93	0.74	9.72	1.24	4.24	5.48		10.74	3.13		0			1.00		0.99	0.94		0.362	**Non-Liq.**	2.9	3.7	100			**0.00**
29.53	9.00	14.93	0.65	4.35	1.43	100	1.476	1.476	0.923	4.83	0.94	0.73	9.31	1.20	4.13	5.33		10.33	3.14		0			1.00		0.98	0.94		0.361	**Non-Liq.**	2.8	3.6	100			**0.00**
30.02	9.15	15.41	0.72	4.64	1.48	100	1.501	1.501	0.920	5.14	0.94	0.72	9.47	1.24	4.44	5.68		10.49	3.15		0			1.00		0.98	0.93		0.360	**Non-Liq.**	2.8	3.7	100			**0.00**
30.51	9.30	20.42	0.74	3.64	1.96	100	1.526	1.526	0.918	3.94	0.89	0.72	12.91	1.65	3.36	5.01		13.95	2.98		0			1.00		0.98	0.93		0.359	**Non-Liq.**	3.2	4.4	100			**0.00**
31.00	9.45	17.11	0.74	4.32	1.64	100	1.550	1.550	0.915	4.75	0.92	0.70	10.34	1.36	4.08	5.44		11.37	3.10		0			1.00		0.98	0.93		0.358	**Non-Liq.**	2.9	3.9	100			**0.00**
31.50	9.60	18.40	0.67	3.65	1.76	100	1.575	1.575	0.913	3.99	0.90	0.70	11.11	1.45	3.36	4.81		12.15	3.03		0			1.00		0.98	0.92		0.357	**Non-Liq.**	3.1	4.0	100			**0.00**
31.99	9.75	41.64	0.64	1.54	3.99	100	1.599	1.599	0.910	1.60	0.74	0.74	27.87	5.21	1.11	6.32	1.21	45.79	2.48		1	44	2.65	1.58	121.3	0.97	0.92	0.246	0.356	**Non-Liq.**	4.2	11.0	65	10.0	21.0	**0.49**
32.48	9.90	34.31	0.80	2.33	3.29	100	1.624	1.624	0.907	2.45	0.80	0.71	21.97	2.73	1.95	4.68		23.06	2.67		0			1.00		0.98	0.92		0.355	**Non-Liq.**	3.8	6.1	83			**0.00**
32.97	10.05	70.56	1.19	1.69	6.76	100	1.649	1.649	0.904	1.73	0.69	0.74	47.92	9.02	1.27	10.29	1.14	77.51	2.31		1	66	1.98	1.58	153.2	0.96	0.88	0.414	0.354	**Non-Liq.**	4.5	17.3	51	10.0	27.3	**0.26**
33.46	10.20	30.66	1.30	4.24	2.94	100	1.673	1.673	0.901	4.49	0.86	0.67	18.48	2.46	3.98	6.45		19.54	2.89		0			1.00		0.98	0.91		0.352	**Non-Liq.**	3.3	5.9	100			**0.00**
33.96	10.35	14.83	0.85	5.71	1.42	100	1.698	1.698	0.898	6.45	0.97	0.63	7.85	1.13	4.78	5.91		8.87	3.28		0			1.00		0.98	0.91		0.351	**Non-Liq.**	2.6	3.4	100			**0.00**
34.45	10.50	14.77	0.52	3.54	1.41	100	1.722	1.722	0.894	4.01	0.93	0.63	7.83	1.09	3.23	4.31		8.86	3.16		0			1.00		0.98	0.91		0.350	**Non-Liq.**	2.8	3.1	100			**0.00**
