PCM3
CONSTRUCTION MANAGEMENT

Compton Community College District
Geotechnical and Soils Investigation Report
For
Campus Public Safety Building

1. **Original Report Prepared by GeoTek, Inc. dated October 24, 2016**

2. **Supplemental Geotechnical Report and Evaluation regarding over-excavation requirements dated January 16, 2017 prepared by United-Heider Inspection Group**

3. **DSA form 109 Transfer of Responsibility: Geotechnical Engineer from GeoTek to United-Heider Inspection Group dated January 27, 2016**

4. **CGS First review letter dated January 30, 2017**

5. **United-Heider Response to CGS first review letter dated April 5, 2017**

6. **CGS Second review letter dated May 1, 2017**

7. **United-Heider Response to CGS second review letter dated June 2, 2017**

8. **CGS Third review letter and approval dated June 14, 2017**

PCM3, Inc. Site Office
Compton Community College District
1111 E. Artesia Ave., Bond Trailer, Compton, CA 90221

GEOTECHNICAL EVALUATION

FOR

PROPOSED CAMPUS POLICE STATION
EL CAMINO COLLEGE COMPTON CENTER
NORTHWEST CORNER OF ARTESIA BOULEVARD AND DELTA AVENUE
CITY OF COMPTON, LOS ANGELES COUNTY, CALIFORNIA

PREPARED FOR

COMPTON COMMUNITY COLLEGE DISTRICT
1111 EAST ARTESIA BOULEVARD
COMPTON, CALIFORNIA 90221-5393

PREPARED BY

GEOTEK, INC.
710 E. PARKRIDGE AVENUE, SUITE 105
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PROJECT NO. 1529-CR

OCTOBER 24, 2016

GEOTEK

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October 24, 2016
Project No. 1529-CR

Compton Community College District
1111 East Artesia Boulevard
Compton, California 90221-5393

Attention: Mr. Felipe Lopez

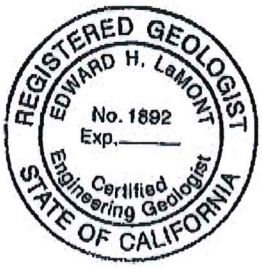
Subject: Geotechnical Evaluation
Proposed Campus Police Station
El Camino College Compton Center
Northwest Corner of Artesia Boulevard and Delta Avenue
City of Compton, Los Angeles County, California

Dear Mr. Lopez:

We are pleased to provide the results of our geotechnical evaluation for the subject project located in the city of Compton. This report presents a discussion of our evaluation and provides preliminary geotechnical recommendations for earthwork, foundation design and construction. In our opinion, site development appears feasible from a geotechnical viewpoint provided that the recommendations presented in this report are incorporated into the design and construction phases of the project.

The opportunity to be of service is sincerely appreciated. If you have any questions, please do not hesitate to contact our office.

Respectfully submitted,
GeoTek, Inc.



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ENCLOSURES

1. PURPOSE AND SCOPE OF SERVICES

The purpose of this study was to evaluate the existing geotechnical conditions for the proposed campus police station. Services provided for this study included the following:

- Research and review of readily available geologic data and general information pertinent to the site,
- A site reconnaissance,
- Excavation of three exploratory test borings,
- Collection of soil samples of the on-site materials,
- Laboratory testing of selected soil samples,
- Evaluation of liquefaction and lateral spread potential,
- Review and evaluation of site seismicity, and;
- Compilation of this geotechnical report which presents our preliminary geotechnical recommendations for site development.

The intent of this report is to aid in the evaluation of the site for future proposed development from a geotechnical perspective. The professional opinions and geotechnical information contained in this report may need to be updated based upon our review of the final site development plans. These plans should be provided to GeoTek, Inc. (GeoTek) for review when available.

2. SITE DESCRIPTION AND PROPOSED DEVELOPMENT

2.1 SITE DESCRIPTION

The 0.34-acre site is located on the northwest corner of Artesia Boulevard and Delta Avenue on the Compton Community College Campus in the city of Compton. Figure 1 presents a site location map. The site is occupied by an abandoned two-story apartment building and carport. A concrete driveway runs in an east-west direction through the central portion of the site.

Underground utilities are most likely present below the site. The property also contains lawn areas and trees up to 12 inches in diameter are present in the southwest corner of the site. The lot has been previously graded. Up to 15 feet of undocumented fill was encountered in the test boring in the southeast quadrant of the property. Five feet of undocumented fill was encountered in the northeast portion and northwest of the central part of the site. The property is relatively planar and flat with a total relief of approximately one foot. The topography of the area generally slopes downward to the southwest at a gradient of less than five percent. A single-family residence is located on the adjacent property to the north, and a paved entrance road to the college is present immediately to the west. A concrete sidewalk runs adjacent to the southern site perimeter.

2.2 PROPOSED DEVELOPMENT

Proposed development will consist of the construction of a single-story, 4,500 square foot wood-frame campus police station. The existing structures on the property will be razed prior to construction. The new building will incorporate concrete slab-on-grade floors and will be supported by conventional isolated and continuous footings that will impose relatively light loads on the underlying soils. The proposed building will be located in the southern portion of the site, and parking facilities for conventional passenger vehicles are proposed along the northern site perimeter. A masonry block wall with a height of nine feet is proposed adjacent to the northern property line, and a second masonry wall eight feet in height will run perpendicular to the western portion of the east-west trending wall. Concrete hardscape areas are proposed adjacent to portions of all sides of the building except the south. Based on the site topography maximum cuts and fills of approximately one foot may be required to achieve proposed finished grade, and major slopes and retaining walls are not proposed.

If the site development differs from the information provided in this report, the recommendations should be subject to further review and evaluation by GeoTek. Final site development plans should be reviewed by GeoTek when they become available.

3. FIELD EXPLORATION AND LABORATORY TESTING

3.1 FIELD EXPLORATION

The soils underlying the site were explored on August 11, 2016 by means of excavating three test borings drilled with a truck-mounted drill-rig to a maximum depth of 56.5 feet below the

existing ground surface. The approximate locations of the explorations are indicated on the Exploration Location Map presented on Figure 4. A hollow-stem auger with an outside diameter of 8.5 inches was utilized. The inside diameter of the auger was 4.5 inches. The soils encountered were examined and visually classified by one of our engineers. A summary of the soil classifications is included in Appendix A.
The exploration logs show subsurface conditions at the dates and locations indicated, and may not be representative of other locations and times. The stratification lines presented on the logs represent the approximate boundaries between soil types, and the transitions may be gradual.

Relatively undisturbed soil samples were recovered at various intervals in the borings with a California sampler. The California sampler is a 2.9-inch outside diameter, 2.5-inch inside diameter, split barrel sampler lined with brass tubes. The sampler was 18 inches long. The sampler conformed to the requirements of ASTM D 3550. A 140-pound automatic trip hammer was utilized, dropping 30 inches for each blow. The relatively undisturbed samples, together with bulk samples of representative soil types, were returned to the laboratory for testing and evaluation. In Boring 1, standard penetration tests were performed with a 2.0-inch outside diameter, 1.5-inch inside diameter, split-barrel sampler. The sampler was 18 inches long. The inside diameter of the sampler shoe was 1.4 inches. The sampler was unlined. The sampler conformed to the requirements of ASTM D 1586. A 140-pound automatic trip hammer was utilized, dropping 30 inches for each blow. An efficiency value of 1.0 was used for the automatic trip hammer. The standard penetration test data are presented on the logs for Boring 1.

3.2 LABORATORY TESTING

Laboratory testing was performed on selected soil samples obtained during our field exploration. The purpose of the laboratory testing was to confirm the field classification of the soils encountered and to evaluate the physical properties of the soils for use in engineering design and analysis.

Included in our laboratory testing were moisture-density determinations on all undisturbed samples. Gradation, hydrometer and Atterberg limit tests were performed on selected samples and used in the liquefaction analysis. An optimum moisture content-maximum dry density relationship was established for a typical soil type so that the relative compaction of the subsoils could be determined. Consolidation testing was performed on selected samples to evaluate the compressibility characteristics of the soils. Expansion index testing was performed on a selected sample to evaluate the expansion potential of the on-site soils. Chemical testing comprised of pH, soluble sulfate, chloride and resistivity testing was conducted on selected

samples. The moisture-density, Atterberg limit and gradation data are presented on the exploration logs in Appendix A. The maximum density, consolidation, expansion index and chemical test data are presented in Appendix B.

4. GEOLOGIC AND SOILS CONDITIONS

4.1 REGIONAL SETTING

The property is situated in the Peninsular Ranges geomorphic province. The Peninsular Ranges province is one of the largest geomorphic units in western North America. It extends approximately 975 miles from the north and northeasterly adjacent the Transverse Ranges geomorphic province to the tip of Baja California. This province varies in width from about 30 to 100 miles. It is bounded on the west by the Pacific Ocean, on the south by the Gulf of California and on the east by the Colorado Desert Province.

The Peninsular Ranges are essentially a series of northwest-southeast oriented fault blocks. Several major fault zones are found in this province. The Elsinore Fault zone and the San Jacinto Fault zone trend northwest-southeast and are found near the middle of the province. The San Andreas Fault zone borders the northeasterly margin of the province.

More specific to the subject property, the site is located just east of the Newport-Inglewood Fault zone, toward the northern boundary of the province. In general, the site is underlain by younger alluvial fan deposits derived from the mountains located to the east. A geologic map that indicates the major faults in the area is included in Figure 2, and a Regional Fault Map is presented on Figure 3.

More specific to the subject property, the Newport-Inglewood Fault is located approximately 1.6 miles to the northwest of the site. A potential earthquake with a magnitude (MCE) of 7.7 may result from this fault. This is the known fault that would create the most significant earthshaking event. No faults are shown in the immediate site vicinity on maps reviewed for the area.

4.2 GENERAL SOIL/GEOLOGIC CONDITIONS

A brief description of the soils encountered on the site is presented in the following sections. Geologic cross-sections are illustrated on Figure 5.

4.2.1 Undocumented Fill

Undocumented fill consisting of stiff to very stiff silt to sandy silt with varying amounts of sand and clay and loose silty sands were encountered in the Boring 1 to a depth of 15 feet and in Borings 2 and 3 to a depth of 5 feet, respectively. Deeper areas of fill may be present in locations that were not explored. The fill contained varying amounts of glass and debris.

4.2.2 Younger Alluvial Fan Deposits

Younger alluvial fan deposits were encountered beneath the fill in all the test borings excavated on the site. These deposits generally consisted of loose to very dense silty sands, and medium stiff to hard sandy silts to clayey silts. These soils exhibit and were tested to have a "very low" expansion potential.

4.3 SURFACE AND GROUNDWATER

4.3.1 Surface Water

Surface water was not observed on the site during our subsurface exploration or site reconnaissance. If encountered during earthwork operations, surface water on this site is the result of precipitation or surface run-off from surrounding areas.

4.3.2 Groundwater

Groundwater was encountered at a depth of 50.5 feet in Boring 1. Based on a review of groundwater levels in the vicinity of the site (Los Angeles County Department of Public Works), the historical high depth to regional groundwater is approximately 7.7 feet below ground surface.

4.4 FAULTING AND SEISMICITY

The geologic structure of the entire southern California area is dominated mainly by northwest-trending faults associated with the San Andreas system. The site is in a seismically active region. No active or potentially active fault is presently known to exist at this site nor is the site situated within an *"Alquist-Priolo"* Earthquake Fault Zone. The nearest zoned fault is the Newport-Inglewood Fault, located approximately 1.6 miles to the northwest.

4.4.1 Historical Site Seismicity

The historical seismicity in the project area has been evaluated. There does not appear to be obvious evidence of ground failure or structural damage due to previous earthquakes to the existing structures on the site.

4.4.2 Seismic Design Parameters

The site is located at approximately 33.8746 Latitude and -118.2084 Longitude. Site spectral accelerations (Ss and S1), for 0.2 and 1.0 second periods for a Class "D" site, were determined from the USGS Website, Earthquake Hazards Program, U.S. Seismic Design Maps for Risk-Targeted Maximum Considered Earthquake (MCE) Ground Motion Response Accelerations for the Conterminous 48 States by Latitude/Longitude. The results are presented in the following table:

SITE SEISMIC PARAMETERS	
Mapped 0.2 sec Period Spectral Acceleration, S_S	1.671g
Mapped 1.0 sec Period Spectral Acceleration, S_1	0.611g
Site Coefficient for Site Class "D", F_a	1.0
Site Coefficient for Site Class "D", F_v	1.5
Maximum Considered Earthquake Spectral Response Acceleration for 0.2 Second, S_{MS}	1.671g
Maximum Considered Earthquake Spectral Response Acceleration for 1.0 Second, S_{M1}	0.917g
5% Damped Design Spectral Response Acceleration Parameter at 0.2 Second, S_{DS}	1.114g
5% Damped Design Spectral Response Acceleration Parameter at 1 second, S_{D1}	0.611g
Peak Ground Acceleration Adjusted for Site Class Effects, PGA_M	0.623g

Final selection of the appropriate seismic design coefficients should be made by the project structural engineer based upon local practices and ordinances, expected building response and desired level of conservatism.

4.5 LIQUEFACTION AND LATERAL SPREAD

The project lies in a zone designated by the State of California as having potential for liquefaction. It is anticipated that major earthquake groundshaking will occur during the lifetime of the proposed development from the seismically active Newport-Inglewood Fault. This is the known fault that would create the most significant earthshaking event. A Design Basis Earthquake of M7.5 yields a predicted peak horizontal ground acceleration of 0.62g.

The standard penetration data obtained in Boring 1 provided input for the LiquefyPro Version 5.0 program for liquefaction-induced settlement. A historic high groundwater level of 7.7 feet below existing grade was utilized. As recommended by the State of California Special Publication 117, our liquefaction analysis has incorporated a safety factor of 1.3. The results of

this evaluation are shown in Appendix C. The liquefaction potential was determined for two scenarios. We encountered either five feet or 15 feet of undocumented fill in the test borings. This fill will be removed and replaced as engineered fill. A liquefaction analysis was conducted from the data collected from Boring 1 for each circumstance. Our analyses revealed a liquefaction-induced settlement potential of 2.8 inches where five of fill was encountered, and 1.7 inches where 15 feet of fill was encountered.

The total settlement will occur over a large area and should not adversely affect local buried utilities. Within a building area, we would estimate the differential dynamic settlement would be about one-half the total. Based on a minimum building dimension of 44 feet and liquefaction-induced settlement of 2.8 inches, a maximum angular distortion of about 1/377 is calculated, which is within tolerable limits. In addition, the angular distortion between 1.7 inches and 2.8 inches of dynamic settlement over the minimum building dimension of 44 feet is 1/480, which is within allowable limits.

The site is relatively flat and there are no nearby structures or slopes that would create a free-face condition. In addition, other than two layers with a 12-inch thickness, the $(N1)_{60}$ values all exceed 15. It is our opinion that lateral spread will not occur on the site.

4.6 OTHER SEISMIC HAZARDS

Evidence of ancient landslides or slope instability at this site was not observed during our investigation. Thus, the potential for landslides is considered negligible for design purposes.

The potential for secondary seismic hazards such as a seiche or tsunami is considered negligible due to site elevation and distance to an open body of water.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 GENERAL

The anticipated site development appears feasible from a geotechnical viewpoint provided that the following recommendations, and those provided by this firm at a later date are properly incorporated into the design of the project. Final site development and grading plans should be reviewed by GeoTek when they become available.

Due to the potential for differential depths of engineered fill on the site, it is recommended that additional reinforcement be added to building floor-slabs and continuous footings. In addition, shoring may be required in some areas along the property line so that all the undocumented fill can be safely removed and replaced as engineered fill.

5.2 EARTHWORK CONSIDERATIONS

Earthwork and grading should be performed in accordance with the applicable grading ordinances of the City of Compton, the 2013 California Building Code (CBC), and recommendations contained in this report. The Grading Guidelines included in Appendix D outline general procedures and do not anticipate all site-specific situations. In the event of conflict, the recommendations presented in the text of this report should supersede those contained in Appendix D.

A review of the stress distribution curves derived from the Boussinesq equation reveal that the footing loads will generally dissipate within the near-surface engineered fill material.

5.2.1 Site Clearing and Demolition

In areas of planned grading and improvements, the existing structures should be removed along with vegetation, roots, and any trash and debris. These materials should be properly disposed of off-site. Voids resulting from site clearing and the removal of tree roots should be backfilled with engineered fill with expansion characteristics similar to the on-site soils.

5.2.2 Police Station, and Retaining Wall and Screen Wall Footings

All artificial fill encountered below and within five feet of the proposed police station and any retaining wall and screen wall footings should be removed until natural soil is encountered. The fill may be stockpiled on-site for future use. Natural soils beneath the police station building and below the bottom of retaining wall and screen wall footings should be removed to a depth of five feet below existing grade or three feet below the bottom of the footings and floor-slabs, whichever depth is greater. A representative of this firm should observe the bottom of the excavations. Any relatively porous or unsuitable soil observed in the bottom of the excavations should be removed until competent natural material is encountered. Competent soil is defined as relatively non-porous material exhibiting a relative compaction of at least 85 percent (ASTM D 1557).

5.2.3 Preparation of Excavation Bottoms

Upon approval, the exposed soils and soils in areas to receive engineered fill should be scarified to a minimum depth of eight inches, moistened to at least the optimum moisture content and compacted to a minimum relative compaction of 90 percent (ASTM D 1557).

5.2.4 Horizontal Extent of Removals

In areas where removal depths exceed five feet below the proposed building, retaining wall and screen wall footings, the horizontal limits of removals outside the perimeter of these structural elements should be equal to the depth of the soil removals below the bottom of the footings where possible.

5.2.5 Pavement Areas

All undocumented fill should be removed below pavement areas. Subsequent to removal of the fill, the soils below proposed asphalt concrete and Portland cement concrete pavement areas should be scarified to a minimum depth of eight inches, moistened to at least the optimum moisture content and compacted to a minimum relative compaction of 90 percent (ASTM D 1557).

5.2.6 Hardscape Areas

All undocumented fill should be removed below proposed hardscape areas. The soils below Portland cement concrete hardscape areas should be scarified to a minimum depth of eight inches, moisture conditioned to at least the optimum moisture content and compacted to a minimum relative compaction of 90 percent (ASTM D1557).

5.2.7 Engineered Fills

The on-site soils are generally considered suitable for reuse as engineered fill provided they are free from vegetation, debris and other deleterious material. Portland cement concrete removed during site clearing may be pulverized into fragments not exceeding three inches in greatest dimension and incorporated into the fill at all levels. The undercut areas should be brought to the final subgrade elevations with fill materials that are placed in loose lifts of eight inches or less, moisture conditioned to at least the optimum moisture content and compacted to a minimum relative compaction of 90 percent (ASTM D 1557).

5.2.8 Import Soils

Import soils should have an expansion potential of "very low." GeoTek, Inc. also recommends that the proposed import soils be tested for expansion and corrosivity potential. GeoTek, Inc.

should be notified a minimum of 72 hours prior to importing so that appropriate sampling and laboratory testing can be performed.

5.2.9 Excavation Characteristics

Excavation in the on-site soils is expected to be feasible utilizing heavy-duty grading equipment in good operating condition.

5.2.10 Temporary Excavations

All temporary excavations for grading purposes and installation of underground utilities should be constructed in accordance with local and Cal-OSHA guidelines. Temporary excavations within the on-site soils should be stable at 1:1 (horizontal:vertical) inclinations for cuts less than 15 feet in height.

Temporary excavations at the project site should be shored where site constraints prevent laying the cuts back to safe inclinations. Short duration vertical cuts of up to 15 feet in height may be necessary.

The proposed excavation, shoring and backfill should be observed by a representative of GeoTek. Further recommendations will likely need to be provided as the excavation progresses, depending on the conditions exposed during grading operations.

5.2.11 Shrinkage and Subsidence

Several factors will impact earthwork balancing on the site, including shrinkage, subsidence, trench spoil from utilities and footing excavations, as well as the accuracy of topography.

Shrinkage is primarily dependent upon the degree of compactive effort achieved during construction. For planning purposes, a shrinkage factor of 10 to 15 percent may be considered for the materials requiring removal and/or recompaction. Site balance areas should be available in order to adjust project grades, depending on actual field conditions at the conclusion of earthwork construction. Subsidence on the order of 0.10 foot may be anticipated for areas to receive fill.

5.3 DESIGN RECOMMENDATIONS

5.3.1 Foundation Design Criteria

The police station will be supported by conventional shallow isolated and continuous footings. Design criteria for a conventional foundation system are presented in general conformance with the 2013 CBC. These are typical design criteria and are not intended to supersede the design by the structural engineer.

Our investigation indicates that the on-site soils have a "very low" expansion potential.

A summary of our preliminary foundation design recommendations is presented in the following table:

FOUNDATION DESIGN RECOMMENDATIONS	
Design Parameter	**"Very Low" Expansion Potential 0≤EI≤20**
Foundation Depth or Minimum Perimeter Beam Depth (inches below the lowest adjacent grade)	Single-story – 12
Minimum Foundation Width (Inches)*	Single-story - 12
Minimum Slab Thickness (inches)	4 – Actual
Sand Blanket and Moisture Retardant Membrane below On-Grade Building Slabs	2 inches of sand** overlying moisture vapor retardant membrane overlying 2 inches of sand**
Minimum Slab Reinforcing	No. 3 reinforcing bars 24 inches on-center, each way, placed in middle of slab
Minimum Reinforcement for Continuous Footings, Grade Beams and Retaining Wall Footings	Four No. 4 reinforcing bars, two placed near the top and two near the bottom of the footing
Presaturation of Subgrade Soil (Percent of Optimum/Depth in Inches)	Minimum of 100% of the optimum moisture content to a depth of at least 12 inches prior to placing concrete

* Code minimums per Table 1809.7 of the 2013 CBC
** Sand should have a sand equivalent of at least 30

It should be noted that the above recommendations are based on soil support characteristics only. The structural engineer should design the slab and beam reinforcement based on actual loading conditions.

An allowable bearing capacity of 2,000 pounds per square foot (psf) may be used for design of footings 12 inches deep and 12 inches wide. This value may be increased by 400 pounds per square foot for each additional 12 inches in depth and 200 pounds per square foot for each additional 12 inches in width to a maximum value of 3,500 psf. An increase of one-third may be applied when considering short-term wind and seismic loads.

Structural foundations may be designed in accordance with the 2013 CBC, and to withstand a total settlement of one inch and maximum differential settlement of one-half of the total settlement over a horizontal distance of 40 feet.

The passive earth pressure may be computed as an equivalent fluid having a density of 300 psf per foot of depth, to a maximum earth pressure of 2,000 psf for footings bearing on engineered fill. A coefficient of friction between soil and concrete of 0.30 may be used with dead load forces. Unless the adjacent ground is covered with pavement, the upper one foot of soil below the adjacent grade should not be used in calculating passive pressure. When combining passive and frictional resistance, the passive pressure component should be reduced by one-third.

The above values may be increased as allowed by Code to resist short-term transient loads.

A moisture and vapor retarding system should be placed below slabs-on-grade where moisture migration through the slab is undesirable. Guidelines for these are provided in the 2013 California Green Building Standards Code (CALGreen) Section 4.505.2, the 2013 CBC Section 1907.1 and ACI 360R-10. The vapor retarder design and construction should also meet the requirements of ASTM E 1643. A portion of the vapor retarder design should be the implementation of a moisture vapor retardant membrane.

It should be realized that the effectiveness of the vapor retarding membrane can be adversely impacted as a result of construction related punctures (e.g. stake penetrations, tears, punctures from walking on the vapor retarder placed on the underlying aggregate layer, etc.). These occurrences should be limited as much as possible during construction. Thicker membranes are generally more resistant to accidental puncture than thinner ones. Products specifically designed for use as moisture/vapor retarders may also be more puncture resistant. Although the CBC specifies a 6 mil vapor retarder membrane, a minimum 10 mil thick membrane with joints properly overlapped and sealed should be considered, unless otherwise specified by the slab design professional. The membrane should consist of Stego wrap or the equivalent.

A two-inch layer of clean sand with a sand equivalent of at least 30 should be placed over the moisture vapor retardant membrane to promote setting of the concrete. The moisture in the sand should not exceed two percent below the optimum moisture content.

Moisture and vapor retarding systems are intended to provide a certain level of resistance to vapor and moisture transmission through the concrete, but do not eliminate it. The acceptable level of moisture transmission through the slab is to a large extent based on the type of flooring used and environmental conditions. Ultimately, the vapor retarding system should be comprised of suitable elements to limit migration of water and reduce transmission of water vapor through the slab to acceptable levels. The selected elements should have suitable properties (i.e. thickness, composition, strength, and permeability) to achieve the desired performance level.

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

GeoTek recommends that a qualified person, such as the flooring contractor, structural engineer, architect, and/or other experts specializing in moisture control within the building be consulted to evaluate the general and specific moisture and vapor transmission paths and associated potential impact on the proposed construction. That person should provide recommendations relative to the slab moisture and vapor retarder systems.

In addition, the recommendations in this report and our services in general are not intended to address mold prevention; since we, along with geotechnical consultants in general, do not practice in the area of mold prevention. If specific recommendations addressing potential mold issues are desired, then a professional mold prevention consultant should be contacted.

We recommend that control joints be placed in two directions spaced approximately 24 to 36 times the thickness of the slab in inches. These joints are a widely accepted means to control cracks and should be reviewed by the project structural engineer.

5.3.2 Miscellaneous Foundation Recommendations

To minimize moisture penetration beneath the slab-on-grade areas, utility trenches should be backfilled with engineered fill, lean concrete or concrete slurry where they intercept the perimeter footing or thickened slab edge.

Soils from the footing excavations should not be placed in the slab-on-grade areas unless properly compacted and tested. The excavations should be free of loose/sloughed materials and be neatly trimmed at the time of concrete placement.

5.3.3 Foundation Set Backs

Where applicable, the following setbacks should apply to all foundations. Any improvements not conforming to these setbacks may be subject to lateral movement and/or differential settlement:

- The outside top edge of all footings should be set back a minimum of H/3 (where H is the slope height) from the face of any descending slope. The setback should be at least five feet and need not exceed 40 feet.
- The bottom of all footings supporting structures near retaining walls should be deepened so as to extend below a 1:1 projection extending upward from the bottom inside edge of the retaining wall footing.
- The bottom of any proposed foundations for structures should be deepened so as to extend below a 1:1 projection extending upward from the bottom of the nearest excavation.

5.3.4 Retaining and Garden Wall Design and Construction

5.3.4.1 General Design Criteria

Retaining wall foundations should be embedded a minimum of 18 inches into engineered fill. Retaining wall foundations should be designed in accordance with Section 5.3.1 of this report. Structural requirements may govern and should be evaluated by the project structural engineer.

All retaining wall plans should be reviewed by this office prior to finalization.

Site clearing and remedial earthwork for all earth retention structures should meet the requirements of this report, unless specifically provided otherwise, or more stringent requirements or recommendations are made by the wall designer. The soil used as backfill

behind retaining walls should have a "very low" expansion potential and should be densified to at least 90 percent relative compaction (ASTM D 1557).

In general, cantilever retaining walls, which are designed to yield at least 0.001H, where H is equal to the height of the structure to the base of the footing may be designed using the active condition. Rigid earth retention structures (including but not limited to rigid walls, and walls braced at the top, such as typical basement walls) should be designed using the at-rest condition.

In addition to the design lateral forces due to retained earth, surcharges due to improvements, such as an adjacent structure or traffic loading, should be considered in the design of the earth retention structures. Loads applied within a 1:1 (h:v) projection from the surcharging structure on the stem of the retaining wall should be considered in the design.

Final selection of the appropriate design parameters should be made by the project earth retention structure designer, based upon the local practices and ordinances, expected structure response, and desired level of conservatism.

5.3.4.2 Cantilevered Walls

The recommendations presented below are for cantilevered retaining walls up to 10 feet high. Active earth pressure may be used for retaining wall design, provided the top of the wall is not restrained from minor deflections. Appropriate fluid unit weights are given below for specific slope gradients of the retained material. These do not include other superimposed loading conditions such as traffic, structures, seismic events, or adverse geologic conditions.

ACTIVE EARTH PRESSURES	
Surface Slope of Retained Materials (h:v)	Equivalent Fluid Pressure (pcf)
Level	35
2:1	60

* The design pressures assume the backfill materials have an expansion index less than or equal to 20. Backfill zone includes the area between the back of the wall to a plane (1:1, h:v) up from the bottom of the wall foundation to the adjacent ground surface.

5.3.4.3 Retaining Wall Backfill and Drainage

Wall backfill should include a minimum one foot wide section of ¾- to 1-inch clean crushed rock or approved equivalent. The rock should be placed immediately adjacent to the back of the wall and extend up from a backdrain to within approximately 12 inches of finish grade. The portion of the rock opposite the back of the wall should be covered with a layer of filter fabric comprised of Mirafi 140N or the equivalent. The upper 12 inches of backfill should consist of compacted on-site soil. Backfill placed within the active zone as defined by a 1:1 (H:V) projection from the back of the retaining wall footing up to the retained surface behind the wall should consist of very low expansive soil. The backfill soil should be placed in lifts no greater than eight inches in thickness and compacted to a minimum of 90 percent relative compaction (ASTM D 1557). Proper surface drainage needs to be provided and maintained. Water should not be allowed to pond behind retaining walls. Waterproofing of site walls should be performed where moisture migration through the walls is undesirable.

Retaining walls should be provided with an adequate pipe and gravel back drain system to reduce the potential for hydrostatic pressures to develop. A four-inch diameter perforated collector pipe (Schedule 40 PVC, or approved equivalent) in a minimum of one cubic foot per linear foot of ¾-inch or one inch clean crushed rock or equivalent, wrapped in filter fabric should be placed near the bottom of the backfill and the water should be directed to an appropriate disposal area.

Walls from two feet to four feet in height may be drained using localized gravel packs (approximately 1.5 cubic feet of gravel in a woven plastic bag) behind weep holes at 10 feet maximum spacing. Weep holes should be provided or the head joints omitted in the first course of block extended above the ground surface. However, nuisance water may still collect in front of the wall.

Drain outlets should be maintained over the life of the project and should not be obstructed or plugged by adjacent improvements.

5.3.4.4 Restrained Retaining Walls

Retaining walls that will be restrained or that have reentrant or male corners should be designed for an at-rest equivalent fluid pressure of 60 pcf, plus any applicable surcharge loading. For areas of male or reentrant corners, the restrained wall design should extend a minimum distance of twice the height of the wall laterally from the corner, or a distance otherwise determined by the project structural engineer.

5.3.4.5 Other Design Considerations

- Retaining and garden wall foundation elements should be designed in accordance with building code setback requirements. A minimum horizontal setback distance of five feet as measured from the top outside edge of the footing to an adjacent slope face is recommended.
- Wall design should consider the additional surcharge loads from superjacent slopes and/or footings, where appropriate.
- No backfill should be placed against concrete until minimum design strengths are evident by compression tests of cylinders.
- The retaining wall footing excavations, backcuts, and backfill materials should be approved by the project geotechnical engineer or their authorized representative.
- Positive separations should be provided in garden walls at horizontal distances not exceeding 20 feet.

5.3.5 Soil Corrosivity

Based on the chemical test results included in Appendix B, the corrosivity test results on samples obtained from the project site indicate that the on-site soils are considered "highly corrosive" to buried ferrous metal in accordance with current standards used by corrosion engineers. Recommendations for protection of buried ferrous metal should be provided by a corrosion engineer.

5.3.6 Soil Sulfate Content

Based on the chemical test results included in Appendix B, the sulfate test results on samples obtained from the project site indicate soluble sulfate contents of less than 0.1% by weight should be expected for the site. Soluble sulfate contents of this level would be in the range of "not applicable" (i.e. negligible) per Table 4.2.1 of ACI 318. Based on the test results and Table 4.3.1 of ACI 318, no special concrete mix design would be necessary to resist sulfate attack.

5.3.7 Concrete Flatwork

5.3.7.1 Exterior Slabs and Sidewalks

Exterior slabs and sidewalks should be designed using a four inch minimum thickness. No specific reinforcement is required from a geotechnical perspective. However, some shrinkage and cracking of the concrete should be anticipated as a result of typical mix designs and curing practices commonly utilized in construction.

Exterior slabs and sidewalks may be under the jurisdiction of the governing agency. If so, jurisdictional design and construction criteria would apply, if more restrictive than the recommendations presented in this report.

Subgrade soils should be pre-moistened prior to placing concrete. The subgrade soils below exterior slabs and sidewalks should be pre-saturated to at least the optimum moisture content to a minimum depth of 12 inches.

All concrete installation, including preparation and compaction of subgrade, should be done in accordance with the City of Compton specifications, and under the observation and testing of GeoTek and a City inspector, if necessary.

5.3.7.2 Concrete Performance

Concrete cracks should be expected. These cracks can vary from sizes that are essentially unnoticeable to more than 0.125-inch in width. Most cracks in concrete, while unsightly, do not significantly impact long-term performance. While it is possible to take measures (proper concrete mix, placement, curing, control joints, etc.) to reduce the extent and size of cracks that occur, some cracking will occur despite the best efforts to minimize it. Concrete can also undergo chemical processes that are dependent upon a wide range of variables, which are difficult, at best, to control. Concrete, while seemingly a stable material, is subject to internal expansion and contraction due to external changes over time.

One of the simplest means to control cracking is to provide weakened control joints for cracking to occur along. These do not prevent cracks from developing; they simply provide a relief point for the stresses that develop. These joints are a widely accepted means to control cracks but are not always effective. Control joints are more effective the more closely spaced they are. GeoTek suggests that control joints be placed in two orthogonal directions and located a distance apart approximately equal to 24 to 36 times the slab thickness.

Exterior concrete flatwork is often some of the most visible aspects of site development. They are typically given the least level of quality control, being considered "non-structural" components. We suggest that the same standards of care be applied to these features as to the structures themselves.

5.4 POST CONSTRUCTION CONSIDERATIONS

5.4.1 Landscape Maintenance and Planting

Water has been shown to weaken the inherent strength of soil, and slope stability is significantly reduced by overly wet conditions. Positive surface drainage away from graded slopes should be maintained and only the amount of irrigation necessary to sustain plant life should be provided for planted slopes. Controlling surface drainage and runoff, and maintaining a suitable vegetation cover can minimize erosion. Plants selected for landscaping should be lightweight, deep-rooted types that require little water and are capable of surviving the prevailing climate.

Overwatering should be avoided. An abatement program to control ground-burrowing rodents should be implemented and maintained. Burrowing rodents can decrease the long-term performance of slopes.

It is common for planting to be placed adjacent to structures in planter or lawn areas. This will result in the introduction of water into the ground adjacent to the foundations. This type of landscaping should be avoided.

5.4.2 Drainage

Positive site drainage should be maintained at all times. Drainage should not flow uncontrolled down any descending slope. Water should be directed away from foundations and not allowed to pond or seep into the ground adjacent to the footings. Paved areas should be sloped at two percent away from the structures. Downspouts should discharge onto paved surfaces sloping away from the structure or into a closed pipe system which outfalls to a street gutter or directly to a storm drain system. Pad drainage should be directed toward approved areas and not be blocked by other improvements.

It is the owner's responsibility to maintain and clean drainage devices. In order to be effective, maintenance should be conducted on a regular and routine schedule and necessary corrections made prior to each rainy season.

5.5 PLAN REVIEW AND CONSTRUCTION OBSERVATIONS

We recommend that site grading, specifications and foundation plans be reviewed by this office prior to construction to check for conformance with the recommendations of this report. We also recommend that GeoTek representatives be present during site grading and foundation

construction to observe and document proper implementation of the geotechnical recommendations. The owner/developer should verify that GeoTek representatives perform at least the following duties:

- Observe site clearing and grubbing operations for proper removal of unsuitable materials.
- Observe and test bottom of removals prior to fill placement.
- Evaluate the suitability of on-site and import materials for fill placement, and collect soil samples for laboratory testing where necessary.
- Observe the fill for uniformity during placement, including utility trench backfill. Also, perform field density testing of the fill materials.
- Observe and probe foundation excavations to confirm suitability of bearing materials with respect to density.

If requested, a construction observation and compaction report can be provided by GeoTek, which can comply with the requirements of the governmental agencies having jurisdiction over the project. We recommend that these agencies be notified prior to commencement of construction so that necessary grading permits can be obtained.

6. INTENT

It is the intent of this report to aid in the design and construction of the proposed development. Implementation of the advice presented in this report is intended to reduce risk associated with construction projects. The professional opinions and geotechnical advice contained in this report are not intended to imply total performance of the project or guarantee that unusual or variable conditions will not be discovered during or after construction.

The scope of our evaluation is limited to the boundaries of the subject property. This report does not and should in no way be construed to encompass any areas beyond the specific area of the proposed construction as indicated to us by our client. Further, no evaluation of any existing site improvements is included. The scope is based on our understanding of the project and the client's needs, our fee estimate (Proposal No. P-0403116) dated April 14, 2016 and geotechnical engineering standards normally used on similar projects in this locality at the present.

7. LIMITATIONS

Our findings are based on site conditions observed and the stated sources. Thus, our comments are professional opinions that are limited to the extent of the available data.

GeoTek has prepared this report in a manner consistent with that level of care and skill ordinarily exercised by members of the engineering and science professions currently practicing under similar conditions in the jurisdiction in which the services are provided, subject to the time limits and physical constraints applicable to this report.

Since our recommendations are based on the site conditions observed and encountered, and laboratory testing, our conclusions and recommendations are professional opinions that are limited to the extent of the available data. Observations during construction are important to allow for any change in recommendations found to be warranted. These opinions have been derived in accordance with current standards of practice and no warranty of any kind is expressed or implied. Standards of care/practice are subject to change with time.

8. SELECTED REFERENCES

American Society of Civil Engineers (ASCE), 2013, "Minimum Design Loads for Buildings and Other Structures," ASCE/SEI 7-10, Third Printing, Errata Incorporated through March 15.

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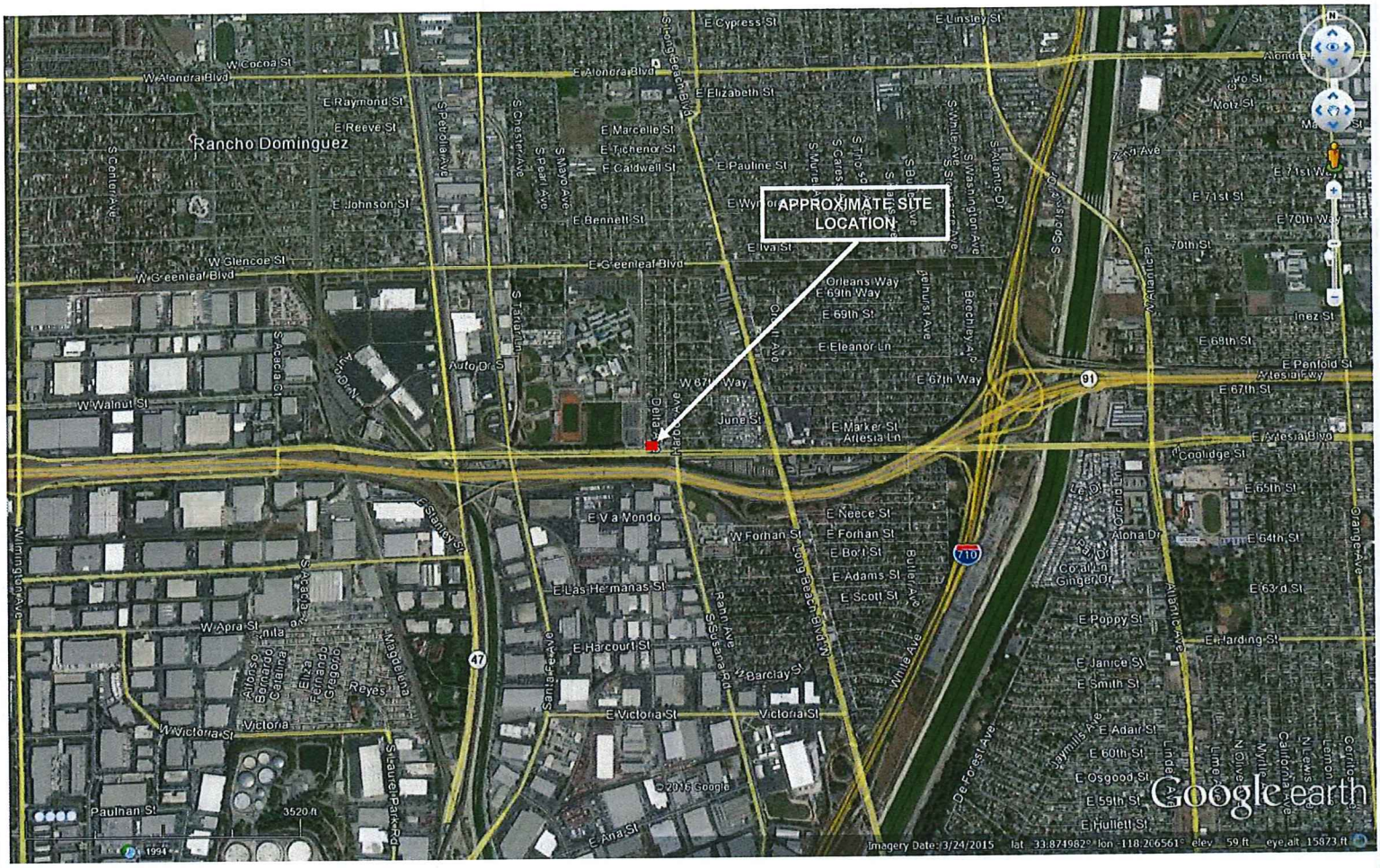


Compton Community College District
Proposed Campus Police Station
City of Compton
Los Angeles County, California

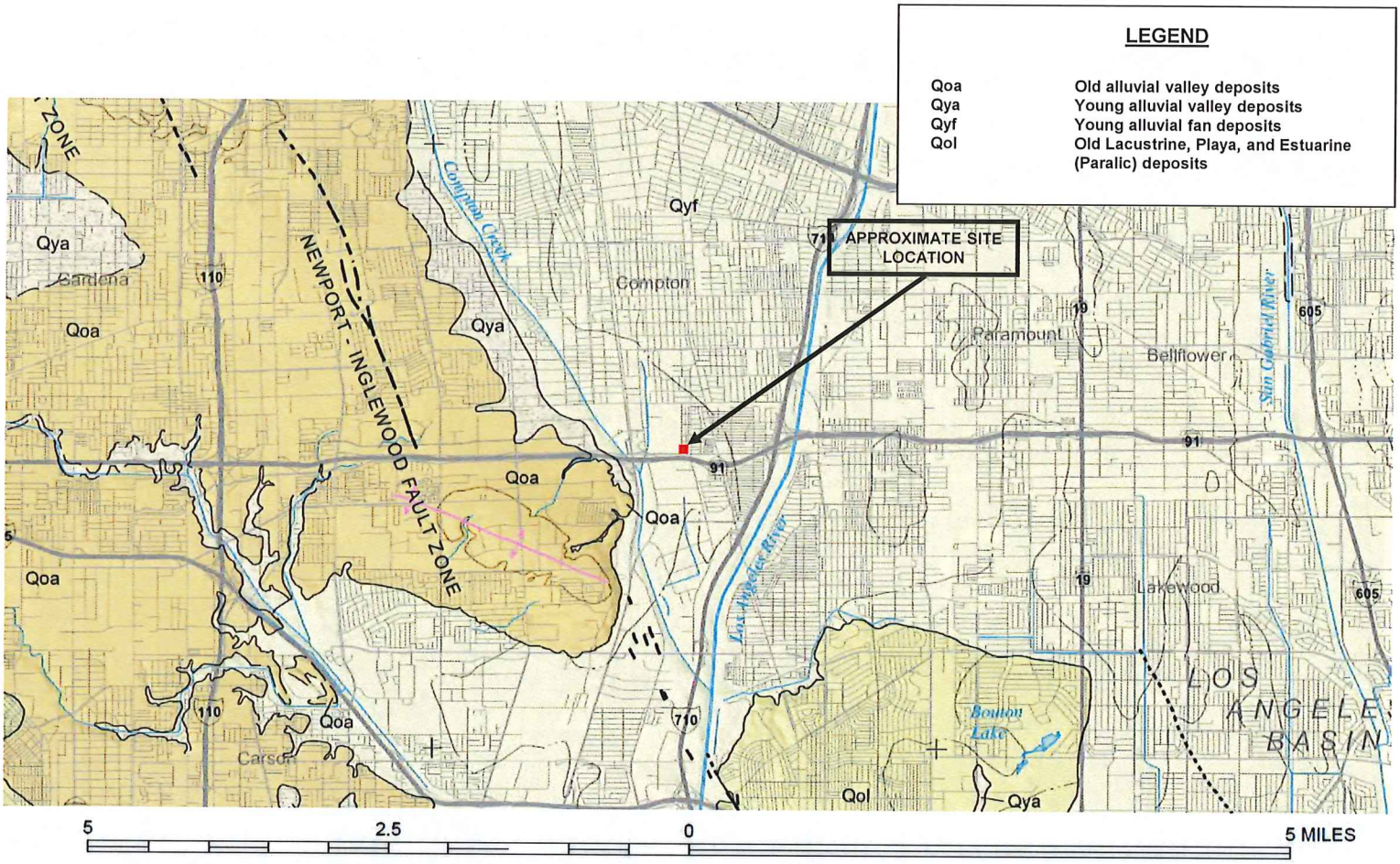
GeoTek Project No. 1529-CR

N

Figure 1

Site Location Map

GEOTEK



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Los Angeles County, California

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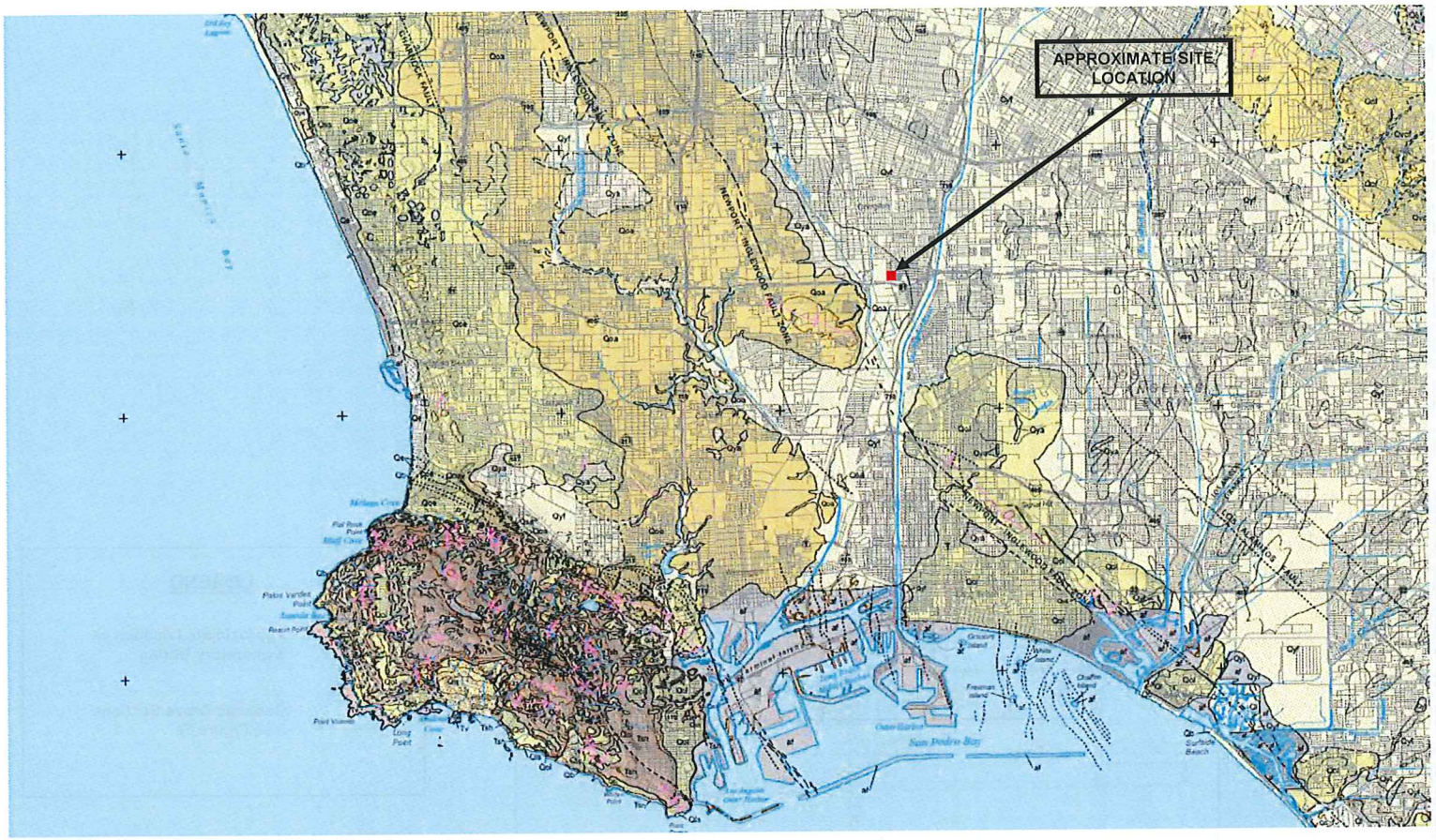
Figure 2

Geologic Map

GEOTEK



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Proposed Campus Police Station
City of Compton
Los Angeles County, California

GeoTek Project No. 1529-CR

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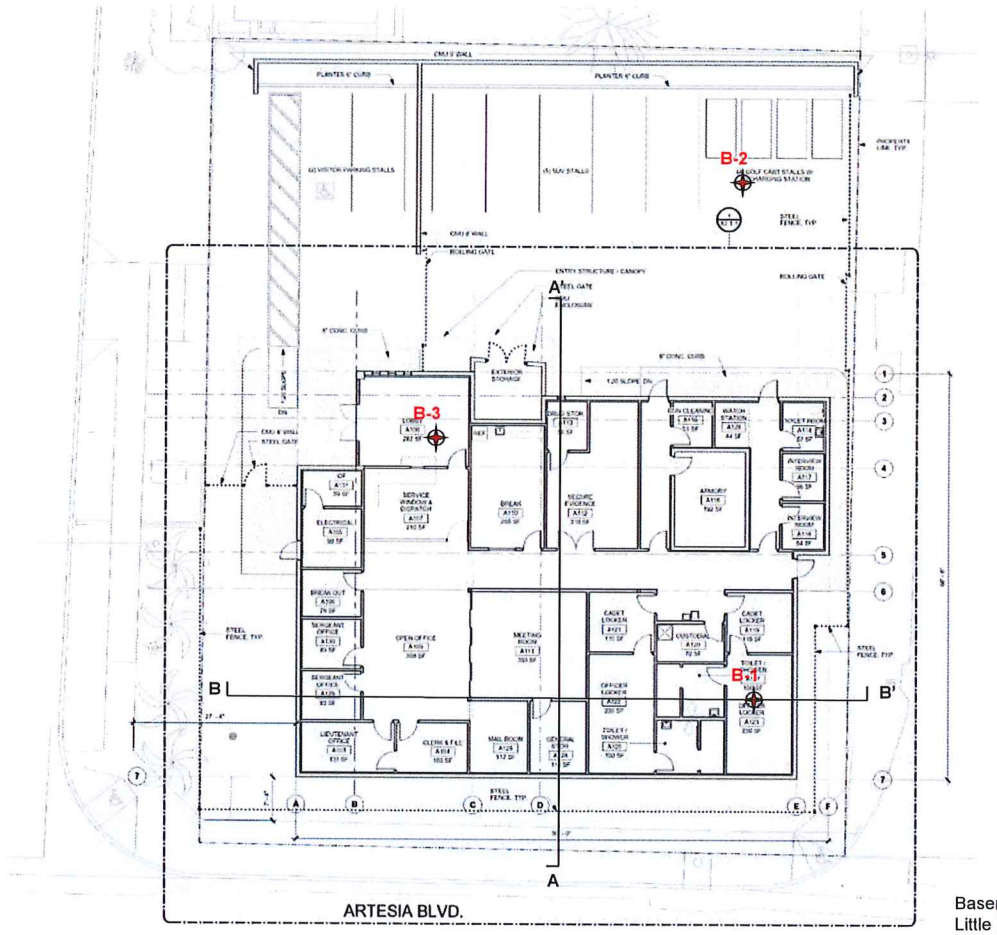
Figure 3

Regional Fault Map

GEOTEK



LEGEND

B-3 — Approximate Location of Exploratory Boring

B ⌊⌋ B' — Geologic Cross Sections (see Figure 5)

Basemap from "Schematic – Enlarged Site Plan," prepared by Little Diversified Architectural Consulting, issued June 29, 2016.

Compton Community College District
Proposed Campus Police Station
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Los Angeles County, California

GeoTek Project No. 1529-CR

N

1 inch ~ 25 feet

Figure 4

Exploration Location Map

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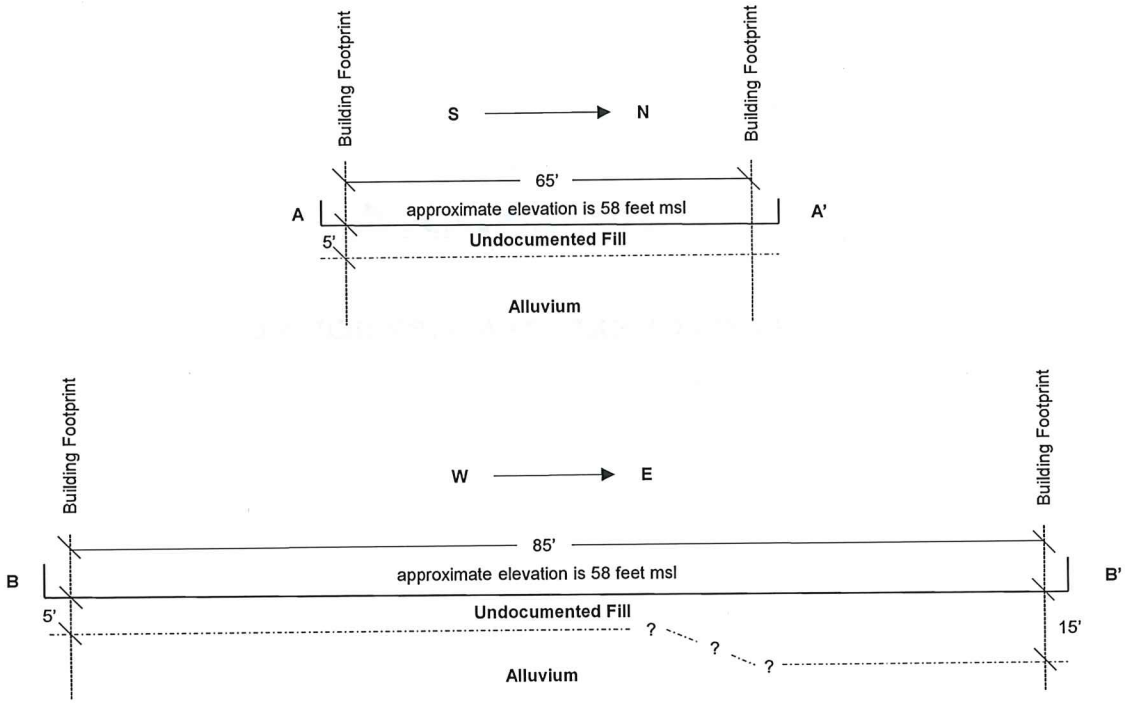


Compton Community College District Proposed Campus Police Station City of Compton Los Angeles County, California GeoTek Project No. 1529-CR	No Scale	**Figure 5** **Geologic Cross Sections**	GEOTEK

APPENDIX A

LOGS OF EXPLORATORY BORINGS

Proposed Campus Police Station
City of Compton, Los Angeles County, California
Project No. 1529-CR

GEOTEK

A - FIELD TESTING AND SAMPLING PROCEDURES

Bulk Samples (Large)

These samples are normally large bags of earth materials over 20 pounds in weight collected from the field by means of hand digging or exploratory cuttings.

Bulk Samples (Small)

These are plastic bag samples which are normally airtight and contain less than 5 pounds in weight of earth materials collected from the field by means of hand digging or exploratory cuttings. These samples are primarily used for determining natural moisture content and classification indices.

B – TRENCH LOG LEGEND

The following abbreviations and symbols often appear in the classification and description of soil and rock on the logs of trenches:

SOILS

USCS	Unified Soil Classification System
f-c	Fine to coarse
f-m	Fine to medium

GEOLOGIC

B: Attitudes	Bedding: strike/dip
J: Attitudes	Joint: strike/dip
C: Contact line	
.....	Dashed line denotes USCS material change
———	Solid Line denotes unit / formational change
———	Thick solid line denotes end of trench

(Additional denotations and symbols are provided on the log of trenches)

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	Compton College	**DRILLER:**	2R Drilling	**LOGGED BY:**	NCT
PROJECT NAME:	Campus Police Station	**DRILL METHOD:**	8" Hollow Stem	**OPERATOR:**	JerryJaime
PROJECT NO.:	1529-CR	**HAMMER:**	Auto 140#/30"	**RIG TYPE:**	CME 75HT
LOCATION:	See Boring Location Map			**DATE:**	8/11/2016

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 in	SAMPLES: Sample Number	USCS Symbol	BORING NO.: B-1 / MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
			B1	ML	**Undocumented Fill** Brown SILT with some f sand, dry, very stiff			EI, SR
5		10 19 17	R1	ML	Light brown sandy SILT with glass, debris, and a trace of clay, slightly moist, very stiff	5.3	98.0	
		9 10 10	SPT1					SA % Passing #200 = 73.1
10		10 10 13	R2		- becoming moist and stiff at 10'	13.9	99.0	
		4 5 7	SPT2		- increase in clay at 11.5'			
15		11 20 17	R3	ML	**Alluvium** Brown clayey SILT with a trace of sand, moist to wet, very stiff	9.4	95	
		3 6 6	SPT3		- becoming stiff at 16.5'			SA % Passing #200 = 98.2 % Clay = 21.4 LL=40, PL=25
20		5 11 16	R4	ML	Dark brown to gray sandy and clayey SILT, wet, very stiff	25.4	98	
		4 6 7	SPT4		- becoming medium stiff at 21.5'			SA % Passing #200 = 71.6 % Clay = 14.4 LL=31, PL=22
25		20	R5			12.4	83	
		44 50 8 9	SPT5	SM/ML	Light brown silty f SAND to sandy SILT, moist, very dense, hard			
		10		ML	Blue-gray clayey SILT with sand, micaceous, wet, stiff			
30		6 6 8	R6			25.0	89	

LEGEND

Sample type: ---Ring; ---SPT; ---Small Bulk; ---Large Bulk; ---No Recovery; ---Water Table

Lab testing: AL = Atterberg Limits; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test; SR = Sulfate/Resisitivity Test; SH = Shear Test; HC= Consolidation; MD = Maximum Density

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	Compton College	**DRILLER:**	2R Drilling	**LOGGED BY:**	NCT
PROJECT NAME:	Campus Police Station	**DRILL METHOD:**	8" Hollow Stem	**OPERATOR:**	JerryJaime
PROJECT NO.:	1529-CR	**HAMMER:**	Auto 140#/30"	**RIG TYPE:**	CME 75HT
LOCATION:	See Boring Location Map			**DATE:**	8/11/2016

BORING NO.: B-1 (continued)

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 in	SAMPLES: Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
		7 9 9	SPT6		- becoming very stiff @ 31.5 feet			
35		6 7 8	SPT7					SA % Passing #200 = 90.5 % Clay = 23.7 LL=37, PL=27
40		15 21 19	SPT8	ML	Gray to brown sandy SILT with a trace of clay, micaceous, very stiff			SA % Passing #200 = 71.9
45		5 7 10	SPT9	ML	Dark gray brown clayey SILT with sand, moist to wet, very stiff,			SA % Passing #200 = 94.1 % Clay = 22.9
50 ▽		17 31 32	SPT10	SM	Gray silty f-m SAND, saturated, very dense ▽			SA % Passing #200 = 12.9
55		11 17	SPT11		- becoming dense at 55'			SA % Passing #200 = 15.3
		27		CL	Dark gray brown silty CLAY with fine sand, saturated, very stiff, micacaous			
					BORING TERMINATED AT 56.5 FEET Groundwater encountered at 50.5 feet. Undocumented fill to 15 feet. Backfilled with excavated soils.			
60								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing: AL = Atterberg Limits; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test; SR = Sulfate/Resisitivity Test; SH = Shear Test; HC= Consolidation; MD = Maximum Density

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	Compton College	**DRILLER:**	2R Drilling	**LOGGED BY:**	NCT
PROJECT NAME:	Campus Police Station	**DRILL METHOD:**	8" Hollow Stem	**OPERATOR:**	JerryJaime
PROJECT NO.:	1529-CR	**HAMMER:**	Auto 140#/30"	**RIG TYPE:**	CME 75HT
LOCATION:	See Boring Location Map			**DATE:**	8/11/2016

BORING NO.: B-2

Depth (ft)	Sample Type	Blows/ 6 in	Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Water Content (%)	Dry Density (pcf)	Others
			B1	ML	**Undocumented Fill** Light brown SILT with sand and small roots, dry, very stiff			
5		6 16 16	R1	ML	**Alluvium** Light brown SILT with a trace of clay and sand, slightly moist, very stiff	3.5	97.0	
10		4 5 5	R2	ML	Dark brown to brown sandy SILT with clay, moist, medium stiff	13.5	91.0	
15		4 5	R3			20.7	85	
		7		ML	Dark brown clayey SILT, moist to wet, medium stiff			
20		4 6 6	R4	ML	Dark gray mottled with brown clayey SILT, micaceous, wet, medium stiff	31.0	87	HC
25		5 7 11	R5		- becoming stiff @ 25 feet	41.2	79	
30					**BORING TERMINATED AT 26.5 FEET** Groundwater not encountered. Undocumented fill to 16 feet. Backfilled with excavated soils.			

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing: AL = Atterberg Limits; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test; SR = Sulfate/Resisitivity Test; SH = Shear Test; HC= Consolidation; MD = Maximum Density

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	Compton College	**DRILLER:**	2R Drilling	**LOGGED BY:**	NCT
PROJECT NAME:	Campus Police Station	**DRILL METHOD:**	8" Hollow Stem	**OPERATOR:**	JerryJaime
PROJECT NO.:	1529-CR	**HAMMER:**	Auto 140#/30"	**RIG TYPE:**	CME 75HT
LOCATION:	See Boring Location Map			**DATE:**	8/11/2016

BORING NO.: B-3

Depth (ft)	Sample Type	Blows/ 6 in	Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Water Content (%)	Dry Density (pcf)	Others
			B1	SM	**Undocumented Fill** Silty fine SAND with small roots, dry, loose			SH, MD
		9 17 19	R1			3.2	89	HC
5				SM	**Alluvium** Silty fine SAND with small roots, slightly moist, loose to medium dense			
		5 9 9	R2	ML	Dark brown to dark gray silt with clay, wet, stiff	23.7	89	HC
10		5 6 8	R3	ML	Dark brown clayey SILT, wet, stiff	25.1	97.0	
15		8 10 10	R4			20.2	106	
				ML	Dark gray mottled with brown clayey SILT, micaceous, wet, very stiff			
20		8 14 21	R5			22.0	105	
					BORING TERMINATED AT 21.5 FEET Groundwater not encountered. Undocumented fill to 18 feet. Backfilled with excavated soils.			
25								
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing: AL = Atterberg Limits; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test; SR = Sulfate/Resisitivity Test; SH = Shear Test; HC= Consolidation; MD = Maximum Density

APPENDIX B

LABORATORY TEST RESULTS

Proposed Campus Police Station
City of Compton, Los Angeles County, California
Project No. 1529-CR

GEOTEK

SUMMARY OF LABORATORY TESTING

Atterberg Limits

Laboratory testing to determine the liquid and plastic limits was performed in general accordance with ASTM D4318. The results of the testing are included on the boring logs in Appendix A.

Classification

Soils were classified visually in general accordance to the Unified Soil Classification System (ASTM Test Method D 2487). The soil classifications are shown on the boring logs in Appendix A.

Consolidation

The compressibility characteristics of the soils were evaluated by performing consolidation testing on three samples in general accordance with ASTM D 2435. The results are included in Appendix B.

Direct Shear

Shear testing was performed in a direct shear machine of the strain-control type in general accordance with ASTM Test Method D 3080. The rate of deformation is approximately 0.035 inch per minute. The samples were sheared under varying confining loads in order to determine the coulomb shear strength parameters, angle of internal friction and cohesion. The results of the testing are presented in Appendix B.

Expansion Index

The expansion potential of the soils was determined by performing expansion index testing on three samples in general accordance with ASTM D 4829. The results of the testing are provided below.

Boring No.	Depth (ft.)	Soil Type	Expansion Index	Classification
B-1	0-5	Silt with some fine sand	13	Very Low

In-Situ Moisture and Density

The natural water content was determined (ASTM D 2216) on samples of the materials recovered during the subsurface exploration. In addition, in-place dry density determinations (ASTM D 2937) were performed on relatively undisturbed samples to measure the unit weight of the subsurface soils. Results of these tests are shown on the boring logs at the appropriate sample depths in Appendix A.

Materials Finer Than the No. 200 Sieve

A #200 sieve wash was performed on selected samples of the soils according to ASTM Test Method D 1140. The results of this testing are presented on the boring logs in Appendix A.

Moisture-Density Relationship

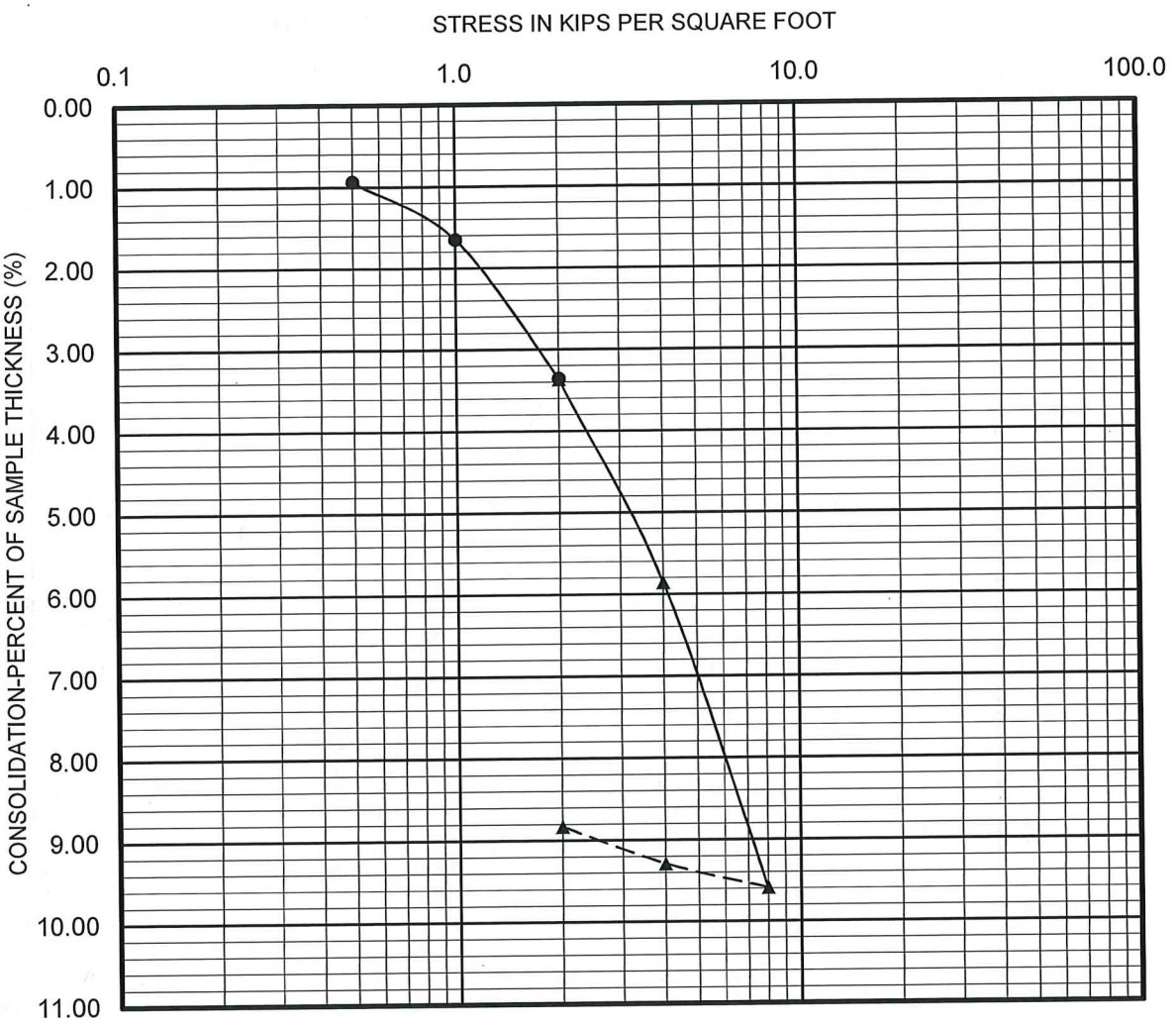
Laboratory testing was performed on two samples obtained during the subsurface exploration. The laboratory maximum dry density and optimum moisture content was determined in general accordance with ASTM D 1557. The results of the testing are provided below.

