FOUNDATION REPORT

BLOSSOM HILL ROAD OVERCROSSING (WIDEN)
(BRIDGE NO. – 37-0348)
SAN JOSE, CALIFORNIA
04-SCl-101, R28.4/R28.9 EA 04-1K280

Prepared For:

HMH Engineers
1570 Oakland Road
San Jose, CA 95131

PARIKH CONSULTANTS, INC.
2360 Qume Drive, Suite A, San Jose, CA 95131
(408) 452-9000

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1.0 INTRODUCTION

This foundation report presents the results of our geotechnical engineering investigation for the proposed "US 101/Blossom Hill Road Interchange Improvement Project - Blossom Hill Road Overcrossing (Widen)" in San Jose, California, hereinafter referred to as "PROJECT". The work was performed in general accordance with the scope of work outlined in our proposal to HMH Engineers (Designer).

The geotechnical recommendations presented in this report are intended for design input and are not intended to be used as specifications. In addition, the data provided in this report including these geotechnical recommendations should not be used for bidding purposes or for construction cost estimates. If the report is provided as a reference document, any interpretation of the data and recommendations should be the sole responsibility of the user and PARIKH Consultants, Inc. (PARIKH) shall not be liable for any consequences.

2.0 SCOPE OF WORK

The purpose of this investigation was to evaluate the general subsurface conditions at the project site, to evaluate their engineering properties, and to provide geotechnical recommendations for the foundation design of the proposed project.

The scope of work performed for this investigation included a review of the readily available soils and geologic literature pertaining to the project site including available as-built Log of Test Borings (LOTB) for the existing structure (Bridge No. 37-0348 R/L); review of boring data, laboratory testing of the representative soil samples, performing engineering analyses based on the field and laboratory data, and preparation of this foundation report. The recommendations in this report are based on the field exploration performed by Parikh, general plan and foundation plan and loading information provided by the designer and Biggs Cardosa Associates (Structural Designer). This foundation report supersedes the preliminary foundation report for "Blossom Hill Road Overcrossing (Widen)" dated July 6, 2018.

3.0 PROJECT DESCRIPTION

The project proposes to modify the US 101/ Blossom Hill Road Interchange to improve traffic operations and connectivity for pedestrians and bicyclists along Blossom Hill Road. The existing Blossom Hill Road Interchange consists of two separate overcrossing structures over US 101 with partial cloverleaf ramps. The project is located within the City of San Jose, in Santa Clara County. It will be implemented as a locally-funded project with the City of San Jose performing advertisement, award and administration (AAA) of the construction contract through a Caltrans encroachment permit.

Blossom Hill Road is a key connector between job locations, mixed-use housing, commercial development and recreational opportunities in an area where San Jose is focused on developing greater internalization of automobile trips, increased use of transit and expanded active transportation. The level-of-service for existing and forecasted traffic is deficient for existing developments and nearby proposed projects. The configuration of the existing interchange and ramp intersections along Blossom Hill Road are not consistent with the latest standards for accommodating balanced use by vehicles, bicyclists and pedestrians.

The proposed project improvements will occur along Blossom Hill Road from east of the Monterey Road / Blossom Hill Road grade separation to the US 101 Northbound Off-Ramp / Coyote Road intersection. All improvements will be constructed within existing Caltrans and City of San Jose rights-of-way.

The proposed improvements on Blossom Hill Road include widening the existing four lanes within the median to provide an additional lane in each direction, plus a fourth eastbound lane which will become an exit-only lane onto the northbound loop on-ramp. This work includes widening the overcrossing between the two existing overcrossing structures over US 101 and seismic retrofit of the existing overcrossings.

The following bridge structures and retaining walls would be modified or constructed in association with the "US 101/Blossom Hill Road Interchange Improvement Project" and path:

1. Blossom Hill Road Overcrossing (OC) (Widen) (Bridge No. 37-0348)
2. NB 101 On-Ramp Pedestrian Overcrossing (POC) (Bridge No. 37-676)
3. SB 101 Off-Ramp Pedestrian Undercrossing (PUC) (Bridge No. 37-675J)
4. SB 101 On-Ramp PUC (Bridge No. 37-675K)

5. Retaining Wall No. 1 (Soil Nail Wall)(Bridge No. 37E0125)
6. Retaining Wall No. 2 (MSE Wall)(Bridge No. 37E0126)

This foundation report is for the "Blossom Hill Road OC (Widen)". A map showing the project location and its vicinity is presented in Appendix I. The following foundation reports will be separately submitted:

1. Foundation Report for NB 101 On-Ramp POC (Bridge No. 37-676).
2. Foundation Report for SB 101 Off-Ramp PUC (Bridge No. 37-675J).
3. Foundation Report for SB 101 On-Ramp PUC (Bridge No. 37-675K).
4. Foundation Report for Retaining Wall No. 1 (Soil Nail Wall)(Bridge No. 37E0125).
5. Foundation Report for Retaining Wall No. 2 (MSE Wall)(Bridge No. 37E0126).

Existing Bridge

The existing "Silver Creek Valley Road OC" carries two lanes of traffic in both eastbound and westbound directions. The overcrossing structures are two-span structures with a bent between NB US 101 and SB US 101. The existing overcrossing structures are not in compliance with the current California seismic code.

Based on the "Route 82/101 Separation" General Plan, the existing bridge is supported by 12-inch PC/PS Alternate "X" Class 70 piles.

Proposed Bridge Widening

Based on the General Plan and Foundation Plan provided by the structural designer, it is proposed to widen the existing "Blossom Hill Road OC". The proposed construction generally consists of:

a) The widening is about 35 feet wide in the median of the existing overcrossing structure. After construction, the entire overcrossing will be approximately 110.5 feet wide,

b) The widening is expected to provide three lanes in the westbound direction and four lanes in the eastbound direction. A separate pedestrian/bike path lane will be provided in the westbound direction.

c) The proposed new bridge is a two-span cast-in-place prestressed concrete box girder structure of approximately 350 feet in length. The foundation will consist of Caltrans Alternative "W" (steel) piles.

All elevations referenced within this report are based on the North American Vertical Datum of 1988 (NAVD 88), unless otherwise noted. To convert elevation at this site from National Geodetic Vertical Datum of 1929 (NGVD 29) to NAVD 88, we added 1.8 feet to the NGVD 29 elevation.

Our recommendations in this report are based on the above information. Any major deviation should be reported to this office for consideration.

4.0 EXCEPTION TO POLICIES AND PROCEDURES

No exception to policies and produces are needed for the preparation of this report. Normal procedures were assumed for construction of the bridge structure throughout our analyses and represent one of the bases of recommendations presented herein. The investigation of the proposed foundations has followed Caltrans policy.

5.0 SITE CONDITIONS

The general project area is the existing interchange of Blossom Hill Road at Route 101 in San Jose, Santa Clara County, California. The existing Blossom Hill Road Overcrossing consists of two structures and is supported by 2 abutments and 1 bent in the middle. Currently, there are two lanes in each direction. The existing grade of Route 101 in the vicinity of the structure is generally level at approximately 200 feet. The existing elevation of Blossom Hill Road at the location of the overcrossing ranges from approximately 220 feet to 230 feet. The existing embankment slope gradient ranges from 1(V): 2(H) to 1(V): 1.5(H).

6.0 FIELD INVESTIGATION AND FIELD TESTING PROGRAM

Field Exploration

Field exploration for the "Blossom Hill Road Overcrossing" was performed in 1970, 2003 and 2018. These field explorations are described below.

Caltrans As-Built LOTB and Parikh 2003 LOTB

We have referred to the boring logs included in the "Geotechnical Engineering Investigation – Route 82/101 Separation (Widen) (Bridge No. 37-0348) dated March 2004" (Geotechnical

Report) prepared by Parikh. The boring information included in this geotechnical report is summarized in the table below:

TABLE 1 - SUMMARY OF AVAILABLE BORING INFORMATION

Boring No.	Location	Approximate Station & Offset	Approx. Ground Elev. (ft)	Approx. Depth (ft)	Bottom Elev. (ft)
Route 82/101 Separation by Caltrans (1970)					
B-1	East side of US101	"A1" Line 60+54, 0 offset	200.0	84.5	115.5
B-3	West side of US101	"A1" Line 56+88, 0 offset	199.0	78.5	121.5
Route 82/101 Separation (Widen) by Parikh (2003)					
03-BL-1	West side of US101	"A1M" Line 56+10, 88.5' Rt.	226.4	105.0	121.4
03-BL-2	East side of US101	"A1M" Line 61+91, 114.5' Rt.	203.4	105.0	98.4

Caltrans As-Built LOTB of Route 82/101 Separation

a) Two borings were drilled and two continuous penetration tests were pushed in November 1970.

b) The penetration tests were pushed to the depth of approximately 68 feet at the location of B-4 and to the depth of approximately 96 feet at the location of B-2.

c) The field exploration was performed on the native soil before the construction of the approach embankment for the Route 82/101 Separation.

d) The borings were drilled and the penetration tests were pushed along the control line of the bridge alignment.

Parikh 2003 LOTB of Route 82/101 Separation (Widening)

The approximate locations of the soil borings are shown on the LOTBs included in Appendix II.

Parikh performed additional field exploration in 2018. The field exploration program was developed based on the preliminary plans provided by the designer and the available field exploration information.

Parikh 2018 Field Exploration

Borings R-18-SC-001 and R-17-SC-002 were drilled, one in the vicinity of Abutment 1 and one in the vicinity of Abutment 3 for this project in August 2018. Cone Penetration Test (CPT)

CPT-18-SC-003 was pushed in the vicinity of Bent 2 for this project in September 2018. The field exploration was performed by the drilling contractor, Geo-Ex Subsurface Exploration and CPT contractor Middle Earth Geo Testing, Inc. The location, approximate ground elevation and depth of these borings and CPT are summarized in the table below.

TABLE 2 – SUBSURFACE INVESTIGATION SUMMARY

Boring No.	Completion Date	Drill Rig Type	Hammer Type	Hammer Efficiency (%)	Approx. Ground Elev. (ft)	Boring/CPT Depth (ft)
R-18-SC-001	8/29/2018	CME 75	Automatic	78	231.0	131.5
R-18-SC-002	8/28/2018	CME 75	Automatic	78	226.0	121.5
CPT-18-SC-003	9/26/2018	CME 75	Automatic	78	203.0	70.0

TABLE 3 - SUMMARY OF BORINGS

Boring/CPT No.	"A" Line Station (ft)	Offset (ft)	Boring Depth (ft)	Approx. Ground Elev. (ft)
R-18-SC-001	56+35	0.0 Lt.	131.5	231.0
R-18-SC-002	61+20	0.0 Lt.	121.5	236.0
CPT-18-SC-003	58+05	70.0 Rt.	70.0	203.0

(1) Boring/CPT location stations and offset and elevations are stated to the nearest foot to be consistent with the LOTB, however they were not surveyed.

CPT-18-SC-003 was terminated at 70 feet because of refusal and the probe could not be pushed further.

The approximate locations of the soil borings and Cone Penetration Test are shown on the "Boring Location Map", Plate 1. The descriptions of the soil materials encountered in the field exploration and relevant boring information are presented on the LOTB included in Appendix II.

Field Testing

a) The current investigation borings (by Parikh) were advanced using a truck-mounted CME-75 drill rig with 8-inch hollow-stem auger and 3 ¼ inch rotary wash drilling method. The soil samples were obtained from the borings during drilling at various depths by driving a 2.5-inch Inside Diameter (I. D.) Modified California Sampler or a 1.375-inch I.D. Standard Penetration Sampler (ASTM Test Method No. 1586). The sampler was driven into the subsurface soils under the impact of a 140 pounds hammer having a free fall of 30 inches. The blow counts required to drive the sampler for the last 12 inches are presented on the LOTB, Appendix II. (When correlating standard penetration data in similar soils, the blow counts for the Modified California sampler can be converted to equivalent Standard Penetration Test sampler by multiplying a factor of safety of 0.65);

b) Pocket penetration tests were also performed on clay samples to evaluate their consistency.

Details of Field Exploration

All the test borings were drilled with a truck-mounted drill rig using 8-inch hollow-stem auger and rotary-wash drilling method. The borings were drilled under the technical supervision of our engineers, who classified and continuously logged the soils encountered during drilling and supervised the collection of soil samples at various depths for visual examination and laboratory testing. The soil samples were visually classified in the field according to the Unified Soil Classification System and then transported to our laboratory for further evaluation and testing. Upon completion of drilling, the boreholes were backfilled with cement grout.

The logs presented in Appendix II were prepared from the field logs which were edited after visual re-examination of the soil samples in the laboratory and results of classification tests on selected soil samples as indicated on the logs.

It should be noted that the descriptions of the soils encountered and relevant boring information presented on the LOTB depict subsurface conditions only at the locations indicated on the plan and on the particular date noted on the LOTB. Because of the variability from place to place within soil/rock in general, subsurface conditions at other locations may differ from conditions occurring at the boring locations explored. The abrupt stratum changes shown on the logs may be gradational and relatively minor changes in soil types within a stratum may not be noted on the logs due to field limitations. Also, the passage of time may result in a change in the soil conditions at these locations due to environmental changes.

7.0 LABORATORY TESTING PROGRAM

The following laboratory tests were performed on selected soil samples collected during field exploration to evaluate the physical and engineering properties of the subsurface soils at the project site to support the foundation recommendations:

a) Laboratory determination of Moisture Contents (ASTM D-2216);

b) Atterberg Limits (ASTM D-4318);
c) Particle Size Analysis (ASTM D-422);
d) Unconfined Compression Test (ASTM D-2166);
e) Corrosivity Test (California Test Method T-643, T-422, and T-417).

The laboratory test methods and test results are presented on plates included in Appendix IV. Laboratory test results for moisture content, total unit weight, unconfined compression, Plasticity Index and grain size classification of the soil samples are summarized in the table in Appendix IV.

8.0 SITE GEOLOGY AND SUBSURFACE CONDITIONS

Geology

General geologic features pertaining to the project site were evaluated by reference to the "Dibblee, T.W.; and Minch, J.A., 2005, Geologic Maps of the San Jose East Quadrangle, Santa Clara County, California; Dibblee Geological Foundation DF-155, scale 1:24,000" and "Dibblee, T.W.; and Minch, J.A., 2005, Geologic Maps of the Santa Teresa Hills Quadrangle, Santa Clara County, California; Dibblee Geological Foundation DF-158, scale 1:24,000".

Based on the geologic map, the project site subsurface soils consist of mainly Holocene surficial sediments with alluvial gravel, sand and clay soil of valley areas (Qa). The general geology of the project area is shown on the "Geologic Map", Plate No. 2.

The descriptions of the subsurface soils encountered in the geotechnical explorations are consistent with the published geologic maps.

Subsurface Conditions

Caltrans As-Built LOTB of Route 82/101 Separation

Based on the as-built LOTB, the subsurface soil conditions generally consist of:

Boring B-1 (East Side of U.S.101)

- Medium stiff silt, underlain by loose to dense sand/gravel,
- Underlain by medium stiff to stiff sandy/clayey silt with intermittent layers of medium

dense silty sand/gravel,

- Underlain by dense silty sand/gravel, underlain by stiff to very stiff silty clay.

Boring B-3 (West Side of U.S.101)

- Medium stiff silt, underlain by medium dense to dense silty sand,
- Underlain by soft to stiff clayey/sandy silt,
- Underlain by very dense sand/gravel,
- Underlain by stiff silty clay.

Parikh 2003 LOTB of Route 82/101 Separation (Widening)

Based on the LOTB of "Route 82/101 Separation", the following subsurface soil conditions were generally encountered in the soil boring:

Boring 03-BL-02 (East Side of U.S.101)

- Embankment/compacted fill underlain by the native alluvial soil.
- The native alluvial soil consists of medium stiff to very stiff lean clay and silt of low plasticity,
- Underlain by medium dense to dense poorly graded sand, well graded sand and clayey sand,
- Underlain by approximately 10 feet of dense to very dense poorly graded gravel,
- Underlain by stiff to very stiff silt and medium dense silty sand,
- Underlain by very stiff to hard silt/lean clay/fat clay to the bottom of the boring. Interbedded layer of medium dense to very dense clayey sand and gravel was encountered between Elev. +131.5 feet and Elev. +121.5 feet.

Boring 03-BL-01 (West Side of U.S.101)

- Embankment/compacted fill underlain by the native alluvial soil.
- The native alluvial soil consists of medium stiff to very stiff lean clay and silt of low plasticity,
- Underlain by medium dense to dense poorly graded sand, well graded sand and clayey sand,

- Underlain by stiff to very stiff silt and medium dense silty sand,
- Underlain by very stiff to hard silt/lean clay/fat clay to the bottom of the boring.

Parikh 2018 LOTB of "Blossom Hill Road Overcrossing (Widening)"

Based on Borings R-18-SC-001 and R-18-SC-002 and Cone Penetration Probe CPT-18-SC-003 data, the descriptions of the subsurface soil materials encountered in each of the exploratory boring and the material interpretation of the CPT are summarized in the table below. Detailed soil descriptions and location of the borings are presented on the LOTBs.

Boring R-18-SC-001

- Approximately 8 feet of medium dense silty sand,
- Underlain by approximately 15 feet of very stiff to hard sandy lean clay,
- Underlain by approximately 6 feet of medium dense clayey sand,
- Underlain by approximately 10 feet of medium stiff lean clay,
- Underlain by approximately 89 feet of interbedded layers of medium dense sand and soft to very stiff silt/lean clay to the boring depth of 131.5 feet.

CPT-18-SC-003

- Approximately 10 feet of stiff to very stiff lean clay,
- Underlain by approximately 60 feet of interbedded layers of medium dense sand and medium stiff to stiff lean clay to the CPT depth of 70 feet.

Boring R-18-SC-002

- Approximately 23 feet of medium dense silty/clayey sand,
- Underlain by approximately 42 feet of very soft to very stiff silt,
- Underlain by approximately 50 feet of interbedded layers of medium dense to very dense sand and stiff to very stiff lean clay/silt, underlain by bottom layer of very stiff lean clay to fat clay at Elev. 110.0 feet to the boring depth of 121.5 feet.

Due to limitations inherent in geotechnical investigations, it is neither uncommon to encounter unforeseen variations in the subsurface soil conditions during construction nor is it practical to determine all such variations during an acceptable program of drilling and sampling for a project of this scope. Such variations, when encountered, generally require additional engineering services to attain properly constructed project. We, therefore, recommend that a contingency fund be provided to accommodate any additional charges resulting from technical services that may be required during construction.

9.0 GROUNDWATER

Groundwater measured during the field exploration is summarized in the table below.

TABLE 4 - SUMMARY OF MEASURED GROUNDWATER LEVEL

Boring/CPT No.	Date	Depth (feet)	Elevation (feet)
B-1	11/19/1970	25	175
B-3	11/20/1970	15	185
03-BL-1	5/28/2003	55.5	171
03-BL-2	Not encountered		
R-18-SC-001	8/29/2018	30	201
R-18-SC-002	8/28/2018	25	201
CPT-18-SC-003	9/26/2018	26.3	176.7

Groundwater level is anticipated to vary with the passage of time due to seasonal groundwater fluctuations, variations in yearly rainfall, water elevations in the nearby creeks, surface and subsurface flows, ground surface run-off, and other environmental factors that may not be present at the time of the investigation.

Based on the summary of measured groundwater level and ground elevation, the relatively high groundwater level measured in Borings R-18-SC-001 and R-18-SC-002 appears to be perched groundwater table. However, measured groundwater depth in these soil borings was used for engineering analysis at each of the bridge support.

10.0 SCOUR EVALUATION

There is no significant drainage or flowing bodies of water passing through or adjacent to the site. Therefore, scour should not be a design concern and was not considered for foundation design.

11.0 CORROSION

The corrosion investigation for this project was performed on the selected samples from borings drilled in 2003 and 2018 in general accordance with the provisions of California Test Methods 417, 422 and 643. A summary of the corrosion test results is presented in the table below, and the test results are presented in Appendix IV.

TABLE 5 - SUMMARY OF CORROSION TEST RESULT

Boring	Approx. Sample Depth (feet)	Minimum Resistivity (ohms-cm)	PH	Water-soluble Chloride (ppm)	Water-soluble Sulfate (ppm)
03-BL-1	29.0	2,490	8.06	Not tested	Not tested
03-BL-2	56.0	1,660	8.14	Not tested	Not tested
R-18-SC-001	36.0	2,680	7.18	4.6	0.9
R-18-SC-002	31.0	1,880	7.36	9.4	29.7

According to the Section 10.7.5. of the AASHTO LRFD Bridge Design Specifications (BDS) – Sixth Edition (2012) with Caltrans Amendment, the following soil, water or site conditions shall be considered as indicators of potential pile corrosion or deterioration:

- Minimum resistivity equal to or less than 1,000 ohm-cm,
- Chloride concentration equal to or greater than 500 ppm,
- Sulfate concentration equal to or greater than 2,000 ppm,
- pH equals to or less than 5.5
- Landfills and cinder fills,
- Mines or industrial drainage,
- Suspected chemical wastes, and
- Stray currents.

Per Caltrans Corrosion Guidelines (Version 3.0, March 2018), Caltrans considers a project site to be corrosive for structural elements if one or more of the following conditions exist for the representative soil and/or water samples taken at the project site:

- Chloride concentration equal to or greater than 500 ppm, or
- Sulfate concentration equal to or greater than 1,500 ppm, or
- pH equals to or less than 5.5.

Therefore the on-site soil materials should be non-corrosive according to the criteria above.

12.0 SITE SEISMICITY AND ANALYSIS

12.1 Seismic Sources

The project is located in a seismically active part of northern California. Many faults exist in the regional area. These faults are capable of producing earthquakes and may cause strong ground shaking at the site.

Maximum magnitudes (M_{max}) of some of the closest faults in the area are based on Caltrans ARS Online Website. These maximum moment magnitudes represent the largest earthquake a fault is capable of generating and is related to the seismic moment. The earthquake data of the active faults in the project vicinity are summarized in the table below.

TABLE 6- ARS DATA

Fault (Fault ID)	Maximum Moment Magnitude of Fault, M_{Max}	Fault Type	Site-to-Fault Distance, R_{rup}* (miles)	Peak Ground Acceleration (PGA) Based on Deterministic Data (g)
Silver Creek (148)	6.9	Strike Slip	2.15	0.389
Cascade fault (153)	6.7	Reverse	3.12	0.412
Hayward (Southern extension) (149)	6.7	Strike Slip	4.03	0.317
Monte Vista-Shannon (154)	6.4	Reverse	4.82	0.288
Calaveras (Central) 2011 CFM (151)	6.9	Strike Slip	6.67	0.261
San Andreas (Santa Cruz Mts) 2011 CFM (158)	8.0	Strike Slip	11.86	0.246

*Closest distance (mi) to the fault rupture plane as obtained from Caltrans ARS Online Website.

12.2 Seismic Design Criteria

The development of the Acceleration Response Spectrum (ARS) followed the standard Caltrans procedure by using Caltrans ARS Online webtool (Ver. 2.3.09). The ARS curve is based on several input parameters, including site location (longitude/latitude), average shear wave velocity for the top 100 feet (Vs_{30m}), and other site parameters, such as fault characteristics and site-to-fault distances.

Average shear wave velocities (Vs_{30m}) for the top 100 feet at the project site was calculated by using established correlations and the procedure provided in the "Caltrans Design Manual (Version 2.0, 2012)". The design method incorporates both deterministic and probabilistic seismic hazards to produce the design response spectrum.

Based on all the available boring/CPT data, we have calculated the Vs_{30m}. The Vs_{30m} are summarized in the following table.

TABLE 7- SUMMARY OF CALCULATED Vs_{30m}

Boring/CPT No.	Boring/CPT Depth	Rock Depth (ft)	Vs_{30m} (m/s)
03-BL-1	105.0	Not encountered	270
03-BL-2	105.0	Not encountered	293
R-18-SC-001	131.5	Not encountered	202
R-18-SC-002	121.5	Not encountered	204
CPT-18-SC-003	70.0	Not encountered	258

The ARS was developed based on the shear wave velocity of 220 m/s. Average shear wave velocity calculation is included in Appendix VI.

The site location and the relevant parameters are summarized as follows, and the recommended design curve is presented on Appendix V.

Input

- Site Location: 37.2572ºN/121.7963ºW
- Average V_{S30m}: 220 m/s
- Depth to rock with a shear wave velocity of 1.0 km/sec ($Z_{1.0}$) = N/A
- Depth to rock with a shear wave velocity of 2.5 km/sec ($Z_{2.5}$) = N/A

Output

- The recommended ARS curve is based on the maximum of the comparison of the deterministic data and Caltrans Probabilistic data. The recommended ARS curve at this site is based on the Probabilistic curve.
- An adjustment factor for the near-fault effect was applied to the calculated spectral acceleration values. The increase of 20% to the spectral acceleration values corresponds to period longer than 1 second and linearly tapes to zero at a period of 0.5 seconds.
- Anticipated Peak Ground Acceleration (PGA): 0.627 g

- Near Fault Effect: Yes
- Basin Effect: No. The project site is not located within the limit of the $Z_{2.5}$ contour map for Northern California.
- Governing Fault is the Silver Creek Fault (Fault I.D.=148, Mmax=6.9)

12.3 Seismic Hazards/Liquefaction Potential

Potential seismic hazards may arise from three sources: surface fault rupture, ground shaking and liquefaction. Since no active faults pass through the site, the potential for fault rupture does not exist at the site. As shown on the ARS Online Map, Plate No. 3, the closest active fault is Silver Creek fault, which is located approximately 2.1 miles northeast from the project site.

12.3.1 Seismic Hazards

Potential seismic hazards may arise from three sources: surface fault rupture, ground shaking and liquefaction.

12.3.2 Seismic Ground Shaking

Based on available geological and seismic data, the project site is expected to experience strong ground shaking. PGA of 0.627 g was estimated for the site which is discussed in Section 12.2.

12.3.3 Surface Fault Rupture

Since no known active fault passes through the project site and the project site is not within a state Alquist-Priolo Zone, the potential for fault rupture does not exist.

12.3.4 Liquefaction Potential

Liquefaction is a phenomenon in which saturated cohesionless soils are subject to a temporary but essentially total loss of shear strength under the reversing, cyclic shear stresses associated with earthquake shaking. Submerged cohesionless sands and silts of low relative density are the type of soils, which usually are susceptible to liquefaction. Clays are generally not susceptible to liquefaction.

The liquefaction potential was evaluated in accordance with the methods proposed by Youd, et al. (2001). The evaluation was done using the boring data from all the available borings using a Magnitude 6.9 earthquake and a peak ground acceleration of 0.627 g (Caltrans Online Probabilistic ARS). This method compares the estimates of the earthquake-induced shear stress to the susceptibility of soil liquefaction. According to Bray (2006), liquefaction appears to occur in soils where these fines are either non-plastic or are low plasticity silts and/or silty clays (PI<12%, and LL<37%), and with high water content relative to their liquid limit (w>0.85 LL). Estimated fine content has been added to the sand layers (without any sieve analyses) based on the visual inspection and soil classification of the soil sample.

Based on the results of the liquefaction analyses, liquefaction potential may exist at the project site at the isolated locations for the loose to medium dense cohesionless soil encountered in the borings/CPT with the following estimated post-liquefaction settlements.

TABLE 8 - SUMMARY OF ESTIMATED POST-LIQUEFACTION SETTLEMENT

Support No.	Boring/CPT No.	Estimated liquefiable Soil Depth (ft)	Approx. Thickness (ft)	Estimated liquefiable Soil Top Elev.(ft)	Estimated liquefiable Soil Bottom Elev.(ft)	$(N_1)_{60,CS}$	Estimated Post-liquefaction Settlement (inches)
Abut 1	R-18-SC-001	28.0	5.5	203.0	197.5	13.2	1.26
		65.0	11.0	166.0	155.0	10.9	2.92
		81.0	5.5	150.0	144.5	22.6	0.84
	03-BL-1	68.0	4.4	158.4	154.0	19.0	0.77
Bent 2	CPT-18-SC-003	26.5	2.0	176.5	174.5	-	0.6
		31.3	3.5	171.7	168.2	-	0.9
Abut 3	R-18-SC-002	64.5	12.5	161.5	149.0	17.4	2.33
	03-BL-2	59.9	2.1	143.5	141.4	24.0	0.31

Based on the results of the liquefaction analyses as shown above, it appears that:

a) The potentially liquefiable soil encountered in Boring BL-1, CPT-18-SC-003 and Boring BL-2 exists in isolated pocket or lens (thickness between 2 feet and 4.4 feet) and should not cause downdrag to the pile.

b) By comparison of the borings drilled in 2018 and 2003 (Boring R-18-SC-001 and

BL-1 and Boring R-18-SC-002 and BL-2), it appears that the potentially liquefiable soils encountered in these borings are isolated and discontinuous.

c) Some of the potentially liquefiable soil encountered in the soil borings are very deep at the depth of 60 feet or greater. These potentially liquefiable layers are not anticipated to have any effect on the pile capacity analyses in the foundation recommendations. Downdrag is not considered for potential post-liquefaction settlement encountered at the depth of 60 feet or greater.

d) Boring 03-BL-2 encountered sand between Elev. +143.5 and Elev. +141.4. $(N_1)_{60,CS}$ of 24 may be considered marginally liquefiable. In addition to that, the 2.1 feet thick can be considered as isolated pocket/lens.

The post-liquefaction settlement due to the potential liquefiable soil encountered between Elev. +203 feet and Elev. +197.5 feet in Boring R-18-SC-001 might cause downdrag and reduce the load carrying capacity of the piles. Downdrag load has been considered in the calculations of the vertical capacities of Abutment 1.