34.94	10.65	14.53	0.46	3.18	1.39	100	1.747	1.747	0.891	3.61	0.93	0.63	7.59	1.05	2.84	3.89		8.62	3.14		0			1.00		0.98	0.90		0.349	**Non-Liq.**	2.9	3.0	100			**0.00**
35.43	10.80	15.37	0.50	3.26	1.47	100	1.772	1.772	0.888	3.69	0.92	0.62	7.99	1.11	2.92	4.04		9.03	3.13		0			1.00		0.98	0.90		0.347	**Non-Liq.**	2.9	3.1	100			**0.00**
35.93	10.95	16.04	0.63	3.95	1.54	100	1.796	1.796	0.884	4.45	0.93	0.61	8.21	1.17	3.65	4.82		9.25	3.17		0			1.00		0.98	0.90		0.346	**Non-Liq.**	2.8	3.3	100			**0.00**
36.42	11.10	14.70	0.68	4.64	1.41	100	1.821	1.821	0.880	5.30	0.96	0.59	7.23	1.06	4.37	5.43		8.25	3.26		0			1.00		0.98	0.90		0.344	**Non-Liq.**	2.6	3.1	100			**0.00**
36.91	11.25	16.75	0.66	3.96	1.60	100	1.845	1.845	0.877	4.45	0.93	0.60	8.40	1.21	3.65	4.86		9.44	3.16		0			1.00		0.98	0.89		0.343	**Non-Liq.**	2.8	3.3	100			**0.00**
37.40	11.40	35.26	0.66	1.89	3.38	100	1.870	1.870	0.873	1.99	0.78	0.64	20.19	2.61	1.46	4.06		21.32	2.64		0			1.00		0.97	0.89		0.341	**Non-Liq.**	3.8	5.6	81			**0.00**
37.89	11.55	38.89	0.74	1.89	3.72	100	1.895	1.895	0.869	1.99	0.77	0.64	22.27	2.88	1.46	4.35		23.41	2.61		0			1.00		0.97	0.89		0.340	**Non-Liq.**	3.9	6.0	77			**0.00**
38.39	11.70	60.97	0.90	1.47	5.84	100	1.919	1.919	0.865	1.52	0.71	0.66	36.68	4.58	1.02	5.60	1.22	38.01	2.37		1	37	2.18	1.00	82.8	0.96	0.89	0.133	0.338	**Non-Liq.**	4.4	8.7	56	7.9	16.6	**0.79**
38.88	11.85	112.79	1.11	0.98	10.80	100	1.944	1.944	0.861	1.00	0.61	0.69	72.41	8.45	0.50	8.96	1.06	73.68	2.02		1	64	1.33	1.00	97.8	0.95	0.83	0.167	0.337	**Non-Liq.**	5.0	14.6	32	4.9	19.6	**0.51**
39.37	12.00	122.32	1.51	1.23	11.71	100	1.969	1.969	0.857	1.25	0.62	0.68	77.50	9.34	0.77	10.11	1.08	78.76	2.06		1	67	1.38	1.00	109.0	0.94	0.83	0.200	0.335	**Non-Liq.**	5.0	15.8	34	5.9	21.8	**0.39**
39.86	12.15	163.10	2.27	1.39	15.62	100	1.993	1.993	0.852	1.41	0.60	0.68	104.08	12.72	0.93	13.65	1.07	105.37	2.00		1	79	1.30	1.00	136.5	0.93	0.78	0.316	0.333	**Non-Liq.**	5.1	20.7	30	6.6	27.3	**0.23**