Boring No.	Depth (ft.)	Description	Maximum Dry Density (pcf)	Optimum Moisture Content (%)
B-3	0-5	Silty fine sand	117.0	13.5

Sulfate Content, Resistivity and Chloride Content

Testing to determine the water-soluble sulfate content was performed by others in general accordance with California Test No. 417. Resistivity testing was completed by others in general accordance with California Test No. 643. Testing to determine the chloride content was performed by others in general accordance with California Test No. 422. The results of the testing are provided below.

Boring No.	Depth (ft.)	pH CT-643	Chloride CT-422 (ppm)	Sulfate CT-417 (% by weight)	Resistivity ASTM G187 (ohm-cm)
B-1	0-5	8.4	32	0.003	1809



Seating Cycle
Loading Prior to Inundation
Loading After Inundation
Rebound Cycle

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 2435

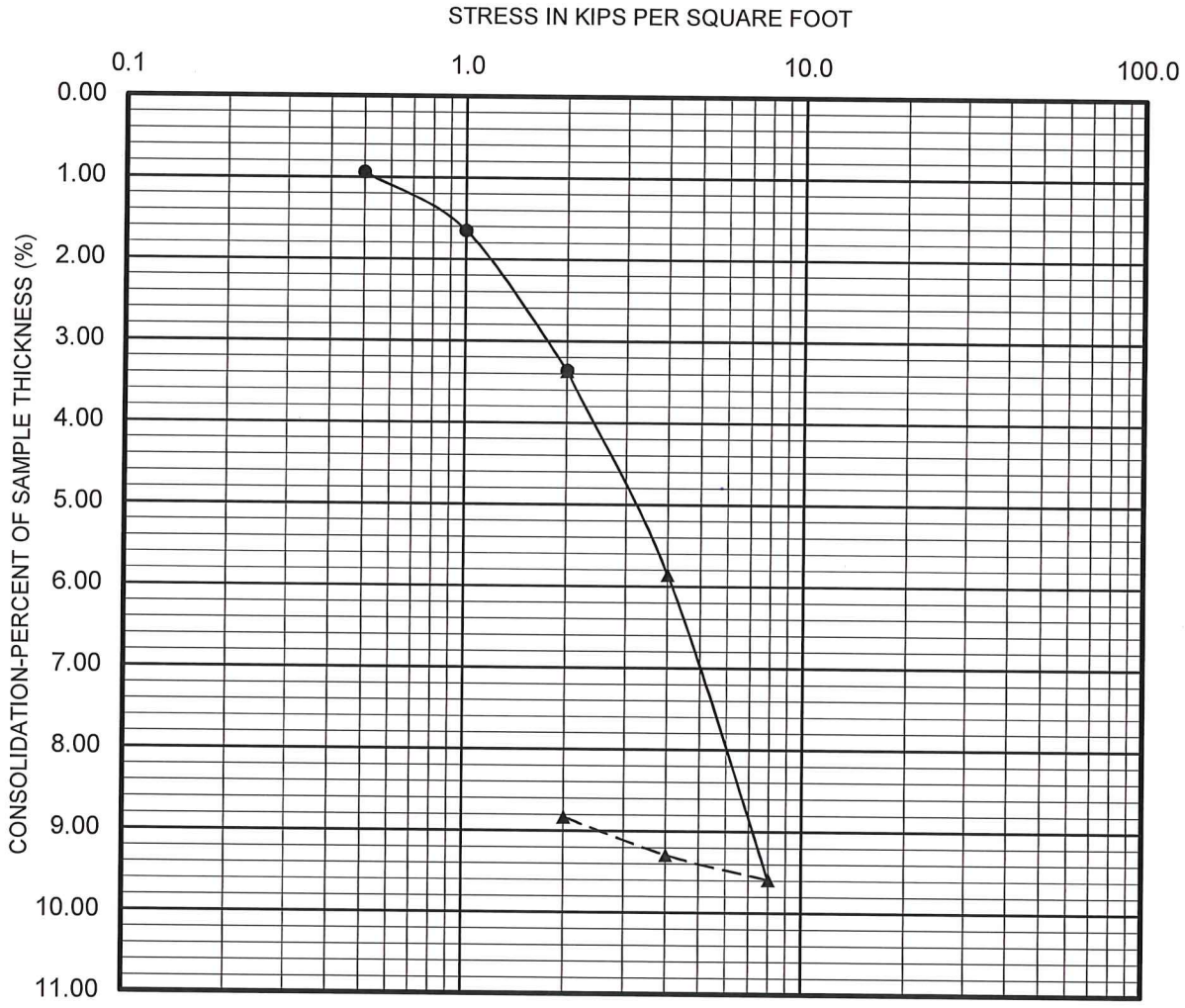
GEOTEK

CHECKED BY: NCT	Lab: DI
PROJECT NO.: 1529-CR	Date: 09/16

CONSOLIDATION REPORT

Sample: B-2 @ 20'

Compton College
Compton, California



Seating Cycle
Loading Prior to Inundation
Loading After Inundation
Rebound Cycle

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 2435

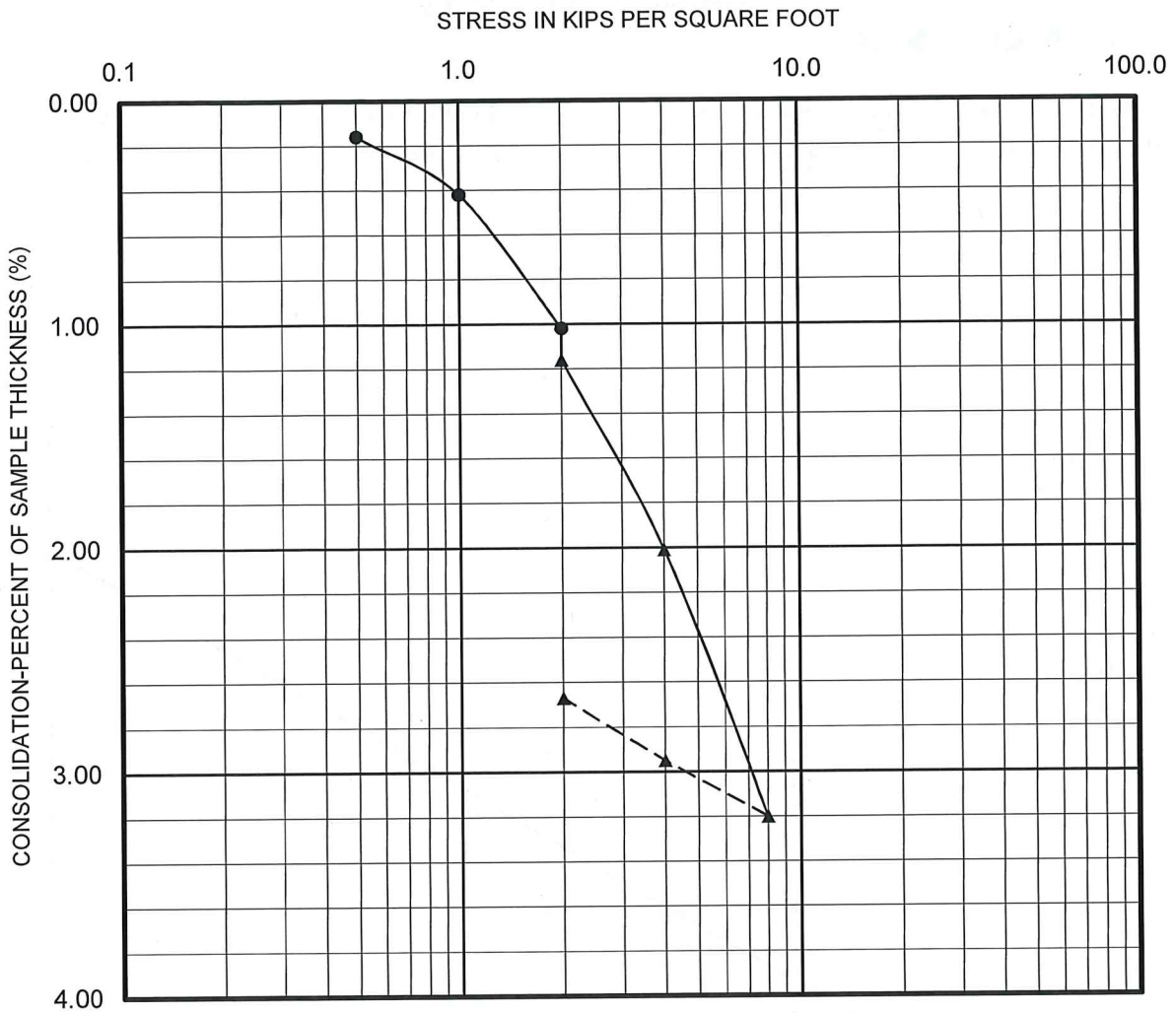
GEOTEK

CHECKED BY: NCT	Lab: DI
PROJECT NO.: 1529-CR	Date: 09/16

CONSOLIDATION REPORT

Sample: B-2 @ 20'

Compton College
Compton, California



Seating Cycle
Loading Prior to Inundation
Loading After Inundation
Rebound Cycle

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 2435

GEOTEK

CHECKED BY: NCT	Lab: DI
PROJECT NO.: 1529-CR	Date: 09/16

CONSOLIDATION REPORT

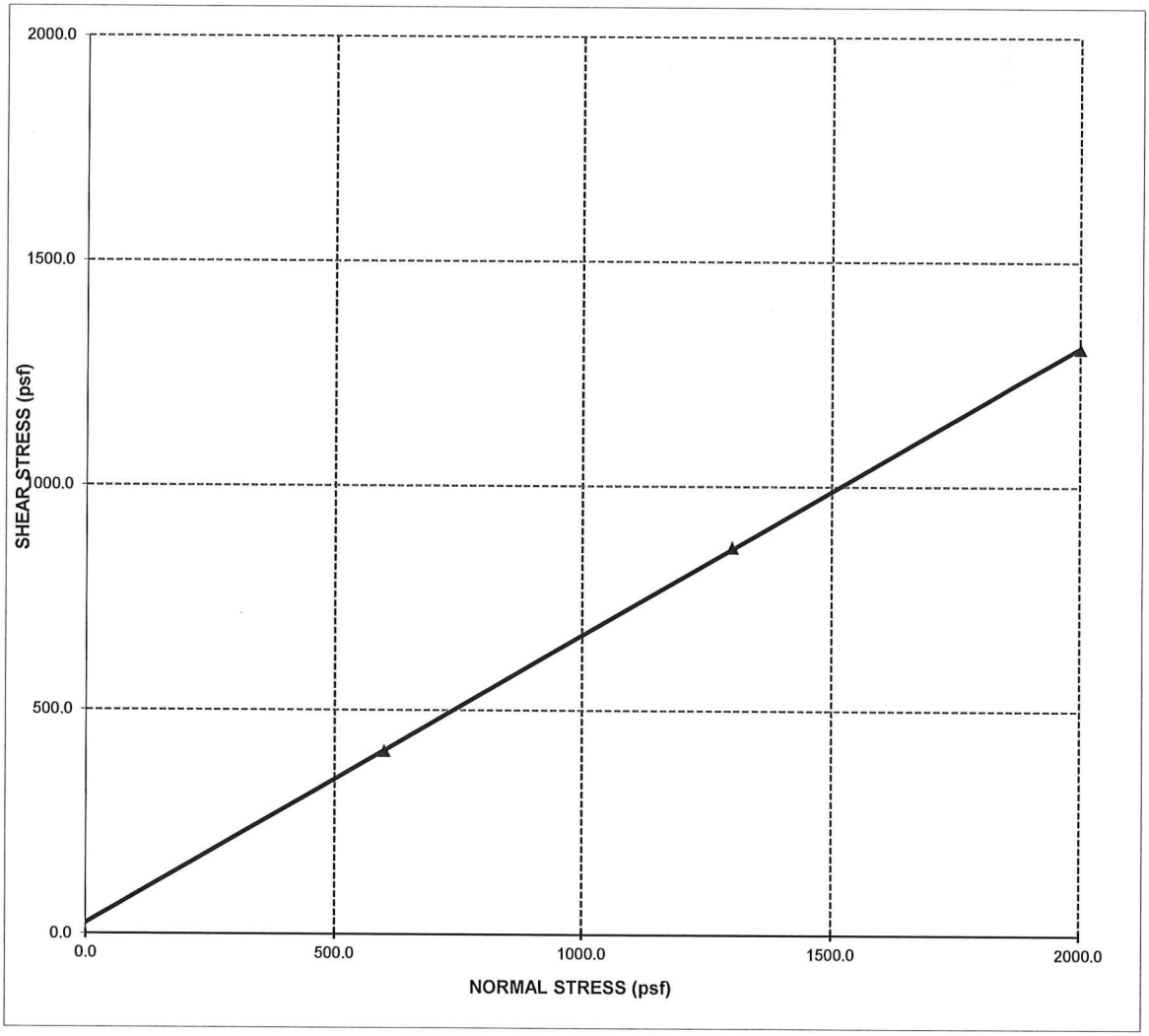
Sample: B-3 @ 7'

Compton College
Compton, California

GEOTEK

DIRECT SHEAR TEST

Project Name:	Campus Police Station	***Sample Location:***	B-3 @ 0 - 5
Project Number:	1529-CR	***Date Tested:***	9/8/2016



Shear Strength: Φ = **32.7** ^{o} , **C = 24.29 psf**

Notes: 1 - The soil specimen used in the shear box was a ring sample remolded to approximately 90% relative compaction from a bulk sample collected during the field investigation.

2 - The above reflect shear strength at saturated conditions.

3 - The tests were run at a shear rate of 0.035 in/min.

APPENDIX C

LIQUEFACTION ANALYSES

Proposed Campus Police Station
City of Compton, Los Angeles County, California
Project No. 1529-CR

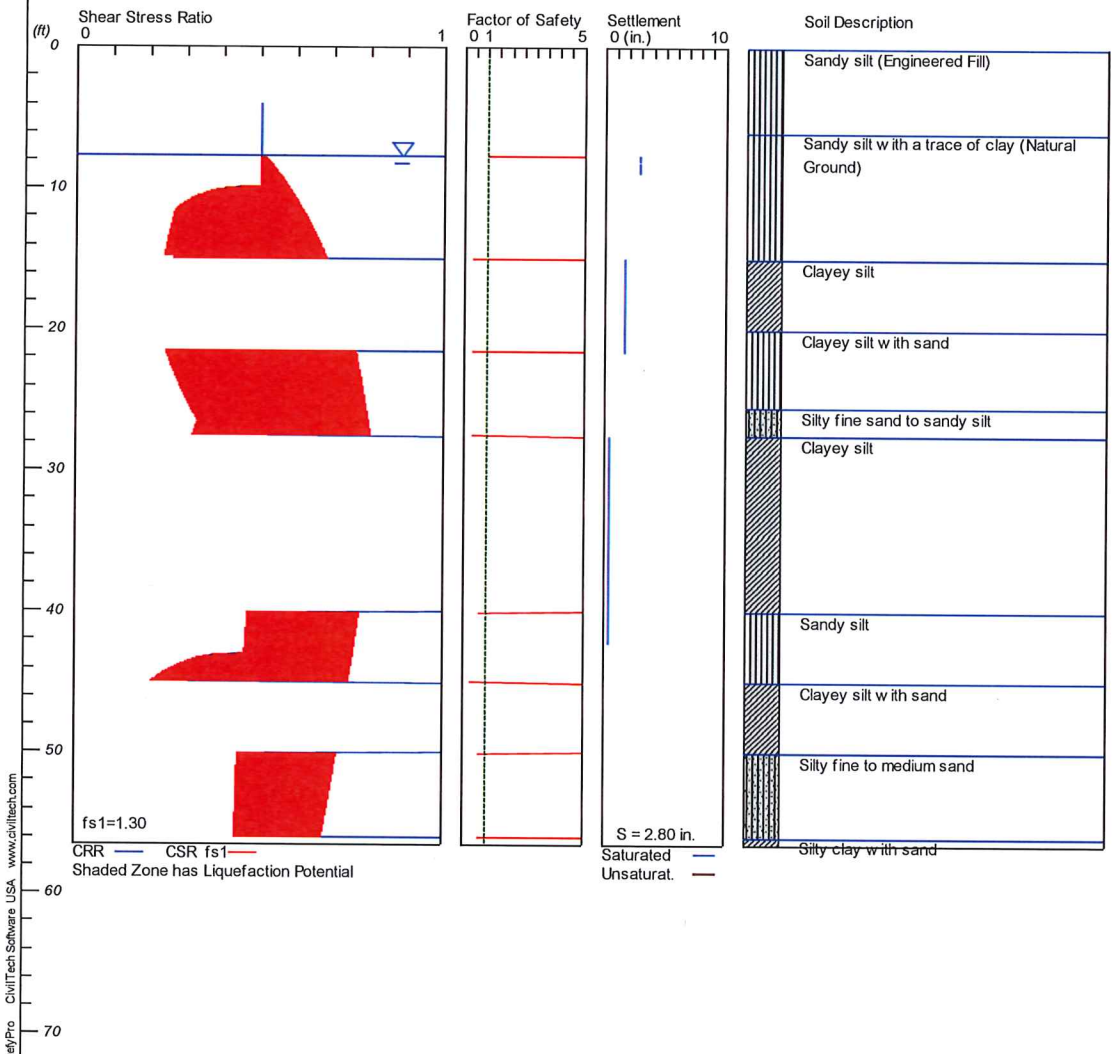
GEOTEK

LIQUEFACTION ANALYSIS

CAMPUS POLICE STATION, 5 FEET OF ENGINEERED FILL

Hole No.=B-1 Water Depth=7.7 ft

Magnitude=7.5
Acceleration=0.62g



GeoTek, Inc.

Summary 5 feet eng fill

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LIQUEFACTION ANALYSIS SUMMARY

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Input File Name: G:\Projects\1501 to 1550\1529CR Compton Community College Campus Police Station\Liquefaction\Liquefaction 5 Feet Engineered Fill.liq
Title: CAMPUS POLICE STATION, COMPTON COLLEGE
Subtitle:

Surface Elev.=
Hole No.=B-1
Depth of Hole= 56.50 ft
Water Table during Earthquake= 7.70 ft
Water Table during In-Situ Testing= 50.50 ft
Max. Acceleration= 0.62 g
Earthquake Magnitude= 7.50

Input Data:
Surface Elev.=
Hole No.=B-1
Depth of Hole=56.50 ft
Water Table during Earthquake= 7.70 ft
Water Table during In-Situ Testing= 50.50 ft
Max. Acceleration=0.62 g
Earthquake Magnitude=7.50
No-Liquefiable Soils: CL, OL are Non-Liq. Soil

1. SPT or BPT Calculation.
2. Settlement Analysis Method: Ishihara / Yoshimine
3. Fines Correction for Liquefaction: Idriss/Seed
4. Fine Correction for Settlement: During Liquefaction*
5. Settlement Calculation in: All zones*
6. Hammer Energy Ratio, Ce = 1.25
7. Borehole Diameter, Cb= 1
8. Sampling Method, Cs= 1
9. User request factor of safety (apply to CSR) , User= 1.3
   Plot one CSR curve (fs1=User)
10. Use Curve Smoothing: Yes*

* Recommended Options

Summary 5 feet eng fill

In-Situ Test Data:

Depth ft	SPT	gamma pcf	Fines %
4.00	45.00	130.00	73.00
6.50	20.00	103.00	73.00
11.50	12.00	113.00	73.00
16.50	12.00	104.00	NoLiq
21.50	13.00	123.00	NoLiq
26.50	19.00	110.00	50.00
31.50	18.00	120.00	NoLiq
35.00	15.00	130.00	NoLiq
40.00	40.00	130.00	71.90
45.00	17.00	130.00	NoLiq
50.00	63.00	130.00	12.90
55.00	44.00	130.00	15.30

Output Results:

Settlement of Saturated Sands=2.78 in.
Settlement of Unsaturated Sands=0.02 in.
Total Settlement of Saturated and Unsaturated Sands=2.80 in.
Differential Settlement=1.400 to 1.848 in.

Depth ft	CRRm	CSRfs	F.S.	S_sat. in.	S_dry in.	S_all in.
4.00	0.50	0.52	5.00	2.78	0.02	2.80
5.00	0.50	0.52	5.00	2.78	0.02	2.80
6.00	0.50	0.52	5.00	2.78	0.02	2.79
7.00	0.50	0.52	5.00	2.78	0.01	2.79
8.00	0.50	0.52	0.95*	2.78	0.00	2.78
9.00	0.50	0.55	0.90*	2.77	0.00	2.77
10.00	0.40	0.58	0.69*	2.72	0.00	2.72
11.00	0.30	0.61	0.49*	2.56	0.00	2.56
12.00	0.26	0.63	0.42*	2.34	0.00	2.34
13.00	0.25	0.65	0.39*	2.11	0.00	2.11
14.00	0.25	0.67	0.37*	1.88	0.00	1.88
15.00	2.00	0.69	5.00	1.64	0.00	1.64
16.00	2.00	0.70	5.00	1.64	0.00	1.64
17.00	2.00	0.72	5.00	1.64	0.00	1.64
18.00	2.00	0.73	5.00	1.64	0.00	1.64
19.00	2.00	0.74	5.00	1.64	0.00	1.64
20.00	2.00	0.75	5.00	1.64	0.00	1.64
21.00	2.00	0.76	5.00	1.64	0.00	1.64
22.00	0.25	0.77	0.32*	1.55	0.00	1.55
23.00	0.27	0.78	0.34*	1.32	0.00	1.32

			Summary	5 feet eng fill		
24.00	0.28	0.78	0.36*	1.10	0.00	1.10
25.00	0.30	0.79	0.38*	0.90	0.00	0.90
26.00	0.32	0.80	0.40*	0.70	0.00	0.70
27.00	0.32	0.80	0.40*	0.52	0.00	0.52
28.00	2.00	0.81	5.00	0.41	0.00	0.41
29.00	2.00	0.81	5.00	0.41	0.00	0.41
30.00	2.00	0.82	5.00	0.41	0.00	0.41
31.00	2.00	0.82	5.00	0.41	0.00	0.41
32.00	2.00	0.81	5.00	0.41	0.00	0.41
33.00	2.00	0.81	5.00	0.41	0.00	0.41
34.00	2.00	0.81	5.00	0.41	0.00	0.41
35.00	2.00	0.80	5.00	0.41	0.00	0.41
36.00	2.00	0.80	5.00	0.41	0.00	0.41
37.00	2.00	0.79	5.00	0.41	0.00	0.41
38.00	2.00	0.79	5.00	0.41	0.00	0.41
39.00	2.00	0.78	5.00	0.41	0.00	0.41
40.00	2.00	0.78	5.00	0.41	0.00	0.41
41.00	0.47	0.77	0.61*	0.41	0.00	0.41
42.00	0.46	0.77	0.61*	0.41	0.00	0.41
43.00	0.46	0.76	0.61*	0.37	0.00	0.37
44.00	0.27	0.75	0.36*	0.19	0.00	0.19
45.00	0.21	0.75	0.28*	0.00	0.00	0.00
46.00	2.00	0.74	5.00	0.00	0.00	0.00
47.00	2.00	0.74	5.00	0.00	0.00	0.00
48.00	2.00	0.73	5.00	0.00	0.00	0.00
49.00	2.00	0.72	5.00	0.00	0.00	0.00
50.00	2.00	0.72	5.00	0.00	0.00	0.00
51.00	0.44	0.71	0.62*	0.00	0.00	0.00
52.00	0.44	0.70	0.63*	0.00	0.00	0.00
53.00	0.44	0.70	0.63*	0.00	0.00	0.00
54.00	0.44	0.69	0.64*	0.00	0.00	0.00
55.00	0.44	0.68	0.64*	0.00	0.00	0.00
56.00	0.44	0.68	0.65*	0.00	0.00	0.00

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* F.S.<1, Liquefaction Potential Zone
(F.S. is limited to 5, CRR is limited to 2, CSR is limited to 2)

Units: Unit: qc, fs, Stress or Pressure = atm (1.0581tsf); Unit Weight = pcf; Depth = ft; Settlement = in.

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1 atm (atmosphere) = 1 tsf (ton/ft2)
CRRm Cyclic resistance ratio from soils
CSRsf Cyclic stress ratio induced by a given earthquake (with user request factor of safety)
F.S. Factor of Safety against liquefaction, F.S.=CRRm/CSRsf
S_sat Settlement from saturated sands
S_dry Settlement from Unsaturated Sands

Summary 5 feet eng fill

S_all	Total Settlement from Saturated and Unsaturated Sands
NoLiq	No-Liquefy Soils

Details 5 feet eng fill

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LIQUEFACTION ANALYSIS CALCULATION DETAILS

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Input File Name: G:\Projects\1501 to 1550\1529CR Compton Community College Campus Police Station\Liquefaction\Liquefaction 15 Feet Engineered Fill.liq
Title: CAMPUS POLICE STATION, COMPTON COLLEGE
Subtitle:

Input Data:
Surface Elev.=
Hole No.=B-1
Depth of Hole=56.50 ft
Water Table during Earthquake= 7.70 ft
Water Table during In-Situ Testing= 50.50 ft
Max. Acceleration=0.62 g
Earthquake Magnitude=7.50
No-Liquefiable Soils: CL, OL are Non-Liq. Soil
1. SPT or BPT Calculation.
2. Settlement Analysis Method: Ishihara / Yoshimine
3. Fines Correction for Liquefaction: Idriss/Seed
4. Fine Correction for Settlement: During Liquefaction*
5. Settlement Calculation in: All zones*
6. Hammer Energy Ratio, Ce = 1.25
7. Borehole Diameter, Cb= 1
8. Sampling Method, Cs= 1
9. User request factor of safety (apply to CSR) , User= 1.3
   Plot one CSR curve (fs1=User)
10. Average two input data between two Depths: Yes*
* Recommended Options

In-Situ Test Data:

Depth ft	SPT	Gamma pcf	Fines %
4.00	45.00	130.00	73.00
6.50	20.00	103.00	73.00
11.50	9.00	113.00	73.00
16.50	11.00	104.00	NoLiq

Details 5 feet eng fill

21.50	13.00	123.00	NoLiq
26.50	19.00	110.00	50.00
31.50	18.00	120.00	NoLiq
35.00	15.00	130.00	NoLiq
40.00	40.00	130.00	71.90
45.00	17.00	130.00	NoLiq
50.00	63.00	130.00	12.90
55.00	44.00	130.00	15.30

Output Results:

Calculation segment, dz=0.050 ft

User defined Print Interval, dp=1.00 ft

Peak Ground Acceleration (PGA), a_max = 0.62g

CSR Calculation:

Depth	gamma	sigma	gamma'	sigma'	rd	mZ	a(z)	CSR	x	fs1 =CSRfs
ft	pcf	atm	pcf	atm		g	g			
4.00	130.00	0.246	130.00	0.246	0.99	0.000	0.620	0.40	1.30	0.52
5.00	119.20	0.305	119.20	0.305	0.99	0.000	0.620	0.40	1.30	0.52
6.00	108.40	0.359	108.40	0.359	0.99	0.000	0.620	0.40	1.30	0.52
7.00	104.00	0.408	104.00	0.408	0.98	0.000	0.620	0.40	1.30	0.52
8.00	106.00	0.458	43.60	0.449	0.98	0.000	0.620	0.40	1.30	0.52
9.00	108.00	0.508	45.60	0.470	0.98	0.000	0.620	0.43	1.30	0.55
10.00	110.00	0.560	47.60	0.492	0.98	0.000	0.620	0.45	1.30	0.58
11.00	112.00	0.612	49.60	0.515	0.97	0.000	0.620	0.47	1.30	0.61
12.00	112.10	0.665	49.70	0.539	0.97	0.000	0.620	0.48	1.30	0.63
13.00	110.30	0.718	47.90	0.562	0.97	0.000	0.620	0.50	1.30	0.65
14.00	108.50	0.770	46.10	0.584	0.97	0.000	0.620	0.51	1.30	0.67
15.00	106.70	0.820	44.30	0.605	0.97	0.000	0.620	0.53	1.30	0.69

Details 5 feet eng fill

16.00	104.90	0.871	42.50	0.626	0.96	0.000	0.620	0.54	1.30	0.70
17.00	105.90	0.920	43.50	0.646	0.96	0.000	0.620	0.55	1.30	0.72
18.00	109.70	0.971	47.30	0.667	0.96	0.000	0.620	0.56	1.30	0.73
19.00	113.50	1.024	51.10	0.690	0.96	0.000	0.620	0.57	1.30	0.74
20.00	117.30	1.078	54.90	0.715	0.95	0.000	0.620	0.58	1.30	0.75
21.00	121.10	1.134	58.70	0.742	0.95	0.000	0.620	0.59	1.30	0.76
22.00	121.70	1.192	59.30	0.770	0.95	0.000	0.620	0.59	1.30	0.77
23.00	119.10	1.249	56.70	0.798	0.95	0.000	0.620	0.60	1.30	0.78
24.00	116.50	1.305	54.10	0.824	0.94	0.000	0.620	0.60	1.30	0.78
25.00	113.90	1.359	51.50	0.849	0.94	0.000	0.620	0.61	1.30	0.79
26.00	111.30	1.412	48.90	0.873	0.94	0.000	0.620	0.61	1.30	0.80
27.00	111.00	1.465	48.60	0.896	0.94	0.000	0.620	0.62	1.30	0.80
28.00	113.00	1.518	50.60	0.919	0.93	0.000	0.620	0.62	1.30	0.81
29.00	115.00	1.571	52.60	0.943	0.93	0.000	0.620	0.63	1.30	0.81
30.00	117.00	1.626	54.60	0.969	0.93	0.000	0.620	0.63	1.30	0.82
31.00	119.00	1.682	56.60	0.995	0.92	0.000	0.620	0.63	1.30	0.82
32.00	121.43	1.739	59.03	1.022	0.91	0.000	0.620	0.63	1.30	0.81
33.00	124.29	1.797	61.89	1.051	0.91	0.000	0.620	0.62	1.30	0.81
34.00	127.14	1.856	64.74	1.081	0.90	0.000	0.620	0.62	1.30	0.81
35.00	130.00	1.917	67.60	1.112	0.89	0.000	0.620	0.62	1.30	0.80
36.00	130.00	1.978	67.60	1.144	0.88	0.000	0.620	0.61	1.30	0.80
37.00	130.00	2.040	67.60	1.176	0.87	0.000	0.620	0.61	1.30	0.79
38.00	130.00	2.101	67.60	1.208	0.86	0.000	0.620	0.61	1.30	0.79
39.00	130.00	2.162	67.60	1.240	0.86	0.000	0.620	0.60	1.30	0.78

			Details	5 feet eng fill						
40.00	130.00	2.224	67.60	1.271	0.85	0.000	0.620	0.60	1.30	0.78
41.00	130.00	2.285	67.60	1.303	0.84	0.000	0.620	0.59	1.30	0.77
42.00	130.00	2.347	67.60	1.335	0.83	0.000	0.620	0.59	1.30	0.77
43.00	130.00	2.408	67.60	1.367	0.82	0.000	0.620	0.58	1.30	0.76
44.00	130.00	2.470	67.60	1.399	0.82	0.000	0.620	0.58	1.30	0.75
45.00	130.00	2.531	67.60	1.431	0.81	0.000	0.620	0.58	1.30	0.75
46.00	130.00	2.593	67.60	1.463	0.80	0.000	0.620	0.57	1.30	0.74
47.00	130.00	2.654	67.60	1.495	0.79	0.000	0.620	0.57	1.30	0.74
48.00	130.00	2.715	67.60	1.527	0.78	0.000	0.620	0.56	1.30	0.73
49.00	130.00	2.777	67.60	1.559	0.78	0.000	0.620	0.56	1.30	0.72
50.00	130.00	2.838	67.60	1.591	0.77	0.000	0.620	0.55	1.30	0.72
51.00	130.00	2.900	67.60	1.623	0.76	0.000	0.620	0.55	1.30	0.71
52.00	130.00	2.961	67.60	1.655	0.75	0.000	0.620	0.54	1.30	0.70
53.00	130.00	3.023	67.60	1.687	0.74	0.000	0.620	0.54	1.30	0.70
54.00	130.00	3.084	67.60	1.719	0.73	0.000	0.620	0.53	1.30	0.69
55.00	130.00	3.145	67.60	1.751	0.73	0.000	0.620	0.53	1.30	0.68
56.00	130.00	3.207	67.60	1.783	0.72	0.000	0.620	0.52	1.30	0.68

CSR is based on water table at 7.70 during earthquake

CRR Calculation from SPT or BPT data:

Depth	SPT	Cebs	Cr	sigma'	Cn	(N1)60	Fines	d(N1)60	(N1)60f	CRR7.5
ft				atm			%			

4.00	45.00	1.25	0.75	0.246	1.70	71.72	73.00	19.34	91.06	0.50

Details 5 feet eng fill

	5.00	35.00	1.25	0.75	0.305	1.70	55.78	73.00	16.16
71.94	0.50								
	6.00	25.00	1.25	0.75	0.359	1.67	39.14	73.00	12.83
51.96	0.50								
	7.00	18.90	1.25	0.75	0.408	1.57	27.74	73.00	10.55
38.28	0.50								
	8.00	16.70	1.25	0.75	0.458	1.48	23.14	73.00	9.63
32.77	0.50								
	9.00	14.50	1.25	0.85	0.508	1.40	21.61	73.00	9.32
30.93	0.50								
	10.00	12.30	1.25	0.85	0.560	1.34	17.47	73.00	8.49
25.96	0.30								
	11.00	10.10	1.25	0.85	0.612	1.28	13.72	73.00	7.74
21.46	0.23								
	12.00	9.20	1.25	0.85	0.665	1.23	11.98	75.80	7.40
19.38	0.21								
	13.00	9.60	1.25	0.85	0.718	1.18	12.04	81.40	7.41
19.45	0.21								
	14.00	10.00	1.25	0.85	0.770	1.14	12.11	87.00	7.42
19.53	0.21								
	15.00	10.40	1.25	0.95	0.820	1.10	13.63	NoLiq	7.73
21.36	0.23								
	16.00	10.80	1.25	0.95	0.871	1.07	13.75	NoLiq	7.75
21.50	0.23								
	17.00	11.20	1.25	0.95	0.920	1.04	13.87	NoLiq	7.77
21.64	0.24								
	18.00	11.60	1.25	0.95	0.971	1.01	13.98	NoLiq	7.80
21.78	0.24								
	19.00	12.00	1.25	0.95	1.024	0.99	14.09	NoLiq	7.82
21.90	0.24								
	20.00	12.40	1.25	0.95	1.078	0.96	14.18	NoLiq	7.84
22.02	0.24								
	21.00	12.80	1.25	0.95	1.134	0.94	14.27	NoLiq	7.85
22.13	0.24								
	22.00	13.60	1.25	0.95	1.192	0.92	14.79	95.90	7.96
22.75	0.25								
	23.00	14.80	1.25	0.95	1.249	0.89	15.73	85.70	8.15
23.87	0.27								
	24.00	16.00	1.25	0.95	1.305	0.88	16.63	75.50	8.33
24.96	0.28								
	25.00	17.20	1.25	0.95	1.359	0.86	17.52	65.30	8.50
26.02	0.30								
	26.00	18.40	1.25	0.95	1.412	0.84	18.39	55.10	8.68
27.06	0.32								
	27.00	18.90	1.25	0.95	1.465	0.83	18.55	55.10	8.71
27.25	0.32								
	28.00	18.70	1.25	1.00	1.518	0.81	18.97	NoLiq	8.80
27.77	0.34								

Details 5 feet eng fill

	29.00	18.50	1.25	1.00	1.571	0.80	18.45	NoLiq	8.69	
27.14	0.32									
	30.00	18.30	1.25	1.00	1.626	0.78	17.94	NoLiq	8.59	
26.53	0.31									
	31.00	18.10	1.25	1.00	1.682	0.77	17.45	NoLiq	8.49	
25.93	0.30									
	32.00	17.57	1.25	1.00	1.739	0.76	16.66	NoLiq	8.33	
24.99	0.28									
	33.00	16.71	1.25	1.00	1.797	0.75	15.59	NoLiq	8.12	
23.70	0.26									
	34.00	15.86	1.25	1.00	1.856	0.73	14.55	NoLiq	7.91	
22.46	0.25									
	35.00	15.00	1.25	1.00	1.917	0.72	13.54	NoLiq	7.71	
21.25	0.23									
	36.00	20.00	1.25	1.00	1.978	0.71	17.77	NoLiq	8.55	
26.33	0.31									
	37.00	25.00	1.25	1.00	2.040	0.70	21.88	NoLiq	9.38	
31.26	0.50									
	38.00	30.00	1.25	1.00	2.101	0.69	25.87	NoLiq	10.17	
36.04	0.50									
	39.00	35.00	1.25	1.00	2.162	0.68	29.75	NoLiq	10.95	
40.70	0.50									
	40.00	40.00	1.25	1.00	2.224	0.67	33.53	NoLiq	11.71	
45.23	0.50									
	41.00	35.40	1.25	1.00	2.285	0.66	29.27	77.72	10.85	
40.13	0.50									
	42.00	30.80	1.25	1.00	2.347	0.65	25.13	83.54	10.03	
35.16	0.50									
	43.00	26.20	1.25	1.00	2.408	0.64	21.11	89.36	9.22	
30.33	0.50									
	44.00	21.60	1.25	1.00	2.470	0.64	17.18	95.18	8.44	
25.62	0.29									
	45.00	17.00	1.25	1.00	2.531	0.63	13.36	NoLiq	7.67	
21.03	0.23									
	46.00	26.20	1.25	1.00	2.593	0.62	20.34	NoLiq	9.07	
29.40	0.39									
	47.00	35.40	1.25	1.00	2.654	0.61	27.16	NoLiq	10.43	
37.59	0.50									
	48.00	44.60	1.25	1.00	2.715	0.61	33.83	NoLiq	11.77	
45.60	0.50									
	49.00	53.80	1.25	1.00	2.777	0.60	40.35	NoLiq	13.07	
53.42	0.50									
	50.00	63.00	1.25	1.00	2.838	0.59	46.74	NoLiq	14.35	
61.09	0.50									
	51.00	59.20	1.25	1.00	2.886	0.59	43.56	13.38	3.71	
47.27	0.50									
	52.00	55.40	1.25	1.00	2.918	0.59	40.54	13.86	3.85	
44.39	0.50									

Details 5 feet eng fill

53.00	51.60	1.25	1.00	2.950	0.58	37.55	14.34	3.97
41.52	0.50							
54.00	47.80	1.25	1.00	2.982	0.58	34.60	14.82	4.08
38.68	0.50							
55.00	44.00	1.25	1.00	3.014	0.58	31.68	15.30	4.16
35.84	0.50							
56.00	44.00	1.25	1.00	3.046	0.57	31.51	15.30	4.15
35.67	0.50							

CRR is based on water table at 50.50 during In-Situ Testing

Factor of Safety, - Earthquake Magnitude= 7.50:

Depth ft	sigC' atm	CRR7.5	x Ksig	=CRRv	x MSF	=CRRm	CSRfs	F.S.=CRRm/CSRfs
4.00	0.16	0.50	1.00	0.50	1.00	0.50	0.52	5.00
5.00	0.20	0.50	1.00	0.50	1.00	0.50	0.52	5.00
6.00	0.23	0.50	1.00	0.50	1.00	0.50	0.52	5.00
7.00	0.27	0.50	1.00	0.50	1.00	0.50	0.52	5.00
8.00	0.30	0.50	1.00	0.50	1.00	0.50	0.52	0.95 *
9.00	0.33	0.50	1.00	0.50	1.00	0.50	0.55	0.90 *
10.00	0.36	0.30	1.00	0.30	1.00	0.30	0.58	0.51 *
11.00	0.40	0.23	1.00	0.23	1.00	0.23	0.61	0.38 *
12.00	0.43	0.21	1.00	0.21	1.00	0.21	0.63	0.33 *
13.00	0.47	0.21	1.00	0.21	1.00	0.21	0.65	0.32 *
14.00	0.50	0.21	1.00	0.21	1.00	0.21	0.67	0.32 *
15.00	0.53	0.23	1.00	0.23	1.00	2.00	0.69	5.00 ^
16.00	0.57	0.23	1.00	0.23	1.00	2.00	0.70	5.00 ^
17.00	0.60	0.24	1.00	0.24	1.00	2.00	0.72	5.00 ^
18.00	0.63	0.24	1.00	0.24	1.00	2.00	0.73	5.00 ^
19.00	0.67	0.24	1.00	0.24	1.00	2.00	0.74	5.00 ^
20.00	0.70	0.24	1.00	0.24	1.00	2.00	0.75	5.00 ^
21.00	0.74	0.24	1.00	0.24	1.00	2.00	0.76	5.00 ^
22.00	0.77	0.25	1.00	0.25	1.00	0.25	0.77	0.32 *
23.00	0.81	0.27	1.00	0.27	1.00	0.27	0.78	0.34 *
24.00	0.85	0.28	1.00	0.28	1.00	0.28	0.78	0.36 *
25.00	0.88	0.30	1.00	0.30	1.00	0.30	0.79	0.38 *
26.00	0.92	0.32	1.00	0.32	1.00	0.32	0.80	0.40 *
27.00	0.95	0.32	1.00	0.32	1.00	0.32	0.80	0.40 *
28.00	0.99	0.34	1.00	0.34	1.00	2.00	0.81	5.00 ^
29.00	1.02	0.32	1.00	0.32	1.00	2.00	0.81	5.00 ^
30.00	1.06	0.31	1.00	0.31	1.00	2.00	0.82	5.00 ^
31.00	1.09	0.30	0.99	0.30	1.00	2.00	0.82	5.00 ^
32.00	1.13	0.28	0.99	0.28	1.00	2.00	0.81	5.00 ^
33.00	1.17	0.26	0.98	0.26	1.00	2.00	0.81	5.00 ^

Details 5 feet eng fill

34.00	1.21	0.25	0.97	0.24	1.00	2.00	0.81	5.00 ^
35.00	1.25	0.23	0.97	0.22	1.00	2.00	0.80	5.00 ^
36.00	1.29	0.31	0.96	0.29	1.00	2.00	0.80	5.00 ^
37.00	1.33	0.50	0.96	0.48	1.00	2.00	0.79	5.00 ^
38.00	1.37	0.50	0.95	0.48	1.00	2.00	0.79	5.00 ^
39.00	1.41	0.50	0.95	0.47	1.00	2.00	0.78	5.00 ^
40.00	1.45	0.50	0.94	0.47	1.00	2.00	0.78	5.00 ^
41.00	1.49	0.50	0.93	0.47	1.00	0.47	0.77	0.61 *
42.00	1.53	0.50	0.93	0.46	1.00	0.46	0.77	0.61 *
43.00	1.57	0.50	0.92	0.46	1.00	0.46	0.76	0.61 *
44.00	1.61	0.29	0.92	0.27	1.00	0.27	0.75	0.36 *
45.00	1.65	0.23	0.91	0.21	1.00	0.21	0.75	0.28 *
46.00	1.69	0.39	0.91	0.36	1.00	2.00	0.74	5.00 ^
47.00	1.73	0.50	0.90	0.45	1.00	2.00	0.74	5.00 ^
48.00	1.76	0.50	0.90	0.45	1.00	2.00	0.73	5.00 ^
49.00	1.80	0.50	0.89	0.45	1.00	2.00	0.72	5.00 ^
50.00	1.84	0.50	0.89	0.44	1.00	2.00	0.72	5.00 ^
51.00	1.88	0.50	0.89	0.44	1.00	0.44	0.71	0.62 *
52.00	1.90	0.50	0.88	0.44	1.00	0.44	0.70	0.63 *
53.00	1.92	0.50	0.88	0.44	1.00	0.44	0.70	0.63 *
54.00	1.94	0.50	0.88	0.44	1.00	0.44	0.69	0.64 *
55.00	1.96	0.50	0.88	0.44	1.00	0.44	0.68	0.64 *
56.00	1.98	0.50	0.87	0.44	1.00	0.44	0.68	0.65 *

* F.S.<1: Liquefaction Potential Zone. (If above water table: F.S.=5)
^ No-liquefiable Soils or above Water Table.
(F.S. is limited to 5, CRR is limited to 2, CSR is limited to 2)

CPT convert to SPT for Settlement Analysis:
Fines Correction for Settlement Analysis:

Depth ft	Ic	qc/N60	qc1 atm	(N1)60	Fines %	d(N1)60	(N1)60s
4.00	-	-	-	91.06	73.00	0.00	91.06
5.00	-	-	-	71.94	73.00	0.00	71.94
6.00	-	-	-	51.96	73.00	0.00	51.96
7.00	-	-	-	38.28	73.00	0.00	38.28
8.00	-	-	-	32.77	73.00	0.00	32.77
9.00	-	-	-	30.93	73.00	0.00	30.93
10.00	-	-	-	25.96	73.00	0.00	25.96
11.00	-	-	-	21.46	73.00	0.00	21.46
12.00	-	-	-	19.38	75.80	0.00	19.38
13.00	-	-	-	19.45	81.40	0.00	19.45
14.00	-	-	-	19.53	87.00	0.00	19.53
15.00	-	-	-	21.36	NoLiq	0.00	21.36
16.00	-	-	-	21.50	NoLiq	0.00	21.50
17.00	-	-	-	21.64	NoLiq	0.00	21.64

Details 5 feet eng fill

18.00	-	-	-	21.78	NoLiq	0.00	21.78
19.00	-	-	-	21.90	NoLiq	0.00	21.90
20.00	-	-	-	22.02	NoLiq	0.00	22.02
21.00	-	-	-	22.13	NoLiq	0.00	22.13
22.00	-	-	-	22.75	95.90	0.00	22.75
23.00	-	-	-	23.87	85.70	0.00	23.87
24.00	-	-	-	24.96	75.50	0.00	24.96
25.00	-	-	-	26.02	65.30	0.00	26.02
26.00	-	-	-	27.06	55.10	0.00	27.06
27.00	-	-	-	27.25	55.10	0.00	27.25
28.00	-	-	-	27.77	NoLiq	0.00	27.77
29.00	-	-	-	27.14	NoLiq	0.00	27.14
30.00	-	-	-	26.53	NoLiq	0.00	26.53
31.00	-	-	-	25.93	NoLiq	0.00	25.93
32.00	-	-	-	24.99	NoLiq	0.00	24.99
33.00	-	-	-	23.70	NoLiq	0.00	23.70
34.00	-	-	-	22.46	NoLiq	0.00	22.46
35.00	-	-	-	21.25	NoLiq	0.00	21.25
36.00	-	-	-	26.33	NoLiq	0.00	26.33
37.00	-	-	-	31.26	NoLiq	0.00	31.26
38.00	-	-	-	36.04	NoLiq	0.00	36.04
39.00	-	-	-	40.70	NoLiq	0.00	40.70
40.00	-	-	-	45.23	NoLiq	0.00	45.23
41.00	-	-	-	40.13	77.72	0.00	40.13
42.00	-	-	-	35.16	83.54	0.00	35.16
43.00	-	-	-	30.33	89.36	0.00	30.33
44.00	-	-	-	25.62	95.18	0.00	25.62
45.00	-	-	-	21.03	NoLiq	0.00	21.03
46.00	-	-	-	29.40	NoLiq	0.00	29.40
47.00	-	-	-	37.59	NoLiq	0.00	37.59
48.00	-	-	-	45.60	NoLiq	0.00	45.60
49.00	-	-	-	53.42	NoLiq	0.00	53.42
50.00	-	-	-	61.09	NoLiq	0.00	61.09
51.00	-	-	-	47.27	13.38	0.00	47.27
52.00	-	-	-	44.39	13.86	0.00	44.39
53.00	-	-	-	41.52	14.34	0.00	41.52
54.00	-	-	-	38.68	14.82	0.00	38.68
55.00	-	-	-	35.84	15.30	0.00	35.84
56.00	-	-	-	35.67	15.30	0.00	35.67

(N1)60s has been fines corrected in liquefaction analysis, therefore d(N1)60=0.

Fines=NoLiq means the soils are not liquefiable.

Settlement of Saturated Sands:

Settlement Analysis Method: Ishihara / Yoshimine

Depth	CSRsf	/ MSF*	=CSRm	F.S.	Fines	(N1)60s	Dr	ec	dsz

Details 5 feet eng fill

dsp	S									
	ft					%		%	%	in.
in.	in.									
	56.45	0.67	1.00	0.67	5.00	NoLiq	42.73	100.00	0.000	
0.0E0	0.000	0.000								
	56.00	0.68	1.00	0.68	0.65	15.30	35.67	100.00	0.000	
0.0E0	0.000	0.000								
	55.00	0.68	1.00	0.68	0.64	15.30	35.84	100.00	0.000	
0.0E0	0.000	0.000								
	54.00	0.69	1.00	0.69	0.64	14.82	38.68	100.00	0.000	
0.0E0	0.000	0.000								
	53.00	0.70	1.00	0.70	0.63	14.34	41.52	100.00	0.000	
0.0E0	0.000	0.000								
	52.00	0.70	1.00	0.70	0.63	13.86	44.39	100.00	0.000	
0.0E0	0.000	0.000								
	51.00	0.71	1.00	0.71	0.62	13.38	47.27	100.00	0.000	
0.0E0	0.000	0.000								
	50.00	0.72	1.00	0.72	5.00	NoLiq	61.09	100.00	0.000	
0.0E0	0.000	0.000								
	49.00	0.72	1.00	0.72	5.00	NoLiq	53.42	100.00	0.000	
0.0E0	0.000	0.000								
	48.00	0.73	1.00	0.73	5.00	NoLiq	45.60	100.00	0.000	
0.0E0	0.000	0.000								
	47.00	0.74	1.00	0.74	5.00	NoLiq	37.59	100.00	0.000	
0.0E0	0.000	0.000								
	46.00	0.74	1.00	0.74	5.00	NoLiq	29.40	88.73	0.000	
0.0E0	0.000	0.000								
	45.00	0.75	1.00	0.75	0.28	NoLiq	21.03	72.39	2.088	
0.0E0	0.000	0.000								
	44.00	0.75	1.00	0.75	0.36	95.18	25.62	80.91	1.707	
1.0E-2	0.190	0.190								
	43.00	0.76	1.00	0.76	0.61	89.36	30.33	90.80	1.011	
6.1E-3	0.175	0.365								
	42.00	0.77	1.00	0.77	0.61	83.54	35.16	100.00	0.000	
0.0E0	0.045	0.411								
	41.00	0.77	1.00	0.77	0.61	77.72	40.13	100.00	0.000	
0.0E0	0.000	0.411								
	40.00	0.78	1.00	0.78	5.00	NoLiq	45.23	100.00	0.000	
0.0E0	0.000	0.411								
	39.00	0.78	1.00	0.78	5.00	NoLiq	40.70	100.00	0.000	
0.0E0	0.000	0.411								
	38.00	0.79	1.00	0.79	5.00	NoLiq	36.04	100.00	0.000	
0.0E0	0.000	0.411								
	37.00	0.79	1.00	0.79	5.00	NoLiq	31.26	92.97	0.000	
0.0E0	0.000	0.411								

Details 5 feet eng fill

	36.00	0.80	1.00	0.80	5.00	NoLiq	26.33	82.31	0.000
0.0E0	0.000	0.411							
	35.00	0.80	1.00	0.80	5.00	NoLiq	21.25	72.79	0.000
0.0E0	0.000	0.411							
	34.00	0.81	1.00	0.81	5.00	NoLiq	22.46	74.98	0.000
0.0E0	0.000	0.411							
	33.00	0.81	1.00	0.81	5.00	NoLiq	23.70	77.28	0.000
0.0E0	0.000	0.411							
	32.00	0.81	1.00	0.81	5.00	NoLiq	24.99	79.70	0.000
0.0E0	0.000	0.411							
	31.00	0.82	1.00	0.82	5.00	NoLiq	25.93	81.53	0.000
0.0E0	0.000	0.411							
	30.00	0.82	1.00	0.82	5.00	NoLiq	26.53	82.70	0.000
0.0E0	0.000	0.411							
	29.00	0.81	1.00	0.81	5.00	NoLiq	27.14	83.93	0.000
0.0E0	0.000	0.411							
	28.00	0.81	1.00	0.81	5.00	NoLiq	27.77	85.23	0.000
0.0E0	0.000	0.411							
	27.00	0.80	1.00	0.80	0.40	55.10	27.25	84.17	1.569
9.4E-3	0.104	0.515							
	26.00	0.80	1.00	0.80	0.40	55.10	27.06	83.78	1.586
9.5E-3	0.187	0.702							
	25.00	0.79	1.00	0.79	0.38	65.30	26.02	81.70	1.674
1.0E-2	0.196	0.898							
	24.00	0.78	1.00	0.78	0.36	75.50	24.96	79.64	1.762
1.1E-2	0.206	1.104							
	23.00	0.78	1.00	0.78	0.34	85.70	23.87	77.59	1.855
1.1E-2	0.217	1.322							
	22.00	0.77	1.00	0.77	0.32	95.90	22.75	75.51	1.948
1.2E-2	0.228	1.550							
	21.00	0.76	1.00	0.76	5.00	NoLiq	22.13	74.38	0.000
0.0E0	0.095	1.645							
	20.00	0.75	1.00	0.75	5.00	NoLiq	22.02	74.18	0.000
0.0E0	0.000	1.645							
	19.00	0.74	1.00	0.74	5.00	NoLiq	21.90	73.97	0.000
0.0E0	0.000	1.645							
	18.00	0.73	1.00	0.73	5.00	NoLiq	21.78	73.74	0.000
0.0E0	0.000	1.645							
	17.00	0.72	1.00	0.72	5.00	NoLiq	21.64	73.49	0.000
0.0E0	0.000	1.645							
	16.00	0.70	1.00	0.70	5.00	NoLiq	21.50	73.23	0.000
0.0E0	0.000	1.645							
	15.00	0.69	1.00	0.69	5.00	NoLiq	21.36	72.99	0.000
0.0E0	0.000	1.645							
	14.00	0.67	1.00	0.67	0.32	87.00	19.53	69.70	2.214
1.3E-2	0.262	1.906							
	13.00	0.65	1.00	0.65	0.32	81.40	19.45	69.54	2.224
1.3E-2	0.266	2.173							

				Details	5 feet eng fill				
	12.00	0.63	1.00	0.63	0.33	75.80	19.38	69.42	2.231
1.3E-2	0.267	2.440							
	11.00	0.61	1.00	0.61	0.38	73.00	21.46	73.17	2.053
1.2E-2	0.262	2.702							
	10.00	0.58	1.00	0.58	0.51	73.00	25.96	81.58	1.662
1.0E-2	0.223	2.925							
	9.00	0.55	1.00	0.55	0.90	73.00	30.93	92.20	0.494
3.0E-3	0.138	3.063							
	8.00	0.52	1.00	0.52	0.95	73.00	32.77	96.68	0.178
1.1E-3	0.023	3.086							
	7.70	0.51	1.00	0.51	0.97	73.00	34.35	100.00	0.000
0.0E0	0.002	3.089							

Settlement of Saturated Sands=3.089 in.
qc1 and (N1)60 is after fines correction in liquefaction analysis
dsz is per each segment, dz=0.05 ft
dsp is per each print interval, dp=1.00 ft
S is cumulated settlement at this depth

Settlement of Unsaturated Sands:

	Depth	sigma'	sigC'	(N1)60s	CSRsf	Gmax	g*Ge/Gm	g_eff	ec7.5	Cec
ec	dsz	dsp	S							
	ft	atm	atm			atm			%	
%	in.	in.	in.							
	7.65	0.44	0.29	34.62	0.51	778.78	2.9E-4	0.2461	0.1096	1.06
0.1157	1.39E-3	0.001	0.001							
	7.00	0.41	0.27	38.28	0.52	775.36	2.7E-4	0.1278	0.0454	1.06
0.0480	5.76E-4	0.011	0.013							
	6.00	0.36	0.23	51.96	0.52	804.69	2.3E-4	0.0531	0.0168	1.06
0.0177	2.13E-4	0.007	0.020							
	5.00	0.30	0.20	71.94	0.52	826.60	1.9E-4	0.0371	0.0117	1.06
0.0124	1.49E-4	0.003	0.023							
	4.00	0.25	0.16	91.06	0.52	802.89	1.6E-4	0.0286	0.0090	1.06
0.0095	1.15E-4	0.003	0.026							

Settlement of Unsaturated Sands=0.026 in.
dsz is per each segment, dz=0.05 ft
dsp is per each print interval, dp=1.00 ft
S is cumulated settlement at this depth

Total Settlement of Saturated and Unsaturated Sands=3.114 in.

Details 5 feet eng fill

Differential Settlement=1.557 to 2.055 in.

Units: Unit: qc, fs, Stress or Pressure = atm (1.0581tsf); Unit Weight = pcf; Depth = ft; Settlement = in.

---

1 atm (atmosphere) = 1.0581 tsf(1 tsf = 1 ton/ft2 = 2 kip/ft2)
1 atm (atmosphere) = 101.325 kPa(1 kPa = 1 kN/m2 = 0.001 Mpa)

SPT	Field data from Standard Penetration Test (SPT)
BPT	Field data from Becker Penetration Test (BPT)
qc	Field data from Cone Penetration Test (CPT) [atm (tsf)]
fs	Friction from CPT testing [atm (tsf)]
Rf	Ratio of fs/qc (%)
gamma	Total unit weight of soil
gamma'	Effective unit weight of soil
Fines	Fines content [%]
D50	Mean grain size
Dr	Relative Density
sigma	Total vertical stress [atm]
sigma'	Effective vertical stress [atm]
sigC'	Effective confining pressure [atm]
rd	Acceleration reduction coefficient by Seed
a_max.	Peak Ground Acceleration (PGA) in ground surface
mZ	Linear acceleration reduction coefficient X depth
a_min.	Minimum acceleration under linear reduction, mZ
CRRv	CRR after overburden stress correction, CRRv=CRR7.5 * Ksig
CRR7.5	Cyclic resistance ratio (M=7.5)
Ksig	Overburden stress correction factor for CRR7.5
CRRm	After magnitude scaling correction CRRm=CRRv * MSF
MSF	Magnitude scaling factor from M=7.5 to user input M
CSR	Cyclic stress ratio induced by earthquake
CSRfs	CSRfs=CSR*fs1 (Default fs1=1)
fs1	First CSR curve in graphic defined in #9 of Advanced page
fs2	2nd CSR curve in graphic defined in #9 of Advanced page
F.S.	Calculated factor of safety against liquefaction

F.S.=CRRm/CSRsf

Cebs	Energy Ratio, Borehole Dia., and Sampling Method Corrections
Cr	Rod Length Corrections
Cn	Overburden Pressure Correction
(N1)60	SPT after corrections, (N1)60=SPT * Cr * Cn * Cebs
d(N1)60	Fines correction of SPT
(N1)60f	(N1)60 after fines corrections, (N1)60f=(N1)60 + d(N1)60
Cq	Overburden stress correction factor
qc1	CPT after Overburden stress correction
dqc1	Fines correction of CPT
qc1f	CPT after Fines and Overburden correction, qc1f=qc1 + dqc1
qc1n	CPT after normalization in Robertson's method

Details 5 feet eng fill

Kc	Fine correction factor in Robertson's Method
qc1f	CPT after Fines correction in Robertson's Method
Ic	Soil type index in Suzuki's and Robertson's Methods
(N1)60s	(N1)60 after settlement fines corrections
CSRm	After magnitude scaling correction for Settlement calculation CSRm=CSRsf / MSF*
CSRfs	Cyclic stress ratio induced by earthquake with user inputed fs
MSF*	Scaling factor from CSR, MSF*=1, based on Item 2 of Page C.
ec	Volumetric strain for saturated sands
dz	Calculation segment, dz=0.050 ft
dsz	Settlement in each segment, dz
dp	User defined print interval
dsp	Settlement in each print interval, dp
Gmax	Shear Modulus at low strain
g_eff	gamma_eff, Effective shear Strain
g*Ge/Gm	gamma_eff * G_eff/G_max, Strain-modulus ratio
ec7.5	Volumetric Strain for magnitude=7.5
Cec	Magnitude correction factor for any magnitude
ec	Volumetric strain for unsaturated sands, ec=Cec * ec7.5
NoLiq	No-Liquefy Soils

References:

1. NCEER Workshop on Evaluation of Liquefaction Resistance of Soils. Youd, T.L., and Idriss, I.M., eds., Technical Report NCEER 97-0022.

SP117. Southern California Earthquake Center. Recommended Procedures for Implementation of DMG Special Publication 117, Guidelines for Analyzing and Mitigating Liquefaction in California. University of Southern California. March 1999.

2. RECENT ADVANCES IN SOIL LIQUEFACTION ENGINEERING AND SEISMIC SITE RESPONSE EVALUATION, Paper No. SPL-2, PROCEEDINGS: Fourth International Conference on Recent Advances in Geotechnical Earthquake Engineering and Soil Dynamics, San Diego, CA, March 2001.

3. RECENT ADVANCES IN SOIL LIQUEFACTION ENGINEERING: A UNIFIED AND CONSISTENT FRAMEWORK, Earthquake Engineering Research Center, Report No. EERC 2003-06 by R.B Seed and etc. April 2003.

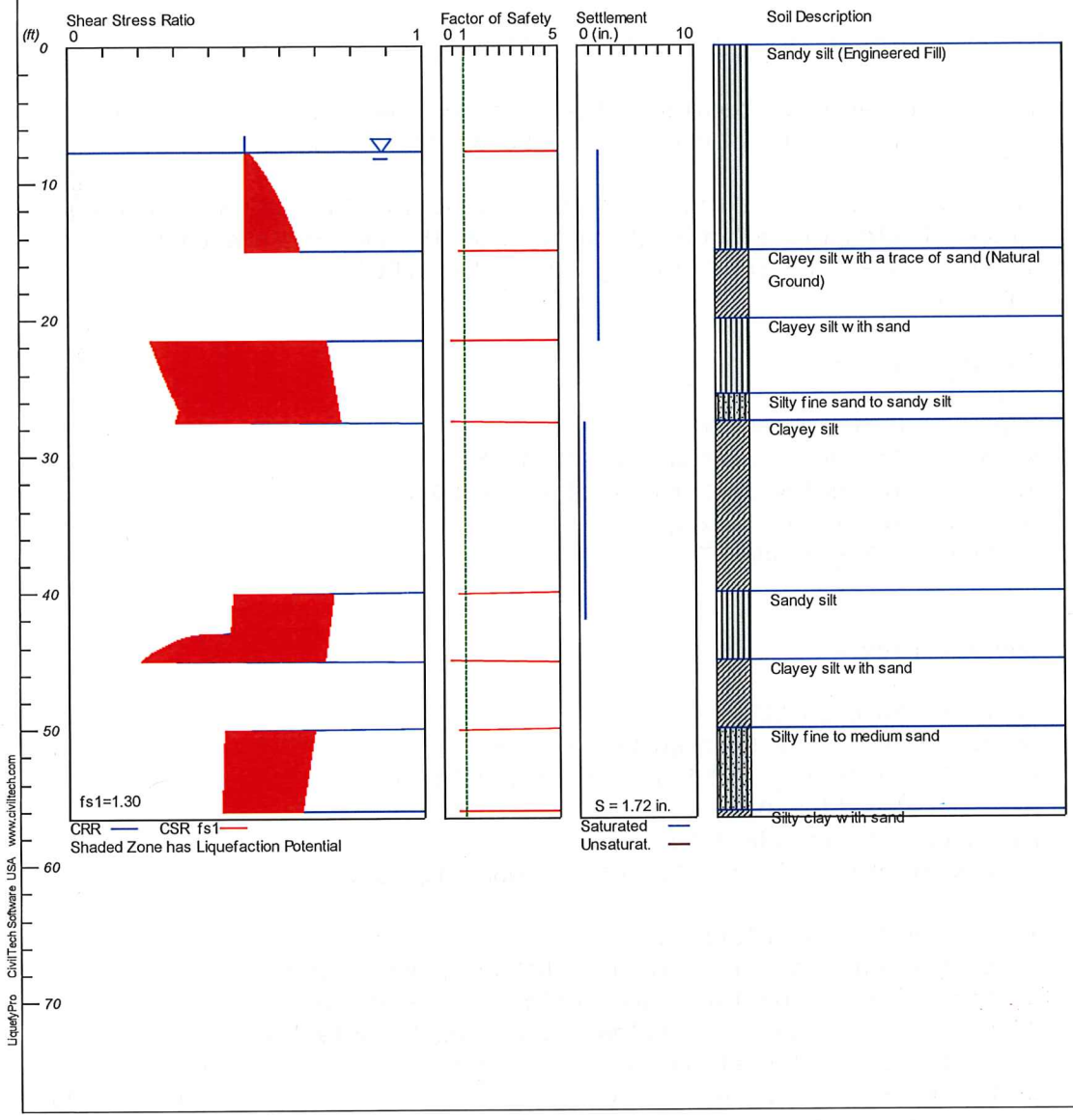
Note: Print Interval you selected does not show complete results. To get complete results, you should select 'Segment' in Print Interval (Item 12, Page C).

LIQUEFACTION ANALYSIS

CAMPUS POLICE STATION, 15 FEET OF ENGINEERED FILL

Hole No.=B-1 Water Depth=7.7 ft

Magnitude=7.5
Acceleration=0.62g



GeoTek, Inc.