Liquefaction analyses are included in Appendix VI.

Lateral Spreading

Liquefaction-induced spreading has been defined as the *"lateral displacement of large surficial blocks of soil as a result of liquefaction in a subsurface layer"*. Lateral spreading refers to the more moderate movements of gently sloping ground due to soil liquefaction. As described by Bartlett and Youd (1992a; 1992b), liquefaction-induced lateral spreading occurs on mild slopes of 0.3% to 5% underlain by loose sand and shallow water. The geologic conditions conducive to lateral spreading (gentle surface slope, shallow water table, and liquefiable cohesionless soils) are frequently found along streams and other waterfronts in recent alluvial or deltaic deposits, as well as in loosely-packed, saturated, sandy fills.

In our opinion, the potential for lateral spreading does not exist because it appears that there is no continuous layer of liquefiable soil and stream/water course at the project site.

13.0 FOUNDATION RECOMMENDATIONS

13.1 General

Based on the findings of our investigation, no major adverse condition was noted for the planned structure provided the recommendations presented in this report are incorporated into the final design and construction. Bridge plans should be reviewed by our office prior to finalizing the plans to see that the intent of our recommendations is included in the plans.

This report was prepared specifically for the proposed project according to the plans provided to us. Normal construction procedures were assumed throughout our analysis and represent one of the bases of recommendations presented herein. Our design recommendations have been based upon the materials and subsurface soil conditions encountered in the soil borings at the project site. Therefore, we should be notified in the event that these conditions are changed, so as to modify or amend our recommendations.

The following foundation recommendations were designed in accordance with the 2012 AASHTO LRFD Bridge Design Specifications (6^{th} Edition) with Caltrans Amendments.

13.2 Earthwork and Grading

All grading operations should be performed in accordance with the project specifications and Caltrans Standard Specifications for Earthwork (Section 19). A representative from PARIKH or regulating agency should observe all excavated areas during grading and perform moisture and density tests on prepared subgrade and compacted fill materials.

13.3 Deep Foundations

The as-built pile driving records indicated at least one of the existing piles at Bent 2 was cut off at a length of 25 feet (versus the design pile length of 62 feet). The estimated compression and tension pile capacity of Abutment 1, Bent 2 and Abutment 3 under seismic load are summarized in the table below:

TABLE 9-SUMMARY OF ESTIMATED EXISTING PILE CAPACITIES

Support	Loading	Pile Capacity Under Seismic Load (Liquefaction Only(2)) (kips)
Abutment 1	Compression	640
	Tension	630
Bent 2	Compression	347
	Tension	340
Abutment 3	Compression	900(1)
	Tension	645

(1) High resistance due to end bearing in dense sand layer.
(2) Downdrag is not considered on existing piles

According to Memo to Designers 20-4 (June 2016), each seismic hazard should be analyzed separately to determine if any of them can cause the existing bridge to collapse. The design will NOT combine the effects of liquefaction induced downdrag with the pile axial demands from seismic ground shaking loading.

Recommended Foundation Type

1. Based on the as-built driving record, available boring information and considering the drivability through the significant strata of medium dense to dense sand, Caltrans Standard Class 200 Alternate "W" piles appear to be the recommended foundation system for the proposed bridge median widening.

2. Cast-In-Drilled-Hole (CIDH) Concrete pile is feasible but not preferred considering medium dense to dense sand below groundwater which may cause soil caving-in. Also driven pile tends to be more cost effective than the CIDH Concrete pile.

3. Shallow foundation is not recommended considering the magnitude of the demand load, medium stiff to stiff subsurface soils at shallow depth and potentially liquefiable soil encountered in Boring R-18-SC-001 for Abutment 1.

Caltrans Standard Class 200 Alternate "W" piles may be designed for the foundation loads at the abutments and bents to the indicated pile tip elevations as shown in Table 12. Pertinent foundation design information provided by the structural designer, including Foundation Design Data and Foundation Loads, are presented in the following tables.

TABLE 10 - FOUNDATION DESIGN DATA

Support No	Design Method	Pile Type	Finish Grade Elev. (ft)	Pile Cut-off Elev. or Bottom of Footing Elev. (ft)	Pile Cap Size (ft)		Permissible Settlement (in)	No. of Piles per Footing
					B	L		
Abut 1	LRFD	Class 200 Alt. W	232.35	215.8 to 216.3(1)	6.33	42.0	1.00	12
Bent 2	LRFD	Class 200 Alt. W	204.0	192.80	26.00	32.0	1.00	40
Abut 3	LRFD	Class 200 Alt. W	229.04	210.3 to 212.8(1)	6.33	42.0	1.00	12

(1) Bottom of abutment footing elevation varies between ends as indicated.

TABLE 11 - FOUNDATION DESIGN LOADS

Support No.	Service-I Limit State (kips)			Strength Limit State (Controlling Group, kips)				Extreme Limit State (Controlling Group, kips)			
	Total Load		Permanent Loads	Compression		Tension		Compression		Tension	
	Per Support	Max Per Pile	Per Support	Per Support	Max. Per Pile.	Per Support	Max. Per Pile.	Per Support	Max. Per Pile.	Per Support	Max. Per Pile.
Abut 1	1,800	250	1,500	2,600	300	N/A	N/A	1,500	220(1)	N/A	N/A
Bent 2	4,500	150	3,900	5,800	220	N/A	N/A	4,000	350(2)	N/A	150(2)
Abut 3	1,800	240	1,500	2,600	300	N/A	N/A	N/A	N/A	N/A	N/A

(1) Extreme event loads provided at Abutment 1 are permanent loads that will need to be resisted under liquefaction downdrag.
(2) Extreme event loads provided at Bent 2 are from Mo+DL. Mo+DL effects to be combined with liquefaction downdrag effects as necessary.

Load and Resistance Factor Design (LRFD) was used for both bent and abutment foundations, per AASHTO LRFD Bridge Design Specifications–6th Edition, with Caltrans Amendments.

The pile cut-off elevations or bottom of footing elevations are shown in Table 10. The evaluation of Load Demands on the piles, based upon LRFD is presented in Table 11 above. The estimated specified tip elevations for the anticipated design loading of the piles are shown in Table 12 below.

TABLE 12 - FOUNDATION RECOMMENDATIONS

Location	Cut-off Elev. Or Bottom of Footing Elev. (ft)	Service-I Limit State Load per Support (kips)		Total Permissible Support Settlement (inches)	Nominal Resistance[(iii), (iv)] (kips)				Design Tip Elev.[(i)] (ft)	Specified Tip Elev. (ft)	Required Nominal Driving Resistance (kips)[(ii)]
					Strength Limit (φ_{qs}&φ_{qp} = 0.7)		Extreme Event (φ_{qs}&φ_{qp} = 1.0)				
		Total	Permanent		Comp.	Tension	Comp.	Tension			
Abut 1	215.8 to 216.3	1,800	1,500	1	430	N/A	234(v)	N/A	141.0 (a-I) 159.5 (a-II) 176.0 (c), 180.0 (d)	141.0	540
Bent 2	192.80	4,500	3,900	1	320	N/A	350	150	135.0 (a-I) 130.0 (a-II) 149.0 (b-II) 143.0 (c), 167.0 (d)	130.0	470
Abut 3	210.3 to 212.8	1,800	1,500	1	430	N/A	N/A	N/A	131.0 (a-I) 163.0 (c), 175.0 (d)	131.0	550

(i) Design tip elevations are controlled by (a-I) Compression (Strength Limit), (a-II) Compression (Extreme Event), (b-II) Tension (Extreme Event), (c) Settlement, (d) Lateral Load.
(ii) The nominal driving resistance required is equal to the nominal resistance needed to support the factored load plus driving resistance from the penetrated soil layers, if any, which do not contribute to the design resistance.
(iii) Column heading modified from *Required Factored Nominal Resistance* to **Nominal Resistance**
(iv) *Resistance* factor for φ_{qs} is for skin friction and φ_{qp} is for end bearing.
(v) The additional downdrag induced load of 14 kips was assumed in the analysis for Abutment 1 for Extreme Event Limit State.
(vi) Lateral Pile Capacity Analysis was performed by the structural designer.

TABLE 13 – PILE DATA TABLE

Location	Pile Type	Cut-off Elev. or Bottom of Footing Elev. (ft)	Nominal Resistance (kips)		Design Tip Elev. (ft)	Specified Tip Elev. (ft)
			Compression	Tension		
Abut 1	Class 200 Alt. W	215.8 to 216.3[(1)]	430	0	141.0 (a) 176.0 (c), 180 (d)	141.0
Bent 2	Class 200 Alt. W	192.80	320	0	130.0 (a), 149.0 (b) 143.0 (c), 167.0 (d)	130.0
Abut 3	Class 200 Alt. W	210.3 to 212.8[(1)]	430	0	131.0 (a) 163.0 (c), 175.0 (d)	131.0

(i) Design tip elevations for Abutments and Bents are controlled by: (a) Compression (b) Tension (c) Settlement (d) Lateral Load
(ii) Lateral Pile Capacity Analysis was performed by the structural designer.

The pile capacities for the Alternate "W" piles were calculated based on guidelines by American Petroleum Institute (API) publication "Recommended Practice for Planning, Designing and Constructing Fixed Offshore Platforms – Working Stress Design" (API RP 2A-WSD, 2002). The pile capacities were derived both from frictional resistance along the pile shaft and end bearing resistance under compression. For soil layers above liquefiable zone, downdrag load is considered as additional ultimate structural demands (Factor of Safety = 1.0) for extreme event. For end bearing resistance, we assumed that a soil plug will be formed during driving.

The estimated design tip elevations and specified tip elevations are based on the general plan, foundation plan, "Foundation Design Data" and "Foundation Design Loads" provided by the structural designer. In the event that these footing bottom elevations are changed, the design pile tip elevations may have to be revised accordingly. The axial pile capacity calculations are presented in Appendix VI.

13.4 Lateral Design for Piles

The piles should not be spaced closer than 3 times the pile diameter measured center-to-center. For piles spaced at center-to-center distance greater than or equal to 3 times the pile diameter, there is no group effect for pile vertical capacity.

Based on the pile layouts provided by the structural designer provided by the structural designer, the following "P-Y" Curve Modification Factors should be used for lateral pile capacity analysis:

- Abutment 1 - Transverse: 0.59, Longitudinal: 0.75
- Bent 2 - Transverse: 0.50, Longitudinal: 0.50
- Abutment 3 - Transverse: 0.59, Longitudinal: 0.75

The piles under the lateral demand using L-PILE software was performed by the structural designer. The L-PILE results will be provided by the structural designer. The recommended L-PILE parameters are included in Appendix VI and in the tables below.

TABLE 14A–GEOTECHNICAL PARAMETERS FOR LPILE ANALYSIS ABUTMENT 1 (Boring R-18-SC-001)

Approx. Depth (ft)	Elevation (ft.)	LPILE Soil Type	c (psf)	Phi (degrees)	Effective Unit Weight γ' (pcf)
0 to 8	231 to 223	Sand (Reese)	-	ϕ = 34°	125
8 to 18	223 to 213	Stiff Clay w/o Free Water (Reese)	c=2500 psf	-	125
18 to 23	213 to 208	Stiff Clay w/o Free Water (Reese)	c=1750 psf	-	125
23 to 28	208 to 203	Sand (Reese)	-	ϕ = 34°	125
28 to 33.5	203 to 197.5	Case I) Sand (Reese)	-	ϕ = 32°	65
		Case II) Soft Clay (Matlock)	Sr = 350	-	65
33.5 to 38.5	197.5 to 192.5	Soft Clay (Matlock)	c=900 psf	-	65
38.5 to 43	192.5 to 188	Soft Clay (Matlock)	c=600 psf	-	65
43 to 65	188 to 166	Sand (Reese)	-	ϕ = 35°	65
65 to 76	166 to 155	Sand (Reese)	-	ϕ = 30°	65
76 to 81	155 to 150	Stiff Clay w/o Free Water (Reese)	c=2500 psf	-	65
81 to 86.5	150 to 144.5	Sand (Reese)	-	ϕ = 34°	65
86.5 to 106	144.5 to 125	Stiff Clay w/o Free Water (Reese)	c=2000 psf	-	65
106 to 115	125 to 116	Sand (Reese)	-	ϕ = 34°	65
115 to 131.5	116 to 99.5	Stiff Clay w/o Free Water (Reese)	c=4000 psf	-	65

(1) Groundwater was measured at the depth of 30 feet below existing ground during drilling at Elevation +201.0 feet. Groundwater was assumed at the depth of 28 feet below existing ground at Elevation +203.0 feet to be consistent with the top elevation of the potential liquefiable soil layer.

(2) Default values of soil modulus (k) and soil strain (ε_{50}) can be used for all layers

TABLE 14B–GEOTECHNICAL PARAMETERS FOR LPILE ANALYSIS BENT 2 (CPT-18-SC-003/03-BL-1 & 03-BL-2)

Approx. Depth (ft)	Elevation (ft.)	LPILE Soil Type	c (psf)	Phi (degrees)	Effective Unit Weight γ' (pcf)
0 to 4	203 to 199	Stiff Clay w/o Free Water (Reese)	c=3000 psf	-	125
4 to 10	199 to 193	Stiff Clay w/o Free Water (Reese)	c=1500 psf	-	125
10 to 15	193 to 188	Sand (Reese)	-	$\phi = 32°$	125
15 to 17	188 to 186	Stiff Clay w/o Free Water (Reese)	c=2000 psf	-	125
17 to 21.5	186 to 181.5	Sand (Reese)	-	$\phi = 34°$	125
21.5 to 23.5	181.5 to 179.5	Soft Clay (Matlock)	c=1500 psf	-	125
23.5 to 26.3	179.5 to 176.7	Sand (Reese)	-	$\phi = 33°$	125
26.3 to 28.5	176.7 to 174.5	Sand (Reese)	-	$\phi = 33°$	65
28.5 to 31.5	174.5 to 171.5	Sand (Reese)	-	$\phi = 36°$	65
31.5 to 34.5	171.5 to 168.5	Sand (Reese)	-	$\phi = 33°$	65
34.5 to 47	168.5 to 156	Soft Clay (Matlock)	c=1200 psf	-	65
47 to 55	156 to 148	Stiff Clay w/o Free Water (Reese)	c=2500 psf	-	65
55 to 70	148 to 133	Stiff Clay w/o Free Water (Reese)	c=1750 psf	-	65
70 to 80	133 to 122	Sand (Reese)	-	$\phi = 42°$	65
80 to 98	122 to 105	Stiff Clay w/o Free Water (Reese)	c=6000 psf	-	65

(1) Default values of soil modulus (k) and soil strain (ε_{50}) can be used for all layers
(2) Groundwater was measured at the depth of 26.3 feet below existing ground during drilling at Elevation +176.7 feet.

TABLE 14C–GEOTECHNICAL PARAMETERS FOR LPILE ANALYSIS ABUTMENT 3 (Boring R-18-SC-002)

Approx. Depth (ft)	Elevation (ft.)	LPILE Soil Type	c (psf)	Phi (degrees)	Effective Unit Weight γ' (pcf)
0 to 13.5	226 to 212.5	Sand (Reese)	-	$\phi = 36°$	125
13.5 to 23	212.5 to 203	Sand (Reese)	-	$\phi = 34°$	125
23 to 25	203 to 201	Stiff Clay w/o Free Water (Reese)	c=2000 psf	-	125
25 to 28	201 to 198	Stiff Clay w/o Free Water (Reese)	c=2000 psf	-	65
28 to 33	198 to 193	Soft Clay (Matlock)	c=400 psf	-	65
33 to 43	193 to 183	Stiff Clay w/o Free Water (Reese)	c=1000 psf	-	65
43 to 48	183 to 178	Soft Clay (Matlock)	c=200 psf	-	65
48 to 64.5	178 to 161.5	Stiff Clay w/o Free Water (Reese)	c=1000 psf	-	65
64.5 to 77	161.5 to 149	Sand (Reese)	-	$\phi = 34°$	65
77 to 86	149 to 140	Stiff Clay w/o Free Water (Reese)	c=2750 psf	-	65
86 to 105	140 to 121	Sand (Reese)	-	$\phi = 38°$	65
105 to 121.5	121 to 104.5	Stiff Clay w/o Free Water (Reese)	c=2750 psf	-	65

(1) Default values of soil modulus (k) and soil strain (ε_{50}) can be used for all layers
(2) Groundwater was measured at the depth of 25.0 feet below existing ground during drilling at Elevation +201.0 feet.

13.5 Lateral Earth Pressures

Abutment retaining walls should be designed to resist the following Applied Lateral Earth Pressures (Equivalent Fluid Pressures-EFP) and live load. These values assume no hydrostatic pore pressure buildup behind the wall and are based on well-drained backfill behind the walls supported in native soil. If hydrostatic pressures are allowed to build up behind the walls, additional lateral loads should be considered in the design.

<u>Applied Lateral Earth Pressure</u>

(a) Active Condition — Recommended active pressure is 36 pcf EFP for the engineered backfill.

(b) At-Rest Condition — Recommended at-rest pressure is 55 pcf EFP for the engineered backfill.

(c) Passive Resistance — 5.0 ksf (ultimate) for seismic design of the abutment backwall (5.5 feet or greater); for activated height less than 5.5 feet, modify proportionally i.e. 5.0x (H/5.5) ksf per. A minimum lateral wall movement of 2% of wall height to mobilize the full ultimate passive resistance is required.

Cantilever walls, which are free to rotate by at least 0.005 radian, may be assumed flexible and designed for the active condition. Walls that are not capable of this movement should be assumed rigid and designed for the at-rest condition. The effect of any surcharge (dead, live, or traffic load) should be added to the preceding lateral earth pressures. A coefficient of 0.4 and 0.5 may be used to determine the additional lateral earth pressures resulting from the surcharge for cantilever walls and rigid walls, respectively.

13.6 Abutment Seismic Design

The foundation soil for the abutments is considered “Marginal” according to Caltrans SDC 1.7 and per AASHTO LRFD C11.6.5. This type of soil is not exempt from “Extreme Event (Seismic)” design.

The diaphragm abutment is very rigid and will rotate very little (not more than 2% at the top), 100% PGA is used to calculate the seismic earth pressure K_{AE} and K_o under the static condition. The following are the recommended values for lateral soil pressure coefficients for rigid foundation:

γ = 125 pcf

K_o = 0.44 (In-Situ Lateral Coefficient)

ΔK_{AE} = 0.38 (Log-Spiral Seismic Active)

Based on the above, incremental seismic force can be calculated as $0.5*H*(\Delta K_{AE}*\gamma*H) = 23.75*H^2$lb/ft.

The loading diagram for the incremental seismic force is included in Appendix VI.

13.7 Settlement

Fill up to approximately 9 feet to 10 feet high is anticipated to be placed on the existing slope at the abutments of the proposed structure. The subsurface soils generally consist of predominantly layers of medium stiff Clayey/Silty Sand (and hard Sandy Clay at Abutment 1), and groundwater was assumed at Elev. +201.0 for analysis purpose.

The following parameters were assumed for the settlement evaluation based on the empirical correlations, consolidation test results and our engineering judgments.

a) A consolidation test was completed on a selected sample in Boring R-18-SC-001 and the resultant consolidation parameters were used in the settlement analysis of the sample's layer.

b) Unconfined Compressive Strength tests result, when available, is used in the settlement calculations (if it is shown in the calculations spreadsheet).

c) The pre-consolidation pressure (Pc) for the samples were estimated by using a factor of 0.25 (Su/p, Skempton 1954, 1957) and dividing the undrained strength (correlated/lab) with this factor. OCR is then calculated by dividing in-situ effective stress to Pc. Over-consolidated clays can be considered settling elastically per ASHTO LFRD Section C10.6.2.4.3. Clays with OCR greater than or equal to 2.5 is considered to be settling elastically and not considered in consolidation settlement calculations.

d) In addition, the $C_c/(1+e0)$ values are calculated based on our calibration/refitting of the original Lambe & Whitman correlations based on in-house lab results from previous projects. The water content from laboratory tests is used as an input to this correlation.

Results of Settlement Evaluations

Settlement analyses indicate that the upper-bound settlement may be between about 0.9 inches and 1.1 inches. The estimated settlements consist of settlement in the over-consolidated (OC) range for clay and elastic settlements for sands and clays (with OCR greater than or equal to 2.5) and normally-consolidated (NC) range for clays/silts. A preliminary coefficient of consolidation coefficient of 0.6 ft^2/day was used in the calculation based on the existence of predominantly low to non-plastic clays and silts in the borings for the project and liquid limit correlations per NAVFAC DM 7.2. This coefficient may need to be revised after the completion of the lab consolidation tests. Based on our previous project experience, a waiting period of 30 days is recommended after the placement of fill prior to the construction of the piles at the abutments and the construction of the pavement.

The settlement calculations are included in Appendix VI.

14.0 CONSTRUCTION CONSIDERATIONS

14.1 General

To a degree, the performance of any structure is dependent upon construction procedures and quality. Hence, observation of foundation construction should be carried out by the responsible Agency. If the encountered subsurface conditions differ from the basis of our recommendations, Parikh should be informed in order to assess the need for design changes. Therefore, the recommendations presented in this report are contingent upon good quality control and these geotechnical observations during construction.

14.2 Caltrans Standard Alternate "W" Pile

a) There are houses as closes as 250 feet from Abutment 3. Noise levels by construction such as pile driving, the construction noise impacts and requirements related to construction noise have been addressed in Section 8 of the PA&ED "US 101/Blossom Hill Road Interchange Improvement Project – Noise Study Report".

b) Medium stiff to hard cohesive soils with interbedded layers of medium dense to dense sands are generally encountered at the project site. Hard driving is expected.

c) Should difficult driving be encountered where the vertical compression requirement is met prior to reaching the specified tip elevation, pile driving may be allowed to terminate if other tip requirements for lateral, tension and settlement are met. Undersize pre-drill (partial length) may be considered to help reach the tip elevation if necessary.

d) In general, a pile may be considered to have reached "practical refusal" if pile advance less than 1 inch under 10 blows or a foot under 100 blows.

e) It is anticipated that the pile capacity will develop after driving as a result of soil "freeze" and dissipation of excess pore water pressures. The final pile capacity can be verified and the gain of pile capacity after initial driving may be evaluated based on "re-driving" after 24-hour (min.) set up. 2018 Caltrans Standard Specifications (Section 49-2.01A (4)(c)) "Department Acceptance" may be used as the pile driving acceptance criteria.

f) As an option, Pile Driving Analyzer (PDA) may be used to evaluate the pile capacity of the driven piles when unanticipated conditions arise. Typical applications of the PDA include capacity evaluation (for both during driving and re-driving) and integrity testing for piles that have experienced hard driving.

g) The piles for the widening at Bent 2 will likely to be driven with low headroom driving equipment. The piles will need to be spliced in sections because of the low headroom. The drivability of the Alt W Class 200 pile to tip should be feasible for spliced pile sections at Bent 2 of the "Blossom Hill Road Overcrossing (Widen)" as long as there is no undue delay in splicing the piles.

h) For Bent 2, the contractor may use impact hammer that do not comply with the minimum energy requirements to advance piles to 3 feet of the specified tip elevation.

i) It is prudent to make the contractor aware of these conditions so that appropriate steps can be taken to comply with the standards and maintain the integrity of the piles.

j) Due to the hard driving condition that may be encountered during pile driving, pile driving should be allowed to terminate short of the specified tip elevation provided the following conditions are satisfied:

- Other requirements including tension and lateral demands are met;
- Pile attaining its capacity and refusal within 5 feet above the specified tip elevation.

15.0 NOTES TO DESIGNER

Should the specified pile tip elevation required to meet lateral load demands exceed the specified pile tip elevation given within this report, the Geotechnical Engineer must be contacted for further recommendations.

16.0 PLAN REVIEW

This report is prepared for the proposed "Blossom Hill Road OC (Widen) (Bridge No. 37-0348)". We recommend that final foundation plans for the proposed project to be reviewed by PARIKH prior to construction so that the intent of our recommendations is included in the project plans and specifications and to further see that no misunderstandings or misinterpretations have occurred. However, design-build elements should be reviewed only from overall compliance standpoint.

17.0 CONSTRUCTION OBSERVATION

To a degree, the performance of any structure is dependent upon construction procedures and quality control measures. Hence, geotechnical observation and testing of grading operations, foundation excavations, and observation of pile installations should be carried out by the Geotechnical Engineer. If the subsurface conditions different from those forming the basis of our recommendations are encountered, this office should be informed in order to assess the need for design changes. Therefore, the recommendations presented in this report are contingent upon good quality control and these geotechnical observations during construction.

18.0 INVESTIGATION LIMITATIONS

Our services consist of professional opinions and recommendations made in accordance with generally accepted geotechnical engineering principles and practices and are based on our site reconnaissance and the assumption that the subsurface conditions do not deviate from observed conditions. All work done is in accordance with generally accepted geotechnical engineering principles and practices. No warranty, expressed or implied, of merchantability or fitness, is made or intended in connection with our work or by the furnishing of oral or written reports or findings.

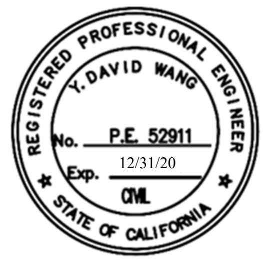
The scope of our services did not include any environmental assessment or investigation for the presence or absence of hazardous or toxic materials in structures, soil, surface water, groundwater or air, below or around this site. Unanticipated soil conditions are commonly encountered and cannot be fully determined by taking soil samples and excavating test borings; different soil conditions may require that additional expenditures be made during construction to attain a properly constructed project. Some contingency fund is thus recommended to accommodate these possible extra costs.

This report has been prepared for the proposed project as described earlier, to assist the engineer in the design of this project. In the event any changes in the design or location of the facilities are planned, or if any variations or undesirable conditions are encountered during construction, our conclusions and recommendations shall not be considered valid unless the changes or variations are reviewed and our recommendations modified or approved by us in writing.

This report is issued with the understanding that it is the designer's responsibility to ensure that the information and recommendations contained herein are incorporated into the project and that necessary steps are also taken to see that the recommendations are carried out in the field.

The findings in this report are valid as of the present date. However, changes in the subsurface conditions can occur with the passage of time, whether they are due to natural processes or to the works of man, on this or adjacent properties. In addition, changes in applicable or appropriate standards occur, whether they result from legislation or from the broadening of knowledge. Accordingly, the findings in this report might be invalidated, wholly or partially, by changes outside of our control.

Respectfully submitted,
PARIKH CONSULTANTS, INC.



Alston Lam, P.E., G.E. 2605
Project Engineer

Y. David Wang, Ph.D., P.E., 52911
Senior Engineer

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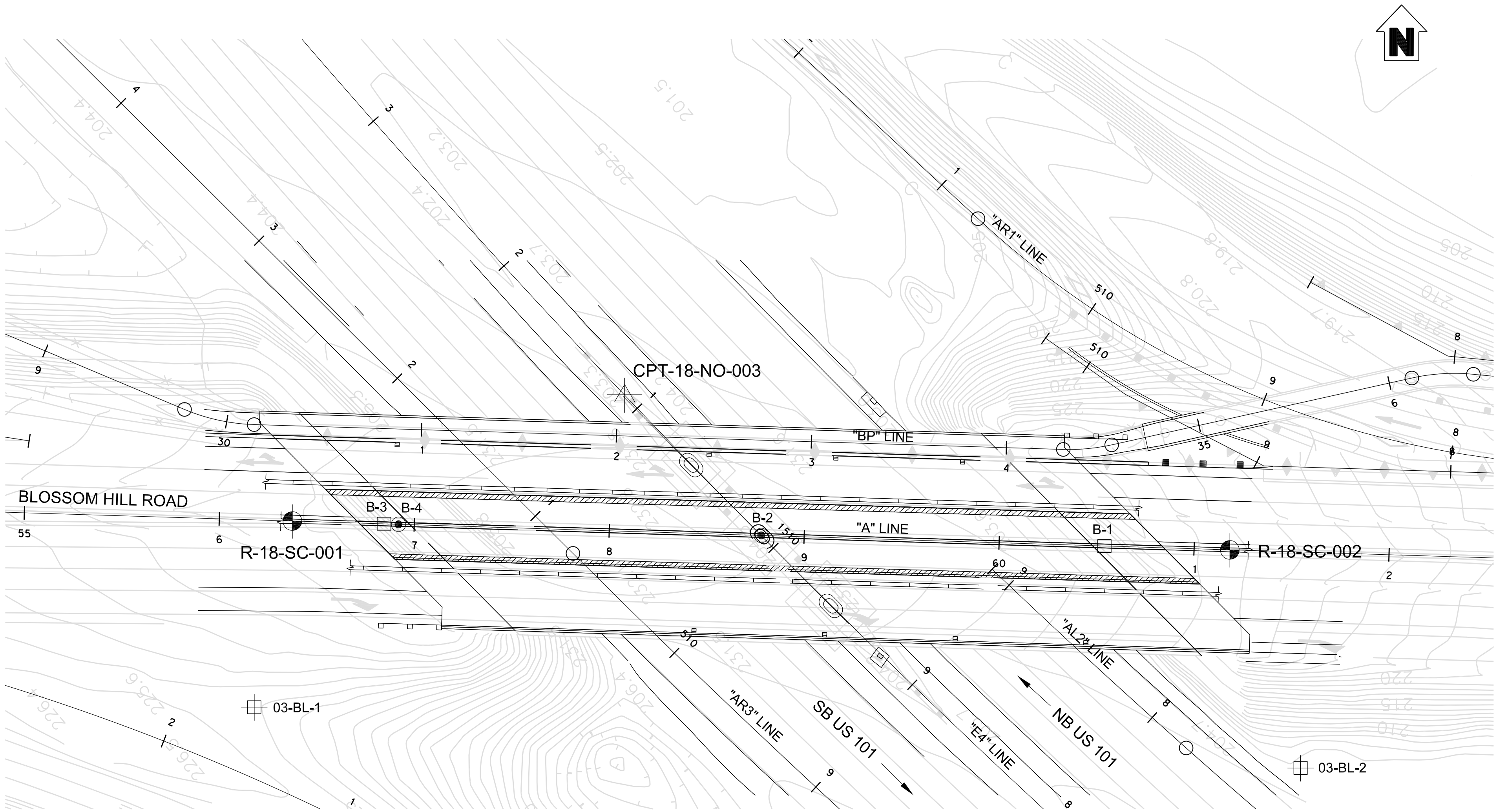


LEGEND

A-18-SC-001 — Approx. Boring Location (Drilled by PARIKH in 2018)

CPT-18-SC-003 — Approx. CPT Location (Pushed by PARIKH in 2018)

03-BL-1 — Approx. Boring Location (Drilled by PARIKH in 2003)

B-1 — As-Built Boring Location (Drilled in 1970)

B-2 — As-Built CPT Location (Conducted in 1970)

SCALE: 1 inch = 100 feet
Note: All units are in feet unless otherwise specified
Reference Map was provided by HMH Engineers.