40.35	12.30	241.84	2.82	1.17	23.16	100	2.018	2.018	0.848	1.18	0.55	0.70	159.15	18.88	0.69	19.57	1.04	160.48	1.81		1	96	1.11	1.00	178.7	0.89	0.77	Infin.	0.332	**Non-Liq.**	5.5	29.4	20	6.3	35.7	**0.12**
40.85	12.45	288.02	3.11	1.08	27.58	100	2.042	2.042	0.843	1.09	0.53	0.71	191.33	22.44	0.60	23.04	1.03	192.69	1.73		1	100	1.06	1.00	203.8	0.84	0.77	Infin.	0.330	**Non-Liq.**	5.6	34.3	17	6.4	40.8	**0.09**
41.34	12.60	302.70	3.43	1.13	28.99	100	2.067	2.067	0.839	1.14	0.53	0.70	199.80	23.63	0.66	24.29	1.03	201.17	1.73		1	100	1.06	1.00	213.0	0.82	0.77	Infin.	0.328	**Non-Liq.**	5.6	35.9	17	6.7	42.6	**0.08**
41.83	12.75	305.11	3.45	1.13	29.22	100	2.092	2.092	0.834	1.14	0.53	0.70	200.19	23.74	0.65	24.39	1.03	201.57	1.73		1	100	1.06	1.00	213.3	0.82	0.76	Infin.	0.326	**Non-Liq.**	5.6	35.9	17	6.7	42.7	**0.08**
42.32	12.90	189.59	3.19	1.68	18.15	100	2.116	2.116	0.830	1.70	0.61	0.66	116.34	14.83	1.22	16.05	1.08	117.65	2.02		1	84	1.33	1.00	155.9	0.92	0.76	0.433	0.325	**Non-Liq.**	5.0	23.3	31	7.9	31.2	**0.16**
42.81	13.05	138.20	2.49	1.80	13.23	100	2.141	2.141	0.825	1.83	0.64	0.64	81.71	10.65	1.34	11.99	1.13	83.00	2.15		1	69	1.55	1.00	128.9	0.93	0.81	0.279	0.323	**Non-Liq.**	4.8	17.3	40	8.4	25.8	**0.24**
43.31	13.20	128.21	1.89	1.48	12.28	100	2.165	2.165	0.820	1.50	0.63	0.64	75.67	9.64	1.00	10.64	1.10	76.97	2.12		1	66	1.49	1.00	114.4	0.94	0.81	0.219	0.321	**Non-Liq.**	4.9	15.9	38	7.0	22.9	**0.31**
43.80	13.35	136.56	2.20	1.61	13.08	100	2.190	2.190	0.816	1.64	0.64	0.63	79.97	10.35	1.14	11.49	1.11	81.28	2.12		1	68	1.50	1.00	121.9	0.93	0.80	0.249	0.319	**Non-Liq.**	4.8	16.8	38	7.6	24.4	**0.27**
44.29	13.50	180.93	2.42	1.34	17.33	100	2.215	2.215	0.811	1.35	0.59	0.65	109.05	13.66	0.86	14.52	1.06	110.40	1.97		1	81	1.26	1.00	139.3	0.91	0.74	0.332	0.317	**Non-Liq.**	5.1	21.5	29	6.4	27.9	**0.19**
44.78	13.65	207.68	2.30	1.11	19.89	100	2.239	2.239	0.806	1.12	0.56	0.66	127.35	15.48	0.62	16.10	1.04	128.74	1.86		1	87	1.16	1.00	148.9	0.90	0.74	0.387	0.315	**Non-Liq.**	5.3	24.1	23	5.7	29.8	**0.17**