Summary 15 feet eng fill

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LIQUEFACTION ANALYSIS SUMMARY

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Input File Name: G:\Projects\1501 to 1550\1529CR Compton Community College Campus Police Station\Liquefaction\Liquefaction 15 Feet Engineered Fill.liq
Title: CAMPUS POLICE STATION, COMPTON COLLEGE
Subtitle:

Surface Elev.=
Hole No.=B-1
Depth of Hole= 56.50 ft
Water Table during Earthquake= 7.70 ft
Water Table during In-Situ Testing= 50.50 ft
Max. Acceleration= 0.62 g
Earthquake Magnitude= 7.50

Input Data:
Surface Elev.=
Hole No.=B-1
Depth of Hole=56.50 ft
Water Table during Earthquake= 7.70 ft
Water Table during In-Situ Testing= 50.50 ft
Max. Acceleration=0.62 g
Earthquake Magnitude=7.50
No-Liquefiable Soils: CL, OL are Non-Liq. Soil

1. SPT or BPT Calculation.
2. Settlement Analysis Method: Ishihara / Yoshimine
3. Fines Correction for Liquefaction: Idriss/Seed
4. Fine Correction for Settlement: During Liquefaction*
5. Settlement Calculation in: All zones*
6. Hammer Energy Ratio, Ce = 1.25
7. Borehole Diameter, Cb= 1
8. Sampling Method, Cs= 1
9. User request factor of safety (apply to CSR) , User= 1.3
   Plot one CSR curve (fs1=User)
10. Use Curve Smoothing: Yes*

* Recommended Options

Summary 15 feet eng fill

In-Situ Test Data:

Depth ft	SPT	gamma pcf	Fines %
6.50	45.00	130.00	73.00
11.50	45.00	130.00	73.00
15.00	45.00	130.00	NoLiq
16.00	12.00	104.00	NoLiq
21.50	13.00	123.00	NoLiq
26.50	19.00	110.00	50.00
31.50	18.00	120.00	NoLiq
35.00	15.00	130.00	NoLiq
40.00	40.00	130.00	71.90
45.00	17.00	130.00	NoLiq
50.00	63.00	130.00	12.90
55.00	44.00	130.00	15.30

Output Results:

Settlement of Saturated Sands=1.72 in.
Settlement of Unsaturated Sands=0.00 in.
Total Settlement of Saturated and Unsaturated Sands=1.72 in.
Differential Settlement=0.861 to 1.137 in.

Depth ft	CRRm	CSRfs	F.S.	S_sat. in.	S_dry in.	S_all in.
6.50	0.50	0.52	5.00	1.72	0.00	1.72
7.50	0.50	0.51	5.00	1.72	0.00	1.72
8.50	0.50	0.54	0.93*	1.72	0.00	1.72
9.50	0.50	0.56	0.89*	1.72	0.00	1.72
10.50	0.50	0.59	0.85*	1.72	0.00	1.72
11.50	0.50	0.61	0.82*	1.72	0.00	1.72
12.50	0.50	0.62	0.80*	1.72	0.00	1.72
13.50	0.50	0.64	0.78*	1.72	0.00	1.72
14.50	0.50	0.65	0.77*	1.72	0.00	1.72
15.50	2.00	0.67	5.00	1.72	0.00	1.72
16.50	2.00	0.68	5.00	1.72	0.00	1.72
17.50	2.00	0.69	5.00	1.72	0.00	1.72
18.50	2.00	0.70	5.00	1.72	0.00	1.72
19.50	2.00	0.71	5.00	1.72	0.00	1.72
20.50	2.00	0.72	5.00	1.72	0.00	1.72
21.50	2.00	0.73	5.00	1.72	0.00	1.72
22.50	0.25	0.74	0.33*	1.50	0.00	1.50
23.50	0.26	0.75	0.35*	1.27	0.00	1.27
24.50	0.28	0.75	0.37*	1.05	0.00	1.05
25.50	0.30	0.76	0.39*	0.84	0.00	0.84

Summary 15 feet eng fill

26.50	0.32	0.77	0.41*	0.64	0.00	0.64
27.50	0.30	0.77	0.39*	0.45	0.00	0.45
28.50	2.00	0.78	5.00	0.44	0.00	0.44
29.50	2.00	0.78	5.00	0.44	0.00	0.44
30.50	2.00	0.78	5.00	0.44	0.00	0.44
31.50	2.00	0.78	5.00	0.44	0.00	0.44
32.50	2.00	0.78	5.00	0.44	0.00	0.44
33.50	2.00	0.78	5.00	0.44	0.00	0.44
34.50	2.00	0.77	5.00	0.44	0.00	0.44
35.50	2.00	0.77	5.00	0.44	0.00	0.44
36.50	2.00	0.77	5.00	0.44	0.00	0.44
37.50	2.00	0.76	5.00	0.44	0.00	0.44
38.50	2.00	0.76	5.00	0.44	0.00	0.44
39.50	2.00	0.75	5.00	0.44	0.00	0.44
40.50	0.46	0.75	0.62*	0.44	0.00	0.44
41.50	0.46	0.74	0.62*	0.44	0.00	0.44
42.50	0.46	0.74	0.62*	0.43	0.00	0.43
43.50	0.30	0.73	0.41*	0.29	0.00	0.29
44.50	0.23	0.73	0.31*	0.08	0.00	0.08
45.50	2.00	0.72	5.00	0.00	0.00	0.00
46.50	2.00	0.72	5.00	0.00	0.00	0.00
47.50	2.00	0.71	5.00	0.00	0.00	0.00
48.50	2.00	0.71	5.00	0.00	0.00	0.00
49.50	2.00	0.70	5.00	0.00	0.00	0.00
50.50	0.44	0.69	0.63*	0.00	0.00	0.00
51.50	0.44	0.69	0.64*	0.00	0.00	0.00
52.50	0.44	0.68	0.64*	0.00	0.00	0.00
53.50	0.44	0.68	0.65*	0.00	0.00	0.00
54.50	0.43	0.67	0.65*	0.00	0.00	0.00
55.50	0.43	0.66	0.65*	0.00	0.00	0.00
56.50	2.00	0.66	5.00	0.00	0.00	0.00

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* F.S.<1, Liquefaction Potential Zone
(F.S. is limited to 5, CRR is limited to 2, CSR is limited to 2)

Units: Unit: qc, fs, Stress or Pressure = atm (1.0581tsf); Unit Weight = pcf; Depth = ft; Settlement = in.

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1 atm (atmosphere) = 1 tsf (ton/ft2)
CRRm Cyclic resistance ratio from soils
CSRsf Cyclic stress ratio induced by a given earthquake (with user request factor of safety)
F.S. Factor of Safety against liquefaction, F.S.=CRRm/CSRsf
S_sat Settlement from saturated sands
S_dry Settlement from Unsaturated Sands
S_all Total Settlement from Saturated and Unsaturated Sands
NoLiq No-Liquefy Soils

Summary 15 feet eng fill

Details 15 feet eng fill

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LIQUEFACTION ANALYSIS CALCULATION DETAILS

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Input File Name: G:\Projects\1501 to 1550\1529CR Compton Community College Campus Police Station\Liquefaction\Liquefaction 15 Feet Engineered Fill.liq
Title: CAMPUS POLICE STATION, COMPTON COLLEGE
Subtitle:

Input Data:
Surface Elev.=
Hole No.=B-1
Depth of Hole=56.50 ft
Water Table during Earthquake= 7.70 ft
Water Table during In-Situ Testing= 50.50 ft
Max. Acceleration=0.62 g
Earthquake Magnitude=7.50
No-Liquefiable Soils: CL, OL are Non-Liq. Soil
1. SPT or BPT Calculation.
2. Settlement Analysis Method: Ishihara / Yoshimine
3. Fines Correction for Liquefaction: Idriss/Seed
4. Fine Correction for Settlement: During Liquefaction*
5. Settlement Calculation in: All zones*
6. Hammer Energy Ratio, Ce = 1.25
7. Borehole Diameter, Cb= 1
8. Sampling Method, Cs= 1
9. User request factor of safety (apply to CSR) , User= 1.3
   Plot one CSR curve (fs1=User)
10. Average two input data between two Depths: Yes*
* Recommended Options

In-Situ Test Data:

Depth ft	SPT	Gamma pcf	Fines %
6.50	45.00	130.00	73.00
11.50	45.00	130.00	73.00
15.00	45.00	130.00	NoLiq
16.00	12.00	104.00	NoLiq

Details 15 feet eng fill

21.50	13.00	123.00	NoLiq
26.50	19.00	110.00	50.00
31.50	18.00	120.00	NoLiq
35.00	15.00	130.00	NoLiq
40.00	40.00	130.00	71.90
45.00	17.00	130.00	NoLiq
50.00	63.00	130.00	12.90
55.00	44.00	130.00	15.30

Output Results:
Calculation segment, dz=0.050 ft
User defined Print Interval, dp=1.00 ft

Peak Ground Acceleration (PGA), a_max = 0.62g

CSR Calculation:

Depth	gamma	sigma	gamma'	sigma'	rd	mZ	a(z)	CSR	x fs1 =CSRfs
ft	pcf	atm	pcf	atm		g	g		
6.50	130.00	0.399	130.00	0.399	0.98	0.000	0.620	0.40	1.30 0.52
7.50	130.00	0.461	130.00	0.461	0.98	0.000	0.620	0.40	1.30 0.51
8.50	130.00	0.522	67.60	0.499	0.98	0.000	0.620	0.41	1.30 0.54
9.50	130.00	0.584	67.60	0.531	0.98	0.000	0.620	0.43	1.30 0.56
10.50	130.00	0.645	67.60	0.562	0.98	0.000	0.620	0.45	1.30 0.59
11.50	130.00	0.706	67.60	0.594	0.97	0.000	0.620	0.47	1.30 0.61
12.50	130.00	0.768	67.60	0.626	0.97	0.000	0.620	0.48	1.30 0.62
13.50	130.00	0.829	67.60	0.658	0.97	0.000	0.620	0.49	1.30 0.64
14.50	130.00	0.891	67.60	0.690	0.97	0.000	0.620	0.50	1.30 0.65
15.50	117.00	0.951	54.60	0.721	0.96	0.000	0.620	0.51	1.30 0.67
16.50	105.73	1.002	43.33	0.742	0.96	0.000	0.620	0.52	1.30 0.68
17.50	109.18	1.053	46.78	0.764	0.96	0.000	0.620	0.53	1.30 0.69

Details 15 feet eng fill

18.50	112.64	1.105	50.24	0.786	0.96	0.000	0.620	0.54	1.30	0.70
19.50	116.09	1.159	53.69	0.811	0.95	0.000	0.620	0.55	1.30	0.71
20.50	119.55	1.215	57.15	0.837	0.95	0.000	0.620	0.56	1.30	0.72
21.50	123.00	1.272	60.60	0.865	0.95	0.000	0.620	0.56	1.30	0.73
22.50	120.40	1.329	58.00	0.893	0.95	0.000	0.620	0.57	1.30	0.74
23.50	117.80	1.386	55.40	0.920	0.95	0.000	0.620	0.57	1.30	0.75
24.50	115.20	1.441	52.80	0.945	0.94	0.000	0.620	0.58	1.30	0.75
25.50	112.60	1.495	50.20	0.970	0.94	0.000	0.620	0.58	1.30	0.76
26.50	110.00	1.547	47.60	0.993	0.94	0.000	0.620	0.59	1.30	0.77
27.50	112.00	1.600	49.60	1.016	0.94	0.000	0.620	0.59	1.30	0.77
28.50	114.00	1.653	51.60	1.040	0.93	0.000	0.620	0.60	1.30	0.78
29.50	116.00	1.707	53.60	1.065	0.93	0.000	0.620	0.60	1.30	0.78
30.50	118.00	1.763	55.60	1.090	0.93	0.000	0.620	0.60	1.30	0.78
31.50	120.00	1.819	57.60	1.117	0.92	0.000	0.620	0.60	1.30	0.78
32.50	122.86	1.876	60.46	1.145	0.91	0.000	0.620	0.60	1.30	0.78
33.50	125.71	1.935	63.31	1.174	0.90	0.000	0.620	0.60	1.30	0.78
34.50	128.57	1.995	66.17	1.205	0.89	0.000	0.620	0.60	1.30	0.77
35.50	130.00	2.056	67.60	1.236	0.89	0.000	0.620	0.59	1.30	0.77
36.50	130.00	2.118	67.60	1.268	0.88	0.000	0.620	0.59	1.30	0.77
37.50	130.00	2.179	67.60	1.300	0.87	0.000	0.620	0.59	1.30	0.76
38.50	130.00	2.240	67.60	1.332	0.86	0.000	0.620	0.58	1.30	0.76
39.50	130.00	2.302	67.60	1.364	0.85	0.000	0.620	0.58	1.30	0.75
40.50	130.00	2.363	67.60	1.396	0.84	0.000	0.620	0.58	1.30	0.75
41.50	130.00	2.425	67.60	1.428	0.84	0.000	0.620	0.57	1.30	0.74

Details 15 feet eng fill

42.50	130.00	2.486	67.60	1.460	0.83	0.000	0.620	0.57	1.30
0.74									
43.50	130.00	2.548	67.60	1.492	0.82	0.000	0.620	0.56	1.30
0.73									
44.50	130.00	2.609	67.60	1.524	0.81	0.000	0.620	0.56	1.30
0.73									
45.50	130.00	2.670	67.60	1.556	0.80	0.000	0.620	0.56	1.30
0.72									
46.50	130.00	2.732	67.60	1.588	0.80	0.000	0.620	0.55	1.30
0.72									
47.50	130.00	2.793	67.60	1.620	0.79	0.000	0.620	0.55	1.30
0.71									
48.50	130.00	2.855	67.60	1.652	0.78	0.000	0.620	0.54	1.30
0.71									
49.50	130.00	2.916	67.60	1.684	0.77	0.000	0.620	0.54	1.30
0.70									
50.50	130.00	2.978	67.60	1.716	0.76	0.000	0.620	0.53	1.30
0.69									
51.50	130.00	3.039	67.60	1.748	0.75	0.000	0.620	0.53	1.30
0.69									
52.50	130.00	3.100	67.60	1.779	0.75	0.000	0.620	0.52	1.30
0.68									
53.50	130.00	3.162	67.60	1.811	0.74	0.000	0.620	0.52	1.30
0.68									
54.50	130.00	3.223	67.60	1.843	0.73	0.000	0.620	0.51	1.30
0.67									
55.50	130.00	3.285	67.60	1.875	0.72	0.000	0.620	0.51	1.30
0.66									
56.50	130.00	3.346	67.60	1.907	0.71	0.000	0.620	0.50	1.30
0.66									

CSR is based on water table at 7.70 during earthquake

CRR Calculation from SPT or BPT data:

Depth	SPT	Cebs	Cr	sigma'	Cn	(N1)60	Fines	d(N1)60	(N1)60f	CRR7.5
ft				atm			%			

6.50	45.00	1.25	0.75	0.399	1.58	66.76	73.00	18.35	85.12	0.50
7.50	45.00	1.25	0.75	0.461	1.47	62.15	73.00	17.43	79.58	0.50
8.50	45.00	1.25	0.85	0.522	1.38	66.17	73.00	18.23	84.40	0.50

Details 15 feet eng fill

	9.50	45.00	1.25	0.85	0.584	1.31	62.59	73.00	17.52
80.10	0.50								
	10.50	45.00	1.25	0.85	0.645	1.25	59.53	73.00	16.91
76.44	0.50								
	11.50	45.00	1.25	0.85	0.706	1.19	56.89	73.00	16.38
73.26	0.50								
	12.50	45.00	1.25	0.85	0.768	1.14	54.56	81.00	15.91
70.47	0.50								
	13.50	45.00	1.25	0.85	0.829	1.10	52.50	89.00	15.50
68.00	0.50								
	14.50	45.00	1.25	0.85	0.891	1.06	50.66	97.00	15.13
65.79	0.50								
	15.50	28.50	1.25	0.95	0.951	1.03	34.71	NoLiq	11.94
46.65	0.50								
	16.50	12.09	1.25	0.95	1.002	1.00	14.34	NoLiq	7.87
22.21	0.24								
	17.50	12.27	1.25	0.95	1.053	0.97	14.21	NoLiq	7.84
22.05	0.24								
	18.50	12.45	1.25	0.95	1.105	0.95	14.07	NoLiq	7.81
21.88	0.24								
	19.50	12.64	1.25	0.95	1.159	0.93	13.94	NoLiq	7.79
21.73	0.24								
	20.50	12.82	1.25	0.95	1.215	0.91	13.81	NoLiq	7.76
21.57	0.23								
	21.50	13.00	1.25	0.95	1.272	0.89	13.69	NoLiq	7.74
21.43	0.23								
	22.50	14.20	1.25	0.95	1.329	0.87	14.63	90.80	7.93
22.55	0.25								
	23.50	15.40	1.25	0.95	1.386	0.85	15.54	80.60	8.11
23.64	0.26								
	24.50	16.60	1.25	0.95	1.441	0.83	16.42	70.40	8.28
24.71	0.28								
	25.50	17.80	1.25	0.95	1.495	0.82	17.29	60.20	8.46
25.75	0.30								
	26.50	19.00	1.25	0.95	1.547	0.80	18.14	50.00	8.63
26.77	0.31								
	27.50	18.80	1.25	0.95	1.600	0.79	17.65	60.20	8.53
26.18	0.30								
	28.50	18.60	1.25	1.00	1.653	0.78	18.08	NoLiq	8.62
26.70	0.31								
	29.50	18.40	1.25	1.00	1.707	0.77	17.60	NoLiq	8.52
26.12	0.30								
	30.50	18.20	1.25	1.00	1.763	0.75	17.14	NoLiq	8.43
25.56	0.29								
	31.50	18.00	1.25	1.00	1.819	0.74	16.68	NoLiq	8.34
25.02	0.28								
	32.50	17.14	1.25	1.00	1.876	0.73	15.64	NoLiq	8.13
23.77	0.26								

Details 15 feet eng fill

	33.50	16.29	1.25	1.00	1.935	0.72	14.64	NoLiq	7.93
22.56	0.25								
	34.50	15.43	1.25	1.00	1.995	0.71	13.65	NoLiq	7.73
21.39	0.23								
	35.50	17.50	1.25	1.00	2.056	0.70	15.25	NoLiq	8.05
23.30	0.26								
	36.50	22.50	1.25	1.00	2.118	0.69	19.33	NoLiq	8.87
28.19	0.35								
	37.50	27.50	1.25	1.00	2.179	0.68	23.29	NoLiq	9.66
32.94	0.50								
	38.50	32.50	1.25	1.00	2.240	0.67	27.14	NoLiq	10.43
37.57	0.50								
	39.50	37.50	1.25	1.00	2.302	0.66	30.89	NoLiq	11.18
42.07	0.50								
	40.50	37.70	1.25	1.00	2.363	0.65	30.66	74.81	11.13
41.79	0.50								
	41.50	33.10	1.25	1.00	2.425	0.64	26.57	80.63	10.31
36.89	0.50								
	42.50	28.50	1.25	1.00	2.486	0.63	22.60	86.45	9.52
32.11	0.50								
	43.50	23.90	1.25	1.00	2.548	0.63	18.72	92.27	8.74
27.46	0.33								
	44.50	19.30	1.25	1.00	2.609	0.62	14.94	98.09	7.99
22.92	0.25								
	45.50	21.60	1.25	1.00	2.670	0.61	16.52	NoLiq	8.30
24.82	0.28								
	46.50	30.80	1.25	1.00	2.732	0.61	23.29	NoLiq	9.66
32.95	0.50								
	47.50	40.00	1.25	1.00	2.793	0.60	29.91	NoLiq	10.98
40.90	0.50								
	48.50	49.20	1.25	1.00	2.855	0.59	36.40	NoLiq	12.28
48.68	0.50								
	49.50	58.40	1.25	1.00	2.916	0.59	42.74	NoLiq	13.55
56.29	0.50								
	50.50	61.10	1.25	1.00	2.978	0.58	44.26	13.14	3.60
47.86	0.50								
	51.50	57.30	1.25	1.00	3.011	0.58	41.28	13.62	3.75
45.03	0.50								
	52.50	53.50	1.25	1.00	3.043	0.57	38.34	14.10	3.88
42.22	0.50								
	53.50	49.70	1.25	1.00	3.075	0.57	35.43	14.58	4.00
39.43	0.50								
	54.50	45.90	1.25	1.00	3.107	0.57	32.55	15.06	4.09
36.64	0.50								
	55.50	44.00	1.25	1.00	3.139	0.56	31.04	15.30	4.13
35.17	0.50								
	56.50	44.00	1.25	1.00	3.171	0.56	30.89	NoLiq	11.18
42.06	0.50								

Details 15 feet eng fill

CRR is based on water table at 50.50 during In-Situ Testing

Factor of Safety, - Earthquake Magnitude= 7.50:

Depth ft	sigC' atm	CRR7.5	x Ksig	=CRRv	x MSF	=CRRm	CSRfs	F.S.=CRRm/CSRfs
6.50	0.26	0.50	1.00	0.50	1.00	0.50	0.52	5.00
7.50	0.30	0.50	1.00	0.50	1.00	0.50	0.51	5.00
8.50	0.34	0.50	1.00	0.50	1.00	0.50	0.54	0.93 *
9.50	0.38	0.50	1.00	0.50	1.00	0.50	0.56	0.89 *
10.50	0.42	0.50	1.00	0.50	1.00	0.50	0.59	0.85 *
11.50	0.46	0.50	1.00	0.50	1.00	0.50	0.61	0.82 *
12.50	0.50	0.50	1.00	0.50	1.00	0.50	0.62	0.80 *
13.50	0.54	0.50	1.00	0.50	1.00	0.50	0.64	0.78 *
14.50	0.58	0.50	1.00	0.50	1.00	0.50	0.65	0.77 *
15.50	0.62	0.50	1.00	0.50	1.00	2.00	0.67	5.00 ^
16.50	0.65	0.24	1.00	0.24	1.00	2.00	0.68	5.00 ^
17.50	0.68	0.24	1.00	0.24	1.00	2.00	0.69	5.00 ^
18.50	0.72	0.24	1.00	0.24	1.00	2.00	0.70	5.00 ^
19.50	0.75	0.24	1.00	0.24	1.00	2.00	0.71	5.00 ^
20.50	0.79	0.23	1.00	0.23	1.00	2.00	0.72	5.00 ^
21.50	0.83	0.23	1.00	0.23	1.00	2.00	0.73	5.00 ^
22.50	0.86	0.25	1.00	0.25	1.00	0.25	0.74	0.33 *
23.50	0.90	0.26	1.00	0.26	1.00	0.26	0.75	0.35 *
24.50	0.94	0.28	1.00	0.28	1.00	0.28	0.75	0.37 *
25.50	0.97	0.30	1.00	0.30	1.00	0.30	0.76	0.39 *
26.50	1.01	0.31	1.01	0.32	1.00	0.32	0.77	0.41 *
27.50	1.04	0.30	1.00	0.30	1.00	0.30	0.77	0.39 *
28.50	1.07	0.31	0.99	0.31	1.00	2.00	0.78	5.00 ^
29.50	1.11	0.30	0.99	0.30	1.00	2.00	0.78	5.00 ^
30.50	1.15	0.29	0.98	0.29	1.00	2.00	0.78	5.00 ^
31.50	1.18	0.28	0.98	0.28	1.00	2.00	0.78	5.00 ^
32.50	1.22	0.26	0.97	0.26	1.00	2.00	0.78	5.00 ^
33.50	1.26	0.25	0.97	0.24	1.00	2.00	0.78	5.00 ^
34.50	1.30	0.23	0.96	0.22	1.00	2.00	0.77	5.00 ^
35.50	1.34	0.26	0.96	0.25	1.00	2.00	0.77	5.00 ^
36.50	1.38	0.35	0.95	0.33	1.00	2.00	0.77	5.00 ^
37.50	1.42	0.50	0.94	0.47	1.00	2.00	0.76	5.00 ^
38.50	1.46	0.50	0.94	0.47	1.00	2.00	0.76	5.00 ^
39.50	1.50	0.50	0.93	0.47	1.00	2.00	0.75	5.00 ^
40.50	1.54	0.50	0.93	0.46	1.00	0.46	0.75	0.62 *
41.50	1.58	0.50	0.92	0.46	1.00	0.46	0.74	0.62 *
42.50	1.62	0.50	0.92	0.46	1.00	0.46	0.74	0.62 *
43.50	1.66	0.33	0.91	0.30	1.00	0.30	0.73	0.41 *

Details 15 feet eng fill

44.50	1.70	0.25	0.91	0.23	1.00	0.23	0.73	0.31 *
45.50	1.74	0.28	0.90	0.25	1.00	2.00	0.72	5.00 ^
46.50	1.78	0.50	0.90	0.45	1.00	2.00	0.72	5.00 ^
47.50	1.82	0.50	0.89	0.45	1.00	2.00	0.71	5.00 ^
48.50	1.86	0.50	0.89	0.44	1.00	2.00	0.71	5.00 ^
49.50	1.90	0.50	0.88	0.44	1.00	2.00	0.70	5.00 ^
50.50	1.94	0.50	0.88	0.44	1.00	0.44	0.69	0.63 *
51.50	1.96	0.50	0.88	0.44	1.00	0.44	0.69	0.64 *
52.50	1.98	0.50	0.87	0.44	1.00	0.44	0.68	0.64 *
53.50	2.00	0.50	0.87	0.44	1.00	0.44	0.68	0.65 *
54.50	2.02	0.50	0.87	0.43	1.00	0.43	0.67	0.65 *
55.50	2.04	0.50	0.87	0.43	1.00	0.43	0.66	0.65 *
56.50	2.06	0.50	0.87	0.43	1.00	2.00	0.66	5.00 ^

* F.S.<1: Liquefaction Potential Zone. (If above water table: F.S.=5)
^ No-liquefiable Soils or above Water Table.
(F.S. is limited to 5, CRR is limited to 2, CSR is limited to 2)

CPT convert to SPT for Settlement Analysis:
Fines Correction for Settlement Analysis:

Depth ft	Ic	qc/N60	qc1 atm	(N1)60	Fines %	d(N1)60	(N1)60s
6.50	-	-	-	85.12	73.00	0.00	85.12
7.50	-	-	-	79.58	73.00	0.00	79.58
8.50	-	-	-	84.40	73.00	0.00	84.40
9.50	-	-	-	80.10	73.00	0.00	80.10
10.50	-	-	-	76.44	73.00	0.00	76.44
11.50	-	-	-	73.26	73.00	0.00	73.26
12.50	-	-	-	70.47	81.00	0.00	70.47
13.50	-	-	-	68.00	89.00	0.00	68.00
14.50	-	-	-	65.79	97.00	0.00	65.79
15.50	-	-	-	46.65	NoLiq	0.00	46.65
16.50	-	-	-	22.21	NoLiq	0.00	22.21
17.50	-	-	-	22.05	NoLiq	0.00	22.05
18.50	-	-	-	21.88	NoLiq	0.00	21.88
19.50	-	-	-	21.73	NoLiq	0.00	21.73
20.50	-	-	-	21.57	NoLiq	0.00	21.57
21.50	-	-	-	21.43	NoLiq	0.00	21.43
22.50	-	-	-	22.55	90.80	0.00	22.55
23.50	-	-	-	23.64	80.60	0.00	23.64
24.50	-	-	-	24.71	70.40	0.00	24.71
25.50	-	-	-	25.75	60.20	0.00	25.75
26.50	-	-	-	26.77	50.00	0.00	26.77
27.50	-	-	-	26.18	60.20	0.00	26.18
28.50	-	-	-	26.70	NoLiq	0.00	26.70
29.50	-	-	-	26.12	NoLiq	0.00	26.12

Details 15 feet eng fill

30.50	-	-	-	25.56	NoLiq	0.00	25.56
31.50	-	-	-	25.02	NoLiq	0.00	25.02
32.50	-	-	-	23.77	NoLiq	0.00	23.77
33.50	-	-	-	22.56	NoLiq	0.00	22.56
34.50	-	-	-	21.39	NoLiq	0.00	21.39
35.50	-	-	-	23.30	NoLiq	0.00	23.30
36.50	-	-	-	28.19	NoLiq	0.00	28.19
37.50	-	-	-	32.94	NoLiq	0.00	32.94
38.50	-	-	-	37.57	NoLiq	0.00	37.57
39.50	-	-	-	42.07	NoLiq	0.00	42.07
40.50	-	-	-	41.79	74.81	0.00	41.79
41.50	-	-	-	36.89	80.63	0.00	36.89
42.50	-	-	-	32.11	86.45	0.00	32.11
43.50	-	-	-	27.46	92.27	0.00	27.46
44.50	-	-	-	22.92	98.09	0.00	22.92
45.50	-	-	-	24.82	NoLiq	0.00	24.82
46.50	-	-	-	32.95	NoLiq	0.00	32.95
47.50	-	-	-	40.90	NoLiq	0.00	40.90
48.50	-	-	-	48.68	NoLiq	0.00	48.68
49.50	-	-	-	56.29	NoLiq	0.00	56.29
50.50	-	-	-	47.86	13.14	0.00	47.86
51.50	-	-	-	45.03	13.62	0.00	45.03
52.50	-	-	-	42.22	14.10	0.00	42.22
53.50	-	-	-	39.43	14.58	0.00	39.43
54.50	-	-	-	36.64	15.06	0.00	36.64
55.50	-	-	-	35.17	15.30	0.00	35.17
56.50	-	-	-	42.06	NoLiq	0.00	42.06

(N1)60s has been fines corrected in liquefaction analysis, therefore d(N1)60=0.

Fines=NoLiq means the soils are not liquefiable.

Settlement of Saturated Sands:

Settlement Analysis Method: Ishihara / Yoshimine

Depth ft	CSRsf	/ MSF*	=CSRm	F.S.	Fines %	(N1)60s	Dr %	ec %	dsz in.	dsp in.	S in.
56.45	0.66	1.00	0.66	5.00	NoLiq	42.07	100.00	0.000	0.0E0	0.000	0.000
55.50	0.66	1.00	0.66	0.65	15.30	35.17	100.00	0.000	0.0E0	0.000	0.000
54.50	0.67	1.00	0.67	0.65	15.06	36.64	100.00	0.000	0.0E0	0.000	0.000

Details 15 feet eng fill

	53.50	0.68	1.00	0.68	0.65	14.58	39.43	100.00	0.000
0.0E0	0.000	0.000							
	52.50	0.68	1.00	0.68	0.64	14.10	42.22	100.00	0.000
0.0E0	0.000	0.000							
	51.50	0.69	1.00	0.69	0.64	13.62	45.03	100.00	0.000
0.0E0	0.000	0.000							
	50.50	0.69	1.00	0.69	0.63	13.14	47.86	100.00	0.000
0.0E0	0.000	0.000							
	49.50	0.70	1.00	0.70	5.00	NoLiq	56.29	100.00	0.000
0.0E0	0.000	0.000							
	48.50	0.71	1.00	0.71	5.00	NoLiq	48.68	100.00	0.000
0.0E0	0.000	0.000							
	47.50	0.71	1.00	0.71	5.00	NoLiq	40.90	100.00	0.000
0.0E0	0.000	0.000							
	46.50	0.72	1.00	0.72	5.00	NoLiq	32.95	97.14	0.000
0.0E0	0.000	0.000							
	45.50	0.72	1.00	0.72	5.00	NoLiq	24.82	79.38	0.000
0.0E0	0.000	0.000							
	44.50	0.73	1.00	0.73	0.31	98.09	22.92	75.83	1.933
1.2E-2	0.084	0.084							
	43.50	0.73	1.00	0.73	0.41	92.27	27.46	84.59	1.550
9.3E-3	0.208	0.292							
	42.50	0.74	1.00	0.74	0.62	86.45	32.11	95.04	0.534
3.2E-3	0.134	0.426							
	41.50	0.74	1.00	0.74	0.62	80.63	36.89	100.00	0.000
0.0E0	0.012	0.437							
	40.50	0.75	1.00	0.75	0.62	74.81	41.79	100.00	0.000
0.0E0	0.000	0.437							
	39.50	0.75	1.00	0.75	5.00	NoLiq	42.07	100.00	0.000
0.0E0	0.000	0.437							
	38.50	0.76	1.00	0.76	5.00	NoLiq	37.57	100.00	0.000
0.0E0	0.000	0.437							
	37.50	0.76	1.00	0.76	5.00	NoLiq	32.94	97.12	0.000
0.0E0	0.000	0.437							
	36.50	0.77	1.00	0.77	5.00	NoLiq	28.19	86.11	0.000
0.0E0	0.000	0.437							
	35.50	0.77	1.00	0.77	5.00	NoLiq	23.30	76.53	0.000
0.0E0	0.000	0.437							
	34.50	0.77	1.00	0.77	5.00	NoLiq	21.39	73.03	0.000
0.0E0	0.000	0.437							
	33.50	0.78	1.00	0.78	5.00	NoLiq	22.56	75.17	0.000
0.0E0	0.000	0.437							
	32.50	0.78	1.00	0.78	5.00	NoLiq	23.77	77.40	0.000
0.0E0	0.000	0.437							
	31.50	0.78	1.00	0.78	5.00	NoLiq	25.02	79.76	0.000
0.0E0	0.000	0.437							
	30.50	0.78	1.00	0.78	5.00	NoLiq	25.56	80.80	0.000
0.0E0	0.000	0.437							

Details 15 feet eng fill

	29.50	0.78	1.00	0.78	5.00	NoLiq	26.12	81.90	0.000
0.0E0	0.000	0.437							
	28.50	0.78	1.00	0.78	5.00	NoLiq	26.70	83.05	0.000
0.0E0	0.000	0.437							
	27.50	0.77	1.00	0.77	0.39	60.20	26.18	82.01	1.661
1.0E-2	0.010	0.447							
	26.50	0.77	1.00	0.77	0.41	50.00	26.77	83.18	1.610
9.7E-3	0.196	0.644							
	25.50	0.76	1.00	0.76	0.39	60.20	25.75	81.16	1.697
1.0E-2	0.199	0.842							
	24.50	0.75	1.00	0.75	0.37	70.40	24.71	79.16	1.784
1.1E-2	0.209	1.051							
	23.50	0.75	1.00	0.75	0.35	80.60	23.64	77.16	1.874
1.1E-2	0.220	1.271							
	22.50	0.74	1.00	0.74	0.33	90.80	22.55	75.15	1.964
1.2E-2	0.231	1.502							
	21.50	0.73	1.00	0.73	5.00	NoLiq	21.43	73.11	0.000
0.0E0	0.217	1.718							
	20.50	0.72	1.00	0.72	5.00	NoLiq	21.57	73.38	0.000
0.0E0	0.000	1.718							
	19.50	0.71	1.00	0.71	5.00	NoLiq	21.73	73.65	0.000
0.0E0	0.000	1.718							
	18.50	0.70	1.00	0.70	5.00	NoLiq	21.88	73.94	0.000
0.0E0	0.000	1.718							
	17.50	0.69	1.00	0.69	5.00	NoLiq	22.05	74.23	0.000
0.0E0	0.000	1.718							
	16.50	0.68	1.00	0.68	5.00	NoLiq	22.21	74.54	0.000
0.0E0	0.000	1.718							
	15.50	0.67	1.00	0.67	5.00	NoLiq	46.65	100.00	0.000
0.0E0	0.000	1.718							
	14.50	0.65	1.00	0.65	0.77	97.00	65.79	100.00	0.000
0.0E0	0.000	1.718							
	13.50	0.64	1.00	0.64	0.78	89.00	68.00	100.00	0.000
0.0E0	0.000	1.718							
	12.50	0.62	1.00	0.62	0.80	81.00	70.47	100.00	0.000
0.0E0	0.000	1.718							
	11.50	0.61	1.00	0.61	0.82	73.00	73.26	100.00	0.000
0.0E0	0.000	1.718							
	10.50	0.59	1.00	0.59	0.85	73.00	76.44	100.00	0.000
0.0E0	0.000	1.718							
	9.50	0.56	1.00	0.56	0.89	73.00	80.10	100.00	0.000
0.0E0	0.000	1.718							
	8.50	0.54	1.00	0.54	0.93	73.00	84.40	100.00	0.000
0.0E0	0.000	1.718							
	7.70	0.51	1.00	0.51	0.97	73.00	78.61	100.00	0.000
0.0E0	0.000	1.718							

Details 15 feet eng fill

Settlement of Saturated Sands=1.718 in.
qc1 and (N1)60 is after fines correction in liquefaction analysis
dsz is per each segment, dz=0.05 ft
dsp is per each print interval, dp=1.00 ft
S is cumulated settlement at this depth

Settlement of Unsaturated Sands:

Depth	sigma'	sigC'	(N1)60s	CSRsf	Gmax	g*Ge/Gm	g_eff	ec7.5	Cec	ec	dsz	dsp	S
ft	atm	atm			atm			%		%	in.	in.	in.
7.65	0.47	0.31	78.85	0.51	1058.35	2.3E-4	0.0518	0.0164	1.06	0.0173	2.07E-4	0.000	0.000
7.50	0.46	0.30	79.58	0.51	1051.16	2.3E-4	0.0498	0.0158	1.06	0.0166	2.00E-4	0.001	0.001
6.50	0.40	0.26	85.12	0.52	1000.72	2.1E-4	0.0405	0.0128	1.06	0.0135	1.62E-4	0.004	0.004

Settlement of Unsaturated Sands=0.004 in.
dsz is per each segment, dz=0.05 ft
dsp is per each print interval, dp=1.00 ft
S is cumulated settlement at this depth

Total Settlement of Saturated and Unsaturated Sands=1.723 in.
Differential Settlement=0.861 to 1.137 in.

Units: Unit: qc, fs, Stress or Pressure = atm (1.0581tsf); Unit Weight = pcf; Depth = ft; Settlement = in.

1 atm (atmosphere) = 1.0581 tsf(1 tsf = 1 ton/ft2 = 2 kip/ft2)
1 atm (atmosphere) = 101.325 kPa(1 kPa = 1 kN/m2 = 0.001 Mpa)

SPT	Field data from Standard Penetration Test (SPT)
BPT	Field data from Becker Penetration Test (BPT)
qc	Field data from Cone Penetration Test (CPT) [atm (tsf)]
fs	Friction from CPT testing [atm (tsf)]
Rf	Ratio of fs/qc (%)
gamma	Total unit weight of soil
gamma'	Effective unit weight of soil
Fines	Fines content [%]
D50	Mean grain size

Details 15 feet eng fill

Dr	Relative Density
sigma	Total vertical stress [atm]
sigma'	Effective vertical stress [atm]
sigC'	Effective confining pressure [atm]
rd	Acceleration reduction coefficient by Seed
a_max.	Peak Ground Acceleration (PGA) in ground surface
mZ	Linear acceleration reduction coefficient X depth
a_min.	Minimum acceleration under linear reduction, mZ
CRRv	CRR after overburden stress correction, CRRv=CRR7.5 * Ksig
CRR7.5	Cyclic resistance ratio (M=7.5)
Ksig	Overburden stress correction factor for CRR7.5
CRRm	After magnitude scaling correction CRRm=CRRv * MSF
MSF	Magnitude scaling factor from M=7.5 to user input M
CSR	Cyclic stress ratio induced by earthquake
CSRfs	CSRfs=CSR*fs1 (Default fs1=1)
fs1	First CSR curve in graphic defined in #9 of Advanced page
fs2	2nd CSR curve in graphic defined in #9 of Advanced page
F.S.	Calculated factor of safety against liquefaction

F.S.=CRRm/CSRsf

Cebs	Energy Ratio, Borehole Dia., and Sampling Method Corrections
Cr	Rod Length Corrections
Cn	Overburden Pressure Correction
(N1)60	SPT after corrections, (N1)60=SPT * Cr * Cn * Cebs
d(N1)60	Fines correction of SPT
(N1)60f	(N1)60 after fines corrections, (N1)60f=(N1)60 + d(N1)60
Cq	Overburden stress correction factor
qc1	CPT after Overburden stress correction
dqc1	Fines correction of CPT
qc1f	CPT after Fines and Overburden correction, qc1f=qc1 + dqc1
qc1n	CPT after normalization in Robertson's method
Kc	Fine correction factor in Robertson's Method
qc1f	CPT after Fines correction in Robertson's Method
Ic	Soil type index in Suzuki's and Robertson's Methods
(N1)60s	(N1)60 after settlement fines corrections
CSRm	After magnitude scaling correction for Settlement

calculation CSRm=CSRsf / MSF*

CSRfs	Cyclic stress ratio induced by earthquake with user

inputed fs

MSF*	Scaling factor from CSR, MSF*=1, based on Item 2 of

Page C.

ec	Volumetric strain for saturated sands
dz	Calculation segment, dz=0.050 ft
dsz	Settlement in each segment, dz
dp	User defined print interval
dsp	Settlement in each print interval, dp
Gmax	Shear Modulus at low strain
g_eff	gamma_eff, Effective shear Strain
g*Ge/Gm	gamma_eff * G_eff/G_max, Strain-modulus ratio

Details 15 feet eng fill

ec7.5	Volumetric Strain for magnitude=7.5
Cec	Magnitude correction factor for any magnitude
ec	Volumetric strain for unsaturated sands, ec=Cec * ec7.5
NoLiq	No-Liquefy Soils

References:

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1. NCEER Workshop on Evaluation of Liquefaction Resistance of Soils. Youd, T.L., and Idriss, I.M., eds., Technical Report NCEER 97-0022.

SP117. Southern California Earthquake Center. Recommended Procedures for Implementation of DMG Special Publication 117, Guidelines for Analyzing and Mitigating Liquefaction in California. University of Southern California. March 1999.

2. RECENT ADVANCES IN SOIL LIQUEFACTION ENGINEERING AND SEISMIC SITE RESPONSE EVALUATION, Paper No. SPL-2, PROCEEDINGS: Fourth International Conference on Recent Advances in Geotechnical Earthquake Engineering and Soil Dynamics, San Diego, CA, March 2001.

3. RECENT ADVANCES IN SOIL LIQUEFACTION ENGINEERING: A UNIFIED AND CONSISTENT FRAMEWORK, Earthquake Engineering Research Center, Report No. EERC 2003-06 by R.B Seed and etc. April 2003.

Note: Print Interval you selected does not show complete results. To get complete results, you should select 'Segment' in Print Interval (Item 12, Page C).

APPENDIX D

GENERAL EARTHWORK AND GRADING GUIDELINES

Proposed Campus Police Station
City of Compton, Los Angeles County, California
Project No. 1529-CR

GEOTEK

GENERAL GRADING GUIDELINES

Guidelines presented herein are intended to address general construction procedures for earthwork construction. Specific situations and conditions often arise which cannot reasonably be discussed in general guidelines, when anticipated these are discussed in the text of the report. Often unanticipated conditions are encountered which may necessitate modification or changes to these guidelines. It is our hope that these will assist the contractor to more efficiently complete the project by providing a reasonable understanding of the procedures that would be expected during earthwork and the testing and observation used to evaluate those procedures.

General

Grading should be performed to at least the minimum requirements of governing agencies, Chapters 18 and 33 of the Uniform Building Code, CBC (2013) and the guidelines presented below.

Preconstruction Meeting

A preconstruction meeting should be held prior to site earthwork. Any questions the contractor has regarding our recommendations, general site conditions, apparent discrepancies between reported and actual conditions and/or differences in procedures the contractor intends to use should be brought up at that meeting. The contractor (including the main onsite representative) should review our report and these guidelines in advance of the meeting. Any comments the contractor may have regarding these guidelines should be brought up at that meeting.

Grading Observation and Testing

1. Observation of the fill placement should be provided by our representative during grading. Verbal communication during the course of each day will be used to inform the contractor of test results. The contractor should receive a copy of the "Daily Field Report" indicating results of field density tests that day. If our representative does not provide the contractor with these reports, our office should be notified.
2. Testing and observation procedures are, by their nature, specific to the work or area observed and location of the tests taken, variability may occur in other locations. The contractor is responsible for the uniformity of the grading operations; our observations and test results are intended to evaluate the contractor's overall level of efforts during grading. The contractor's personnel are the only individuals participating in all aspect of site work. Compaction testing and observation should not be considered as relieving the contractor's responsibility to properly compact the fill.
3. Cleanouts, processed ground to receive fill, key excavations, and subdrains should be observed by our representative prior to placing any fill. It will be the contractor's responsibility to notify our representative or office when such areas are ready for observation.
4. Density tests may be made on the surface material to receive fill, as considered warranted by this firm.

5. In general, density tests would be made at maximum intervals of two feet of fill height or every 1,000 cubic yards of fill placed. Criteria will vary depending on soil conditions and size of the fill. More frequent testing may be performed. In any case, an adequate number of field density tests should be made to evaluate the required compaction and moisture content is generally being obtained.

6. Laboratory testing to support field test procedures will be performed, as considered warranted, based on conditions encountered (e.g. change of material sources, types, etc.) Every effort will be made to process samples in the laboratory as quickly as possible and in progress construction projects are our first priority. However, laboratory workloads may cause in delays and some soils may require a **minimum of 48 to 72 hours to complete test procedures**. Whenever possible, our representative(s) should be informed in advance of operational changes that might result in different source areas for materials.

7. Procedures for testing of fill slopes are as follows:

   a) Density tests should be taken periodically during grading on the flat surface of the fill, three to five feet horizontally from the face of the slope.

   b) If a method other than over building and cutting back to the compacted core is to be employed, slope compaction testing during construction should include testing the outer six inches to three feet in the slope face to determine if the required compaction is being achieved.

8. Finish grade testing of slopes and pad surfaces should be performed after construction is complete.

Site Clearing

1. All vegetation, and other deleterious materials, should be removed from the site. If material is not immediately removed from the site it should be stockpiled in a designated area(s) well outside of all current work areas and delineated with flagging or other means. Site clearing should be performed in advance of any grading in a specific area.

2. Efforts should be made by the contractor to remove all organic or other deleterious material from the fill, as even the most diligent efforts may result in the incorporation of some materials. This is especially important when grading is occurring near the natural grade. All equipment operators should be aware of these efforts. Laborers may be required as root pickers.

3. Nonorganic debris or concrete may be placed in deeper fill areas provided the procedures used are observed and found acceptable by our representative. Typical procedures are similar to those indicated on Plate G-4.

Treatment of Existing Ground

1. Following site clearing, all surficial deposits of alluvium and colluvium as well as weathered or creep effected bedrock, should be removed (see Plates G-1, G-2 and G-3) unless otherwise specifically indicated in the text of this report.

2. In some cases, removal may be recommended to a specified depth (e.g. flat sites where partial alluvial removals may be sufficient). The contractor should not exceed these depths unless directed otherwise by our representative.
3. Groundwater existing in alluvial areas may make excavation difficult. Deeper removals than indicated in the text of the report may be necessary due to saturation during winter months.
4. Subsequent to removals, the natural ground should be processed to a depth of six inches, moistened to near optimum moisture conditions and compacted to fill standards.
5. Exploratory back hoe or dozer trenches still remaining after site removal should be excavated and filled with compacted fill if they can be located.

Subdrainage

1. Subdrainage systems should be provided in canyon bottoms prior to placing fill, and behind buttress and stabilization fills and in other areas indicated in the report. Subdrains should conform to schematic diagrams G-1 and G-5, and be acceptable to our representative.
2. For canyon subdrains, runs less than 500 feet may use six-inch pipe. Typically, runs in excess of 500 feet should have the lower end as eight-inch minimum.
3. Filter material should be clean, 1/2 to 1-inch gravel wrapped in a suitable filter fabric. Class 2 permeable filter material per California Department of Transportation Standards tested by this office to verify its suitability, may be used without filter fabric. A sample of the material should be provided to the Soils Engineer by the contractor at least two working days before it is delivered to the site. The filter should be clean with a wide range of sizes.
4. Approximate delineation of anticipated subdrain locations may be offered at 40-scale plan review stage. During grading, this office would evaluate the necessity of placing additional drains.
5. All subdrainage systems should be observed by our representative during construction and prior to covering with compacted fill.
6. Subdrains should outlet into storm drains where possible. Outlets should be located and protected. The need for backflow preventers should be assessed during construction.
7. Consideration should be given to having subdrains located by the project surveyors.

Fill Placement

1. Unless otherwise indicated, all site soil and bedrock may be reused for compacted fill; however, some special processing or handling may be required (see text of report).
2. Material used in the compacting process should be evenly spread, moisture conditioned, processed, and compacted in thin lifts six (6) to eight (8) inches in compacted thickness to obtain a uniformly dense layer. The fill should be placed and compacted on a nearly horizontal plane, unless otherwise found acceptable by our representative.
3. If the moisture content or relative density varies from that recommended by this firm, the contractor should rework the fill until it is in accordance with the following:

a) Moisture content of the fill should be at or above optimum moisture. Moisture should be evenly distributed without wet and dry pockets. Pre-watering of cut or removal areas should be considered in addition to watering during fill placement, particularly in clay or dry surficial soils. The ability of the contractor to obtain the proper moisture content will control production rates.

b) Each six-inch layer should be compacted to at least 90 percent of the maximum dry density in compliance with the testing method specified by the controlling governmental agency. In most cases, the testing method is ASTM Test Designation D 1557.

4. Rock fragments less than eight inches in diameter may be utilized in the fill, provided:

   a) They are not placed in concentrated pockets;

   b) There is a sufficient percentage of fine-grained material to surround the rocks;

   c) The distribution of the rocks is observed by, and acceptable to, our representative.

5. Rocks exceeding eight (8) inches in diameter should be taken off site, broken into smaller fragments, or placed in accordance with recommendations of this firm in areas designated suitable for rock disposal (see Plate G-4). On projects where significant large quantities of oversized materials are anticipated, alternate guidelines for placement may be included. If significant oversize materials are encountered during construction, these guidelines should be requested.

6. In clay soil, dry or large chunks or blocks are common. If in excess of eight (8) inches minimum dimension, then they are considered as oversized. Sheepsfoot compactors or other suitable methods should be used to break up blocks. When dry, they should be moisture conditioned to provide a uniform condition with the surrounding fill.

Slope Construction

1. The contractor should obtain a minimum relative compaction of 90 percent out to the finished slope face of fill slopes. This may be achieved by either overbuilding the slope and cutting back to the compacted core, or by direct compaction of the slope face with suitable equipment.

2. Slopes trimmed to the compacted core should be overbuilt by at least three (3) feet with compaction efforts out to the edge of the false slope. Failure to properly compact the outer edge results in trimming not exposing the compacted core and additional compaction after trimming may be necessary.

3. If fill slopes are built "at grade" using direct compaction methods, then the slope construction should be performed so that a constant gradient is maintained throughout construction. Soil should not be "spilled" over the slope face nor should slopes be "pushed out" to obtain grades. Compaction equipment should compact each lift along the immediate top of slope. Slopes should be back rolled or otherwise compacted at approximately every 4 feet vertically as the slope is built.

4. Corners and bends in slopes should have special attention during construction as these are the most difficult areas to obtain proper compaction.

5. Cut slopes should be cut to the finished surface. Excessive undercutting and smoothing of the face with fill may necessitate stabilization.

Keyways, Buttress and Stabilization Fills

Keyways are needed to provide support for fill slope and various corrective procedures.

1. Side-hill fills should have an equipment-width key at their toe excavated through all surficial soil and into competent material and tilted back into the hill (Plates G-2, G-3). As the fill is elevated, it should be benched through surficial soil and slopewash, and into competent bedrock or other material deemed suitable by our representatives (See Plates G-1, G-2, and G-3).
2. Fill over cut slopes should be constructed in the following manner:
   a) All surficial soils and weathered rock materials should be removed at the cut-fill interface.
   b) A key at least one and one-half (1.5) equipment width wide (or as needed for compaction), and tipped at least one (1) foot into slope, should be excavated into competent materials and observed by our representative.
   c) The cut portion of the slope should be excavated prior to fill placement to evaluate if stabilization is necessary. The contractor should be responsible for any additional earthwork created by placing fill prior to cut excavation. (see Plate G-3 for schematic details.)
3. Daylight cut lots above descending natural slopes may require removal and replacement of the outer portion of the lot. A schematic diagram for this condition is presented on Plate G-2.
4. A basal key is needed for fill slopes extending over natural slopes. A schematic diagram for this condition is presented on Plate G-2.
5. All fill slopes should be provided with a key unless within the body of a larger overall fill mass. Please refer to Plate G-3 for specific guidelines.

Anticipated buttress and stabilization fills are discussed in the text of the report. The need to stabilize other proposed cut slopes will be evaluated during construction. Plate G-5 shows a schematic of buttress construction.

1. All backcuts should be excavated at gradients of 1:1 or flatter. The backcut configuration should be determined based on the design, exposed conditions, and need to maintain a minimum fill width and provide working room for the equipment.
2. On longer slopes, backcuts and keyways should be excavated in maximum 250 feet long segments. The specific configurations will be determined during construction.
3. All keys should be a minimum of two (2) feet deep at the toe and slope toward the heel at least one foot or two (2%) percent, whichever is greater.
4. Subdrains are to be placed for all stabilization slopes exceeding 10 feet in height. Lower slopes are subject to review. Drains may be required. Guidelines for subdrains are presented on Plate G-5.

5. Benching of backcuts during fill placement is required.

Lot Capping

1. When practical, the upper three (3) feet of material placed below finish grade should be comprised of the least expansive material available. Preferably, highly and very highly expansive materials should not be used. We will attempt to offer advice based on visual evaluations of the materials during grading, but it must be realized that laboratory testing is needed to evaluate the expansive potential of soil. Minimally, this testing takes two (2) to four (4) days to complete.
2. Transition lots (cut and fill) both per plan and those created by remedial grading (e.g. lots above stabilization fills, along daylight lines, above natural slopes, etc.) should be capped with a minimum three foot thick compacted fill blanket.
3. Cut pads should be observed by our representative(s) to evaluate the need for overexcavation and replacement with fill. This may be necessary to reduce water infiltration into highly fractured bedrock or other permeable zones, and/or due to differing expansive potential of materials beneath a structure. The overexcavation should be at least three feet. Deeper overexcavation may be recommended in some cases.

ROCK PLACEMENT AND ROCK FILL GUIDELINES

It is anticipated that large quantities of oversize material would be generated during grading. It's likely that such materials may require special handling for burial. Although alternatives may be developed in the field, the following methods of rock disposal are recommended on a preliminary basis.

Limited Larger Rock

When materials encountered are principally soil with limited quantities of larger rock fragments or boulders, placement in windrows is recommended. The following procedures should be applied:

1. Oversize rock (greater than 8 inches) should be placed in windrows.
   a) Windrows are rows of single file rocks placed to avoid nesting or clusters of rock.
   b) Each adjacent rock should be approximately the same size (within ~one foot in diameter).
   c) The maximum rock size allowed in windrows is four feet
2. A minimum vertical distance of three feet between lifts should be maintained. Also, the windrows should be offset from lift to lift. Rock windrows should not be closer than 15 feet to the face of fill slopes and sufficient space must be maintained for proper slope construction (see Plate G-4).
3. Rocks greater than eight inches in diameter should not be placed within seven feet of the finished subgrade for a roadway or pads and should be held below the depth of the lowest utility. This will allow easier trenching for utility lines.

4. Rocks greater than four feet in diameter should be broken down, if possible, or they may be placed in a dozer trench. Each trench should be excavated into the compacted fill a minimum of one foot deeper than the largest diameter of rock.
   a) The rock should be placed in the trench and granular fill materials (SE>30) should be flooded into the trench to fill voids around the rock.
   b) The over size rock trenches should be no closer together than 15 feet from any slope face.
   c) Trenches at higher elevation should be staggered and there should be a minimum of four feet of compacted fill between the top of the one trench and the bottom of the next higher trench.
   d) It would be necessary to verify 90 percent relative compaction in these pits. A 24 to 72 hour delay to allow for water dissipation should be anticipated prior to additional fill placement.

Structural Rock Fills

If the materials generated for placement in structural fills contains a significant percentage of material more than six (6) inches in one dimension, then placement using conventional soil fill methods with isolated windrows would not be feasible. In such cases the following could be considered:

1. Mixes of large rock or boulders may be placed as rock fill. They should be below the depth of all utilities both on pads and in roadways and below any proposed swimming pools or other excavations. If these fills are placed within seven (7) feet of finished grade, they may affect foundation design.
2. Rock fills are required to be placed in horizontal layers that should **not exceed two feet in thickness, or the maximum rock size present, which ever is less**. All rocks exceeding two feet should be broken down to a smaller size, windrowed (see above), or disposed of in non-structural fill areas. Localized larger rock up to 3 feet in largest dimension may be placed in rock fill as follows:
   a) individual rocks are placed in a given lift so as to be roughly 50% exposed above the typical surface of the fill ,
   b) loaded rock trucks or alternate compactors are worked around the rock on all sides to the satisfaction of the soil engineer,
   c) the portion of the rock above grade is covered with a second lift.
3. Material placed in each lift should be well graded. No unfilled spaces (voids) should be permitted in the rock fill.

Compaction Procedures

Compaction of rock fills is largely procedural. The following procedures have been found to generally produce satisfactory compaction.

1. Provisions for routing of construction traffic over the fill should be implemented.

a) Placement should be by rock trucks crossing the lift being placed and dumping at its edge.

b) The trucks should be routed so that each pass across the fill is via a different path and that all areas are uniformly traversed.

c) The dumped piles should be knocked down and spread by a large dozer (D-8 or larger suggested). (Water should be applied before and during spreading.)

2. Rock fill should be generously watered (sluiced)
   a) Water should be applied by water trucks to the:
      i) dump piles,
      ii) front face of the lift being placed and,
      iii) surface of the fill prior to compaction.
   b) No material should be placed without adequate water.
   c) The number of water trucks and water supply should be sufficient to provide constant water.
   d) Rock fill placement should be suspended when water trucks are unavailable:
      i) for more than 5 minutes straight, or,
      ii) for more than 10 minutes/hour.

3. In addition to the truck pattern and at the discretion of the soil engineer, large, rubber tired compactors may be required.
   a) The need for this equipment will depend largely on the ability of the operators to provide complete and uniform coverage by wheel rolling with the trucks.
   b) Other large compactors will also be considered by the soil engineer provided that required compaction is achieved.

4. Placement and compaction of the rock fill is largely procedural. Observation by trenching should be made to check:
   a) the general segregation of rock size,
   b) for any unfilled spaces between the large blocks, and
   c) the matrix compaction and moisture content.

5. Test fills may be required to evaluate relative compaction of finer grained zones or as deemed appropriate by the soil engineer.
   a) A lift should be constructed by the methods proposed, as proposed

6. Frequency of the test trenching is to be at the discretion of the soil engineer. Control areas may be used to evaluate the contractor's procedures.

7. A minimum horizontal distance of 15 feet should be maintained from the face of the rock fill and any finish slope face. At least the outer 15 feet should be built of conventional fill materials.

Piping Potential and Filter Blankets

Where conventional fill is placed over rock fill, the potential for piping (migration) of the fine grained material from the conventional fill into rock fills will need to be addressed.

The potential for particle migration is related to the grain size comparisons of the materials present and in contact with each other. Provided that 15 percent of the finer soil is larger than the effective pore size of the coarse soil, then particle migration is substantially mitigated. This can be accomplished with a well-graded matrix material for the rock fill and a zone of fill similar to the matrix above it. The specific gradation of the fill materials placed during grading must be known to evaluate the need for any type of filter that may be necessary to cap the rock fills. This, unfortunately, can only be accurately determined during construction.

In the event that poorly graded matrix is used in the rock fills, properly graded filter blankets 2 to 3 feet thick separating rock fills and conventional fill may be needed. As an alternative, use of two layers of filter fabric (Mirafi 700 x or equivalent) could be employed on top of the rock fill. In order to mitigate excess puncturing, the surface of the rock fill should be well broken down and smoothed prior to placing the filter fabric. The first layer of the fabric may then be placed and covered with relatively permeable fill material (with respect to overlying material) 1 to 2 feet thick. The relative permeable material should be compacted to fill standards. The second layer of fabric should be placed and conventional fill placement continued.

Subdrainage

Rock fill areas should be tied to a subdrainage system. If conventional fill is placed that separates the rock from the main canyon subdrain, then a secondary system should be installed. A system consisting of an adequately graded base (3 to 4 percent to the lower side) with a collector system and outlets may suffice.

Additionally, at approximately every 25 foot vertical interval, a collector system with outlets should be placed at the interface of the rock fill and the conventional fill blanketing a fill slope

Monitoring

Depending upon the depth of the rock fill and other factors, monitoring for settlement of the fill areas may be needed following completion of grading. Typically, if rock fill depths exceed 40 feet, monitoring would be recommend prior to construction of any settlement sensitive improvements. Delays of 3 to 6 months or longer can be expected prior to the start of construction.

UTILITY TRENCH CONSTRUCTION AND BACKFILL

Utility trench excavation and backfill is the contractor's responsibility. The geotechnical consultant typically provides periodic observation and testing of these operations. While efforts are made to make sufficient observations and tests to verify that the contractors' methods and procedures are adequate to achieve proper compaction, it is typically impractical to observe all backfill procedures. As such, it is critical that the contractor use consistent backfill procedures.

Compaction methods vary for trench compaction and experience indicates many methods can be successful. However, procedures that "worked" on previous projects may or may not prove effective on a given site. The contractor(s) should outline the procedures proposed, so that we may discuss them **prior** to construction. We will offer comments based on our knowledge of site conditions and experience.

1. Utility trench backfill in slopes, structural areas, in streets and beneath flat work or hardscape should be brought to at least optimum moisture and compacted to at least 90 percent of the laboratory standard. Soil should be moisture conditioned prior to placing in the trench.
2. Flooding and jetting are not typically recommended or acceptable for native soils. Flooding or jetting may be used with select sand having a Sand Equivalent (SE) of 30 or higher. This is typically limited to the following uses:
   a) shallow (12 + inches) under slab interior trenches and,
   b) as bedding in pipe zone.

   The water should be allowed to dissipate prior to pouring slabs or completing trench compaction.
3. Care should be taken not to place soils at high moisture content within the upper three feet of the trench backfill in street areas, as overly wet soils may impact subgrade preparation. Moisture may be reduced to 2% below optimum moisture in areas to be paved within the upper three feet below sub grade.
4. Sand backfill should not be allowed in exterior trenches adjacent to and within an area extending below a 1:1 projection from the outside bottom edge of a footing, unless it is similar to the surrounding soil.
5. Trench compaction testing is generally at the discretion of the geotechnical consultant. Testing frequency will be based on trench depth and the contractor's procedures. A probing rod would be used to assess the consistency of compaction between tested areas and untested areas. If zones are found that are considered less compact than other areas, this would be brought to the contractor's attention.

JOB SAFETY

General

Personnel safety is a primary concern on all job sites. The following summaries are safety considerations for use by all our employees on multi-employer construction sites. On ground personnel are at highest risk of injury and possible fatality on grading construction projects. The company recognizes that construction activities will vary on each site and that job site safety is the contractor's responsibility. However, it is, imperative that all personnel be safety conscious to avoid accidents and potential injury.

In an effort to minimize risks associated with geotechnical testing and observation, the following precautions are to be implemented for the safety of our field personnel on grading and construction projects.

1. Safety Meetings: Our field personnel are directed to attend the contractor's regularly scheduled safety meetings.
2. Safety Vests: Safety vests are provided for and are to be worn by our personnel while on the job site.
3. Safety Flags: Safety flags are provided to our field technicians; one is to be affixed to the vehicle when on site, the other is to be placed atop the spoil pile on all test pits.

In the event that the contractor's representative observes any of our personnel not following the above, we request that it be brought to the attention of our office.

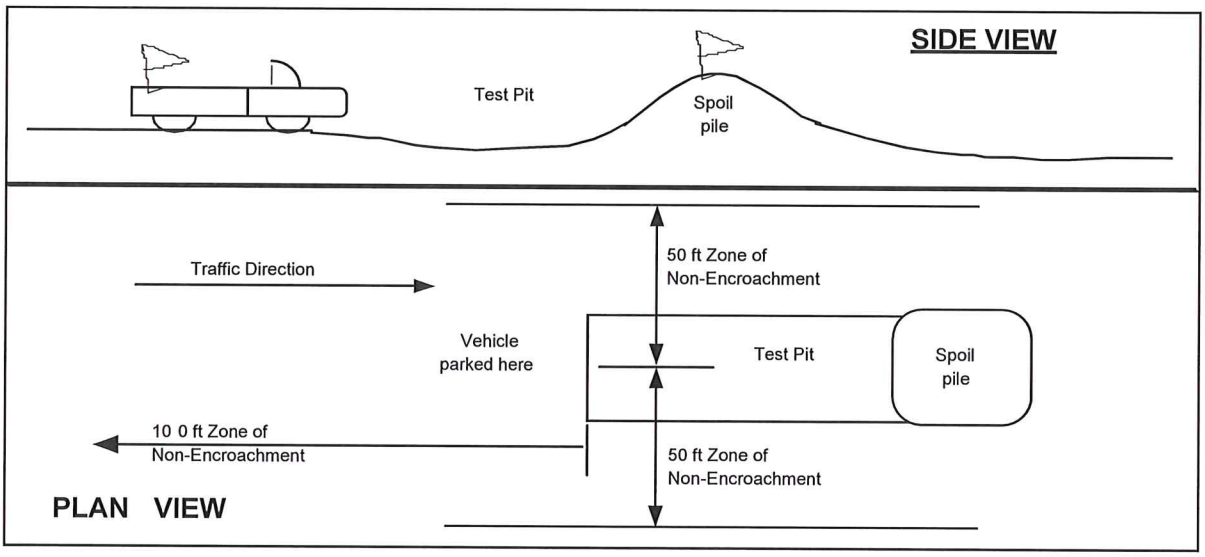
Test Pits Location, Orientation and Clearance

The technician is responsible for selecting test pit locations. The primary concern is the technician's safety. However, it is necessary to take sufficient tests at various locations to obtain a representative sampling of the fill. As such, efforts will be made to coordinate locations with the grading contractors authorized representatives (e.g. dump man, operator, supervisor, grade checker, etc.), and to select locations following or behind the established traffic pattern, preferably outside of current traffic. The contractors authorized representative should direct excavation of the pit and safety during the test period. Again, safety is the paramount concern.

Test pits should be excavated so that the spoil pile is placed away from oncoming traffic. The technician's vehicle is to be placed next to the test pit, opposite the spoil pile. This necessitates that the fill be maintained in a drivable condition. Alternatively, the contractor may opt to park a piece of equipment in front of test pits, particularly in small fill areas or those with limited access.

A zone of non-encroachment should be established for all test pits (see diagram below). No grading equipment should enter this zone during the test procedure. The zone should extend outward to the sides approximately 50 feet from the center of the test pit and 100 feet in the direction of traffic flow. This zone is established both for safety and to avoid excessive ground vibration, which typically decreases test results.

TEST PIT SAFETY PLAN



Slope Tests

When taking slope tests, the technician should park their vehicle directly above or below the test location on the slope. The contractor's representative should effectively keep all equipment at a safe operation distance (e.g. 50 feet) away from the slope during testing.

The technician is directed to withdraw from the active portion of the fill as soon as possible following testing. The technician's vehicle should be parked at the perimeter of the fill in a highly visible location.

Trench Safety

It is the contractor's responsibility to provide safe access into trenches where compaction testing is needed. Trenches for all utilities should be excavated in accordance with CAL-OSHA and any other applicable safety standards. Safe conditions will be required to enable compaction testing of the trench backfill.

All utility trench excavations in excess of 5 feet deep, which a person enters, are to be shored or laid back. Trench access should be provided in accordance with OSHA standards. Our personnel are directed not to enter any trench by being lowered or "riding down" on the equipment.