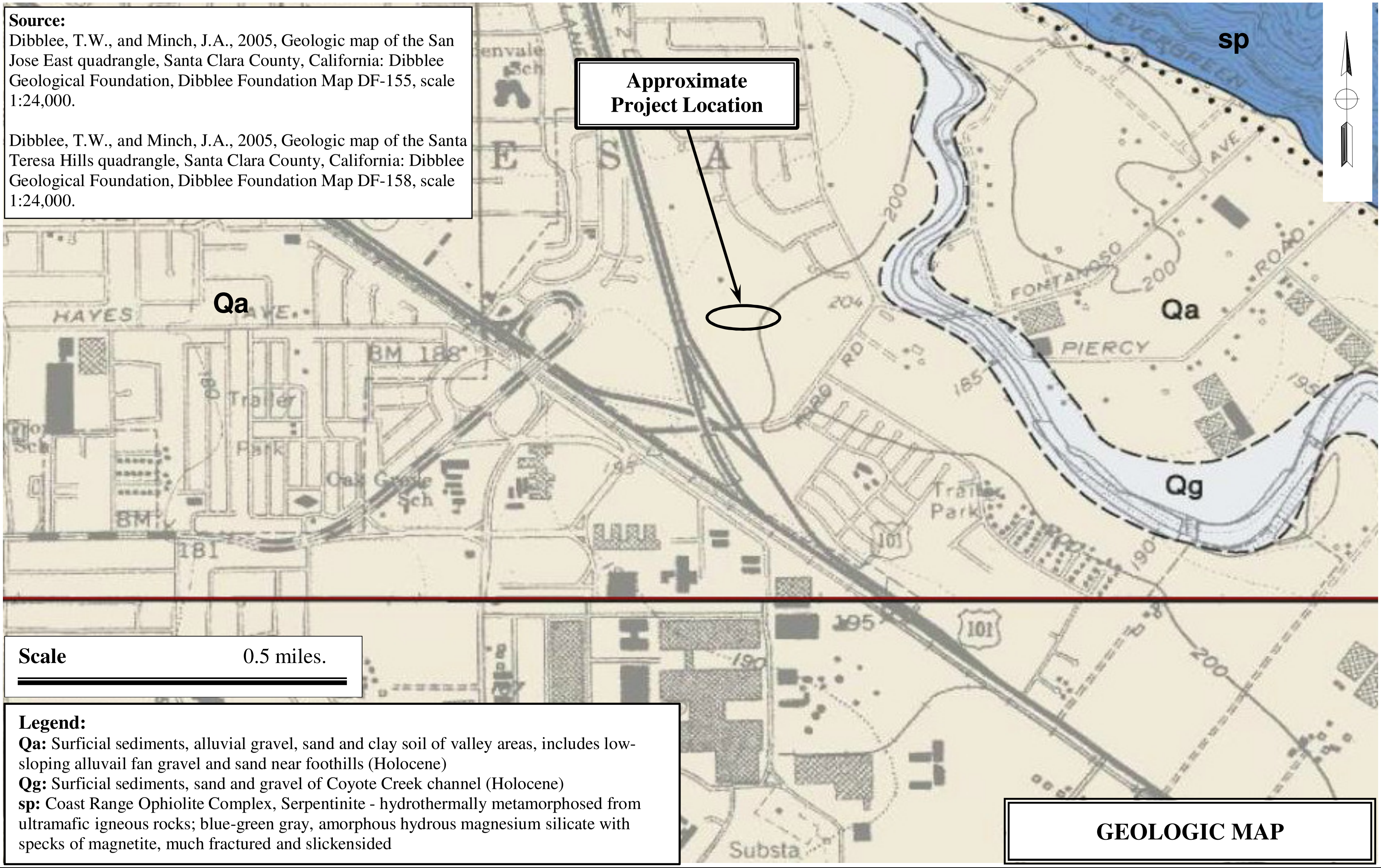
BORING LOCATION MAP

PARIKH
Practicing in the Geosciences

BLOSSOM HILL ROAD OC (WIDEN)
SAN JOSE, CALIFORNIA

JOB NO.:2016-146-BOC

PLATE NO: 1



Source:
Dibblee, T.W., and Minch, J.A., 2005, Geologic map of the San Jose East quadrangle, Santa Clara County, California: Dibblee Geological Foundation, Dibblee Foundation Map DF-155, scale 1:24,000.

Dibblee, T.W., and Minch, J.A., 2005, Geologic map of the Santa Teresa Hills quadrangle, Santa Clara County, California: Dibblee Geological Foundation, Dibblee Foundation Map DF-158, scale 1:24,000.

Scale 0.5 miles.

Legend:
Qa: Surficial sediments, alluvial gravel, sand and clay soil of valley areas, includes low-sloping alluvail fan gravel and sand near foothills (Holocene)
Qg: Surficial sediments, sand and gravel of Coyote Creek channel (Holocene)
sp: Coast Range Ophiolite Complex, Serpentinite - hydrothermally metamorphosed from ultramafic igneous rocks; blue-green gray, amorphous hydrous magnesium silicate with specks of magnetite, much fractured and slickensided

GEOLOGIC MAP

PARIKH
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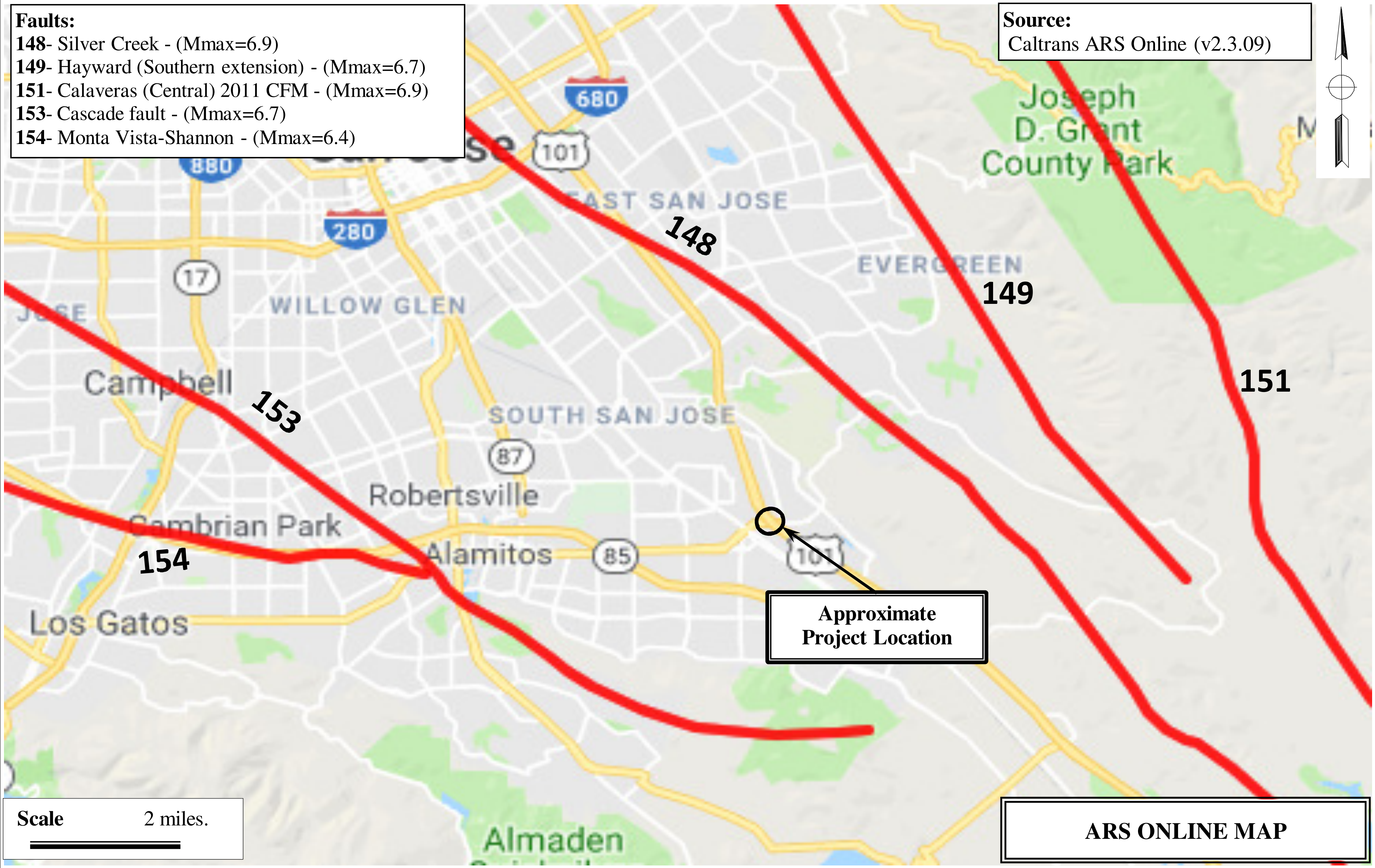
BLOSSOM HILL ROAD OVERCROSSING (WIDEN)
SAN JOSE, CALIFORNIA

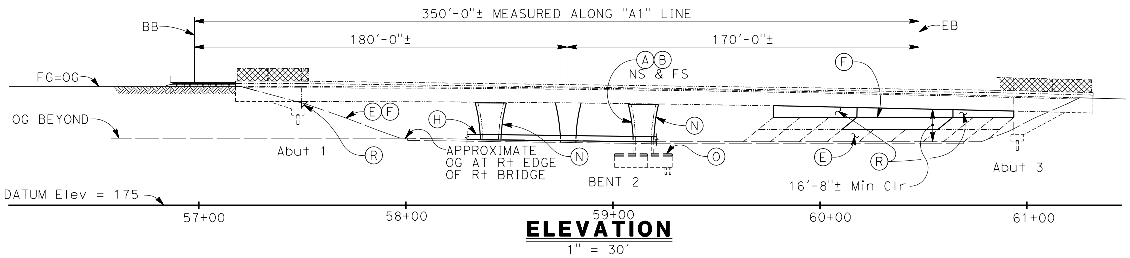
JOB NO.: 2016-146-BOC	**PLATE NO.: 2**



PARIKH
Practicing in the Geosciences

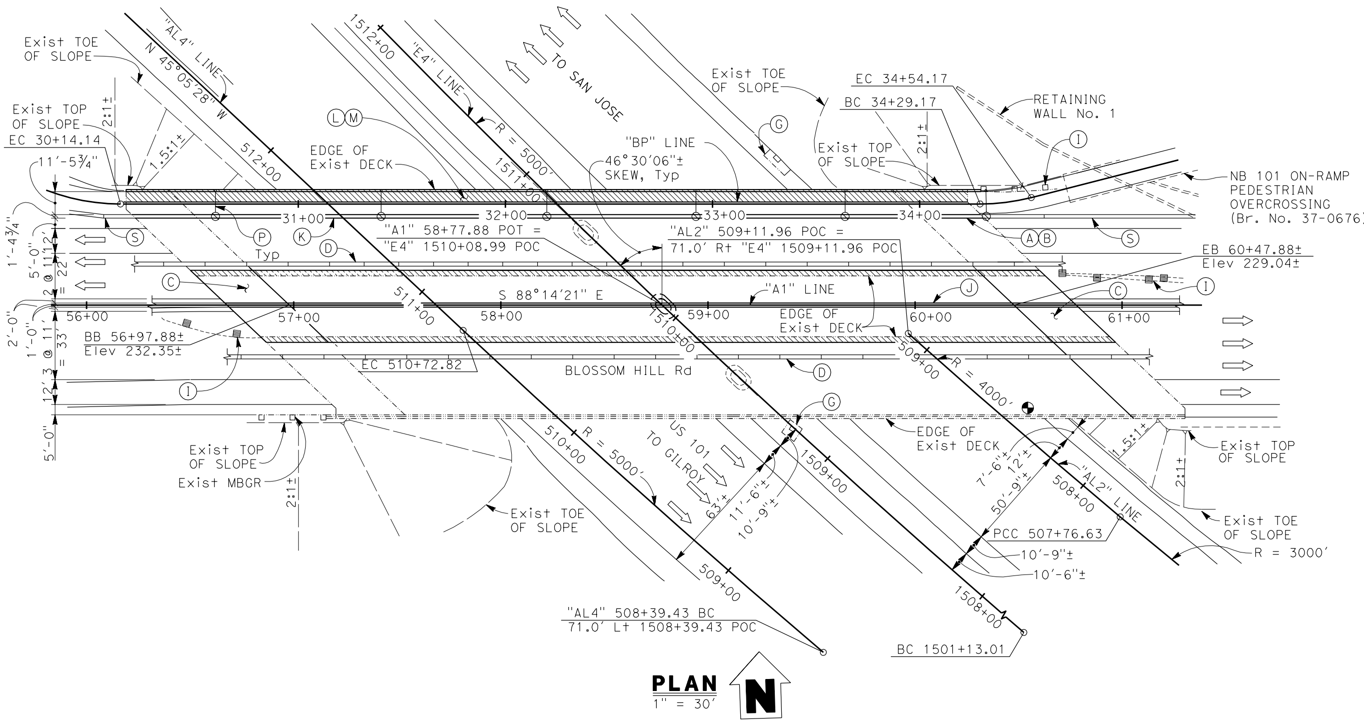
BLOSSOM HILL ROAD OVERCROSSING (WIDEN)
SAN JOSE, CALIFORNIA

JOB NO.: 2016-146-BOC | **PLATE NO.: 3**



ELEVATION
1" = 30'

LEGEND:
- Indicates Point of Minimum Vertical Clearance
- Indicates Bridge Removal (Portion)
- Indicates Existing Structure
- Indicates Traffic Direction



PLAN
1" = 30'

NOTES:
- (A) Paint "BRIDGE NO. 37-0348"
- (B) Paint "BLOSSOM HILL ROAD OC"
- (C) Structure Approach Type N (30D)
- (D) Temporary Railing Type K, see "Roadway Plans"
- (E) Existing Slope Paving
- (F) Remove Exist Slope Paving & construct Slope Paving
- (G) Existing Catch Basin, see "Roadway Plans"
- (H) Remove and Replace Existing Barrier, see "Roadway Plans"
- (I) Remove Existing MBGR, see "Roadway Plans"
- (J) Concrete Median
- (K) Concrete Barrier Type 842 (Mod)
- (L) Exist Fiber Optic lines, Protect in place
- (M) Lightweight Concrete Sidewalk
- (N) Column Retrofit Class F
- (O) Footing Retrofit
- (P) Electrolier, see "Roadway Plans" & "SCHEDULE OF ELECTROLIER LOCATIONS"
- (R) Abutment Fillet Extension Retrofit
- (S) Concrete Barrier Type 842B, see "Roadway Plans"

CURVE ALIGNMENT DATA

ALIGNMENT	R	△	TANGENT	LENGTH
"AL2" LINE	4000.00'	01°56'18"	67.67'	135.33'
"AL4" LINE	5000.00'	02°40'28"	116.72'	233.39'
"E4" LINE	5000.00'	41°15'07"	1881.96'	3599.91'

SCHEDULE OF ELECTROLIER LOCATIONS
"BP" LINE 30+60.00
"BP" LINE 31+40.00
"BP" LINE 32+20.00
"BP" LINE 32+92.00
"BP" LINE 33+64.00
"BP" LINE 34+32.00

NOTE:
THE CONTRACTOR MUST VERIFY ALL CONTROLLING FIELD DIMENSIONS BEFORE ORDERING OR FABRICATING ANY MATERIAL

PLAN CHECK SET/NOT FOR CONSTRUCTION (9/11/19)

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	SCI	101	R28.4/R28.9		

REGISTERED STRUCTURAL ENGINEER DATE

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of scanned copies of this plan sheet.

REGISTERED PROFESSIONAL ENGINEER MAHVASH M. HARMS No. 2639 Exp. 12/31/20 STRUCTURAL STATE OF CALIFORNIA

CITY OF SAN JOSE DOT
200 E. SANTA CLARA St., 8th FLOOR
SAN JOSE, CA 95113

BIGGS CARDOSA ASSOCIATES INC.
865 THE ALAMEDA
SAN JOSE, CALIFORNIA 95126

		BY	CHECKED
DESIGN OVERSIGHT	DESIGN	K. CRUZ	J. ALCIATI
	DETAILS	K. CRUZ	J. ALCIATI
SIGN OFF DATE	QUANTITIES	S. RECHENMACHER	A. HABIBI

LOAD & RESISTANCE FACTOR DESIGN	LIVE LOADING: HL93 W/"LOW-BOY"; PERMIT DESIGN VEHICLE	
LAYOUT	BY G. KENNING	CHECKED J. ALCIATI
SPECIFICATIONS	BY G. KENNING	PLANS AND SPECS COMPARED A. NOTARO

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

G. KENNING
PROJECT ENGINEER

BRIDGE NO. 37-0348
POST MILES R28.61

BLOSSOM HILL Rd OC (WIDEN)
GENERAL PLAN No. 1

DESIGN GENERAL PLAN SHEET (ENGLISH) (REV. 7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0000
PROJECT NUMBER & PHASE: 04160002241
CONTRACT NO.: 04-1K2804

DISREGARD PRINTS BEARING EARLIER REVISION DATES
REVISION DATES 7/11/18 12/5/18 4/17/19
SHEET 1 OF 26

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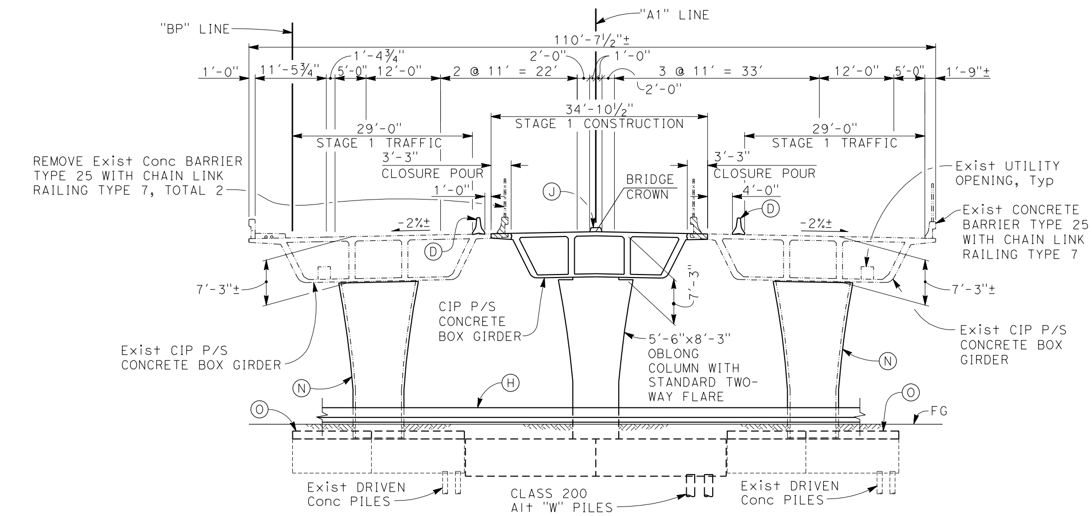
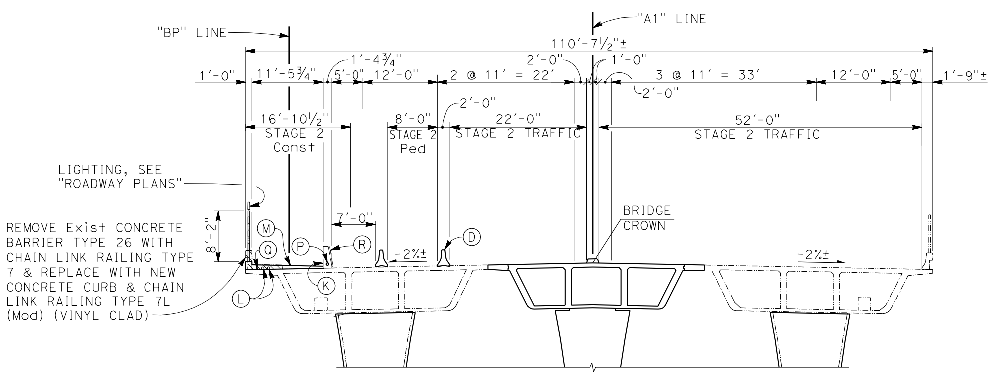
DATE PLOTTED => $DATE
TIME PLOTTED => $TIME
2016309 (2016309AS1)



STAGE 1 CONSTRUCTION TYPICAL SECTION

1" = 10'



NOTE: For details not noted, see "STAGE 1 CONSTRUCTION TYPICAL SECTION"

STAGE 2 CONSTRUCTION TYPICAL SECTION

1" = 10'

NOTE:
THE CONTRACTOR MUST VERIFY ALL CONTROLLING FIELD DIMENSIONS BEFORE ORDERING OR FABRICATING ANY MATERIAL

QUANTITIES

STRUCTURE EXCAVATION (BRIDGE)	750	CY
STRUCTURE BACKFILL (BRIDGE)	500	CY
FURNISH PILING (CLASS 200) (ALTERNATIVE W)	4406	LF
DRIVE PILE (CLASS 200) (ALTERNATIVE W)	64	EA
PRESTRESSING CAST-IN-PLACE CONCRETE	LUMP	SUM
STRUCTURAL CONCRETE, BRIDGE FOOTING	275	CY
STRUCTURAL CONCRETE, BRIDGE	800	CY
STRUCTURAL CONCRETE, BRIDGE (POLYMER FIBER)	330	CY
STRUCTURAL CONCRETE, APPROACH SLAB (TYPE N)	80	CY
STRUCTURAL CONCRETE, APPROACH SLAB (TYPE R)	15	CY
PAVING NOTCH EXTENSION	12	CF
LIGHTWEIGHT CONCRETE	115	CY
ARCHITECTURAL TREATMENT	1440	SQFT
DRILL AND BOND DOWEL	315	LF
DRILL AND BOND DOWEL (CHEMICAL ADHESIVE)(LF)	1540	LF
CLEAN EXPANSION JOINT	165	LF
JOINT SEAL (MR = 2")	266	LF
JOINT SEAL (TYPE AL)	60	LF
BAR REINFORCING STEEL (BRIDGE)	401100	LB
BAR REINFORCING STEEL (EPOXY COATED)	4770	LB
HEADED BAR REINFORCEMENT	270	EA
ASPHALT MEMBRANE WATERPROOFING	225	SF
BRIDGE REMOVAL (PORTION)	LUMP	SUM
COLUMN CASING	42100	LB
REMOVE SLOPE PAVING	340	SQYD
SLOPE PAVING (CONCRETE)	10	CY
CHAIN LINK RAILING (TYPE 7 MODIFIED) (VINYL CLAD)	410	LF
CONCRETE BARRIER TYPE 842 (MODIFIED)	410	LF

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	SCI	101	R28.4/R28.9		

REGISTERED STRUCTURAL ENGINEER DATE

REGISTERED PROFESSIONAL ENGINEER MAHVASH M. HARMS No. 2639 Exp. 12/31/20 STRUCTURAL STATE OF CALIFORNIA

PLANS APPROVAL DATE

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CITY OF SAN JOSE DOT
200 E. SANTA CLARA St., 8th FLOOR
SAN JOSE, CA 95113

BIGGS CARDOSA ASSOCIATES INC.
865 THE ALAMEDA
SAN JOSE, CALIFORNIA 95126

LEGEND:
Indicates Bridge Removal (Portion)
Indicates Existing Structure

NOTES:
- (A) Paint "BRIDGE NO. 37-0348"
- (B) Paint "BLOSSOM HILL ROAD OC"
- (C) Structure Approach Type N (30D)
- (D) Temporary Railing Type K, see "Roadway Plans"
- (E) Existing Slope Paving
- (F) Remove Exist Slope Paving & construct Slope Paving
- (G) Existing Catch Basin, see "Roadway Plans"
- (H) Remove and Replace Existing Barrier, see "Roadway Plans"
- (I) Remove Existing MBGR, see "Roadway Plans"
- (J) Concrete Median
- (K) Concrete Barrier Type 842 (Mod)
- (L) Exist Fiber Optic lines, Protect in place
- (M) Lightweight Concrete Sidewalk
- (N) Column Retrofit Class F
- (O) Footing Retrofit
- (P) 2" Dia conduits with fiber optic future city interconnect, see "Roadway Plans"
- (Q) 2" Dia conduit for lighting, see "Roadway Plans"
- (R) Architectural Treatment, see "Roadway Plans"

PLAN CHECK SET/NOT FOR CONSTRUCTION (9/11/19)

		BY	CHECKED		BY	CHECKED
DESIGN OVERSIGHT	DESIGN	K. CRUZ	J. ALCIATI	LOAD & RESISTANCE FACTOR DESIGN	LIVE LOADING: HL93 W/"LOW-BOY"; PERMIT DESIGN VEHICLE	
	DETAILS	K. CRUZ	J. ALCIATI	LAYOUT	G. KENNING	J. ALCIATI
SIGN OFF DATE	QUANTITIES	S. RECHENMACHER	A. HABIBI	SPECIFICATIONS	G. KENNING	PLANS AND SPECS COMPARED A. NOTARO

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

G. KENNING
PROJECT ENGINEER

BRIDGE NO. 37-0348
POST MILES R28.61

BLOSSOM HILL Rd OC (WIDEN)
GENERAL PLAN No. 2

DESIGN GENERAL PLAN SHEET (ENGLISH) (REV. 7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0000
PROJECT NUMBER & PHASE: 04160002241
CONTRACT NO.: 04-1K2804
FILE => $REQUEST

DISREGARD PRINTS BEARING EARLIER REVISION DATES
REVISION DATES 7/11/18 12/5/18 4/17/19
SHEET 2 OF 26

2016309 (2016309AS2)
USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	SCI	101	R28.4/R28.9		

REGISTERED STRUCTURAL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER MAHVASH M. HARMS No. 2639 Exp. 12/31/20 STRUCTURAL STATE OF CALIFORNIA

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CITY OF SAN JOSE DOT
200 E. SANTA CLARA St., 8th FLOOR
SAN JOSE, CA 95113

BIGGS CARDOSA ASSOCIATES INC.
865 THE ALAMEDA
SAN JOSE, CALIFORNIA 95126

PILE DATA TABLE

LOCATION	PILE TYPE	NOMINAL RESISTANCE (kips)		DESIGN TIP Elev (ft)	SPECIFIED TIP Elev (ft)	REQUIRED NOMINAL DRIVING RESISTANCE (kips)
		COMPRESSION	TENSION			
ABUTMENT 1	CLASS 200 Alt "W"	430	0	141.0(a); 176.0(c); 180.0(d)	141.0	540
BENT 2	CLASS 200 Alt "W"	350	150	130.0(a); 149.0(b); 143.0(c); 167.0(d)	130.0	470
ABUTMENT 3	CLASS 200 Alt "W"	430	0	131.0(a); 163.0(c); 175.0(d)	131.0	550

NOTES:

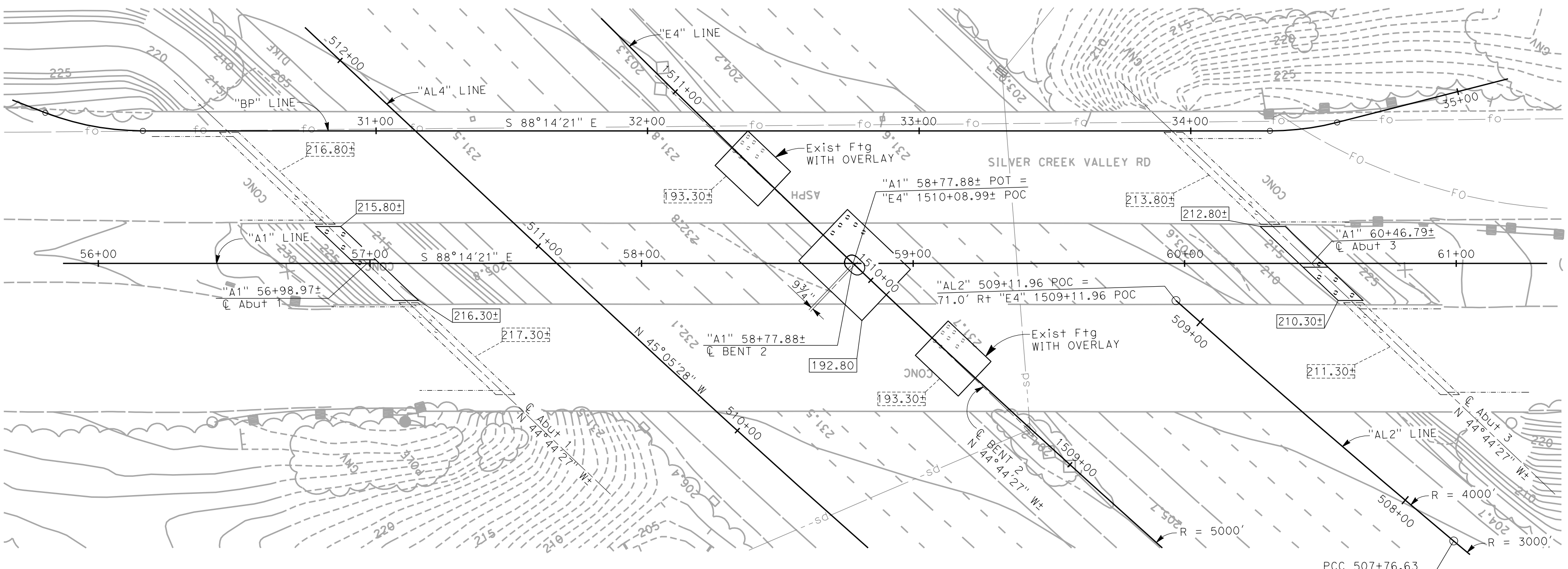
1. Design tip elevations for Abutments and Bents are controlled by: (a) Compression, (b) Tension, (c) Settlement, (d) Lateral load.
2. The specified tip elevation must not be raised above the design tip for tension load, lateral load, and tolerable settlement.