45.28	13.80	266.06	2.53	0.95	25.48	100	2.264	2.264	0.801	0.96	0.53	0.67	167.16	19.74	0.46	20.20	1.02	168.59	1.73		1	98	1.06	1.00	178.6	0.86	0.74	Infin.	0.313	**Non-Liq.**	5.6	30.1	17	5.6	35.7	**0.11**
45.77	13.95	256.56	2.71	1.06	24.57	100	2.288	2.288	0.796	1.06	0.54	0.66	158.55	19.12	0.56	19.69	1.03	159.98	1.78		1	96	1.09	1.00	174.7	0.87	0.73	Infin.	0.311	**Non-Liq.**	5.5	29.0	19	5.9	34.9	**0.11**
46.26	14.10	213.06	2.48	1.16	20.40	100	2.313	2.313	0.791	1.18	0.57	0.64	127.91	15.81	0.67	16.48	1.04	129.32	1.88		1	87	1.17	1.00	151.1	0.89	0.73	0.401	0.309	**Non-Liq.**	5.3	24.3	24	5.9	30.2	**0.15**
46.75	14.25	178.54	2.34	1.31	17.10	100	2.338	2.338	0.786	1.33	0.59	0.62	103.96	13.21	0.82	14.03	1.06	105.34	1.98		1	79	1.27	1.00	134.1	0.91	0.73	0.304	0.307	**Non-Liq.**	5.1	20.6	29	6.3	26.8	**0.20**
47.24	14.40	191.55	2.58	1.35	18.34	100	2.362	2.362	0.781	1.36	0.59	0.62	111.26	14.23	0.86	15.08	1.06	112.65	1.97		1	82	1.26	1.00	141.6	0.91	0.73	0.344	0.305	**Non-Liq.**	5.2	21.9	28	6.5	28.3	**0.17**
47.74	14.55	147.61	2.34	1.59	14.14	100	2.387	2.387	0.776	1.61	0.63	0.60	82.13	10.92	1.10	12.02	1.10	83.48	2.11		1	69	1.48	1.00	123.2	0.92	0.78	0.254	0.303	**Non-Liq.**	4.9	17.2	37	7.5	24.6	**0.23**
48.23	14.70	130.90	1.87	1.43	12.53	100	2.411	2.411	0.771	1.45	0.63	0.59	72.01	9.47	0.93	10.41	1.10	73.36	2.12		1	64	1.50	1.00	110.1	0.93	0.78	0.204	0.301	**Non-Liq.**	4.8	15.2	38	6.9	22.0	**0.29**
48.72	14.85	138.55	1.86	1.34	13.27	100	2.436	2.436	0.766	1.37	0.62	0.59	76.45	9.97	0.85	10.82	1.08	77.82	2.09		1	66	1.43	1.00	111.4	0.93	0.78	0.209	0.300	**Non-Liq.**	4.9	15.8	36	6.4	22.3	**0.28**
49.21	15.00	156.35	2.00	1.28	14.97	120	2.466	2.466	0.761	1.30	0.61	0.60	86.93	11.25	0.78	12.03	1.07	88.32	2.03		1	72	1.34	1.00	118.6	0.92	0.71	0.235	0.298	**Non-Liq.**	5.0	17.6	32	6.1	23.7	**0.24**
49.70	15.15	193.69	2.22	1.14	18.55	120	2.495	2.495	0.756	1.16	0.58	0.61	110.08	13.91	0.64	14.55	1.05	111.52	1.92		1	81	1.21	1.00	134.8	0.90	0.71	0.308	0.296	**Non-Liq.**	5.2	21.3	26	5.7	27.0	**0.18**