Our personnel are directed not to enter any excavation which;

1. is 5 feet or deeper unless shored or laid back,
2. exit points or ladders are not provided,
3. displays any evidence of instability, has any loose rock or other debris which could fall into the trench, or
4. displays any other evidence of any unsafe conditions regardless of depth.

If the contractor fails to provide safe access to trenches for compaction testing, our company policy requires that the soil technician withdraws and notifies their supervisor. The contractor's representative will then be contacted in an effort to affect a solution. All backfill not tested due to safety concerns or other reasons is subject to reprocessing and/or removal.

Procedures

In the event that the technician's safety is jeopardized or compromised as a result of the contractor's failure to comply with any of the above, the technician is directed to inform both the developer's and contractor's representatives. If the condition is not rectified, the technician is required, by company policy, to immediately withdraw and notify their supervisor. The contractor's representative will then be contacted in an effort to affect a solution. No further testing will be performed until the situation is rectified. Any fill placed in the interim can be considered unacceptable and subject to reprocessing, recompaction or removal.

In the event that the soil technician does not comply with the above or other established safety guidelines, we request that the contractor bring this to technician's attention and notify our project manager or office. Effective communication and coordination between the contractors' representative and the field technician(s) is strongly encouraged in order to implement the above safety program and safety in general.

The safety procedures outlined above should be discussed at the contractor's safety meetings. This will serve to inform and remind equipment operators of these safety procedures particularly the zone of non-encroachment.

The safety procedures outlined above should be discussed at the contractor's safety meetings. This will serve to inform and remind equipment operators of these safety procedures particularly the zone of non-encroachment.

UNITED-HEIDER
INSPECTION GROUP
An ETS Company

January 16, 2017

Compton Community College District
C/O Ms. Sheri Phillips
PCM3, Inc.
970 Brighton Court, 2nd Floor
San Dimas, California 91773

Subject: Campus Public Safety Building
Compton Community College
1111 East Artesia Boulevard
Compton, California 90221
United Heider Inspection Group Project No.: 10-17036PW

Reference: 1) Geotechnical Evaluation – Proposed Campus Police Station, prepared by GeoTek, Inc., dated October 24, 2016
2) Site Improvement Plans, prepared by Little Architects, dated October 21, 2016

Dear Ms. Phillips,

Our firm reviewed the above documents and visited the project site on two separate occasions to view the site of the proposed Campus Public Safety Building. The new building will be located at the NW corner of Delta Avenue and Artesia Boulevard located at the SE corner of the Compton Campus, as depicted on the attached drawing.

During these visits, an excavator was utilized to explore the soil conditions to a depth ranging from ten (10) to twelve (12) feet below the existing surface. These trench locations are depicted on the attached drawing, along with the boring locations performed by GeoTek, Inc. Trench T-1 was performed on December 30, 2016 and due to the constant rain, no testing of the soil was performed. Trenches T-2 & T-3 were performed on January 4, 2017 and density testing was performed at two elevations in each trench. Please refer to the findings in the table below.

Trench 1 –	0-4'	Light brown fine sandy SILT, slightly moist, little dense
	4' to 4.5'	Dark brown sandy SILT, trace organic material, slightly moist
	4.5' to 9.0'	Light brown fine sandy SILT slightly moist, little dense
	9.0' to 12'	Dark brown fine sandy SILT, some slight porosity
Trench 2 -	0-10'	Light brown fine sandy SILT, slightly moist, slightly dense
	At -4'	Dry density 82.5 pcf @ 6.1% moisture - Rel. compaction = 77%
	At -8'	Dry density 91.0 pcf @ 8.7% moisture - Rel. compaction = 85%
Trench 3 -	0-10'	Light brown fine sandy SILT, slightly moist, slightly dense
	At -6'	Dry density 93.0 pcf @ 6.4% moisture - Rel. compaction = 87%
	At -9.5'	Dry density 89.4 pcf @ 8.4% moisture - Rel. compaction = 83%

The encountered soil was tested in accordance with ASTM D 1557 and the following values were obtained.

Maximum Dry Density, pcf = 107.1 pcf
Optimum Moisture Content, % = 16.5 percent

Based upon our observations in the three trenches, we did not observe fills deeper than 4.5 feet from the ground surface. Our Trench T-3 was located in the approximate location where B-1 was performed for the GeoTek exploration. We accept the referenced Geotechnical Report prepared by GeoTek, Inc. and the recommendations contained within, with the exception of the encountered fill depth.

We recommend that the building site be overexcavated to a depth that will be the deeper of 4.5 feet below the existing grade or 3.0 feet below the deepest foundation, whichever is deeper. The overexcavation should extend laterally beyond the outer edge of the foundations to a width of 5 feet or the depth of overexcavation, whichever is wider. The bottom of the overexcavation should be scarified, moisture conditioned as necessary and compacted to a minimum relative compaction of 90%. The engineered fill should be placed in loose lifts, not exceeding 8" and compacted to a minimum relative compaction of 90%, with a moisture content between -2% to +2% of the optimum moisture content. Should undocumented fills be encountered during the overexcavation operations that extend deeper than the above recommended depth, then the fills should be removed until native alluvial soils are encountered. All other recommendations contained in the referenced GeoTek report should be followed.

If you have any questions, or need additional information, please contact us at your convenience.

Respectfully submitted,

UNITED-HEIDER INSPECTION GROUP

REGISTERED PROFESSIONAL ENGINEER DENNIS W. HEIDER C 47379 EXP.12/31/2017 CIVIL STATE OF CALIFORNIA

Dennis W. Heider, RCE
Principal Engineer

REGISTERED PROFESSIONAL ENGINEER COREY T. DARE No. 2013 Exp. 6-30-2018 GEOTECHNICAL STATE OF CALIFORNIA

Corey T. Dare, PE, GE
Principal Geotechnical Engineer

Attachment: Drawing

DSA 109

TRANSFER OF RESPONSIBILITY: GEOTECHNICAL ENGINEER

DSA File No. 19 C1

Application No. 03 - 117673

Whenever a change occurs in Geotechnical Engineer (GE) from that reported on Line 25d of form DSA-1, the new GE must complete and sign this form, submit it to DSA and distribute copies as specified below.

References: Title 24, Part 1, Section 4-333(a); Part 2, Sections 1704A.7.1 and 1803A.1.

1. Name of School District: Compton Community College District

Project Name/Location: Compton Community College, Public Safety Building

1111 East Artesia Boulevard, Compton, California 90221

2. Effective Date of Change: 01/16/17

3. Geotechnical Engineer's Review of Work Done: Check ***one*** box below as applicable. I have reviewed the geotechnical investigation (soils) report, applicable test and inspections reports, the DSA approved plans and specifications, and the work performed by the previous geotechnical consultant.

- ☐ I concur with the previous geotechnical consultant's findings, conclusions and recommendations as presented in their report(s).
- ☒ I concur in general with the previous geotechnical consultant's findings, conclusions and recommendations, however, I am also providing supplemental recommendations (attached).
- ☐ I do not concur with the previous geotechnical consultant's conclusions and I have provided recommendations to the school district as attached.

4. Geotechnical Engineer's Acceptance of Responsibility: The firm by which I am employed has been retained by the School District named above to perform the required geotechnical engineering, testing and inspection services during the remaining construction phase of this project.

As of 01/16/17 (effective date), I will be acting as the responsible Geotechnical Engineer (GE) on the DSA approved project described above.

I accept responsibility as noted in Section 3 above, and I will be responsible for verifying that the required geotechnical services for the project are performed, the work inspected and materials tested in accordance with the DSA approved plans and specifications. Reports of tests and inspections will be submitted as required by Sections 4-335 and 4-336 of the California Administrative Code (Title 24, Part 1).

I have forwarded a copy of this completed and signed form to the prior GE.

SIGNATURE: Corey T. Dare DATE: 01/27/17

5. Geotechnical Engineer's Information:

Name: Corey T. Dare

Registration #: 2013

Laboratory Name: United-Heider Inspection Group LEA # 143

Stamp:

REGISTERED PROFESSIONAL ENGINEER
COREY T. DARE
No. 2013
Exp. 6-30-2018
GEOTECHNICAL
STATE OF CALIFORNIA

cc: Prior Geotechnical Engineer
School District Project Architect Structural Engineer Project Inspector

FOR DSA USE ONLY

☐ eTracker updated ☐ copy forwarded to Field Engineer

DATE _____ by INITIAL _____

STATE OF CALIFORNIA, NATURAL RESOURCES AGENCY EDMUND G. BROWN JR., GOVERNOR

DEPARTMENT OF CONSERVATION

CALIFORNIA GEOLOGICAL SURVEY

SCHOOL REVIEW UNIT • 801 K STREET, MS 12-31 • SACRAMENTO, CALIFORNIA 95814

PHONE 916 / 324-7324 • FAX 916 / 445-3334 • TDD 916 / 324-2555 • WEB SITE conservation.ca.gov/cgs

1ST Review

January 30, 2017

Mr. Felipe Lopez
Chief Business Office
Los Angeles Unified School District
333 South Beaudry Avenue
Los Angeles, CA 90017

17 FEB 14 PM 1:53

Subject: **Engineering Geology and Seismology Review for Compton Community College – Public Safety Building 1111 East Artesia Boulevard, Compton, CA 90221 CGS Application No. 03-CGS2617**

Dear Mr. Lopez:

In accordance with your request and transmittal of documents on December 1, 2016, the California Geological Survey has reviewed the engineering geology and seismology aspects of the consulting report prepared for Compton Community College in Compton. It is our understanding that this project involves the construction of a one-story public safety building. This review was performed in accordance with Title 24, California Code of Regulations, 2013 California Building Code (CBC) and followed CGS Note 48 guidelines. We reviewed the following report:

> **Geotechnical Evaluation for Proposed Campus Police Station, El Camino College Compton Center, Northwest Corner of Artesia Boulevard and Delta Avenue, City of Compton, Los Angeles County, California:** GeoTek, Inc., 710 East Parkridge Avenue, Suite 105, Corona, CA 92879; company Project No. 1529-CR, report dated October 24, 2016, 22 pages, 5 figures, 4 appendices.

Based on our review, GeoTek, Inc. generally provides a thorough assessment of the engineering geology and seismology issues with respect to the proposed improvements. However, the consultant is requested to provide updated liquefaction and seismic settlement analyses and to assess the severity of potential differential settlements and associated requirements for the gradient of the recommended removal bottom. The consultant is also requested to assess the potential for flooding and dam inundation to occur at the site. The principal concerns identified at the site by the consultant are the potential for strong ground shaking and soils that are "highly" corrosive to buried ferrous metals. Their evaluation indicates that deep-seated slope instability is not a design concern for the project.

Note 48 Checklist Review Comments

In the numbered paragraphs below, this review is keyed to the paragraph numbers of California Geological Survey Note 48 (October, 2013 edition), *Checklist for the Review of Engineering Geology and Seismology Reports for California Public Schools, Hospitals, and Essential Services Buildings.*

Project Location

1. Site Location Map, Street Address, County Name: Adequately addressed.
2. Plot Plan with Exploration Data with Building Footprint: Adequately addressed.
3. Site Coordinates: Adequately addressed. Latitude and Longitude provided in report: 33.8746°N, 118.2084°W

Engineering Geology/Site Characterization

4. Regional Geology and Regional Fault Maps: Adequately addressed.
5. Geologic Map of Site: Not provided and therefore not reviewed.
6. Subsurface Geology: Adequately addressed. The consultant reports the site is underlain by younger alluvial fan deposits and 5 to 15 ft of undocumented fill based on published mapping and 3 borings drilled to a maximum depth of 56.5 ft. Groundwater was reportedly encountered at a depth in 50.5 ft in boring B-1.
7. Geologic Cross Sections: Adequately addressed. Two provided.
8. Active Faulting & Coseismic Deformation Across Site: Adequately addressed. The consultant reports the site is not within an Alquist-Priolo Earthquake Fault Zone and no active or potentially active faults are known to exist at the site.
9. Geologic Hazard Zones (Liquefaction & Landslides): Adequately addressed. The consultant reports the site is within a State-designated zone of potential liquefaction.
10. Geotechnical Testing of Representative Samples: Adequately addressed.
11. Geological Consideration of Grading Plans and Foundation Plans: **Additional information is requested.** The consultant provides recommendations for shallow isolated and continuous footings and for preparation of the subgrade soils, including removal of all the existing undocumented fill below the building area. CGS notes the consultant's anticipated depth of overexcavation to remove the fill varies from 5 to 15 ft below the building and the consultant reports a difference of 1.1 inch in total potential seismic settlement between these two removal depths (see Item 20 for details). The consultant's cross section B-B' suggests the **transition from 5 to 15 ft of fill may be much more abrupt than the minimum building width**, but specific guidelines for the maximum gradient of the removal bottom are not provided by the consultant. *The consultant should evaluate and discuss the recommended gradient of the removal bottom to address potential differential settlement below the building. The consultant's design recommendations should consider the results of the updated analyses requested in Item 20.*

Seismology & Calculation of Earthquake Ground Motion

12. Evaluation of Historic Seismicity: Adequately addressed. The consultant reports there is no evidence of ground failure or structural damage at the site due to previous earthquakes.
13. Classify the Geologic Subgrade (Site Class): Adequately addressed. The site soil profile is classified as **Site Class D**, Stiff Soil, which appears reasonable based on the blow count data provided.
14. General Procedure Seismic Parameters: Adequately addressed. The consultant provides the following seismic parameters derived from a map-based analysis, which are consistent with the USGS Seismic Design Maps website:
    $S_S = 1.671g$ and $S_1 = 0.611g$
    $S_{DS} = 1.114g$ and $S_{D1} = 0.611g$
15. Seismic Design Category: Adequately addressed. $S_1 < 0.75$, Category D.
16. Site-Specific Ground Motion Analysis: Not applicable.
17. Deaggregated Seismic Source Parameters: Adequately addressed. The consultant selects a magnitude of 7.5 for use in their liquefaction and seismic settlement analyses, which appears reasonable.
18. Time-Histories of Earthquake Ground Motion: Not applicable.

Liquefaction/Seismic Settlement Analysis

19. Geologic Setting for Occurrence of Seismically Induced Liquefaction: Adequately addressed. The consultant reports the native site soils consist primarily of sandy silt, clayey silt, silty sand, and lean clay. The consultant reports a historic high groundwater depth of 7.7 ft, which appears reasonable based on the Seismic Hazard Report for the South Gate quadrangle.
20. Seismic Settlement Calculations: **Additional information is requested.** The consultant provides the results of liquefaction and seismic settlement analyses for anticipated removal depths of 5 ft and 15 ft based on data from boring B-1 and a PGA of 0.62*g*. CGS notes that some silt layers appear to be assigned as nonliquefiable, but the basis for excluding them has not been provided. CGS also notes the consultant reports that a C_E value of 1.25 was used in the liquefaction analyses; however, an efficiency of **1.0** was reported for the automatic trip hammer (page 3 of report). The "curve smoothing" function has been selected in the consultant's analysis; however, this function does not appear applicable for the transition between fill and native soil, which is likely an abrupt contact. An SPT-equivalent blow count of 18 is shown at a depth of 31.5 ft, but a California drive blow count of 14 is shown in the boring log at this depth. The consultant provides estimated differential seismic settlements over the minimum width of the building (44 ft) based on one half of the total seismic settlement and based on the difference between settlements calculated with 5 ft of fill removal and with 15 ft of fill removal. *The consultant should provide updated liquefaction and seismic settlement analyses considering the comments noted above. The consultant should also provide updated estimates of differential seismic settlement considering the results of the updated analyses, the response to Item 11 regarding the recommended gradient of the removal bottom, and considering the recommendations in Section 7.6.6 of the SCEC Guidelines for Implementation of SP 117.*

21. Other Liquefaction Effects: **Additional information is requested.** CGS notes that potentially liquefiable soils may remain within 10 ft of the ground surface below some portions of the building footprint. *The consultant should evaluate and discuss the potential for surface manifestations and loss of bearing capacity to occur at the site.*
22. Mitigation Options for Liquefaction: **Additional information is requested.** *The consultant should provide updated recommendations as needed to address potential adverse effects from seismic settlement, surface manifestations, and/or loss of bearing capacity.*

Slope Stability Analysis

23. Geologic Setting for Occurrence of Landslides: Adequately addressed. The consultant reports the site is relatively flat and there is no evidence of ancient slides or slope instability observed at the site. The consultant therefore concludes the potential for landslides at the site is considered negligible
24. Determination of Static and Dynamic Strength Parameters: Not applicable.
25. Determination of Pseudo-Static Coefficient (Keq): Not applicable.
26. Identify Critical Slip Surfaces for Static and Dynamic Analyses: Not applicable.
27. Dynamic Site Conditions: Not applicable.
28. Mitigation Options/Other Slope Failure: Not applicable.

Other Geologic Hazards or Adverse Site Conditions

29. Expansive Soils: Adequately addressed. The consultant reports the site soils have a "very low" expansion potential (EI = 13).
30. Corrosive/Reactive Geochemistry of the Geologic Subgrade: Adequately addressed. The consultant reports the sulfate content in the site soils is "not applicable" and no special concrete mix design is required. However, the consultant reports the site soils are "highly" corrosive to buried ferrous metals abased on resistivity testing. Recommendations for this condition are referred to a corrosion engineer.
31. Conditional Geologic Assessment: Selected geologic hazards addressed by the consultant are listed below:
    C. Flooding: **Additional information is requested.** The consultant does not assess the potential for flooding or inundation due to catastrophic dam failure to occur at the site. *The consultant should evaluate and discuss the potential for flooding and dam inundation to occur at the site.*

Report Documentation

32. Geology, Seismology, and Geotechnical References: Adequately addressed.
33. Certified Engineering Geologist: Adequately addressed.
    Edward H. LaMont, Certified Engineering Geologist #1892
34. Registered Geotechnical Engineer: Adequately addressed.
    Glenn S. Fraser, Registered Geotechnical Engineer #2381

UNITED-HEIDER
INSPECTION GROUP
An ETS Company

April 5, 2017

CGS Application No. 03-CGS2617

California Geological Survey
School Review Unit, 801 K Street, MS 12-31
Sacramento, California 95814

Attention: Mr. Brian J. Swanson, CEG

Subject: **Response to CGS January 30, 2017 Review Letter**
Compton Community College – Public Safety Building
1111 East Artesia Boulevard, Compton, California 90221
United-Heider Project# 10-17036PW

Project Reference Documents:

1) Geotechnical Evaluation for Proposed Campus Police Station El Camino College Compton Center, Northwest Corner of Artesia Boulevard and Delta Avenue, City Of Compton, Los Angeles County, California 90221, prepared by Geotek, Inc., 710 E. Park Ridge Avenue, Suite 105, Corona, California 92879; report dated October 24, 2016.

2) Supplemental Letter, Campus Public Safety Building, Compton Community College, 1111 East Artesia Boulevard Compton, California 90221; prepared by United Heider Inspection Group, Project No. 10-17036PW, letter dated January 27, 2017.

Dear Mr. Swanson:

In response to your request for additional information regarding the geological consideration of grading and foundation plans, undocumented fill, and seismic settlement, as detailed in Note 48, Sections 11, 20, 21, and 22 as well as 31 regarding Dam Inundation and Flooding, **United-Heider Inspection Group (United-Heider)** is providing the following clarifications to your concerns associated with this project.

Comment, Note 48 #11 (Geological Consideration of Grading Plans and Foundation Plan)

United-Heider Response:

In a process of assuming the role of Geotechnical Engineer-of-Record for this project, United-Heider performed additional field investigation on January 4, 2017 to address the extent of undocumented fill by excavating three additional exploratory trenches at the project site. Based upon our observations, we did not observe fills at depths greater than 4.5 feet from the existing ground surface. For more detailed information, please see the attached Supplemental Letter (Reference #2). Therefore, we have revised our foundation recommendations as follows.

The building site should be overexcavated to a depth that will be deeper of 4.5 feet below the existing grade or 3.0 feet below the deepest foundation, whichever is deeper. The overexcavation should extend laterally beyond the outer edge of the foundations to a width of 5 feet or the depth of overexcavation, whichever is wider. The bottom of the overexcavation should be scarified, moisture conditioned as necessary, and compacted to a minimum relative compaction of 90%. The engineered fill should be placed in loose lifts, not exceeding 8 inches and compacted to a minimum relative compaction of 90%, with a moisture content between -2% to +2% of the optimum moisture content. Should undocumented fills be encountered during the overexcavation operations that extend deeper than the above recommended depth, then the fills should be removed until native alluvial soils are encountered.

Comment, Note 48 #20:

Seismic Settlement Calculations: Additional information is requested. The consultant provides the results of liquefaction and seismic settlement analyses for anticipated removal depths of 5 ft and 15 ft based on data from boring B-1 and a PGA of 0.62g. CGS notes that some silt layers appear to be assigned as non-liquefiable, but the basis for excluding them has not been provided. CGS also notes that consultant report that a C_E value of 1.25 was used in the liquefaction analyses; however, an efficiency of 1.0 was reported for the automatic trip hammer (Page 3 of report). The "curve smoothing" function has been selected in the consultant's analysis; however, this function does not appear applicable for the transition between fill and native soil, which is likely an abrupt contact. An SPT-equivalent blow count of 18 is shown at a depth of 31.5 ft, but a California drive blow count of 14 is shown in the boring logs at this depth. The consultant provides estimated differential seismic settlements over the minimum width of the building (44 ft) based on one half of the total seismic settlement and based on the difference between settlements calculated with 5 ft of fill removal and with 15 ft of fill removal. The consultant should provide updated liquefaction and seismic settlement analyses considering the comments noted above. The consultant should also provide updated estimates of differential seismic settlement considering the results of the updated analyses, the response to Item 11 regarding the recommended gradient of the removal bottom, and considering the recommendations in Section 7.6.6 of the SCEC Guidelines for Implementation of SP 117.

United-Heider Response:

As requested, we reviewed the liquefaction analysis as well as other pertinent parameters that were used in the calculations. As indicated on the CGS comments letter, we noticed a few typos and errors. Also due to changes

in details and additional findings from the project site we have reviewed the liquefaction analysis using corrected input parameters. As recommended in the original geotechnical report, removal and replacement of 15 feet of fills is voided. In our calculations, any stiff silt containing 14.4% and higher clay with Plasticity Index of 10 or higher has been considered non-liquefiable soils. We also noticed that the blow counts are supposed to be 9 (corrected blow count) instead of 18 which we revised on our revised liquefaction analyses. We received the hammer efficiency calibration chart for the hammer we used for the sampling performed by SPT Cal, dated March 19, 2016. The average efficiency of the hammer calibrated for depths from 30 to 50 feet was 84.1 percent. Therefore, we used a C_E value of 1.25 as a safe factor in our calculation. Other factors such as borehole diameter (C_b) and sampling method (C_s) were picked as 1.15 and 1.2, respectively. A factor-of-safety of 1.3 was used.

We performed additional research to determine the historical high ground water level at the project site. Based on the Seismic Hazard Zone Report (1998) for the Long Beach 7.5-Minute Quadrangle Los Angeles County, California, the report suggests a historical ground water at the project site of approximately 22 to 23 feet. Los Angeles County Department of Public Works water data (http://dpw.lacounty.gov/general/wells) for a point located about 2800 feet southwest (Well 883G, Ref Elev. 56 ft) of the project site indicates a high water level at 29 feet below the existing surface measured on 5/12/1994. Therefore, available data suggest historical high groundwater appears to be at least 22 feet below the existing surface. However, we used 7.7 feet for analysis purposes as was reported in the original geotechnical report.

In addition to these factors, we re-evaluated the seismic parameters used for liquefaction analysis. Based on our revised parameters, a Peak Ground Acceleration (PGA) of still 0.62g is applicable. However, Moment Magnitude (M) to cause this peak acceleration was found to be 6.6M which is evident from Probabilistic Seismic Hazard Deaggregation on NEHRP Site Class D; see attached Deaggregation figure for PGA. Using these parameters as input, we performed a liquefaction analysis on Boring B-1 using the Liquefy-Pro V5.5b developed by CivilTech Software. Based on the liquefaction analysis calculated results, total estimated vertical settlement of 0.96 inches and differential settlements from 0.48 to 0.63 inches were obtained.

We also evaluated potential loss of bearing strength/surface manifestation due to liquefaction. Using an analysis based on recommendations provided by Ishihara (1985) for stratified soils, the upper most non-liquefiable soil layer (H_1) is 11.5 feet over a liquefiable layer (H_2) 3.5 ft (15.0-11.5 = 3.5 ft), and the ratio of non-liquefiable to

potential liquefiable layer is 3.2, which indicates that a potential for surface manifestation is unlikely. For detail thickness analysis, please refer to graphical liquefaction analysis results attached.

For the construction of the proposed building, over excavation and backfill with an engineered soil on the upper 4 to 5 feet undocumented subgrade soil should be adequate. We conclude our foundation recommendations for the project to be appropriate, and should accommodate the estimated total and differential settlements, provided structure is properly designed from a structural standpoint for a total settlement of one inch and differential settlement of at least one half the calculated total settlement within a span of 40 feet.

Comment, Note 48, #21:

Other Liquefaction effects: Additional information is requested. CGS notes that potentially liquefiable soils may remain within 10 ft of the ground surface below some portions of the building footprint. The consultant should evaluate and discuss the potential for surface manifestations and loss of bearing capacity to occur at the site. Additional information may be needed.

United-Heider Response:

Please see our response to comment #20.

Comment, Note 48, #22:

Mitigation Options for Liquefaction: Additional information is requested. The consultant should provide updated recommendations as needed to address potential adverse effects from seismic settlement, surface manifestations, and/or loss of bearing capacity.

United-Heider Response:

Please see our response to comment #20.

Comment, Note 48, #31-C:

The consultant does not assess the potential for flooding or inundation due to catastrophic dam failure to occur at the site. The consultant should evaluate and discuss the potential for flooding and dam inundation to occur at the site.

United-Heider Response:

Flooding: We evaluated the project site which did not appear to be subject to significant flooding. As shown on the attached *Figure 6, Flood Hazard Map*, FEMA (2008) has mapped the proposed building location as within Zone X (dot); i.e., a flood-hazard area which is within the area of 0.2% annual chance floodplain, areas of one percent annual chance flood with average depths of less than one foot or with drainage areas less than one square mile. Therefore, the site is considered to have a relatively low hazard of significant flooding. An in-depth engineering evaluation of the flooding potential of the site is beyond the scope of this study or our expertise, and a flood specialist should be contacted if a more in-depth flooding analysis is desired.

Dam Inundation: The site does not appear to be subject to inundation from a dam failure since the site does not appear to be situated in the downstream path of a nearby dam or reservoir. A review of the "Safety Element Exhibit G of the Los Angeles City General Plan" indicated that the site is within a Flood Control Basin area, as shown on attached *Figure 7, Inundation and Tsunami Hazard Map*.

We trust that this letter provides the information needed at this time. Should you or members of the review team have questions or need additional information, please contact us at (925) 314-7180.

Sincerely,
UNITED-HEIDER INSPECTION GROUP

Raghubar Shrestha, Ph.D., P.E.
Senior Engineer

Corey T. Dare, P.E., G.E.
Principal Geotechnical Engineer

REGISTERED PROFESSIONAL ENGINEER
COREY T. DARE
No. 2013
Exp. 6-30-2018
GEOTECHNICAL
STATE OF CALIFORNIA

Attachments:
- CGS Review Comments Letter, dated January 30 2017
- Reference #2 - Supplemental Letter-Campus Public Safety Building Compton Community College 1111 East Artesia Boulevard Compton, California 90221 United Heider Inspection Group Project No.: 10-17036PW, letter dated January 27, 2017
- Hammer Calibration Report, dated May 19, 2016
- PSH Deaggregation on NEHRP Site Class D (PGA)
- Liquefaction Analysis Results
- Fig 6 - Flood Hazard Map
- Fig 7 - Inundation and Tsunami Hazard Map

Distribution: 1 plus PDF to Addressee
PDF to Ted Beckwith, DSA, 700 North Alameda Street, Suite 5-500, Los Angeles, California 90012 (Ted.Beckwith@dgs.ca.gov)
PDF to Felipe R. Lopez, CCCD 1111 East Artesia Boulevard, Compton, California 90221 (flopez@elcamino.edu)
1 to Ms. Sheri Phillips, PCM3, Inc., 970 Brighton Court, 2nd Floor, San Dimas, California 91773
1 to Shoji Takeshima, Architect, Little Diversified Architectural Consulting, Inc., 1300 Dove Street, Suite 100, Newport Beach, California 92660

RS/CTD:pmf

STATE OF CALIFORNIA, NATURAL RESOURCES AGENCY EDMUND G. BROWN JR., GOVERNOR

DEPARTMENT OF CONSERVATION

CALIFORNIA GEOLOGICAL SURVEY

SCHOOL REVIEW UNIT • 801 K STREET, MS 12-31 • SACRAMENTO, CALIFORNIA 95814

PHONE 916 / 324-7324 • FAX 916 / 445-3334 • TDD 916 / 324-2555 • WEB SITE conservation.ca.gov/cgs

January 30, 2017

Mr. Felipe Lopez
Chief Business Office
Los Angeles Unified School District
333 South Beaudry Avenue
Los Angeles, CA 90017

17FEB 14 PM 1:53

Subject: **Engineering Geology and Seismology Review for Compton Community College – Public Safety Building 1111 East Artesia Boulevard, Compton, CA 90221 CGS Application No. 03-CGS2617**

Dear Mr. Lopez:

In accordance with your request and transmittal of documents on December 1, 2016, the California Geological Survey has reviewed the engineering geology and seismology aspects of the consulting report prepared for Compton Community College in Compton. It is our understanding that this project involves the construction of a one-story public safety building. This review was performed in accordance with Title 24, California Code of Regulations, 2013 California Building Code (CBC) and followed CGS Note 48 guidelines. We reviewed the following report:

> **Geotechnical Evaluation for Proposed Campus Police Station, El Camino College Compton Center, Northwest Corner of Artesia Boulevard and Delta Avenue, City of Compton, Los Angeles County, California:** GeoTek, Inc., 710 East Parkridge Avenue, Suite 105, Corona, CA 92879; company Project No. 1529-CR, report dated October 24, 2016, 22 pages, 5 figures, 4 appendices.

Based on our review, GeoTek, Inc. generally provides a thorough assessment of the engineering geology and seismology issues with respect to the proposed improvements. However, the consultant is requested to provide updated liquefaction and seismic settlement analyses and to assess the severity of potential differential settlements and associated requirements for the gradient of the recommended removal bottom. The consultant is also requested to assess the potential for flooding and dam inundation to occur at the site. The principal concerns identified at the site by the consultant are the potential for strong ground shaking and soils that are "highly" corrosive to buried ferrous metals. Their evaluation indicates that deep-seated slope instability is not a design concern for the project.

In conclusion, ***the engineering geology and seismology issues at this site are not adequately assessed in the referenced report.*** It is recommended that additional information be provided as requested in the attached Note 48 Checklist Review Comments portion of this letter. The consultant is reminded that one copy of all supplemental documents should be submitted directly to CGS and should include the CGS application number. If you have any further questions about this review letter, please contact the reviewer at (213) 239-0885.

Respectfully submitted,

Brian J. Swanson
Engineering Geologist
PG 6494, CEG 2055

Concur

Anne M. Rosinski
Senior Engineering Geologist
PG 7481, CEG 2353

Enclosures:

Note 48 Checklist Review Comments
Keyed to: *Note 48 - Checklist for the Review of Engineering Geology and Seismology Reports for California Public Schools, Hospitals, and Essential Services Buildings*

Copies to:

Edward H. LaMont, *Certified Engineering Geologist*, Glenn S. Fraser, *Registered Geotechnical Engineer*
GeoTek, Inc., 710 East Parkridge Avenue, Suite 105, Corona, CA 92879-1097

Shoji Takeshima, *Architect*
Little Diversified Architectural Consulting, Inc., 1300 Dove Street, Suite 100, Newport Beach, CA 92660

Ted Beckwith, *Senior Structural Engineer*
Division of State Architect, 700 North Alameda Street, Suite 5-500, Los Angeles, CA 90012

Note 48 Checklist Review Comments

In the numbered paragraphs below, this review is keyed to the paragraph numbers of California Geological Survey Note 48 (October, 2013 edition), *Checklist for the Review of Engineering Geology and Seismology Reports for California Public Schools, Hospitals, and Essential Services Buildings.*

Project Location

1. Site Location Map, Street Address, County Name: Adequately addressed.
2. Plot Plan with Exploration Data with Building Footprint: Adequately addressed.
3. Site Coordinates: Adequately addressed. Latitude and Longitude provided in report: 33.8746°N, 118.2084°W

Engineering Geology/Site Characterization

4. Regional Geology and Regional Fault Maps: Adequately addressed.
5. Geologic Map of Site: Not provided and therefore not reviewed.
6. Subsurface Geology: Adequately addressed. The consultant reports the site is underlain by younger alluvial fan deposits and 5 to 15 ft of undocumented fill based on published mapping and 3 borings drilled to a maximum depth of 56.5 ft. Groundwater was reportedly encountered at a depth in 50.5 ft in boring B-1.
7. Geologic Cross Sections: Adequately addressed. Two provided.
8. Active Faulting & Coseismic Deformation Across Site: Adequately addressed. The consultant reports the site is not within an Alquist-Priolo Earthquake Fault Zone and no active or potentially active faults are known to exist at the site.
9. Geologic Hazard Zones (Liquefaction & Landslides): Adequately addressed. The consultant reports the site is within a State-designated zone of potential liquefaction.
10. Geotechnical Testing of Representative Samples: Adequately addressed.
11. Geological Consideration of Grading Plans and Foundation Plans: **Additional information is requested.** The consultant provides recommendations for shallow isolated and continuous footings and for preparation of the subgrade soils, including removal of all the existing undocumented fill below the building area. CGS notes the consultant's anticipated depth of overexcavation to remove the fill varies from 5 to 15 ft below the building and the consultant reports a difference of 1.1 inch in total potential seismic settlement between these two removal depths (see Item 20 for details). The consultant's cross section B-B' suggests the **transition from 5 to 15 ft of fill may be much more abrupt than the minimum building width,** but specific guidelines for the maximum gradient of the removal bottom are not provided by the consultant. *The consultant should evaluate and discuss the recommended gradient of the removal bottom to address potential differential settlement below the building. The consultant's design recommendations should consider the results of the updated analyses requested in Item 20.*

Seismology & Calculation of Earthquake Ground Motion

12. Evaluation of Historic Seismicity: Adequately addressed. The consultant reports there is no evidence of ground failure or structural damage at the site due to previous earthquakes.
13. Classify the Geologic Subgrade (Site Class): Adequately addressed. The site soil profile is classified as **Site Class D**, Stiff Soil, which appears reasonable based on the blow count data provided.
14. General Procedure Seismic Parameters: Adequately addressed. The consultant provides the following seismic parameters derived from a map-based analysis, which are consistent with the USGS Seismic Design Maps website:
    $S_S = 1.671g$ and $S_1 = 0.611g$
    $\mathbf{S_{DS} = 1.114g}$ and $\mathbf{S_{D1} = 0.611g}$
15. Seismic Design Category: Adequately addressed. $S_1 < 0.75$. Category D.
16. Site-Specific Ground Motion Analysis: Not applicable.
17. Deaggregated Seismic Source Parameters: Adequately addressed. The consultant selects a magnitude of 7.5 for use in their liquefaction and seismic settlement analyses, which appears reasonable.
18. Time-Histories of Earthquake Ground Motion: Not applicable.

Liquefaction/Seismic Settlement Analysis

19. Geologic Setting for Occurrence of Seismically Induced Liquefaction: Adequately addressed. The consultant reports the native site soils consist primarily of sandy silt, clayey silt, silty sand, and lean clay. The consultant reports a historic high groundwater depth of 7.7 ft, which appears reasonable based on the Seismic Hazard Report for the South Gate quadrangle.
20. Seismic Settlement Calculations: **Additional information is requested.** The consultant provides the results of liquefaction and seismic settlement analyses for anticipated removal depths of 5 ft and 15 ft based on data from boring B-1 and a PGA of 0.62*g*. CGS notes that some silt layers appear to be assigned as nonliquefiable, but the basis for excluding them has not been provided. CGS also notes the consultant reports that a C_E value of 1.25 was used in the liquefaction analyses; however, an efficiency of **1.0** was reported for the automatic trip hammer (page 3 of report). The "curve smoothing" function has been selected in the consultant's analysis; however, this function does not appear applicable for the transition between fill and native soil, which is likely an abrupt contact. An SPT-equivalent blow count of 18 is shown at a depth of 31.5 ft, but a California drive blow count of 14 is shown in the boring log at this depth. The consultant provides estimated differential seismic settlements over the minimum width of the building (44 ft) based on one half of the total seismic settlement and based on the difference between settlements calculated with 5 ft of fill removal and with 15 ft of fill removal. *The consultant should provide updated liquefaction and seismic settlement analyses considering the comments noted above. The consultant should also provide updated estimates of differential seismic settlement considering the results of the updated analyses, the response to Item 11 regarding the recommended gradient of the removal bottom, and considering the recommendations in Section 7.6.6 of the SCEC Guidelines for Implementation of SP 117.*

21. Other Liquefaction Effects: **Additional information is requested.** CGS notes that potentially liquefiable soils may remain within 10 ft of the ground surface below some portions of the building footprint. *The consultant should evaluate and discuss the potential for surface manifestations and loss of bearing capacity to occur at the site.*
22. Mitigation Options for Liquefaction: **Additional information is requested.** *The consultant should provide updated recommendations as needed to address potential adverse effects from seismic settlement, surface manifestations, and/or loss of bearing capacity.*

Slope Stability Analysis

23. Geologic Setting for Occurrence of Landslides: Adequately addressed. The consultant reports the site is relatively flat and there is no evidence of ancient slides or slope instability observed at the site. The consultant therefore concludes the potential for landslides at the site is considered negligible
24. Determination of Static and Dynamic Strength Parameters: Not applicable.
25. Determination of Pseudo-Static Coefficient (Keq): Not applicable.
26. Identify Critical Slip Surfaces for Static and Dynamic Analyses: Not applicable.
27. Dynamic Site Conditions: Not applicable.
28. Mitigation Options/Other Slope Failure: Not applicable.

Other Geologic Hazards or Adverse Site Conditions

29. Expansive Soils: Adequately addressed. The consultant reports the site soils have a "very low" expansion potential (EI = 13).
30. Corrosive/Reactive Geochemistry of the Geologic Subgrade: Adequately addressed. The consultant reports the sulfate content in the site soils is "not applicable" and no special concrete mix design is required. However, the consultant reports the site soils are "highly" corrosive to buried ferrous metals abased on resistivity testing. Recommendations for this condition are referred to a corrosion engineer.
31. Conditional Geologic Assessment: Selected geologic hazards addressed by the consultant are listed below:
    C. Flooding: **Additional information is requested.** The consultant does not assess the potential for flooding or inundation due to catastrophic dam failure to occur at the site. *The consultant should evaluate and discuss the potential for flooding and dam inundation to occur at the site.*

Report Documentation

32. Geology, Seismology, and Geotechnical References: Adequately addressed.
33. Certified Engineering Geologist: Adequately addressed.
    Edward H. LaMont, Certified Engineering Geologist #1892
34. Registered Geotechnical Engineer: Adequately addressed.
    Glenn S. Fraser, Registered Geotechnical Engineer #2381

UNITED-HEIDER
INSPECTION GROUP
An ETS Company

January 27, 2017

Compton Community College District
C/O Ms. Sheri Phillips
PCM3, Inc.
970 Brighton Court, 2nd Floor
San Dimas, California 91773

Subject: Campus Public Safety Building
Compton Community College
1111 East Artesia Boulevard
Compton, California 90221
United Heider Inspection Group Project No.: 10-17036PW

Reference: 1) Geotechnical Evaluation – Proposed Campus Police Station, prepared by GeoTek, Inc., dated October 24, 2016
2) Site Improvement Plans, prepared by Little Architects, dated October 21, 2016

Dear Ms. Phillips,

Our firm reviewed the above documents and visited the project site on two separate occasions to view the site of the proposed Campus Public Safety Building. The new building will be located at the NW corner of Delta Avenue and Artesia Boulevard located at the SE corner of the Compton Campus, as depicted on the attached drawing.

During these visits, an excavator was utilized to explore the soil conditions to a depth ranging from ten (10) to twelve (12) feet below the existing surface. These trench locations are depicted on the attached drawing, along with the boring locations performed by GeoTek, Inc. Trench T-1 was performed on December 30, 2016 and due to the constant rain, no testing of the soil was performed. Trenches T-2 & T-3 were performed on January 4, 2017 and density testing was performed at two elevations in each trench. Please refer to the findings in the table below.

Trench 1 –	0-4'	Light brown fine sandy SILT, slightly moist, little dense
	4' to 4.5'	Dark brown sandy SILT, trace organic material, slightly moist
	4.5' to 9.0'	Light brown fine sandy SILT slightly moist, little dense
	9.0' to 12'	Dark brown fine sandy SILT, some slight porosity
Trench 2 -	0-10'	Light brown fine sandy SILT, slightly moist, slightly dense
	At -4'	Dry density 82.5 pcf @ 6.1% moisture - Rel. compaction = 77%
	At -8'	Dry density 91.0 pcf @ 8.7% moisture - Rel. compaction = 85%
Trench 3 -	0-10'	Light brown fine sandy SILT, slightly moist, slightly dense
	At -6'	Dry density 93.0 pcf @ 6.4% moisture - Rel. compaction = 87%
	At -9.5'	Dry density 89.4 pcf @ 8.4% moisture - Rel. compaction = 83%

The encountered soil was tested in accordance with ASTM D 1557 and the following values were obtained.

Maximum Dry Density, pcf = 107.1 pcf
Optimum Moisture Content, % = 16.5 percent

Based upon our observations in the three trenches, we did not observe fills deeper than 4.5 feet from the ground surface. Our Trench T-3 was located in the approximate location where B-1 was performed for the GeoTek exploration. We accept the referenced Geotechnical Report prepared by GeoTek, Inc. and the recommendations contained within, with the exception of the encountered fill depth.

We recommend that the building site be overexcavated to a depth that will be the deeper of 4.5 feet below the existing grade or 3.0 feet below the deepest foundation, whichever is deeper. The overexcavation should extend laterally beyond the outer edge of the foundations to a width of 5 feet or the depth of overexcavation, whichever is wider. The bottom of the overexcavation should be scarified, moisture conditioned as necessary and compacted to a minimum relative compaction of 90%. The engineered fill should be placed in loose lifts, not exceeding 8" and compacted to a minimum relative compaction of 90%, with a moisture content between -2% to +2% of the optimum moisture content. Should undocumented fills be encountered during the overexcavation operations that extend deeper than the above recommended depth, then the fills should be removed until native alluvial soils are encountered. All other recommendations contained in the referenced GeoTek report should be followed.

If you have any questions, or need additional information, please contact us at your convenience.

Respectfully submitted,

UNITED-HEIDER INSPECTION GROUP

REGISTERED PROFESSIONAL ENGINEER
DENNIS W. HEIDER
C47379
EXP 12/31/2017
CIVIL
STATE OF CALIFORNIA

Dennis W. Heider, RCE
Principal Engineer

REGISTERED PROFESSIONAL ENGINEER
COREY T. DARE
No. 2613
Exp. 6-30-2018
GEOTECHNICAL
STATE OF CALIFORNIA

Corey T. Dare, PE, GE
Principal Geotechnical Engineer

Attachment: Drawing/Plans

UNITED-HEIDER
INSPECTION GROUP

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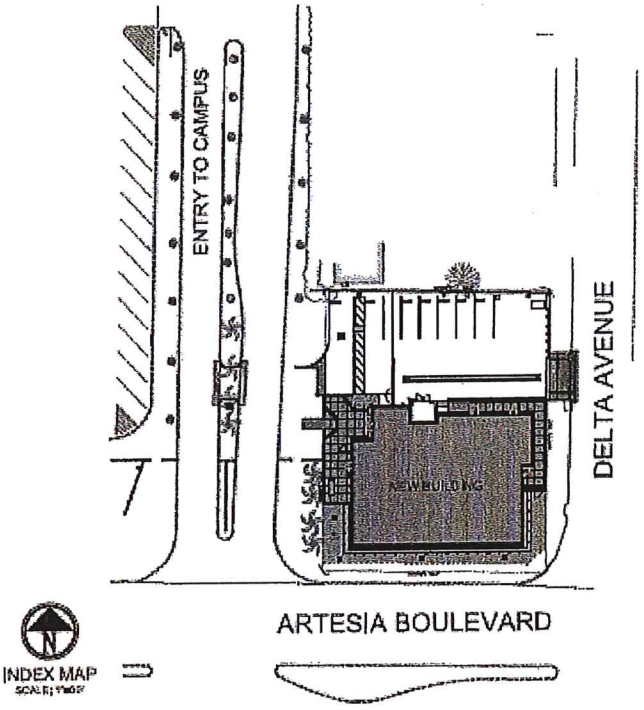
SITE IMPROVEMENT PLANS
FOR
COMPTON COMMUNITY COLLEGE
CAMPUS PUBLIC SAFETY BUILDING



22620 Goldencrest Drive, Suite 114 | Moreno Valley, California 92553 | P: 951.697.4777 | F: 951.697.4770
800 South Rochester Avenue, Suite A | Ontario, California 91761| P: 909.673.0292 | F: 909.673.0272
3050 Pullman Street | Costa Mesa, California 92626
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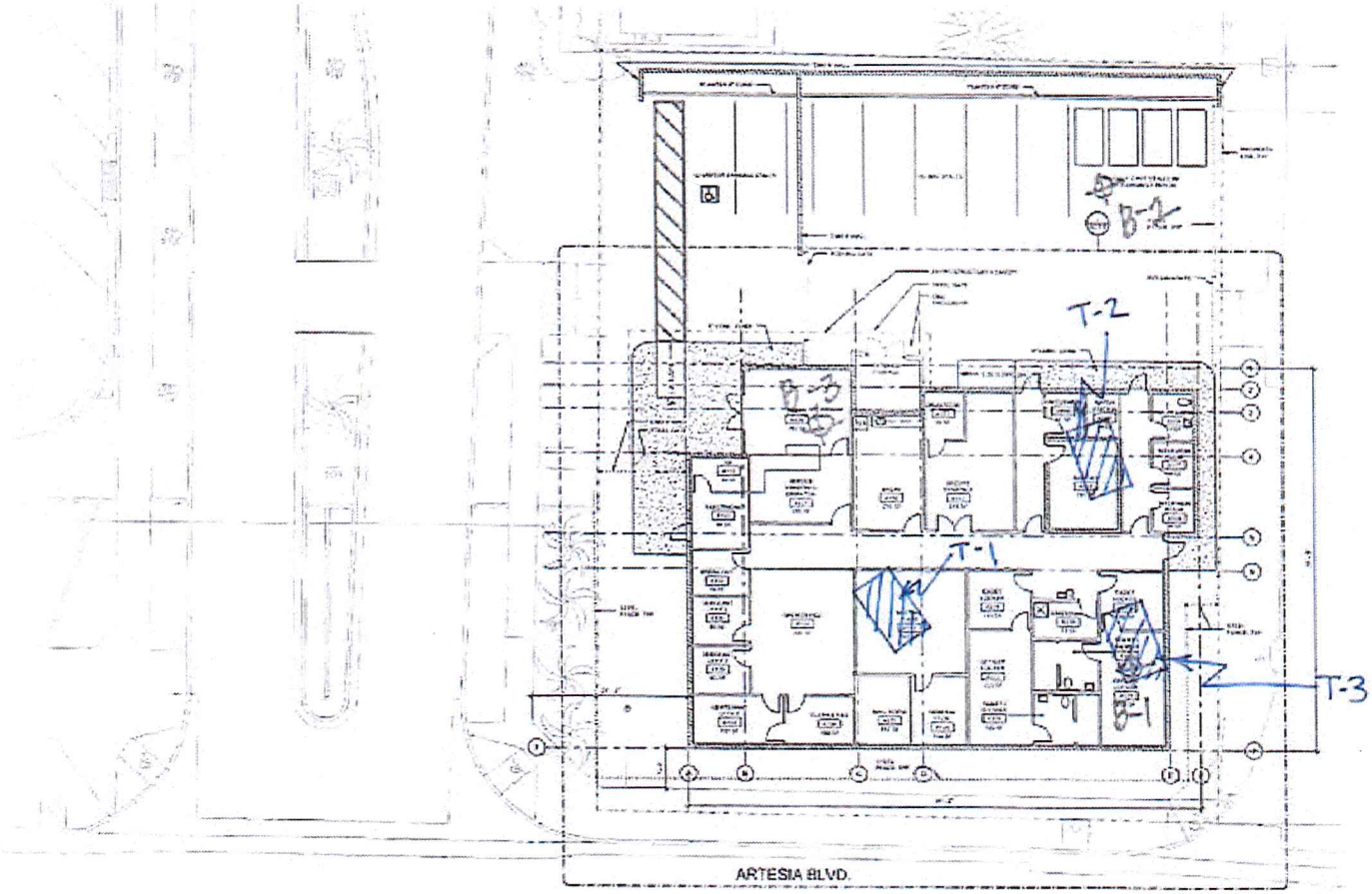
1529-CR



1 ENLARGED SITE PLAN V3

LITTLE

COMPTON CCD

COMPTON CAMPUS POLICE STATION - EXISTING SITE & BUILDING DEMOLITION

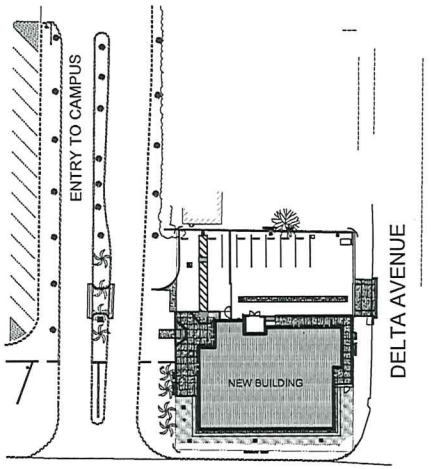
1111 EAST ARTESIA BOULEVARD, COMPTON CALIFORNIA 90221

SCHEMATIC - ENLARGED SITE PLAN

913-4675-00

A1.1.1

SITE IMPROVEMENT PLANS
FOR
COMPTON COMMUNITY COLLEGE
CAMPUS PUBLIC SAFETY BUILDING



INDEX MAP
SCALE: 1"=300'

GENERAL NOTES FOR GRADING

1. ALL WORK SHALL CONFORM WITH THE "GREENBOOK" STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION (SSPWC), LATEST EDITION AND THE LATEST REVISIONS THERETO, THE WORK AREA TRAFFIC CONTROL HANDBOOK (W.A.T.C.H. MANUAL), A.D.A. TITLE 24 REQUIREMENTS, AND THE 2013 C.B.C. UNLESS SPECIFIED OTHERWISE IN THE CONTRACT SPECIFICATIONS.
2. A COPY OF THE DIVISION OF STATE ARCHITECT APPROVED VERSION OF THESE PLANS MUST BE IN THE POSSESSION OF A RESPONSIBLE PERSON AND AVAILABLE AT THE JOB SITE AT ALL TIMES.
3. AT LEAST TWO (2) WORKING DAYS PRIOR TO COMMENCING CONSTRUCTION, THE CONTRACTOR SHALL CONTACT THE REGIONAL NOTIFICATION CENTER (UNDERGROUND SERVICE ALERT OF SOUTHERN CALIFORNIA – U.S.A. AT 811) TO OBTAIN AN INQUIRY IDENTIFICATION NUMBER AND TO REQUEST THE UTILITY OWNERS TO MARK OR OTHERWISE INDICATE THE LOCATION OF THEIR SUBSURFACE FACILITIES. THE CONTRACTOR SHALL DETERMINE THE LOCATION AND DEPTH OF ALL UTILITIES, INCLUDING ALL SERVICE CONNECTIONS, WHICH HAVE BEEN MARKED BY THE RESPECTIVE OWNERS AND WHICH MAY AFFECT OR BE AFFECTED BY ITS OPERATIONS. THE CONTRACTOR SHALL TAKE ALL NECESSARY MEASURES TO PROTECT ALL UTILITIES AND ALL STRUCTURES FOUND AT THE SITE.
4. THROUGHOUT ALL PHASES OF CONSTRUCTION, INCLUDING SUSPENSION OF WORK, UNTIL FINAL ACCEPTANCE OF THE PROJECT, THE CONTRACTOR SHALL KEEP THE WORK SITE CLEAN AND FREE FROM RUBBISH AND DEBRIS. THE CONTRACTOR SHALL ALSO ABATE DUST NUISANCE BY CLEANING, SWEEPING AND SPRINKLING WITH WATER AND USING DUST FENCES OR OTHER METHODS AS DIRECTED BY THE CONSTRUCTION MANAGER OR FIELD INSPECTOR THROUGHOUT THE CONSTRUCTION OPERATION.
5. KEEP A RECORD OF CHANGES THAT OCCUR DURING CONSTRUCTION AND SUBMIT THIS RECORD TO THE SCHOOL DISTRICT CERTIFIED AS "RECORD DRAWING" PLANS.
6. ALL DAMAGE CAUSED TO PUBLIC STREETS, INCLUDING HAUL ROUTES, ALLEYS, SIDEWALKS, CURBS OR STREET FURNISHINGS, OR TO PRIVATE PROPERTY SHALL BE REPAIRED AT THE SOLE EXPENSE OF THE CONTRACTOR TO THE PUBLIC WORKS INSPECTOR'S & THE PROJECT CIVIL ENGINEER'S SATISFACTION.
7. THE CONTRACTOR SHALL REMOVE AND REPLACE ANY BROKEN OR DAMAGED SIDEWALK, CURB, GUTTER OR ASPHALT PAVING CAUSED BY THEIR WORK AT THE DIRECTION OF THE OWNER AT NO ADDITIONAL COST TO THE OWNER.
8. TRIM TREE ROOTS AS NECESSARY TO CONSTRUCT PAVEMENT AND INSTALL HEADERS. TRIM ROOTS UNDER THE DIRECTION OF A CERTIFIED ARBORIST. THE DISTRICT OAR WILL NOTIFY THE DISTRICT GARDENING SUPERVISOR PRIOR TO TRIMMING ROOTS.
9. UPON MOBILIZATION THE CONTRACTOR SHALL POTHOLE AND EXPOSE THE EXISTING UTILITIES AT ALL CROSSINGS AND AT THE POINT OF TIE-IN; THEN CONTACT THE ENGINEER TO VERIFY THE ELEVATION OF THE EXISTING FACILITIES.
10. SURVEY MONUMENTS SHALL BE PRESERVED AND REFERENCED BEFORE CONSTRUCTION AND RE-PLACED AFTER CONSTRUCTION PURSUANT TO SECTION 2-9 OF THE STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION (SSPWC).
11. EITHER WATER OR DUST PALLIATIVE, OR BOTH, MUST BE APPLIED FOR THE ALLEVIATION OR PREVENTION OF EXCESSIVE DUST RESULTING FROM THE LOADING OR TRANSPORTATION OF EARTH FROM OR TO THE PROJECT SITE OR PRIVATE AND PUBLIC ROADWAYS.
12. CONSTRUCT STRAIGHT GRADES BETWEEN ELEVATIONS SHOWN ON PLAN UNLESS INTERRUPTED BY A GRADE CHANGE LINE. ANY DEVIATION FROM THE GRADING PLAN MUST HAVE PRIOR APPROVAL FROM THE ENGINEER.
13. ALL AREAS TO RECEIVE COMPACTED FILL SHALL BE INSPECTED AND APPROVED BY THE SOILS ENGINEER (AND ENGINEERING GEOLOGIST, WHERE EMPLOYED) AFTER REMOVAL OF UNSUITABLE MATERIAL AND EXCAVATION OF KEYWAYS AND BENCHES, AND PRIOR TO PLACEMENT OF SUBSURFACE DRAINAGE SYSTEMS OR ANY FILLS.
14. ALL SOILS OR ROCK MATERIALS DEEMED UNSUITABLE FOR PLACEMENT IN COMPACTED FILL SHALL BE REMOVED FROM THE SITE. ANY IMPORTED MATERIAL SHALL BE TESTED PER DISTRICT REQUIREMENTS AND APPROVED BY THE SCHOOL DISTRICT AND SOILS ENGINEER PRIOR TO USE IN COMPACTED FILL. BLOCKY MATERIAL SHALL BE BROKEN INTO SUITABLE PARTICLE SIZES, BEFORE BEING USED AS FILL IN CONFORMANCE THE PROJECT SOILS REPORT.
15. ALL TREE ROOTS, ABANDONED IRRIGATION LINES, UTILITY SERVICES, SEPTIC TANKS AND SIMILAR MATERIALS SHALL BE REMOVED FROM THE SITE AND VOIDS CREATED THEREBY SHALL BE PROPERLY FILLED AND COMPACTED AS DIRECTED BY THE GEOTECHNICAL ENGINEER WITHIN THE LIMITS OF ALL OVER-EXCAVATED AREAS.
16. ALL EXCAVATED BACK SLOPES AND KEYS FOR BUTTRESS FILLS MUST BE EXAMINED BY THE ENGINEERING GEOLOGIST AND SOILS ENGINEER TO INSURE ALL POTENTIAL PLANES OF FAILURE HAVE BEEN EXPOSED IN THE EXCAVATION AND WILL BE ADEQUATELY SUPPORTED BY THE PROPOSED BUTTRESS FILLS.
17. THE SOILS ENGINEER SHALL SUBMIT RECOMMENDATIONS FOR CORRECTIVE WORK TO INSURE SLOPE STABILITY WHERE UNSTABLE MATERIAL IS EXPOSED AT THE TOP OF CUTS. COORDINATE WITH ARCHITECT OF RECORD AND OWNERS REPRESENTATIVE.
18. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING STORM DAMAGE PREVENTION MEASURES OR EROSION CONTROL DEVICES AND/OR TO PERFORM CERTAIN GRADING TO PREVENT SOIL OR EXCESS RUNOFF FROM FLOWING INTO PUBLIC STREETS OR ADJACENT PROPERTIES. IN THE EVENT OF SUCH AN OCCURRENCE, CLEANUP SHALL COMMENCE IMMEDIATELY. SHOULD CITY FORCES OR THE CITY CONTRACTOR PERFORM ANY CLEANUP RESULTING FROM THIS DEVELOPMENT, THE CONTRACTOR SHALL PAY THE COST INCURRED WITHIN TEN (10) WORKING DAYS UPON RECEIPT OF BILLING.
19. THE CONTRACTOR OR HIS AGENT SHALL BE RESPONSIBLE FOR REMOVAL AND CLEANUP OF ANY SPILL ON PUBLIC STREETS DURING THE GRADING OPERATION, AS WELL AS REPAIR OF DAMAGE TO HAUL ROUTES AND EXISTING FACILITIES.
20. MAXIMUM SLOPES FOR BOTH CUT AND FILL SHALL BE 2:1.
21. NO OVERSIZE OR OVERWEIGHT LOADS ARE PERMITTED WITHOUT A SEPARATE MOVING PERMIT.
22. ALL EQUIPMENT USED TO HAUL EXCAVATION OR FILL MATERIAL FROM OR TO THE SITE SHALL FOLLOW A DESIGNATED ROUTE OR ROUTES IN GOING TO AND FROM THE SITE. THE CONTRACTOR SHALL BE ENTITLED TO THE DESIGNATION OF A ROUTE PROVIDING ACCESS TO A SPECIFIED PLACE OTHER THAN THE SITE, AFTER SHOWING TO THE SATISFACTION OF THE CITY BUILDING OFFICIAL THAT SUCH SPECIFIED PLACE IS A PLACE WHERE EXCAVATION MATERIAL MAY BE REASONABLY DEPOSITED OR FILL MATERIAL MAY BE OBTAINED. A SEPARATE ENCROACHMENT PERMIT IS REQUIRED WHEN IT IS NECESSARY TO FLAG TRAFFIC OR INSTALL ANY TRAFFIC CONTROL DEVICES NO CITY RIGHT-OF-WAY.
23. FINE GRADING TO BE NO LESS THAN THE FOLLOWING UNLESS STATED OTHERWISE ON THE PLANS:

	CROSS-SLOPE	LONGITUDINAL-SLOPE
PERVIOUS SURFACES	2.00%	1.00%
ASPHALT SURFACES	1.00%	1.00%
CONCRETE SURFACES	0.50%	0.50%

24. THE CONTRACTOR SHALL NOTIFY THE DSA INSPECTOR AND OWNERS REPRESENTATIVE AT LEAST 48 HOURS IN ADVANCE OF REQUIRED INSPECTIONS AT FOLLOWING STAGES OF THE WORK:

(A) INITIAL: WHEN THE SITE HAS BEEN CLEARED OF VEGETATION AND UNAPPROVED FILL AND IT HAS BEEN SCARIFIED, BENCHED OR OTHERWISE PREPARED FOR FILL. NO FILL SHALL HAVE BEEN PLACED PRIOR TO THIS INSPECTION.

(B) ROUGH: WHEN APPROPRIATE FINAL ELEVATIONS HAVE BEEN ESTABLISHED; DRAINAGE TERRACES, SWALES AND BERMS INSTALLED AT THE TOP OF THE SLOPES.

(C) FINAL: WHEN GRADING HAS BEEN COMPLETED; ALL DRAINAGE DEVICES INSTALLED; SLOPE PLANTING ESTABLISHED, IRRIGATION SYSTEMS INSTALLED AND THE RECORD PLANS, REQUIRED STATEMENTS, AND REPORTS HAVE BEEN SUBMITTED.

25. ANY EARTH ROCK, GRAVEL, SAND, STONE OR OTHER EXCAVATED MATERIAL DEPOSITED OR CAUSED TO ROLL, FLOW OR WASH UPON ANY PUBLIC PLACE OR PRIVATE PROPERTY SHALL BE REMOVED FROM SUCH PUBLIC PLACE OR PRIVATE PROPERTY AT THE END OF THE WORKDAY BY THE CONTRACTOR RESPONSIBLE FOR THE DEPOSITION. IF AN ADVERSE CONDITION IS CAUSED BY DEPOSIT, THE CONDITION SHALL BE CORRECTED IMMEDIATELY.
26. EVERY EFFORT SHOULD BE USED TO ELIMINATE THE DISCHARGE OF NON-STORMWATER FROM THE PROJECT SITE AT ALL TIMES.
27. ALL TRUCKS HAULING DIRT, SAND, OIL, OR OTHER LOOSE MATERIALS ON A HIGHWAY ARE TO BE COVERED OR SHOULD MAINTAIN AT LEAST TWO FEET OF FREEBOARD IN ACCORDANCE WITH THE REQUIREMENTS OF CALIFORNIA VEHICLE CODE SECTION 23114. (FREEBOARD MEANS VERTICAL SPACE BETWEEN THE TOP OF THE LOAD AND TOP OF THE TRAILER).
28. RAISE UTILITY BOXES TO ULTIMATE FINISH SURFACE IN SCOPE OF WORK AREAS.
29. CONTRACTOR SHALL HIRE A LICENSED SURVEYOR TO STAKE ALL CATCH BASINS, STORM DRAIN PIPE, SAW-CUT LINES, BUILDING PADS, FINISH FLOORS, SWALES AND GRADE BREAKS. TWO STAKES SHALL BE PROVIDED FOR ALL CATCH BASINS.
30. IN ORDER TO MITIGATE THE IMPACTS ON CULTURAL RESOURCES OR LANDSCAPING, IF CULTURAL MATERIAL SUGGESTIVE OF PREHISTORIC OR HISTORIC ORIGIN IS ENCOUNTERED, WORK IN THE VICINITY OF THE FIND SHALL BE STOPPED, AND THE OWNER SHALL BE NOTIFIED. GRADING, CONSTRUCTION OR LANDSCAPING SHALL NOT RESUME UNTIL THE FIND IS EVALUATED AND IT IS DETERMINED WHETHER THE MATERIAL IS ARCHAEOLOGICALLY SIGNIFICANT AND ADDITIONAL MITIGATION IS REQUIRED.
31. NO PERSON SHALL, WHEN HAULING ANY EARTH, SAND, GRAVEL, ROCK, STONE OR OTHER EXCAVATED MATERIAL OR DEBRIS OVER ANY PUBLIC STREET, ALLEY OR OTHER PUBLIC PLACE, ALLOW SUCH MATERIAL TO BLOW OR SPILL OVER UPON SUCH STREET, ALLEY OR PUBLIC PLACE OR ADJACENT PRIVATE PROPERTY OR ANY WATER BODIES, CREEKS OR STREAMS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE CLEANUP AND REMOVAL OF ANY CONSTRUCTION OR SOILS MATERIALS DEPOSITED ON THE PUBLIC RIGHT-OF-WAY, PUBLIC WATERS OR ADJACENT PRIVATE PROPERTY.

SHEET INDEX	
SHEET	DESIGNATION
C1.0	SITE IMPROVEMENT PLAN TITLE SHEET
C1.1	GRADING PLAN
C1.2	GRADING DETAIL SHEET
C1.3	GRADING DETAIL SHEET

FOR WORK WITHIN, OR NEAR, THE PUBLIC RIGHT-OF-WAY
Underground Service Alert
CALL: 811
TWO WORKING DAYS BEFORE YOU DIG

HORIZONTAL CONTROL

AN AUTOCAD GEOMETRIC ELECTRONIC FILE SHALL BE MADE AVAILABLE TO THE CONTRACTOR UPON REQUEST FOR THE CONTRACTOR'S SURVEYOR TO LAYOUT THE CONSTRUCTION STAKING OF THE PROJECT. THE SURVEYOR OR CONTRACTOR WILL NEED TO SIGN A WAIVER FORM BEFORE RELEASE OF ANY CAD ELECTRONIC DRAWINGS.

BENCH MARK INFORMATION:

ADD 0.08 FEET TO ELEVATION SHOWN HEREON TO EQUAL THE LOS ANGELES COUNTY DEPARTMENT OF PUBLIC WORKS 2005 ADJUSTMENT OF THE NORTH AMERICAN DATUM OF 1988 (NAVD88) PER THE FOLLOWING LOS ANGELES COUNTY BENCHMARKS:

GARDENA QUAD, 2005 ADJUSTMENT:

LA COUNTY DPW BM Y12223 2005 ADJ. ELEV. = 63.673' NAVD88 PER COUNTY ELEV.=63.39 PER THIS SURVEY (HDNGN & AERIAL MAP) L&DPW TAG IN EAST CURB 1FT. NORTH OF BEGINNING OF CURB RETURN AT NORTHEAST CORNER OF ALAMEDA STREET (EAST BARREL) AND GREENLEAF BLVD. LA COUNTY DPW BM Y12222 2005 ADJ. ELEV.=83.496' NAVD88 PER COUNTY ELEV.=83.42' PER THIS SURVEY (HDNGN & AERIAL MAP) L&DPW TAG IN EAST CURB 1 FT. SOUTH OF BEGINNING OF CURB RETURN AT SOUTHEAST CORNER ALAMEDA STREET (EAST BARREL) & GREENLEAF BLVD.

ANY USER OF ELEVATION AND/OR COORDINATES SHOWN HEREON FOR THE CONTROL OF CONSTRUCTION, SHALL VERIFY AT LEAST 3 POINTS SHOWN HEREON, FOR MATHEMATICAL CONSISTENCY PRIOR TO SUCH USE.