LEGEND:

- Indicates Bottom of Footing Elevation
- Indicates Bottom of Existing Footing Elevation
- Indicates Pile
- Indicates Existing Pile
- Indicates Existing Structure

NOTES:

1. Verify utility locations with "ROADWAY PLANS"
2. There is a vertical datum difference between the project datum (NAVD 88) and the as built datum (NGVD 29). The following datum conversion was used in design: Elev (NAVD 88) = Elev (NGVD 29) +1.8



BENCH MARK AND DATUM

MONUMENT	COORDINATES		ELEVATION	DESCRIPTION/LOCATION
	NORTHING	EASTING		
107	1,918,675.697	6,184,775.266	220.36	SET MAG NAIL & SHINER ± 70' EAST OF SILVER CREEK VALLEY Rd OVERPASS.
118	1,919,879.851	6,183,487.929	197.17	SET MAG NAIL & SHINER AT 101 SOUTHBOUND SHOULDER.

FOUNDATION PLAN

1" = 20'

NOTE:
THE CONTRACTOR MUST VERIFY ALL CONTROLLING FIELD DIMENSIONS BEFORE ORDERING OR FABRICATING ANY MATERIAL

PLAN CHECK SET/NOT FOR CONSTRUCTION (9/11/19)

GEOTECHNICAL PROFESSIONAL APPROVAL DATE

DESIGN OVERSIGHT

SIGN OFF DATE

SCALE: AS SHOWN	VERT.DATUM NAVD88	HORZ.DATUM CCS83 ZONE 3
PHOTOGRAMMETRY AS OF: JULY 2016	ALIGNMENT TIES	
SURVEYED BY HMH	DRAFTED BY RADMAN AERIAL	
FIELD CHECKED BY RADMAN AERIAL	CHECKED BY RADMAN AERIAL	

DESIGN	BY K. CRUZ	CHECKED J. ALCIATI
DETAILS	BY K. CRUZ	CHECKED J. ALCIATI
QUANTITIES	BY S. RECHENMACHER	CHECKED A. HABIBI

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

G. KENNING
PROJECT ENGINEER

BRIDGE NO. 37-0348
POST MILES R28.61

BLOSSOM HILL Rd OC (WIDEN)
FOUNDATION PLAN

FOUNDATION PLAN SHEET (ENGLISH) (REV. 7-16-10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0000
PROJECT NUMBER & PHASE: 04160002241
CONTRACT NO.: 04-1K2804

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES 7/11/18 12/5/18 4/17/19

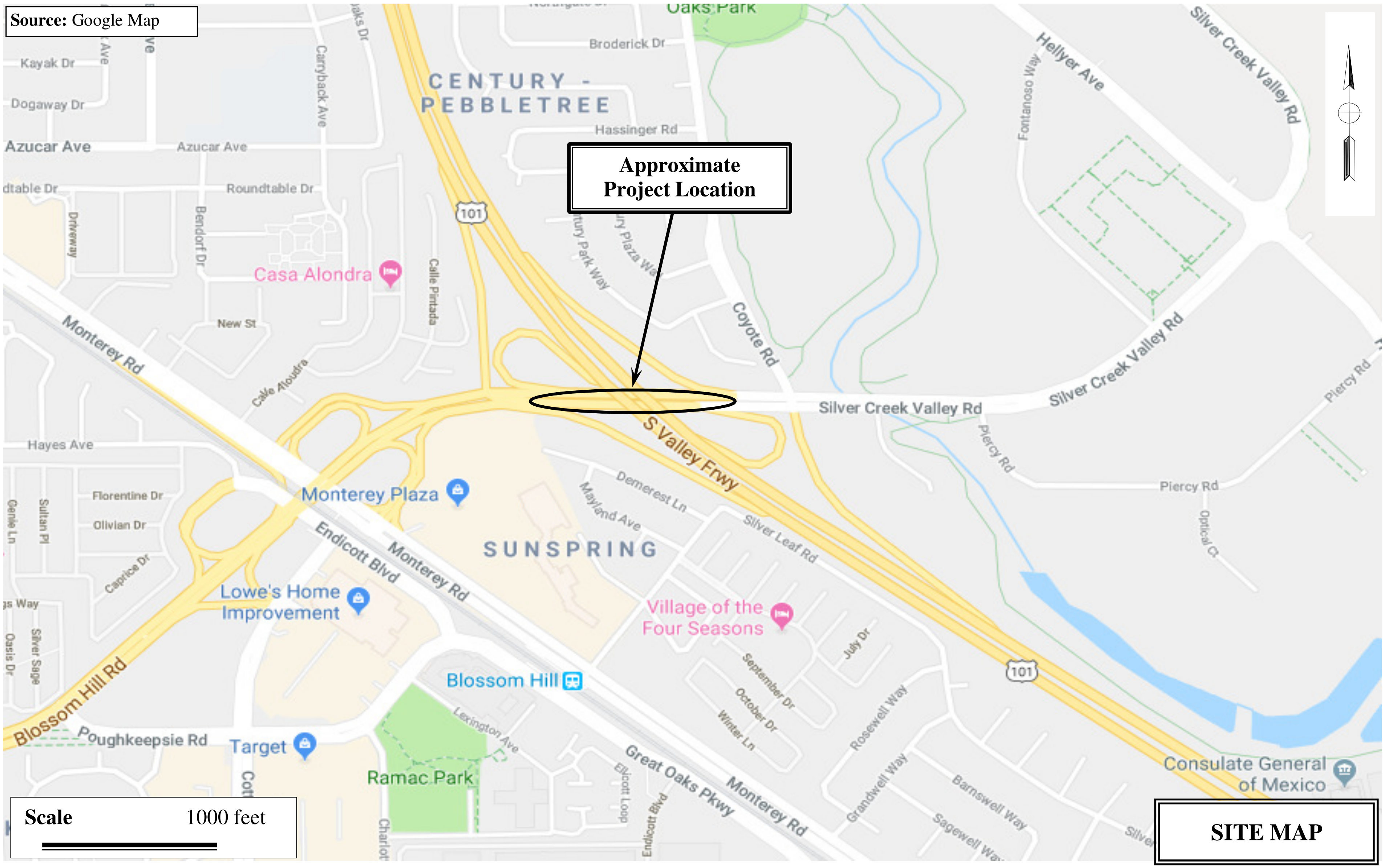
SHEET 4 OF 26

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

2016309 (2016309AS4)

APPENDIX I



PARIKH
Practicing in the Geosciences

BLOSSOM HILL ROAD OVERCROSSING (WIDEN)
SAN JOSE, CALIFORNIA

JOB NO.: 2016-146-BOC	**APPENDIX I**

APPENDIX II

APPENDIX II

FIELD EXPLORATION

All the test borings were drilled with a truck-mounted drill rig using 8-inch diameter hollow-stem auger and switched to rotary-wash drilling method with 3.3-inch diameter drilling bit. The soil samples were obtained from the borings during drilling at various depths by driving a 2.5 inches Inside Diameter (I. D.) Modified California Sampler or a 1.375 inches I.D. Standard Penetration Sampler (ASTM Test Method No. 1586). The sampler was driven into the subsurface soils under the impact of a 140 pounds hammer having a free fall of 30 inches. The blow counts required to drive the sampler for the last 12 inches are presented on the Logs of Test Borings, Appendix II. (When correlating standard penetration data in similar soils, the blow counts for the Modified California sampler can be converted to equivalent Standard Penetration Test sampler by multiplying a factor of 0.65). Pocket penetration tests were also performed on clay samples to evaluate their consistency. Upon completion of drilling, the boreholes were backfilled with cement grout.

The borings were drilled under the technical supervision of our engineers, who classified and continuously logged the soils encountered during drilling and supervised the collection of soil samples at various depths for visual examination and laboratory testing. The soil samples were visually classified in the field according to the Caltrans "Soil and Rock Logging, Classification and Presentation Manual" (2010 Edition) and then transported to our laboratory for further evaluation and testing.

The descriptions of the soils encountered and relevant boring information are presented on the Log of Test Borings attached in Appendix II. The laboratory test methods and results are presented in Appendix IV. The logs presented in Appendix II were prepared from the field logs which were edited after visual re-examination of the soil samples in the laboratory and results of classification tests on selected soil samples as indicated on the logs.

The descriptions and related information presented on these logs of test borings depict subsurface conditions only at the locations indicated on the plan and on the particular date noted on the logs. Because of the variability from place to place within soil/rock in general, subsurface conditions at other locations may differ from conditions occurring at the location explored. The abrupt stratum changes shown on the logs may be gradational and relatively minor changes in soil types within a stratum may not be noted on the logs due to field limitations. Also, the passage of time may result in a change in the soil conditions at these locations due to environmental changes.

LOG OF TEST BORINGS
(FIELD EXPLORATION PERFORMED IN 2018 AND AS-BUILT)

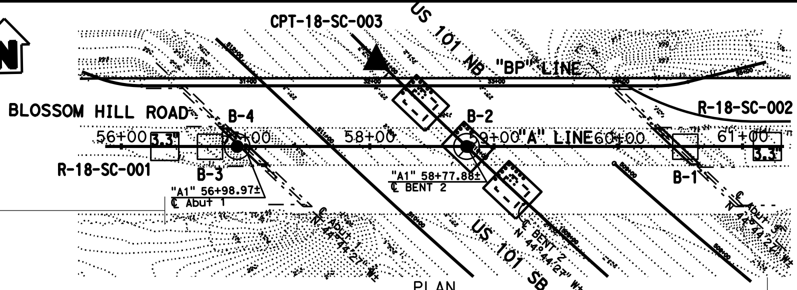
NOTES:

Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2" Modified California Sampler: I.D. = 2.5"; O.D. = 3" Hammer Assembly: A 140 lb hammer with a 30" drop (Automatic Hammer)

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock, Logging, Classification, and Presentation Manual (2010)

See Caltrans 2015 Standard Plans A10F, A10G and A10H for Soil and Rock Legend.

All dimensions are in feet unless otherwise shown



PLAN
1"=50'

BENCH MARK:

NGS QQ453 (HS 2787)
Elev. 190.83
4.7 miles northwest along the southern Pacific Company Railroad from the station at Coyote.
Vertical Datum: NAVDBB
Horizontal Datum: CCS83, Zone 3, Epoch 2010.00
in U.S Survey Feet.

BOREHOLE LOCATION TABLE

Hole ID	Alignment Name	Station and Offset
R-18-SC-001	"A" Line	56+35 0' Lt.
R-18-SC-002	"A" Line	61+20 0' Lt.
CPT-18-SC-003	"A" Line	58+05 70' Rt.

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	SCI	101	R28.4/R28.9		

GEOTECHNICAL PROFESSIONAL 10-15-19 DATE

REGISTERED PROFESSIONAL ENGINEER GARY PARIKH No. 666 Exp. 12/31/19 GEOTECHNICAL STATE OF CALIFORNIA

PLANS APPROVAL DATE

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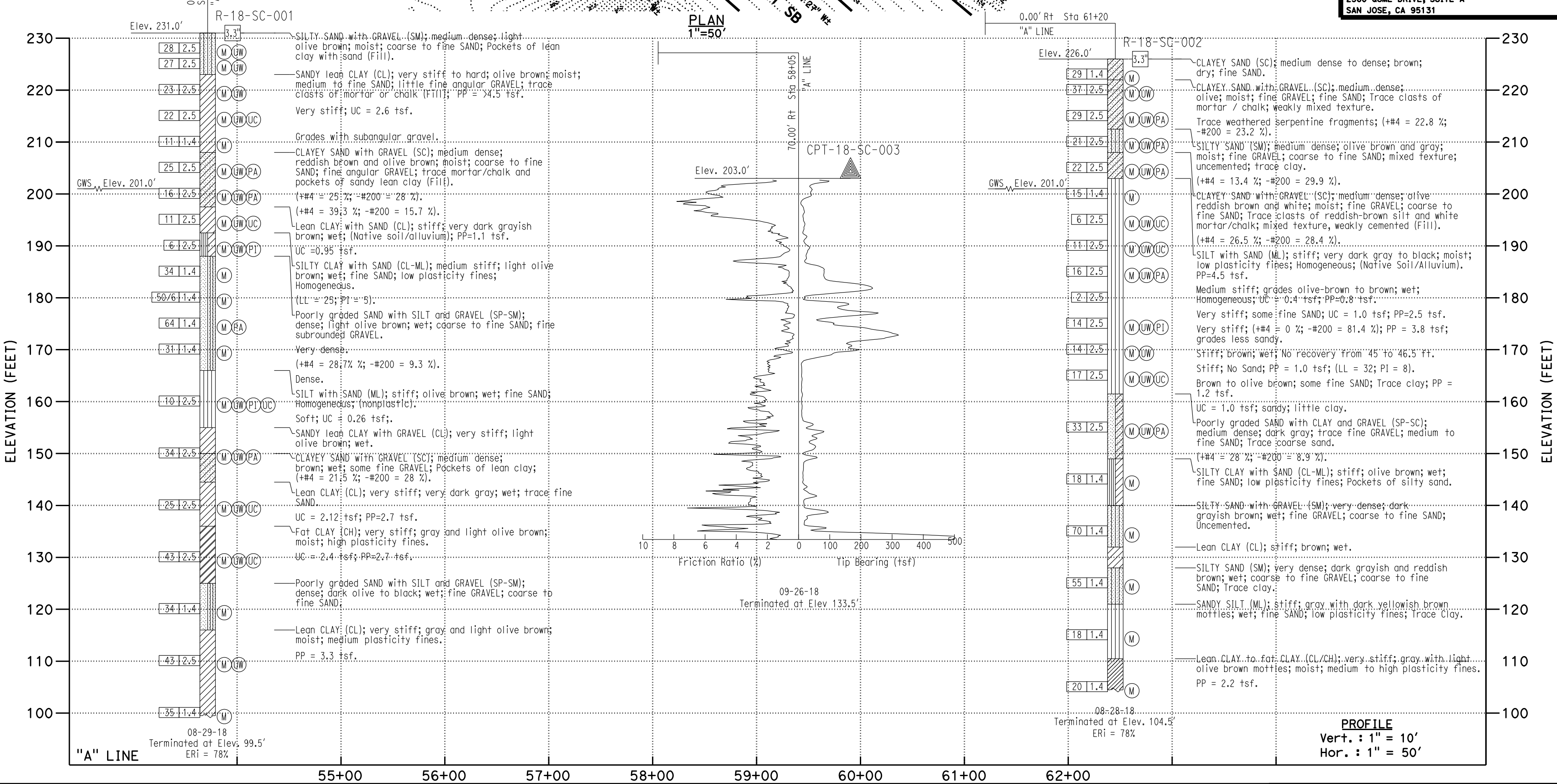
CITY OF SAN JOSE DOT
200 E. SANTA CLARA St., 8th FLOOR
SAN JOSE, CA 95113

PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131



PROFILE
Vert. : 1" = 10'
Hor. : 1" = 50'

DESIGN OVERSIGHT	DRAWN BY	KIM OUYANG	L.S. BHANGOO FIELD INVESTIGATION BY:
SIGN OFF DATE	CHECKED BY	ALSTON LAM	DATE: AUGUST 2018 TO SEPTEMBER 2018

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

ALSTON LAM
PROJECT ENGINEER

BRIDGE NO. 37-0348
POST MILES R28.61

BLOSSOM HILL ROAD OC (WIDEN)
LOG OF TEST BORINGS 1 OF 2

GS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 03/14/12)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0000
PROJECT NUMBER & PHASE: 04160002241
CONTRACT NO.: 04-1K2804

DISREGARD PRINTS BEARING EARLIER REVISION DATES
REVISION DATES 7-11-18 4-9-19 10-15-19

SHEET 25 OF 26

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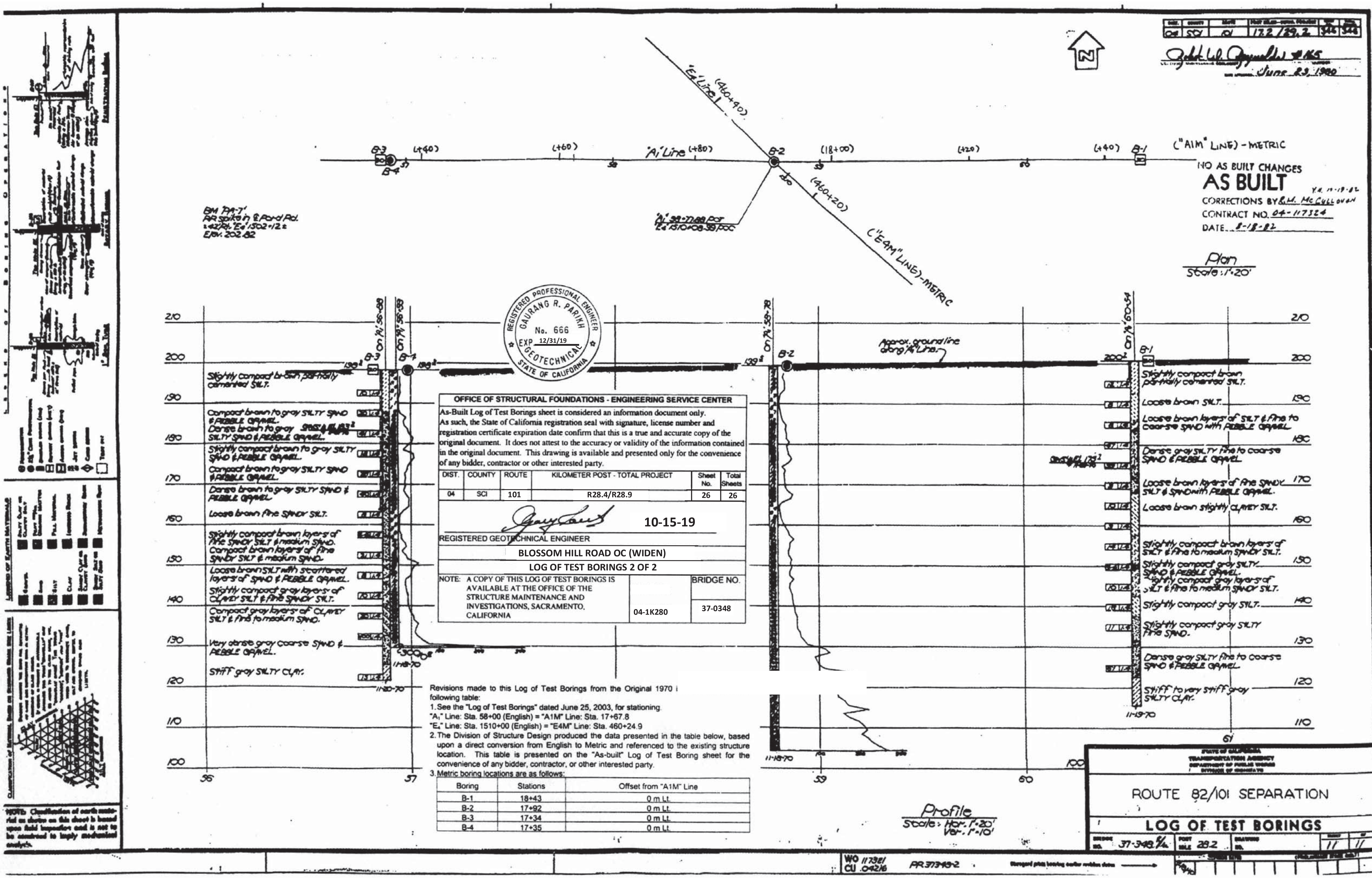
USERNAME => ogouthier DATE PLOTTED => 19-SEP-2019 TIME PLOTTED => 13:52



OFFICE OF STRUCTURAL FOUNDATIONS - ENGINEERING SERVICE CENTER

As-Built Log of Test Borings sheet is considered an information document only. As such, the State of California registration seal with signature, license number and registration certificate expiration date confirm that this is a true and accurate copy of the original document. It does not attest to the accuracy or validity of the information contained in the original document. This drawing is available and presented only for the convenience of any bidder, contractor or other interested party.

DIST.	COUNTY	ROUTE	KILOMETER POST - TOTAL PROJECT	Sheet No.	Total Sheets
04	SCI	101	R28.4/R28.9	26	26

10-15-19

REGISTERED GEOTECHNICAL ENGINEER

BLOSSOM HILL ROAD OC (WIDEN)

LOG OF TEST BORINGS 2 OF 2

NOTE: A COPY OF THIS LOG OF TEST BORINGS IS AVAILABLE AT THE OFFICE OF THE STRUCTURE MAINTENANCE AND INVESTIGATIONS, SACRAMENTO, CALIFORNIA

04-1K280

BRIDGE NO. 37-0348

Revisions made to this Log of Test Borings from the Original 1970 i following table:

1. See the "Log of Test Borings" dated June 25, 2003, for stationing.
"A1" Line: Sta. 58+00 (English) = "A1M" Line: Sta. 17+67.8
"E1" Line: Sta. 1510+00 (English) = "E4M" Line: Sta. 460+24.9
2. The Division of Structure Design produced the data presented in the table below, based upon a direct conversion from English to Metric and referenced to the existing structure location. This table is presented on the "As-built" Log of Test Boring sheet for the convenience of any bidder, contractor, or other interested party.
3. Metric boring locations are as follows:

Boring	Stations	Offset from "A1M" Line
B-1	18+43	0 m Lt.
B-2	17+92	0 m Lt.
B-3	17+34	0 m Lt.
B-4	17+35	0 m Lt.

REFERENCE LOG OF TEST BORINGS
(FIELD EXPLORATION PERFORMED IN 2003)

c: \acad\203110.GDB\LOTB.dwg

CONSISTENCY CLASSIFICATION FOR SOILS
According to the Standard Penetration Test (ASTM D-1586)

SPT N-Value (Blows/305mm)	Granular	SPT N-Value (Blows/305mm)	Cohesive
0-4	Very loose	<2	Very soft
5-10	Loose	2-4	Soft
11-30	Medium Dense	5-8	Firm
31-50	Dense	9-15	Stiff
>50	Very Dense	16-30	Very Stiff
		>30	Hard

LEGEND OF EARTH MATERIALS (USCS)
BASED ON ASTM D2487, D2488

- FILL MATERIAL
- CLAY (CL or CH)
- SILT (ML or MH)
- PEAT and/or ORGANIC MATTER
- WELL-GRADED GRAVEL (GW)
- POORLY-GRADED GRAVEL (GP)
- SILTY GRAVEL (GM)
- CLAYEY GRAVEL (GC)
- POORLY-GRADED SAND (SP)
- WELL-GRADED SAND (SW)
- SILTY SAND (SM) or SANDY SILT
- CLAYEY SAND (SC) or SANDY CLAY
- COBBLES/BOULDERS
- IGNEOUS ROCK
- SEDIMENTARY ROCK
- METAMORPHIC ROCK

NOTE: Visual classifications of earth materials are based on field inspection and are confirmed or revised with laboratory test results as necessary.

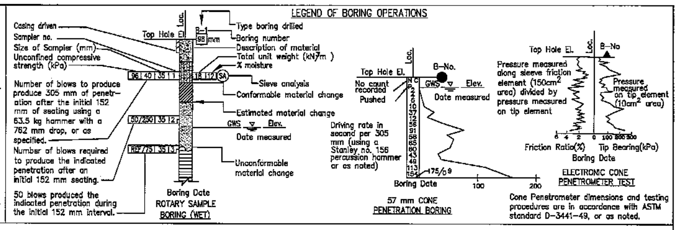
TYPES OF BORINGS

- 57 mm CONE PENETRATION
- ROTARY WASH
- ELECTRONIC CONE PENETROMETER
- AUGER BORING (DRY)
- TEST PIT
- DIAMOND CORE BORING
- SOIL TUBE

IN-SITU, LAB & FIELD TEST DESIGNATIONS

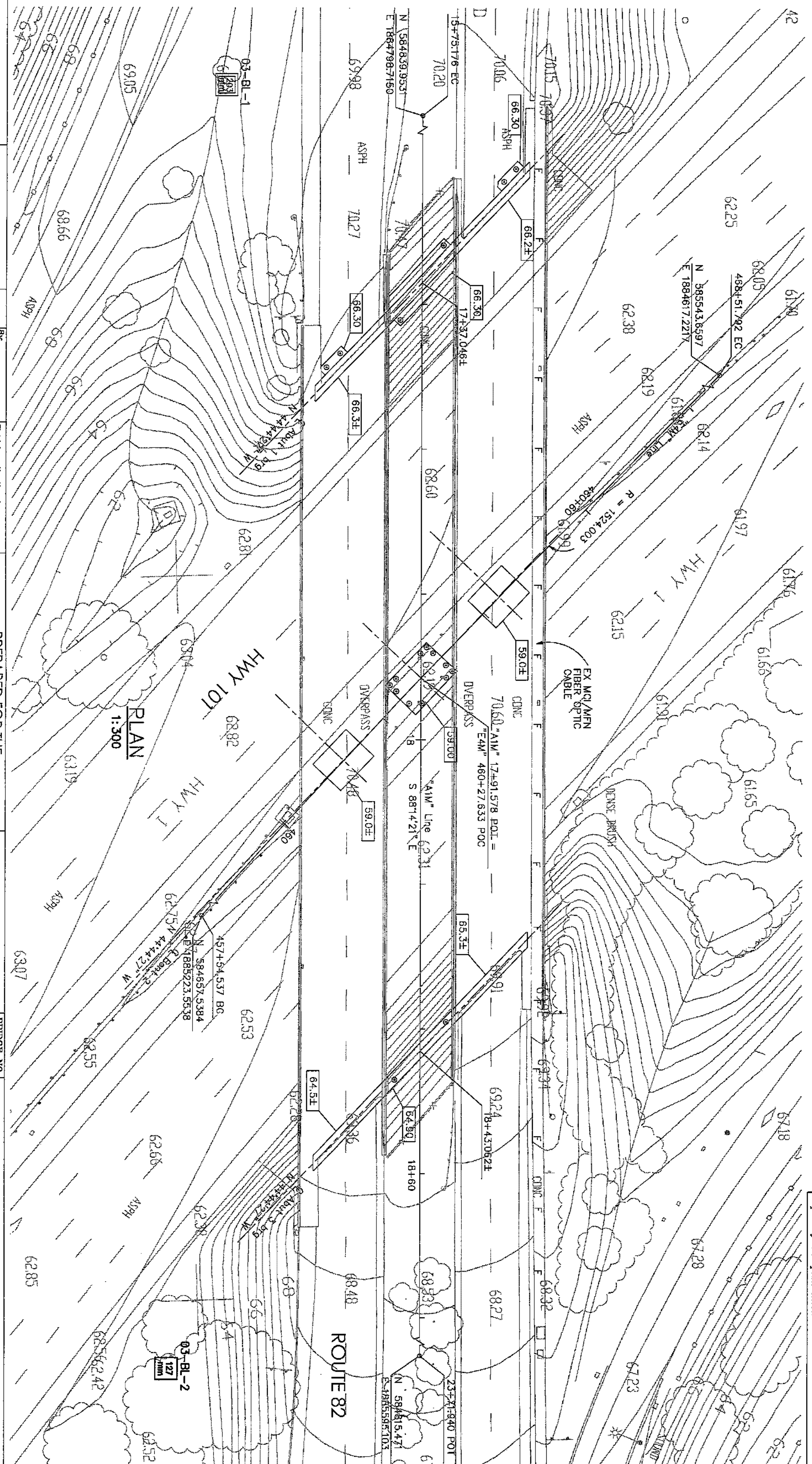
- AL ATTERBERG LIMITS
- CA CHEMICAL ANALYSIS
- CN CONSOLIDATION
- CU CONSOLIDATED UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- MD MAX. DRY DENSITY
- PP POCKET PENETROMETER
- SA SIEVE ANALYSIS
- TV TORVANE
- UC UNCONFINED COMPRESSION
- UU UNCONSOLIDATED UNDRAINED TRIAXIAL
- VS VANE SHEAR

LEGEND OF BORING OPERATIONS



BENCK MARK
BM #453 NGS BRASS DISK "QQ 453"
N 584755.327
E 1884281.661
Elev. = 58.166

DATUM
Horizontal : NAD83, CA-HPGN, EPOCH 1991.35, Metric
Vertical : NAVD 88, Metric
Supplementary Information may Be Obtained from the District Office, Surveys Branch or Right of Way Engineering Branch
111 Grand Avenue, Oakland, California.