Earth Systems Pacific - EVALUATION OF LIQUEFACTION POTENTIAL AND INDUCED GROUND SUBSIDENCE

Camarillo High School Visitors Bleachers **Project No: 303275-003** Method Used: 1 1998 NCEER (Robertson & Wride)

Ground Compaction Remediated to depth of: 2.0 feet Settlement Analysis using Tokimatsu & Seed (1987) using clean sand Qc1n/N1(60) ratio =5 Plot Limiting Ic:

Sounding: CPT-22 **Earthquake Magnitude: 6.8** **PGA, g: 0.77** **Calc GWT (feet): 52.0** Qc1n/N1(60): 5 **1** 2.6



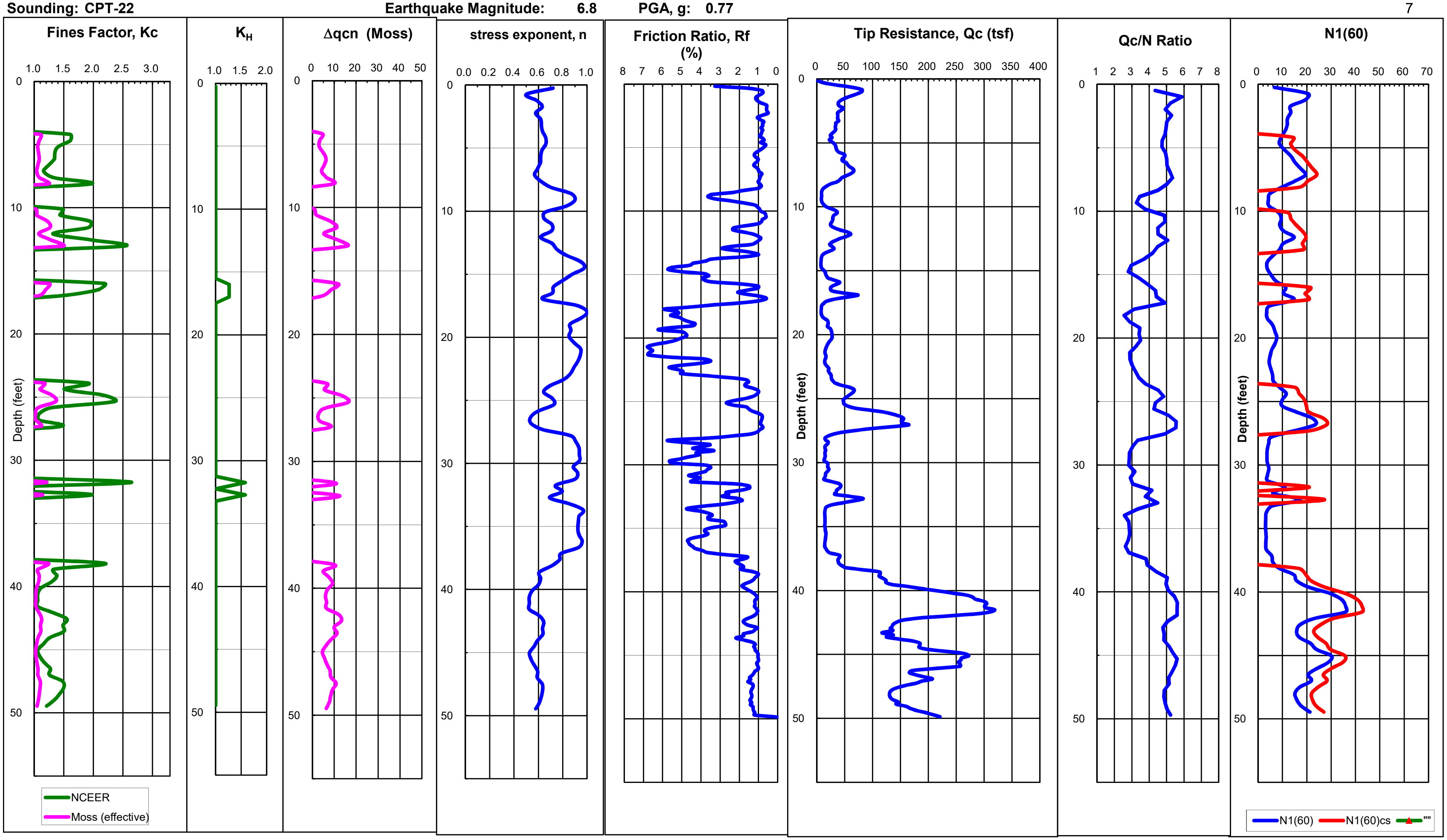
Total Thickness of Liquefiable Layers: 0.0 feet **Estimated Total Ground Subsidence (Settlement): 1.8 inches**

Earth Systems Pacific - EVALUATION OF LIQUEFACTION POTENTIAL AND INDUCED GROUND SUBSIDENCE

3 avg increment =0.15m | Camarillo High School Visitors Bleachers | Project No: 303275-003 | Method Used: 1998 NCEER (Robertson & Wride)