EXISTING UNDERGROUND STRUCTURES

THE LOCATIONS OF THE EXISTING UNDERGROUND UTILITIES, AS SHOWN ON THESE PLANS, WERE OBTAINED FROM SOURCES OF VARYING RELIABILITY. NO REPRESENTATION IS MADE AS TO THE ACCURACY OR COMPLETENESS OF SAID UTILITY INFORMATION. THE CONTRACTOR IS CAUTIONED THAT ONLY ACTUAL EXCAVATION WILL REVEAL THE LOCATIONS OF SUCH UNDERGROUND UTILITIES. CONTRACTOR ASSUMES ALL LIABILITY AND RESPONSIBILITY FOR THE UNDERGROUND UTILITY PIPES, CONDUITS, OR STRUCTURES SHOWN OR NOT SHOWN ON THESE PLANS. CONTRACTOR SHALL VERIFY LOCATIONS OF EXISTING UTILITIES PRIOR TO ANY EXCAVATION OR IMPROVEMENT. THE CONTRACTOR SHALL TAKE PRECAUTIONARY MEASURES TO PROTECT THE UTILITY LINES SHOWN TO BE PROTECTED HEREON AND ANY OTHER LINES NOT OF RECORD OR NOT SHOWN HEREON.

EARTHWORK NOTICE TO CONTRACTOR: NO EARTHWORK ANALYSIS HAS BEEN COMPLETED WITH RESPECT TO VOLUMES OF SOILS TO BE EXCAVATED, PLACED, OR IMPORTED IN ORDER TO PROVIDE THE FINISHED GRADES SHOWN ON THE PLANS. THE CONTRACTOR IS SOLELY RESPONSIBLE FOR VERIFYING THE EARTHWORK QUANTITIES NECESSARY TO COMPLETE THE PROJECT.

GENERAL NOTES TO CONTRACTOR

1. THE CONTRACTOR'S ATTENTION IS DIRECTED TO SECTION 7-10, PUBLIC CONVENIENCE AND SAFETY, OF THE STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION (GREENBOOK), IN REGARDS TO SAFETY ORDERS.
2. SCOPE OF WORK:
   A. FURNISH ALL LABOR, SUPERVISION, MATERIALS, EQUIPMENT & FACILITIES NECESSARY TO FURNISH, FABRICATE, DELIVER, STORE AND INSTALL ALL WORK NOTED ON THE DRAWINGS.
   B. THE CONTRACTOR SHALL FURNISH & INSTALL ALL WORK NECESSARY TO MAKE A COMPLETE SYSTEM WHETHER OR NOT SUCH DETAILS ARE MENTIONED IN THESE SPECIFICATIONS OR SHOWN ON THE PLANS, BUT WHICH ARE OBVIOUSLY NECESSARY TO MAKE A COMPLETE SYSTEM, EXCEPTING ONLY THOSE PORTIONS THAT ARE SPECIFICALLY MENTIONED HEREIN OR PLAINLY MARKED ON THE ACCOMPANYING DRAWINGS AS BEING INSTALLED UNDER ANOTHER SECTION OF THE SPECIFICATION.
3. IT SHALL BE THE CONTRACTORS RESPONSIBILITY TO VERIFY AVAILABLE SPACES FOR INSTALLING THE WORK.
4. COORDINATION: THE DRAWINGS ARE DIAGRAMMATIC & INTENDED TO SHOW SCOPE. CONTRACTOR SHALL COORDINATE HIS WORK WITH OTHER TRADES TO PROVIDE BEST ARRANGEMENT OF ALL DUCT, PIPES, CONDUIT, ETC.
5. WORKMANSHIP: THE WORK SHALL BE ACCOMPLISHED BY THE USE OF COMPETENT MECHANICS SKILLED IN THEIR TRADE. THE ENGINEER AND ARCHITECT SHALL HAVE THE RIGHT TO INTERPRET COMPLIANCE OF WORKMANSHIP WITH THE CONTRACT DOCUMENTS.
6. MATERIALS: ALL MATERIALS, APPLIANCES & EQUIPMENT SHALL BE NEW & THE BEST OF THEIR RESPECTIVE KIND, FREE FROM ALL DEFECTS AND OF THE MAKE, BRAND, AND QUANTITY SPECIFIED.
7. CLEAN-UP: UPON COMPLETION OF THE WORK UNDER THIS SECTION THE CONTRACTOR SHALL REMOVE ALL SURPLUS MATERIALS, EQUIPMENT & DEBRIS INCIDENTAL TO THIS WORK & LEAVE THE PREMISES CLEAN AND ORDERLY.

RECOMMENDATIONS AND CONCLUSIONS OF SOILS REPORT No. 1450-CR, DATED FEBRUARY 19, 2016 BY GEOTEK, INC. AND ADDENDUM DATED MARCH 1, 2016, SHALL BE THOROUGHLY COMPLIED WITH. WHERE CONFLICTING INFORMATION BETWEEN THIS GRADING PLAN AND/OR THE PROJECT EARTHWORK SPECIFICATIONS & THE MENTIONED REPORT OCCUR, NOTIFY THE OWNER.

GRADING PLANS, DRAINAGE IMPROVEMENTS, ROAD AND ACCESS REQUIREMENTS AND ENVIRONMENTAL HEALTH CONSIDERATIONS SHALL COMPLY WITH ALL LOCAL ORDINANCES.

LEGEND

POWER POLE	SIGN POST
SEWER MANHOLE	WIRE FENCE
STORM DRAIN MANHOLE	CHAIN LINK FENCE
TELEPHONE MANHOLE	BLOCK WALL
FIRE HYDRANT	TREE
SEWER CLEANOUT	
WATER VALVE	SURVEY MONUMENT
GAS VALVE	FLOW DIRECTION
WATER METER	EDGE OF PAVEMENT
GAS METER	FINISHED SURFACE
WATER VAULT	FINISHED FLOOR
GAS VAULT	FLOW LINE
TELEPHONE VAULT	CURB FACE
ELECTRIC VAULT	GRADE BREAK
WELL	HIGH POINT
ELECTRIC PULLBOX	INVERT
GUY WIRE	STORM DRAIN
LIGHT	DOMESTIC WATER
(58.00) EXISTING ELEVATION	SANITARY SEWER
58.00 PROPOSED ELEVATION	GAS
58 = EXISTING CONTOURS	ELECTRICAL/POWER
58 = PROPOSED CONTOUR	COMMUNICATIONS
DEPTH FROM SURFACE 1'-0"	DEPTHS SHOWN ARE APPROXIMATE. ESTIMATED DEPTHS ARE FROM THE GROUND SURFACE TO THE CENTER OF THE FACILITY, INVERT OF WASTE LINES, OR TO THE FACILITY TRACER WIRE. DEPTH ESTIMATES SHOULD BE USED WITH CAUTION AND MAY VARY ALONG THE LENGTH OF THE FACILITY.

ABBREVIATIONS

ABND	ABANDONED	L T & T	LEAD TACK AND TAG
AC	ASPHALT PAVEMENT	MH	MANHOLE
AP	ANGLE POINT	NG	NATURAL GROUND
BLDG	BUILDING	N.I.C.	NOT IN CONTRACT
BC	BEGINNING OF CURVE	P.C.C.	PORTLAND CEMENT CONCRETE
BW	BACK OF WALK	PL	PROPERTY LINE
CL	CENTERLINE	PIV	POST INDICATOR VALVE
CF	CURB FACE HEIGHT	PP	POWER POLE
CLF	CHAIN LINK FENCE	RCE	REGISTERED CIVIL ENGINEER
CONC	CONCRETE	RR	RAILROAD
DCV	DETECTOR CHECK VALVE	S	SLOPE
DESC	DESCRIBED	SDMH	STORM DRAIN MANHOLE
D/W	DRIVEWAY	SL	STREET LIGHT
DI	DROP INLET	SMH	SEWER MANHOLE
DS	DOWN SPOUT	S.P.P.W.C.	STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION (LATEST EDITION).
EP	EDGE OF PAVEMENT		
EC	END OF CURVE	S.S.P.W.C.	STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION (GREEN BOOK), LATEST EDITION
EX	EXISTING		
FDC	FIRE DEPARTMENT CONNECTION		
FH	FIRE HYDRANT	SW	SIDEWALK
FL	FLOWLINE	TC	TOP OF CURB
FS	FINISH SURFACE	TELE	TELEPHONE
GA	GUY ANCHOR	TG	TOP OF GRATE
GB	GRADE BREAK	TCO	TOP OF CLEANOUT
GP	GUARD POST	TS	TRAFFIC SIGN
GV	GAS VALVE	TW	TOP OF WALL
HB	HOSE BIBB	TYP.	TYPICAL
HP	HIGH POINT	UDG	UNDERGROUND CONDUIT
ICV	IRRIGATION CONTROL VALVE	UTIL	UTILITY
INV	INVERT	WM	WATER METER
IP	IRON PIPE	WV	WATER VALVE
L	LENGTH	W VLT	WATER VAULT
LIP	LIP OF GUTTER	VIF	VERIFY IN FIELD
LP	LIGHT POLE	VLT	VAULT

FLOOD ZONE INFORMATION

Per Flood Insurance Rate Map Number 06037C1815F, dated September 26, 2008, the flood zone for this area is ZONE X (SHADED). ZONE X (SHADED) is an area of 0.2% (500-year) annual chance flood; areas of 1% (100-year) annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile and areas protected by levees from a 1% (100-year) annual chance flood.

Date: July 12, 2016
To: Division of State Architect, DSA
From: David Dent, Chief Building Official
Re: Compton Community College Swing Space Project - Flood Zone

To whom it may concern,

Most of Compton has been identified to be in flood Zone X (Unshaded) or Zone X (Shaded). These areas have no base flood elevations and are protected from the base flood by a credited flood protection system. The City of Compton does not require new projects in these zones to be built with specific design considerations to protect them from a possible flood. The City of Compton does not require the finish floor of a building to be elevated above a base flood elevation in these zones. The City of Compton does not require special foundations (such as concrete versus wood) for new projects based on if they are in a Zone X (shaded) or Zone X (unshaded).

Sincerely,

David Dent
Chief Building Official

205 S. Willowbrook Avenue, Compton, CA 90220 * (310) 605-5509 * (310) 605-5598

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COMPTON CCD

COMPTON COLLEGE CAMPUS PUBLIC SAFETY BUILDING
1111 EAST ARTESIA BOULEVARD, COMPTON CALIFORNIA 90221

IDENTIFICATION STAMP
DIV. OF THE STATE ARCHITECT
OFFICE OF REGULATION SERVICES
FILE NO:
AP
AC ___ FLD ___ DS ___
DATE ___

FPL FPL and Associates, Inc.
Traffic-Transportation-CIVIL-CAD
10 Corporate Park, Suite 310
Irvine, CA 92606
Phone: 949-252-1668

No. C 34871
Exp. 06-30-17
CIVIL
STATE OF CALIFORNIA

PRINCIPAL IN CHARGE
RC
PROJECT MANAGER
RC
DRAWN BY
AL

NO	REASON	DATE

REGISTERED ARCHITECT
NO. C27097
REN.8-30-16
STATE OF CALIFORNIA

TITLE SHEET

100% CD SET

913-4675-00

10/21/16 | C1.0

SPT CAL

SPT HAMMER ENERGY MEASUREMENTS

Prepared by;

SPT CAL
5512 Belem Dr
Chino Hills, CA 91709

909-730-2161
bc@sptcal.com

2R Drilling, Inc.
3968 Chino Ave.
Chino, CA 91710
909-465-1765

Project Title: 2R Drilling Rig 8 2016
Project Description: Ontario

Rig 8

Energy Transfer Ratio = 84.1 @ 55.2 blows per minute

Testing was performed on May 19, 2016 in Ontario, California

Hammer Energy Measurements performed in accordance to ASTM D4633 using an approved and calibrated SPT Analyzer from Pile Dynamics, Inc.

Depth	ETR%	BPM
30	84.3	54,9
35	83.9	55.3
40	84.7	55.1
45	83.7	54.8
50	83.9	55.4
	84.1	55.2

Thank you very much. It was a pleasure to work with you and your drill crews.

Sincerely yours,

Brian Serl
Calibration Engineer
SPTCAL.COM

PRESENTATION OF SPT ANALYZER TEST DATA

1. Introduction

This report presents the results of SPT Hammer Energy Measurements recorded with an SPT Analyzer from Pile Dynamics carried out on May 19, 2016 in Ontario, California

2. Field Equipment and Procedures

The drill used is referred to at 2R Drilling as Rig 8. A CME 750. It has an attached Landa Auto Hammer which has the same specifications as a CME Auto Hammer.

The Landa Auto Hammer uses a 140 lb. weight dropped 30" on to an anvil above the bore hole. AWJ drill rod connects the anvil to a split spoon type soil sampler inside an 8" o.d. hollow stem auger at the designated sample depth. After a seeding blow the sampler is driven 18". The number of blows required to penetrate the last 12" is referred to as the "N value", which is related to soil strength.

The first recording was taken at 30' below ground surface and then every 5' to final recording at 50'.

3. Instrumentation

An SPT Analyzer from Pile Dynamics was used to record and the process the data. The raw data was stored directly in the SPT Analyzer computer with subsequent analysis in the office with PDA-W and PDIPlot software. The measurements and analysis were conducted in general accordance with ASTM D4945 and ASTM D6066 test standards.

The SPT Analyzer is fully compliant with the minimum digital sampling frequency requirements of ASTM D4633-05 (50 kHz) and EN ISO 22476-3:2005 (100 kHz), as well as with the low pass filter, (cutoff frequency of 5000 Hz instead of 3000 Hz) requirements of ASTM D4633-05. All equipment and analysis also conform to ASTM D6066.

A 2' instrumented section of AWJ rod, with two sets of accelerometers and strain transducers mounted on opposite sides of the drill rod, was placed below the anvil. It measured strain and acceleration of every hammer blow. The SPT Analyzer then calculates the amount of energy transferred to the rod by force and velocity measurements.

4. Observations

The drill rig motor is diesel fueled. The throttle control is electronically controlled. The 55.2 blows per minute average were very consistent for every blow. The drill and sample equipment was brand new and is probably the cause of such high energy efficiency rates.

5. Results

Results from the SPT Hammer Energy Measurements are summarized below. It shows the Energy Transfer Ratio (ETR) at each sampling depth. ETR is the ratio of the measured maximum transferred energy to rated energy of the hammer which is the product of the weight of the hammer times the height of the fall. 140 lb x 30" = 4200 lb-in = 0.350 kip-ft.

Depth	ETR%	BPM
30	84.3	54,9
35	83.9	55.3
40	84.7	55.1
45	83.7	54.8
50	83.9	55.4
	84.1	55.2

If you have any questions please do not hesitate to call or email.

Thank you,

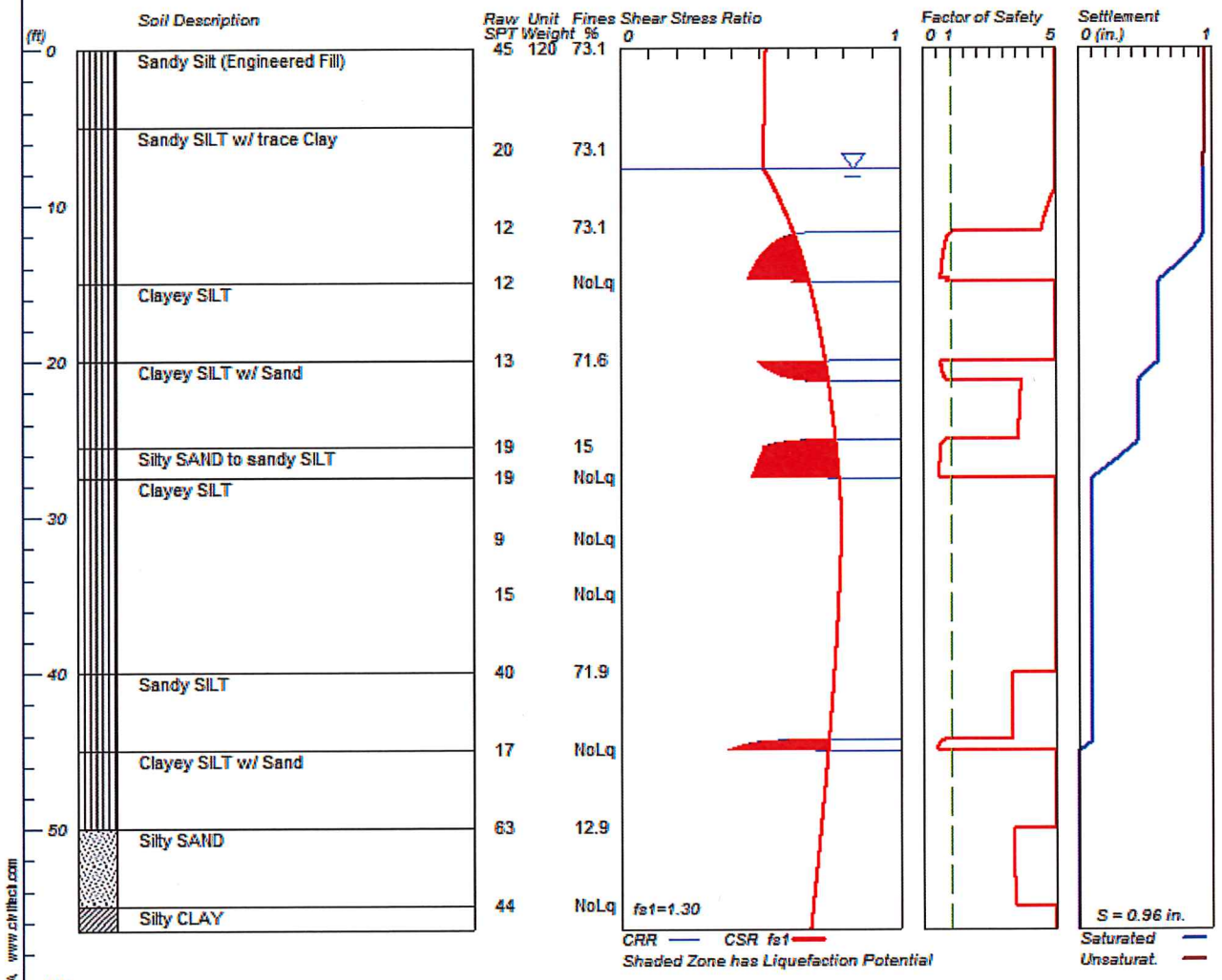
Brian Serl
Calibration Engineer
SPT CAL
909-730-2161
bc@sptcal.com

LIQUEFACTION ANALYSIS

Campus Police Station

Hole No.=B-1 Water Depth=7.7 ft

Magnitude=6.6
Acceleration=.62g



Geosphere Consultants, Inc.
AN ESI COMPANY

Plate A-1

****

LIQUEFACTION ANALYSIS CALCULATION SHEET

www.civiltech.com
(425) 453-6488 Fax (425) 453-5848

****

Licensed to , 3/30/2017 4:30:43 PM

Input File Name: C:\Users\alim\Desktop\Liquefy\Compton - Campus Police Station B1 @ 7.7.liq
Title: Campus Police Station
Subtitle:

Surface Elev.=
Hole No.=B-1
Depth of Hole= 56.5 ft
Water Table during Earthquake= 7.7 ft
Water Table during In-Situ Testing= 50.5 ft
Max. Acceleration= 0.62 g
Earthquake Magnitude= 6.6

Input Data:

Surface Elev.=
Hole No.=B-1
Depth of Hole=56.5 ft
Water Table during Earthquake= 7.7 ft
Water Table during In-Situ Testing= 50.5 ft
Max. Acceleration=0.62 g
Earthquake Magnitude=6.6

1. SPT or BPT Calculation.
2. Settlement Analysis Method: Ishihara / Yoshimine*
3. Fines Correction for Liquefaction: Idriss/Seed (SPT only)
4. Fine Correction for Settlement: During Liquefaction*
5. Settlement Calculation in: All zones*
6. Hammer Energy Ratio, Ce = 1.25
7. Borehole Diameter, Cb= 1.15
8. Sampling Method, Cs= 1.2
9. User request factor of safety (apply to CSR) , User= 1.3
   Plot one CSR curve (fs1=User)
10. Use Curve Smoothing: Yes*

* Recommended Options

In-Situ Test Data:

Depth ft	SPT	gamma pcf	Fines %
0.0	45.0	120.0	73.1
6.5	20.0	120.0	73.1

11.5	12.0	120.0	73.1
15.0	12.0	120.0	NoLiq
20.0	13.0	120.0	71.6
25.5	19.0	120.0	15.0
27.5	19.0	120.0	NoLiq
31.5	9.0	120.0	NoLiq
35.0	15.0	120.0	NoLiq
40.0	40.0	120.0	71.9
45.0	17.0	120.0	NoLiq
50.0	63.0	120.0	12.9
55.0	44.0	120.0	NoLiq

Output Results:

Settlement of Saturated Sands=0.94 in.
Settlement of Unsaturated Sands=0.02 in.
Total Settlement of Saturated and Unsaturated Sands=0.96 in.
Differential Settlement=0.479 to 0.633 in.

Depth ft	CRRm	CSRsf	F.S.	S_sat. in.	S_dry in.	S_all in.
0.00	2.77	0.52	5.00	0.94	0.02	0.96
0.50	2.77	0.52	5.00	0.94	0.02	0.96
1.00	2.77	0.52	5.00	0.94	0.02	0.96
1.50	2.77	0.52	5.00	0.94	0.02	0.96
2.00	2.77	0.52	5.00	0.94	0.02	0.96
2.50	2.77	0.52	5.00	0.94	0.01	0.96
3.00	2.77	0.52	5.00	0.94	0.01	0.96
3.50	2.77	0.52	5.00	0.94	0.01	0.95
4.00	2.77	0.52	5.00	0.94	0.01	0.95
4.50	2.77	0.52	5.00	0.94	0.01	0.95
5.00	2.77	0.52	5.00	0.94	0.01	0.95
5.50	2.77	0.52	5.00	0.94	0.01	0.95
6.00	2.77	0.52	5.00	0.94	0.01	0.95
6.50	2.77	0.52	5.00	0.94	0.01	0.95
7.00	2.77	0.52	5.00	0.94	0.00	0.95
7.50	2.77	0.51	5.00	0.94	0.00	0.94
8.00	2.77	0.52	5.00	0.94	0.00	0.94
8.50	2.77	0.54	5.00	0.94	0.00	0.94
9.00	2.77	0.55	5.00	0.94	0.00	0.94
9.50	2.77	0.57	4.88	0.94	0.00	0.94
10.00	2.77	0.58	4.77	0.94	0.00	0.94
10.50	2.77	0.59	4.67	0.94	0.00	0.94
11.00	2.77	0.60	4.59	0.94	0.00	0.94
11.50	2.77	0.62	4.50	0.94	0.00	0.94
12.00	0.61	0.63	0.97*	0.93	0.00	0.93
12.50	0.54	0.64	0.86*	0.89	0.00	0.89
13.00	0.51	0.64	0.80*	0.85	0.00	0.85
13.50	0.49	0.65	0.76*	0.79	0.00	0.79
14.00	0.48	0.66	0.72*	0.73	0.00	0.73
14.50	0.46	0.67	0.69*	0.66	0.00	0.66

15.00	2.00	0.68	5.00	0.60	0.00	0.60
15.50	2.00	0.68	5.00	0.60	0.00	0.60
16.00	2.00	0.69	5.00	0.60	0.00	0.60
16.50	2.00	0.70	5.00	0.60	0.00	0.60
17.00	2.00	0.70	5.00	0.60	0.00	0.60
17.50	2.00	0.71	5.00	0.60	0.00	0.60
18.00	2.00	0.71	5.00	0.60	0.00	0.60
18.50	2.00	0.72	5.00	0.60	0.00	0.60
19.00	2.00	0.72	5.00	0.60	0.00	0.60
19.50	2.00	0.73	5.00	0.60	0.00	0.60
20.00	2.00	0.73	5.00	0.60	0.00	0.60
20.50	0.52	0.74	0.71*	0.54	0.00	0.54
21.00	0.57	0.74	0.77*	0.48	0.00	0.48
21.50	2.77	0.75	3.71	0.45	0.00	0.45
22.00	2.77	0.75	3.69	0.45	0.00	0.45
22.50	2.77	0.75	3.68	0.45	0.00	0.45
23.00	2.77	0.76	3.66	0.45	0.00	0.45
23.50	2.77	0.76	3.64	0.45	0.00	0.45
24.00	2.77	0.76	3.63	0.45	0.00	0.45
24.50	2.77	0.77	3.61	0.45	0.00	0.45
25.00	2.77	0.77	3.60	0.45	0.00	0.45
25.50	0.51	0.77	0.66*	0.41	0.00	0.41
26.00	0.50	0.78	0.65*	0.34	0.00	0.34
26.50	0.49	0.78	0.63*	0.27	0.00	0.27
27.00	0.48	0.78	0.61*	0.19	0.00	0.19
27.50	0.47	0.78	0.60*	0.11	0.00	0.11
28.00	2.00	0.79	5.00	0.10	0.00	0.10
28.50	2.00	0.79	5.00	0.10	0.00	0.10
29.00	2.00	0.79	5.00	0.10	0.00	0.10
29.50	2.00	0.79	5.00	0.10	0.00	0.10
30.00	2.00	0.79	5.00	0.10	0.00	0.10
30.50	2.00	0.79	5.00	0.10	0.00	0.10
31.00	2.00	0.79	5.00	0.10	0.00	0.10
31.50	2.00	0.79	5.00	0.10	0.00	0.10
32.00	2.00	0.79	5.00	0.10	0.00	0.10
32.50	2.00	0.79	5.00	0.10	0.00	0.10
33.00	2.00	0.79	5.00	0.10	0.00	0.10
33.50	2.00	0.79	5.00	0.10	0.00	0.10
34.00	2.00	0.79	5.00	0.10	0.00	0.10
34.50	2.00	0.79	5.00	0.10	0.00	0.10
35.00	2.00	0.78	5.00	0.10	0.00	0.10
35.50	2.00	0.78	5.00	0.10	0.00	0.10
36.00	2.00	0.78	5.00	0.10	0.00	0.10
36.50	2.00	0.78	5.00	0.10	0.00	0.10
37.00	2.00	0.78	5.00	0.10	0.00	0.10
37.50	2.00	0.78	5.00	0.10	0.00	0.10
38.00	2.00	0.77	5.00	0.10	0.00	0.10
38.50	2.00	0.77	5.00	0.10	0.00	0.10
39.00	2.00	0.77	5.00	0.10	0.00	0.10
39.50	2.00	0.77	5.00	0.10	0.00	0.10
40.00	2.00	0.77	5.00	0.10	0.00	0.10
40.50	2.56	0.76	3.35	0.10	0.00	0.10

41.00	2.55	0.76	3.35	0.10	0.00	0.10
41.50	2.54	0.76	3.35	0.10	0.00	0.10
42.00	2.54	0.76	3.35	0.10	0.00	0.10
42.50	2.53	0.76	3.35	0.10	0.00	0.10
43.00	2.52	0.75	3.35	0.10	0.00	0.10
43.50	2.52	0.75	3.35	0.10	0.00	0.10
44.00	2.51	0.75	3.35	0.10	0.00	0.10
44.50	0.50	0.75	0.67*	0.09	0.00	0.09
45.00	0.38	0.74	0.52*	0.01	0.00	0.01
45.50	2.00	0.74	5.00	0.00	0.00	0.00
46.00	2.00	0.74	5.00	0.00	0.00	0.00
46.50	2.00	0.74	5.00	0.00	0.00	0.00
47.00	2.00	0.73	5.00	0.00	0.00	0.00
47.50	2.00	0.73	5.00	0.00	0.00	0.00
48.00	2.00	0.73	5.00	0.00	0.00	0.00
48.50	2.00	0.73	5.00	0.00	0.00	0.00
49.00	2.00	0.72	5.00	0.00	0.00	0.00
49.50	2.00	0.72	5.00	0.00	0.00	0.00
50.00	2.00	0.72	5.00	0.00	0.00	0.00
50.50	2.43	0.71	3.40	0.00	0.00	0.00
51.00	2.42	0.71	3.40	0.00	0.00	0.00
51.50	2.42	0.71	3.41	0.00	0.00	0.00
52.00	2.42	0.71	3.42	0.00	0.00	0.00
52.50	2.42	0.70	3.43	0.00	0.00	0.00
53.00	2.41	0.70	3.44	0.00	0.00	0.00
53.50	2.41	0.70	3.45	0.00	0.00	0.00
54.00	2.41	0.69	3.47	0.00	0.00	0.00
54.50	2.40	0.69	3.48	0.00	0.00	0.00
55.00	2.40	0.69	3.49	0.00	0.00	0.00
55.50	2.00	0.69	5.00	0.00	0.00	0.00
56.00	2.00	0.68	5.00	0.00	0.00	0.00
56.50	2.00	0.68	5.00	0.00	0.00	0.00

---

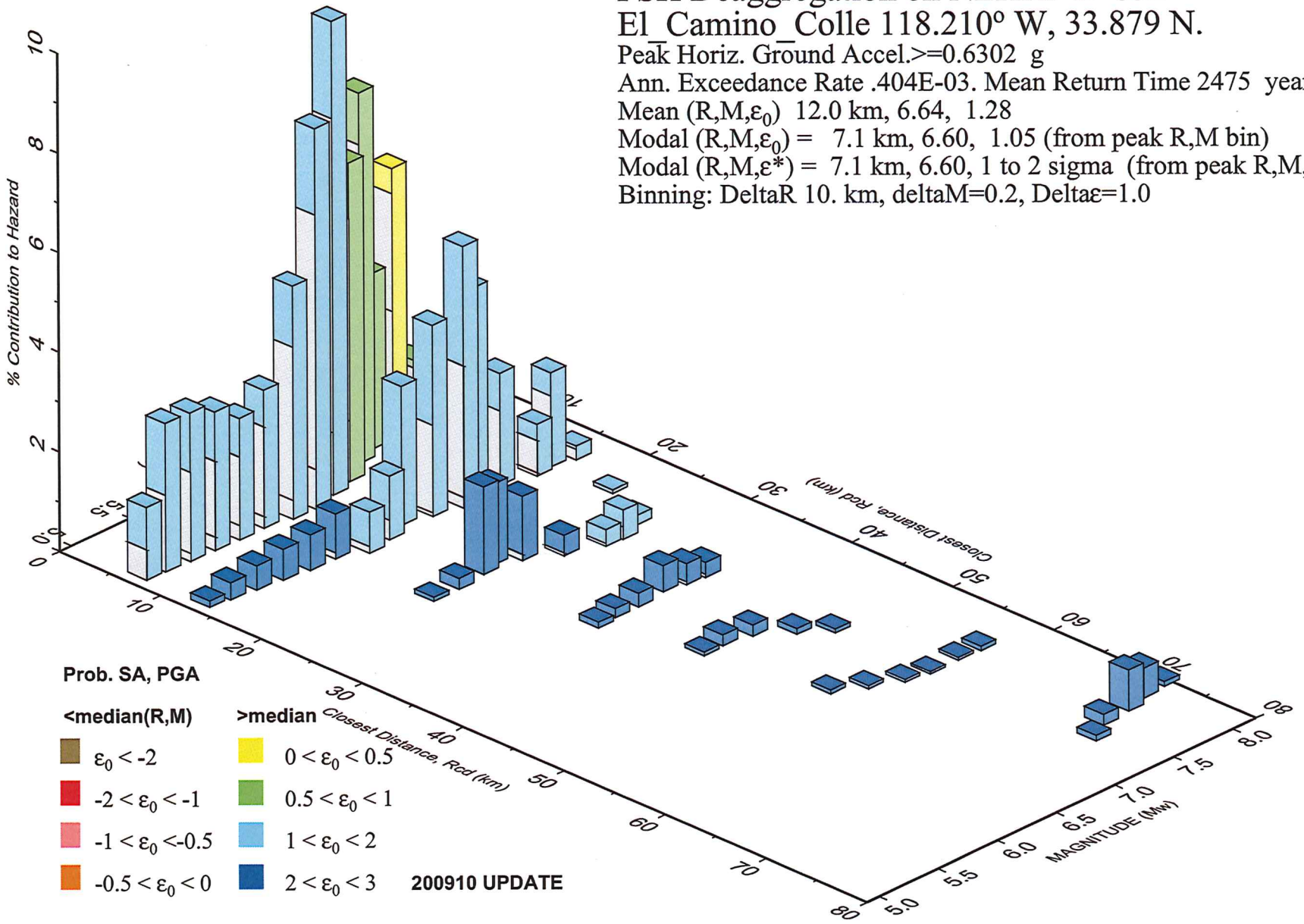
* F.S.<1, Liquefaction Potential Zone
(F.S. is limited to 5, CRR is limited to 2, CSR is limited to 2)

Units Depth = ft, Stress or Pressure = tsf (atm), Unit Weight = pcf, Settlement = in.

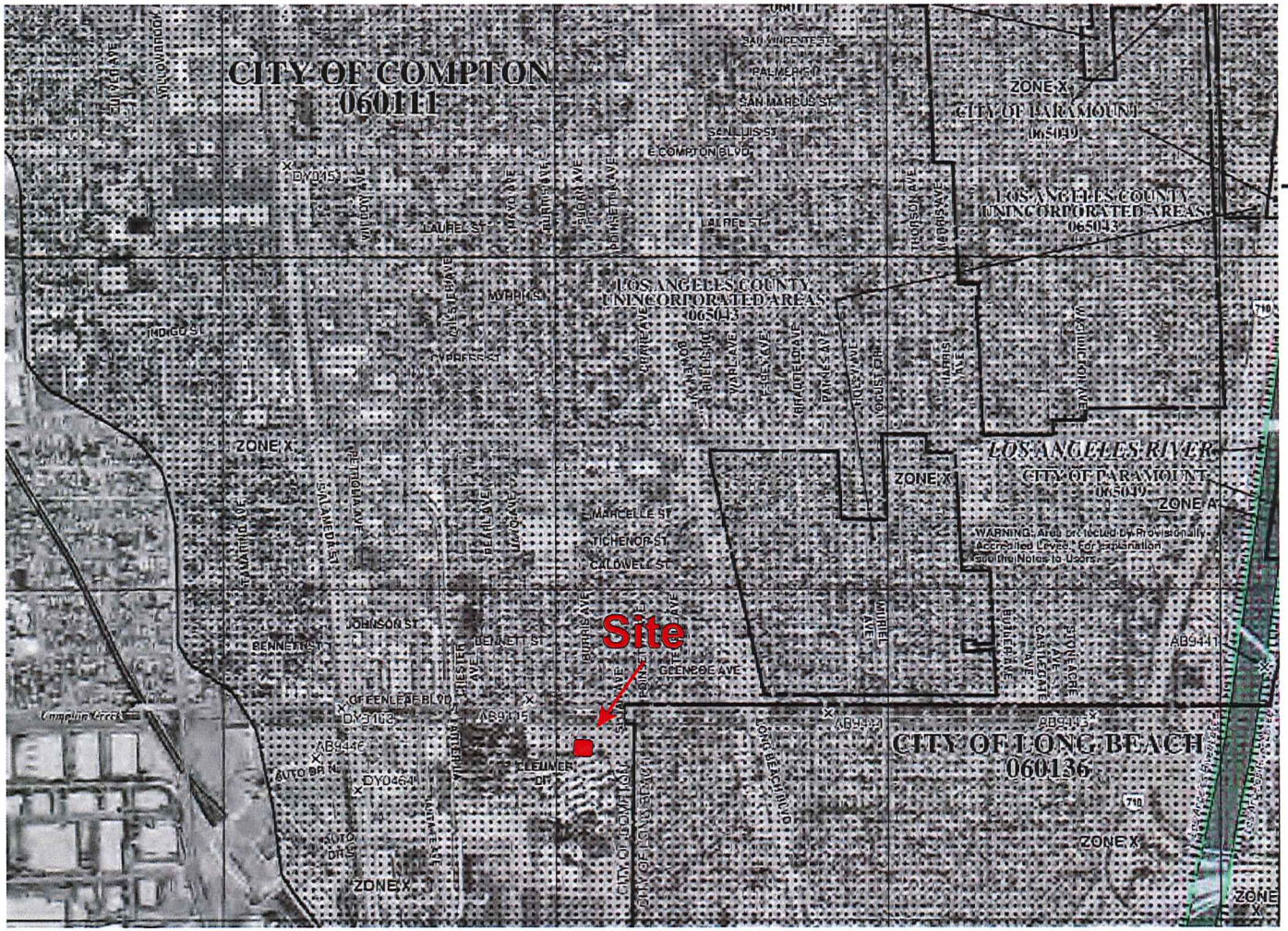
CRRm	Cyclic resistance ratio from soils
CSRsf	Cyclic stress ratio induced by a given earthquake (with user request factor of safety)
F.S.	Factor of Safety against liquefaction, F.S.=CRRm/CSRsf
S_sat	Settlement from saturated sands
S_dry	Settlement from Unsaturated Sands
S_all	Total Settlement from Saturated and Unsaturated Sands
NoLiq	No-Liquefy Soils

PSH Deaggregation on NEHRP D soil
El_Camino_Colle 118.210° W, 33.879 N.

Peak Horiz. Ground Accel.>=0.6302 g
Ann. Exceedance Rate .404E-03. Mean Return Time 2475 years
Mean (R,M,ε_0) 12.0 km, 6.64, 1.28
Modal (R,M,ε_0) = 7.1 km, 6.60, 1.05 (from peak R,M bin)
Modal (R,M,ε^*) = 7.1 km, 6.60, 1 to 2 sigma (from peak R,M,ε bin)
Binning: DeltaR 10. km, deltaM=0.2, Deltaε=1.0



GMT 2015 Nov 17 00:44:12 Distance (R), magnitude (M), epsilon (E0,E) deaggregation for a site on soil with average vs= 260. m/s top 30 m. USGS CGHT PSHA2008 UPDATE Bins with lt 0.05% contrib. omitted



For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 1000'

500 0 1000 2000 FEET

300 0 300 600 METERS

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 1815F

FIRM

FLOOD INSURANCE RATE MAP

LOS ANGELES COUNTY, CALIFORNIA

AND INCORPORATED AREAS

PANEL 1815 OF 2350

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
LOS ANGELES COUNTY	065043	1815	F
CARSON, CITY OF	060107	1815	F
COMPTON, CITY OF	060111	1815	F
LONG BEACH, CITY OF	060136	1815	F
LOS ANGELES, CITY OF	060137	1815	F
LYNWOOD, CITY OF	060535	1815	F
PARAMOUNT, CITY OF	065049	1815	F
SOUTH GATE, CITY OF	060163	1815	F

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
06037C1815F

EFFECTIVE DATE
SEPTEMBER 26, 2008

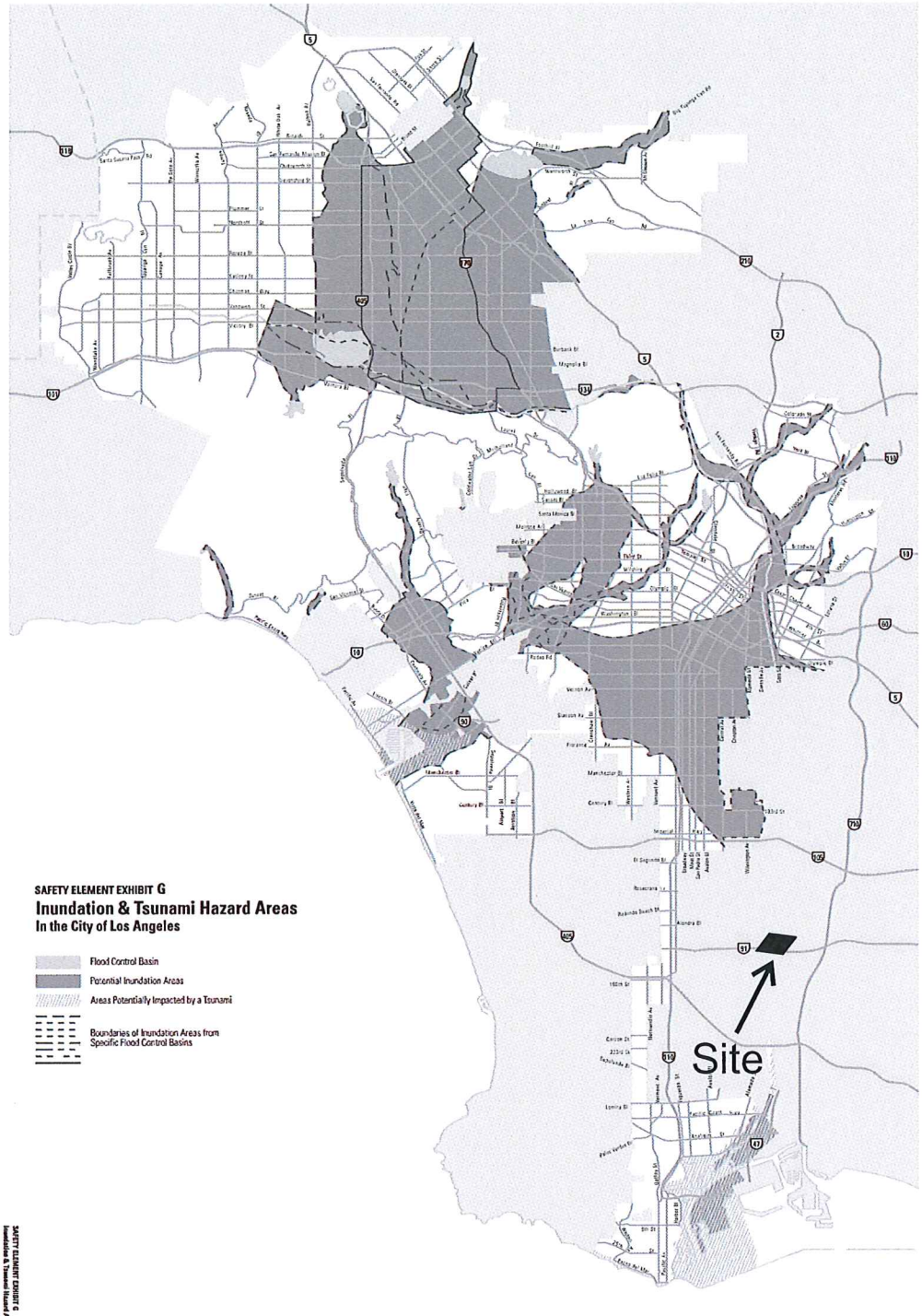
Federal Emergency Management Agency

Zone X (dot) - Other Flood Areas: Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

Zone X (blank) - Other Areas: Areas determined to be outside the 0.2% annual chance floodplain.

Zone A - No base flood elevation determined.

Compton Center - Public Safety Building 1111 E. Artesia Blvd Compton, California	United-Heider #10-17036-PW	March 2017
UNITED-HEIDER INSPECTION GROUP	Flood Hazard Map	Figure 6



Compton Center - Public Safety Buildling 1111 E. Artesia Blvd, Compton, California	United-Heider # 10-17036-PW	March 2017
UNITED-HEIDER INSPECTION GROUP An ETS Company	Inundation and Tsunami Hazard Map	Figure 7

Heider Invoicing Summary

Heider	Purchase Order and Invoice #	Swing Space Phase 2	Public Safety Bldg.	Little Theater	Invoice	Date of Invoice	Sent to District	Warrant Number	Amount Paid	Date of Warrant
	FO No. 2017-09	**$ 7,700.00**								
	FO No. 2017-19		**$ 15,000.00**							
	FO No. 2017-03									
Compaction Testing		$ 2,190.00			12876	7/28/17	8/30/17			
		$ 1,492.50								
Engineering Services				$ 750.00	12939	8/2/17				
Engineering Services			$ 1,725.00		13015	8/10/17	12/11/17			
Engineering Services			$ 6,000.00		13086	8/17/17	12/11/17			
Engineering Services			$ 3,500.00		14191	10/31/17				
Total Invoiced:		$ 3,682.50	$ 11,225.00							
Balance Left		**$ 4,017.50**	**$ 3,775.00**						**$ -**	

2nd review

State of California • Natural Resources Agency
Department of Conservation
California Geological Survey
801 K Street • MS 12-31
Sacramento, CA 95814
(916) 324-7324 • FAX (916) 445-3334

Edmund G. Brown Jr., *Governor*
John G. Parrish, Ph.D., *State Geologist*

2017 MAY 11 AM 12: 55

Mr. Steven Haigler
Interim Chief Business Officer
Compton Community College District
1111 East Artesia Boulevard
Compton, CA 90221

May 1, 2017

Subject: **Second Engineering Geology and Seismology Review for Compton Community College – Public Safety Building**
1111 East Artesia Boulevard, Compton, CA 90221
CGS Application No. 03-CGS2617

Dear Mr. Haigler:

In accordance with your request and transmittal of additional documents, the California Geological Survey performed a second review of the engineering geology and seismology aspects of the consulting reports prepared for Compton College in Compton. The response reports reviewed herein were prepared by United-Heider Inspection Group, who has reportedly assumed the role of "Geotechnical Engineer of Record" for the project in place of GeoTek, Inc. However, United-Heider has **not stated they are assuming the role of "Engineering Geologist of Record".** This review was performed in accordance with Title 24, California Code of Regulations, 2013 California Building Code (CBC) and followed CGS Note 48 guidelines. We reviewed the following response reports, which we received via email on April 17, 2017, as a reply to our request for additional information:

Response to CGS January 30, 2017 Review Letter, Compton Community College – Public Safety Building, 1111 East Artesia Boulevard, Compton, California 90221: United-Heider Inspection Group, 22620 Goldencrest Drive, Suite 114, Moreno Valley, CA 92553; company Project No. 10-17036PW, report dated April 5, 2017, 6 pages, 7 attachments, *including the following supplemental letter report*:

Campus Public Safety Building, Compton Community College, 1111 East Artesia Boulevard, Compton, California 90221: United-Heider Inspection Group, 22620 Goldencrest Drive, Suite 114, Moreno Valley, CA 92553; company Project No. 10-17036PW, report dated January 27, 2017, 2 pages, 3 attachments.

CGS previously reviewed the following report:

Geotechnical Evaluation for Proposed Campus Police Station, El Camino College Compton Center, Northwest Corner of Artesia Boulevard and Delta Avenue, City of Compton, Los Angeles County, California: GeoTek, Inc., 710 East Parkridge Avenue,

Suite 105, Corona, CA 92879; company Project No. 1529-CR, report dated October 24, 2016, 22 pages, 5 figures, 4 appendices.

CGS previously reviewed and submitted our findings regarding this project in our review letter dated January 30, 2017.

Site Characterization

GeoTek previously interpreted the presence of up to 15 ft (at B-1) of undocumented fill capping the site based on boring data. United-Heider provides descriptions of 3 new trenches reportedly excavated to depths of 10 to 12 ft to reassess the shallow soil conditions at the proposed building site. United-Heider reports that fills deeper than 4.5 feet were not observed in these trenches (one of which was reportedly located at boring B-1); however, fill material is not distinguished from native alluvial soils in the trench descriptions provided. CGS notes that GeoTek documented glass and debris in a sample collected between depths of 5 and 6.5 ft in their boring B-1, which suggests the presence of local undocumented fill to at least this depth.

Liquefaction and Seismic Settlement

United-Heider provides an updated liquefaction analysis based on data from GeoTek's boring B-1 and several revised input parameters. The earthquake magnitude was reduced from 7.5 to 6.6, which appears reasonable based on the deaggregation provided. The sampler correction factor was increased from 1.0 to 1.2, which presumes the SPT samplers used by GeoTek, Inc. could accept liners but were unlined. The borehole diameter correction factor was also increased from 1.0 to 1.15, which is consistent with an 8-inch diameter boring; however, CGS notes the boring was drilled with hollow-stem-augers and the borehole correction factor should represent the **inner diameter** of the hollow stem per Section 5.4.3 of the SCEC Guidelines for Implementation of SP 117. CGS also notes the "curve smoothing" function was again selected in the analysis. As noted in our original review letter, this function assumes uniform gradual transitions between discrete samples depths, which does not appear applicable for the abrupt transition expected between the fill and the alluvium. The higher blow counts recorded at 5 to 6.5 (and possibly the immediately underlying sample) in B-1 are apparently representative of the undocumented fill cap with respect to lower blow counts in the underlying native alluvial soils. Similar conditions are also apparent in boring B-3. *The consultant should provide revised liquefaction and seismic settlement analyses considering an appropriate borehole diameter correction factor. The consultant should justify the use of the "curve smoothing" function with respect to the fill/alluvium contact or ignore this option in the revised analyses. The consultant should verify with GeoTek, Inc. that the SPT samplers they used for B-1 had space for a liner but were unlined. The consultant should also provide a summary table showing adjusted blow counts at depth for each correction factor, including the fines correction factor, for review. The consultant should provide updated recommendations for differential settlement, as needed, based on the updated analyses.*

The consultant also provides an assessment of potential loss of bearing strength and surface manifestations based on the procedures of Ishihara (1985). *The consultant should provide an updated assessment based on the results of the revised analyses requested above and resulting depth and thickness of liquefiable materials.* CGS notes the procedures of Ishihara (1985) are an appropriate basis for assessing the potential for surface manifestations, but are **not adequate to assess potential loss of bearing capacity** with respect to a given building load. *Instead, the*

consultants should evaluate the bearing capacity of the soils considering the residual strength of the soil at depth in its liquefied state (see Section 1803A.5.12 of the 2013 CBC and Section 11.8.3 of ASCE 7-10).

Flooding and Dam Inundation

- **Flooding:** The consultant reports the site is within Zone X, defined as flood-hazard areas that are within the area of the 0.2% annual chance floodplain, or areas of one-percent annual chance flood with average depths of less than one foot or with drainage areas of less than one square mile.

- **Dam Inundation:** The consultant reports the site does not appear to be subject to inundation from dam failure and provides an inundation hazard map for the City of Los Angeles. However, CGS notes this hazard map does not appear to address the Compton College area, which is not in the City of Los Angeles. Review of the dam inundation map issued in the 1990 Los Angeles County Safety Element suggests the **site may be within a potential dam inundation area**. *The consultant should re-evaluate the potential for dam inundation to occur at the site.*

In conclusion, ***the engineering geology and seismology hazards at this site are not adequately addressed by the consultant.*** Details of the requested information are summarized in the Comments portion of this review letter. The consultant is reminded that one copy of all supplemental documents should be submitted directly to CGS and should include the CGS application number. If you have any further questions about this review letter, please contact the reviewer at (213) 239-0885.

Respectfully submitted

Brian J. Swanson
Engineering Geologist
PG 6494, CEG 2055

Concur:

Jennifer Thornburg
Senior Engineering Geologist
PG 5476, CEG 2240

Copies to:

Edward H. LaMont, *Certified Engineering Geologist*
GeoTek, Inc., 710 East Parkridge Avenue, Suite 105, Corona, CA 92879-1097

Corey T. Dare, *Registered Geotechnical Engineer*
United-Heider Inspection Group, 22620 Goldencrest Drive, Suite 114, Moreno Valley, CA 92553

Shoji Takeshima, *Architect*
Little Diversified Architectural Consulting, Inc., 1300 Dove Street, Suite 100, Newport Beach, CA 92660

Ted Beckwith, *Senior Structural Engineer*
Division of State Architect, 700 North Alameda Street, Suite 5-500, Los Angeles, CA 90012

UNITED-HEIDER
INSPECTION GROUP
An ETS Company

June 2, 2017

CGS Application No. 03-CGS2617

California Geological Survey
School Review Unit, 801 K Street, MS 12-31
Sacramento, California 95814

Attention: Mr. Brian J. Swanson, CEG

Subject: **Response to Second CGS Review Letter**
Compton Community College – Public Safety Building
1111 East Artesia Boulevard, Compton, California 90221
United-Heider Project# 10-17036PW

Project Reference Documents:

1) Response to CGS January 30, 2017 Review Letter, Compton Community College - Public Safety Building, 1111 East Artesia Boulevard, Compton, California 90221: United-Heider Inspection Group, 22620 Goldencrest Drive, Suite 114, Moreno Valley, California 92553; Company Project No. 10-17036PW, report dated April 5, 2017.

2) Supplemental Letter, Campus Public Safety Building, Compton Community College, 1111 East Artesia Boulevard, Compton, California 90221; prepared by United Heider Inspection Group, Project No. 10-17036PW, letter dated January 27, 2017.

3) Geotechnical Evaluation for Proposed Campus Police Station El Camino College Compton Center, Northwest Corner of Artesia Boulevard and Delta Avenue, City of Compton, Los Angeles County, California 90221, prepared by Geotek, Inc., 710 E. Park Ridge Avenue, Suite 105, Corona, California 92879; report dated October 24, 2016.

Dear Mr. Swanson:

In response to the California Geological Survey (CGS) second Engineering Geology and Seismology Review Comments and CGS' request for additional information regarding the geological considerations concerning grading, undocumented fill, seismic settlement, and dam inundation, **United-Heider Inspection Group (United-Heider)** is providing the following responses and clarifications to CGS' concerns associated with this project based on our phone conversation and email correspondences recently.

Also, in response to CGS' comment concerning the Certified Engineering Geologist (CEG) responsible charge of the project, United-Heider is hereby assuming both roles of "Geotechnical Engineer-of-Record" and "Engineering Geologist-of-Record" for this project.

***Site Characterization*:**

United-Heider Response:

As recommended in our previous Response Letter to CGS Review Comments, the building site would be overexcavated to a depth of a minimum of 4.5 feet below the existing grade, or 3.0 feet below the deepest foundation, whichever is deeper. Should undocumented fills be encountered during the overexcavation operations that extend deeper than the above recommended depth, then these fills would be removed until competent native alluvial soils are encountered.

***Liquefaction and Seismic Settlement*:**

United-Heider Response:

As requested, and per discussion with you on the phone as well as via email correspondence, we re-reviewed the liquefaction analysis which was performed using reconstructed data interpreted from the original Geotek report, as well as other pertinent parameters that were originally assumed in the calculations. As indicated on the CGS comments letter, we further revised some of the analysis input parameters based on additional collection of data and per your advice. It was reasonable to use a sampler correction factor as 1.0 instead of 1.2 where the Standard Penetration Test (SPT) sampler was used, based on actual equipment used by Geotek's drilling subcontractor. A borehole correction factor of 1.0 was used as per SP 117 guidelines for inner diameter of the hollow stem auger. As a result, for our revised analyses, we used hammer energy ratio factor (C_E) 1.25, borehole diameter (C_b) factor 1.0, sampling method (C_s) factor 1.0, and a factor-of-safety for liquefaction of 1.3.

Based on a Peak Ground Acceleration (PGA) of 0.62g, Moment Magnitude (M) of 6.6M, and other parameters as indicated above, we performed liquefaction analyses on Borings B-1 & B-3 using the Liquefy-Pro V5.5b computer program developed by CivilTech Software. Detailed analysis results are attached with this letter, and a summary of results is presented in the table below.

Boring #	Analysis Options	Settlement (Inches)		
	Curve Smoothing	Dry	Saturated	Total
B-1	Yes	0.018	0.833	0.85
	No	0.018	0.976	0.99
B-3	Yes	0.046	0.666	0.71
	No	0.016	0.433	0.45

The results of our liquefaction settlement analyses indicated that a total potential maximum settlement of approximately 1 inch could occur at or near the location of Boring B-1, and a total potential maximum settlement of approximately ¾ inch could occur at or near Boring B-3. A maximum average potential differential settlement on the order of ½ inch is anticipated at the project site, assuming all the worse scenarios considered in our analyses occurred concurrently.

We also re-evaluated potential loss of bearing strength/surface manifestation due to liquefaction. Using an analysis based on recommendations provided by Ishihara (1985) for stratified soils, an identified uppermost non-liquefiable soil layer (H_1) 11 feet in thickness over a liquefiable layer (H_2) 5 feet in thickness (16.0-11.0 = 5.0 ft.), the ratio of non-liquefiable to potential liquefiable layer is 2.5, in our opinion providing an adequate capping layer, indicating that a potential for significant surface manifestation and loss of bearing capacity is unlikely. For our detailed thickness analysis, please refer to the graphical liquefaction analysis results attached.

For the construction of the proposed building, over excavation and backfill with an engineered soil replacing the upper 4 to 5 feet of interpreted, undocumented subgrade soil should be adequate. However, if any additional soft or undocumented fill materials are encountered at the design over-excavation elevation, we will direct such materials be over-excavated/removed, and replaced with engineered fill. Due to this thicker upper engineered fill layer with no potential for significant surface manifestation of liquefied soil underneath, we conclude that our foundation recommendations for the project remain appropriate, and should accommodate the estimated total and differential liquefaction settlements without significantly affecting the structural integrity of the new building, provided the structure is properly designed for a total settlement of 1 inch and differential settlement of at least one half of the calculated total settlement within a span of 40 feet.

Dam Inundation: As suggested on second review comments, we re-evaluated the project site for location within a potential dam inundation zone. A review of the "City of Compton (City) Safety Element Draft Compton General Plan 2030" indicates that although the site is technically not within the City limits, the Compton CC campus adjoins and is located directly downstream of a City-identified dam inundation zone, as shown on attached *Figure 7a, Seismic and Flood Hazards Map*.

Per the City Safety Element, three dams, consisting of the Whittier Narrows Dam (11 miles upstream from Compton), the Hansen Dam (30 miles upstream from Compton), and the Sepulveda Dam (29 miles upstream from Compton) could cause flooding in the mapped inundation area if a dam failure occurred. Failure of the Hansen

Dam and the Sepulveda Dam would cause flooding within 11 to 12 hours with an inundation depth of about one foot at or near project site. However these dams are owned, controlled, and maintained by U.S Army Corps of Engineers and comply with the requirements of the State Division of Safety of Dams. Therefore, the potential for failure or overtopping of these engineered dams is expected to be low. However, a general public safety plan should be in place in case of flood emergency.

An in-depth engineering evaluation of the flooding potential of the site is beyond the scope of this study or our expertise, and a flood specialist should be contacted if a more in-depth flooding analysis is desired.

We trust that this letter provides the information needed at this time. Should you or members of the review team have questions or need additional information, please contact us at (951) 697-4777.