PLAN
1:300

DIST	04
COUNTY	SCl
ROUTE	82/101
KILOMETER POST TOTAL PROJECT	0.0/0.5 R 44.9 / R 46.3
SHEET NO.	
TOTAL SHEETS	

REGISTERED ENGINEER-GEOTECHNICAL

PLANS APPROVAL DATE

PARIKH CONSULTANTS, INC.
356 SOUTH MILPITAS BLVD.
MILPITAS CA 95035

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REGISTERED PROFESSIONAL GEOTECHNICAL ENGINEER GARY PARIKH No. GE 666 STATE OF CALIFORNIA

DESIGN OVERSIGHT

SIGN OFF DATE

DESIGN By: F. WANG/R. AU
CHECKED A. KOZOMPOLIS
Field Investigation by: D. ALEXANDER

PREPARED FOR THE
STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS
0 10 20 30 40 50 60 70 80 90 100

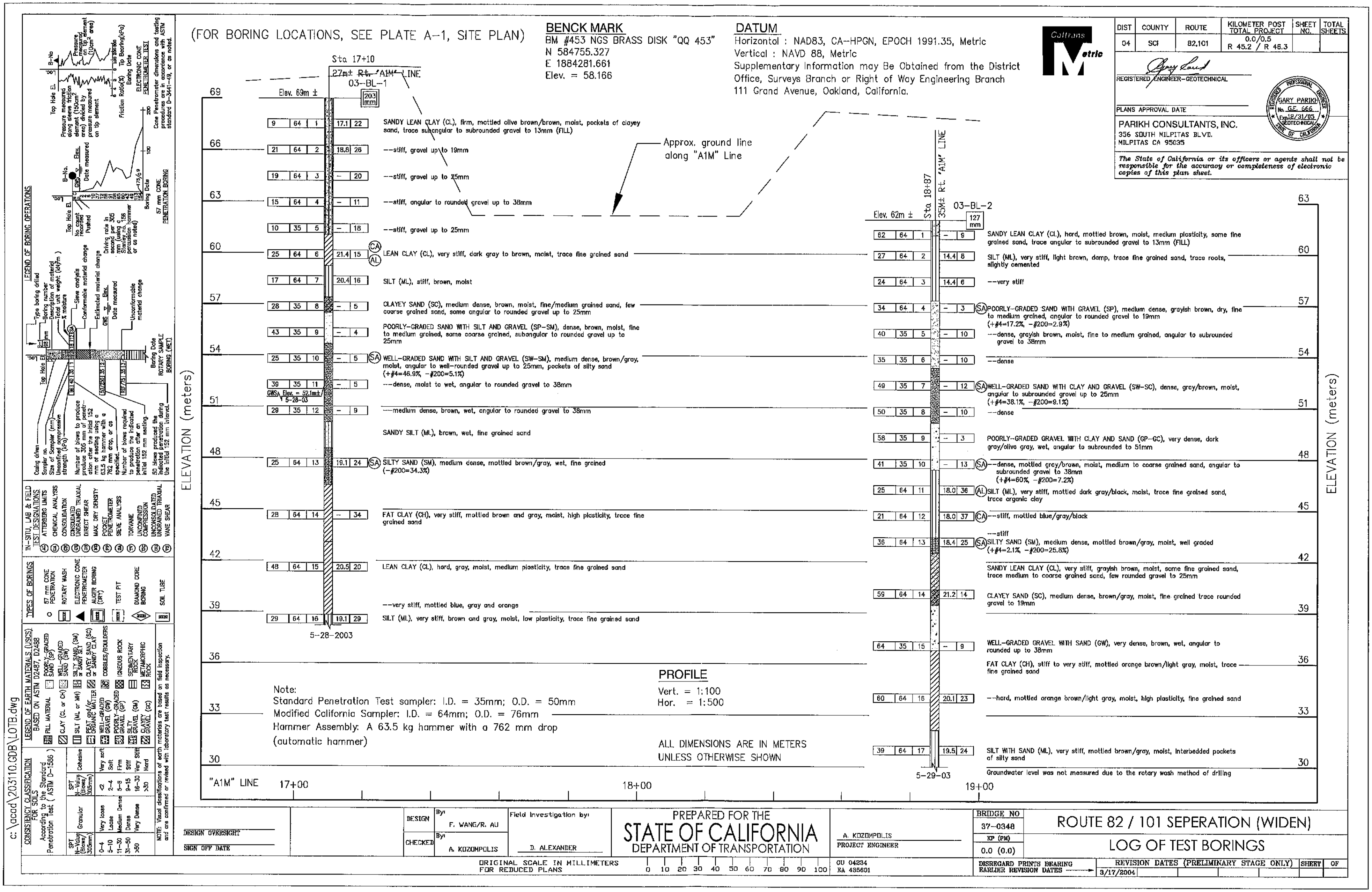
A. KOZOMPOLIS
PROJECT ENGINEER

CU 04234
EA 43601

BRIDGE NO. 37-0348
KP (PM) 0.0 (0.0)

ROUTE 82 / 101 SEPERATION (WIDEN)
LOG OF TEST BORINGS

DISREGARD PRINTS BEARING EARLIER REVISION DATES → 3/17/2004
REVISION DATES (PRELIMINARY STAGE ONLY)
SHEET OF



c:\acad\203110.GDB\LOTB.dwg
CONSISTENCY CLASSIFICATION FOR SOILS
LEGEND OF EARTH MATERIALS (USCS)
TYPES OF BORINGS
IN-SITU, LAB & FIELD TEST DESIGNATIONS
LEGEND OF BORING OPERATIONS
(FOR BORING LOCATIONS, SEE PLATE A-1, SITE PLAN)
BENCK MARK
BM #453 NGS BRASS DISK "QQ 453"
N 584755.327
E 1884281.661
Elev. = 58.166
DATUM
Horizontal : NAD83, CA-HPGN, EPOCH 1991.35, Metric
Vertical : NAVD 88, Metric
Supplementary Information may Be Obtained from the District Office, Surveys Branch or Right of Way Engineering Branch
111 Grand Avenue, Oakland, California.
Sta 17+10
27m± Rt. 'A1M' LINE
03-BL-1
Elev. 69m ±
SANDY LEAN CLAY (CL), firm, mottled olive brown/brown, moist, pockets of clayey sand, trace subangular to subrounded gravel to 13mm (FILL)
--stiff, gravel up to 19mm
--stiff, gravel up to 25mm
--stiff, angular to rounded gravel up to 38mm
--stiff, gravel up to 25mm
LEAN CLAY (CL), very stiff, dark gray to brown, moist, trace fine grained sand
SILT (ML), stiff, brown, moist
CLAYEY SAND (SC), medium dense, brown, moist, fine/medium grained sand, few coarse grained sand, some angular to rounded gravel up to 25mm
POORLY-GRADED SAND WITH SILT AND GRAVEL (SP-SM), dense, brown, moist, fine to medium grained, some coarse grained, subangular to rounded gravel up to 25mm
WELL-GRADED SAND WITH SILT AND GRAVEL (SW-SM), medium dense, brown/gray, moist, angular to well-rounded gravel up to 25mm, pockets of silty sand (+#4=46.9%, -#200=5.1%)
---dense, moist to wet, angular to rounded gravel to 38mm
---medium dense, brown, wet, angular to rounded gravel to 38mm
SANDY SILT (ML), brown, wet, fine grained sand
SILTY SAND (SM), medium dense, mottled brown/gray, wet, fine grained (-#200=34.3%)
FAT CLAY (CH), very stiff, mottled brown and gray, moist, high plasticity, trace fine grained sand
LEAN CLAY (CL), hard, gray, moist, medium plasticity, trace fine grained sand
--very stiff, mottled blue, gray and orange
SILT (ML), very stiff, brown and gray, moist, low plasticity, trace fine grained sand
5-28-2003
Approx. ground line along "A1M" Line
Sta 18+87
35M± Rt. 'A1M' LINE
03-BL-2
Elev. 62m ±
SANDY LEAN CLAY (CL), hard, mottled brown, moist, medium plasticity, some fine grained sand, trace angular to subrounded gravel to 13mm (FILL)
SILT (ML), very stiff, light brown, damp, trace fine grained sand, trace roots, slightly cemented
--very stiff
POORLY-GRADED SAND WITH GRAVEL (SP), medium dense, grayish brown, dry, fine to medium grained, angular to rounded gravel to 19mm (+#4=17.2%, -#200=2.9%)
--dense, grayish brown, moist, fine to medium grained, angular to subrounded gravel to 38mm
--dense
WELL-GRADED SAND WITH CLAY AND GRAVEL (SW-SC), dense, gray/brown, moist, angular to subrounded gravel up to 25mm (+#4=38.1%, -#200=9.1%)
--dense
POORLY-GRADED GRAVEL WITH CLAY AND SAND (GP-GC), very dense, dark gray/olive gray, wet, angular to subrounded to 51mm
--dense, mottled gray/brown, moist, medium to coarse grained sand, angular to subrounded gravel to 38mm (+#4=60%, -#200=7.2%)
SILT (ML), very stiff, mottled dark gray/black, moist, trace fine grained sand, trace organic clay
--stiff, mottled blue/gray/black
--stiff
SILTY SAND (SM), medium dense, mottled brown/gray, moist, well graded (+#4=2.1%, -#200=25.8%)
SANDY LEAN CLAY (CL), very stiff, grayish brown, moist, some fine grained sand, trace medium to coarse grained sand, few rounded gravel to 25mm
CLAYEY SAND (SC), medium dense, brown/gray, moist, fine grained trace rounded gravel to 19mm
WELL-GRADED GRAVEL WITH SAND (GW), very dense, brown, wet, angular to rounded up to 38mm
FAT CLAY (CH), stiff to very stiff, mottled orange brown/light gray, moist, trace fine grained sand
--hard, mottled orange brown/light gray, moist, high plasticity, fine grained sand
SILT WITH SAND (ML), very stiff, mottled brown/gray, moist, interbedded pockets of silty sand
Groundwater level was not measured due to the rotary wash method of drilling
5-29-03
ELEVATION (meters)
Note:
Standard Penetration Test sampler: I.D. = 35mm; O.D. = 50mm
Modified California Sampler: I.D. = 64mm; O.D. = 76mm
Hammer Assembly: A 63.5 kg hammer with a 762 mm drop
(automatic hammer)
PROFILE
Vert. = 1:100
Hor. = 1:500
ALL DIMENSIONS ARE IN METERS
UNLESS OTHERWISE SHOWN
"A1M" LINE
17+00
18+00
19+00
DIST 04 COUNTY SCl ROUTE 82,101 KILOMETER POST TOTAL PROJECT 0.0/0.5 R 45.2 / R 46.3 SHEET NO. TOTAL SHEETS
REGISTERED ENGINEER-GEOTECHNICAL
PLANS APPROVAL DATE
PARIKH CONSULTANTS, INC.
356 SOUTH MILPITAS BLVD.
MILPITAS CA 95035
The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.
GARY PARIKH No. GE 666 Exp. 12/31/03 GEOTECHNICAL
DESIGN OVERSIGHT
SIGN OFF DATE
DESIGN By: F. WANG/R. AU
CHECKED By: A. KOZOMPOLIS
Field Investigation by: D. ALEXANDER
PREPARED FOR THE
STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION
A. KOZOMPOLIS
PROJECT ENGINEER
BRIDGE NO. 37-0348
KP (PM) 0.0 (0.0)
ROUTE 82 / 101 SEPERATION (WIDEN)
LOG OF TEST BORINGS
ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS
CU 04234
EA 435601
DISREGARD PRINTS BEARING EARLIER REVISION DATES
REVISION DATES (PRELIMINARY STAGE ONLY)
3/17/2004
SHEET OF

APPENDIX III

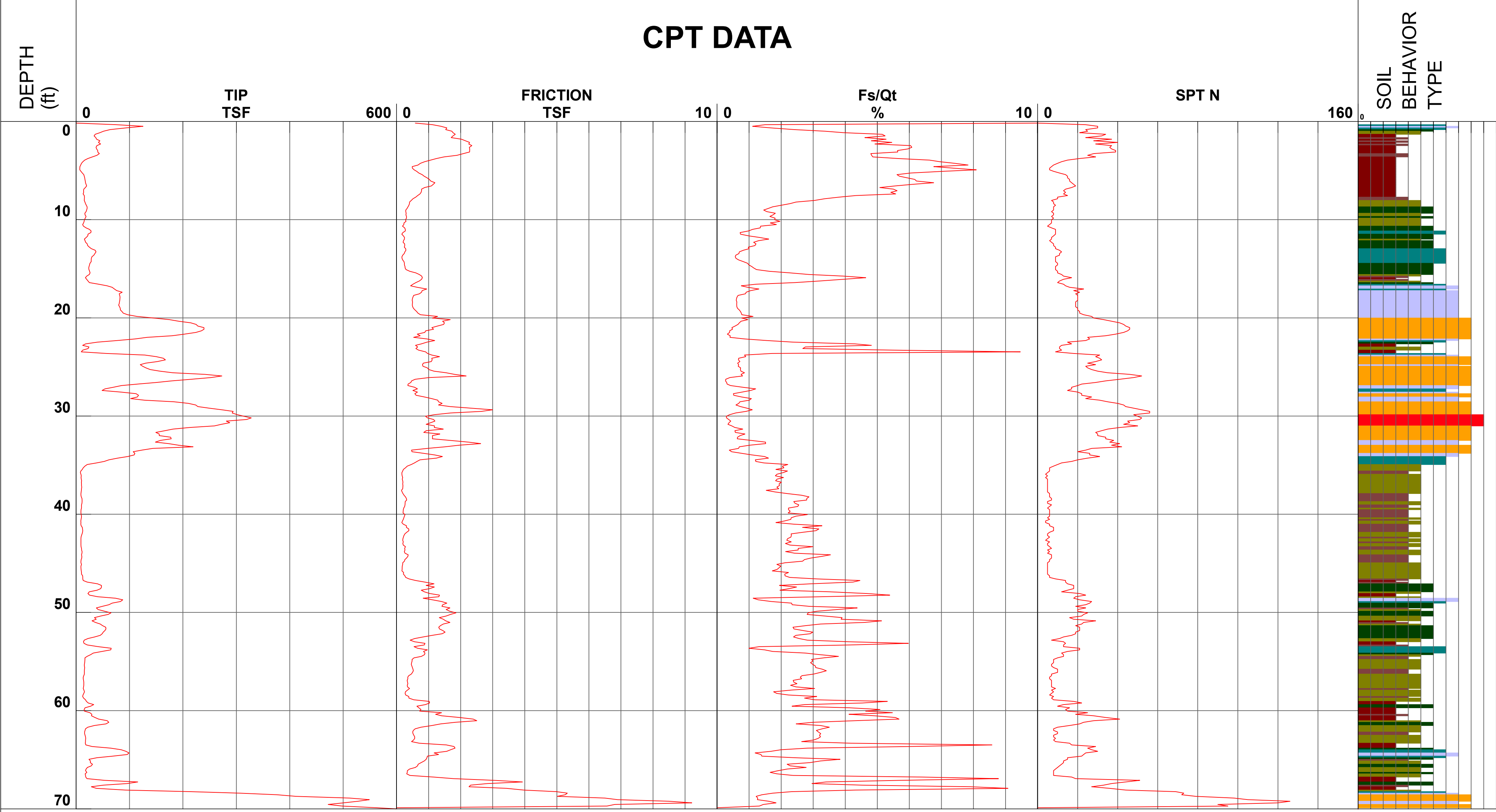
Parikh Consultants

Project	US 101 Blossom Hill Rd IC Improvement Prc	Operator	RB-JM
Job Number	2016-146	Cone Number	DDG1418
Hole Number	CPT-18-SC-003	Date and Time	9/26/2018 12:24:13 PM
EST GW Depth During Test			26.3 ft

Filename	SDF(113).cpt
GPS	
Maximum Depth	70.21 ft

Net Area Ratio .8

CPT DATA



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

Cone Size 15cm squared

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

US 101 Blossom Hill Rd IC Improvement Project

Project ID: Parikh Consultants
Data File: SDF(113).cpt
CPT Date: 9/26/2018 12:24:13 PM
GW During Test: 30 ft

Sounding ID: CPT-18-SC-003
Project No: 2016-146
Cone/Rig: DDG1418

Depth ft	qc PS tsf	* qc1n PS -	q1ncs PS -	* qt PS tsf	Slv Stss tsf	pore prss (psi)	Frct Rato %	* Mat Typ Zon	* Material Behavior Description	Unit Wght pcf	Qc to N	* SPT R-N1 60%	SPT R-N 60%	* SPT IcN1 60%	* Rel Den %	* Ftn Ang deg	Und Shr tsf	OCR -	* Fin Ic %	* Ic SBT Indx	* Nk -
0.33	75.2	120.5	152.0	75.2	1.1	0.1	1.5	6	clean SAND to silty SAND	125	5.0	24	15	23	73	48	-	-	12	1.97	16
0.49	125.1	200.7	211.2	125.1	1.4	0.3	1.1	6	clean SAND to silty SAND	125	5.0	40	25	36	90	48	-	-	7	1.72	16
0.66	93.6	150.1	184.4	93.6	1.6	0.2	1.7	6	clean SAND to silty SAND	125	5.0	30	19	29	80	48	-	-	11	1.94	16
0.82	63.5	101.9	162.6	63.5	1.5	0.3	2.4	5	silty SAND to sandy SILT	120	4.0	25	16	21	68	48	-	-	18	2.17	16
0.98	51.4	82.5	171.3	51.4	1.7	0.3	3.4	5	silty SAND to sandy SILT	120	4.0	21	13	19	61	48	-	-	24	2.34	16
1.15	44.6	71.5	175.1	44.6	1.8	0.5	4.0	4	clayy SILT to silty CLAY	115	2.0	36	22	17	-	-	3.1	9.9	28	2.43	15
1.31	35.6	57.1	184.3	35.6	1.8	0.4	5.2	4	clayy SILT to silty CLAY	115	2.0	29	18	14	-	-	2.5	9.9	35	2.58	15
1.48	33.5	53.8	-	33.6	1.8	0.7	5.3	4	clayy SILT to silty CLAY	115	2.0	27	17	14	-	-	2.4	9.9	36	2.61	15
1.64	37.0	59.3	175.6	37.0	1.7	0.4	4.6	4	clayy SILT to silty CLAY	115	2.0	30	18	15	-	-	2.6	9.9	32	2.54	15
1.80	38.4	61.5	193.7	38.4	2.0	0.3	5.3	4	clayy SILT to silty CLAY	115	2.0	31	19	15	-	-	2.7	9.9	34	2.57	15
1.97	44.6	71.5	197.2	44.6	2.1	0.5	4.8	4	clayy SILT to silty CLAY	115	2.0	36	22	17	-	-	3.1	9.9	31	2.50	15
2.13	41.7	66.9	206.0	41.8	2.3	0.7	5.5	4	clayy SILT to silty CLAY	115	2.0	33	21	17	-	-	2.9	9.9	33	2.56	15
2.30	45.8	73.4	202.5	45.8	2.3	0.6	4.9	4	clayy SILT to silty CLAY	115	2.0	37	23	18	-	-	3.2	9.9	31	2.50	15
2.46	38.9	62.4	-	38.9	2.3	-0.3	6.1	4	clayy SILT to silty CLAY	115	2.0	31	19	16	-	-	2.7	9.9	36	2.61	15
2.62	37.3	59.9	-	37.3	2.3	0.1	6.1	3	silty CLAY to CLAY	115	1.5	40	25	15	-	-	2.6	9.9	37	2.63	15
2.79	38.3	61.4	-	38.3	2.3	0.3	6.0	4	clayy SILT to silty CLAY	115	2.0	31	19	16	-	-	2.7	9.9	36	2.61	15
2.95	40.5	65.0	207.4	40.5	2.3	0.0	5.7	4	clayy SILT to silty CLAY	115	2.0	33	20	16	-	-	2.9	9.9	34	2.58	15
3.12	40.4	64.8	207.3	40.4	2.3	-0.2	5.7	4	clayy SILT to silty CLAY	115	2.0	32	20	16	-	-	2.8	9.9	34	2.58	15
3.28	43.5	69.8	194.7	43.5	2.1	0.3	4.8	4	clayy SILT to silty CLAY	115	2.0	35	22	17	-	-	3.1	9.9	31	2.50	15
3.45	39.1	62.7	185.8	39.1	1.9	-2.7	4.8	4	clayy SILT to silty CLAY	115	2.0	31	20	16	-	-	2.8	9.9	32	2.54	15
3.61	30.5	48.9	-	30.4	1.5	-2.6	4.9	4	clayy SILT to silty CLAY	115	2.0	24	15	13	-	-	2.1	9.9	36	2.61	15
3.77	22.2	35.5	-	22.1	1.2	-2.7	5.7	3	silty CLAY to CLAY	115	1.5	24	15	10	-	-	1.6	9.9	44	2.76	15
3.94	16.0	25.7	-	16.0	1.1	-2.6	6.7	3	silty CLAY to CLAY	115	1.5	17	11	8	-	-	1.1	9.9	53	2.91	15
4.10	12.6	20.2	-	12.6	0.9	-2.5	7.1	3	silty CLAY to CLAY	115	1.5	13	8	6	-	-	0.9	9.9	59	3.00	15
4.27	10.1	16.1	-	10.0	0.7	-2.3	7.6	3	silty CLAY to CLAY	115	1.5	11	7	5	-	-	0.7	9.9	65	3.10	15
4.43	8.6	13.7	-	8.5	0.7	-2.2	8.1	3	silty CLAY to CLAY	115	1.5	9	6	5	-	-	0.6	9.9	70	3.17	15
4.59	7.2	11.5	-	7.2	0.5	-2.0	7.0	3	silty CLAY to CLAY	115	1.5	8	5	4	-	-	0.5	8.5	72	3.19	15
4.76	6.7	10.8	-	6.7	0.5	-1.8	7.7	3	silty CLAY to CLAY	115	1.5	7	4	4	-	-	0.5	7.6	76	3.24	15
4.92	6.8	10.9	-	6.7	0.5	-1.7	8.4	3	silty CLAY to CLAY	115	1.5	7	5	4	-	-	0.5	7.5	78	3.26	15
5.09	8.9	14.3	-	8.9	0.6	-2.1	7.3	3	silty CLAY to CLAY	115	1.5	10	6	5	-	-	0.6	9.6	67	3.13	15
5.25	11.5	18.5	-	11.5	0.7	-1.1	6.2	3	silty CLAY to CLAY	115	1.5	12	8	6	-	-	0.8	9.9	58	2.99	15
5.41	14.2	22.8	-	14.2	0.8	-1.1	5.7	3	silty CLAY to CLAY	115	1.5	15	9	7	-	-	1.0	9.9	52	2.90	15
5.58	15.2	24.3	-	15.1	0.9	-1.0	5.8	3	silty CLAY to CLAY	115	1.5	16	10	7	-	-	1.0	9.9	51	2.88	15
5.74	16.0	25.7	-	16.0	1.0	-0.8	6.1	3	silty CLAY to CLAY	115	1.5	17	11	8	-	-	1.1	9.9	51	2.88	15
5.91	16.6	26.6	-	16.6	1.0	-1.2	6.3	3	silty CLAY to CLAY	115	1.5	18	11	8	-	-	1.1	9.9	51	2.88	15
6.07	17.2	27.5	-	17.2	1.1	-0.5	6.3	3	silty CLAY to CLAY	115	1.5	18	11	8	-	-	1.2	9.9	50	2.87	15
6.23	17.7	28.4	-	17.7	1.2	-1.8	6.9	3	silty CLAY to CLAY	115	1.5	19	12	8	-	-	1.2	9.9	51	2.89	15
6.40	18.8	30.1	-	18.7	1.1	-1.8	6.2	3	silty CLAY to CLAY	115	1.5	20	13	9	-	-	1.3	9.9	48	2.84	15
6.56	19.6	31.4	-	19.6	1.1	-2.0	5.7	3	silty CLAY to CLAY	115	1.5	21	13	9	-	-	1.4	9.9	46	2.80	15
6.73	17.3	27.7	-	17.2	0.9	-2.2	5.2	3	silty CLAY to CLAY	115	1.5	18	12	8	-	-	1.2	9.9	47	2.81	15
6.89	14.2	22.8	-	14.2	0.8	-2.0	5.7	3	silty CLAY to CLAY	115	1.5	15	9	7	-	-	1.0	9.9	52	2.90	15
7.05	13.8	22.2	-	13.8	0.8	-1.7	5.8	3	silty CLAY to CLAY	115	1.5	15	9	7	-	-	0.9	9.9	53	2.91	15
7.22	14.2	22.7	-	14.1	0.8	-0.3	5.6	3	silty CLAY to CLAY	115	1.5	15	9	7	-	-	1.0	9.9	52	2.90	15
7.38	13.1	21.0	-	13.1	0.7	0.2	5.8	3	silty CLAY to CLAY	115	1.5	14	9	6	-	-	0.9	9.8	54	2.93	15
7.55	15.2	24.4	-	15.2	0.7	-0.3	4.5	3	silty CLAY to CLAY	115	1.5	16	10	7	-	-	1.0	9.9	46	2.81	15
7.71	15.7	25.2	-	15.7	0.6	-0.3	3.9	4	clayy SILT to silty CLAY	115	2.0	13	8	7	-	-	1.1	9.9	44	2.76	15
7.87	15.3	24.6	-	15.3	0.5	-0.3	3.5	4	clayy SILT to silty CLAY	115	2.0	12	8	7	-	-	1.1	9.9	42	2.73	15
8.04	15.1	24.2	-	15.1	0.5	-0.1	3.1	4	clayy SILT to silty CLAY	115	2.0	12	8	7	-	-	1.0	9.9	41	2.71	15
8.20	16.4	26.3	-	16.4	0.4	-0.2	2.5	4	clayy SILT to silty CLAY	115	2.0	13	8	7	-	-	1.1	9.9	37	2.63	15
8.37	17.6	28.3	90.4	17.6	0.4	-0.2	2.3	4	clayy SILT to silty CLAY	115	2.0	14	9	7	-	-	1.2	9.9	34	2.58	15
8.53	19.2	26.5	82.8	19.1	0.4	-0.2	2.1	4	clayy SILT to silty CLAY	115	2.0	13	10	7	-	-	1.3	9.9	34	2.57	15
8.69	20.6	28.1	79.0	20.6	0.4	-0.3	1.8	5	silty SAND to sandy SILT	120	4.0	7	5	7	25	35	-	-	31	2.51	16
8.86	20.5	27.8	75.7	20.5	0.3	-0.2	1.6	5	silty SAND to sandy SILT	120	4.0	7	5	7	25	35	-	-	30	2.49	16
9.02	19.9	26.6	71.6	19.8	0.3	-0.3	1.5	5	silty SAND to sandy SILT	120	4.0	7	5	6	23	35	-	-	30	2.48	16
9.19	18.5	24.6	72.1	18.5	0.3	-0.3	1.6	5	silty SAND to sandy SILT	120	4.0	6	5	6	21	34	-	-	32	2.53	16
9.35	16.3	24.6	77.8	16.3	0.3	-0.3	1.9	4	clayy SILT to silty CLAY	115	2.0	12	8	6	-	-	1.1	9.6	34	2.57	15
9.51	16.8	24.9	76.7	16.8	0.3	-0.2	1.8	4	clayy SILT to silty CLAY	115	2.0	12	8	6	-	-	1.1	9.7	33	2.56	15
9.68	18.7	24.3	73.7	18.7	0.3	-0.2	1.7	4	clayy SILT to silty CLAY	115	2.0	12	9	6	-	-	1.3	9.9	33	2.55	15
9.84	17.0	24.8	77.8	17.0	0.3	-0.1	1.9	4	clayy SILT to silty CLAY	115	2.0	12	9	6	-	-	1.2	9.5	34	2.57	15
10.01	15.3	22.0	-	15.3	0.3	-0.2	1.9	4	clayy SILT to silty CLAY	115	2.0	11	8	6	-	-	1.0	8.4	36	2.61	15
10.17	15.0	24.0	-	14.9	0.3	-0.2	2.0	4	clayy SILT to silty CLAY	115	2.0	12	7	6	-	-	1.0	8.0	36	2.60	15
10.34	13.9	19.5	-	13.9	0.2	-0.2	1.7	4	clayy SILT to silty CLAY	115	2.0	10	7	5	-	-	0.9	7.3	37	2.64	15
10.50	12.3	19.8	-	12.3	0.2	-0.2	1.9	4	clayy SILT to silty CLAY	115	2.0	10	6	5	-	-	0.8	6.4	39	2.66	15
10.66	13.7	18.8	-	13.6	0.2	-0.2	1.4	4	clayy SILT to silty CLAY	115	2.0	9	7	5	-	-	0.9	6.9	36	2.61	15
10.83	18.7	23.0	66.4	18.7	0.3	-0.2	1.4	5	silty SAND to sandy SILT	120	4.0	6	5	6	18	33	-	-	32	2.52	16
10.99	24.8	30.1	66.6	24.7	0.3	-0.2	1.1	5	silty SAND to sandy SILT	120	4.0	8	6	7	27	35	-	-	25	2.37	16
11.16	28.0	33.7	66.0	28.0	0.3	-0.2	1.0	5	silty SAND to sandy SILT	120	4.0	8	7	7	31	36	-	-	23	2.30	16
11.32	27.6	33.1	58.7	27.6	0.2	-0.2	0.7	5	silty SAND to sandy SILT	120	4.0	8	7	7	30	36	-	-	20	2.24	16
11.48	22.4	26.6	54.7	22.4	0.2	-0.2	0.8	5	silty SAND to sandy SILT	120	4.0	7	6	6	23	34	-	-	24	2.33	16
11.65	21.7	25.6	60.5	21.7	0.2	-0.2	1.0	5	silty SAND to sandy SILT	120	4.0	6	5	6	22	34	-	-	27	2.41	16
11.81	18.9	22.1	65.5	18.9	0.3	-0.2	1.4	5	silty SAND to sandy SILT	120	4.0	6	5	5	17	33	-	-	32	2.54	16
11.98	15.3	19.4	-	15.3	0.2	-0.1	1.7	4	clayy SILT to silty CLAY	115	2.0	10	8	5	-	-	1.0	6.9	37	2.64	15
12.14	16.8	19.4	62.5	16.8	0.2	0.0	1.4	4	clayy SILT to silty CLAY	115	2.0	10	8	5	-	-	1.1	7.5	35	2.58	15
12.30	17.8	20.4	60.1	17.8	0.2	0.0	1.2	5	silty SAND to sandy SILT	120	4.0	5	4	5	15	32	-	-	32	2.53	16
12.47	20.8	23.7	64.4	20.8	0.3	0.0	1.3	5	silty SAND to sandy SILT	120	4.0	6	5	6	19	33	-	-	30	2.49	16
12.63	21.6	24.5	64.2	21.6	0.3	0.0	1.2	5	silty SAND to sandy SILT	120	4.0	6	5	6	21	33	-	-	29	2.47	16
12.80	24.8	27.9	61.8	24.8	0.2	0.0	1.0	5	silty SAND to sandy SILT	120	4.0	7	6	6	25	34	-	-	25	2.38	16
12.96	28.5	31.8	65.4	28.5	0.3	0.0	1.0	5	silty SAND to sandy SILT	120	4.0	8	7	7	29	35	-	-	24	2.33	16
13.12	35.7	39.6	66.1	35.6	0.3	0.0	0.8	5	silty SAND to sandy SILT	120	4.0	10	9	8	36	36	-	-	19	2.20	16
13.29	37.4	41.2	64.0	37.4	0.3	0.0	0.7	5	silty SAND to sandy SILT	120	4.0	10	9	9	38	36	-	-	17	2.15	16
13.45	35.1	38.5	61.6	35.1	0.2	0.1	0.7	5	silty SAND to sandy SILT	120	4.0	10	9	8	35	36	-	-	18	2.17	16
13.62	33.1	36.1	57.2	33.1	0.2	0.1	0.6	5	silty SAND to sandy SILT	120	4.0	9	8	8	33	35	-	-	18	2.17	16
13.78	29.7	32.1	54.1	29.7	0.2	0.0	0.6	5	silty SAND to sandy SILT	120	4.0	8	7	7	30	35	-	-	19	2.21	16
13.94	28.6	30.8	53.9	28.6	0.2	0.0	0.6	5	silty SAND to sandy SILT	120	4.0	8	7	7	28	34	-	-	20	2.23	16
14.11	28.4	30.4	56.0	28.4	0.2	0.0	0.7	5	silty SAND to sandy SILT	120	4.0	8	7	7	28	34	-	-	21	2.27	16
14.27	28.3	30.0	59.4	28.3	0.2	0.0	0.8	5	silty SAND to sandy SILT	120	4.0	8	7	7	27	34	-	-	23	2.31	16
14.44	25.9	27.4	61.1	25.9	0.2	0.0	1.0	5	silty SAND to sandy SILT	120	4.0	7	6	6	24	34	-	-	26	2.38	16
14.60	24.9	26.2	61.1	24.9	0.2	0.0	1.0	5	silty SAND to sandy SILT	120	4.0	7	6	6	23	33	-	-	27	2.41	16
14.76	24.3	25.4	62.7	24.3	0.3	0.0	1.1	5	silty SAND to sandy SILT	120	4.0	6	6	6	22	33	-	-	28	2.44	16
14.93	23.5	24.4	63.5	23.5	0.3	0.0	1.2	5	silty SAND to sandy SILT	120	4.0	6	6	6	20	33	-	-	29	2.47	16
15.09	24.1	24.9	65.8	24.1	0.3	0.0	1.3	5	silty SAND to sandy SILT	120	4.0	6	6	6	21	33	-	-	30	2.47	16
15.26	25.3	26.0	75.5	25.3	0.4	0.0	1.7	4	clayy SILT to silty CLAY	115	2.0	13	13	6	-	-	1.7	9.0	32	2.53	15
15.42	26.3	27.8	90.7	26.3	0.6	-0.1	2.4	4	clayy SILT to silty CLAY	115	2.0	14	13	7	-	-	1.8	9.3	35	2.59	15