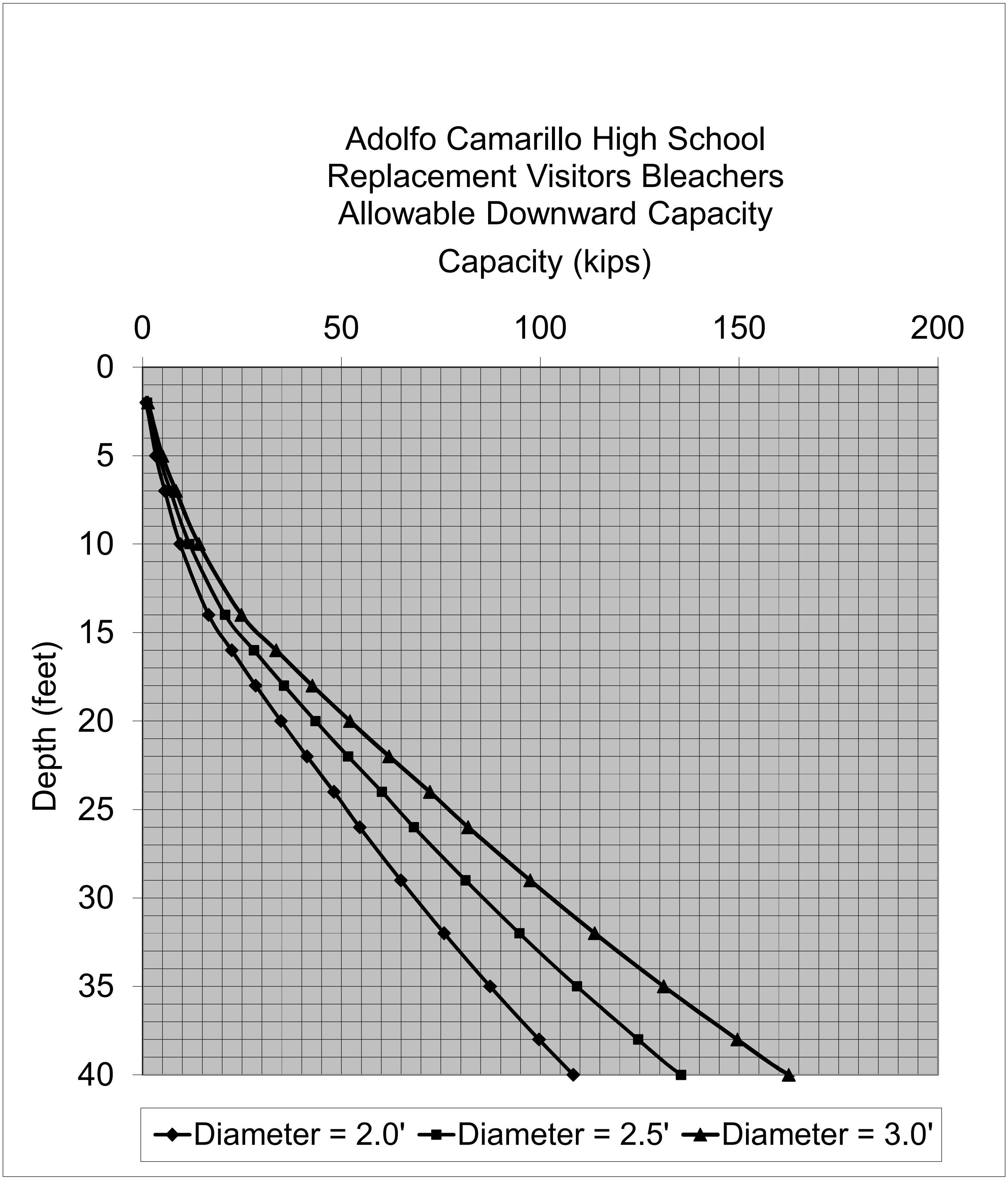
Ignore 1st/last increment into sand/silt soils: 0 | Use which FC adjustment: 1 Based on Clean Sand Qc1n | Use which Apparent FC Curve: 0 Robertson Lower Bound | Plot 7