Sincerely,
UNITED-HEIDER INSPECTION GROUP

Raghubar Shrestha, Ph.D., P.E.
Senior Engineer

Corey T. Dare, P.E., G.E.
Principal Geotechnical Engineer

REGISTERED PROFESSIONAL ENGINEER
COREY T. DARE
No. 2013
Exp. 6-30-2018
GEOTECHNICAL
STATE OF CALIFORNIA

Michael I. Bracher, CEG 1048
Certified Engineering Geologist

PROFESSIONAL GEOLOGIST
MICHAEL I. BRACHER
NO. EG 1048
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

Dennis Heider, PE
Principal Engineer

Attachments:
- Second CGS Review Comments Letter, dated May 1, 2017
- Revised Liquefaction Analysis Results
- Figure 7 - Revised Dam Inundation Map

Distribution: PDF to Addressee; Brian.Swanson@conservation.ca.gov
PDF to Ted Beckwith, DSA, 700 North Alameda Street, Suite 5-500, Los Angeles, California 90012 (Ted.Beckwith@dgs.ca.gov)
PDF to Shoji Takeshima, Architect, Little Diversified Architectural Consulting, Inc., 1300 Dove Street, Suite 100, Newport Beach, California 92660; (shoji.takeshima@littleonline.com)
PDF to Felipe R. Lopez, CCCD, 1111 East Artesia Boulevard, Compton, California 90221 (flopez@elcamino.edu)

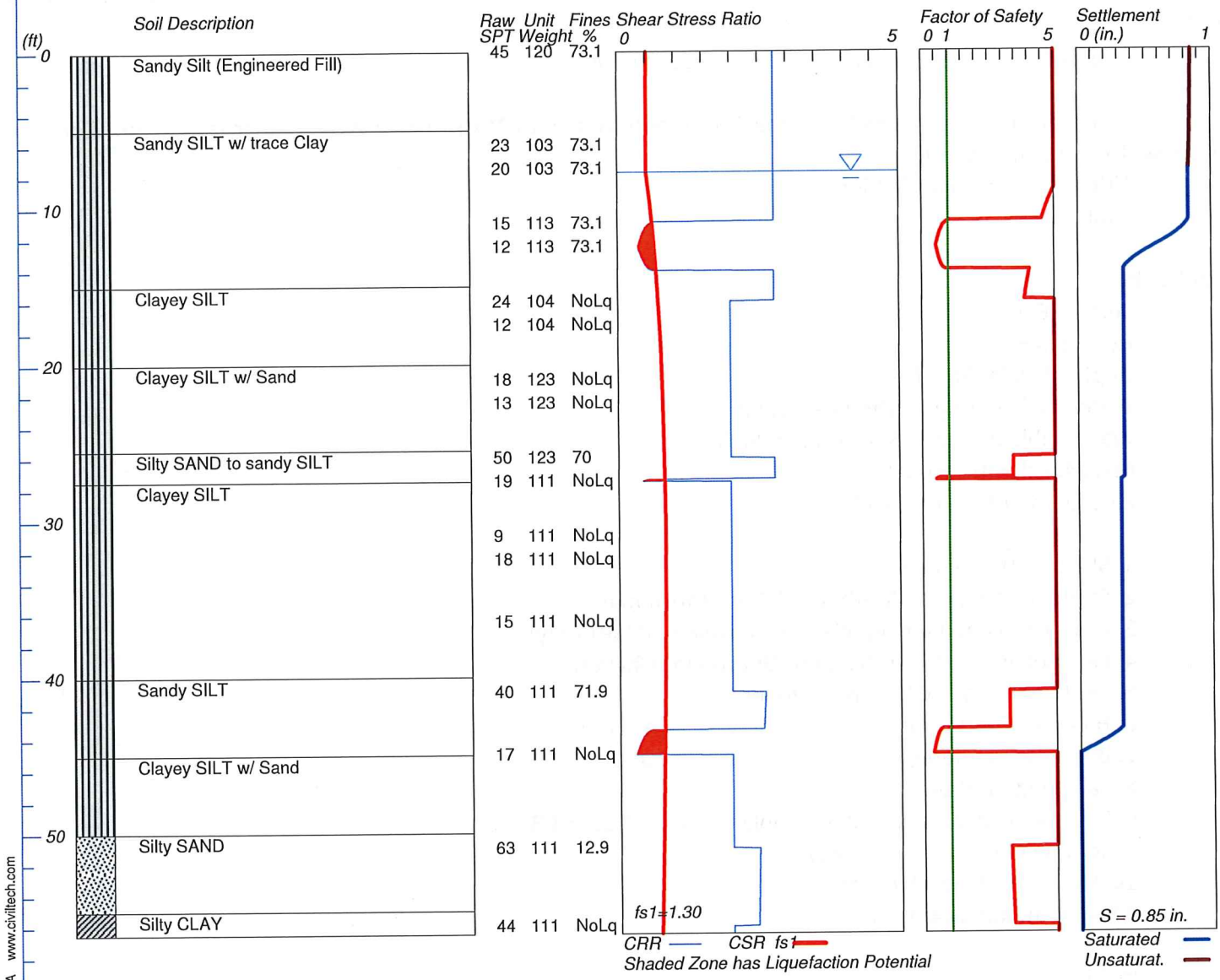
RS/CTD/MIB/DH:pmf

LIQUEFACTION ANALYSIS

Campus Police Station

Hole No.=B-1 Water Depth=7.7 ft Surface Elev.=54

Magnitude=6.6
Acceleration=0.62g



LiquefyPro CivilTech Software USA www.civiltech.com

****

LIQUEFACTION ANALYSIS CALCULATION SHEET

www.civiltech.com
(425) 453-6488 Fax (425) 453-5848

****

Licensed to , 5/17/2017 4:05:20 PM

Input File Name: C:\Users\rshrestha\Documents\Geo-3-15-16\GEO\Proj-2017\Heider-United Proj\Compton Police\Revised with MC & SPT.liq

Title: Campus Police Station

Subtitle:

Input Data:

Surface Elev.=54
Hole No.=B-1
Depth of Hole=56.5 ft
Water Table during Earthquake= 7.7 ft
Water Table during In-Situ Testing= 50.5 ft
Max. Acceleration=0.62 g
Earthquake Magnitude=6.6

1. SPT or BPT Calculation.
2. Settlement Analysis Method: Ishihara / Yoshimine*
3. Fines Correction for Liquefaction: Idriss/Seed (SPT only)
4. Fine Correction for Settlement: During Liquefaction*
5. Settlement Calculation in: All zones*
6. Hammer Energy Ratio, Ce = 1.25
7. Borehole Diameter, Cb= 1
8. Sampling Method, Cs= 1
9. User request factor of safety (apply to CSR) , User= 1.3
   Plot one CSR curve (fs1=User)
10. Use Curve Smoothing: Yes*

* Recommended Options

In-Situ Test Data:

Depth ft	SPT	Gamma pcf	Fines %
0.0	45.0	120.0	73.1
6.0	23.0	103.0	73.1
7.5	20.0	103.0	73.1
11.0	15.0	113.0	73.1
12.5	12.0	113.0	73.1
16.0	24.0	104.0	NoLiq
17.5	12.0	104.0	NoLiq
21.0	18.0	123.0	NoLiq
22.5	13.0	123.0	NoLiq

26.0	50.0	123.0	70.0
27.5	19.0	111.0	NoLiq
31.0	9.0	111.0	NoLiq
32.5	18.0	111.0	NoLiq
36.5	15.0	111.0	NoLiq
41.0	40.0	111.0	71.9
45.0	17.0	111.0	NoLiq
51.0	63.0	111.0	12.9
56.0	44.0	111.0	NoLiq

Output Results:

Calculation segment, dz=0.050 ft
User defined Print Interval, dp=0.50 ft

CSR Calculation:

Depth ft	gamma pcf	sigma tsf	gamma' pcf	sigma' tsf	rd	CSR	x fs1	=CSRfs
0.00	120.0	0.000	120.0	0.000	1.00	0.40	1.3	0.52
0.50	118.6	0.030	118.6	0.030	1.00	0.40	1.3	0.52
1.00	117.2	0.059	117.2	0.059	1.00	0.40	1.3	0.52
1.50	115.8	0.088	115.8	0.088	1.00	0.40	1.3	0.52
2.00	114.3	0.117	114.3	0.117	1.00	0.40	1.3	0.52
2.50	112.9	0.146	112.9	0.146	0.99	0.40	1.3	0.52
3.00	111.5	0.174	111.5	0.174	0.99	0.40	1.3	0.52
3.50	110.1	0.201	110.1	0.201	0.99	0.40	1.3	0.52
4.00	108.7	0.229	108.7	0.229	0.99	0.40	1.3	0.52
4.50	107.3	0.256	107.3	0.256	0.99	0.40	1.3	0.52
5.00	105.8	0.282	105.8	0.282	0.99	0.40	1.3	0.52
5.50	104.4	0.309	104.4	0.309	0.99	0.40	1.3	0.52
6.00	103.0	0.335	103.0	0.335	0.99	0.40	1.3	0.52
6.50	103.0	0.360	103.0	0.360	0.98	0.40	1.3	0.52
7.00	103.0	0.386	103.0	0.386	0.98	0.40	1.3	0.52
7.50	103.0	0.412	103.0	0.412	0.98	0.40	1.3	0.51
8.00	104.4	0.438	42.0	0.429	0.98	0.40	1.3	0.53
8.50	105.9	0.464	43.5	0.439	0.98	0.42	1.3	0.54
9.00	107.3	0.491	44.9	0.450	0.98	0.43	1.3	0.56
9.50	108.7	0.518	46.3	0.462	0.98	0.44	1.3	0.57
10.00	110.1	0.545	47.7	0.473	0.98	0.45	1.3	0.59
10.50	111.6	0.573	49.2	0.485	0.98	0.46	1.3	0.60
11.00	113.0	0.601	50.6	0.498	0.97	0.47	1.3	0.62
11.50	113.0	0.629	50.6	0.511	0.97	0.48	1.3	0.63
12.00	113.0	0.657	50.6	0.523	0.97	0.49	1.3	0.64
12.50	113.0	0.686	50.6	0.536	0.97	0.50	1.3	0.65
13.00	111.7	0.714	49.3	0.548	0.97	0.51	1.3	0.66
13.50	110.4	0.741	48.0	0.561	0.97	0.52	1.3	0.67
14.00	109.1	0.769	46.7	0.572	0.97	0.52	1.3	0.68
14.50	107.9	0.796	45.5	0.584	0.97	0.53	1.3	0.69
15.00	106.6	0.823	44.2	0.595	0.97	0.54	1.3	0.70
15.50	105.3	0.849	42.9	0.606	0.96	0.54	1.3	0.71

16.00	104.0	0.876	41.6	0.617	0.96	0.55	1.3	0.72
16.50	104.0	0.902	41.6	0.627	0.96	0.56	1.3	0.72
17.00	104.0	0.928	41.6	0.637	0.96	0.56	1.3	0.73
17.50	104.0	0.954	41.6	0.648	0.96	0.57	1.3	0.74
18.00	106.7	0.980	44.3	0.659	0.96	0.57	1.3	0.75
18.50	109.4	1.007	47.0	0.670	0.96	0.58	1.3	0.75
19.00	112.1	1.035	49.7	0.682	0.96	0.58	1.3	0.76
19.50	114.9	1.063	52.5	0.695	0.95	0.59	1.3	0.77
20.00	117.6	1.092	55.2	0.708	0.95	0.59	1.3	0.77
20.50	120.3	1.122	57.9	0.722	0.95	0.60	1.3	0.77
21.00	123.0	1.152	60.6	0.737	0.95	0.60	1.3	0.78
21.50	123.0	1.183	60.6	0.752	0.95	0.60	1.3	0.78
22.00	123.0	1.213	60.6	0.767	0.95	0.60	1.3	0.79
22.50	123.0	1.244	60.6	0.782	0.95	0.61	1.3	0.79
23.00	123.0	1.275	60.6	0.798	0.95	0.61	1.3	0.79
23.50	123.0	1.306	60.6	0.813	0.95	0.61	1.3	0.80
24.00	123.0	1.336	60.6	0.828	0.94	0.61	1.3	0.80
24.50	123.0	1.367	60.6	0.843	0.94	0.62	1.3	0.80
25.00	123.0	1.398	60.6	0.858	0.94	0.62	1.3	0.80
25.50	123.0	1.429	60.6	0.873	0.94	0.62	1.3	0.81
26.00	123.0	1.459	60.6	0.889	0.94	0.62	1.3	0.81
26.50	119.0	1.490	56.6	0.903	0.94	0.62	1.3	0.81
27.00	115.0	1.519	52.6	0.917	0.94	0.63	1.3	0.81
27.50	111.0	1.547	48.6	0.930	0.94	0.63	1.3	0.82
28.00	111.0	1.575	48.6	0.942	0.93	0.63	1.3	0.82
28.50	111.0	1.603	48.6	0.954	0.93	0.63	1.3	0.82
29.00	111.0	1.631	48.6	0.966	0.93	0.63	1.3	0.82
29.50	111.0	1.658	48.6	0.978	0.93	0.64	1.3	0.83
30.00	111.0	1.686	48.6	0.990	0.93	0.64	1.3	0.83
30.50	111.0	1.714	48.6	1.003	0.93	0.64	1.3	0.83
31.00	111.0	1.742	48.6	1.015	0.92	0.64	1.3	0.83
31.50	111.0	1.769	48.6	1.027	0.92	0.64	1.3	0.83
32.00	111.0	1.797	48.6	1.039	0.91	0.64	1.3	0.83
32.50	111.0	1.825	48.6	1.051	0.91	0.64	1.3	0.83
33.00	111.0	1.853	48.6	1.063	0.91	0.64	1.3	0.83
33.50	111.0	1.880	48.6	1.075	0.90	0.64	1.3	0.83
34.00	111.0	1.908	48.6	1.088	0.90	0.63	1.3	0.82
34.50	111.0	1.936	48.6	1.100	0.89	0.63	1.3	0.82
35.00	111.0	1.964	48.6	1.112	0.89	0.63	1.3	0.82
35.50	111.0	1.991	48.6	1.124	0.89	0.63	1.3	0.82
36.00	111.0	2.019	48.6	1.136	0.88	0.63	1.3	0.82
36.50	111.0	2.047	48.6	1.148	0.88	0.63	1.3	0.82
37.00	111.0	2.075	48.6	1.160	0.87	0.63	1.3	0.82
37.50	111.0	2.102	48.6	1.173	0.87	0.63	1.3	0.82
38.00	111.0	2.130	48.6	1.185	0.86	0.63	1.3	0.81
38.50	111.0	2.158	48.6	1.197	0.86	0.63	1.3	0.81
39.00	111.0	2.186	48.6	1.209	0.86	0.62	1.3	0.81
39.50	111.0	2.213	48.6	1.221	0.85	0.62	1.3	0.81
40.00	111.0	2.241	48.6	1.233	0.85	0.62	1.3	0.81
40.50	111.0	2.269	48.6	1.246	0.84	0.62	1.3	0.81
41.00	111.0	2.297	48.6	1.258	0.84	0.62	1.3	0.80
41.50	111.0	2.324	48.6	1.270	0.84	0.62	1.3	0.80

42.00	111.0	2.352	48.6	1.282	0.83	0.62	1.3	0.80
42.50	111.0	2.380	48.6	1.294	0.83	0.61	1.3	0.80
43.00	111.0	2.408	48.6	1.306	0.82	0.61	1.3	0.80
43.50	111.0	2.435	48.6	1.318	0.82	0.61	1.3	0.79
44.00	111.0	2.463	48.6	1.331	0.82	0.61	1.3	0.79
44.50	111.0	2.491	48.6	1.343	0.81	0.61	1.3	0.79
45.00	111.0	2.519	48.6	1.355	0.81	0.61	1.3	0.79
45.50	111.0	2.546	48.6	1.367	0.80	0.60	1.3	0.78
46.00	111.0	2.574	48.6	1.379	0.80	0.60	1.3	0.78
46.50	111.0	2.602	48.6	1.391	0.80	0.60	1.3	0.78
47.00	111.0	2.630	48.6	1.403	0.79	0.60	1.3	0.78
47.50	111.0	2.657	48.6	1.416	0.79	0.60	1.3	0.77
48.00	111.0	2.685	48.6	1.428	0.78	0.59	1.3	0.77
48.50	111.0	2.713	48.6	1.440	0.78	0.59	1.3	0.77
49.00	111.0	2.741	48.6	1.452	0.78	0.59	1.3	0.77
49.50	111.0	2.768	48.6	1.464	0.77	0.59	1.3	0.76
50.00	111.0	2.796	48.6	1.476	0.77	0.59	1.3	0.76
50.50	111.0	2.824	48.6	1.489	0.76	0.58	1.3	0.76
51.00	111.0	2.852	48.6	1.501	0.76	0.58	1.3	0.76
51.50	111.0	2.879	48.6	1.513	0.75	0.58	1.3	0.75
52.00	111.0	2.907	48.6	1.525	0.75	0.58	1.3	0.75
52.50	111.0	2.935	48.6	1.537	0.75	0.57	1.3	0.75
53.00	111.0	2.963	48.6	1.549	0.74	0.57	1.3	0.74
53.50	111.0	2.990	48.6	1.561	0.74	0.57	1.3	0.74
54.00	111.0	3.018	48.6	1.574	0.73	0.57	1.3	0.74
54.50	111.0	3.046	48.6	1.586	0.73	0.57	1.3	0.74
55.00	111.0	3.074	48.6	1.598	0.73	0.56	1.3	0.73
55.50	111.0	3.101	48.6	1.610	0.72	0.56	1.3	0.73
56.00	111.0	3.129	48.6	1.622	0.72	0.56	1.3	0.73
56.50	111.0	3.157	48.6	1.634	0.71	0.56	1.3	0.72

CSR is based on water table at 7.7 during earthquake

CRR Calculation from SPT or BPT data:

Depth ft	SPT	Cebs	Cr	sigma' tsf	Cn	(N1)60	Fines %	d(N1)60	(N1)60f	CRR7.5
0.00	45.00	1.25	0.75	0.000	1.70	71.72	73.10	19.34	91.06	2.00
0.50	43.17	1.25	0.75	0.030	1.70	68.80	73.10	18.76	87.56	2.00
1.00	41.33	1.25	0.75	0.059	1.70	65.88	73.10	18.18	84.05	2.00
1.50	39.50	1.25	0.75	0.088	1.70	62.95	73.10	17.59	80.54	2.00
2.00	37.67	1.25	0.75	0.117	1.70	60.03	73.10	17.01	77.04	2.00
2.50	35.83	1.25	0.75	0.146	1.70	57.11	73.10	16.42	73.53	2.00
3.00	34.00	1.25	0.75	0.174	1.70	54.19	73.10	15.84	70.03	2.00
3.50	32.17	1.25	0.75	0.201	1.70	51.27	73.10	15.25	66.52	2.00
4.00	30.33	1.25	0.75	0.229	1.70	48.34	73.10	14.67	63.01	2.00
4.50	28.50	1.25	0.75	0.256	1.70	45.42	73.10	14.08	59.51	2.00
5.00	26.67	1.25	0.75	0.282	1.70	42.50	73.10	13.50	56.00	2.00
5.50	24.83	1.25	0.75	0.309	1.70	39.58	73.10	12.92	52.49	2.00
6.00	23.00	1.25	0.75	0.335	1.70	36.66	73.10	12.33	48.99	2.00
6.50	22.00	1.25	0.75	0.360	1.67	34.35	73.10	11.87	46.22	2.00
7.00	21.00	1.25	0.75	0.386	1.61	31.68	73.10	11.34	43.01	2.00

7.50	20.00	1.25	0.75	0.412	1.56	29.21	73.10	10.84	40.05	2.00
8.00	19.29	1.25	0.75	0.438	1.51	27.32	73.10	10.46	37.79	2.00
8.50	18.57	1.25	0.85	0.464	1.47	28.96	73.10	10.79	39.76	2.00
9.00	17.86	1.25	0.85	0.491	1.43	27.08	73.10	10.42	37.50	2.00
9.50	17.14	1.25	0.85	0.518	1.39	25.31	73.10	10.06	35.38	2.00
10.00	16.43	1.25	0.85	0.545	1.35	23.64	73.10	9.73	33.37	2.00
10.50	15.71	1.25	0.85	0.573	1.32	22.06	73.10	9.41	31.47	2.00
11.00	15.00	1.25	0.85	0.601	1.29	20.56	73.10	9.11	29.67	0.41
11.50	14.00	1.25	0.85	0.629	1.26	18.75	73.10	8.75	27.50	0.33
12.00	13.00	1.25	0.85	0.657	1.23	17.04	73.10	8.41	25.44	0.29
12.50	12.00	1.25	0.85	0.686	1.21	15.40	73.10	8.08	23.48	0.26
13.00	13.71	1.25	0.85	0.714	1.18	17.25	73.10	8.45	25.70	0.29
13.50	15.43	1.25	0.85	0.741	1.16	19.04	73.10	8.81	27.84	0.34
14.00	17.14	1.25	0.85	0.769	1.14	20.77	73.10	9.15	29.93	0.44
14.50	18.86	1.25	0.85	0.796	1.12	22.46	73.10	9.49	31.95	2.00
15.00	20.57	1.25	0.95	0.823	1.10	26.93	73.10	10.39	37.32	2.00
15.50	22.29	1.25	0.95	0.849	1.09	28.71	73.10	10.74	39.46	2.00
16.00	24.00	1.25	0.95	0.876	1.07	30.46	NoLiq	11.09	41.55	2.00
16.50	20.00	1.25	0.95	0.902	1.05	25.01	NoLiq	10.00	35.01	2.00
17.00	16.00	1.25	0.95	0.928	1.04	19.73	NoLiq	8.95	28.67	0.36
17.50	12.00	1.25	0.95	0.954	1.02	14.59	NoLiq	7.92	22.51	0.25
18.00	12.86	1.25	0.95	0.980	1.01	15.42	NoLiq	8.08	23.51	0.26
18.50	13.71	1.25	0.95	1.007	1.00	16.23	NoLiq	8.25	24.48	0.27
19.00	14.57	1.25	0.95	1.035	0.98	17.01	NoLiq	8.40	25.41	0.29
19.50	15.43	1.25	0.95	1.063	0.97	17.77	NoLiq	8.55	26.33	0.31
20.00	16.29	1.25	0.95	1.092	0.96	18.51	NoLiq	8.70	27.21	0.32
20.50	17.14	1.25	0.95	1.122	0.94	19.22	NoLiq	8.84	28.07	0.34
21.00	18.00	1.25	0.95	1.152	0.93	19.92	NoLiq	8.98	28.90	0.37
21.50	16.33	1.25	0.95	1.183	0.92	17.83	NoLiq	8.57	26.40	0.31
22.00	14.67	1.25	0.95	1.213	0.91	15.81	NoLiq	8.16	23.97	0.27
22.50	13.00	1.25	0.95	1.244	0.90	13.84	NoLiq	7.77	21.61	0.24
23.00	18.29	1.25	0.95	1.275	0.89	19.23	NoLiq	8.85	28.08	0.35
23.50	23.57	1.25	0.95	1.306	0.88	24.50	NoLiq	9.90	34.39	2.00
24.00	28.86	1.25	0.95	1.336	0.87	29.64	NoLiq	10.93	40.57	2.00
24.50	34.14	1.25	0.95	1.367	0.86	34.67	NoLiq	11.93	46.61	2.00
25.00	39.43	1.25	0.95	1.398	0.85	39.60	NoLiq	12.92	52.52	2.00
25.50	44.71	1.25	0.95	1.429	0.84	44.42	NoLiq	13.88	58.31	2.00
26.00	50.00	1.25	0.95	1.459	0.83	49.15	NoLiq	14.83	63.98	2.00
26.50	39.67	1.25	0.95	1.490	0.82	38.59	70.00	12.72	51.31	2.00
27.00	29.34	1.25	0.95	1.519	0.81	28.26	70.00	10.65	38.92	2.00
27.50	19.00	1.25	0.95	1.547	0.80	18.14	70.00	8.63	26.77	0.31
28.00	17.57	1.25	1.00	1.575	0.80	17.50	NoLiq	8.50	26.00	0.30
28.50	16.14	1.25	1.00	1.603	0.79	15.94	NoLiq	8.19	24.13	0.27
29.00	14.71	1.25	1.00	1.631	0.78	14.40	NoLiq	7.88	22.28	0.24
29.50	13.29	1.25	1.00	1.658	0.78	12.90	NoLiq	7.58	20.48	0.22
30.00	11.86	1.25	1.00	1.686	0.77	11.41	NoLiq	7.28	18.70	0.20
30.50	10.43	1.25	1.00	1.714	0.76	9.96	NoLiq	6.99	16.95	0.18
31.00	9.00	1.25	1.00	1.742	0.76	8.53	NoLiq	6.71	15.23	0.16
31.50	12.00	1.25	1.00	1.769	0.75	11.28	NoLiq	7.26	18.53	0.20
32.00	15.00	1.25	1.00	1.797	0.75	13.99	NoLiq	7.80	21.78	0.24
32.50	18.00	1.25	1.00	1.825	0.74	16.65	NoLiq	8.33	24.99	0.28
33.00	17.63	1.25	1.00	1.853	0.73	16.19	NoLiq	8.24	24.42	0.27

33.50	17.25	1.25	1.00	1.880	0.73	15.72	NoLiq	8.14	23.87	0.27
34.00	16.88	1.25	1.00	1.908	0.72	15.27	NoLiq	8.05	23.32	0.26
34.50	16.50	1.25	1.00	1.936	0.72	14.82	NoLiq	7.96	22.79	0.25
35.00	16.13	1.25	1.00	1.964	0.71	14.38	NoLiq	7.88	22.26	0.24
35.50	15.75	1.25	1.00	1.991	0.71	13.95	NoLiq	7.79	21.74	0.24
36.00	15.38	1.25	1.00	2.019	0.70	13.53	NoLiq	7.71	21.23	0.23
36.50	15.00	1.25	1.00	2.047	0.70	13.11	NoLiq	7.62	20.73	0.22
37.00	17.78	1.25	1.00	2.075	0.69	15.43	NoLiq	8.09	23.51	0.26
37.50	20.55	1.25	1.00	2.102	0.69	17.72	NoLiq	8.54	26.26	0.30
38.00	23.33	1.25	1.00	2.130	0.69	19.98	NoLiq	9.00	28.98	0.37
38.50	26.11	1.25	1.00	2.158	0.68	22.22	NoLiq	9.44	31.66	2.00
39.00	28.89	1.25	1.00	2.186	0.68	24.42	NoLiq	9.88	34.31	2.00
39.50	31.66	1.25	1.00	2.213	0.67	26.60	NoLiq	10.32	36.93	2.00
40.00	34.44	1.25	1.00	2.241	0.67	28.76	NoLiq	10.75	39.51	2.00
40.50	37.22	1.25	1.00	2.269	0.66	30.89	NoLiq	11.18	42.07	2.00
41.00	40.00	1.25	1.00	2.297	0.66	32.99	NoLiq	11.60	44.59	2.00
41.50	37.13	1.25	1.00	2.324	0.66	30.44	71.90	11.09	41.53	2.00
42.00	34.25	1.25	1.00	2.352	0.65	27.92	71.90	10.58	38.50	2.00
42.50	31.38	1.25	1.00	2.380	0.65	25.42	71.90	10.08	35.51	2.00
43.00	28.50	1.25	1.00	2.408	0.64	22.96	71.90	9.59	32.55	2.00
43.50	25.63	1.25	1.00	2.435	0.64	20.53	71.90	9.11	29.63	0.41
44.00	22.75	1.25	1.00	2.463	0.64	18.12	71.90	8.62	26.75	0.31
44.50	19.88	1.25	1.00	2.491	0.63	15.74	71.90	8.15	23.89	0.27
45.00	17.00	1.25	1.00	2.519	0.63	13.39	71.90	7.68	21.07	0.23
45.50	20.83	1.25	1.00	2.546	0.63	16.32	NoLiq	8.26	24.58	0.28
46.00	24.66	1.25	1.00	2.574	0.62	19.22	NoLiq	8.84	28.06	0.34
46.50	28.50	1.25	1.00	2.602	0.62	22.08	NoLiq	9.42	31.50	2.00
47.00	32.33	1.25	1.00	2.630	0.62	24.92	NoLiq	9.98	34.91	2.00
47.50	36.16	1.25	1.00	2.657	0.61	27.73	NoLiq	10.55	38.28	2.00
48.00	40.00	1.25	1.00	2.685	0.61	30.51	NoLiq	11.10	41.61	2.00
48.50	43.83	1.25	1.00	2.713	0.61	33.26	NoLiq	11.65	44.92	2.00
49.00	47.66	1.25	1.00	2.741	0.60	35.99	NoLiq	12.20	48.19	2.00
49.50	51.50	1.25	1.00	2.768	0.60	38.69	NoLiq	12.74	51.43	2.00
50.00	55.33	1.25	1.00	2.796	0.60	41.36	NoLiq	13.27	54.63	2.00
50.50	59.16	1.25	1.00	2.824	0.60	44.01	NoLiq	13.80	57.81	2.00
51.00	63.00	1.25	1.00	2.838	0.59	46.75	NoLiq	14.35	61.10	2.00
51.50	61.10	1.25	1.00	2.850	0.59	45.24	12.90	3.50	48.74	2.00
52.00	59.20	1.25	1.00	2.862	0.59	43.74	12.90	3.44	47.19	2.00
52.50	57.30	1.25	1.00	2.874	0.59	42.25	12.90	3.39	45.64	2.00
53.00	55.40	1.25	1.00	2.886	0.59	40.76	12.90	3.34	44.10	2.00
53.50	53.50	1.25	1.00	2.898	0.59	39.28	12.90	3.28	42.57	2.00
54.00	51.60	1.25	1.00	2.910	0.59	37.81	12.90	3.23	41.04	2.00
54.50	49.70	1.25	1.00	2.923	0.58	36.34	12.90	3.18	39.52	2.00
55.00	47.80	1.25	1.00	2.935	0.58	34.88	12.90	3.12	38.00	2.00
55.50	45.90	1.25	1.00	2.947	0.58	33.42	12.90	3.07	36.49	2.00
56.00	44.00	1.25	1.00	2.959	0.58	31.97	12.90	3.02	34.99	2.00
56.50	44.00	1.25	1.00	2.971	0.58	31.91	NoLiq	11.38	43.29	2.00

CRR is based on water table at 50.5 during In-Situ Testing

Factor of Safety, - Earthquake Magnitude= 6.6:

Depth	sigC'	CRR7.5	x Ksig	=CRRv	x MSF	=CRRm	/ CSRfs	=F.S.

ft	tsf	tsf		tsf		tsf	tsf	CRRm/CSRfs
0.00	0.00	2.00	1.00	2.00	1.39	2.77	0.52	5.00
0.50	0.02	2.00	1.00	2.00	1.39	2.77	0.52	5.00
1.00	0.04	2.00	1.00	2.00	1.39	2.77	0.52	5.00
1.50	0.06	2.00	1.00	2.00	1.39	2.77	0.52	5.00
2.00	0.08	2.00	1.00	2.00	1.39	2.77	0.52	5.00
2.50	0.09	2.00	1.00	2.00	1.39	2.77	0.52	5.00
3.00	0.11	2.00	1.00	2.00	1.39	2.77	0.52	5.00
3.50	0.13	2.00	1.00	2.00	1.39	2.77	0.52	5.00
4.00	0.15	2.00	1.00	2.00	1.39	2.77	0.52	5.00
4.50	0.17	2.00	1.00	2.00	1.39	2.77	0.52	5.00
5.00	0.18	2.00	1.00	2.00	1.39	2.77	0.52	5.00
5.50	0.20	2.00	1.00	2.00	1.39	2.77	0.52	5.00
6.00	0.22	2.00	1.00	2.00	1.39	2.77	0.52	5.00
6.50	0.23	2.00	1.00	2.00	1.39	2.77	0.52	5.00
7.00	0.25	2.00	1.00	2.00	1.39	2.77	0.52	5.00
7.50	0.27	2.00	1.00	2.00	1.39	2.77	0.51	5.00
8.00	0.28	2.00	1.00	2.00	1.39	2.77	0.53	5.00
8.50	0.30	2.00	1.00	2.00	1.39	2.77	0.54	5.00
9.00	0.32	2.00	1.00	2.00	1.39	2.77	0.56	4.96
9.50	0.34	2.00	1.00	2.00	1.39	2.77	0.57	4.83
10.00	0.35	2.00	1.00	2.00	1.39	2.77	0.59	4.71
10.50	0.37	2.00	1.00	2.00	1.39	2.77	0.60	4.60
11.00	0.39	0.41	1.00	0.41	1.39	0.57	0.62	0.93 *
11.50	0.41	0.33	1.00	0.33	1.39	0.46	0.63	0.73 *
12.00	0.43	0.29	1.00	0.29	1.39	0.40	0.64	0.63 *
12.50	0.45	0.26	1.00	0.26	1.39	0.36	0.65	0.55 *
13.00	0.46	0.29	1.00	0.29	1.39	0.41	0.66	0.62 *
13.50	0.48	0.34	1.00	0.34	1.39	0.47	0.67	0.70 *
14.00	0.50	0.44	1.00	0.44	1.39	0.62	0.68	0.90 *
14.50	0.52	2.00	1.00	2.00	1.39	2.77	0.69	4.02
15.00	0.53	2.00	1.00	2.00	1.39	2.77	0.70	3.97
15.50	0.55	2.00	1.00	2.00	1.39	2.77	0.71	3.92
16.00	0.57	2.00	1.00	2.00	1.39	2.00	0.72	5.00 ^
16.50	0.59	2.00	1.00	2.00	1.39	2.00	0.72	5.00 ^
17.00	0.60	0.36	1.00	0.36	1.39	2.00	0.73	5.00 ^
17.50	0.62	0.25	1.00	0.25	1.39	2.00	0.74	5.00 ^
18.00	0.64	0.26	1.00	0.26	1.39	2.00	0.75	5.00 ^
18.50	0.65	0.27	1.00	0.27	1.39	2.00	0.75	5.00 ^
19.00	0.67	0.29	1.00	0.29	1.39	2.00	0.76	5.00 ^
19.50	0.69	0.31	1.00	0.31	1.39	2.00	0.77	5.00 ^
20.00	0.71	0.32	1.00	0.32	1.39	2.00	0.77	5.00 ^
20.50	0.73	0.34	1.00	0.34	1.39	2.00	0.77	5.00 ^
21.00	0.75	0.37	1.00	0.37	1.39	2.00	0.78	5.00 ^
21.50	0.77	0.31	1.00	0.31	1.39	2.00	0.78	5.00 ^
22.00	0.79	0.27	1.00	0.27	1.39	2.00	0.79	5.00 ^
22.50	0.81	0.24	1.00	0.24	1.39	2.00	0.79	5.00 ^
23.00	0.83	0.35	1.00	0.35	1.39	2.00	0.79	5.00 ^
23.50	0.85	2.00	1.00	2.00	1.39	2.00	0.80	5.00 ^
24.00	0.87	2.00	1.00	2.00	1.39	2.00	0.80	5.00 ^
24.50	0.89	2.00	1.00	2.00	1.39	2.00	0.80	5.00 ^

25.00	0.91	2.00	1.00	2.00	1.39	2.00	0.80	5.00 ^
25.50	0.93	2.00	1.00	2.00	1.39	2.00	0.81	5.00 ^
26.00	0.95	2.00	1.00	2.00	1.39	2.00	0.81	5.00 ^
26.50	0.97	2.00	1.00	2.00	1.39	2.77	0.81	3.42
27.00	0.99	2.00	1.00	2.00	1.39	2.77	0.81	3.41
27.50	1.01	0.31	1.01	0.32	1.39	0.44	0.82	0.54 *
28.00	1.02	0.30	1.00	0.30	1.39	2.00	0.82	5.00 ^
28.50	1.04	0.27	1.00	0.27	1.39	2.00	0.82	5.00 ^
29.00	1.06	0.24	1.00	0.24	1.39	2.00	0.82	5.00 ^
29.50	1.08	0.22	0.99	0.22	1.39	2.00	0.83	5.00 ^
30.00	1.10	0.20	0.99	0.20	1.39	2.00	0.83	5.00 ^
30.50	1.11	0.18	0.99	0.18	1.39	2.00	0.83	5.00 ^
31.00	1.13	0.16	0.99	0.16	1.39	2.00	0.83	5.00 ^
31.50	1.15	0.20	0.98	0.20	1.39	2.00	0.83	5.00 ^
32.00	1.17	0.24	0.98	0.23	1.39	2.00	0.83	5.00 ^
32.50	1.19	0.28	0.98	0.28	1.39	2.00	0.83	5.00 ^
33.00	1.20	0.27	0.97	0.27	1.39	2.00	0.83	5.00 ^
33.50	1.22	0.27	0.97	0.26	1.39	2.00	0.83	5.00 ^
34.00	1.24	0.26	0.97	0.25	1.39	2.00	0.82	5.00 ^
34.50	1.26	0.25	0.97	0.24	1.39	2.00	0.82	5.00 ^
35.00	1.28	0.24	0.96	0.23	1.39	2.00	0.82	5.00 ^
35.50	1.29	0.24	0.96	0.23	1.39	2.00	0.82	5.00 ^
36.00	1.31	0.23	0.96	0.22	1.39	2.00	0.82	5.00 ^
36.50	1.33	0.22	0.96	0.21	1.39	2.00	0.82	5.00 ^
37.00	1.35	0.26	0.95	0.25	1.39	2.00	0.82	5.00 ^
37.50	1.37	0.30	0.95	0.29	1.39	2.00	0.82	5.00 ^
38.00	1.38	0.37	0.95	0.35	1.39	2.00	0.81	5.00 ^
38.50	1.40	2.00	0.95	1.89	1.39	2.00	0.81	5.00 ^
39.00	1.42	2.00	0.94	1.89	1.39	2.00	0.81	5.00 ^
39.50	1.44	2.00	0.94	1.88	1.39	2.00	0.81	5.00 ^
40.00	1.46	2.00	0.94	1.88	1.39	2.00	0.81	5.00 ^
40.50	1.47	2.00	0.94	1.87	1.39	2.00	0.81	5.00 ^
41.00	1.49	2.00	0.93	1.87	1.39	2.00	0.80	5.00 ^
41.50	1.51	2.00	0.93	1.86	1.39	2.58	0.80	3.22
42.00	1.53	2.00	0.93	1.86	1.39	2.58	0.80	3.22
42.50	1.55	2.00	0.93	1.85	1.39	2.57	0.80	3.22
43.00	1.56	2.00	0.92	1.85	1.39	2.56	0.80	3.22
43.50	1.58	0.41	0.92	0.38	1.39	0.52	0.79	0.66 *
44.00	1.60	0.31	0.92	0.29	1.39	0.40	0.79	0.51 *
44.50	1.62	0.27	0.92	0.24	1.39	0.34	0.79	0.43 *
45.00	1.64	0.23	0.91	0.21	1.39	0.29	0.79	0.37 *
45.50	1.66	0.28	0.91	0.25	1.39	2.00	0.78	5.00 ^
46.00	1.67	0.34	0.91	0.31	1.39	2.00	0.78	5.00 ^
46.50	1.69	2.00	0.91	1.82	1.39	2.00	0.78	5.00 ^
47.00	1.71	2.00	0.91	1.81	1.39	2.00	0.78	5.00 ^
47.50	1.73	2.00	0.90	1.81	1.39	2.00	0.77	5.00 ^
48.00	1.75	2.00	0.90	1.80	1.39	2.00	0.77	5.00 ^
48.50	1.76	2.00	0.90	1.80	1.39	2.00	0.77	5.00 ^
49.00	1.78	2.00	0.90	1.79	1.39	2.00	0.77	5.00 ^
49.50	1.80	2.00	0.89	1.79	1.39	2.00	0.76	5.00 ^
50.00	1.82	2.00	0.89	1.79	1.39	2.00	0.76	5.00 ^
50.50	1.84	2.00	0.89	1.78	1.39	2.00	0.76	5.00 ^

51.00	1.84	2.00	0.89	1.78	1.39	2.00	0.76	5.00 ^
51.50	1.85	2.00	0.89	1.78	1.39	2.46	0.75	3.27
52.00	1.86	2.00	0.89	1.78	1.39	2.46	0.75	3.28
52.50	1.87	2.00	0.89	1.77	1.39	2.46	0.75	3.29
53.00	1.88	2.00	0.89	1.77	1.39	2.46	0.74	3.30
53.50	1.88	2.00	0.88	1.77	1.39	2.45	0.74	3.31
54.00	1.89	2.00	0.88	1.77	1.39	2.45	0.74	3.32
54.50	1.90	2.00	0.88	1.77	1.39	2.45	0.74	3.33
55.00	1.91	2.00	0.88	1.76	1.39	2.45	0.73	3.34
55.50	1.92	2.00	0.88	1.76	1.39	2.44	0.73	3.35
56.00	1.92	2.00	0.88	1.76	1.39	2.44	0.73	3.36
56.50	1.93	2.00	0.88	1.76	1.39	2.00	0.72	5.00 ^

* F.S.<1: Liquefaction Potential Zone. (If above water table: F.S.=5)
^ No-liquefiable Soils.
(F.S. is limited to 5, CRR is limited to 2, CSR is limited to 2)

CPT convert to SPT for Settlement Analysis:
Fines Correction for Settlement Analysis:

Depth ft	Ic	qc/N60	qc1 tsf	(N1)60	Fines %	d(N1)60	(N1)60s
0.00	-	-	-	91.06	73.10	0.00	91.06
0.50	-	-	-	87.56	73.10	0.00	87.56
1.00	-	-	-	84.05	73.10	0.00	84.05
1.50	-	-	-	80.54	73.10	0.00	80.54
2.00	-	-	-	77.04	73.10	0.00	77.04
2.50	-	-	-	73.53	73.10	0.00	73.53
3.00	-	-	-	70.03	73.10	0.00	70.03
3.50	-	-	-	66.52	73.10	0.00	66.52
4.00	-	-	-	63.01	73.10	0.00	63.01
4.50	-	-	-	59.51	73.10	0.00	59.51
5.00	-	-	-	56.00	73.10	0.00	56.00
5.50	-	-	-	52.49	73.10	0.00	52.49
6.00	-	-	-	48.99	73.10	0.00	48.99
6.50	-	-	-	46.22	73.10	0.00	46.22
7.00	-	-	-	43.01	73.10	0.00	43.01
7.50	-	-	-	40.05	73.10	0.00	40.05
8.00	-	-	-	37.79	73.10	0.00	37.79
8.50	-	-	-	39.76	73.10	0.00	39.76
9.00	-	-	-	37.50	73.10	0.00	37.50
9.50	-	-	-	35.38	73.10	0.00	35.38
10.00	-	-	-	33.37	73.10	0.00	33.37
10.50	-	-	-	31.47	73.10	0.00	31.47
11.00	-	-	-	29.67	73.10	0.00	29.67
11.50	-	-	-	27.50	73.10	0.00	27.50
12.00	-	-	-	25.44	73.10	0.00	25.44
12.50	-	-	-	23.48	73.10	0.00	23.48
13.00	-	-	-	25.70	73.10	0.00	25.70
13.50	-	-	-	27.84	73.10	0.00	27.84
14.00	-	-	-	29.93	73.10	0.00	29.93

14.50	-	-	-	31.95	73.10	0.00	31.95
15.00	-	-	-	37.32	73.10	0.00	37.32
15.50	-	-	-	39.46	73.10	0.00	39.46
16.00	-	-	-	41.55	NoLiq	0.00	41.55
16.50	-	-	-	35.01	NoLiq	0.00	35.01
17.00	-	-	-	28.67	NoLiq	0.00	28.67
17.50	-	-	-	22.51	NoLiq	0.00	22.51
18.00	-	-	-	23.51	NoLiq	0.00	23.51
18.50	-	-	-	24.48	NoLiq	0.00	24.48
19.00	-	-	-	25.41	NoLiq	0.00	25.41
19.50	-	-	-	26.33	NoLiq	0.00	26.33
20.00	-	-	-	27.21	NoLiq	0.00	27.21
20.50	-	-	-	28.07	NoLiq	0.00	28.07
21.00	-	-	-	28.90	NoLiq	0.00	28.90
21.50	-	-	-	26.40	NoLiq	0.00	26.40
22.00	-	-	-	23.97	NoLiq	0.00	23.97
22.50	-	-	-	21.61	NoLiq	0.00	21.61
23.00	-	-	-	28.08	NoLiq	0.00	28.08
23.50	-	-	-	34.39	NoLiq	0.00	34.39
24.00	-	-	-	40.57	NoLiq	0.00	40.57
24.50	-	-	-	46.61	NoLiq	0.00	46.61
25.00	-	-	-	52.52	NoLiq	0.00	52.52
25.50	-	-	-	58.31	NoLiq	0.00	58.31
26.00	-	-	-	63.98	NoLiq	0.00	63.98
26.50	-	-	-	51.31	70.00	0.00	51.31
27.00	-	-	-	38.92	70.00	0.00	38.92
27.50	-	-	-	26.77	70.00	0.00	26.77
28.00	-	-	-	26.00	NoLiq	0.00	26.00
28.50	-	-	-	24.13	NoLiq	0.00	24.13
29.00	-	-	-	22.28	NoLiq	0.00	22.28
29.50	-	-	-	20.48	NoLiq	0.00	20.48
30.00	-	-	-	18.70	NoLiq	0.00	18.70
30.50	-	-	-	16.95	NoLiq	0.00	16.95
31.00	-	-	-	15.23	NoLiq	0.00	15.23
31.50	-	-	-	18.53	NoLiq	0.00	18.53
32.00	-	-	-	21.78	NoLiq	0.00	21.78
32.50	-	-	-	24.99	NoLiq	0.00	24.99
33.00	-	-	-	24.42	NoLiq	0.00	24.42
33.50	-	-	-	23.87	NoLiq	0.00	23.87
34.00	-	-	-	23.32	NoLiq	0.00	23.32
34.50	-	-	-	22.79	NoLiq	0.00	22.79
35.00	-	-	-	22.26	NoLiq	0.00	22.26
35.50	-	-	-	21.74	NoLiq	0.00	21.74
36.00	-	-	-	21.23	NoLiq	0.00	21.23
36.50	-	-	-	20.73	NoLiq	0.00	20.73
37.00	-	-	-	23.51	NoLiq	0.00	23.51
37.50	-	-	-	26.26	NoLiq	0.00	26.26
38.00	-	-	-	28.98	NoLiq	0.00	28.98
38.50	-	-	-	31.66	NoLiq	0.00	31.66
39.00	-	-	-	34.31	NoLiq	0.00	34.31
39.50	-	-	-	36.93	NoLiq	0.00	36.93
40.00	-	-	-	39.51	NoLiq	0.00	39.51

40.50	-	-	-	42.07	NoLiq	0.00	42.07
41.00	-	-	-	44.59	NoLiq	0.00	44.59
41.50	-	-	-	41.53	71.90	0.00	41.53
42.00	-	-	-	38.50	71.90	0.00	38.50
42.50	-	-	-	35.51	71.90	0.00	35.51
43.00	-	-	-	32.55	71.90	0.00	32.55
43.50	-	-	-	29.63	71.90	0.00	29.63
44.00	-	-	-	26.75	71.90	0.00	26.75
44.50	-	-	-	23.89	71.90	0.00	23.89
45.00	-	-	-	21.07	71.90	0.00	21.07
45.50	-	-	-	24.58	NoLiq	0.00	24.58
46.00	-	-	-	28.06	NoLiq	0.00	28.06
46.50	-	-	-	31.50	NoLiq	0.00	31.50
47.00	-	-	-	34.91	NoLiq	0.00	34.91
47.50	-	-	-	38.28	NoLiq	0.00	38.28
48.00	-	-	-	41.61	NoLiq	0.00	41.61
48.50	-	-	-	44.92	NoLiq	0.00	44.92
49.00	-	-	-	48.19	NoLiq	0.00	48.19
49.50	-	-	-	51.43	NoLiq	0.00	51.43
50.00	-	-	-	54.63	NoLiq	0.00	54.63
50.50	-	-	-	57.81	NoLiq	0.00	57.81
51.00	-	-	-	61.10	NoLiq	0.00	61.10
51.50	-	-	-	48.74	12.90	0.00	48.74
52.00	-	-	-	47.19	12.90	0.00	47.19
52.50	-	-	-	45.64	12.90	0.00	45.64
53.00	-	-	-	44.10	12.90	0.00	44.10
53.50	-	-	-	42.57	12.90	0.00	42.57
54.00	-	-	-	41.04	12.90	0.00	41.04
54.50	-	-	-	39.52	12.90	0.00	39.52
55.00	-	-	-	38.00	12.90	0.00	38.00
55.50	-	-	-	36.49	12.90	0.00	36.49
56.00	-	-	-	34.99	12.90	0.00	34.99
56.50	-	-	-	43.29	NoLiq	0.00	43.29

(N1)60s has been fines corrected in liquefaction analysis, therefore d(N1)60=0.
Fines=NoLiq means the soils are not liquefiable.

Settlement of Saturated Sands:
Settlement Analysis Method: Ishihara / Yoshimine*

Depth	CSRsf	/ MSF*	=CSRm	F.S.	Fines	(N1)60s	Dr	ec	dsz	dsp	S
ft	tsf		tsf		%		%	%	in.	in.	in.
56.45	0.72	1.0	0.72	5.00	NoLiq	43.30	100.00	0.000	0.0E0	0.000	0.000
56.00	0.73	1.0	0.73	3.36	12.90	34.99	100.00	0.000	0.0E0	0.000	0.000
55.50	0.73	1.0	0.73	3.35	12.90	36.49	100.00	0.000	0.0E0	0.000	0.000

55.00	0.73	1.0	0.73	3.34	12.90	38.00	100.00	0.000	0.0E0	0.000	0.000
54.50	0.74	1.0	0.74	3.33	12.90	39.52	100.00	0.000	0.0E0	0.000	0.000
54.00	0.74	1.0	0.74	3.32	12.90	41.04	100.00	0.000	0.0E0	0.000	0.000
53.50	0.74	1.0	0.74	3.31	12.90	42.57	100.00	0.000	0.0E0	0.000	0.000
53.00	0.74	1.0	0.74	3.30	12.90	44.10	100.00	0.000	0.0E0	0.000	0.000
52.50	0.75	1.0	0.75	3.29	12.90	45.64	100.00	0.000	0.0E0	0.000	0.000
52.00	0.75	1.0	0.75	3.28	12.90	47.19	100.00	0.000	0.0E0	0.000	0.000
51.50	0.75	1.0	0.75	3.27	12.90	48.74	100.00	0.000	0.0E0	0.000	0.000
51.00	0.76	1.0	0.76	5.00	NoLiq	61.10	100.00	0.000	0.0E0	0.000	0.000
50.50	0.76	1.0	0.76	5.00	NoLiq	57.81	100.00	0.000	0.0E0	0.000	0.000
50.00	0.76	1.0	0.76	5.00	NoLiq	54.63	100.00	0.000	0.0E0	0.000	0.000
49.50	0.76	1.0	0.76	5.00	NoLiq	51.43	100.00	0.000	0.0E0	0.000	0.000
49.00	0.77	1.0	0.77	5.00	NoLiq	48.19	100.00	0.000	0.0E0	0.000	0.000
48.50	0.77	1.0	0.77	5.00	NoLiq	44.92	100.00	0.000	0.0E0	0.000	0.000
48.00	0.77	1.0	0.77	5.00	NoLiq	41.61	100.00	0.000	0.0E0	0.000	0.000
47.50	0.77	1.0	0.77	5.00	NoLiq	38.28	100.00	0.000	0.0E0	0.000	0.000
47.00	0.78	1.0	0.78	5.00	NoLiq	34.91	100.00	0.000	0.0E0	0.000	0.000
46.50	0.78	1.0	0.78	5.00	NoLiq	31.50	93.55	0.000	0.0E0	0.000	0.000
46.00	0.78	1.0	0.78	5.00	NoLiq	28.06	85.83	0.000	0.0E0	0.000	0.000
45.50	0.78	1.0	0.78	5.00	NoLiq	24.58	78.92	0.000	0.0E0	0.000	0.000
45.00	0.79	1.0	0.79	0.37	71.90	21.07	72.46	2.085	1.3E-2	0.013	0.013
44.50	0.79	1.0	0.79	0.43	71.90	23.89	77.62	1.853	1.1E-2	0.117	0.130
44.00	0.79	1.0	0.79	0.51	71.90	26.75	83.14	1.598	9.6E-3	0.103	0.233
43.50	0.79	1.0	0.79	0.66	71.90	29.63	89.23	1.054	6.3E-3	0.080	0.313
43.00	0.80	1.0	0.80	3.22	71.90	32.55	96.14	0.000	0.0E0	0.006	0.319
42.50	0.80	1.0	0.80	3.22	71.90	35.51	100.00	0.000	0.0E0	0.000	0.319

42.00	0.80	1.0	0.80	3.22	71.90	38.50	100.00	0.000	0.0E0	0.000	0.319
41.50	0.80	1.0	0.80	3.22	71.90	41.53	100.00	0.000	0.0E0	0.000	0.319
41.00	0.80	1.0	0.80	5.00	NoLiq	44.59	100.00	0.000	0.0E0	0.000	0.319
40.50	0.81	1.0	0.81	5.00	NoLiq	42.07	100.00	0.000	0.0E0	0.000	0.319
40.00	0.81	1.0	0.81	5.00	NoLiq	39.51	100.00	0.000	0.0E0	0.000	0.319
39.50	0.81	1.0	0.81	5.00	NoLiq	36.93	100.00	0.000	0.0E0	0.000	0.319
39.00	0.81	1.0	0.81	5.00	NoLiq	34.31	100.00	0.000	0.0E0	0.000	0.319
38.50	0.81	1.0	0.81	5.00	NoLiq	31.66	93.94	0.000	0.0E0	0.000	0.319
38.00	0.81	1.0	0.81	5.00	NoLiq	28.98	87.80	0.000	0.0E0	0.000	0.319
37.50	0.82	1.0	0.82	5.00	NoLiq	26.26	82.18	0.000	0.0E0	0.000	0.319
37.00	0.82	1.0	0.82	5.00	NoLiq	23.51	76.92	0.000	0.0E0	0.000	0.319
36.50	0.82	1.0	0.82	5.00	NoLiq	20.73	71.85	0.000	0.0E0	0.000	0.319
36.00	0.82	1.0	0.82	5.00	NoLiq	21.23	72.75	0.000	0.0E0	0.000	0.319
35.50	0.82	1.0	0.82	5.00	NoLiq	21.74	73.68	0.000	0.0E0	0.000	0.319
35.00	0.82	1.0	0.82	5.00	NoLiq	22.26	74.62	0.000	0.0E0	0.000	0.319
34.50	0.82	1.0	0.82	5.00	NoLiq	22.79	75.58	0.000	0.0E0	0.000	0.319
34.00	0.82	1.0	0.82	5.00	NoLiq	23.32	76.57	0.000	0.0E0	0.000	0.319
33.50	0.83	1.0	0.83	5.00	NoLiq	23.87	77.58	0.000	0.0E0	0.000	0.319
33.00	0.83	1.0	0.83	5.00	NoLiq	24.42	78.62	0.000	0.0E0	0.000	0.319
32.50	0.83	1.0	0.83	5.00	NoLiq	24.99	79.69	0.000	0.0E0	0.000	0.319
32.00	0.83	1.0	0.83	5.00	NoLiq	21.78	73.75	0.000	0.0E0	0.000	0.319
31.50	0.83	1.0	0.83	5.00	NoLiq	18.53	67.88	0.000	0.0E0	0.000	0.319
31.00	0.83	1.0	0.83	5.00	NoLiq	15.23	61.72	0.000	0.0E0	0.000	0.319
30.50	0.83	1.0	0.83	5.00	NoLiq	16.95	64.98	0.000	0.0E0	0.000	0.319
30.00	0.83	1.0	0.83	5.00	NoLiq	18.70	68.19	0.000	0.0E0	0.000	0.319
29.50	0.83	1.0	0.83	5.00	NoLiq	20.48	71.39	0.000	0.0E0	0.000	0.319

	29.00	0.82	1.0	0.82	5.00	NoLiq	22.28	74.66	0.000	0.0E0	0.000
0.319											
	28.50	0.82	1.0	0.82	5.00	NoLiq	24.13	78.06	0.000	0.0E0	0.000
0.319											
	28.00	0.82	1.0	0.82	5.00	NoLiq	26.00	81.66	0.000	0.0E0	0.000
0.319											
	27.50	0.82	1.0	0.82	0.54	70.00	26.77	83.18	1.560	9.4E-3	0.009
0.328											
	27.00	0.81	1.0	0.81	3.41	70.00	38.92	100.00	0.000	0.0E0	0.015
0.343											
	26.50	0.81	1.0	0.81	3.42	70.00	51.31	100.00	0.000	0.0E0	0.000
0.343											
	26.00	0.81	1.0	0.81	5.00	NoLiq	63.98	100.00	0.000	0.0E0	0.000
0.343											
	25.50	0.81	1.0	0.81	5.00	NoLiq	58.31	100.00	0.000	0.0E0	0.000
0.343											
	25.00	0.80	1.0	0.80	5.00	NoLiq	52.52	100.00	0.000	0.0E0	0.000
0.343											
	24.50	0.80	1.0	0.80	5.00	NoLiq	46.61	100.00	0.000	0.0E0	0.000
0.343											
	24.00	0.80	1.0	0.80	5.00	NoLiq	40.57	100.00	0.000	0.0E0	0.000
0.343											
	23.50	0.80	1.0	0.80	5.00	NoLiq	34.39	100.00	0.000	0.0E0	0.000
0.343											
	23.00	0.79	1.0	0.79	5.00	NoLiq	28.08	85.87	0.000	0.0E0	0.000
0.343											
	22.50	0.79	1.0	0.79	5.00	NoLiq	21.61	73.44	0.000	0.0E0	0.000
0.343											
	22.00	0.79	1.0	0.79	5.00	NoLiq	23.97	77.78	0.000	0.0E0	0.000
0.343											
	21.50	0.78	1.0	0.78	5.00	NoLiq	26.40	82.45	0.000	0.0E0	0.000
0.343											
	21.00	0.78	1.0	0.78	5.00	NoLiq	28.90	87.62	0.000	0.0E0	0.000
0.343											
	20.50	0.77	1.0	0.77	5.00	NoLiq	28.07	85.85	0.000	0.0E0	0.000
0.343											
	20.00	0.77	1.0	0.77	5.00	NoLiq	27.21	84.08	0.000	0.0E0	0.000
0.343											
	19.50	0.77	1.0	0.77	5.00	NoLiq	26.33	82.30	0.000	0.0E0	0.000
0.343											
	19.00	0.76	1.0	0.76	5.00	NoLiq	25.41	80.52	0.000	0.0E0	0.000
0.343											
	18.50	0.75	1.0	0.75	5.00	NoLiq	24.48	78.72	0.000	0.0E0	0.000
0.343											
	18.00	0.75	1.0	0.75	5.00	NoLiq	23.51	76.91	0.000	0.0E0	0.000
0.343											
	17.50	0.74	1.0	0.74	5.00	NoLiq	22.51	75.08	0.000	0.0E0	0.000
0.343											
	17.00	0.73	1.0	0.73	5.00	NoLiq	28.67	87.14	0.000	0.0E0	0.000
0.343											
	16.50	0.72	1.0	0.72	5.00	NoLiq	35.01	100.00	0.000	0.0E0	0.000
0.343											

	16.00	0.72	1.0	0.72	5.00	NoLiq	41.55	100.00	0.000	0.0E0	0.000
0.343											
	15.50	0.71	1.0	0.71	3.92	73.10	39.46	100.00	0.000	0.0E0	0.000
0.343											
	15.00	0.70	1.0	0.70	3.97	73.10	37.32	100.00	0.000	0.0E0	0.000
0.343											
	14.50	0.69	1.0	0.69	4.02	73.10	31.95	94.63	0.000	0.0E0	0.000
0.343											
	14.00	0.68	1.0	0.68	0.90	73.10	29.93	89.89	0.629	3.8E-3	0.004
0.347											
	13.50	0.67	1.0	0.67	0.70	73.10	27.84	85.39	1.171	7.0E-3	0.057
0.405											
	13.00	0.66	1.0	0.66	0.62	73.10	25.70	81.07	1.567	9.4E-3	0.083
0.488											
	12.50	0.65	1.0	0.65	0.55	73.10	23.48	76.86	1.858	1.1E-2	0.105
0.592											
	12.00	0.64	1.0	0.64	0.63	73.10	25.44	80.57	1.568	9.4E-3	0.103
0.696											
	11.50	0.63	1.0	0.63	0.73	73.10	27.50	84.68	1.138	6.8E-3	0.080
0.776											
	11.00	0.62	1.0	0.62	0.93	73.10	29.67	89.32	0.595	3.6E-3	0.051
0.827											
	10.50	0.60	1.0	0.60	4.60	73.10	31.47	93.48	0.000	0.0E0	0.005
0.833											
	10.00	0.59	1.0	0.59	4.71	73.10	33.37	98.23	0.000	0.0E0	0.000
0.833											
	9.50	0.57	1.0	0.57	4.83	73.10	35.38	100.00	0.000	0.0E0	0.000
0.833											
	9.00	0.56	1.0	0.56	4.96	73.10	37.50	100.00	0.000	0.0E0	0.000
0.833											
	8.50	0.54	1.0	0.54	5.00	73.10	39.76	100.00	0.000	0.0E0	0.000
0.833											
	8.00	0.53	1.0	0.53	5.00	73.10	37.79	100.00	0.000	0.0E0	0.000
0.833											
	7.70	0.51	1.0	0.51	5.00	73.10	39.13	100.00	0.000	0.0E0	0.000
0.833											

Settlement of Saturated Sands=0.833 in.
qc1 and (N1)60 is after fines correction in liquefaction analysis
dsz is per each segment, dz=0.05 ft
dsp is per each print interval, dp=0.50 ft
S is cumulated settlement at this depth

Settlement of Unsaturated Sands:

	Depth	sigma'	sigC'	(N1)60s	CSRsf	Gmax	g*Ge/Gm	g_eff	ec7.5	Cec	ec
dsz	dsp	S									
	ft	tsf	tsf		tsf	tsf			%		%
in.	in.	in.									

	7.65	0.42	0.27	39.36	0.51	793.6	2.7E-4	0.1312	0.0433	0.81	0.0349
4.19E-4	0.000	0.000									
	7.50	0.41	0.27	40.05	0.51	790.8	2.7E-4	0.1169	0.0370	0.81	0.0298
3.58E-4	0.001	0.002									
	7.00	0.39	0.25	43.01	0.52	784.1	2.5E-4	0.0816	0.0258	0.81	0.0208
2.50E-4	0.003	0.004									
	6.50	0.36	0.23	46.22	0.52	775.9	2.4E-4	0.0617	0.0195	0.81	0.0157
1.89E-4	0.002	0.007									
	6.00	0.33	0.22	48.99	0.52	762.3	2.3E-4	0.0506	0.0160	0.81	0.0129
1.55E-4	0.002	0.008									
	5.50	0.31	0.20	52.49	0.52	749.2	2.1E-4	0.0433	0.0137	0.81	0.0110
1.32E-4	0.001	0.010									
	5.00	0.28	0.18	56.00	0.52	732.2	2.0E-4	0.0387	0.0122	0.81	0.0099
1.18E-4	0.001	0.011									
	4.50	0.26	0.17	59.51	0.52	711.0	1.9E-4	0.0358	0.0113	0.81	0.0091
1.10E-4	0.001	0.012									
	4.00	0.23	0.15	63.01	0.52	685.4	1.7E-4	0.0390	0.0123	0.81	0.0099
1.19E-4	0.001	0.013									
	3.50	0.20	0.13	66.52	0.52	654.8	1.6E-4	0.0329	0.0104	0.81	0.0084
1.01E-4	0.001	0.014									
	3.00	0.17	0.11	70.03	0.52	618.6	1.5E-4	0.0281	0.0089	0.81	0.0072
8.59E-5	0.001	0.015									
	2.50	0.15	0.09	73.53	0.52	575.7	1.3E-4	0.0244	0.0077	0.81	0.0062
7.47E-5	0.001	0.016									
	2.00	0.12	0.08	77.04	0.52	524.6	1.2E-4	0.0249	0.0079	0.81	0.0063
7.61E-5	0.001	0.017									
	1.50	0.09	0.06	80.54	0.52	462.5	1.0E-4	0.0199	0.0063	0.81	0.0051
6.09E-5	0.001	0.017									
	1.00	0.06	0.04	84.05	0.52	384.2	8.1E-5	0.0142	0.0045	0.81	0.0036
4.34E-5	0.001	0.018									
	0.50	0.03	0.02	87.56	0.52	276.2	5.7E-5	0.0085	0.0027	0.81	0.0022
2.60E-5	0.000	0.018									
	0.00	0.00	0.00	91.06	0.52	5.1	1.0E-6	0.0010	0.0003	0.81	0.0003
3.11E-6	0.000	0.018									

Settlement of Unsaturated Sands=0.018 in.
dsz is per each segment, dz=0.05 ft
dsp is per each print interval, dp=0.50 ft
S is cumulated settlement at this depth

Total Settlement of Saturated and Unsaturated Sands=0.851 in.
Differential Settlement=0.426 to 0.562 in.

Units Depth = ft, Stress or Pressure = tsf (atm), Unit Weight = pcf, Settlement = in.

SPT	Field data from Standard Penetration Test (SPT)
BPT	Field data from Becker Penetration Test (BPT)
qc	Field data from Cone Penetration Test (CPT)
fs	Friction from CPT testing

gamma	Total unit weight of soil
gamma'	Effective unit weight of soil
Fines	Fines content [%]
D50	Mean grain size
Dr	Relative Density
sigma	Total vertical stress [tsf]
sigma'	Effective vertical stress [tsf]
sigC'	Effective confining pressure [tsf]
rd	Stress reduction coefficient
CRRv	CRR after overburden stress correction, CRRv=CRR7.5 * Ksig
CRR7.5	Cyclic resistance ratio (M=7.5)
Ksig	Overburden stress correction factor for CRR7.5
CRRm	After magnitude scaling correction CRRm=CRRv * MSF
MSF	Magnitude scaling factor from M=7.5 to user input M
CSR	Cyclic stress ratio induced by earthquake
CSRfs	CSRfs=CSR*fs1 (Default fs1=1)
fs1	First CSR curve in graphic defined in #9 of Advanced page
fs2	2nd CSR curve in graphic defined in #9 of Advanced page
F.S.	Calculated factor of safety against liquefaction F.S.=CRRm/CSRsf
Cebs	Energy Ratio, Borehole Dia., and Sampling Method Corrections
Cr	Rod Length Corrections
Cn	Overburden Pressure Correction
(N1)60	SPT after corrections, (N1)60=SPT * Cr * Cn * Cebs
d(N1)60	Fines correction of SPT
(N1)60f	(N1)60 after fines corrections, (N1)60f=(N1)60 + d(N1)60
Cq	Overburden stress correction factor
qc1	CPT after Overburden stress correction
dqc1	Fines correction of CPT
qc1f	CPT after Fines and Overburden correction, qc1f=qc1 + dqc1
qc1n	CPT after normalization in Robertson's method
Kc	Fine correction factor in Robertson's Method
qc1f	CPT after Fines correction in Robertson's Method
Ic	Soil type index in Suzuki's and Robertson's Methods
(N1)60s	(N1)60 after settlement fines corrections
CSRm	After magnitude scaling correction for Settlement calculation CSRm=CSRsf / MSF*
CSRfs	Cyclic stress ratio induced by earthquake with user inputed fs
MSF*	Scaling factor from CSR, MSF*=1, base on Item 2 of Page C.
ec	Volumetric strain for saturated sands
dz	Calculation segment, dz=0.050 ft
dsz	Settlement in each segment, dz
dp	User defined print interval
dsp	Settlement in each print interval, dp
Gmax	Shear Modulus at low strain
g_eff	gamma_eff, Effective shear Strain
g*Ge/Gm	gamma_eff * G_eff/G_max, Strain-modulus ratio
ec7.5	Volumetric Strain for magnitude=7.5
Cec	Magnitude correction factor for any magnitude
ec	Volumetric strain for unsaturated sands, ec=Cec * ec7.5
NoLiq	No-Liquefy Soils

References:

1. NCEER Workshop on Evaluation of Liquefaction Resistance of Soils. Youd, T.L., and Idriss, I.M., eds., Technical Report NCEER 97-0022.

SP117. Southern California Earthquake Center. Recommended Procedures for Implementation of DMG Special Publication 117, Guidelines for

Analyzing and Mitigating Liquefaction in California. University of Southern California. March 1999.

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International Conference on Recent Advances in Geotechnical Earthquake Engineering and Soil Dynamics, San Diego, CA, March 2001.