* Indicates the parameter was calculated using the normalized point stress.
The parameters listed above were determined using empirical correlations.
A Professional Engineer must determine their suitability for analysis and design.

Middle Earth Geo Testing

US 101 Blossom Hill Rd IC Improvement Project

Project ID: Parikh Consultants
Data File: SDF(113).cpt
CPT Date: 9/26/2018 12:24:13 PM
GW During Test: 30 ft

Sounding ID: CPT-18-SC-003
Project No: 2016-146
Cone/Rig: DDG1418

. . Depth ft	. qc PS tsf	* qc1n PS -	. q1ncs PS -	* qt PS tsf	. Slv Stss tsf	. pore prss (psi)	. Frct Rato %	* Mat Typ Zon	* Material Behavior Description	. Unit Wght pcf	. Qc to N	* SPT R-N1 60%	. SPT R-N 60%	* SPT IcN1 60%	* Rel Den %	* Ftn Ang deg	. Und Shr tsf	. OCR - -	* Fin Ic %	* Ic SBT Indx	* Nk - -
15.58	24.7	27.1	-	24.7	0.7	-0.1	3.0	4	clayy SILT to silty CLAY	115	2.0	14	12	7	-	-	1.7	8.6	38	2.66	15
15.75	19.9	21.6	-	20.0	0.8	1.1	4.1	3	silty CLAY to CLAY	115	1.5	14	13	6	-	-	1.3	6.8	48	2.83	15
15.91	17.3	18.6	-	17.4	0.8	2.1	4.9	3	silty CLAY to CLAY	115	1.5	12	12	6	-	-	1.2	5.8	54	2.93	15
16.08	19.7	21.0	-	19.8	0.8	2.4	4.1	3	silty CLAY to CLAY	115	1.5	14	13	6	-	-	1.3	6.6	48	2.84	15
16.24	22.2	23.4	-	22.3	0.7	2.4	3.3	4	clayy SILT to silty CLAY	115	2.0	12	11	6	-	-	1.5	7.4	43	2.74	15
16.40	24.9	25.9	-	24.9	0.6	2.9	2.5	4	clayy SILT to silty CLAY	115	2.0	13	12	7	-	-	1.7	8.2	37	2.63	15
16.57	42.1	41.5	78.3	42.1	0.5	1.9	1.2	5	silty SAND to sandy SILT	120	4.0	10	11	9	38	36	-	-	22	2.28	16
16.73	57.9	56.9	77.7	57.9	0.4	1.5	0.8	6	clean SAND to silty SAND	125	5.0	11	12	11	48	38	-	-	14	2.05	16
16.90	67.4	65.8	90.3	67.4	0.6	1.2	1.0	6	clean SAND to silty SAND	125	5.0	13	13	13	53	38	-	-	14	2.05	16
17.06	71.8	69.8	103.2	71.8	0.9	0.8	1.3	5	silty SAND to sandy SILT	120	4.0	17	18	14	55	39	-	-	16	2.11	16
17.23	75.9	73.4	99.2	75.9	0.8	0.3	1.1	6	clean SAND to silty SAND	125	5.0	15	15	15	57	39	-	-	14	2.04	16
17.39	86.3	83.0	103.3	86.3	0.8	0.2	0.9	6	clean SAND to silty SAND	125	5.0	17	17	16	61	40	-	-	12	1.95	16
17.55	80.5	77.1	97.7	80.6	0.7	0.3	0.9	6	clean SAND to silty SAND	125	5.0	15	16	15	58	39	-	-	12	1.97	16
17.72	81.5	77.7	92.1	81.5	0.5	0.2	0.7	6	clean SAND to silty SAND	125	5.0	16	16	15	59	39	-	-	10	1.90	16
17.88	82.2	77.9	91.4	82.2	0.5	0.3	0.6	6	clean SAND to silty SAND	125	5.0	16	16	15	59	39	-	-	10	1.88	16
18.05	82.0	77.3	90.5	82.0	0.5	0.4	0.6	6	clean SAND to silty SAND	125	5.0	15	16	15	59	39	-	-	10	1.88	16
18.21	81.7	76.7	89.8	81.8	0.5	0.4	0.6	6	clean SAND to silty SAND	125	5.0	15	16	14	58	39	-	-	10	1.88	16
18.37	81.1	75.8	89.5	81.1	0.5	0.4	0.6	6	clean SAND to silty SAND	125	5.0	15	16	14	58	39	-	-	10	1.89	16
18.54	80.8	75.2	88.9	80.8	0.5	0.4	0.6	6	clean SAND to silty SAND	125	5.0	15	16	14	58	39	-	-	10	1.89	16
18.70	79.7	73.7	87.8	79.7	0.5	0.5	0.6	6	clean SAND to silty SAND	125	5.0	15	16	14	57	39	-	-	10	1.90	16
18.87	81.3	74.9	88.8	81.3	0.5	0.5	0.6	6	clean SAND to silty SAND	125	5.0	15	16	14	57	39	-	-	10	1.90	16
19.03	82.7	75.8	90.1	82.7	0.5	0.5	0.6	6	clean SAND to silty SAND	125	5.0	15	17	14	58	39	-	-	10	1.90	16
19.19	83.0	75.8	91.5	83.0	0.6	0.5	0.7	6	clean SAND to silty SAND	125	5.0	15	17	14	58	39	-	-	11	1.92	16
19.36	85.8	77.9	94.4	85.8	0.6	0.6	0.7	6	clean SAND to silty SAND	125	5.0	16	17	15	59	39	-	-	11	1.92	16
19.52	88.3	79.9	96.7	88.3	0.7	0.7	0.8	6	clean SAND to silty SAND	125	5.0	16	18	15	60	39	-	-	11	1.92	16
19.69	96.3	86.7	102.9	96.3	0.7	0.6	0.8	6	clean SAND to silty SAND	125	5.0	17	19	16	62	39	-	-	10	1.90	16
19.85	113.9	102.2	125.8	113.9	1.3	0.7	1.1	6	clean SAND to silty SAND	125	5.0	20	23	20	68	40	-	-	11	1.94	16
20.01	145.2	129.6	139.4	145.2	1.1	0.8	0.8	6	clean SAND to silty SAND	125	5.0	26	29	23	76	42	-	-	7	1.76	16
20.18	174.7	155.3	167.4	174.7	1.7	0.7	1.0	6	clean SAND to silty SAND	125	5.0	31	35	28	82	42	-	-	7	1.76	16
20.34	192.1	170.0	171.4	192.1	1.4	1.0	0.8	6	clean SAND to silty SAND	125	5.0	34	38	29	85	43	-	-	5	1.66	16
20.51	214.8	189.3	189.3	214.8	1.5	1.0	0.7	6	clean SAND to silty SAND	125	5.0	38	43	32	88	43	-	-	5	1.60	16
20.67	224.8	197.4	197.4	224.8	1.5	1.2	0.7	6	clean SAND to silty SAND	125	5.0	39	45	33	89	44	-	-	5	1.57	16
20.83	227.9	199.2	199.2	227.9	1.3	1.2	0.6	6	clean SAND to silty SAND	125	5.0	40	46	33	90	44	-	-	5	1.52	16
21.00	239.4	208.5	208.5	239.5	1.1	1.5	0.5	6	clean SAND to silty SAND	125	5.0	42	48	34	91	44	-	-	5	1.45	16
21.16	239.5	207.7	207.7	239.6	1.2	1.9	0.5	6	clean SAND to silty SAND	125	5.0	42	48	34	91	44	-	-	5	1.47	16
21.33	234.5	202.5	202.5	234.5	0.9	1.1	0.4	6	clean SAND to silty SAND	125	5.0	40	47	33	90	44	-	-	5	1.42	16
21.49	224.4	193.0	193.0	224.4	0.9	1.3	0.4	6	clean SAND to silty SAND	125	5.0	39	45	31	89	43	-	-	5	1.44	16
21.65	202.8	173.7	173.7	202.8	0.6	1.0	0.3	6	clean SAND to silty SAND	125	5.0	35	41	28	85	43	-	-	5	1.43	16
21.82	180.0	153.6	153.6	180.0	0.7	0.7	0.4	6	clean SAND to silty SAND	125	5.0	31	36	26	81	42	-	-	5	1.53	16
21.98	132.9	113.0	112.9	132.9	0.5	0.6	0.4	6	clean SAND to silty SAND	125	5.0	23	27	20	71	41	-	-	5	1.65	16
22.15	110.4	93.5	111.1	110.4	0.9	0.6	0.9	6	clean SAND to silty SAND	125	5.0	19	22	18	65	40	-	-	10	1.90	16
22.31	76.6	64.6	106.0	76.6	1.2	0.1	1.6	5	silty SAND to sandy SILT	120	4.0	16	19	14	53	37	-	-	19	2.19	16
22.47	39.9	33.5	99.2	39.9	0.9	0.3	2.5	4	clayy SILT to silty CLAY	115	2.0	17	20	8	-	-	2.7	9.5	32	2.54	15
22.64	18.1	13.4	-	18.1	0.8	0.5	4.6	3	silty CLAY to CLAY	115	1.5	9	12	4	-	-	1.2	4.1	61	3.03	15
22.80	12.3	9.1	-	12.3	0.6	0.7	5.4	3	silty CLAY to CLAY	115	1.5	6	8	3	-	-	0.8	2.7	75	3.22	15
22.97	24.0	17.6	-	24.0	0.7	1.4	2.9	4	clayy SILT to silty CLAY	115	2.0	9	12	5	-	-	1.6	5.5	47	2.81	15
23.13	22.4	16.3	-	22.4	0.6	0.5	2.8	4	clayy SILT to silty CLAY	115	2.0	8	11	5	-	-	1.5	5.0	48	2.83	15
23.30	12.5	9.0	-	12.5	0.7	0.4	6.2	3	silty CLAY to CLAY	115	1.5	6	8	3	-	-	0.8	2.7	78	3.26	15
23.46	9.6	6.9	-	9.6	0.9	0.9	9.9	2	Organic SOILS - Peats	100	1.0	7	10	3	-	-	0.9	1.9	95	3.49	10
23.62	56.6	46.4	95.3	56.6	1.0	1.0	1.8	5	silty SAND to sandy SILT	120	4.0	12	14	10	42	35	-	-	24	2.33	16
23.79	128.6	105.1	121.0	128.6	1.1	0.6	0.9	6	clean SAND to silty SAND	125	5.0	21	26	20	69	40	-	-	9	1.86	16
23.95	150.0	122.2	136.9	150.0	1.3	1.3	0.9	6	clean SAND to silty SAND	125	5.0	24	30	22	74	41	-	-	9	1.82	16
24.12	163.4	132.7	138.7	163.5	1.1	0.8	0.7	6	clean SAND to silty SAND	125	5.0	27	33	23	76	41	-	-	6	1.71	16
24.28	167.1	135.1	140.5	167.1	1.1	1.0	0.7	6	clean SAND to silty SAND	125	5.0	27	33	24	77	41	-	-	6	1.70	16
24.44	152.2	122.7	131.8	152.2	1.1	1.0	0.7	6	clean SAND to silty SAND	125	5.0	25	30	22	74	41	-	-	7	1.75	16
24.61	130.2	104.5	114.4	130.2	0.8	0.8	0.6	6	clean SAND to silty SAND	125	5.0	21	26	19	68	40	-	-	8	1.78	16
24.77	120.1	96.1	108.3	120.1	0.8	0.9	0.7	6	clean SAND to silty SAND	125	5.0	19	24	18	66	39	-	-	9	1.83	16
24.94	124.7	99.4	110.8	124.7	0.8	0.9	0.7	6	clean SAND to silty SAND	125	5.0	20	25	18	67	40	-	-	8	1.81	16
25.10	130.5	103.7	116.5	130.5	1.0	0.9	0.7	6	clean SAND to silty SAND	125	5.0	21	26	19	68	40	-	-	9	1.82	16
25.26	138.8	110.0	121.5	138.8	1.0	0.4	0.7	6	clean SAND to silty SAND	125	5.0	22	28	20	70	40	-	-	8	1.80	16
25.43	156.9	123.8	133.8	156.9	1.2	0.4	0.7	6	clean SAND to silty SAND	125	5.0	25	31	22	74	41	-	-	7	1.76	16
25.59	181.1	142.4	153.0	181.1	1.5	0.6	0.9	6	clean SAND to silty SAND	125	5.0	28	36	26	79	41	-	-	7	1.75	16
25.76	240.9	188.9	188.9	241.0	1.8	0.8	0.8	6	clean SAND to silty SAND	125	5.0	38	48	32	88	43	-	-	5	1.62	16
25.92	272.9	213.3	213.3	272.9	2.2	0.8	0.8	6	clean SAND to silty SAND	125	5.0	43	55	36	92	43	-	-	5	1.60	16
26.08	252.6	196.8	196.8	252.6	1.0	0.9	0.4	6	clean SAND to silty SAND	125	5.0	39	51	32	89	43	-	-	5	1.44	16
26.25	215.4	167.3	167.3	215.5	0.6	0.9	0.3	6	clean SAND to silty SAND	125	5.0	33	43	27	84	42	-	-	5	1.41	16
26.41	179.0	138.5	138.5	179.1	0.5	1.3	0.3	6	clean SAND to silty SAND	125	5.0	28	36	23	78	41	-	-	5	1.48	16
26.58	150.2	115.9	115.9	150.2	0.4	1.2	0.3	6	clean SAND to silty SAND	125	5.0	23	30	20	72	40	-	-	5	1.57	16
26.74	115.1	88.5	91.3	115.2	0.4	0.4	0.3	6	clean SAND to silty SAND	125	5.0	18	23	16	63	39	-	-	6	1.69	16
26.90	84.9	65.0	75.5	84.9	0.4	0.4	0.4	6	clean SAND to silty SAND	125	5.0	13	17	12	53	37	-	-	10	1.87	16
27.07	69.6	53.2	76.4	69.6	0.6	0.3	0.8	5	silty SAND to sandy SILT	120	4.0	13	17	11	46	36	-	-	16	2.09	16
27.23	54.0	41.2	78.2	54.1	0.7	0.2	1.2	5	silty SAND to sandy SILT	120	4.0	10	14	9	38	34	-	-	22	2.28	16
27.40	48.5	36.8	70.9	48.5	0.5	0.2	1.1	5	silty SAND to sandy SILT	120	4.0	9	12	8	34	33	-	-	22	2.29	16
27.56	83.7	63.4	83.8	83.7	0.7	0.1	0.8	6	clean SAND to silty SAND	125	5.0	13	17	13	52	37	-	-	13	2.02	16
27.72	112.2	84.7	94.2	112.2	0.6	0.3	0.5	6	clean SAND to silty SAND	125	5.0	17	22	15	62	38	-	-	8	1.81	16
27.89	116.8	87.9	97.2	116.9	0.6	0.4	0.5	6	clean SAND to silty SAND	125	5.0	18	23	16	63	39	-	-	8	1.80	16
28.05	114.4	85.8	102.0	114.4	0.9	0.6	0.8	6	clean SAND to silty SAND	125	5.0	17	23	16	62	38	-	-	10	1.90	16
28.22	102.0	76.3	102.4	102.0	1.1	0.7	1.1	6	clean SAND to silty SAND	125	5.0	15	20	15	58	38	-	-	14	2.03	16
28.38	127.7	95.2	116.7	127.7	1.3	0.7	1.0	6	clean SAND to silty SAND	125	5.0	19	26	18	65	39	-	-	11	1.94	16
28.54	183.3	136.2	143.2	183.3	1.3	-0.3	0.7	6	clean SAND to silty SAND	125	5.0	27	37	24	77	41	-	-	6	1.72	16
28.71	210.4	156.0	157.4	210.4	1.4	-0.6	0.7	6	clean SAND to silty SAND	125	5.0	31	42	27	82	42	-	-	5	1.66	16
28.87	223.8	165.4	165.4	223.8	1.3	-0.8	0.6	6	clean SAND to silty SAND	125	5.0	33	45	28	84	42	-	-	5	1.60	16
29.04	228.0	168.0	169.2	228.0	1.7	-0.2	0.7	6	clean SAND to silty SAND	125	5.0	34	46	29	84	42	-	-	5	1.66	16
29.20	249.3	183.1	190.0	249.3	2.3	-0.2	0.9	6	clean SAND to silty SAND	125	5.0	37	50	32	87	42	-	-	6	1.70	16
29.36	273.0	199.9	210.6	273.0	3.0	-0.6	1.1	6	clean SAND to silty SAND	125	5.0	40	55	35	90	43	-	-	7	1.72	16
29.53	294.1	214.8	214.8	294.1	2.7	-2.6	0.9	6	clean SAND to silty SAND	125	5.0	43	59	37	92	43	-	-	5	1.64	16
29.69	292.1	212.7	212.7	292.1	1.7	-2.3	0.6	6	clean SAND to silty SAND	125	5.0	43	58	35	92	43	-	-	5	1.51	16
29.86	302.0	219.3	219.3	301.9	1.2	-1.9	0.4	6	clean SAND to silty SAND	125	5.0	44	60	35	93	43	-	-	5	1.39	16
30.02	314.4	227.9	227.9	314.4	0.9	-0.3	0.3	7	grvly SAND to dense SAND	130	6.0	38	52	35	94	43	-	-	5	1.31	16
30.19	327.7	237.3	237.3	327.7	1.0	-0.2	0.3	7	grvly SAND to dense SAND	130	6.0	40	55	37	95	44	-	-	5	1.30	16
30.35	319.1	230.7	230.7	319.1	1.2	-0.2	0.4	6	clean SAND to silty SAND	125	5.0	46	64	36	95	43	-	-	5	1.36	16
30.51	281.2	203.0	203.0	281.3	1.2	0.0	0.4	6	clean SAND to silty SAND	125	5.0	41	56	33	90	43	-	-	5	1.44	16
30.68	287.7	207.3	207.3	287.7	1.1	1.3	0.4	6	clean SAND to silty SAND	125	5.0	41	58	33	91	43	-	-	5	1.40	16
30.84	272.2	195.9	195.9	272.2	0.9	1.6	0.3	6	clean SAND to silty SAND	125	5.0	39	54	31	89	43	-	-	5	1.40	16

* Indicates the parameter was calculated using the normalized point stress.
The parameters listed above were determined using empirical correlations.
A Professional Engineer must determine their suitability for analysis and design.

US 101 Blossom Hill Rd IC Improvement Project

Project ID: Parikh Consultants
Data File: SDF(113).cpt
CPT Date: 9/26/2018 12:24:13 PM
GW During Test: 30 ft