Sounding: CPT-22 | **Earthquake Magnitude: 6.8** | **PGA, g: 0.77**

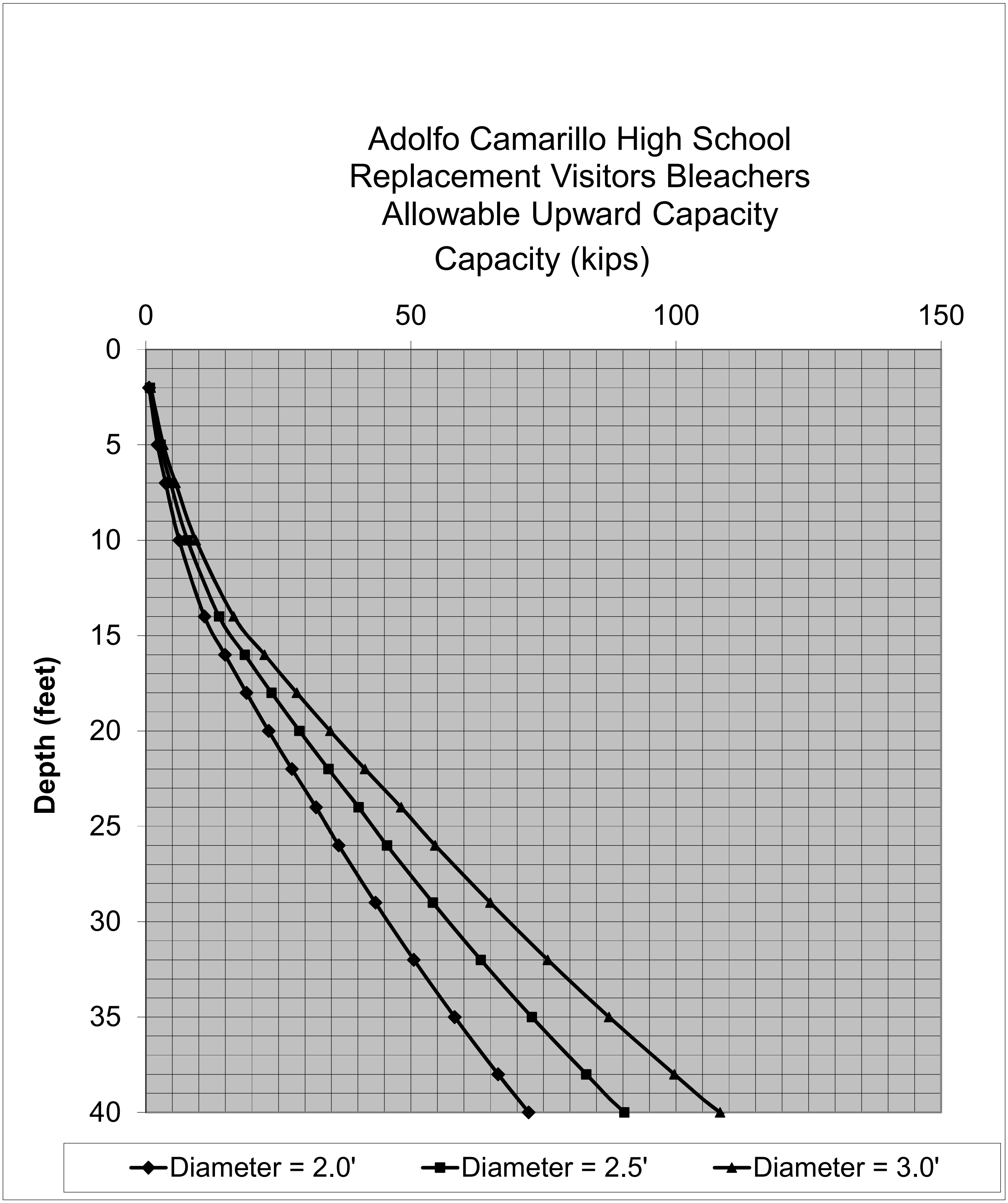


APPENDIX E

Pile Capacity Graphs



Adolfo Camarillo High School
Replacement Visitors Bleachers
Allowable Downward Capacity
Capacity (kips)
0
50
100
150
200
0
5
10
15
20
25
30
35
40
Depth (feet)
Diameter = 2.0'
Diameter = 2.5'
Diameter = 3.0'


Adolfo Camarillo High School
Replacement Visitors Bleachers
Allowable Upward Capacity
Capacity (kips)
0
50
100
150
0
5
10
15
20
25
30
35
40
Depth (feet)
Diameter = 2.0'
Diameter = 2.5'
Diameter = 3.0'