3. RECENT ADVANCES IN SOIL LIQUEFACTION ENGINEERING: A UNIFIED AND CONSISTENT FRAMEWORK, Earthquake Engineering Research Center,

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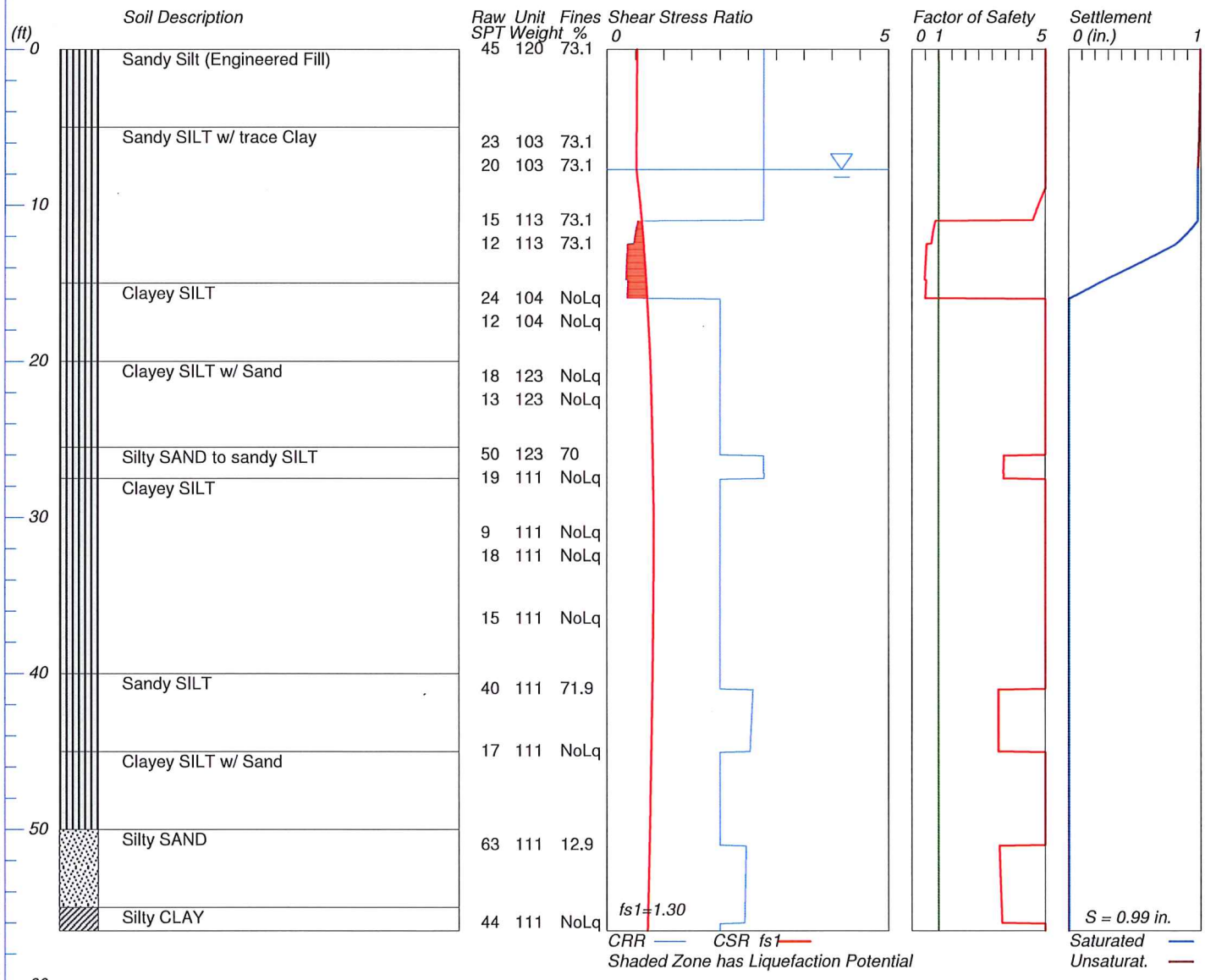
LIQUEFACTION ANALYSIS

Campus Police Station

Hole No.=B-1 Water Depth=7.7 ft Surface Elev.=54

Magnitude=6.6
Acceleration=0.62g



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LIQUEFACTION ANALYSIS CALCULATION SHEET

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Input File Name: C:\Users\rshrestha\Documents\Geo-3-15-16\GEO\Proj-2017\Heider-United Proj\Compton Police\Revised with MC & SPT.liq

Title: Campus Police Station

Subtitle:

Input Data:

Surface Elev.=54

Hole No.=B-1

Depth of Hole=56.5 ft

Water Table during Earthquake= 7.7 ft

Water Table during In-Situ Testing= 50.5 ft

Max. Acceleration=0.62 g

Earthquake Magnitude=6.6

1. SPT or BPT Calculation.
2. Settlement Analysis Method: Ishihara / Yoshimine*
3. Fines Correction for Liquefaction: Idriss/Seed (SPT only)
4. Fine Correction for Settlement: During Liquefaction*
5. Settlement Calculation in: All zones*
6. Hammer Energy Ratio, Ce = 1.25
7. Borehole Diameter, Cb= 1
8. Sampling Method, Cs= 1
9. User request factor of safety (apply to CSR) , User= 1.3
   Plot one CSR curve (fs1=User)
10. Use Curve Smoothing: No

* Recommended Options

In-Situ Test Data:

Depth ft	SPT	Gamma pcf	Fines %
0.0	45.0	120.0	73.1
6.0	23.0	103.0	73.1
7.5	20.0	103.0	73.1
11.0	15.0	113.0	73.1
12.5	12.0	113.0	73.1
16.0	24.0	104.0	NoLiq
17.5	12.0	104.0	NoLiq
21.0	18.0	123.0	NoLiq
22.5	13.0	123.0	NoLiq

26.0	50.0	123.0	70.0
27.5	19.0	111.0	NoLiq
31.0	9.0	111.0	NoLiq
32.5	18.0	111.0	NoLiq
36.5	15.0	111.0	NoLiq
41.0	40.0	111.0	71.9
45.0	17.0	111.0	NoLiq
51.0	63.0	111.0	12.9
56.0	44.0	111.0	NoLiq

Output Results:

Calculation segment, dz=0.050 ft

User defined Print Interval, dp=0.50 ft

CSR Calculation:

Depth ft	gamma pcf	sigma tsf	gamma' pcf	sigma' tsf	rd	CSR	x fs1	=CSRfs
0.00	120.0	0.000	120.0	0.000	1.00	0.40	1.3	0.52
0.50	120.0	0.030	120.0	0.030	1.00	0.40	1.3	0.52
1.00	120.0	0.060	120.0	0.060	1.00	0.40	1.3	0.52
1.50	120.0	0.090	120.0	0.090	1.00	0.40	1.3	0.52
2.00	120.0	0.120	120.0	0.120	1.00	0.40	1.3	0.52
2.50	120.0	0.150	120.0	0.150	0.99	0.40	1.3	0.52
3.00	120.0	0.180	120.0	0.180	0.99	0.40	1.3	0.52
3.50	120.0	0.210	120.0	0.210	0.99	0.40	1.3	0.52
4.00	120.0	0.240	120.0	0.240	0.99	0.40	1.3	0.52
4.50	120.0	0.270	120.0	0.270	0.99	0.40	1.3	0.52
5.00	120.0	0.300	120.0	0.300	0.99	0.40	1.3	0.52
5.50	120.0	0.330	120.0	0.330	0.99	0.40	1.3	0.52
6.00	103.0	0.360	103.0	0.360	0.99	0.40	1.3	0.52
6.50	103.0	0.386	103.0	0.386	0.98	0.40	1.3	0.52
7.00	103.0	0.412	103.0	0.412	0.98	0.40	1.3	0.52
7.50	103.0	0.437	103.0	0.437	0.98	0.40	1.3	0.51
8.00	103.0	0.463	40.6	0.454	0.98	0.40	1.3	0.52
8.50	103.0	0.489	40.6	0.464	0.98	0.42	1.3	0.54
9.00	103.0	0.515	40.6	0.474	0.98	0.43	1.3	0.56
9.50	103.0	0.540	40.6	0.484	0.98	0.44	1.3	0.57
10.00	103.0	0.566	40.6	0.494	0.98	0.45	1.3	0.59
10.50	103.0	0.592	40.6	0.504	0.98	0.46	1.3	0.60
11.00	113.0	0.618	50.6	0.515	0.97	0.47	1.3	0.61
11.50	113.0	0.646	50.6	0.527	0.97	0.48	1.3	0.62
12.00	113.0	0.674	50.6	0.540	0.97	0.49	1.3	0.64
12.50	113.0	0.702	50.6	0.553	0.97	0.50	1.3	0.65
13.00	113.0	0.731	50.6	0.565	0.97	0.51	1.3	0.66
13.50	113.0	0.759	50.6	0.578	0.97	0.51	1.3	0.67
14.00	113.0	0.787	50.6	0.590	0.97	0.52	1.3	0.68
14.50	113.0	0.815	50.6	0.603	0.97	0.53	1.3	0.68
15.00	113.0	0.844	50.6	0.616	0.97	0.53	1.3	0.69
15.50	113.0	0.872	50.6	0.628	0.96	0.54	1.3	0.70

16.00	104.0	0.900	41.6	0.641	0.96	0.54	1.3	0.71
16.50	104.0	0.926	41.6	0.651	0.96	0.55	1.3	0.72
17.00	104.0	0.952	41.6	0.662	0.96	0.56	1.3	0.72
17.50	104.0	0.978	41.6	0.672	0.96	0.56	1.3	0.73
18.00	104.0	1.004	41.6	0.683	0.96	0.57	1.3	0.74
18.50	104.0	1.030	41.6	0.693	0.96	0.57	1.3	0.75
19.00	104.0	1.056	41.6	0.703	0.96	0.58	1.3	0.75
19.50	104.0	1.082	41.6	0.714	0.95	0.58	1.3	0.76
20.00	104.0	1.108	41.6	0.724	0.95	0.59	1.3	0.76
20.50	104.0	1.134	41.6	0.735	0.95	0.59	1.3	0.77
21.00	104.0	1.160	41.6	0.745	0.95	0.60	1.3	0.78
21.50	123.0	1.190	60.6	0.760	0.95	0.60	1.3	0.78
22.00	123.0	1.221	60.6	0.775	0.95	0.60	1.3	0.78
22.50	123.0	1.252	60.6	0.790	0.95	0.61	1.3	0.79
23.00	123.0	1.283	60.6	0.805	0.95	0.61	1.3	0.79
23.50	123.0	1.313	60.6	0.820	0.95	0.61	1.3	0.79
24.00	123.0	1.344	60.6	0.835	0.94	0.61	1.3	0.80
24.50	123.0	1.375	60.6	0.851	0.94	0.61	1.3	0.80
25.00	123.0	1.406	60.6	0.866	0.94	0.62	1.3	0.80
25.50	123.0	1.436	60.6	0.881	0.94	0.62	1.3	0.80
26.00	123.0	1.467	60.6	0.896	0.94	0.62	1.3	0.81
26.50	123.0	1.498	60.6	0.911	0.94	0.62	1.3	0.81
27.00	123.0	1.529	60.6	0.926	0.94	0.62	1.3	0.81
27.50	123.0	1.559	60.6	0.942	0.94	0.62	1.3	0.81
28.00	111.0	1.587	48.6	0.954	0.93	0.63	1.3	0.81
28.50	111.0	1.615	48.6	0.966	0.93	0.63	1.3	0.82
29.00	111.0	1.643	48.6	0.978	0.93	0.63	1.3	0.82
29.50	111.0	1.671	48.6	0.990	0.93	0.63	1.3	0.82
30.00	111.0	1.698	48.6	1.003	0.93	0.63	1.3	0.83
30.50	111.0	1.726	48.6	1.015	0.93	0.63	1.3	0.83
31.00	111.0	1.754	48.6	1.027	0.92	0.63	1.3	0.82
31.50	111.0	1.782	48.6	1.039	0.92	0.63	1.3	0.82
32.00	111.0	1.809	48.6	1.051	0.91	0.63	1.3	0.82
32.50	111.0	1.837	48.6	1.063	0.91	0.63	1.3	0.82
33.00	111.0	1.865	48.6	1.075	0.91	0.63	1.3	0.82
33.50	111.0	1.893	48.6	1.088	0.90	0.63	1.3	0.82
34.00	111.0	1.920	48.6	1.100	0.90	0.63	1.3	0.82
34.50	111.0	1.948	48.6	1.112	0.89	0.63	1.3	0.82
35.00	111.0	1.976	48.6	1.124	0.89	0.63	1.3	0.82
35.50	111.0	2.004	48.6	1.136	0.89	0.63	1.3	0.82
36.00	111.0	2.031	48.6	1.148	0.88	0.63	1.3	0.82
36.50	111.0	2.059	48.6	1.161	0.88	0.63	1.3	0.82
37.00	111.0	2.087	48.6	1.173	0.87	0.63	1.3	0.81
37.50	111.0	2.115	48.6	1.185	0.87	0.62	1.3	0.81
38.00	111.0	2.142	48.6	1.197	0.86	0.62	1.3	0.81
38.50	111.0	2.170	48.6	1.209	0.86	0.62	1.3	0.81
39.00	111.0	2.198	48.6	1.221	0.86	0.62	1.3	0.81
39.50	111.0	2.226	48.6	1.233	0.85	0.62	1.3	0.81
40.00	111.0	2.253	48.6	1.246	0.85	0.62	1.3	0.80
40.50	111.0	2.281	48.6	1.258	0.84	0.62	1.3	0.80
41.00	111.0	2.309	48.6	1.270	0.84	0.62	1.3	0.80
41.50	111.0	2.337	48.6	1.282	0.84	0.61	1.3	0.80

42.00	111.0	2.364	48.6	1.294	0.83	0.61	1.3	0.80
42.50	111.0	2.392	48.6	1.306	0.83	0.61	1.3	0.79
43.00	111.0	2.420	48.6	1.318	0.82	0.61	1.3	0.79
43.50	111.0	2.448	48.6	1.331	0.82	0.61	1.3	0.79
44.00	111.0	2.475	48.6	1.343	0.82	0.61	1.3	0.79
44.50	111.0	2.503	48.6	1.355	0.81	0.60	1.3	0.79
45.00	111.0	2.531	48.6	1.367	0.81	0.60	1.3	0.78
45.50	111.0	2.559	48.6	1.379	0.80	0.60	1.3	0.78
46.00	111.0	2.586	48.6	1.391	0.80	0.60	1.3	0.78
46.50	111.0	2.614	48.6	1.404	0.80	0.60	1.3	0.78
47.00	111.0	2.642	48.6	1.416	0.79	0.60	1.3	0.77
47.50	111.0	2.670	48.6	1.428	0.79	0.59	1.3	0.77
48.00	111.0	2.697	48.6	1.440	0.78	0.59	1.3	0.77
48.50	111.0	2.725	48.6	1.452	0.78	0.59	1.3	0.77
49.00	111.0	2.753	48.6	1.464	0.78	0.59	1.3	0.76
49.50	111.0	2.781	48.6	1.476	0.77	0.59	1.3	0.76
50.00	111.0	2.808	48.6	1.489	0.77	0.58	1.3	0.76
50.50	111.0	2.836	48.6	1.501	0.76	0.58	1.3	0.76
51.00	111.0	2.864	48.6	1.513	0.76	0.58	1.3	0.75
51.50	111.0	2.892	48.6	1.525	0.75	0.58	1.3	0.75
52.00	111.0	2.919	48.6	1.537	0.75	0.57	1.3	0.75
52.50	111.0	2.947	48.6	1.549	0.75	0.57	1.3	0.74
53.00	111.0	2.975	48.6	1.561	0.74	0.57	1.3	0.74
53.50	111.0	3.003	48.6	1.574	0.74	0.57	1.3	0.74
54.00	111.0	3.030	48.6	1.586	0.73	0.57	1.3	0.74
54.50	111.0	3.058	48.6	1.598	0.73	0.56	1.3	0.73
55.00	111.0	3.086	48.6	1.610	0.73	0.56	1.3	0.73
55.50	111.0	3.114	48.6	1.622	0.72	0.56	1.3	0.73
56.00	111.0	3.141	48.6	1.634	0.72	0.56	1.3	0.72
56.50	111.0	3.169	48.6	1.647	0.71	0.55	1.3	0.72

CSR is based on water table at 7.7 during earthquake

CRR Calculation from SPT or BPT data:

Depth ft	SPT	Cebs	Cr	sigma' tsf	Cn	(N1)60	Fines %	d(N1)60	(N1)60f	CRR7.5
0.00	45.00	1.25	0.75	0.000	1.70	71.72	73.10	19.34	91.06	2.00
0.50	45.00	1.25	0.75	0.030	1.70	71.72	73.10	19.34	91.06	2.00
1.00	45.00	1.25	0.75	0.060	1.70	71.72	73.10	19.34	91.06	2.00
1.50	45.00	1.25	0.75	0.090	1.70	71.72	73.10	19.34	91.06	2.00
2.00	45.00	1.25	0.75	0.120	1.70	71.72	73.10	19.34	91.06	2.00
2.50	45.00	1.25	0.75	0.150	1.70	71.72	73.10	19.34	91.06	2.00
3.00	45.00	1.25	0.75	0.180	1.70	71.72	73.10	19.34	91.06	2.00
3.50	45.00	1.25	0.75	0.210	1.70	71.72	73.10	19.34	91.06	2.00
4.00	45.00	1.25	0.75	0.240	1.70	71.72	73.10	19.34	91.06	2.00
4.50	45.00	1.25	0.75	0.270	1.70	71.72	73.10	19.34	91.06	2.00
5.00	45.00	1.25	0.75	0.300	1.70	71.72	73.10	19.34	91.06	2.00
5.50	45.00	1.25	0.75	0.330	1.70	71.72	73.10	19.34	91.06	2.00
6.00	23.00	1.25	0.75	0.360	1.67	35.94	73.10	12.19	48.12	2.00
6.50	23.00	1.25	0.75	0.386	1.61	34.72	73.10	11.94	46.66	2.00
7.00	23.00	1.25	0.75	0.412	1.56	33.61	73.10	11.72	45.34	2.00

7.50	20.00	1.25	0.75	0.437	1.51	28.36	73.10	10.67	39.03	2.00
8.00	20.00	1.25	0.75	0.463	1.47	27.56	73.10	10.51	38.07	2.00
8.50	20.00	1.25	0.85	0.489	1.43	30.40	73.10	11.08	41.47	2.00
9.00	20.00	1.25	0.85	0.515	1.39	29.63	73.10	10.93	40.55	2.00
9.50	20.00	1.25	0.85	0.540	1.36	28.91	73.10	10.78	39.69	2.00
10.00	20.00	1.25	0.85	0.566	1.33	28.25	73.10	10.65	38.89	2.00
10.50	20.00	1.25	0.85	0.592	1.30	27.62	73.10	10.52	38.15	2.00
11.00	15.00	1.25	0.85	0.618	1.27	20.28	73.10	9.06	29.34	0.39
11.50	15.00	1.25	0.85	0.646	1.24	19.83	73.10	8.97	28.80	0.37
12.00	15.00	1.25	0.85	0.674	1.22	19.41	73.10	8.88	28.30	0.35
12.50	12.00	1.25	0.85	0.702	1.19	15.21	73.10	8.04	23.26	0.26
13.00	12.00	1.25	0.85	0.731	1.17	14.92	73.10	7.98	22.90	0.25
13.50	12.00	1.25	0.85	0.759	1.15	14.64	73.10	7.93	22.56	0.25
14.00	12.00	1.25	0.85	0.787	1.13	14.37	73.10	7.87	22.25	0.24
14.50	12.00	1.25	0.85	0.815	1.11	14.12	73.10	7.82	21.95	0.24
15.00	12.00	1.25	0.95	0.844	1.09	15.52	73.10	8.10	23.62	0.26
15.50	12.00	1.25	0.95	0.872	1.07	15.26	73.10	8.05	23.31	0.26
16.00	24.00	1.25	0.95	0.900	1.05	30.04	NoLiq	11.01	41.05	2.00
16.50	24.00	1.25	0.95	0.926	1.04	29.62	NoLiq	10.92	40.54	2.00
17.00	24.00	1.25	0.95	0.952	1.02	29.21	NoLiq	10.84	40.05	2.00
17.50	12.00	1.25	0.95	0.978	1.01	14.41	NoLiq	7.88	22.29	0.24
18.00	12.00	1.25	0.95	1.004	1.00	14.22	NoLiq	7.84	22.07	0.24
18.50	12.00	1.25	0.95	1.030	0.99	14.04	NoLiq	7.81	21.85	0.24
19.00	12.00	1.25	0.95	1.056	0.97	13.87	NoLiq	7.77	21.64	0.24
19.50	12.00	1.25	0.95	1.082	0.96	13.70	NoLiq	7.74	21.44	0.23
20.00	12.00	1.25	0.95	1.108	0.95	13.54	NoLiq	7.71	21.25	0.23
20.50	12.00	1.25	0.95	1.134	0.94	13.38	NoLiq	7.68	21.06	0.23
21.00	12.00	1.25	0.95	1.160	0.93	13.23	NoLiq	7.65	20.88	0.23
21.50	18.00	1.25	0.95	1.190	0.92	19.59	NoLiq	8.92	28.51	0.36
22.00	18.00	1.25	0.95	1.221	0.90	19.34	NoLiq	8.87	28.21	0.35
22.50	18.00	1.25	0.95	1.252	0.89	19.10	NoLiq	8.82	27.93	0.34
23.00	13.00	1.25	0.95	1.283	0.88	13.63	NoLiq	7.73	21.36	0.23
23.50	13.00	1.25	0.95	1.313	0.87	13.47	NoLiq	7.69	21.17	0.23
24.00	13.00	1.25	0.95	1.344	0.86	13.32	NoLiq	7.66	20.98	0.23
24.50	13.00	1.25	0.95	1.375	0.85	13.17	NoLiq	7.63	20.80	0.23
25.00	13.00	1.25	0.95	1.406	0.84	13.02	NoLiq	7.60	20.63	0.22
25.50	13.00	1.25	0.95	1.436	0.83	12.88	NoLiq	7.58	20.46	0.22
26.00	13.00	1.25	0.95	1.467	0.83	12.75	NoLiq	7.55	20.29	0.22
26.50	50.00	1.25	0.95	1.498	0.82	48.52	70.00	14.70	63.22	2.00
27.00	50.00	1.25	0.95	1.529	0.81	48.02	70.00	14.60	62.63	2.00
27.50	50.00	1.25	0.95	1.559	0.80	47.55	70.00	14.51	62.06	2.00
28.00	19.00	1.25	1.00	1.587	0.79	18.85	NoLiq	8.77	27.62	0.33
28.50	19.00	1.25	1.00	1.615	0.79	18.69	NoLiq	8.74	27.43	0.33
29.00	19.00	1.25	1.00	1.643	0.78	18.53	NoLiq	8.71	27.24	0.32
29.50	19.00	1.25	1.00	1.671	0.77	18.38	NoLiq	8.68	27.05	0.32
30.00	19.00	1.25	1.00	1.698	0.77	18.22	NoLiq	8.64	26.87	0.32
30.50	19.00	1.25	1.00	1.726	0.76	18.08	NoLiq	8.62	26.69	0.31
31.00	19.00	1.25	1.00	1.754	0.76	17.93	NoLiq	8.59	26.52	0.31
31.50	9.00	1.25	1.00	1.782	0.75	8.43	NoLiq	6.69	15.11	0.16
32.00	9.00	1.25	1.00	1.809	0.74	8.36	NoLiq	6.67	15.04	0.16
32.50	9.00	1.25	1.00	1.837	0.74	8.30	NoLiq	6.66	14.96	0.16
33.00	18.00	1.25	1.00	1.865	0.73	16.48	NoLiq	8.30	24.77	0.28

33.50	18.00	1.25	1.00	1.893	0.73	16.36	NoLiq	8.27	24.63	0.28
34.00	18.00	1.25	1.00	1.920	0.72	16.24	NoLiq	8.25	24.48	0.27
34.50	18.00	1.25	1.00	1.948	0.72	16.12	NoLiq	8.22	24.34	0.27
35.00	18.00	1.25	1.00	1.976	0.71	16.01	NoLiq	8.20	24.21	0.27
35.50	18.00	1.25	1.00	2.004	0.71	15.90	NoLiq	8.18	24.07	0.27
36.00	18.00	1.25	1.00	2.031	0.70	15.79	NoLiq	8.16	23.94	0.27
36.50	18.00	1.25	1.00	2.059	0.70	15.68	NoLiq	8.14	23.82	0.26
37.00	15.00	1.25	1.00	2.087	0.69	12.98	NoLiq	7.60	20.58	0.22
37.50	15.00	1.25	1.00	2.115	0.69	12.89	NoLiq	7.58	20.47	0.22
38.00	15.00	1.25	1.00	2.142	0.68	12.81	NoLiq	7.56	20.37	0.22
38.50	15.00	1.25	1.00	2.170	0.68	12.73	NoLiq	7.55	20.27	0.22
39.00	15.00	1.25	1.00	2.198	0.67	12.65	NoLiq	7.53	20.18	0.22
39.50	15.00	1.25	1.00	2.226	0.67	12.57	NoLiq	7.51	20.08	0.22
40.00	15.00	1.25	1.00	2.253	0.67	12.49	NoLiq	7.50	19.99	0.22
40.50	15.00	1.25	1.00	2.281	0.66	12.41	NoLiq	7.48	19.90	0.22
41.00	15.00	1.25	1.00	2.309	0.66	12.34	NoLiq	7.47	19.81	0.21
41.50	40.00	1.25	1.00	2.337	0.65	32.71	71.90	11.54	44.25	2.00
42.00	40.00	1.25	1.00	2.364	0.65	32.52	71.90	11.50	44.02	2.00
42.50	40.00	1.25	1.00	2.392	0.65	32.33	71.90	11.47	43.79	2.00
43.00	40.00	1.25	1.00	2.420	0.64	32.14	71.90	11.43	43.57	2.00
43.50	40.00	1.25	1.00	2.448	0.64	31.96	71.90	11.39	43.35	2.00
44.00	40.00	1.25	1.00	2.475	0.64	31.78	71.90	11.36	43.14	2.00
44.50	40.00	1.25	1.00	2.503	0.63	31.60	71.90	11.32	42.92	2.00
45.00	40.00	1.25	1.00	2.531	0.63	31.43	71.90	11.29	42.72	2.00
45.50	17.00	1.25	1.00	2.559	0.63	13.28	NoLiq	7.66	20.94	0.23
46.00	17.00	1.25	1.00	2.586	0.62	13.21	NoLiq	7.64	20.86	0.23
46.50	17.00	1.25	1.00	2.614	0.62	13.14	NoLiq	7.63	20.77	0.23
47.00	17.00	1.25	1.00	2.642	0.62	13.07	NoLiq	7.61	20.69	0.22
47.50	17.00	1.25	1.00	2.670	0.61	13.01	NoLiq	7.60	20.61	0.22
48.00	17.00	1.25	1.00	2.697	0.61	12.94	NoLiq	7.59	20.53	0.22
48.50	17.00	1.25	1.00	2.725	0.61	12.87	NoLiq	7.57	20.45	0.22
49.00	17.00	1.25	1.00	2.753	0.60	12.81	NoLiq	7.56	20.37	0.22
49.50	17.00	1.25	1.00	2.781	0.60	12.74	NoLiq	7.55	20.29	0.22
50.00	17.00	1.25	1.00	2.808	0.60	12.68	NoLiq	7.54	20.22	0.22
50.50	17.00	1.25	1.00	2.836	0.59	12.62	NoLiq	7.52	20.14	0.22
51.00	17.00	1.25	1.00	2.850	0.59	12.59	NoLiq	7.52	20.11	0.22
51.50	63.00	1.25	1.00	2.862	0.59	46.55	12.90	3.55	50.10	2.00
52.00	63.00	1.25	1.00	2.874	0.59	46.45	12.90	3.54	50.00	2.00
52.50	63.00	1.25	1.00	2.886	0.59	46.35	12.90	3.54	49.89	2.00
53.00	63.00	1.25	1.00	2.898	0.59	46.26	12.90	3.54	49.79	2.00
53.50	63.00	1.25	1.00	2.911	0.59	46.16	12.90	3.53	49.69	2.00
54.00	63.00	1.25	1.00	2.923	0.58	46.06	12.90	3.53	49.59	2.00
54.50	63.00	1.25	1.00	2.935	0.58	45.97	12.90	3.53	49.49	2.00
55.00	63.00	1.25	1.00	2.947	0.58	45.87	12.90	3.52	49.40	2.00
55.50	63.00	1.25	1.00	2.959	0.58	45.78	12.90	3.52	49.30	2.00
56.00	63.00	1.25	1.00	2.971	0.58	45.69	12.90	3.52	49.20	2.00
56.50	44.00	1.25	1.00	2.983	0.58	31.84	NoLiq	11.37	43.21	2.00

CRR is based on water table at 50.5 during In-Situ Testing

Factor of Safety, - Earthquake Magnitude= 6.6:

Depth	sigC'	CRR7.5	x Ksig	=CRRv	x MSF	=CRRm	/ CSRfs	=F.S.

ft	tsf	tsf		tsf		tsf	tsf	CRRm/CSRfs
0.00	0.00	2.00	1.00	2.00	1.39	2.77	0.52	5.00
0.50	0.02	2.00	1.00	2.00	1.39	2.77	0.52	5.00
1.00	0.04	2.00	1.00	2.00	1.39	2.77	0.52	5.00
1.50	0.06	2.00	1.00	2.00	1.39	2.77	0.52	5.00
2.00	0.08	2.00	1.00	2.00	1.39	2.77	0.52	5.00
2.50	0.10	2.00	1.00	2.00	1.39	2.77	0.52	5.00
3.00	0.12	2.00	1.00	2.00	1.39	2.77	0.52	5.00
3.50	0.14	2.00	1.00	2.00	1.39	2.77	0.52	5.00
4.00	0.16	2.00	1.00	2.00	1.39	2.77	0.52	5.00
4.50	0.18	2.00	1.00	2.00	1.39	2.77	0.52	5.00
5.00	0.20	2.00	1.00	2.00	1.39	2.77	0.52	5.00
5.50	0.21	2.00	1.00	2.00	1.39	2.77	0.52	5.00
6.00	0.23	2.00	1.00	2.00	1.39	2.77	0.52	5.00
6.50	0.25	2.00	1.00	2.00	1.39	2.77	0.52	5.00
7.00	0.27	2.00	1.00	2.00	1.39	2.77	0.52	5.00
7.50	0.28	2.00	1.00	2.00	1.39	2.77	0.51	5.00
8.00	0.30	2.00	1.00	2.00	1.39	2.77	0.52	5.00
8.50	0.32	2.00	1.00	2.00	1.39	2.77	0.54	5.00
9.00	0.33	2.00	1.00	2.00	1.39	2.77	0.56	4.98
9.50	0.35	2.00	1.00	2.00	1.39	2.77	0.57	4.85
10.00	0.37	2.00	1.00	2.00	1.39	2.77	0.59	4.73
10.50	0.38	2.00	1.00	2.00	1.39	2.77	0.60	4.63
11.00	0.40	0.39	1.00	0.39	1.39	0.54	0.61	0.88 *
11.50	0.42	0.37	1.00	0.37	1.39	0.51	0.62	0.82 *
12.00	0.44	0.35	1.00	0.35	1.39	0.49	0.64	0.77 *
12.50	0.46	0.26	1.00	0.26	1.39	0.36	0.65	0.55 *
13.00	0.47	0.25	1.00	0.25	1.39	0.35	0.66	0.53 *
13.50	0.49	0.25	1.00	0.25	1.39	0.34	0.67	0.51 *
14.00	0.51	0.24	1.00	0.24	1.39	0.34	0.68	0.50 *
14.50	0.53	0.24	1.00	0.24	1.39	0.33	0.68	0.49 *
15.00	0.55	0.26	1.00	0.26	1.39	0.36	0.69	0.52 *
15.50	0.57	0.26	1.00	0.26	1.39	0.36	0.70	0.51 *
16.00	0.59	2.00	1.00	2.00	1.39	2.00	0.71	5.00 ^
16.50	0.60	2.00	1.00	2.00	1.39	2.00	0.72	5.00 ^
17.00	0.62	2.00	1.00	2.00	1.39	2.00	0.72	5.00 ^
17.50	0.64	0.24	1.00	0.24	1.39	2.00	0.73	5.00 ^
18.00	0.65	0.24	1.00	0.24	1.39	2.00	0.74	5.00 ^
18.50	0.67	0.24	1.00	0.24	1.39	2.00	0.75	5.00 ^
19.00	0.69	0.24	1.00	0.24	1.39	2.00	0.75	5.00 ^
19.50	0.70	0.23	1.00	0.23	1.39	2.00	0.76	5.00 ^
20.00	0.72	0.23	1.00	0.23	1.39	2.00	0.76	5.00 ^
20.50	0.74	0.23	1.00	0.23	1.39	2.00	0.77	5.00 ^
21.00	0.75	0.23	1.00	0.23	1.39	2.00	0.78	5.00 ^
21.50	0.77	0.36	1.00	0.36	1.39	2.00	0.78	5.00 ^
22.00	0.79	0.35	1.00	0.35	1.39	2.00	0.78	5.00 ^
22.50	0.81	0.34	1.00	0.34	1.39	2.00	0.79	5.00 ^
23.00	0.83	0.23	1.00	0.23	1.39	2.00	0.79	5.00 ^
23.50	0.85	0.23	1.00	0.23	1.39	2.00	0.79	5.00 ^
24.00	0.87	0.23	1.00	0.23	1.39	2.00	0.80	5.00 ^
24.50	0.89	0.23	1.00	0.23	1.39	2.00	0.80	5.00 ^

25.00	0.91	0.22	1.00	0.22	1.39	2.00	0.80	5.00 ^
25.50	0.93	0.22	1.00	0.22	1.39	2.00	0.80	5.00 ^
26.00	0.95	0.22	1.00	0.22	1.39	2.00	0.81	5.00 ^
26.50	0.97	2.00	1.00	2.00	1.39	2.77	0.81	3.43
27.00	0.99	2.00	1.00	2.00	1.39	2.77	0.81	3.42
27.50	1.01	2.00	1.00	2.01	1.39	2.78	0.81	3.43
28.00	1.03	0.33	1.00	0.33	1.39	2.00	0.81	5.00 ^
28.50	1.05	0.33	1.00	0.33	1.39	2.00	0.82	5.00 ^
29.00	1.07	0.32	1.00	0.32	1.39	2.00	0.82	5.00 ^
29.50	1.09	0.32	0.99	0.32	1.39	2.00	0.82	5.00 ^
30.00	1.10	0.32	0.99	0.31	1.39	2.00	0.83	5.00 ^
30.50	1.12	0.31	0.99	0.31	1.39	2.00	0.83	5.00 ^
31.00	1.14	0.31	0.98	0.30	1.39	2.00	0.82	5.00 ^
31.50	1.16	0.16	0.98	0.16	1.39	2.00	0.82	5.00 ^
32.00	1.18	0.16	0.98	0.16	1.39	2.00	0.82	5.00 ^
32.50	1.19	0.16	0.98	0.16	1.39	2.00	0.82	5.00 ^
33.00	1.21	0.28	0.97	0.27	1.39	2.00	0.82	5.00 ^
33.50	1.23	0.28	0.97	0.27	1.39	2.00	0.82	5.00 ^
34.00	1.25	0.27	0.97	0.27	1.39	2.00	0.82	5.00 ^
34.50	1.27	0.27	0.97	0.26	1.39	2.00	0.82	5.00 ^
35.00	1.28	0.27	0.96	0.26	1.39	2.00	0.82	5.00 ^
35.50	1.30	0.27	0.96	0.26	1.39	2.00	0.82	5.00 ^
36.00	1.32	0.27	0.96	0.26	1.39	2.00	0.82	5.00 ^
36.50	1.34	0.26	0.96	0.25	1.39	2.00	0.82	5.00 ^
37.00	1.36	0.22	0.95	0.21	1.39	2.00	0.81	5.00 ^
37.50	1.37	0.22	0.95	0.21	1.39	2.00	0.81	5.00 ^
38.00	1.39	0.22	0.95	0.21	1.39	2.00	0.81	5.00 ^
38.50	1.41	0.22	0.94	0.21	1.39	2.00	0.81	5.00 ^
39.00	1.43	0.22	0.94	0.21	1.39	2.00	0.81	5.00 ^
39.50	1.45	0.22	0.94	0.20	1.39	2.00	0.81	5.00 ^
40.00	1.46	0.22	0.94	0.20	1.39	2.00	0.80	5.00 ^
40.50	1.48	0.22	0.94	0.20	1.39	2.00	0.80	5.00 ^
41.00	1.50	0.21	0.93	0.20	1.39	2.00	0.80	5.00 ^
41.50	1.52	2.00	0.93	1.86	1.39	2.58	0.80	3.23
42.00	1.54	2.00	0.93	1.86	1.39	2.57	0.80	3.23
42.50	1.55	2.00	0.93	1.85	1.39	2.57	0.79	3.23
43.00	1.57	2.00	0.92	1.85	1.39	2.56	0.79	3.23
43.50	1.59	2.00	0.92	1.84	1.39	2.55	0.79	3.23
44.00	1.61	2.00	0.92	1.84	1.39	2.55	0.79	3.23
44.50	1.63	2.00	0.92	1.83	1.39	2.54	0.79	3.23
45.00	1.65	2.00	0.91	1.83	1.39	2.53	0.78	3.23
45.50	1.66	0.23	0.91	0.21	1.39	2.00	0.78	5.00 ^
46.00	1.68	0.23	0.91	0.21	1.39	2.00	0.78	5.00 ^
46.50	1.70	0.23	0.91	0.20	1.39	2.00	0.78	5.00 ^
47.00	1.72	0.22	0.90	0.20	1.39	2.00	0.77	5.00 ^
47.50	1.74	0.22	0.90	0.20	1.39	2.00	0.77	5.00 ^
48.00	1.75	0.22	0.90	0.20	1.39	2.00	0.77	5.00 ^
48.50	1.77	0.22	0.90	0.20	1.39	2.00	0.77	5.00 ^
49.00	1.79	0.22	0.90	0.20	1.39	2.00	0.76	5.00 ^
49.50	1.81	0.22	0.89	0.20	1.39	2.00	0.76	5.00 ^
50.00	1.83	0.22	0.89	0.20	1.39	2.00	0.76	5.00 ^
50.50	1.84	0.22	0.89	0.19	1.39	2.00	0.76	5.00 ^

51.00	1.85	0.22	0.89	0.19	1.39	2.00	0.75	5.00 ^
51.50	1.86	2.00	0.89	1.78	1.39	2.46	0.75	3.28
52.00	1.87	2.00	0.89	1.77	1.39	2.46	0.75	3.29
52.50	1.88	2.00	0.89	1.77	1.39	2.46	0.74	3.30
53.00	1.88	2.00	0.88	1.77	1.39	2.45	0.74	3.31
53.50	1.89	2.00	0.88	1.77	1.39	2.45	0.74	3.32
54.00	1.90	2.00	0.88	1.77	1.39	2.45	0.74	3.33
54.50	1.91	2.00	0.88	1.76	1.39	2.45	0.73	3.34
55.00	1.92	2.00	0.88	1.76	1.39	2.44	0.73	3.35
55.50	1.92	2.00	0.88	1.76	1.39	2.44	0.73	3.36
56.00	1.93	2.00	0.88	1.76	1.39	2.44	0.72	3.37
56.50	1.94	2.00	0.88	1.76	1.39	2.00	0.72	5.00 ^

* F.S.<1: Liquefaction Potential Zone. (If above water table: F.S.=5)
^ No-liquefiable Soils.
(F.S. is limited to 5, CRR is limited to 2, CSR is limited to 2)

CPT convert to SPT for Settlement Analysis:
Fines Correction for Settlement Analysis:

Depth ft	Ic	qc/N60	qc1 tsf	(N1)60	Fines %	d(N1)60	(N1)60s
0.00	-	-	-	91.06	73.10	0.00	91.06
0.50	-	-	-	91.06	73.10	0.00	91.06
1.00	-	-	-	91.06	73.10	0.00	91.06
1.50	-	-	-	91.06	73.10	0.00	91.06
2.00	-	-	-	91.06	73.10	0.00	91.06
2.50	-	-	-	91.06	73.10	0.00	91.06
3.00	-	-	-	91.06	73.10	0.00	91.06
3.50	-	-	-	91.06	73.10	0.00	91.06
4.00	-	-	-	91.06	73.10	0.00	91.06
4.50	-	-	-	91.06	73.10	0.00	91.06
5.00	-	-	-	91.06	73.10	0.00	91.06
5.50	-	-	-	91.06	73.10	0.00	91.06
6.00	-	-	-	48.12	73.10	0.00	48.12
6.50	-	-	-	46.66	73.10	0.00	46.66
7.00	-	-	-	45.34	73.10	0.00	45.34
7.50	-	-	-	39.03	73.10	0.00	39.03
8.00	-	-	-	38.07	73.10	0.00	38.07
8.50	-	-	-	41.47	73.10	0.00	41.47
9.00	-	-	-	40.55	73.10	0.00	40.55
9.50	-	-	-	39.69	73.10	0.00	39.69
10.00	-	-	-	38.89	73.10	0.00	38.89
10.50	-	-	-	38.15	73.10	0.00	38.15
11.00	-	-	-	29.34	73.10	0.00	29.34
11.50	-	-	-	28.80	73.10	0.00	28.80
12.00	-	-	-	28.30	73.10	0.00	28.30
12.50	-	-	-	23.26	73.10	0.00	23.26
13.00	-	-	-	22.90	73.10	0.00	22.90
13.50	-	-	-	22.56	73.10	0.00	22.56
14.00	-	-	-	22.25	73.10	0.00	22.25

14.50	-	-	-	21.95	73.10	0.00	21.95
15.00	-	-	-	23.62	73.10	0.00	23.62
15.50	-	-	-	23.31	73.10	0.00	23.31
16.00	-	-	-	41.05	NoLiq	0.00	41.05
16.50	-	-	-	40.54	NoLiq	0.00	40.54
17.00	-	-	-	40.05	NoLiq	0.00	40.05
17.50	-	-	-	22.29	NoLiq	0.00	22.29
18.00	-	-	-	22.07	NoLiq	0.00	22.07
18.50	-	-	-	21.85	NoLiq	0.00	21.85
19.00	-	-	-	21.64	NoLiq	0.00	21.64
19.50	-	-	-	21.44	NoLiq	0.00	21.44
20.00	-	-	-	21.25	NoLiq	0.00	21.25
20.50	-	-	-	21.06	NoLiq	0.00	21.06
21.00	-	-	-	20.88	NoLiq	0.00	20.88
21.50	-	-	-	28.51	NoLiq	0.00	28.51
22.00	-	-	-	28.21	NoLiq	0.00	28.21
22.50	-	-	-	27.93	NoLiq	0.00	27.93
23.00	-	-	-	21.36	NoLiq	0.00	21.36
23.50	-	-	-	21.17	NoLiq	0.00	21.17
24.00	-	-	-	20.98	NoLiq	0.00	20.98
24.50	-	-	-	20.80	NoLiq	0.00	20.80
25.00	-	-	-	20.63	NoLiq	0.00	20.63
25.50	-	-	-	20.46	NoLiq	0.00	20.46
26.00	-	-	-	20.29	NoLiq	0.00	20.29
26.50	-	-	-	63.22	70.00	0.00	63.22
27.00	-	-	-	62.63	70.00	0.00	62.63
27.50	-	-	-	62.06	70.00	0.00	62.06
28.00	-	-	-	27.62	NoLiq	0.00	27.62
28.50	-	-	-	27.43	NoLiq	0.00	27.43
29.00	-	-	-	27.24	NoLiq	0.00	27.24
29.50	-	-	-	27.05	NoLiq	0.00	27.05
30.00	-	-	-	26.87	NoLiq	0.00	26.87
30.50	-	-	-	26.69	NoLiq	0.00	26.69
31.00	-	-	-	26.52	NoLiq	0.00	26.52
31.50	-	-	-	15.11	NoLiq	0.00	15.11
32.00	-	-	-	15.04	NoLiq	0.00	15.04
32.50	-	-	-	14.96	NoLiq	0.00	14.96
33.00	-	-	-	24.77	NoLiq	0.00	24.77
33.50	-	-	-	24.63	NoLiq	0.00	24.63
34.00	-	-	-	24.48	NoLiq	0.00	24.48
34.50	-	-	-	24.34	NoLiq	0.00	24.34
35.00	-	-	-	24.21	NoLiq	0.00	24.21
35.50	-	-	-	24.07	NoLiq	0.00	24.07
36.00	-	-	-	23.94	NoLiq	0.00	23.94
36.50	-	-	-	23.82	NoLiq	0.00	23.82
37.00	-	-	-	20.58	NoLiq	0.00	20.58
37.50	-	-	-	20.47	NoLiq	0.00	20.47
38.00	-	-	-	20.37	NoLiq	0.00	20.37
38.50	-	-	-	20.27	NoLiq	0.00	20.27
39.00	-	-	-	20.18	NoLiq	0.00	20.18
39.50	-	-	-	20.08	NoLiq	0.00	20.08
40.00	-	-	-	19.99	NoLiq	0.00	19.99

40.50	-	-	-	19.90	NoLiq	0.00	19.90
41.00	-	-	-	19.81	NoLiq	0.00	19.81
41.50	-	-	-	44.25	71.90	0.00	44.25
42.00	-	-	-	44.02	71.90	0.00	44.02
42.50	-	-	-	43.79	71.90	0.00	43.79
43.00	-	-	-	43.57	71.90	0.00	43.57
43.50	-	-	-	43.35	71.90	0.00	43.35
44.00	-	-	-	43.14	71.90	0.00	43.14
44.50	-	-	-	42.92	71.90	0.00	42.92
45.00	-	-	-	42.72	71.90	0.00	42.72
45.50	-	-	-	20.94	NoLiq	0.00	20.94
46.00	-	-	-	20.86	NoLiq	0.00	20.86
46.50	-	-	-	20.77	NoLiq	0.00	20.77
47.00	-	-	-	20.69	NoLiq	0.00	20.69
47.50	-	-	-	20.61	NoLiq	0.00	20.61
48.00	-	-	-	20.53	NoLiq	0.00	20.53
48.50	-	-	-	20.45	NoLiq	0.00	20.45
49.00	-	-	-	20.37	NoLiq	0.00	20.37
49.50	-	-	-	20.29	NoLiq	0.00	20.29
50.00	-	-	-	20.22	NoLiq	0.00	20.22
50.50	-	-	-	20.14	NoLiq	0.00	20.14
51.00	-	-	-	20.11	NoLiq	0.00	20.11
51.50	-	-	-	50.10	12.90	0.00	50.10
52.00	-	-	-	50.00	12.90	0.00	50.00
52.50	-	-	-	49.89	12.90	0.00	49.89
53.00	-	-	-	49.79	12.90	0.00	49.79
53.50	-	-	-	49.69	12.90	0.00	49.69
54.00	-	-	-	49.59	12.90	0.00	49.59
54.50	-	-	-	49.49	12.90	0.00	49.49
55.00	-	-	-	49.40	12.90	0.00	49.40
55.50	-	-	-	49.30	12.90	0.00	49.30
56.00	-	-	-	49.20	12.90	0.00	49.20
56.50	-	-	-	43.21	NoLiq	0.00	43.21

(N1)60s has been fines corrected in liquefaction analysis, therefore d(N1)60=0.
Fines=NoLiq means the soils are not liquefiable.

Settlement of Saturated Sands:
Settlement Analysis Method: Ishihara / Yoshimine*

Depth	CSRsf	/ MSF*	=CSRm	F.S.	Fines	(N1)60s	Dr	ec	dsz	dsp	S
ft	tsf		tsf		%		%	%	in.	in.	in.
56.45	0.72	1.0	0.72	5.00	NoLiq	43.22	100.00	0.000	0.0E0	0.000	0.000
56.00	0.72	1.0	0.72	3.37	12.90	49.20	100.00	0.000	0.0E0	0.000	0.000
55.50	0.73	1.0	0.73	3.36	12.90	49.30	100.00	0.000	0.0E0	0.000	0.000

	55.00	0.73	1.0	0.73	3.35	12.90	49.40	100.00	0.000	0.0E0	0.000
0.000											
	54.50	0.73	1.0	0.73	3.34	12.90	49.49	100.00	0.000	0.0E0	0.000
0.000											
	54.00	0.74	1.0	0.74	3.33	12.90	49.59	100.00	0.000	0.0E0	0.000
0.000											
	53.50	0.74	1.0	0.74	3.32	12.90	49.69	100.00	0.000	0.0E0	0.000
0.000											
	53.00	0.74	1.0	0.74	3.31	12.90	49.79	100.00	0.000	0.0E0	0.000
0.000											
	52.50	0.74	1.0	0.74	3.30	12.90	49.89	100.00	0.000	0.0E0	0.000
0.000											
	52.00	0.75	1.0	0.75	3.29	12.90	50.00	100.00	0.000	0.0E0	0.000
0.000											
	51.50	0.75	1.0	0.75	3.28	12.90	50.10	100.00	0.000	0.0E0	0.000
0.000											
	51.00	0.75	1.0	0.75	5.00	NoLiq	20.11	70.73	0.000	0.0E0	0.000
0.000											
	50.50	0.76	1.0	0.76	5.00	NoLiq	20.14	70.79	0.000	0.0E0	0.000
0.000											
	50.00	0.76	1.0	0.76	5.00	NoLiq	20.22	70.93	0.000	0.0E0	0.000
0.000											
	49.50	0.76	1.0	0.76	5.00	NoLiq	20.29	71.06	0.000	0.0E0	0.000
0.000											
	49.00	0.76	1.0	0.76	5.00	NoLiq	20.37	71.20	0.000	0.0E0	0.000
0.000											
	48.50	0.77	1.0	0.77	5.00	NoLiq	20.45	71.34	0.000	0.0E0	0.000
0.000											
	48.00	0.77	1.0	0.77	5.00	NoLiq	20.53	71.49	0.000	0.0E0	0.000
0.000											
	47.50	0.77	1.0	0.77	5.00	NoLiq	20.61	71.63	0.000	0.0E0	0.000
0.000											
	47.00	0.77	1.0	0.77	5.00	NoLiq	20.69	71.78	0.000	0.0E0	0.000
0.000											
	46.50	0.78	1.0	0.78	5.00	NoLiq	20.77	71.93	0.000	0.0E0	0.000
0.000											
	46.00	0.78	1.0	0.78	5.00	NoLiq	20.86	72.08	0.000	0.0E0	0.000
0.000											
	45.50	0.78	1.0	0.78	5.00	NoLiq	20.94	72.23	0.000	0.0E0	0.000
0.000											
	45.00	0.78	1.0	0.78	3.23	71.90	42.72	100.00	0.000	0.0E0	0.000
0.000											
	44.50	0.79	1.0	0.79	3.23	71.90	42.92	100.00	0.000	0.0E0	0.000
0.000											
	44.00	0.79	1.0	0.79	3.23	71.90	43.14	100.00	0.000	0.0E0	0.000
0.000											
	43.50	0.79	1.0	0.79	3.23	71.90	43.35	100.00	0.000	0.0E0	0.000
0.000											
	43.00	0.79	1.0	0.79	3.23	71.90	43.57	100.00	0.000	0.0E0	0.000
0.000											
	42.50	0.79	1.0	0.79	3.23	71.90	43.79	100.00	0.000	0.0E0	0.000
0.000											

	42.00	0.80	1.0	0.80	3.23	71.90	44.02	100.00	0.000	0.0E0	0.000
0.000											
	41.50	0.80	1.0	0.80	3.23	71.90	44.25	100.00	0.000	0.0E0	0.000
0.000											
	41.00	0.80	1.0	0.80	5.00	NoLiq	19.81	70.19	0.000	0.0E0	0.000
0.000											
	40.50	0.80	1.0	0.80	5.00	NoLiq	19.90	70.35	0.000	0.0E0	0.000
0.000											
	40.00	0.80	1.0	0.80	5.00	NoLiq	19.99	70.52	0.000	0.0E0	0.000
0.000											
	39.50	0.81	1.0	0.81	5.00	NoLiq	20.08	70.69	0.000	0.0E0	0.000
0.000											
	39.00	0.81	1.0	0.81	5.00	NoLiq	20.18	70.86	0.000	0.0E0	0.000
0.000											
	38.50	0.81	1.0	0.81	5.00	NoLiq	20.27	71.03	0.000	0.0E0	0.000
0.000											
	38.00	0.81	1.0	0.81	5.00	NoLiq	20.37	71.21	0.000	0.0E0	0.000
0.000											
	37.50	0.81	1.0	0.81	5.00	NoLiq	20.47	71.39	0.000	0.0E0	0.000
0.000											
	37.00	0.81	1.0	0.81	5.00	NoLiq	20.58	71.57	0.000	0.0E0	0.000
0.000											
	36.50	0.82	1.0	0.82	5.00	NoLiq	23.82	77.48	0.000	0.0E0	0.000
0.000											
	36.00	0.82	1.0	0.82	5.00	NoLiq	23.94	77.72	0.000	0.0E0	0.000
0.000											
	35.50	0.82	1.0	0.82	5.00	NoLiq	24.07	77.97	0.000	0.0E0	0.000
0.000											
	35.00	0.82	1.0	0.82	5.00	NoLiq	24.21	78.22	0.000	0.0E0	0.000
0.000											
	34.50	0.82	1.0	0.82	5.00	NoLiq	24.34	78.47	0.000	0.0E0	0.000
0.000											
	34.00	0.82	1.0	0.82	5.00	NoLiq	24.48	78.74	0.000	0.0E0	0.000
0.000											
	33.50	0.82	1.0	0.82	5.00	NoLiq	24.63	79.01	0.000	0.0E0	0.000
0.000											
	33.00	0.82	1.0	0.82	5.00	NoLiq	24.77	79.28	0.000	0.0E0	0.000
0.000											
	32.50	0.82	1.0	0.82	5.00	NoLiq	14.96	61.20	0.000	0.0E0	0.000
0.000											
	32.00	0.82	1.0	0.82	5.00	NoLiq	15.04	61.35	0.000	0.0E0	0.000
0.000											
	31.50	0.82	1.0	0.82	5.00	NoLiq	15.11	61.50	0.000	0.0E0	0.000
0.000											
	31.00	0.82	1.0	0.82	5.00	NoLiq	26.52	82.69	0.000	0.0E0	0.000
0.000											
	30.50	0.83	1.0	0.83	5.00	NoLiq	26.69	83.03	0.000	0.0E0	0.000
0.000											
	30.00	0.83	1.0	0.83	5.00	NoLiq	26.87	83.39	0.000	0.0E0	0.000
0.000											
	29.50	0.82	1.0	0.82	5.00	NoLiq	27.05	83.75	0.000	0.0E0	0.000
0.000											

29.00	0.82	1.0	0.82	5.00	NoLiq	27.24	84.13	0.000	0.0E0	0.000	0.000
28.50	0.82	1.0	0.82	5.00	NoLiq	27.43	84.52	0.000	0.0E0	0.000	0.000
28.00	0.81	1.0	0.81	5.00	NoLiq	27.62	84.92	0.000	0.0E0	0.000	0.000
27.50	0.81	1.0	0.81	3.43	70.00	62.06	100.00	0.000	0.0E0	0.000	0.000
27.00	0.81	1.0	0.81	3.42	70.00	62.63	100.00	0.000	0.0E0	0.000	0.000
26.50	0.81	1.0	0.81	3.43	70.00	63.22	100.00	0.000	0.0E0	0.000	0.000
26.00	0.81	1.0	0.81	5.00	NoLiq	20.29	71.07	0.000	0.0E0	0.000	0.000
25.50	0.80	1.0	0.80	5.00	NoLiq	20.46	71.36	0.000	0.0E0	0.000	0.000
25.00	0.80	1.0	0.80	5.00	NoLiq	20.63	71.66	0.000	0.0E0	0.000	0.000
24.50	0.80	1.0	0.80	5.00	NoLiq	20.80	71.98	0.000	0.0E0	0.000	0.000
24.00	0.80	1.0	0.80	5.00	NoLiq	20.98	72.30	0.000	0.0E0	0.000	0.000
23.50	0.79	1.0	0.79	5.00	NoLiq	21.17	72.64	0.000	0.0E0	0.000	0.000
23.00	0.79	1.0	0.79	5.00	NoLiq	21.36	72.98	0.000	0.0E0	0.000	0.000
22.50	0.79	1.0	0.79	5.00	NoLiq	27.93	85.55	0.000	0.0E0	0.000	0.000
22.00	0.78	1.0	0.78	5.00	NoLiq	28.21	86.16	0.000	0.0E0	0.000	0.000
21.50	0.78	1.0	0.78	5.00	NoLiq	28.51	86.79	0.000	0.0E0	0.000	0.000
21.00	0.78	1.0	0.78	5.00	NoLiq	20.88	72.12	0.000	0.0E0	0.000	0.000
20.50	0.77	1.0	0.77	5.00	NoLiq	21.06	72.44	0.000	0.0E0	0.000	0.000
20.00	0.76	1.0	0.76	5.00	NoLiq	21.25	72.78	0.000	0.0E0	0.000	0.000
19.50	0.76	1.0	0.76	5.00	NoLiq	21.44	73.13	0.000	0.0E0	0.000	0.000
19.00	0.75	1.0	0.75	5.00	NoLiq	21.64	73.49	0.000	0.0E0	0.000	0.000
18.50	0.75	1.0	0.75	5.00	NoLiq	21.85	73.87	0.000	0.0E0	0.000	0.000
18.00	0.74	1.0	0.74	5.00	NoLiq	22.07	74.27	0.000	0.0E0	0.000	0.000
17.50	0.73	1.0	0.73	5.00	NoLiq	22.29	74.68	0.000	0.0E0	0.000	0.000
17.00	0.72	1.0	0.72	5.00	NoLiq	40.05	100.00	0.000	0.0E0	0.000	0.000
16.50	0.72	1.0	0.72	5.00	NoLiq	40.54	100.00	0.000	0.0E0	0.000	0.000

	16.00	0.71	1.0	0.71	5.00	NoLiq	41.05	100.00	0.000	0.0E0	0.000
0.000											
	15.50	0.70	1.0	0.70	0.51	73.10	23.31	76.55	1.896	1.1E-2	0.115
0.115											
	15.00	0.69	1.0	0.69	0.52	73.10	23.62	77.12	1.862	1.1E-2	0.113
0.227											
	14.50	0.68	1.0	0.68	0.49	73.10	21.95	74.05	2.014	1.2E-2	0.117
0.344											
	14.00	0.68	1.0	0.68	0.50	73.10	22.25	74.59	1.989	1.2E-2	0.120
0.464											
	13.50	0.67	1.0	0.67	0.51	73.10	22.56	75.18	1.957	1.2E-2	0.118
0.583											
	13.00	0.66	1.0	0.66	0.53	73.10	22.90	75.79	1.921	1.2E-2	0.116
0.699											
	12.50	0.65	1.0	0.65	0.55	73.10	23.26	76.45	1.880	1.1E-2	0.114
0.813											
	12.00	0.64	1.0	0.64	0.77	73.10	28.30	86.33	0.986	5.9E-3	0.063
0.876											
	11.50	0.62	1.0	0.62	0.82	73.10	28.80	87.41	0.844	5.1E-3	0.054
0.930											
	11.00	0.61	1.0	0.61	0.88	73.10	29.34	88.58	0.697	4.2E-3	0.046
0.976											
	10.50	0.60	1.0	0.60	4.63	73.10	38.15	100.00	0.000	0.0E0	0.000
0.976											
	10.00	0.59	1.0	0.59	4.73	73.10	38.89	100.00	0.000	0.0E0	0.000
0.976											
	9.50	0.57	1.0	0.57	4.85	73.10	39.69	100.00	0.000	0.0E0	0.000
0.976											
	9.00	0.56	1.0	0.56	4.98	73.10	40.55	100.00	0.000	0.0E0	0.000
0.976											
	8.50	0.54	1.0	0.54	5.00	73.10	41.47	100.00	0.000	0.0E0	0.000
0.976											
	8.00	0.52	1.0	0.52	5.00	73.10	38.07	100.00	0.000	0.0E0	0.000
0.976											
	7.70	0.51	1.0	0.51	5.00	73.10	38.63	100.00	0.000	0.0E0	0.000
0.976											

Settlement of Saturated Sands=0.976 in.
qc1 and (N1)60 is after fines correction in liquefaction analysis
dsz is per each segment, dz=0.05 ft
dsp is per each print interval, dp=0.50 ft
S is cumulated settlement at this depth

Settlement of Unsaturated Sands:

Depth	sigma'	sigC'	(N1)60s	CSRsf	Gmax	g*Ge/Gm	g_eff	ec7.5	Cec	ec	dsz	dsp	S
ft	tsf	tsf		tsf	tsf			%		%	in.	in.	in.

	7.65	0.44	0.29	38.73	0.51	812.8	2.8E-4	0.1776	0.0613	0.81	0.0494
5.92E-4	0.001	0.001									
	7.50	0.44	0.28	39.03	0.51	807.7	2.8E-4	0.1605	0.0542	0.81	0.0437
5.25E-4	0.002	0.002									
	7.00	0.41	0.27	45.34	0.52	823.7	2.6E-4	0.0887	0.0281	0.81	0.0226
2.71E-4	0.003	0.005									
	6.50	0.39	0.25	46.66	0.52	805.2	2.5E-4	0.0709	0.0224	0.81	0.0181
2.17E-4	0.002	0.008									
	6.00	0.36	0.23	48.12	0.52	785.9	2.4E-4	0.0586	0.0185	0.81	0.0149
1.79E-4	0.002	0.010									
	5.50	0.33	0.21	91.06	0.52	930.5	1.8E-4	0.0349	0.0111	0.81	0.0089
1.07E-4	0.001	0.011									
	5.00	0.30	0.20	91.06	0.52	887.2	1.8E-4	0.0327	0.0103	0.81	0.0083
1.00E-4	0.001	0.012									
	4.50	0.27	0.18	91.06	0.52	841.6	1.7E-4	0.0304	0.0096	0.81	0.0078
9.31E-5	0.001	0.013									
	4.00	0.24	0.16	91.06	0.52	793.5	1.6E-4	0.0281	0.0089	0.81	0.0072
8.61E-5	0.001	0.014									
	3.50	0.21	0.14	91.06	0.52	742.3	1.5E-4	0.0284	0.0090	0.81	0.0072
8.68E-5	0.001	0.014									
	3.00	0.18	0.12	91.06	0.52	687.2	1.4E-4	0.0254	0.0080	0.81	0.0065
7.78E-5	0.001	0.015									
	2.50	0.15	0.10	91.06	0.52	627.3	1.2E-4	0.0231	0.0073	0.81	0.0059
7.05E-5	0.001	0.016									
	2.00	0.12	0.08	91.06	0.52	561.1	1.1E-4	0.0235	0.0074	0.81	0.0060
7.18E-5	0.001	0.017									
	1.50	0.09	0.06	91.06	0.52	485.9	9.7E-5	0.0189	0.0060	0.81	0.0048
5.78E-5	0.001	0.017									
	1.00	0.06	0.04	91.06	0.52	396.8	7.9E-5	0.0137	0.0043	0.81	0.0035
4.20E-5	0.000	0.018									
	0.50	0.03	0.02	91.06	0.52	280.6	5.6E-5	0.0084	0.0026	0.81	0.0021
2.56E-5	0.000	0.018									
	0.00	0.00	0.00	91.06	0.52	5.1	1.0E-6	0.0010	0.0003	0.81	0.0003
3.11E-6	0.000	0.018									

Settlement of Unsaturated Sands=0.018 in.
dsz is per each segment, dz=0.05 ft
dsp is per each print interval, dp=0.50 ft
S is cumulated settlement at this depth

Total Settlement of Saturated and Unsaturated Sands=0.994 in.
Differential Settlement=0.497 to 0.656 in.

Units	Depth = ft, Stress or Pressure = tsf (atm), Unit Weight = pcf, Settlement = in.

SPT	Field data from Standard Penetration Test (SPT)
BPT	Field data from Becker Penetration Test (BPT)
qc	Field data from Cone Penetration Test (CPT)
fs	Friction from CPT testing

gamma	Total unit weight of soil
gamma'	Effective unit weight of soil
Fines	Fines content [%]
D50	Mean grain size
Dr	Relative Density
sigma	Total vertical stress [tsf]
sigma'	Effective vertical stress [tsf]
sigC'	Effective confining pressure [tsf]
rd	Stress reduction coefficient
CRRv	CRR after overburden stress correction, CRRv=CRR7.5 * Ksig
CRR7.5	Cyclic resistance ratio (M=7.5)
Ksig	Overburden stress correction factor for CRR7.5
CRRm	After magnitude scaling correction CRRm=CRRv * MSF
MSF	Magnitude scaling factor from M=7.5 to user input M
CSR	Cyclic stress ratio induced by earthquake
CSRfs	CSRfs=CSR*fs1 (Default fs1=1)
fs1	First CSR curve in graphic defined in #9 of Advanced page
fs2	2nd CSR curve in graphic defined in #9 of Advanced page
F.S.	Calculated factor of safety against liquefaction F.S.=CRRm/CSRsf
Cebs	Energy Ratio, Borehole Dia., and Sampling Method Corrections
Cr	Rod Length Corrections
Cn	Overburden Pressure Correction
(N1)60	SPT after corrections, (N1)60=SPT * Cr * Cn * Cebs
d(N1)60	Fines correction of SPT
(N1)60f	(N1)60 after fines corrections, (N1)60f=(N1)60 + d(N1)60
Cq	Overburden stress correction factor
qc1	CPT after Overburden stress correction
dqc1	Fines correction of CPT
qc1f	CPT after Fines and Overburden correction, qc1f=qc1 + dqc1
qc1n	CPT after normalization in Robertson's method
Kc	Fine correction factor in Robertson's Method
qc1f	CPT after Fines correction in Robertson's Method
Ic	Soil type index in Suzuki's and Robertson's Methods
(N1)60s	(N1)60 after settlement fines corrections
CSRm	After magnitude scaling correction for Settlement calculation CSRm=CSRsf / MSF*
CSRfs	Cyclic stress ratio induced by earthquake with user inputed fs
MSF*	Scaling factor from CSR, MSF*=1, base on Item 2 of Page C.
ec	Volumetric strain for saturated sands
dz	Calculation segment, dz=0.050 ft
dsz	Settlement in each segment, dz
dp	User defined print interval
dsp	Settlement in each print interval, dp
Gmax	Shear Modulus at low strain
g_eff	gamma_eff, Effective shear Strain
g*Ge/Gm	gamma_eff * G_eff/G_max, Strain-modulus ratio
ec7.5	Volumetric Strain for magnitude=7.5
Cec	Magnitude correction factor for any magnitude
ec	Volumetric strain for unsaturated sands, ec=Cec * ec7.5
NoLiq	No-Liquefy Soils

References:

1. NCEER Workshop on Evaluation of Liquefaction Resistance of Soils. Youd, T.L., and Idriss, I.M., eds., Technical Report NCEER 97-0022.

SP117. Southern California Earthquake Center. Recommended Procedures for Implementation of DMG Special Publication 117, Guidelines for

Analyzing and Mitigating Liquefaction in California. University of Southern California. March 1999.

2. RECENT ADVANCES IN SOIL LIQUEFACTION ENGINEERING AND SEISMIC SITE RESPONSE EVALUATION, Paper No. SPL-2, PROCEEDINGS: Fourth

International Conference on Recent Advances in Geotechnical Earthquake Engineering and Soil Dynamics, San Diego, CA, March 2001.

3. RECENT ADVANCES IN SOIL LIQUEFACTION ENGINEERING: A UNIFIED AND CONSISTENT FRAMEWORK, Earthquake Engineering Research Center,

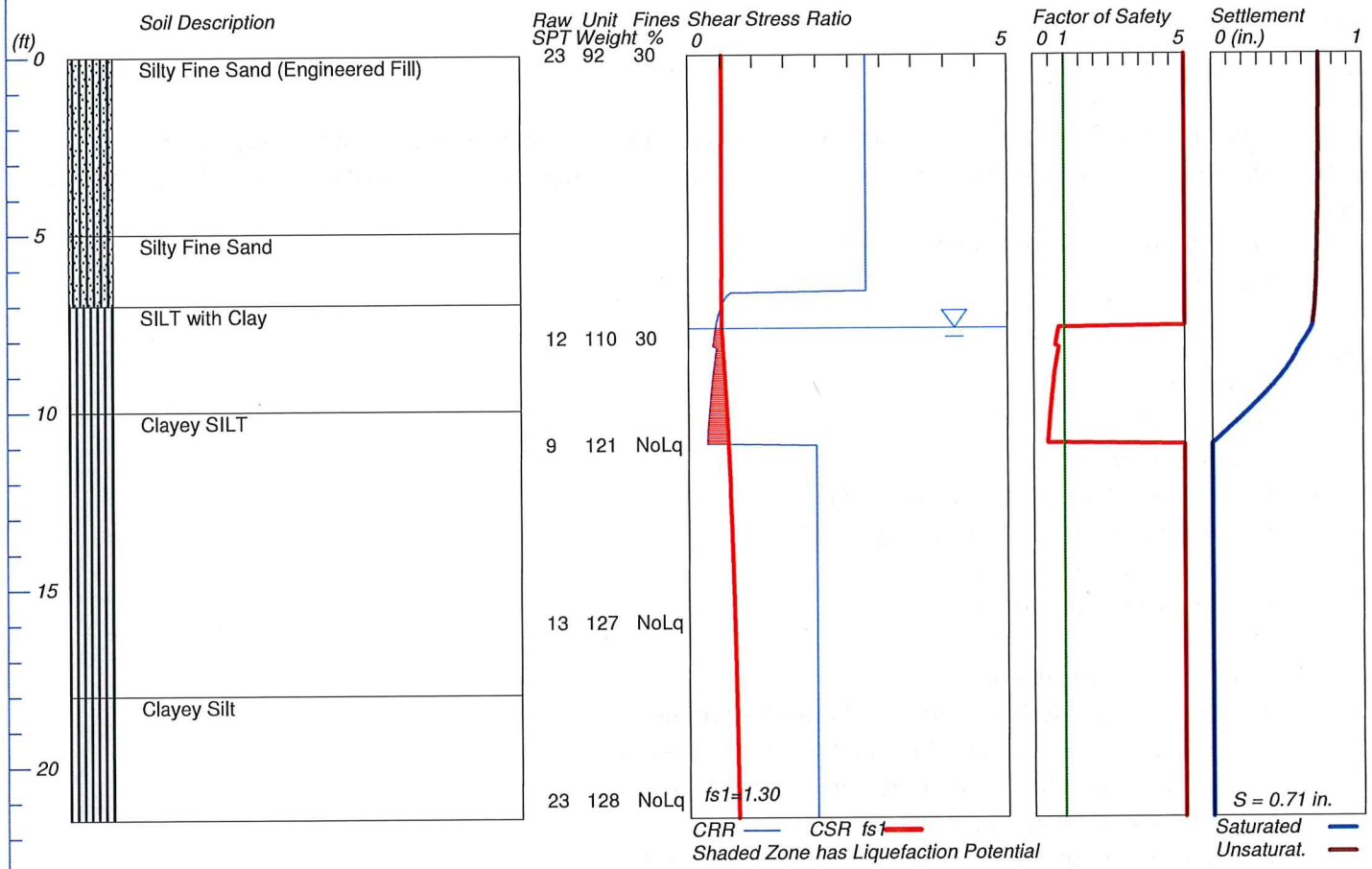
Report No. EERC 2003-06 by R.B Seed and etc. April 2003.