Sounding ID: CPT-18-SC-003
Project No: 2016-146
Cone/Rig: DDG1418

. Depth ft	. qc PS tsf	* qc1n PS -	. q1ncs PS -	* qt PS tsf	. Slv Stss tsf	. pore prss (psi)	. Frct Rato %	* Mat Typ Zon	* Material Behavior Description	. Unit Wght pcf	. Qc to N	* SPT R-N1 60%	. SPT R-N 60%	* SPT IcN1 60%	* Rel Den %	* Ftn Ang deg	. Und Shr tsf	. OCR -	* Fin Ic %	* Ic SBT Indx	* Nk -
31.01	258.9	186.1	186.1	259.0	1.2	1.7	0.5	6	clean SAND to silty SAND	125	5.0	37	52	31	88	42	-	-	5	1.49	16
31.17	212.7	152.7	152.7	212.7	1.2	1.6	0.6	6	clean SAND to silty SAND	125	5.0	31	43	26	81	41	-	-	5	1.61	16
31.33	181.3	130.0	140.9	181.4	1.5	1.9	0.8	6	clean SAND to silty SAND	125	5.0	26	36	23	76	40	-	-	7	1.77	16
31.50	166.4	119.1	123.9	166.5	0.9	2.2	0.6	6	clean SAND to silty SAND	125	5.0	24	33	21	73	40	-	-	6	1.70	16
31.66	149.1	106.6	114.1	149.2	0.8	1.9	0.6	6	clean SAND to silty SAND	125	5.0	21	30	19	69	39	-	-	7	1.75	16
31.83	155.5	111.0	126.5	155.5	1.3	2.2	0.9	6	clean SAND to silty SAND	125	5.0	22	31	21	70	40	-	-	9	1.84	16
31.99	155.5	110.8	122.1	155.6	1.1	2.4	0.7	6	clean SAND to silty SAND	125	5.0	22	31	20	70	40	-	-	8	1.79	16
32.15	177.0	126.0	132.1	177.0	1.1	1.9	0.6	6	clean SAND to silty SAND	125	5.0	25	35	22	75	40	-	-	6	1.72	16
32.32	178.0	126.5	132.4	178.0	1.1	1.4	0.6	6	clean SAND to silty SAND	125	5.0	25	36	22	75	40	-	-	6	1.71	16
32.48	157.7	111.9	132.7	157.7	1.7	1.3	1.1	6	clean SAND to silty SAND	125	5.0	22	32	21	71	40	-	-	10	1.90	16
32.65	148.3	105.1	139.8	148.3	2.2	0.8	1.5	5	silty SAND to sandy SILT	120	4.0	26	37	21	69	39	-	-	14	2.02	16
32.81	173.1	122.5	155.4	173.1	2.6	1.0	1.5	6	clean SAND to silty SAND	125	5.0	25	35	24	74	40	-	-	12	1.97	16
32.97	191.5	135.4	152.1	191.5	1.9	0.8	1.0	6	clean SAND to silty SAND	125	5.0	27	38	25	77	41	-	-	9	1.82	16
33.14	219.1	154.7	157.1	219.1	1.5	1.4	0.7	6	clean SAND to silty SAND	125	5.0	31	44	27	81	41	-	-	6	1.67	16
33.30	143.4	101.1	112.6	143.4	1.0	0.6	0.7	6	clean SAND to silty SAND	125	5.0	20	29	18	67	39	-	-	8	1.81	16
33.47	123.1	86.7	92.1	123.1	0.5	0.5	0.4	6	clean SAND to silty SAND	125	5.0	17	25	15	62	38	-	-	7	1.74	16
33.63	106.9	75.2	84.8	106.9	0.5	0.5	0.5	6	clean SAND to silty SAND	125	5.0	15	21	14	58	37	-	-	9	1.83	16
33.79	110.1	77.3	95.0	110.1	0.8	0.7	0.8	6	clean SAND to silty SAND	125	5.0	15	22	15	59	37	-	-	11	1.94	16
33.96	108.8	76.3	103.1	108.8	1.2	1.0	1.1	6	clean SAND to silty SAND	125	5.0	15	22	15	58	37	-	-	14	2.04	16
34.12	96.6	67.7	107.0	96.7	1.4	0.6	1.5	5	silty SAND to sandy SILT	120	4.0	17	24	14	54	37	-	-	18	2.16	16
34.29	77.9	54.5	99.5	77.8	1.2	-2.2	1.6	5	silty SAND to sandy SILT	120	4.0	14	19	12	47	35	-	-	21	2.26	16
34.45	61.3	42.8	79.5	61.2	0.7	-3.0	1.2	5	silty SAND to sandy SILT	120	4.0	11	15	9	39	34	-	-	21	2.27	16
34.61	52.7	36.7	75.5	52.6	0.6	-3.4	1.3	5	silty SAND to sandy SILT	120	4.0	9	13	8	34	33	-	-	24	2.33	16
34.78	38.4	19.8	-	38.4	0.6	-3.4	1.5	4	clayy SILT to silty CLAY	115	2.0	10	19	5	-	-	2.6	6.2	36	2.61	15
34.94	20.8	10.7	-	20.8	0.5	-1.0	2.5	3	silty CLAY to CLAY	115	1.5	7	14	3	-	-	1.3	3.2	56	2.96	15
35.11	16.4	8.4	-	16.4	0.3	1.2	2.3	3	silty CLAY to CLAY	115	1.5	6	11	3	-	-	1.0	2.4	62	3.05	15
35.27	13.2	6.8	-	13.2	0.3	1.7	2.5	3	silty CLAY to CLAY	115	1.5	5	9	2	-	-	0.8	1.9	70	3.16	15
35.43	11.7	5.9	-	11.7	0.2	1.9	2.2	3	silty CLAY to CLAY	115	1.5	4	8	2	-	-	0.7	1.6	73	3.20	15
35.60	8.7	4.4	-	8.8	0.2	2.0	2.9	3	silty CLAY to CLAY	115	1.5	3	6	2	-	-	0.5	1.1	89	3.39	15
35.76	8.1	4.1	-	8.1	0.2	2.3	2.8	3	silty CLAY to CLAY	115	1.5	3	5	2	-	-	0.4	1.0	92	3.43	15
35.93	9.0	4.6	-	9.0	0.2	2.6	2.5	3	silty CLAY to CLAY	115	1.5	3	6	2	-	-	0.5	1.1	85	3.34	15
36.09	9.6	4.9	-	9.7	0.2	2.8	2.3	3	silty CLAY to CLAY	115	1.5	3	6	2	-	-	0.5	1.2	81	3.30	15
36.26	9.3	4.7	-	9.4	0.2	3.0	2.7	3	silty CLAY to CLAY	115	1.5	3	6	2	-	-	0.5	1.2	85	3.35	15
36.42	9.6	4.8	-	9.6	0.2	3.2	2.4	3	silty CLAY to CLAY	115	1.5	3	6	2	-	-	0.5	1.2	82	3.31	15
36.58	10.3	5.2	-	10.4	0.2	3.3	2.3	3	silty CLAY to CLAY	115	1.5	3	7	2	-	-	0.6	1.4	78	3.27	15
36.75	9.9	5.0	-	9.9	0.2	3.5	2.6	3	silty CLAY to CLAY	115	1.5	3	7	2	-	-	0.6	1.3	82	3.31	15
36.91	10.0	5.0	-	10.1	0.2	3.7	2.5	3	silty CLAY to CLAY	115	1.5	3	7	2	-	-	0.6	1.3	81	3.30	15
37.08	10.2	5.1	-	10.3	0.2	3.9	2.5	3	silty CLAY to CLAY	115	1.5	3	7	2	-	-	0.6	1.3	80	3.29	15
37.24	10.5	5.2	-	10.6	0.2	4.1	2.4	3	silty CLAY to CLAY	115	1.5	3	7	2	-	-	0.6	1.4	78	3.27	15
37.40	10.0	5.0	-	10.1	0.2	4.3	2.5	3	silty CLAY to CLAY	115	1.5	3	7	2	-	-	0.6	1.3	81	3.30	15
37.57	9.8	4.9	-	9.9	0.2	4.5	2.0	3	silty CLAY to CLAY	115	1.5	3	7	2	-	-	0.6	1.2	79	3.27	15
37.73	9.5	4.7	-	9.6	0.2	4.7	2.4	3	silty CLAY to CLAY	115	1.5	3	6	2	-	-	0.5	1.2	83	3.33	15
37.90	9.1	4.5	-	9.2	0.2	4.9	2.9	3	silty CLAY to CLAY	115	1.5	3	6	2	-	-	0.5	1.1	89	3.39	15
38.06	8.9	4.4	-	9.1	0.2	6.3	3.5	3	silty CLAY to CLAY	115	1.5	3	6	2	-	-	0.5	1.1	94	3.44	15
38.22	9.7	4.8	-	9.8	0.3	6.6	3.8	3	silty CLAY to CLAY	115	1.5	3	6	2	-	-	0.5	1.2	91	3.42	15
38.39	10.9	5.4	-	11.1	0.3	6.8	3.5	3	silty CLAY to CLAY	115	1.5	4	7	2	-	-	0.6	1.4	85	3.35	15
38.55	11.2	5.5	-	11.4	0.3	7.0	3.5	3	silty CLAY to CLAY	115	1.5	4	7	2	-	-	0.6	1.4	84	3.34	15
38.72	11.3	5.5	-	11.5	0.3	7.2	3.0	3	silty CLAY to CLAY	115	1.5	4	8	2	-	-	0.7	1.5	81	3.30	15
38.88	10.9	5.3	-	11.1	0.3	7.4	3.1	3	silty CLAY to CLAY	115	1.5	4	7	2	-	-	0.6	1.4	83	3.32	15
39.04	10.2	5.0	-	10.3	0.3	7.7	3.3	3	silty CLAY to CLAY	115	1.5	3	7	2	-	-	0.6	1.3	87	3.37	15
39.21	10.0	4.9	-	10.2	0.3	8.1	3.3	3	silty CLAY to CLAY	115	1.5	3	7	2	-	-	0.6	1.2	88	3.38	15
39.37	10.0	4.8	-	10.1	0.2	8.4	2.9	3	silty CLAY to CLAY	115	1.5	3	7	2	-	-	0.6	1.2	86	3.36	15
39.54	9.3	4.5	-	9.4	0.2	8.7	3.0	3	silty CLAY to CLAY	115	1.5	3	6	2	-	-	0.5	1.1	90	3.40	15
39.70	9.0	4.4	-	9.2	0.2	9.0	3.1	3	silty CLAY to CLAY	115	1.5	3	6	2	-	-	0.5	1.1	92	3.42	15
39.86	9.1	4.4	-	9.2	0.2	9.4	3.0	3	silty CLAY to CLAY	115	1.5	3	6	2	-	-	0.5	1.1	91	3.42	15
40.03	9.4	4.5	-	9.6	0.3	9.7	3.8	3	silty CLAY to CLAY	115	1.5	3	6	2	-	-	0.5	1.1	94	3.45	15
40.19	10.0	4.8	-	10.2	0.2	12.1	3.2	3	silty CLAY to CLAY	115	1.5	3	7	2	-	-	0.6	1.2	88	3.39	15
40.36	9.9	4.7	-	10.1	0.2	12.4	3.1	3	silty CLAY to CLAY	115	1.5	3	7	2	-	-	0.5	1.2	88	3.38	15
40.52	9.2	4.4	-	9.4	0.2	13.0	3.1	3	silty CLAY to CLAY	115	1.5	3	6	2	-	-	0.5	1.1	92	3.42	15
40.68	8.8	4.2	-	9.1	0.2	13.6	2.9	3	silty CLAY to CLAY	115	1.5	3	6	2	-	-	0.5	1.0	92	3.43	15
40.85	8.9	4.2	-	9.2	0.2	14.1	2.5	3	silty CLAY to CLAY	115	1.5	3	6	2	-	-	0.5	1.0	89	3.39	15
41.01	8.8	4.2	-	9.1	0.2	14.6	3.3	3	silty CLAY to CLAY	115	1.5	3	6	2	-	-	0.5	1.0	95	3.46	15
41.18	9.4	4.5	-	9.7	0.3	15.1	4.4	3	silty CLAY to CLAY	115	1.5	3	6	2	-	-	0.5	1.1	95	3.49	15
41.34	11.5	5.4	-	11.9	0.3	18.0	3.4	3	silty CLAY to CLAY	115	1.5	4	8	2	-	-	0.7	1.4	84	3.34	15
41.50	11.9	5.6	-	12.3	0.4	18.5	4.0	3	silty CLAY to CLAY	115	1.5	4	8	2	-	-	0.7	1.5	86	3.36	15
41.67	12.4	5.8	-	12.8	0.4	19.2	3.9	3	silty CLAY to CLAY	115	1.5	4	8	2	-	-	0.7	1.5	84	3.33	15
41.83	11.9	5.6	-	12.3	0.3	19.4	3.4	3	silty CLAY to CLAY	115	1.5	4	8	2	-	-	0.7	1.5	83	3.32	15
42.00	11.2	5.2	-	11.6	0.3	20.0	3.0	3	silty CLAY to CLAY	115	1.5	3	7	2	-	-	0.6	1.3	83	3.32	15
42.16	10.0	4.7	-	10.4	0.2	21.0	3.1	3	silty CLAY to CLAY	115	1.5	3	7	2	-	-	0.6	1.2	89	3.39	15
42.32	9.3	4.4	-	9.8	0.2	21.7	3.2	3	silty CLAY to CLAY	115	1.5	3	6	2	-	-	0.5	1.0	92	3.43	15
42.49	9.1	4.2	-	9.6	0.2	22.5	3.0	3	silty CLAY to CLAY	115	1.5	3	6	2	-	-	0.5	1.0	93	3.44	15
42.65	8.9	4.2	-	9.4	0.2	23.3	3.0	3	silty CLAY to CLAY	115	1.5	3	6	2	-	-	0.5	1.0	94	3.45	15
42.82	9.0	4.2	-	9.4	0.2	24.2	3.2	3	silty CLAY to CLAY	115	1.5	3	6	2	-	-	0.5	1.0	95	3.46	15
42.98	9.1	4.2	-	9.6	0.2	25.1	3.0	3	silty CLAY to CLAY	115	1.5	3	6	2	-	-	0.5	1.0	93	3.43	15
43.15	9.2	4.2	-	9.7	0.2	26.1	3.2	3	silty CLAY to CLAY	115	1.5	3	6	2	-	-	0.5	1.0	94	3.45	15
43.31	9.2	4.3	-	9.7	0.3	27.2	4.2	3	silty CLAY to CLAY	115	1.5	3	6	2	-	-	0.5	1.0	95	3.51	15
43.47	10.0	4.6	-	10.6	0.3	28.4	3.4	3	silty CLAY to CLAY	115	1.5	3	7	2	-	-	0.6	1.1	92	3.42	15
43.64	10.4	4.8	-	11.0	0.3	28.9	3.4	3	silty CLAY to CLAY	115	1.5	3	7	2	-	-	0.6	1.2	90	3.40	15
43.80	11.2	5.1	-	11.8	0.2	30.3	2.8	3	silty CLAY to CLAY	115	1.5	3	7	2	-	-	0.6	1.3	83	3.32	15
43.97	10.9	5.0	-	11.5	0.3	31.1	3.2	3	silty CLAY to CLAY	115	1.5	3	7	2	-	-	0.6	1.2	87	3.37	15
44.13	10.3	4.7	-	10.9	0.4	32.1	4.8	3	silty CLAY to CLAY	115	1.5	3	7	2	-	-	0.6	1.1	95	3.49	15
44.29	10.7	4.9	-	11.4	0.4	33.2	4.3	3	silty CLAY to CLAY	115	1.5	3	7	2	-	-	0.6	1.2	94	3.45	15
44.46	10.6	4.8	-	11.2	0.3	35.1	3.9	3	silty CLAY to CLAY	115	1.5	3	7	2	-	-	0.6	1.2	92	3.43	15
44.62	9.5	4.3	-	10.2	0.3	35.9	3.8	3	silty CLAY to CLAY	115	1.5	3	6	2	-	-	0.5	1.0	95	3.48	15
44.79	9.1	4.1	-	9.9	0.2	37.6	3.8	3	silty CLAY to CLAY	115	1.5	3	6	2	-	-	0.5	1.0	95	3.50	15
44.95	9.1	4.1	-	9.8	0.2	39.4	3.0	3	silty CLAY to CLAY	115	1.5	3	6	2	-	-	0.5	1.0	95	3.45	15
45.11	10.2	4.6	-	11.1	0.2	48.1	2.5	3	silty CLAY to CLAY	115	1.5	3	7	2	-	-	0.6	1.1	86	3.36	15
45.28	9.0	4.1	-	10.0	0.2	51.1	2.8	3	silty CLAY to CLAY	115	1.5	3	6	2	-	-	0.5	0.9	94	3.45	15
45.44	9.0	4.0	-	10.0	0.2	54.2	2.8	3	silty CLAY to CLAY	115	1.5	3	6	2	-	-	0.5	0.9	94	3.45	15
45.61	9.3	4.2	-	10.4	0.2	57.5	2.7	3	silty CLAY to CLAY	115	1.5	3	6	2	-	-	0.5	1.0	92	3.42	15
45.77	9.7	4.3	-	10.9	0.2	61.0	2.4	3	silty CLAY to CLAY	115	1.5	3	6	2	-	-	0.5	1.0	88	3.38	15
45.93	9.9	4.4	-	11.2	0.2	64.3	3.1	3	silty CLAY to CLAY	115	1.5	3	7	2	-	-	0.5	1.1	92	3.42	15
46.10	10.1	4.5	-	11.4	0.2	67.2	2.9	3	silty CLAY to CLAY	115	1.5	3	7	2	-	-	0.6	1.1	90	3.40	15
46.26	12.1	5.4	-	13.5	0.3	71.7	2.7	3	silty CLAY to CLAY	115	1.5	4	8	2	-	-	0.7	1.4	81	3.30	15

* Indicates the parameter was calculated using the normalized point stress.
The parameters listed above were determined using empirical correlations.
A Professional Engineer must determine their suitability for analysis and design.

Middle Earth Geo Testing

US 101 Blossom Hill Rd IC Improvement Project

Project ID: Parikh Consultants
Data File: SDF(113).cpt
CPT Date: 9/26/2018 12:24:13 PM
GW During Test: 30 ft

Sounding ID: CPT-18-SC-003
Project No: 2016-146
Cone/Rig: DDG1418

. Depth ft	. qc PS tsf	* qc1n PS -	. q1ncs PS -	* qt PS tsf	. Slv Stss tsf	. pore prss (psi)	. Frct Rato %	* Mat Typ Zon	* Material Behavior Description	. Unit Wght pcf	. Qc to N	* SPT R-N1 60%	. SPT R-N 60%	* SPT IcN1 60%	* Rel Den %	* Ftn Ang deg	. Und Shr tsf	. OCR -	* Fin Ic %	* Ic SBT Indx	* Nk -
46.43	12.5	5.6	-	13.9	0.3	71.5	2.9	3	silty CLAY to CLAY	115	1.5	4	8	2	-	-	0.7	1.4	81	3.29	15
46.59	12.6	5.6	-	13.9	0.4	66.1	4.0	3	silty CLAY to CLAY	115	1.5	4	8	2	-	-	0.7	1.4	87	3.37	15
46.75	13.4	5.9	-	14.7	0.6	69.7	5.6	3	silty CLAY to CLAY	115	1.5	4	9	3	-	-	0.8	1.5	92	3.42	15
46.92	20.9	9.2	-	22.4	0.9	77.2	4.9	3	silty CLAY to CLAY	115	1.5	6	14	3	-	-	1.3	2.6	73	3.20	15
47.08	39.9	17.6	-	40.2	1.2	15.9	3.1	3	silty CLAY to CLAY	115	1.5	12	27	5	-	-	2.7	5.4	48	2.84	15
47.25	47.3	20.8	-	47.5	0.9	10.3	2.1	4	clayy SILT to silty CLAY	115	2.0	10	24	5	-	-	3.2	6.5	39	2.67	15
47.41	47.5	20.9	-	47.7	1.2	9.8	2.6	4	clayy SILT to silty CLAY	115	2.0	10	24	6	-	-	3.2	6.5	42	2.73	15
47.57	46.0	20.2	-	46.1	1.0	5.4	2.4	4	clayy SILT to silty CLAY	115	2.0	10	23	5	-	-	3.1	6.3	41	2.71	15
47.74	39.3	17.2	-	39.4	0.8	6.0	2.1	4	clayy SILT to silty CLAY	115	2.0	9	20	5	-	-	2.6	5.3	43	2.74	15
47.90	24.5	10.7	-	24.7	0.9	6.2	4.0	3	silty CLAY to CLAY	115	1.5	7	16	4	-	-	1.6	3.1	65	3.09	15
48.07	22.2	9.7	-	22.4	1.0	10.5	5.4	3	silty CLAY to CLAY	115	1.5	6	15	4	-	-	1.4	2.8	73	3.21	15
48.23	24.9	10.8	-	25.1	1.3	10.8	6.1	3	silty CLAY to CLAY	115	1.5	7	17	4	-	-	1.6	3.2	73	3.20	15
48.39	40.4	17.6	-	40.6	1.3	12.4	3.5	3	silty CLAY to CLAY	115	1.5	12	27	5	-	-	2.7	5.4	50	2.87	15
48.56	73.6	47.1	81.6	73.7	0.8	7.8	1.2	5	silty SAND to sandy SILT	120	4.0	12	18	10	42	34	-	-	20	2.23	16
48.72	87.4	55.9	92.5	87.5	1.1	5.4	1.3	5	silty SAND to sandy SILT	120	4.0	14	22	12	48	35	-	-	19	2.20	16
48.89	83.0	53.0	101.6	83.1	1.4	1.8	1.8	5	silty SAND to sandy SILT	120	4.0	13	21	12	46	35	-	-	22	2.29	16
49.05	67.5	43.1	109.6	67.6	1.6	5.3	2.4	5	silty SAND to sandy SILT	120	4.0	11	17	10	39	33	-	-	29	2.45	16
49.22	61.4	26.4	-	61.4	1.4	0.2	2.5	4	clayy SILT to silty CLAY	115	2.0	13	31	7	-	-	4.2	8.3	36	2.62	15
49.38	49.3	21.2	-	49.2	1.4	-3.3	3.1	4	clayy SILT to silty CLAY	115	2.0	11	25	6	-	-	3.3	6.6	44	2.76	15
49.54	38.1	16.3	-	38.0	1.7	-3.5	4.7	3	silty CLAY to CLAY	115	1.5	11	25	5	-	-	2.5	5.0	57	2.97	15
49.71	41.2	17.6	-	41.1	1.5	-2.8	4.0	3	silty CLAY to CLAY	115	1.5	12	27	5	-	-	2.7	5.4	52	2.90	15
49.87	53.4	22.8	-	53.3	1.7	-3.4	3.3	4	clayy SILT to silty CLAY	115	2.0	11	27	6	-	-	3.6	7.1	43	2.75	15
50.04	65.3	27.8	-	65.2	1.9	-3.8	3.0	4	clayy SILT to silty CLAY	115	2.0	14	33	7	-	-	4.4	8.8	38	2.66	15
50.20	59.9	25.5	-	59.9	1.7	-4.6	3.0	4	clayy SILT to silty CLAY	115	2.0	13	30	7	-	-	4.1	8.0	40	2.68	15
50.36	45.9	19.5	-	45.8	1.5	-6.0	3.6	3	silty CLAY to CLAY	115	1.5	13	31	6	-	-	3.1	6.0	48	2.83	15
50.53	34.2	14.5	-	34.1	1.3	-6.2	4.3	3	silty CLAY to CLAY	115	1.5	10	23	5	-	-	2.3	4.4	58	2.99	15
50.69	37.6	15.9	-	37.5	1.5	-5.9	4.2	3	silty CLAY to CLAY	115	1.5	11	25	5	-	-	2.5	4.8	55	2.95	15
50.86	29.9	12.6	-	29.8	1.5	-5.9	5.7	3	silty CLAY to CLAY	115	1.5	8	20	4	-	-	1.9	3.7	67	3.12	15
51.02	36.1	15.2	-	36.0	1.7	-5.7	5.0	3	silty CLAY to CLAY	115	1.5	10	24	5	-	-	2.4	4.6	60	3.02	15
51.18	45.1	19.0	-	45.0	1.5	-5.5	3.5	3	silty CLAY to CLAY	115	1.5	13	30	5	-	-	3.0	5.8	48	2.83	15
51.35	49.5	20.8	-	49.3	1.4	-5.5	2.9	4	clayy SILT to silty CLAY	115	2.0	10	25	6	-	-	3.3	6.4	44	2.76	15
51.51	55.5	23.3	-	55.4	1.3	-5.5	2.5	4	clayy SILT to silty CLAY	115	2.0	12	28	6	-	-	3.8	7.3	39	2.67	15
51.68	55.9	23.4	-	55.7	1.3	-5.5	2.5	4	clayy SILT to silty CLAY	115	2.0	12	28	6	-	-	3.8	7.3	39	2.68	15
51.84	53.9	22.5	-	53.8	1.4	-5.5	2.8	4	clayy SILT to silty CLAY	115	2.0	11	27	6	-	-	3.6	7.0	41	2.72	15
52.00	50.8	21.2	-	50.7	1.5	-5.6	3.2	4	clayy SILT to silty CLAY	115	2.0	11	25	6	-	-	3.4	6.6	44	2.77	15
52.17	48.9	20.4	-	48.8	1.4	-5.6	3.1	4	clayy SILT to silty CLAY	115	2.0	10	24	6	-	-	3.3	6.3	45	2.78	15
52.33	45.1	18.8	-	45.0	1.1	-5.5	2.6	4	clayy SILT to silty CLAY	115	2.0	9	23	5	-	-	3.0	5.8	44	2.77	15
52.50	34.8	14.4	-	34.7	0.8	-5.5	2.6	3	silty CLAY to CLAY	115	1.5	10	23	4	-	-	2.3	4.3	50	2.87	15
52.66	22.1	9.1	-	22.0	0.6	-5.4	3.0	3	silty CLAY to CLAY	115	1.5	6	15	3	-	-	1.4	2.6	64	3.08	15
52.82	15.1	6.2	-	15.0	0.4	-5.3	3.5	3	silty CLAY to CLAY	115	1.5	4	10	2	-	-	0.9	1.6	80	3.29	15
52.99	13.7	5.6	-	13.6	0.6	-5.1	5.3	3	silty CLAY to CLAY	115	1.5	4	9	2	-	-	0.8	1.4	93	3.44	15
53.15	14.8	6.1	-	14.7	0.9	-5.0	7.6	2	Organic SOILS - Peats	100	1.0	6	15	3	-	-	1.3	1.6	95	3.49	10
53.32	20.8	8.6	-	20.7	0.9	-4.9	4.9	3	silty CLAY to CLAY	115	1.5	6	14	3	-	-	1.3	2.4	76	3.23	15
53.48	41.4	17.0	-	41.3	0.5	-4.7	1.4	4	clayy SILT to silty CLAY	115	2.0	8	21	4	-	-	2.8	5.2	38	2.66	15
53.64	65.9	41.0	73.7	65.8	0.7	-5.0	1.0	5	silty SAND to sandy SILT	120	4.0	10	16	9	38	33	-	-	21	2.25	16
53.81	64.9	40.3	86.5	64.8	1.0	-5.2	1.6	5	silty SAND to sandy SILT	120	4.0	10	16	9	37	33	-	-	25	2.36	16
53.97	48.4	19.8	-	48.4	0.8	-1.2	1.9	4	clayy SILT to silty CLAY	115	2.0	10	24	5	-	-	3.2	6.1	38	2.66	15
54.14	32.2	13.1	-	32.2	0.9	-1.8	3.1	3	silty CLAY to CLAY	115	1.5	9	21	4	-	-	2.1	3.9	55	2.94	15
54.30	27.3	11.1	-	27.2	0.9	-1.3	3.6	3	silty CLAY to CLAY	115	1.5	7	18	4	-	-	1.8	3.2	62	3.05	15
54.46	20.5	8.3	-	20.5	0.8	-1.3	4.5	3	silty CLAY to CLAY	115	1.5	6	14	3	-	-	1.3	2.3	75	3.22	15
54.63	16.3	6.6	-	16.3	0.5	-1.1	4.1	3	silty CLAY to CLAY	115	1.5	4	11	3	-	-	1.0	1.8	81	3.30	15
54.79	16.4	6.6	-	16.4	0.5	-0.9	3.7	3	silty CLAY to CLAY	115	1.5	4	11	3	-	-	1.0	1.8	79	3.27	15
54.96	16.2	6.6	-	16.2	0.5	-0.7	3.7	3	silty CLAY to CLAY	115	1.5	4	11	3	-	-	1.0	1.7	80	3.28	15
55.12	16.1	6.5	-	16.1	0.5	0.4	3.7	3	silty CLAY to CLAY	115	1.5	4	11	3	-	-	1.0	1.7	80	3.28	15
55.28	15.3	6.2	-	15.4	0.5	0.5	3.8	3	silty CLAY to CLAY	115	1.5	4	10	2	-	-	0.9	1.6	82	3.31	15
55.45	15.5	6.2	-	15.5	0.5	0.7	3.9	3	silty CLAY to CLAY	115	1.5	4	10	2	-	-	0.9	1.6	82	3.32	15
55.61	16.1	6.4	-	16.1	0.5	0.9	3.9	3	silty CLAY to CLAY	115	1.5	4	11	3	-	-	1.0	1.7	81	3.30	15
55.78	15.7	6.3	-	15.7	0.5	1.1	4.2	3	silty CLAY to CLAY	115	1.5	4	10	3	-	-	0.9	1.6	83	3.33	15
55.94	15.4	6.1	-	15.4	0.5	1.2	4.3	3	silty CLAY to CLAY	115	1.5	4	10	3	-	-	0.9	1.6	85	3.35	15
56.11	15.4	6.2	-	15.4	0.5	1.3	4.1	3	silty CLAY to CLAY	115	1.5	4	10	2	-	-	0.9	1.6	84	3.34	15
56.27	15.3	6.1	-	15.3	0.5	1.3	3.9	3	silty CLAY to CLAY	115	1.5	4	10	2	-	-	0.9	1.6	83	3.32	15
56.43	14.3	5.7	-	14.4	0.4	1.5	3.5	3	silty CLAY to CLAY	115	1.5	4	10	2	-	-	0.8	1.4	84	3.33	15
56.60	13.4	5.3	-	13.5	0.3	1.6	3.5	3	silty CLAY to CLAY	115	1.5	4	9	2	-	-	0.8	1.3	87	3.36	15
56.76	13.4	5.3	-	13.4	0.4	1.8	3.5	3	silty CLAY to CLAY	115	1.5	4	9	2	-	-	0.8	1.3	87	3.37	15
56.93	13.9	5.5	-	14.0	0.3	2.0	3.1	3	silty CLAY to CLAY	115	1.5	4	9	2	-	-	0.8	1.4	83	3.33	15
57.09	14.3	5.7	-	14.4	0.3	2.2	3.1	3	silty CLAY to CLAY	115	1.5	4	10	2	-	-	0.8	1.4	82	3.31	15
57.25	14.2	5.6	-	14.3	0.4	2.3	3.3	3	silty CLAY to CLAY	115	1.5	4	9	2	-	-	0.8	1.4	83	3.33	15
57.42	14.5	5.7	-	14.6	0.3	3.1	3.0	3	silty CLAY to CLAY	115	1.5	4	10	2	-	-	0.8	1.4	81	3.30	15
57.58	13.9	5.4	-	13.9	0.3	3.3	3.3	3	silty CLAY to CLAY	115	1.5	4	9	2	-	-	0.8	1.4	85	3.34	15
57.75	13.3	5.2	-	13.4	0.4	3.5	4.1	3	silty CLAY to CLAY	115	1.5	3	9	2	-	-	0.8	1.3	91	3.42	15
57.91	14.7	5.8	-	14.8	0.3	3.8	3.0	3	silty CLAY to CLAY	115	1.5	4	10	2	-	-	0.9	1.5	81	3.30	15
58.07	15.7	6.1	-	15.8	0.3	3.9	2.3	3	silty CLAY to CLAY	115	1.5	4	10	2	-	-	0.9	1.6	73	3.20	15
58.24	14.3	5.6	-	14.4	0.3	4.1	2.5	3	silty CLAY to CLAY	115	1.5	4	10	2	-	-	0.8	1.4	78	3.27	15
58.40	12.8	5.0	-	12.9	0.3	4.4	3.0	3	silty CLAY to CLAY	115	1.5	3	9	2	-	-	0.7	1.2	87	3.37	15
58.57	12.2	4.8	-	12.3	0.4	4.8	4.3	3	silty CLAY to CLAY	115	1.5	3	8	2	-	-	0.7	1.1	95	3.48	15
58.73	14.0	5.4	-	14.1	0.4	5.2	3.6	3	silty CLAY to CLAY	115	1.5	4	9	2	-	-	0.8	1.3	87	3.37	15
58.89	17.7	6.9	-	17.8	0.5	5.6	3.8	3	silty CLAY to CLAY	115	1.5	5	12	3	-	-	1.1	1.8	79	3.27	15
59.06	19.2	7.4	-	19.3	1.0	5.6	6.5	3	silty CLAY to CLAY	115	1.5	5	13	3	-	-	1.2	2.0	87	3.37	15
59.22	22.7	8.8	-	22.8	1.0	6.0	5.4	3	silty CLAY to CLAY	115	1.5	6	15	3	-	-	1.4	2.5	77	3.25	15
59.39	33.0	12.7	-	33.1	0.9	6.2	3.0	3	silty CLAY to CLAY	115	1.5	8	22	4	-	-	2.2	3.8	55	2.95	15
59.55	27.0	10.4	-	27.1	0.6	5.1	2.7	3	silty CLAY to CLAY	115	1.5	7	18	3	-	-	1.7	3.0	59	3.01	15
59.71	16.8	6.5	-	16.9	0.7	5.0	5.2	3	silty CLAY to CLAY	115	1.5	4	11	3	-	-	1.0	1.7	87	3.37	15
59.88	15.0	5.8	-	15.1	0.8	5.7	6.7	3	silty CLAY to CLAY	115	1.5	4	10	3	-	-	0.9	1.5	95	3.49	15
60.04	15.5	5.9	-	15.6	0.7	6.4	6.0	3	silty CLAY to CLAY	115	1.5	4	10	3	-	-	0.9	1.5	94	3.45	15
60.21	25.7	9.8	-	25.9	1.4	9.4	6.3	3	silty CLAY to CLAY	115	1.5	7	17	4	-	-	1.6	2.8	77	3.25	15
60.37	29.6	11.3	-	29.8	1.2	9.7	4.7	3	silty CLAY to CLAY	115	1.5	8	20	4	-	-	1.9	3.3	66	3.11	15
60.53	28.7	10.9	-	28.9	1.4	10.3	5.6	3	silty CLAY to CLAY	115	1.5	7	19	4	-	-	1.8	3.2	71	3.17	15
60.70	35.3	13.5	-	35.5	2.0	10.7	6.2	3	silty CLAY to CLAY	115	1.5	9	24	5	-	-	2.3	4.0	67	3.12	15
60.86	42.1	16.0	-	42.4	2.4	12.3	6.2	3	silty CLAY to CLAY	115	1.5	11	28	5	-	-	2.8	4.8	63	3.06	15
61.03	58.1	22.1	-	58.4	2.5	11.6	4.6	3	silty CLAY to CLAY	115	1.5	15	39	6	-	-	3.9	6.8	50	2.86	15
61.19	61.2	23.2	-	61.3	1.8	4.7	3.2	4	clayy SILT to silty CLAY	115	2.0	12	31	6	-	-	4.1	7.2	43	2.74	15
61.35	55.8	21.1	-	55.8	1.4	-0.4	2.6	4	clayy SILT to silty CLAY	115	2.0	11	28	6	-	-	3.8	6.5	42	2.72	15
61.52	34.3	13.0	-	34.3	1.1	-1.3	3.6	3	silty CLAY to CLAY	115	1.5	9	23	4	-	-	2.2	3.8	58	2.99	15
61.68	21.7	8.2	-	21.7	0.8	-0.9	4.2	3	silty CLAY to CLAY	115	1.5	5	14	3	-	-	1.3	2.2	74	3.22	15

* Indicates the parameter was calculated using the normalized point stress.
The parameters listed above were determined using empirical correlations.
A Professional Engineer must determine their suitability for analysis and design.