LIQUEFACTION ANALYSIS

Campus Police Station

Hole No.=B-2 Water Depth=7.7 ft Surface Elev.=54

Magnitude=6.6
Acceleration=0.62g



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LIQUEFACTION ANALYSIS CALCULATION SHEET

www.civiltech.com
(425) 453-6488 Fax (425) 453-5848

****

Licensed to , 5/23/2017 9:33:19 AM

Input File Name: C:\Users\rshrestha\Box Sync\Geosphere-R Drive Folder\Geotech Projects by Number\Non-GEO Projects\Compton CC\PW - Campus Police Station\Response to CGS\Liquefy Pro\Raghu\Revised with M

Title: Campus Police Station
Subtitle:

Input Data:

Surface Elev.=54
Hole No.=B-2
Depth of Hole=21.5 ft
Water Table during Earthquake= 7.7 ft
Water Table during In-Situ Testing= 50.0 ft
Max. Acceleration=0.62 g
Earthquake Magnitude=6.6

1. SPT or BPT Calculation.
2. Settlement Analysis Method: Ishihara / Yoshimine*
3. Fines Correction for Liquefaction: Idriss/Seed (SPT only)
4. Fine Correction for Settlement: During Liquefaction*
5. Settlement Calculation in: All zones*
6. Hammer Energy Ratio, Ce = 1.25
7. Borehole Diameter, Cb= 1
8. Sampling Method, Cs= 1
9. User request factor of safety (apply to CSR) , User= 1.3
   Plot one CSR curve (fs1=User)
10. Use Curve Smoothing: Yes*

* Recommended Options

In-Situ Test Data:

Depth ft	SPT	Gamma pcf	Fines %
0.0	23.0	92.0	30.0
8.0	12.0	110.0	30.0
11.0	9.0	121.0	NoLiq
16.0	13.0	127.0	NoLiq
21.0	23.0	128.0	NoLiq

Output Results:

Calculation segment, dz=0.050 ft

User defined Print Interval, dp=0.50 ft

CSR Calculation:

Depth ft	gamma pcf	sigma tsf	gamma' pcf	sigma' tsf	rd	CSR	x fs1	=CSRfs
0.00	92.0	0.000	92.0	0.000	1.00	0.40	1.3	0.52
0.50	93.1	0.023	93.1	0.023	1.00	0.40	1.3	0.52
1.00	94.3	0.047	94.3	0.047	1.00	0.40	1.3	0.52
1.50	95.4	0.070	95.4	0.070	1.00	0.40	1.3	0.52
2.00	96.5	0.094	96.5	0.094	1.00	0.40	1.3	0.52
2.50	97.6	0.118	97.6	0.118	0.99	0.40	1.3	0.52
3.00	98.8	0.143	98.8	0.143	0.99	0.40	1.3	0.52
3.50	99.9	0.168	99.9	0.168	0.99	0.40	1.3	0.52
4.00	101.0	0.193	101.0	0.193	0.99	0.40	1.3	0.52
4.50	102.1	0.218	102.1	0.218	0.99	0.40	1.3	0.52
5.00	103.3	0.244	103.3	0.244	0.99	0.40	1.3	0.52
5.50	104.4	0.270	104.4	0.270	0.99	0.40	1.3	0.52
6.00	105.5	0.296	105.5	0.296	0.99	0.40	1.3	0.52
6.50	106.6	0.323	106.6	0.323	0.98	0.40	1.3	0.52
7.00	107.8	0.349	107.8	0.349	0.98	0.40	1.3	0.52
7.50	108.9	0.376	108.9	0.376	0.98	0.40	1.3	0.51
8.00	110.0	0.404	47.6	0.394	0.98	0.40	1.3	0.53
8.50	111.8	0.431	49.4	0.407	0.98	0.42	1.3	0.55
9.00	113.7	0.460	51.3	0.419	0.98	0.43	1.3	0.56
9.50	115.5	0.488	53.1	0.432	0.98	0.45	1.3	0.58
10.00	117.3	0.517	54.9	0.446	0.98	0.46	1.3	0.59
10.50	119.2	0.547	56.8	0.460	0.98	0.47	1.3	0.61
11.00	121.0	0.577	58.6	0.474	0.97	0.48	1.3	0.62
11.50	121.6	0.607	59.2	0.489	0.97	0.49	1.3	0.63
12.00	122.2	0.638	59.8	0.504	0.97	0.50	1.3	0.64
12.50	122.8	0.668	60.4	0.519	0.97	0.50	1.3	0.66
13.00	123.4	0.699	61.0	0.534	0.97	0.51	1.3	0.67
13.50	124.0	0.730	61.6	0.549	0.97	0.52	1.3	0.67
14.00	124.6	0.761	62.2	0.564	0.97	0.53	1.3	0.68
14.50	125.2	0.792	62.8	0.580	0.97	0.53	1.3	0.69
15.00	125.8	0.824	63.4	0.596	0.97	0.54	1.3	0.70
15.50	126.4	0.855	64.0	0.612	0.96	0.54	1.3	0.71
16.00	127.0	0.887	64.6	0.628	0.96	0.55	1.3	0.71
16.50	127.1	0.919	64.7	0.644	0.96	0.55	1.3	0.72
17.00	127.2	0.950	64.8	0.660	0.96	0.56	1.3	0.72
17.50	127.3	0.982	64.9	0.676	0.96	0.56	1.3	0.73
18.00	127.4	1.014	65.0	0.693	0.96	0.57	1.3	0.73
18.50	127.5	1.046	65.1	0.709	0.96	0.57	1.3	0.74
19.00	127.6	1.078	65.2	0.725	0.96	0.57	1.3	0.74
19.50	127.7	1.110	65.3	0.742	0.95	0.58	1.3	0.75
20.00	127.8	1.142	65.4	0.758	0.95	0.58	1.3	0.75
20.50	127.9	1.174	65.5	0.774	0.95	0.58	1.3	0.76
21.00	128.0	1.206	65.6	0.791	0.95	0.58	1.3	0.76
21.50	128.0	1.238	65.6	0.807	0.95	0.59	1.3	0.76

CSR is based on water table at 7.7 during earthquake

CRR Calculation from SPT or BPT data:

Depth ft	SPT	Cebs	Cr	sigma' tsf	Cn	(N1)60	Fines %	d(N1)60	(N1)60f	CRR7.5
0.00	23.00	1.25	0.75	0.000	1.70	36.66	30.00	10.36	47.02	2.00
0.50	22.31	1.25	0.75	0.023	1.70	35.56	30.00	10.19	45.75	2.00
1.00	21.63	1.25	0.75	0.047	1.70	34.46	30.00	10.02	44.49	2.00
1.50	20.94	1.25	0.75	0.070	1.70	33.37	30.00	9.86	43.22	2.00
2.00	20.25	1.25	0.75	0.094	1.70	32.27	30.00	9.69	41.96	2.00
2.50	19.56	1.25	0.75	0.118	1.70	31.18	30.00	9.52	40.70	2.00
3.00	18.88	1.25	0.75	0.143	1.70	30.08	30.00	9.35	39.43	2.00
3.50	18.19	1.25	0.75	0.168	1.70	28.99	30.00	9.18	38.17	2.00
4.00	17.50	1.25	0.75	0.193	1.70	27.89	30.00	9.01	36.90	2.00
4.50	16.81	1.25	0.75	0.218	1.70	26.79	30.00	8.84	35.64	2.00
5.00	16.12	1.25	0.75	0.244	1.70	25.70	30.00	8.67	34.37	2.00
5.50	15.44	1.25	0.75	0.270	1.70	24.60	30.00	8.50	33.11	2.00
6.00	14.75	1.25	0.75	0.296	1.70	23.51	30.00	8.33	31.84	2.00
6.50	14.06	1.25	0.75	0.323	1.70	22.41	30.00	8.16	30.58	2.00
7.00	13.37	1.25	0.75	0.349	1.69	21.21	30.00	7.98	29.19	0.38
7.50	12.69	1.25	0.75	0.376	1.63	19.39	30.00	7.70	27.08	0.32
8.00	12.00	1.25	0.75	0.404	1.57	17.70	30.00	7.44	25.14	0.28
8.50	11.50	1.25	0.85	0.431	1.52	18.60	30.00	7.58	26.18	0.30
9.00	11.00	1.25	0.85	0.460	1.47	17.24	30.00	7.37	24.61	0.28
9.50	10.50	1.25	0.85	0.488	1.43	15.97	30.00	7.17	23.14	0.25
10.00	10.00	1.25	0.85	0.517	1.39	14.77	30.00	6.99	21.76	0.24
10.50	9.50	1.25	0.85	0.547	1.35	13.65	30.00	6.81	20.46	0.22
11.00	9.00	1.25	0.85	0.577	1.32	12.59	NoLiq	7.52	20.11	0.22
11.50	9.40	1.25	0.85	0.607	1.28	12.82	NoLiq	7.56	20.38	0.22
12.00	9.80	1.25	0.85	0.638	1.25	13.04	NoLiq	7.61	20.65	0.22
12.50	10.20	1.25	0.85	0.668	1.22	13.26	NoLiq	7.65	20.91	0.23
13.00	10.60	1.25	0.85	0.699	1.20	13.47	NoLiq	7.69	21.16	0.23
13.50	11.00	1.25	0.85	0.730	1.17	13.68	NoLiq	7.74	21.42	0.23
14.00	11.40	1.25	0.85	0.761	1.15	13.88	NoLiq	7.78	21.66	0.24
14.50	11.80	1.25	0.85	0.792	1.12	14.09	NoLiq	7.82	21.90	0.24
15.00	12.20	1.25	0.95	0.824	1.10	15.96	NoLiq	8.19	24.16	0.27
15.50	12.60	1.25	0.95	0.855	1.08	16.18	NoLiq	8.24	24.42	0.27
16.00	13.00	1.25	0.95	0.887	1.06	16.39	NoLiq	8.28	24.67	0.28
16.50	14.00	1.25	0.95	0.919	1.04	17.35	NoLiq	8.47	25.82	0.30
17.00	15.00	1.25	0.95	0.950	1.03	18.27	NoLiq	8.65	26.93	0.32
17.50	16.00	1.25	0.95	0.982	1.01	19.17	NoLiq	8.83	28.01	0.34
18.00	17.00	1.25	0.95	1.014	0.99	20.05	NoLiq	9.01	29.06	0.38
18.50	18.00	1.25	0.95	1.046	0.98	20.90	NoLiq	9.18	30.08	0.48
19.00	19.00	1.25	0.95	1.078	0.96	21.73	NoLiq	9.35	31.08	2.00
19.50	20.00	1.25	0.95	1.110	0.95	22.55	NoLiq	9.51	32.05	2.00
20.00	21.00	1.25	0.95	1.142	0.94	23.34	NoLiq	9.67	33.01	2.00
20.50	22.00	1.25	0.95	1.174	0.92	24.12	NoLiq	9.82	33.94	2.00
21.00	23.00	1.25	0.95	1.206	0.91	24.88	NoLiq	9.98	34.85	2.00
21.50	23.00	1.25	0.95	1.238	0.90	24.55	NoLiq	9.91	34.46	2.00

CRR is based on water table at 50.0 during In-Situ Testing

Factor of Safety, - Earthquake Magnitude= 6.6:

Depth ft	sigC' tsf	CRR7.5 tsf	x Ksig	=CRRv tsf	x MSF	=CRRm tsf	/ CSRfs tsf	=F.S. CRRm/CSRfs
0.00	0.00	2.00	1.00	2.00	1.39	2.77	0.52	5.00
0.50	0.02	2.00	1.00	2.00	1.39	2.77	0.52	5.00
1.00	0.03	2.00	1.00	2.00	1.39	2.77	0.52	5.00
1.50	0.05	2.00	1.00	2.00	1.39	2.77	0.52	5.00
2.00	0.06	2.00	1.00	2.00	1.39	2.77	0.52	5.00
2.50	0.08	2.00	1.00	2.00	1.39	2.77	0.52	5.00
3.00	0.09	2.00	1.00	2.00	1.39	2.77	0.52	5.00
3.50	0.11	2.00	1.00	2.00	1.39	2.77	0.52	5.00
4.00	0.13	2.00	1.00	2.00	1.39	2.77	0.52	5.00
4.50	0.14	2.00	1.00	2.00	1.39	2.77	0.52	5.00
5.00	0.16	2.00	1.00	2.00	1.39	2.77	0.52	5.00
5.50	0.18	2.00	1.00	2.00	1.39	2.77	0.52	5.00
6.00	0.19	2.00	1.00	2.00	1.39	2.77	0.52	5.00
6.50	0.21	2.00	1.00	2.00	1.39	2.77	0.52	5.00
7.00	0.23	0.38	1.00	0.38	1.39	0.53	0.52	5.00
7.50	0.24	0.32	1.00	0.32	1.39	0.45	0.51	5.00
8.00	0.26	0.28	1.00	0.28	1.39	0.40	0.53	0.75 *
8.50	0.28	0.30	1.00	0.30	1.39	0.42	0.55	0.77 *
9.00	0.30	0.28	1.00	0.28	1.39	0.38	0.56	0.68 *
9.50	0.32	0.25	1.00	0.25	1.39	0.35	0.58	0.61 *
10.00	0.34	0.24	1.00	0.24	1.39	0.33	0.59	0.55 *
10.50	0.36	0.22	1.00	0.22	1.39	0.31	0.61	0.51 *
11.00	0.37	0.22	1.00	0.22	1.39	2.00	0.62	5.00 ^
11.50	0.39	0.22	1.00	0.22	1.39	2.00	0.63	5.00 ^
12.00	0.41	0.22	1.00	0.22	1.39	2.00	0.64	5.00 ^
12.50	0.43	0.23	1.00	0.23	1.39	2.00	0.66	5.00 ^
13.00	0.45	0.23	1.00	0.23	1.39	2.00	0.67	5.00 ^
13.50	0.47	0.23	1.00	0.23	1.39	2.00	0.67	5.00 ^
14.00	0.49	0.24	1.00	0.24	1.39	2.00	0.68	5.00 ^
14.50	0.51	0.24	1.00	0.24	1.39	2.00	0.69	5.00 ^
15.00	0.54	0.27	1.00	0.27	1.39	2.00	0.70	5.00 ^
15.50	0.56	0.27	1.00	0.27	1.39	2.00	0.71	5.00 ^
16.00	0.58	0.28	1.00	0.28	1.39	2.00	0.71	5.00 ^
16.50	0.60	0.30	1.00	0.30	1.39	2.00	0.72	5.00 ^
17.00	0.62	0.32	1.00	0.32	1.39	2.00	0.72	5.00 ^
17.50	0.64	0.34	1.00	0.34	1.39	2.00	0.73	5.00 ^
18.00	0.66	0.38	1.00	0.38	1.39	2.00	0.73	5.00 ^
18.50	0.68	0.48	1.00	0.48	1.39	2.00	0.74	5.00 ^
19.00	0.70	2.00	1.00	2.00	1.39	2.00	0.74	5.00 ^
19.50	0.72	2.00	1.00	2.00	1.39	2.00	0.75	5.00 ^
20.00	0.74	2.00	1.00	2.00	1.39	2.00	0.75	5.00 ^
20.50	0.76	2.00	1.00	2.00	1.39	2.00	0.76	5.00 ^
21.00	0.78	2.00	1.00	2.00	1.39	2.00	0.76	5.00 ^
21.50	0.80	2.00	1.00	2.00	1.39	2.00	0.76	5.00 ^

* F.S.<1: Liquefaction Potential Zone. (If above water table: F.S.=5)

^ No-liquefiable Soils.
(F.S. is limited to 5, CRR is limited to 2, CSR is limited to 2)

CPT convert to SPT for Settlement Analysis:
Fines Correction for Settlement Analysis:

Depth ft	Ic	qc/N60	qc1 tsf	(N1)60	Fines %	d(N1)60	(N1)60s
0.00	-	-	-	47.02	30.00	0.00	47.02
0.50	-	-	-	45.75	30.00	0.00	45.75
1.00	-	-	-	44.49	30.00	0.00	44.49
1.50	-	-	-	43.22	30.00	0.00	43.22
2.00	-	-	-	41.96	30.00	0.00	41.96
2.50	-	-	-	40.70	30.00	0.00	40.70
3.00	-	-	-	39.43	30.00	0.00	39.43
3.50	-	-	-	38.17	30.00	0.00	38.17
4.00	-	-	-	36.90	30.00	0.00	36.90
4.50	-	-	-	35.64	30.00	0.00	35.64
5.00	-	-	-	34.37	30.00	0.00	34.37
5.50	-	-	-	33.11	30.00	0.00	33.11
6.00	-	-	-	31.84	30.00	0.00	31.84
6.50	-	-	-	30.58	30.00	0.00	30.58
7.00	-	-	-	29.19	30.00	0.00	29.19
7.50	-	-	-	27.08	30.00	0.00	27.08
8.00	-	-	-	25.14	30.00	0.00	25.14
8.50	-	-	-	26.18	30.00	0.00	26.18
9.00	-	-	-	24.61	30.00	0.00	24.61
9.50	-	-	-	23.14	30.00	0.00	23.14
10.00	-	-	-	21.76	30.00	0.00	21.76
10.50	-	-	-	20.46	30.00	0.00	20.46
11.00	-	-	-	20.11	NoLiq	0.00	20.11
11.50	-	-	-	20.38	NoLiq	0.00	20.38
12.00	-	-	-	20.65	NoLiq	0.00	20.65
12.50	-	-	-	20.91	NoLiq	0.00	20.91
13.00	-	-	-	21.16	NoLiq	0.00	21.16
13.50	-	-	-	21.42	NoLiq	0.00	21.42
14.00	-	-	-	21.66	NoLiq	0.00	21.66
14.50	-	-	-	21.90	NoLiq	0.00	21.90
15.00	-	-	-	24.16	NoLiq	0.00	24.16
15.50	-	-	-	24.42	NoLiq	0.00	24.42
16.00	-	-	-	24.67	NoLiq	0.00	24.67
16.50	-	-	-	25.82	NoLiq	0.00	25.82
17.00	-	-	-	26.93	NoLiq	0.00	26.93
17.50	-	-	-	28.01	NoLiq	0.00	28.01
18.00	-	-	-	29.06	NoLiq	0.00	29.06
18.50	-	-	-	30.08	NoLiq	0.00	30.08
19.00	-	-	-	31.08	NoLiq	0.00	31.08
19.50	-	-	-	32.05	NoLiq	0.00	32.05
20.00	-	-	-	33.01	NoLiq	0.00	33.01
20.50	-	-	-	33.94	NoLiq	0.00	33.94
21.00	-	-	-	34.85	NoLiq	0.00	34.85

21.50	-	-	-	34.46	NoLiq	0.00	34.46	

(N1)60s has been fines corrected in liquefaction analysis, therefore d(N1)60=0.
Fines=NoLiq means the soils are not liquefiable.

Settlement of Saturated Sands:
Settlement Analysis Method: Ishihara / Yoshimine*

Depth	CSRsf	/ MSF*	=CSRm	F.S.	Fines	(N1)60s	Dr	ec	dsz	dsp	S
ft	tsf		tsf		%		%	%	in.	in.	in.
21.45	0.76	1.0	0.76	5.00	NoLiq	34.50	100.00	0.000	0.0E0	0.000	0.000
21.00	0.76	1.0	0.76	5.00	NoLiq	34.85	100.00	0.000	0.0E0	0.000	0.000
20.50	0.76	1.0	0.76	5.00	NoLiq	33.94	99.73	0.000	0.0E0	0.000	0.000
20.00	0.75	1.0	0.75	5.00	NoLiq	33.01	97.29	0.000	0.0E0	0.000	0.000
19.50	0.75	1.0	0.75	5.00	NoLiq	32.05	94.90	0.000	0.0E0	0.000	0.000
19.00	0.74	1.0	0.74	5.00	NoLiq	31.08	92.55	0.000	0.0E0	0.000	0.000
18.50	0.74	1.0	0.74	5.00	NoLiq	30.08	90.24	0.000	0.0E0	0.000	0.000
18.00	0.73	1.0	0.73	5.00	NoLiq	29.06	87.97	0.000	0.0E0	0.000	0.000
17.50	0.73	1.0	0.73	5.00	NoLiq	28.01	85.72	0.000	0.0E0	0.000	0.000
17.00	0.72	1.0	0.72	5.00	NoLiq	26.93	83.50	0.000	0.0E0	0.000	0.000
16.50	0.72	1.0	0.72	5.00	NoLiq	25.82	81.30	0.000	0.0E0	0.000	0.000
16.00	0.71	1.0	0.71	5.00	NoLiq	24.67	79.09	0.000	0.0E0	0.000	0.000
15.50	0.71	1.0	0.71	5.00	NoLiq	24.42	78.61	0.000	0.0E0	0.000	0.000
15.00	0.70	1.0	0.70	5.00	NoLiq	24.16	78.12	0.000	0.0E0	0.000	0.000
14.50	0.69	1.0	0.69	5.00	NoLiq	21.90	73.97	0.000	0.0E0	0.000	0.000
14.00	0.68	1.0	0.68	5.00	NoLiq	21.66	73.53	0.000	0.0E0	0.000	0.000
13.50	0.67	1.0	0.67	5.00	NoLiq	21.42	73.09	0.000	0.0E0	0.000	0.000
13.00	0.67	1.0	0.67	5.00	NoLiq	21.16	72.63	0.000	0.0E0	0.000	0.000
12.50	0.66	1.0	0.66	5.00	NoLiq	20.91	72.17	0.000	0.0E0	0.000	0.000

	12.00	0.64	1.0	0.64	5.00	NoLiq	20.65	71.70	0.000	0.0E0	0.000
0.000											
	11.50	0.63	1.0	0.63	5.00	NoLiq	20.38	71.22	0.000	0.0E0	0.000
0.000											
	11.00	0.62	1.0	0.62	5.00	NoLiq	20.11	70.73	0.000	0.0E0	0.000
0.000											
	10.50	0.61	1.0	0.61	0.51	30.00	20.46	71.37	2.134	1.3E-2	0.131
0.131											
	10.00	0.59	1.0	0.59	0.55	30.00	21.76	73.71	2.013	1.2E-2	0.124
0.255											
	9.50	0.58	1.0	0.58	0.61	30.00	23.14	76.22	1.848	1.1E-2	0.116
0.371											
	9.00	0.56	1.0	0.56	0.68	30.00	24.61	78.97	1.543	9.3E-3	0.101
0.472											
	8.50	0.55	1.0	0.55	0.77	30.00	26.18	82.01	1.156	6.9E-3	0.080
0.552											
	8.00	0.53	1.0	0.53	0.75	30.00	25.14	79.99	1.295	7.8E-3	0.073
0.625											
	7.70	0.51	1.0	0.51	0.82	30.00	26.29	82.23	1.022	6.1E-3	0.041
0.666											

Settlement of Saturated Sands=0.666 in.
qc1 and (N1)60 is after fines correction in liquefaction analysis
dsz is per each segment, dz=0.05 ft
dsp is per each print interval, dp=0.50 ft
S is cumulated settlement at this depth

Settlement of Unsaturated Sands:

dsz	Depth	sigma'	sigC'	(N1)60s	CSRsf	Gmax	g*Ge/Gm	g_eff	ec7.5	Cec	ec
	dsp	S									
	ft	tsf	tsf		tsf	tsf			%		%
in.	in.	in.									

	7.65	0.38	0.25	26.49	0.51	665.8	3.0E-4	0.3156	0.2148	0.81	0.1731
2.08E-3	0.002	0.002									
	7.50	0.38	0.24	27.08	0.51	663.6	2.9E-4	0.2567	0.1694	0.81	0.1365
1.64E-3	0.005	0.007									
	7.00	0.35	0.23	29.19	0.52	655.5	2.7E-4	0.1416	0.0840	0.81	0.0677
8.12E-4	0.011	0.019									
	6.50	0.32	0.21	30.58	0.52	639.6	2.6E-4	0.0949	0.0524	0.81	0.0422
5.07E-4	0.006	0.025									
	6.00	0.30	0.19	31.84	0.52	621.1	2.5E-4	0.0696	0.0360	0.81	0.0290
3.48E-4	0.004	0.029									
	5.50	0.27	0.18	33.11	0.52	600.7	2.3E-4	0.0547	0.0265	0.81	0.0214
2.56E-4	0.003	0.032									
	5.00	0.24	0.16	34.37	0.52	578.3	2.2E-4	0.0457	0.0206	0.81	0.0166
2.00E-4	0.002	0.034									
	4.50	0.22	0.14	35.64	0.52	553.7	2.0E-4	0.0969	0.0407	0.81	0.0328
3.93E-4	0.003	0.037									

	4.00	0.19	0.13	36.90	0.52	526.6	1.9E-4	0.0490	0.0191	0.81	0.0154
1.84E-4	0.003	0.040									
	3.50	0.17	0.11	38.17	0.52	496.7	1.8E-4	0.0402	0.0144	0.81	0.0116
1.39E-4	0.002	0.042									
	3.00	0.14	0.09	39.43	0.52	463.5	1.6E-4	0.0332	0.0109	0.81	0.0088
1.05E-4	0.001	0.043									
	2.50	0.12	0.08	40.70	0.52	426.3	1.4E-4	0.0277	0.0088	0.81	0.0071
8.47E-5	0.001	0.044									
	2.00	0.09	0.06	41.96	0.52	384.1	1.3E-4	0.0237	0.0075	0.81	0.0060
7.23E-5	0.001	0.045									
	1.50	0.07	0.05	43.22	0.52	334.9	1.1E-4	0.0229	0.0072	0.81	0.0058
7.00E-5	0.001	0.045									
	1.00	0.05	0.03	44.49	0.52	275.3	8.8E-5	0.0164	0.0052	0.81	0.0042
5.00E-5	0.001	0.046									
	0.50	0.02	0.02	45.75	0.52	195.9	6.2E-5	0.0097	0.0031	0.81	0.0025
2.96E-5	0.000	0.046									
	0.00	0.00	0.00	47.02	0.52	4.1	1.3E-6	0.0010	0.0003	0.81	0.0003
3.11E-6	0.000	0.046									

Settlement of Unsaturated Sands=0.046 in.
dsz is per each segment, dz=0.05 ft
dsp is per each print interval, dp=0.50 ft
S is cumulated settlement at this depth

Total Settlement of Saturated and Unsaturated Sands=0.712 in.
Differential Settlement=0.356 to 0.470 in.

Units Depth = ft, Stress or Pressure = tsf (atm), Unit Weight = pcf, Settlement = in.

SPT	Field data from Standard Penetration Test (SPT)
BPT	Field data from Becker Penetration Test (BPT)
qc	Field data from Cone Penetration Test (CPT)
fs	Friction from CPT testing
gamma	Total unit weight of soil
gamma'	Effective unit weight of soil
Fines	Fines content [%]
D50	Mean grain size
Dr	Relative Density
sigma	Total vertical stress [tsf]
sigma'	Effective vertical stress [tsf]
sigC'	Effective confining pressure [tsf]
rd	Stress reduction coefficient
CRRv	CRR after overburden stress correction, CRRv=CRR7.5 * Ksig
CRR7.5	Cyclic resistance ratio (M=7.5)
Ksig	Overburden stress correction factor for CRR7.5
CRRm	After magnitude scaling correction CRRm=CRRv * MSF
MSF	Magnitude scaling factor from M=7.5 to user input M
CSR	Cyclic stress ratio induced by earthquake
CSRfs	CSRfs=CSR*fs1 (Default fs1=1)

fs1	First CSR curve in graphic defined in #9 of Advanced page
fs2	2nd CSR curve in graphic defined in #9 of Advanced page
F.S.	Calculated factor of safety against liquefaction F.S.=CRRm/CSRsf
Cebs	Energy Ratio, Borehole Dia., and Sampling Method Corrections
Cr	Rod Length Corrections
Cn	Overburden Pressure Correction
(N1)60	SPT after corrections, (N1)60=SPT * Cr * Cn * Cebs
d(N1)60	Fines correction of SPT
(N1)60f	(N1)60 after fines corrections, (N1)60f=(N1)60 + d(N1)60
Cq	Overburden stress correction factor
qc1	CPT after Overburden stress correction
dqc1	Fines correction of CPT
qc1f	CPT after Fines and Overburden correction, qc1f=qc1 + dqc1
qc1n	CPT after normalization in Robertson's method
Kc	Fine correction factor in Robertson's Method
qc1f	CPT after Fines correction in Robertson's Method
Ic	Soil type index in Suzuki's and Robertson's Methods
(N1)60s	(N1)60 after settlement fines corrections
CSRm	After magnitude scaling correction for Settlement calculation CSRm=CSRsf / MSF*
CSRfs	Cyclic stress ratio induced by earthquake with user inputed fs
MSF*	Scaling factor from CSR, MSF*=1, base on Item 2 of Page C.
ec	Volumetric strain for saturated sands
dz	Calculation segment, dz=0.050 ft
dsz	Settlement in each segment, dz
dp	User defined print interval
dsp	Settlement in each print interval, dp
Gmax	Shear Modulus at low strain
g_eff	gamma_eff, Effective shear Strain
g*Ge/Gm	gamma_eff * G_eff/G_max, Strain-modulus ratio
ec7.5	Volumetric Strain for magnitude=7.5
Cec	Magnitude correction factor for any magnitude
ec	Volumetric strain for unsaturated sands, ec=Cec * ec7.5
NoLiq	No-Liquefy Soils

References:

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1. NCEER Workshop on Evaluation of Liquefaction Resistance of Soils. Youd, T.L., and Idriss, I.M., eds., Technical Report NCEER 97-0022.

SP117. Southern California Earthquake Center. Recommended Procedures for Implementation of DMG Special Publication 117, Guidelines for

Analyzing and Mitigating Liquefaction in California. University of Southern California. March 1999.

2. RECENT ADVANCES IN SOIL LIQUEFACTION ENGINEERING AND SEISMIC SITE RESPONSE EVALUATION, Paper No. SPL-2, PROCEEDINGS: Fourth

International Conference on Recent Advances in Geotechnical Earthquake Engineering and Soil Dynamics, San Diego, CA, March 2001.

3. RECENT ADVANCES IN SOIL LIQUEFACTION ENGINEERING: A UNIFIED AND CONSISTENT FRAMEWORK, Earthquake Engineering Research Center,

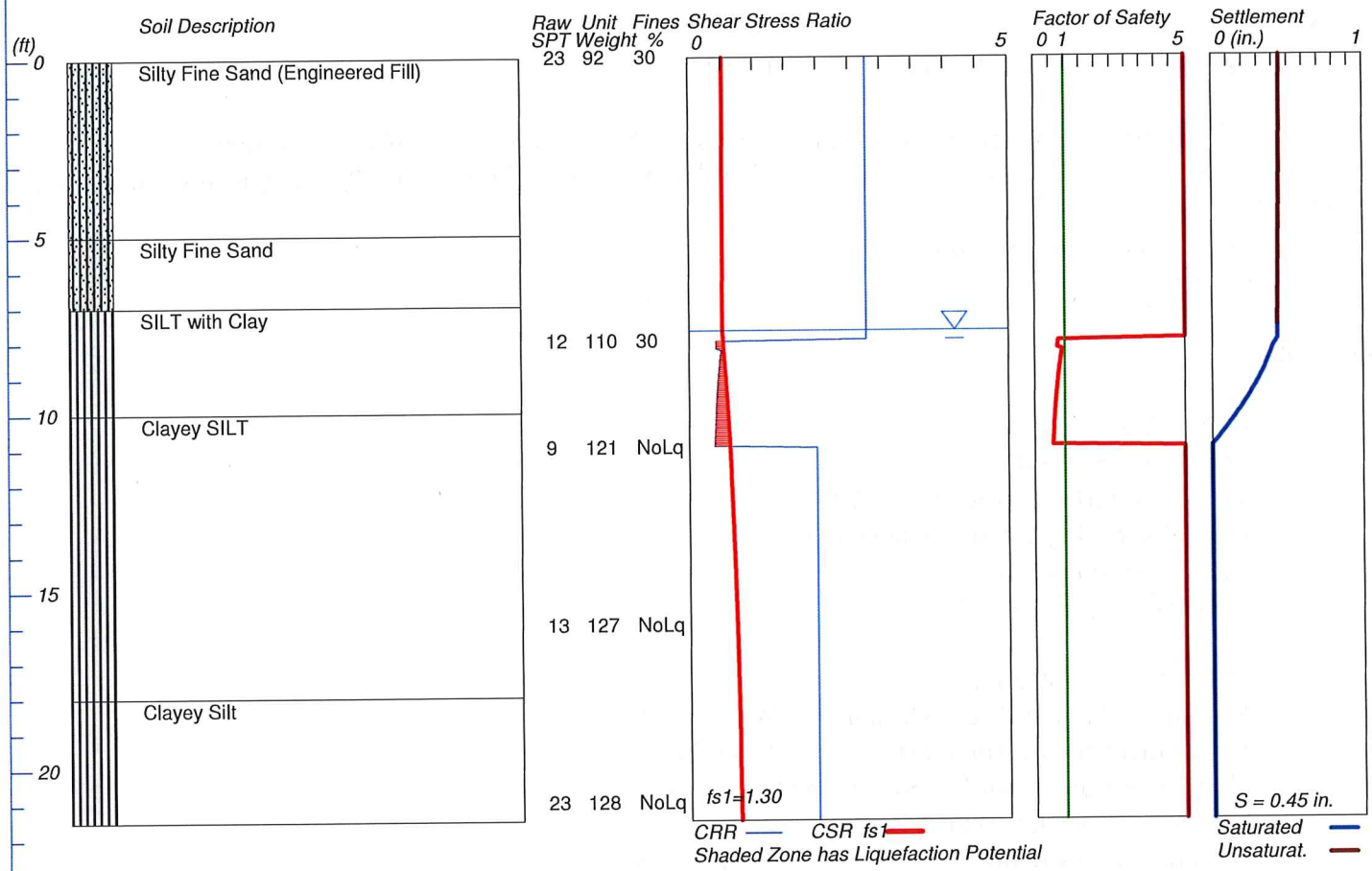
Report No. EERC 2003-06 by R.B Seed and etc. April 2003.

LIQUEFACTION ANALYSIS

Campus Police Station

Hole No.=B-2 Water Depth=7.7 ft Surface Elev.=54

Magnitude=6.6
Acceleration=0.62g



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LIQUEFACTION ANALYSIS CALCULATION SHEET

www.civiltech.com
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Input File Name: C:\Users\rshrestha\Box Sync\Geosphere-R Drive Folder\Geotech Projects by Number\Non-GEO Projects\Compton CC\PW - Campus Police Station\Response to CGS\Liquefy Pro\Raghu\Revised with M

Title: Campus Police Station
Subtitle:

Input Data:

Surface Elev.=54
Hole No.=B-2
Depth of Hole=21.5 ft
Water Table during Earthquake= 7.7 ft
Water Table during In-Situ Testing= 50.0 ft
Max. Acceleration=0.62 g
Earthquake Magnitude=6.6

1. SPT or BPT Calculation.
2. Settlement Analysis Method: Ishihara / Yoshimine*
3. Fines Correction for Liquefaction: Idriss/Seed (SPT only)
4. Fine Correction for Settlement: During Liquefaction*
5. Settlement Calculation in: All zones*
6. Hammer Energy Ratio, Ce = 1.25
7. Borehole Diameter, Cb= 1
8. Sampling Method, Cs= 1
9. User request factor of safety (apply to CSR) , User= 1.3
   Plot one CSR curve (fs1=User)
10. Use Curve Smoothing: No

* Recommended Options

In-Situ Test Data:

Depth ft	SPT	Gamma pcf	Fines %
0.0	23.0	92.0	30.0
8.0	12.0	110.0	30.0
11.0	9.0	121.0	NoLiq
16.0	13.0	127.0	NoLiq
21.0	23.0	128.0	NoLiq

Output Results:

Calculation segment, dz=0.050 ft

User defined Print Interval, dp=0.50 ft

CSR Calculation:

Depth ft	gamma pcf	sigma tsf	gamma' pcf	sigma' tsf	rd	CSR	x fs1	=CSRfs
0.00	92.0	0.000	92.0	0.000	1.00	0.40	1.3	0.52
0.50	92.0	0.023	92.0	0.023	1.00	0.40	1.3	0.52
1.00	92.0	0.046	92.0	0.046	1.00	0.40	1.3	0.52
1.50	92.0	0.069	92.0	0.069	1.00	0.40	1.3	0.52
2.00	92.0	0.092	92.0	0.092	1.00	0.40	1.3	0.52
2.50	92.0	0.115	92.0	0.115	0.99	0.40	1.3	0.52
3.00	92.0	0.138	92.0	0.138	0.99	0.40	1.3	0.52
3.50	92.0	0.161	92.0	0.161	0.99	0.40	1.3	0.52
4.00	92.0	0.184	92.0	0.184	0.99	0.40	1.3	0.52
4.50	92.0	0.207	92.0	0.207	0.99	0.40	1.3	0.52
5.00	92.0	0.230	92.0	0.230	0.99	0.40	1.3	0.52
5.50	92.0	0.253	92.0	0.253	0.99	0.40	1.3	0.52
6.00	92.0	0.276	92.0	0.276	0.99	0.40	1.3	0.52
6.50	92.0	0.299	92.0	0.299	0.98	0.40	1.3	0.52
7.00	92.0	0.322	92.0	0.322	0.98	0.40	1.3	0.52
7.50	92.0	0.345	92.0	0.345	0.98	0.40	1.3	0.51
8.00	110.0	0.368	47.6	0.359	0.98	0.41	1.3	0.53
8.50	110.0	0.396	47.6	0.371	0.98	0.42	1.3	0.55
9.00	110.0	0.423	47.6	0.382	0.98	0.44	1.3	0.57
9.50	110.0	0.451	47.6	0.394	0.98	0.45	1.3	0.59
10.00	110.0	0.478	47.6	0.406	0.98	0.46	1.3	0.60
10.50	110.0	0.506	47.6	0.418	0.98	0.48	1.3	0.62
11.00	121.0	0.533	58.6	0.430	0.97	0.49	1.3	0.63
11.50	121.0	0.563	58.6	0.445	0.97	0.50	1.3	0.65
12.00	121.0	0.594	58.6	0.459	0.97	0.51	1.3	0.66
12.50	121.0	0.624	58.6	0.474	0.97	0.51	1.3	0.67
13.00	121.0	0.654	58.6	0.489	0.97	0.52	1.3	0.68
13.50	121.0	0.684	58.6	0.503	0.97	0.53	1.3	0.69
14.00	121.0	0.715	58.6	0.518	0.97	0.54	1.3	0.70
14.50	121.0	0.745	58.6	0.533	0.97	0.54	1.3	0.71
15.00	121.0	0.775	58.6	0.547	0.97	0.55	1.3	0.72
15.50	121.0	0.805	58.6	0.562	0.96	0.56	1.3	0.72
16.00	127.0	0.836	64.6	0.577	0.96	0.56	1.3	0.73
16.50	127.0	0.867	64.6	0.593	0.96	0.57	1.3	0.74
17.00	127.0	0.899	64.6	0.609	0.96	0.57	1.3	0.74
17.50	127.0	0.931	64.6	0.625	0.96	0.58	1.3	0.75
18.00	127.0	0.963	64.6	0.641	0.96	0.58	1.3	0.75
18.50	127.0	0.994	64.6	0.657	0.96	0.58	1.3	0.76
19.00	127.0	1.026	64.6	0.673	0.96	0.59	1.3	0.76
19.50	127.0	1.058	64.6	0.690	0.95	0.59	1.3	0.77
20.00	127.0	1.090	64.6	0.706	0.95	0.59	1.3	0.77
20.50	127.0	1.121	64.6	0.722	0.95	0.60	1.3	0.77
21.00	127.0	1.153	64.6	0.738	0.95	0.60	1.3	0.78
21.50	128.0	1.185	65.6	0.754	0.95	0.60	1.3	0.78

CSR is based on water table at 7.7 during earthquake

CRR Calculation from SPT or BPT data:

Depth ft	SPT	Cebs	Cr	sigma' tsf	Cn	(N1)60	Fines %	d(N1)60	(N1)60f	CRR7.5
0.00	23.00	1.25	0.75	0.000	1.70	36.66	30.00	10.36	47.02	2.00
0.50	23.00	1.25	0.75	0.023	1.70	36.66	30.00	10.36	47.02	2.00
1.00	23.00	1.25	0.75	0.046	1.70	36.66	30.00	10.36	47.02	2.00
1.50	23.00	1.25	0.75	0.069	1.70	36.66	30.00	10.36	47.02	2.00
2.00	23.00	1.25	0.75	0.092	1.70	36.66	30.00	10.36	47.02	2.00
2.50	23.00	1.25	0.75	0.115	1.70	36.66	30.00	10.36	47.02	2.00
3.00	23.00	1.25	0.75	0.138	1.70	36.66	30.00	10.36	47.02	2.00
3.50	23.00	1.25	0.75	0.161	1.70	36.66	30.00	10.36	47.02	2.00
4.00	23.00	1.25	0.75	0.184	1.70	36.66	30.00	10.36	47.02	2.00
4.50	23.00	1.25	0.75	0.207	1.70	36.66	30.00	10.36	47.02	2.00
5.00	23.00	1.25	0.75	0.230	1.70	36.66	30.00	10.36	47.02	2.00
5.50	23.00	1.25	0.75	0.253	1.70	36.66	30.00	10.36	47.02	2.00
6.00	23.00	1.25	0.75	0.276	1.70	36.66	30.00	10.36	47.02	2.00
6.50	23.00	1.25	0.75	0.299	1.70	36.66	30.00	10.36	47.02	2.00
7.00	23.00	1.25	0.75	0.322	1.70	36.66	30.00	10.36	47.02	2.00
7.50	23.00	1.25	0.75	0.345	1.70	36.66	30.00	10.36	47.02	2.00
8.00	12.00	1.25	0.75	0.368	1.65	18.54	30.00	7.57	26.11	0.30
8.50	12.00	1.25	0.85	0.396	1.59	20.27	30.00	7.83	28.11	0.35
9.00	12.00	1.25	0.85	0.423	1.54	19.60	30.00	7.73	27.33	0.33
9.50	12.00	1.25	0.85	0.451	1.49	19.00	30.00	7.64	26.63	0.31
10.00	12.00	1.25	0.85	0.478	1.45	18.44	30.00	7.55	25.99	0.30
10.50	12.00	1.25	0.85	0.506	1.41	17.93	30.00	7.47	25.41	0.29
11.00	9.00	1.25	0.85	0.533	1.37	13.10	NoLiq	7.62	20.72	0.22
11.50	9.00	1.25	0.85	0.563	1.33	12.74	NoLiq	7.55	20.29	0.22
12.00	9.00	1.25	0.85	0.594	1.30	12.41	NoLiq	7.48	19.89	0.22
12.50	9.00	1.25	0.85	0.624	1.27	12.11	NoLiq	7.42	19.53	0.21
13.00	9.00	1.25	0.85	0.654	1.24	11.82	NoLiq	7.36	19.19	0.21
13.50	9.00	1.25	0.85	0.684	1.21	11.56	NoLiq	7.31	18.87	0.20
14.00	9.00	1.25	0.85	0.715	1.18	11.31	NoLiq	7.26	18.58	0.20
14.50	9.00	1.25	0.85	0.745	1.16	11.08	NoLiq	7.22	18.30	0.20
15.00	9.00	1.25	0.95	0.775	1.14	12.14	NoLiq	7.43	19.57	0.21
15.50	9.00	1.25	0.95	0.805	1.11	11.91	NoLiq	7.38	19.29	0.21
16.00	13.00	1.25	0.95	0.836	1.09	16.89	NoLiq	8.38	25.27	0.29
16.50	13.00	1.25	0.95	0.867	1.07	16.58	NoLiq	8.32	24.89	0.28
17.00	13.00	1.25	0.95	0.899	1.05	16.28	NoLiq	8.26	24.54	0.28
17.50	13.00	1.25	0.95	0.931	1.04	16.00	NoLiq	8.20	24.20	0.27
18.00	13.00	1.25	0.95	0.963	1.02	15.74	NoLiq	8.15	23.88	0.27
18.50	13.00	1.25	0.95	0.994	1.00	15.48	NoLiq	8.10	23.58	0.26
19.00	13.00	1.25	0.95	1.026	0.99	15.24	NoLiq	8.05	23.29	0.26
19.50	13.00	1.25	0.95	1.058	0.97	15.01	NoLiq	8.00	23.01	0.25
20.00	13.00	1.25	0.95	1.090	0.96	14.79	NoLiq	7.96	22.75	0.25
20.50	13.00	1.25	0.95	1.121	0.94	14.58	NoLiq	7.92	22.49	0.25
21.00	13.00	1.25	0.95	1.153	0.93	14.38	NoLiq	7.88	22.25	0.24
21.50	23.00	1.25	0.95	1.185	0.92	25.09	NoLiq	10.02	35.11	2.00

CRR is based on water table at 50.0 during In-Situ Testing

Factor of Safety, - Earthquake Magnitude= 6.6:

Depth ft	sigC' tsf	CRR7.5 tsf	x Ksig	=CRRv tsf	x MSF	=CRRm tsf	/ CSRfs tsf	=F.S. CRRm/CSRfs
0.00	0.00	2.00	1.00	2.00	1.39	2.77	0.52	5.00
0.50	0.01	2.00	1.00	2.00	1.39	2.77	0.52	5.00
1.00	0.03	2.00	1.00	2.00	1.39	2.77	0.52	5.00
1.50	0.04	2.00	1.00	2.00	1.39	2.77	0.52	5.00
2.00	0.06	2.00	1.00	2.00	1.39	2.77	0.52	5.00
2.50	0.07	2.00	1.00	2.00	1.39	2.77	0.52	5.00
3.00	0.09	2.00	1.00	2.00	1.39	2.77	0.52	5.00
3.50	0.10	2.00	1.00	2.00	1.39	2.77	0.52	5.00
4.00	0.12	2.00	1.00	2.00	1.39	2.77	0.52	5.00
4.50	0.13	2.00	1.00	2.00	1.39	2.77	0.52	5.00
5.00	0.15	2.00	1.00	2.00	1.39	2.77	0.52	5.00
5.50	0.16	2.00	1.00	2.00	1.39	2.77	0.52	5.00
6.00	0.18	2.00	1.00	2.00	1.39	2.77	0.52	5.00
6.50	0.19	2.00	1.00	2.00	1.39	2.77	0.52	5.00
7.00	0.21	2.00	1.00	2.00	1.39	2.77	0.52	5.00
7.50	0.22	2.00	1.00	2.00	1.39	2.77	0.51	5.00
8.00	0.24	0.30	1.00	0.30	1.39	0.42	0.53	0.79 *
8.50	0.26	0.35	1.00	0.35	1.39	0.48	0.55	0.88 *
9.00	0.27	0.33	1.00	0.33	1.39	0.45	0.57	0.80 *
9.50	0.29	0.31	1.00	0.31	1.39	0.43	0.59	0.74 *
10.00	0.31	0.30	1.00	0.30	1.39	0.42	0.60	0.69 *
10.50	0.33	0.29	1.00	0.29	1.39	0.40	0.62	0.65 *
11.00	0.35	0.22	1.00	0.22	1.39	2.00	0.63	5.00 ^
11.50	0.37	0.22	1.00	0.22	1.39	2.00	0.65	5.00 ^
12.00	0.39	0.22	1.00	0.22	1.39	2.00	0.66	5.00 ^
12.50	0.41	0.21	1.00	0.21	1.39	2.00	0.67	5.00 ^
13.00	0.43	0.21	1.00	0.21	1.39	2.00	0.68	5.00 ^
13.50	0.44	0.20	1.00	0.20	1.39	2.00	0.69	5.00 ^
14.00	0.46	0.20	1.00	0.20	1.39	2.00	0.70	5.00 ^
14.50	0.48	0.20	1.00	0.20	1.39	2.00	0.71	5.00 ^
15.00	0.50	0.21	1.00	0.21	1.39	2.00	0.72	5.00 ^
15.50	0.52	0.21	1.00	0.21	1.39	2.00	0.72	5.00 ^
16.00	0.54	0.29	1.00	0.29	1.39	2.00	0.73	5.00 ^
16.50	0.56	0.28	1.00	0.28	1.39	2.00	0.74	5.00 ^
17.00	0.58	0.28	1.00	0.28	1.39	2.00	0.74	5.00 ^
17.50	0.60	0.27	1.00	0.27	1.39	2.00	0.75	5.00 ^
18.00	0.63	0.27	1.00	0.27	1.39	2.00	0.75	5.00 ^
18.50	0.65	0.26	1.00	0.26	1.39	2.00	0.76	5.00 ^
19.00	0.67	0.26	1.00	0.26	1.39	2.00	0.76	5.00 ^
19.50	0.69	0.25	1.00	0.25	1.39	2.00	0.77	5.00 ^
20.00	0.71	0.25	1.00	0.25	1.39	2.00	0.77	5.00 ^
20.50	0.73	0.25	1.00	0.25	1.39	2.00	0.77	5.00 ^
21.00	0.75	0.24	1.00	0.24	1.39	2.00	0.78	5.00 ^
21.50	0.77	2.00	1.00	2.00	1.39	2.00	0.78	5.00 ^

* F.S.<1: Liquefaction Potential Zone. (If above water table: F.S.=5)

^ No-liquefiable Soils.
(F.S. is limited to 5, CRR is limited to 2, CSR is limited to 2)

CPT convert to SPT for Settlement Analysis:
Fines Correction for Settlement Analysis:

Depth ft	Ic	qc/N60	qc1 tsf	(N1)60	Fines %	d(N1)60	(N1)60s
0.00	-	-	-	47.02	30.00	0.00	47.02
0.50	-	-	-	47.02	30.00	0.00	47.02
1.00	-	-	-	47.02	30.00	0.00	47.02
1.50	-	-	-	47.02	30.00	0.00	47.02
2.00	-	-	-	47.02	30.00	0.00	47.02
2.50	-	-	-	47.02	30.00	0.00	47.02
3.00	-	-	-	47.02	30.00	0.00	47.02
3.50	-	-	-	47.02	30.00	0.00	47.02
4.00	-	-	-	47.02	30.00	0.00	47.02
4.50	-	-	-	47.02	30.00	0.00	47.02
5.00	-	-	-	47.02	30.00	0.00	47.02
5.50	-	-	-	47.02	30.00	0.00	47.02
6.00	-	-	-	47.02	30.00	0.00	47.02
6.50	-	-	-	47.02	30.00	0.00	47.02
7.00	-	-	-	47.02	30.00	0.00	47.02
7.50	-	-	-	47.02	30.00	0.00	47.02
8.00	-	-	-	26.11	30.00	0.00	26.11
8.50	-	-	-	28.11	30.00	0.00	28.11
9.00	-	-	-	27.33	30.00	0.00	27.33
9.50	-	-	-	26.63	30.00	0.00	26.63
10.00	-	-	-	25.99	30.00	0.00	25.99
10.50	-	-	-	25.41	30.00	0.00	25.41
11.00	-	-	-	20.72	NoLiq	0.00	20.72
11.50	-	-	-	20.29	NoLiq	0.00	20.29
12.00	-	-	-	19.89	NoLiq	0.00	19.89
12.50	-	-	-	19.53	NoLiq	0.00	19.53
13.00	-	-	-	19.19	NoLiq	0.00	19.19
13.50	-	-	-	18.87	NoLiq	0.00	18.87
14.00	-	-	-	18.58	NoLiq	0.00	18.58
14.50	-	-	-	18.30	NoLiq	0.00	18.30
15.00	-	-	-	19.57	NoLiq	0.00	19.57
15.50	-	-	-	19.29	NoLiq	0.00	19.29
16.00	-	-	-	25.27	NoLiq	0.00	25.27
16.50	-	-	-	24.89	NoLiq	0.00	24.89
17.00	-	-	-	24.54	NoLiq	0.00	24.54
17.50	-	-	-	24.20	NoLiq	0.00	24.20
18.00	-	-	-	23.88	NoLiq	0.00	23.88
18.50	-	-	-	23.58	NoLiq	0.00	23.58
19.00	-	-	-	23.29	NoLiq	0.00	23.29
19.50	-	-	-	23.01	NoLiq	0.00	23.01
20.00	-	-	-	22.75	NoLiq	0.00	22.75
20.50	-	-	-	22.49	NoLiq	0.00	22.49
21.00	-	-	-	22.25	NoLiq	0.00	22.25

21.50	-	-	-	35.11	NoLiq	0.00	35.11	

(N1)60s has been fines corrected in liquefaction analysis, therefore d(N1)60=0.
Fines=NoLiq means the soils are not liquefiable.

Settlement of Saturated Sands:
Settlement Analysis Method: Ishihara / Yoshimine*

Depth	CSRsf	/ MSF*	=CSRm	F.S.	Fines	(N1)60s	Dr	ec	dsz	dsp	S
ft	tsf		tsf		%		%	%	in.	in.	in.
21.45	0.78	1.0	0.78	5.00	NoLiq	35.15	100.00	0.000	0.0E0	0.000	0.000
21.00	0.78	1.0	0.78	5.00	NoLiq	22.25	74.61	0.000	0.0E0	0.000	0.000
20.50	0.77	1.0	0.77	5.00	NoLiq	22.49	75.05	0.000	0.0E0	0.000	0.000
20.00	0.77	1.0	0.77	5.00	NoLiq	22.75	75.51	0.000	0.0E0	0.000	0.000
19.50	0.77	1.0	0.77	5.00	NoLiq	23.01	76.00	0.000	0.0E0	0.000	0.000
19.00	0.76	1.0	0.76	5.00	NoLiq	23.29	76.50	0.000	0.0E0	0.000	0.000
18.50	0.76	1.0	0.76	5.00	NoLiq	23.58	77.04	0.000	0.0E0	0.000	0.000
18.00	0.75	1.0	0.75	5.00	NoLiq	23.88	77.61	0.000	0.0E0	0.000	0.000
17.50	0.75	1.0	0.75	5.00	NoLiq	24.20	78.21	0.000	0.0E0	0.000	0.000
17.00	0.74	1.0	0.74	5.00	NoLiq	24.54	78.84	0.000	0.0E0	0.000	0.000
16.50	0.74	1.0	0.74	5.00	NoLiq	24.89	79.51	0.000	0.0E0	0.000	0.000
16.00	0.73	1.0	0.73	5.00	NoLiq	25.27	80.23	0.000	0.0E0	0.000	0.000
15.50	0.72	1.0	0.72	5.00	NoLiq	19.29	69.26	0.000	0.0E0	0.000	0.000
15.00	0.72	1.0	0.72	5.00	NoLiq	19.57	69.76	0.000	0.0E0	0.000	0.000
14.50	0.71	1.0	0.71	5.00	NoLiq	18.30	67.46	0.000	0.0E0	0.000	0.000
14.00	0.70	1.0	0.70	5.00	NoLiq	18.58	67.97	0.000	0.0E0	0.000	0.000
13.50	0.69	1.0	0.69	5.00	NoLiq	18.87	68.50	0.000	0.0E0	0.000	0.000
13.00	0.68	1.0	0.68	5.00	NoLiq	19.19	69.08	0.000	0.0E0	0.000	0.000
12.50	0.67	1.0	0.67	5.00	NoLiq	19.53	69.69	0.000	0.0E0	0.000	0.000

	12.00	0.66	1.0	0.66	5.00	NoLiq	19.89	70.35	0.000	0.0E0	0.000
0.000											
	11.50	0.65	1.0	0.65	5.00	NoLiq	20.29	71.06	0.000	0.0E0	0.000
0.000											
	11.00	0.63	1.0	0.63	5.00	NoLiq	20.72	71.83	0.000	0.0E0	0.000
0.000											
	10.50	0.62	1.0	0.62	0.65	30.00	25.41	80.50	1.523	9.1E-3	0.095
0.095											
	10.00	0.60	1.0	0.60	0.69	30.00	25.99	81.64	1.372	8.2E-3	0.086
0.182											
	9.50	0.59	1.0	0.59	0.74	30.00	26.63	82.91	1.196	7.2E-3	0.077
0.258											
	9.00	0.57	1.0	0.57	0.80	30.00	27.33	84.33	0.995	6.0E-3	0.065
0.324											
	8.50	0.55	1.0	0.55	0.88	30.00	28.11	85.94	0.789	4.7E-3	0.053
0.377											
	8.00	0.53	1.0	0.53	0.79	30.00	26.11	81.88	1.105	6.6E-3	0.056
0.433											
	7.70	0.51	1.0	0.51	5.00	30.00	46.53	100.00	0.000	0.0E0	0.000
0.433											

Settlement of Saturated Sands=0.433 in.
qc1 and (N1)60 is after fines correction in liquefaction analysis
dsz is per each segment, dz=0.05 ft
dsp is per each print interval, dp=0.50 ft
S is cumulated settlement at this depth

Settlement of Unsaturated Sands:

Depth	sigma'	sigC'	(N1)60s	CSRsf	Gmax	g*Ge/Gm	g_eff	ec7.5	Cec	ec	dsz	dsp	S
ft	tsf	tsf		tsf	tsf			%		%	in.	in.	in.
7.65	0.35	0.23	46.66	0.51	769.1	2.4E-4	0.0574	0.0182	0.81	0.0146	1.76E-4	0.000	0.000
7.50	0.35	0.22	47.02	0.51	763.4	2.3E-4	0.0550	0.0174	0.81	0.0140	1.68E-4	0.001	0.001
7.00	0.32	0.21	47.02	0.52	737.5	2.3E-4	0.0494	0.0156	0.81	0.0126	1.51E-4	0.002	0.002
6.50	0.30	0.19	47.02	0.52	710.7	2.2E-4	0.0450	0.0142	0.81	0.0115	1.38E-4	0.001	0.004
6.00	0.28	0.18	47.02	0.52	682.8	2.1E-4	0.0416	0.0131	0.81	0.0106	1.27E-4	0.001	0.005
5.50	0.25	0.16	47.02	0.52	653.7	2.0E-4	0.0388	0.0123	0.81	0.0099	1.19E-4	0.001	0.006
5.00	0.23	0.15	47.02	0.52	623.3	1.9E-4	0.0497	0.0157	0.81	0.0127	1.52E-4	0.001	0.007
4.50	0.21	0.13	47.02	0.52	591.3	1.8E-4	0.0435	0.0138	0.81	0.0111	1.33E-4	0.001	0.009

	4.00	0.18	0.12	47.02	0.52	557.5	1.7E-4	0.0380	0.0120	0.81	0.0097
1.16E-4	0.001	0.010									
	3.50	0.16	0.10	47.02	0.52	521.5	1.6E-4	0.0331	0.0105	0.81	0.0084
1.01E-4	0.001	0.011									
	3.00	0.14	0.09	47.02	0.52	482.8	1.5E-4	0.0289	0.0091	0.81	0.0074
8.84E-5	0.001	0.012									
	2.50	0.12	0.07	47.02	0.52	440.8	1.4E-4	0.0254	0.0080	0.81	0.0065
7.75E-5	0.001	0.013									
	2.00	0.09	0.06	47.02	0.52	394.2	1.2E-4	0.0226	0.0071	0.81	0.0058
6.91E-5	0.001	0.014									
	1.50	0.07	0.04	47.02	0.52	341.4	1.1E-4	0.0217	0.0069	0.81	0.0055
6.63E-5	0.001	0.014									
	1.00	0.05	0.03	47.02	0.52	278.8	8.6E-5	0.0157	0.0050	0.81	0.0040
4.81E-5	0.001	0.015									
	0.50	0.02	0.01	47.02	0.52	197.2	6.1E-5	0.0095	0.0030	0.81	0.0024
2.91E-5	0.000	0.015									
	0.00	0.00	0.00	47.02	0.52	4.1	1.3E-6	0.0010	0.0003	0.81	0.0003
3.11E-6	0.000	0.016									

Settlement of Unsaturated Sands=0.016 in.
dsz is per each segment, dz=0.05 ft
dsp is per each print interval, dp=0.50 ft
S is cumulated settlement at this depth

Total Settlement of Saturated and Unsaturated Sands=0.448 in.
Differential Settlement=0.224 to 0.296 in.

Units Depth = ft, Stress or Pressure = tsf (atm), Unit Weight = pcf, Settlement = in.

SPT	Field data from Standard Penetration Test (SPT)
BPT	Field data from Becker Penetration Test (BPT)
qc	Field data from Cone Penetration Test (CPT)
fs	Friction from CPT testing
gamma	Total unit weight of soil
gamma'	Effective unit weight of soil
Fines	Fines content [%]
D50	Mean grain size
Dr	Relative Density
sigma	Total vertical stress [tsf]
sigma'	Effective vertical stress [tsf]
sigC'	Effective confining pressure [tsf]
rd	Stress reduction coefficient
CRRv	CRR after overburden stress correction, CRRv=CRR7.5 * Ksig
CRR7.5	Cyclic resistance ratio (M=7.5)
Ksig	Overburden stress correction factor for CRR7.5
CRRm	After magnitude scaling correction CRRm=CRRv * MSF
MSF	Magnitude scaling factor from M=7.5 to user input M
CSR	Cyclic stress ratio induced by earthquake
CSRfs	CSRfs=CSR*fs1 (Default fs1=1)

fs1	First CSR curve in graphic defined in #9 of Advanced page
fs2	2nd CSR curve in graphic defined in #9 of Advanced page
F.S.	Calculated factor of safety against liquefaction F.S.=CRRm/CSRsf
Cebs	Energy Ratio, Borehole Dia., and Sampling Method Corrections
Cr	Rod Length Corrections
Cn	Overburden Pressure Correction
(N1)60	SPT after corrections, (N1)60=SPT * Cr * Cn * Cebs
d(N1)60	Fines correction of SPT
(N1)60f	(N1)60 after fines corrections, (N1)60f=(N1)60 + d(N1)60
Cq	Overburden stress correction factor
qc1	CPT after Overburden stress correction
dqc1	Fines correction of CPT
qc1f	CPT after Fines and Overburden correction, qc1f=qc1 + dqc1
qc1n	CPT after normalization in Robertson's method
Kc	Fine correction factor in Robertson's Method
qc1f	CPT after Fines correction in Robertson's Method
Ic	Soil type index in Suzuki's and Robertson's Methods
(N1)60s	(N1)60 after settlement fines corrections
CSRm	After magnitude scaling correction for Settlement calculation CSRm=CSRsf / MSF*
CSRfs	Cyclic stress ratio induced by earthquake with user inputed fs
MSF*	Scaling factor from CSR, MSF*=1, base on Item 2 of Page C.
ec	Volumetric strain for saturated sands
dz	Calculation segment, dz=0.050 ft
dsz	Settlement in each segment, dz
dp	User defined print interval
dsp	Settlement in each print interval, dp
Gmax	Shear Modulus at low strain
g_eff	gamma_eff, Effective shear Strain
g*Ge/Gm	gamma_eff * G_eff/G_max, Strain-modulus ratio
ec7.5	Volumetric Strain for magnitude=7.5
Cec	Magnitude correction factor for any magnitude
ec	Volumetric strain for unsaturated sands, ec=Cec * ec7.5
NoLiq	No-Liquefy Soils

References:

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1. NCEER Workshop on Evaluation of Liquefaction Resistance of Soils. Youd, T.L., and Idriss, I.M., eds., Technical Report NCEER 97-0022.

SP117. Southern California Earthquake Center. Recommended Procedures for Implementation of DMG Special Publication 117, Guidelines for

Analyzing and Mitigating Liquefaction in California. University of Southern California. March 1999.

2. RECENT ADVANCES IN SOIL LIQUEFACTION ENGINEERING AND SEISMIC SITE RESPONSE EVALUATION, Paper No. SPL-2, PROCEEDINGS: Fourth

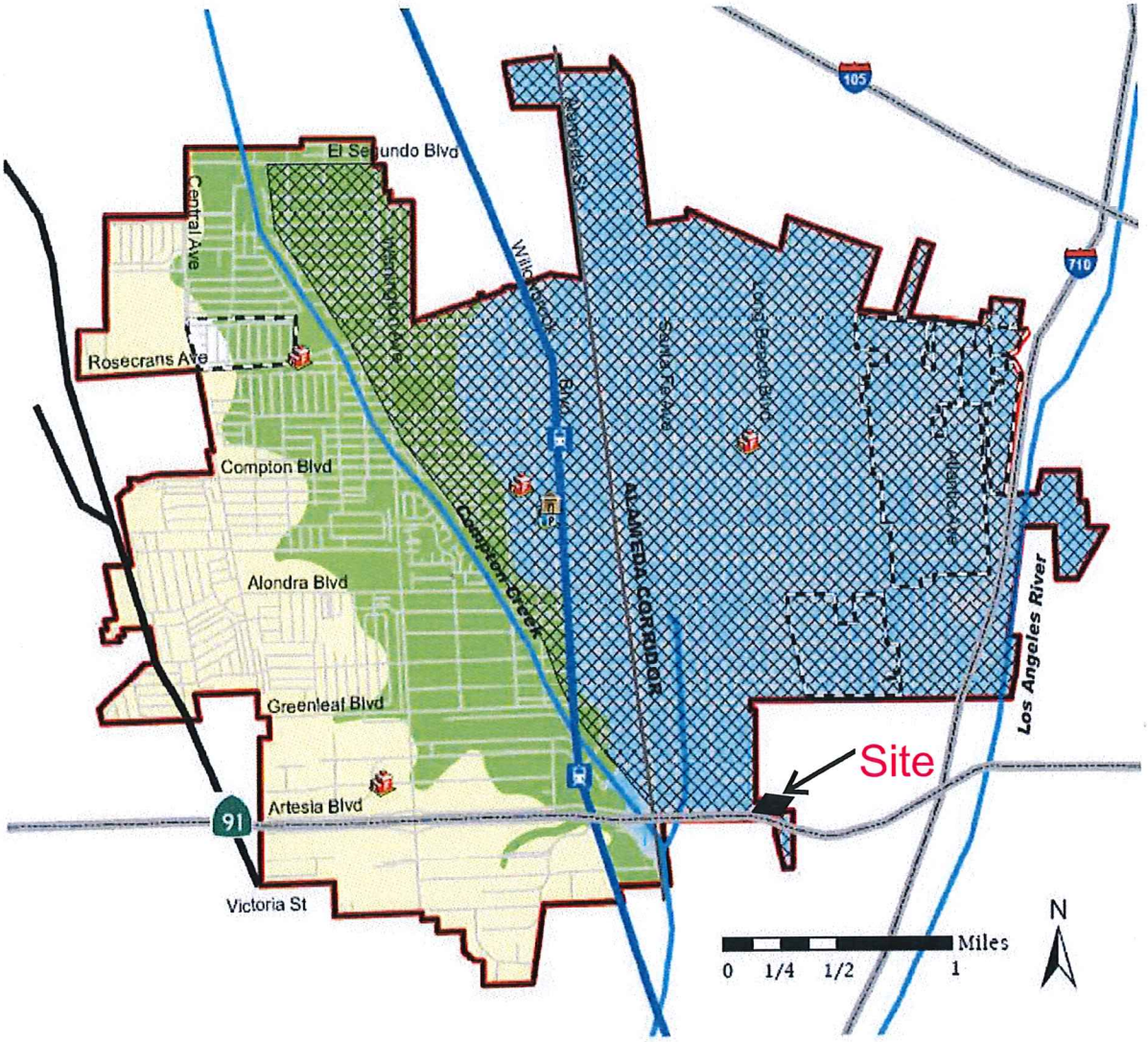
International Conference on Recent Advances in Geotechnical Earthquake Engineering and Soil Dynamics, San Diego, CA, March 2001.

3. RECENT ADVANCES IN SOIL LIQUEFACTION ENGINEERING: A UNIFIED AND CONSISTENT FRAMEWORK, Earthquake Engineering Research Center,

Report No. EERC 2003-06 by R.B Seed and etc. April 2003.

EXHIBIT 1
SEISMIC AND FLOOD HAZARDS

SOURCE: U. S. ENVIRONMENTAL PROTECTION AGENCY AND CITY OF COMPTON MULTI-HAZARD FUNCTIONAL PLAN



Source: City of Compton General Plan,
Public Safety Element

No Scale

Compton Center - Public Safety Buildling 1111 E. Artesia Blvd, Compton, California	United-Heider # 10-17036-PW	May 2017
UNITED-HEIDER INSPECTION GROUP An ETS Company	Dam Inundation Map	Figure 7

3rd review & approval

State of California • Natural Resources Agency
Department of Conservation
California Geological Survey
801 K Street • MS 12-31
Sacramento, CA 95814
(916) 324-7324 • FAX (916) 445-3334

Edmund G. Brown Jr., *Governor*
John G. Parrish, Ph.D., *State Geologist*

June 14, 2017

Mr. Steven Haigler
Interim Chief Business Officer
Compton Community College District
1111 East Artesia Boulevard
Compton, CA 90221

Subject: **Third Engineering Geology and Seismology Review for Compton Community College – Public Safety Building 1111 East Artesia Boulevard, Compton, CA 90221 CGS Application No. 03-CGS2617**

Dear Mr. Haigler:

In accordance with your request and transmittal of additional documents, the California Geological Survey performed a second review of the engineering geology and seismology aspects of the consulting reports prepared for Compton College in Compton. The June 2, 2017 response report states that United-Heider Inspection Group has now assumed the role of both "Geotechnical Engineer of Record" and "Engineering Geologist of Record" (report signed by Michael I. Bracher CEG #1048). This review was performed in accordance with Title 24, California Code of Regulations, 2013 California Building Code (CBC) and followed CGS Note 48 guidelines. We reviewed the following response report, which we received on June 2, 2017, as a reply to our request for additional information:

> **Response to Second CGS Review Letter, Compton Community College – Public Safety Building, 1111 East Artesia Boulevard, Compton, California 90221:** United-Heider Inspection Group, 22620 Goldencrest Drive, Suite 114, Moreno Valley, CA 92553; company Project No. 10-17036PW, report dated June 2, 2017, 4 pages, 3 attachments.

CGS previously reviewed the following reports:

> **Response to CGS January 30, 2017 Review Letter, Compton Community College – Public Safety Building, 1111 East Artesia Boulevard, Compton, California 90221:** United-Heider Inspection Group, 22620 Goldencrest Drive, Suite 114, Moreno Valley, CA 92553; company Project No. 10-17036PW, report dated April 5, 2017, 6 pages, 7 attachments, *including the following supplemental letter report*:
>
> **Campus Public Safety Building, Compton Community College, 1111 East Artesia Boulevard, Compton, California 90221:** United-Heider Inspection Group, 22620

In conclusion, ***the engineering geology and seismology hazards at this site are adequately characterized in the reports prepared by the consultants.*** Therefore, no additional information is requested of the consultants relative to this project. If you have any further questions about this review letter, please contact the reviewer at (213) 239-0885.

Respectfully submitted

Brian J. Swanson
Engineering Geologist
PG 6494, CEG 2055

Concur:

Anne M. Rosinski
Senior Engineering Geologist
PG 7481, CEG 2353

Enclosures:

Note 48 Checklist Review Comments
Keyed to: *Note 48 - Checklist for the Review of Engineering Geology and Seismology Reports for California Public Schools, Hospitals, and Essential Services Buildings*

Copies to:

Michael I. Bracher, *Certified Engineering Geologist*, and Corey T. Dare, *Registered Geotechnical Engineer*
United-Heider Inspection Group, 22620 Goldencrest Drive, Suite 114, Moreno Valley, CA 92553

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Ted Beckwith, *Senior Structural Engineer*
Division of State Architect, 700 North Alameda Street, Suite 5-500, Los Angeles, CA 90012