Middle Earth Geo Testing

US 101 Blossom Hill Rd IC Improvement Project

Project ID: Parikh Consultants
Data File: SDF(113).cpt
CPT Date: 9/26/2018 12:24:13 PM
GW During Test: 30 ft

Sounding ID: CPT-18-SC-003
Project No: 2016-146
Cone/Rig: DDG1418

. Depth ft	. qc PS tsf	* qc1n PS -	. q1ncs PS -	* qt PS tsf	. Slv Stss tsf	. pore prss (psi)	. Frct Rato %	* Mat Typ Zon	* Material Behavior Description	. Unit Wght pcf	. Qc to N	* SPT R-N1 60%	. SPT R-N 60%	* SPT IcN1 60%	* Rel Den %	* Ftn Ang deg	. Und Shr tsf	. OCR -	* Fin Ic %	* Ic SBT Indx	* Nk -
61.85	17.6	6.7	-	17.6	0.6	-0.3	4.1	3	silty CLAY to CLAY	115	1.5	4	12	3	-	-	1.1	1.7	81	3.30	15
62.01	16.8	6.4	-	16.8	0.5	0.1	4.0	3	silty CLAY to CLAY	115	1.5	4	11	3	-	-	1.0	1.6	82	3.32	15
62.17	15.8	6.0	-	15.9	0.5	0.4	4.1	3	silty CLAY to CLAY	115	1.5	4	11	2	-	-	0.9	1.5	86	3.35	15
62.34	15.9	6.0	-	15.9	0.5	0.7	4.2	3	silty CLAY to CLAY	115	1.5	4	11	2	-	-	0.9	1.5	86	3.36	15
62.50	16.8	6.4	-	16.9	0.5	1.0	4.1	3	silty CLAY to CLAY	115	1.5	4	11	3	-	-	1.0	1.6	83	3.32	15
62.67	17.5	6.6	-	17.5	0.6	1.3	4.1	3	silty CLAY to CLAY	115	1.5	4	12	3	-	-	1.0	1.7	82	3.31	15
62.83	18.0	6.8	-	18.0	0.6	1.6	4.0	3	silty CLAY to CLAY	115	1.5	5	12	3	-	-	1.1	1.8	80	3.29	15
63.00	17.6	6.7	-	17.7	0.5	1.8	3.8	3	silty CLAY to CLAY	115	1.5	4	12	3	-	-	1.1	1.7	80	3.29	15
63.16	17.7	6.7	-	17.8	0.5	2.1	3.3	3	silty CLAY to CLAY	115	1.5	4	12	3	-	-	1.1	1.7	77	3.25	15
63.32	17.1	6.4	-	17.1	0.7	2.3	5.3	3	silty CLAY to CLAY	115	1.5	4	11	3	-	-	1.0	1.6	88	3.38	15
63.49	18.1	6.8	-	18.2	1.6	2.7	9.9	2	Organic SOILS - Peats	100	1.0	7	18	3	-	-	1.6	1.8	95	3.52	10
63.65	29.9	11.3	-	29.9	1.8	3.4	6.9	3	silty CLAY to CLAY	115	1.5	8	20	4	-	-	1.9	3.2	74	3.22	15
63.82	64.5	24.3	-	64.5	1.8	2.7	3.0	4	clayy SILT to silty CLAY	115	2.0	12	32	7	-	-	4.4	7.4	41	2.71	15
63.98	84.4	49.8	108.1	84.3	1.7	-0.8	2.1	5	silty SAND to sandy SILT	120	4.0	12	21	11	44	34	-	-	25	2.36	16
64.14	93.2	55.0	103.6	93.1	1.6	-5.2	1.8	5	silty SAND to sandy SILT	120	4.0	14	23	12	47	34	-	-	22	2.28	16
64.31	98.9	58.3	92.3	98.8	1.2	-6.2	1.2	5	silty SAND to sandy SILT	120	4.0	15	25	12	49	35	-	-	18	2.16	16
64.47	95.6	56.3	95.9	95.5	1.3	-6.8	1.4	5	silty SAND to sandy SILT	120	4.0	14	24	12	48	34	-	-	19	2.21	16
64.64	68.9	40.5	85.0	68.8	1.0	-6.8	1.5	5	silty SAND to sandy SILT	120	4.0	10	17	9	37	32	-	-	24	2.34	16
64.80	39.0	14.7	-	38.9	0.9	-6.7	2.7	3	silty CLAY to CLAY	115	1.5	10	26	4	-	-	2.6	4.2	50	2.87	15
64.96	24.0	9.1	-	23.9	0.9	-6.4	4.6	3	silty CLAY to CLAY	115	1.5	6	16	3	-	-	1.5	2.4	73	3.20	15
65.13	26.7	10.1	-	26.7	0.9	-3.6	3.8	3	silty CLAY to CLAY	115	1.5	7	18	3	-	-	1.7	2.8	66	3.11	15
65.29	26.5	10.0	-	26.4	0.8	-3.4	3.4	3	silty CLAY to CLAY	115	1.5	7	18	3	-	-	1.7	2.7	64	3.08	15
65.46	30.7	11.6	-	30.6	0.7	-3.1	2.5	3	silty CLAY to CLAY	115	1.5	8	20	4	-	-	2.0	3.2	55	2.95	15
65.62	28.6	10.8	-	28.6	0.7	-3.1	2.6	3	silty CLAY to CLAY	115	1.5	7	19	3	-	-	1.8	3.0	58	2.99	15
65.78	21.1	8.0	-	21.1	0.6	-2.9	3.4	3	silty CLAY to CLAY	115	1.5	5	14	3	-	-	1.3	2.1	72	3.18	15
65.95	18.6	7.0	-	18.6	0.4	-2.8	2.8	3	silty CLAY to CLAY	115	1.5	5	12	3	-	-	1.1	1.8	72	3.19	15
66.11	17.7	6.7	-	17.6	0.3	-2.6	2.5	3	silty CLAY to CLAY	115	1.5	4	12	2	-	-	1.1	1.6	72	3.19	15
66.28	20.2	7.6	-	20.2	0.3	-2.4	2.0	3	silty CLAY to CLAY	115	1.5	5	13	3	-	-	1.2	1.9	65	3.09	15
66.44	17.0	6.4	-	17.0	0.3	-2.3	2.4	3	silty CLAY to CLAY	115	1.5	4	11	2	-	-	1.0	1.6	74	3.21	15
66.60	17.5	6.6	-	17.4	0.4	-2.1	3.1	3	silty CLAY to CLAY	115	1.5	4	12	2	-	-	1.0	1.6	77	3.25	15
66.77	18.0	6.8	-	18.0	1.1	-2.0	8.1	2	Organic SOILS - Peats	100	1.0	7	18	3	-	-	1.6	1.7	95	3.47	10
66.93	20.3	7.7	-	20.2	1.8	-1.8	9.9	2	Organic SOILS - Peats	100	1.0	8	20	3	-	-	1.9	1.9	95	3.48	10
67.10	53.4	20.2	-	53.4	3.0	-1.3	6.2	3	silty CLAY to CLAY	115	1.5	13	36	6	-	-	3.6	5.8	57	2.98	15
67.26	115.5	67.1	161.6	115.4	3.9	-1.6	3.5	4	clayy SILT to silty CLAY	115	2.0	34	58	16	-	-	8.0	9.9	27	2.42	15
67.42	96.0	55.7	138.6	96.0	2.8	-1.8	3.1	4	clayy SILT to silty CLAY	115	2.0	28	48	13	-	-	6.6	9.9	28	2.44	15
67.59	51.1	19.3	-	51.0	2.3	-1.6	4.9	3	silty CLAY to CLAY	115	1.5	13	34	6	-	-	3.4	5.5	54	2.93	15
67.75	28.6	10.8	-	28.7	2.3	2.9	9.2	3	silty CLAY to CLAY	115	1.5	7	19	4	-	-	1.8	2.9	83	3.32	15
67.92	37.8	14.3	-	38.0	3.4	9.1	9.9	3	silty CLAY to CLAY	115	1.5	10	25	5	-	-	2.5	4.0	76	3.24	15
68.08	91.8	34.7	-	92.0	4.0	9.3	4.5	3	silty CLAY to CLAY	115	1.5	23	61	9	-	-	6.3	9.9	41	2.70	15
68.24	214.7	124.1	183.2	214.8	5.0	6.3	2.4	5	silty SAND to sandy SILT	120	4.0	31	54	25	74	39	-	-	16	2.11	16
68.41	305.8	176.7	212.3	305.9	5.3	1.7	1.8	6	clean SAND to silty SAND	125	5.0	35	61	34	86	41	-	-	11	1.91	16
68.57	376.1	217.1	237.4	376.1	5.3	1.4	1.4	6	clean SAND to silty SAND	125	5.0	43	75	39	93	42	-	-	8	1.78	16
68.74	411.6	237.4	247.9	411.7	5.0	2.6	1.2	6	clean SAND to silty SAND	125	5.0	47	82	42	95	42	-	-	6	1.71	16
68.90	511.7	294.8	298.7	511.7	6.5	3.0	1.3	6	clean SAND to silty SAND	125	5.0	59	100	51	95	44	-	-	5	1.66	16
69.07	549.0	316.0	315.3	549.0	6.9	3.2	1.3	6	clean SAND to silty SAND	125	5.0	63	100	55	95	44	-	-	5	1.64	16
69.23	527.7	303.5	323.3	527.8	8.5	2.6	1.6	6	clean SAND to silty SAND	125	5.0	61	100	54	95	44	-	-	7	1.74	16
69.39	500.6	287.6	318.6	500.6	9.2	3.9	1.9	6	clean SAND to silty SAND	125	5.0	58	100	52	95	43	-	-	8	1.80	16
69.56	471.9	270.9	286.8	472.0	6.8	4.7	1.5	6	clean SAND to silty SAND	125	5.0	54	94	48	95	43	-	-	7	1.73	16
69.72	498.2	285.8	293.7	498.3	6.6	6.3	1.3	6	clean SAND to silty SAND	125	5.0	57	100	50	95	43	-	-	6	1.69	16

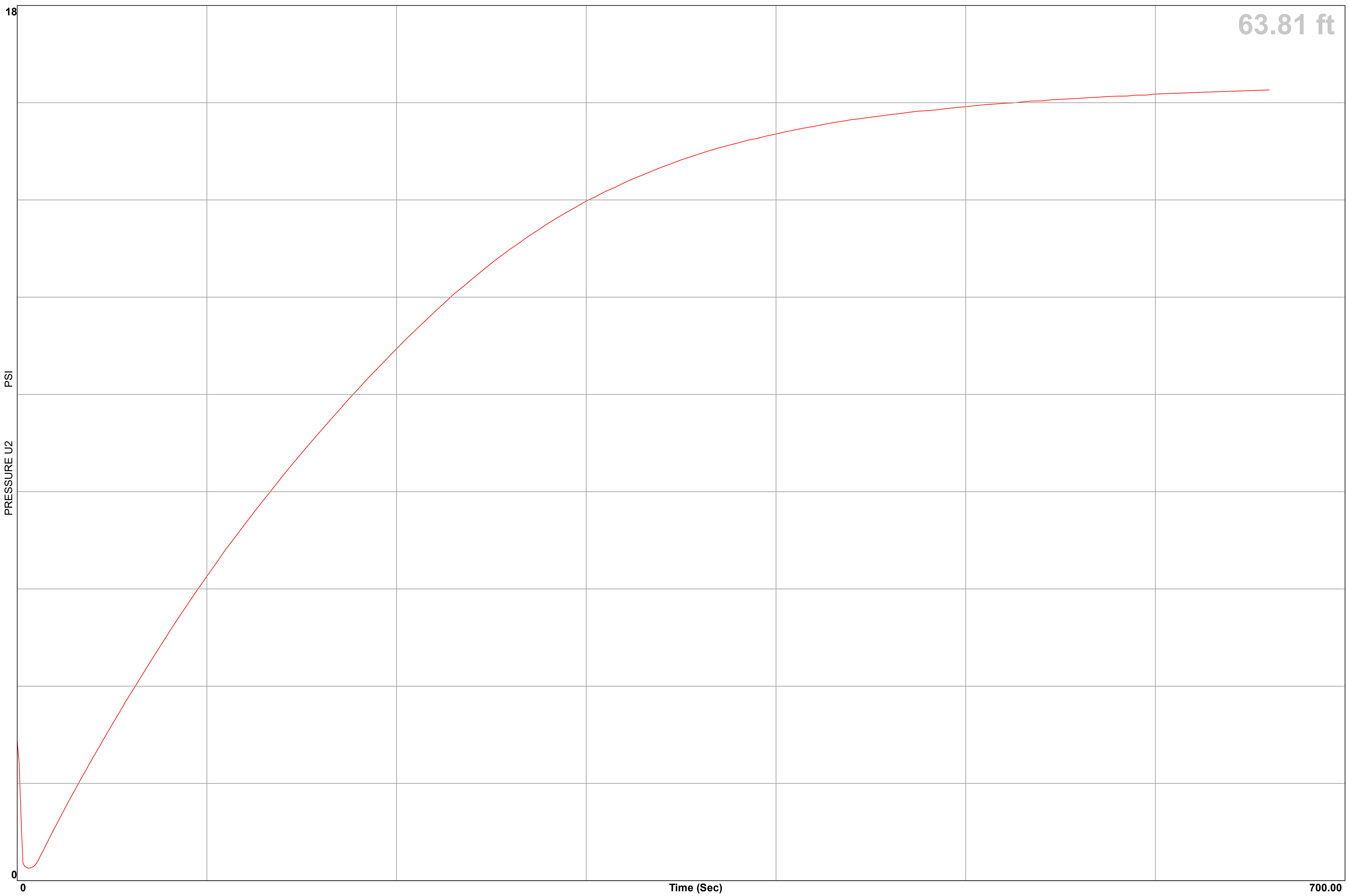
* Indicates the parameter was calculated using the normalized point stress.
The parameters listed above were determined using empirical correlations.
A Professional Engineer must determine their suitability for analysis and design.

Middle Earth Geo Testing

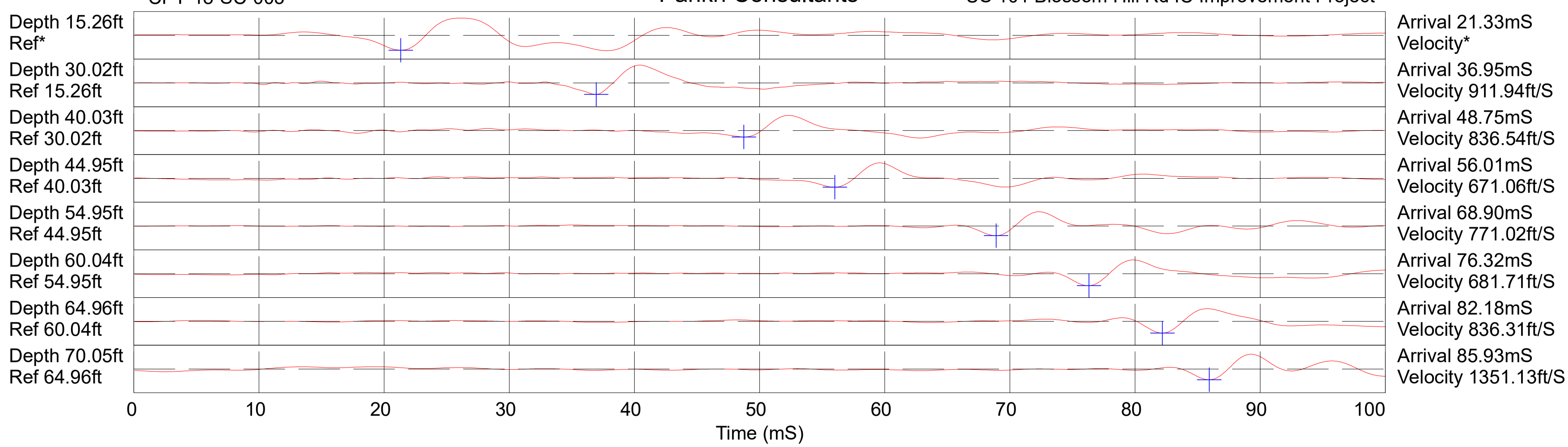
Parikh Consultants

Location	US 101 Blossom Hill Rd IC Improvement Pr	Operator	RB-JM
Job Number	2016-146	Cone Number	DDG1418
Hole Number	CPT-18-SC-003	Date and Time	9/26/2018 12:24:13 PM
Equilized Pressure	16.2	EST GW Depth During Test	26.3

GPS



CPT-18-SC-003 — Parikh Consultants — US 101 Blossom Hill Rd IC Improvement Project



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

COMMENT:

APPENDIX IV

APPENDIX IV
LABORATORY TESTS

Classification Tests

The field classification of the samples was visually verified in the laboratory according to the Unified Soil Classification System. The results are presented on “Log of Test Borings”, Appendix II.

Moisture-Density

The natural moisture contents were determined for selected undisturbed samples of the soils in accordance with American Standard Test Method (ASTM) D-2216 and dry unit weights were calculated based on natural moisture contents and total unit weights. This information was used to classify and correlate the soils. The results are presented on Plate IV-1, "Laboratory Test Summary ", Appendix IV.

Atterberg Limits

The Atterberg Limits were determined for selected samples of the fine-grained materials. These results were used to classify the soils, as well as to obtain an indication of the expansion potential with variations in moisture content. The Atterberg Limits were determined in accordance with ASTM D-4318. The results of the test are presented on Plate IV-2, "Plasticity Chart", Appendix IV.

Grain Size Classification

Grain size classification tests (ASTM D-422) were performed on selected samples of granular soil to aid in the classification. The results are presented on Plates. IV-3A and IV-3B, "Grain Size Distribution Curves", Appendix IV.

Unconfined Compression Tests

Strength tests were performed on selected undisturbed samples using unconfined compression machine. Unconfined compression tests were performed in accordance with ASTM D 2166. The results are presented on Plates IV-4A through IV-4H, "Unconfined Compression Test", Appendix IV.

Corrosion Tests

Corrosion tests were performed on selected samples to determine the corrosion potential of the soils. The pH and minimum resistivity tests were performed according to California Test Method CT-643. Sulfate (California Test Method CT-417) and chloride (California Test Method CT-422) tests were performed by Sunland Analytical. The test results are presented on Plates IV-5A and IV-5B, Appendix IV.

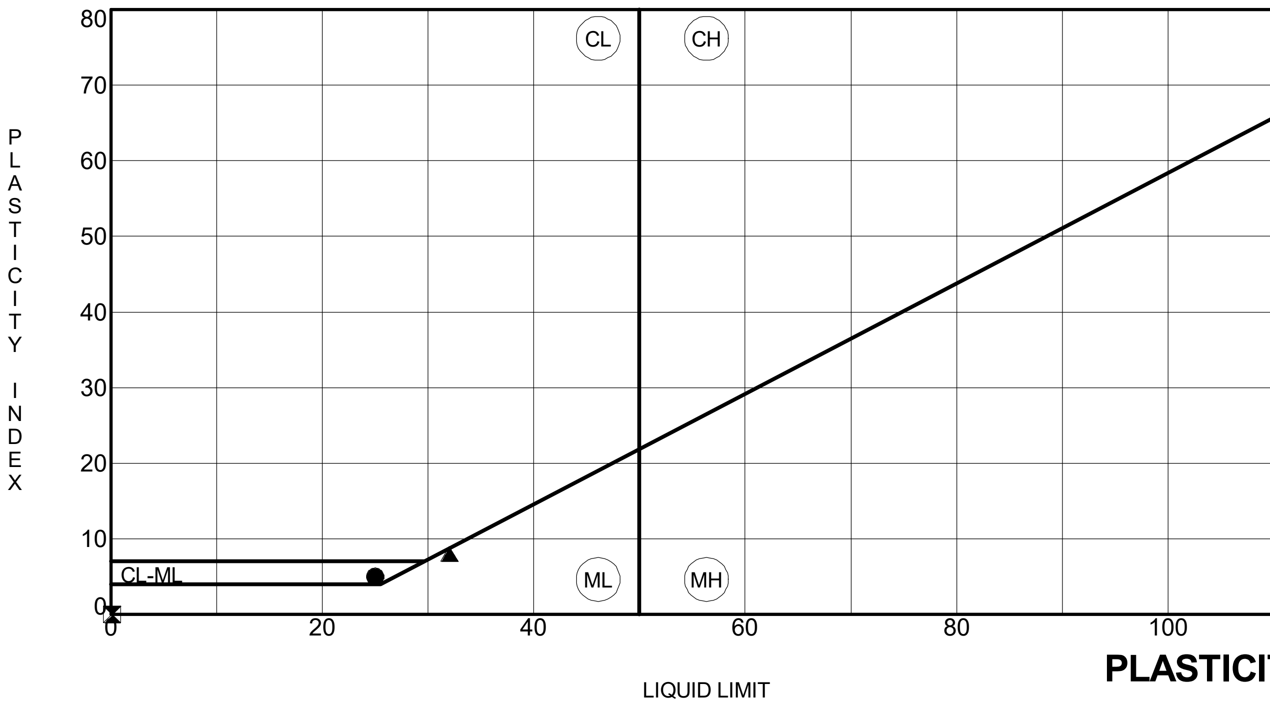
Consolidation Tests

Consolidation tests were performed on selected samples to determine the consolidation potential of the soils. The consolidation test was performed in general accordance with ASTM D 2435. The test results are presented on Plates IV-6A through IV-6C, Appendix IV.

LABORATORY TEST SUMMARY

Borehole	Sample Number	Depth	Classi-fication	Water Content	Dry Density	Liquid Limit	Plastic Limit	Plasticity Index	% > Sieve 4	% < Sieve 200	Unconfined Shear Strength (tsf)
R-18-SC-001	1	3.0	SM	23.2	99.8						
R-18-SC-001	2	6.0	SM	30.1	91.2						
R-18-SC-001	3	11.0	CL	26.2	98.7						
R-18-SC-001	4	16.0	CL	22.2	100.0						1.3
R-18-SC-001	5	21.0	CL	25.4	-						
R-18-SC-001	6	26.0	SC	28.9	98.2				25.0	28.0	
R-18-SC-001	7	31.0	SC	11.1	139.7				39.3	15.7	
R-18-SC-001	8	36.0	CL	18.3	108.6						0.5
R-18-SC-001	9	41.0	CL	19.4	106.4	25	20	5			
R-18-SC-001	10	46.0	SP-SM	6.8	-						
R-18-SC-001	11	51.0	SP-SM	8.3	-						
R-18-SC-001	12	56.0	SP-SM	11.6	-				28.7	9.3	
R-18-SC-001	13	61.0	SP-SM	12.5	-						
R-18-SC-001	14	71.0	ML	26.6	96.9	NP	NP	NP			0.1
R-18-SC-001	15	81.0	SP-SC	15.6	123.7				21.5	28.0	
R-18-SC-001	16	91.0	CL	26.8	96.5						1.0
R-18-SC-001	17	101.0	CH	22.8	113.7						1.2
R-18-SC-001	18	111.0	SP-SM	8.2	-						
R-18-SC-001	19	121.0	CL	22.8	104.7						
R-18-SC-001	20	131.0	CL	15.2	-						
R-18-SC-002	1	3.0	SC	6.7	-						
R-18-SC-002	2	6.0	SC	20.9	104.6						
R-18-SC-002	3	11.0	SC	20.3	102.7				22.8	23.2	
R-18-SC-002	4	16.0	SM	24.2	102.7				13.4	29.9	
R-18-SC-002	5	21.0	SC	25.8	98.3				26.5	28.4	
R-18-SC-002	6	26.0	ML	18.6	-						
R-18-SC-002	7	31.0	ML	23.2	79.3						0.2
R-18-SC-002	8	36.0	ML	18.6	105.9						0.5
R-18-SC-002	9	41.0	ML	17.8	107.9				0.0	81.4	
R-18-SC-002	10	46.0	ML	-	-						
R-18-SC-002	11	51.0	ML	28.2	98.4	32	24	8			
R-18-SC-002	12	56.0	ML	25.1	103.9						
R-18-SC-002	13	61.0	ML	21.8	105.6						0.5
R-18-SC-002	14	71.0	SP-SM	11.5	130.0				28.0	8.9	
R-18-SC-002	15	81.0	CL-ML	26.0	-						
R-18-SC-002	16	91.0	SM	8.3	-						
R-18-SC-002	17	101.0	SP-SM	9.7	-						
R-18-SC-002	18	111.0	ML	26.7	-						
R-18-SC-002	19	121.0	CL/CH	24.9	-						

ATTERBERG LIMITS



PLASTICITY

	BOREHOLE	SAMPLE #	DEPTH	LL	PL	PI	Fines	Classification
●	**R-18-SC-001**	**9**	**41.0**	**25**	**20**	**5**		**Lean CLAY with SAND**
⧗	**R-18-SC-001**	**14**	**71.0**	**NP**	**NP**	**NP**		**SILT with SAND**
▲	**R-18-SC-002**	**11**	**51.0**	**32**	**24**	**8**		**SILT with SAND**

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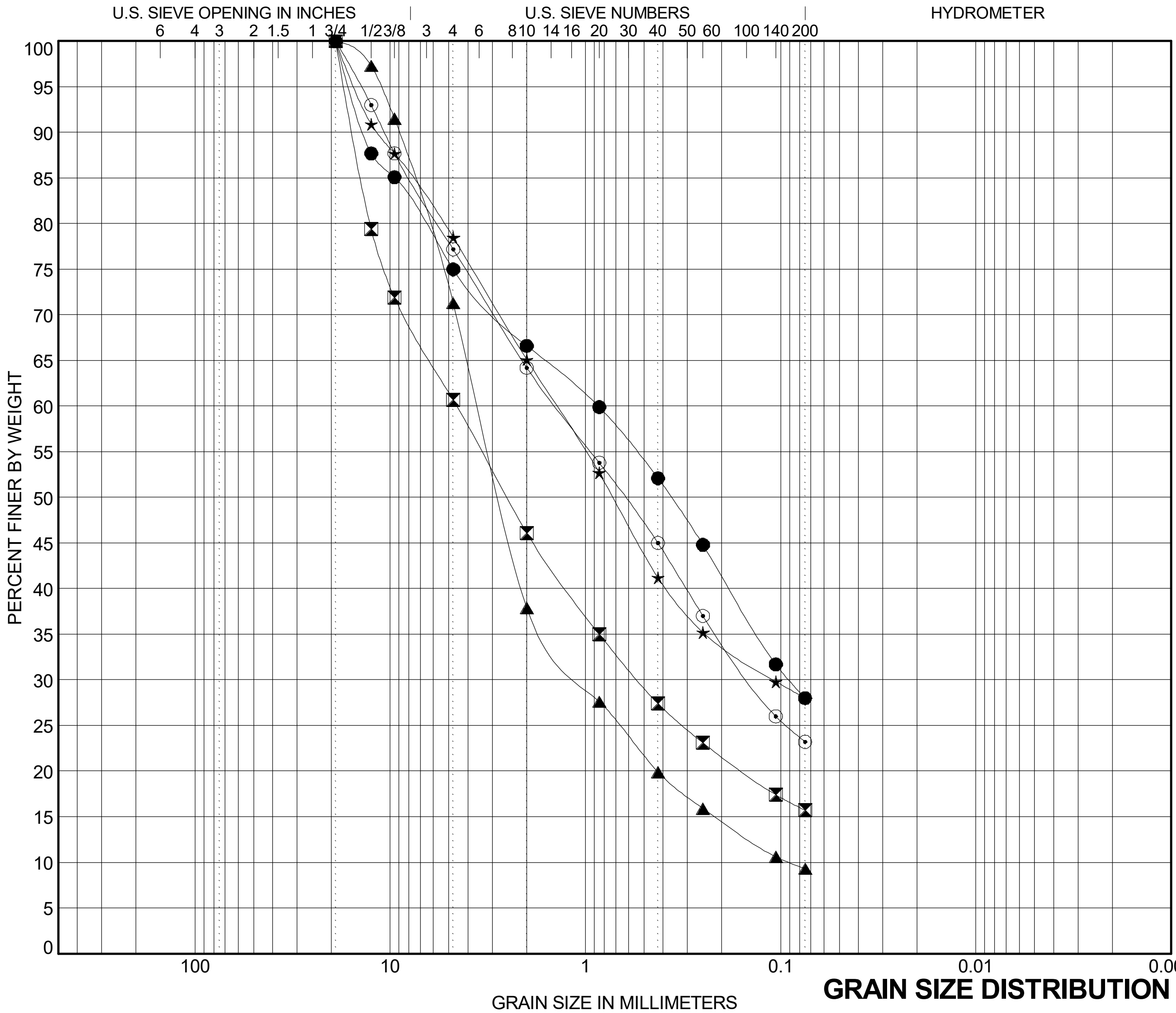
BLOSSOM HILL ROAD OVERCROSSING (WIDEN)
SAN JOSE, CALIFORNIA

JOB NO: 2016-146-BOC | **PLATE NO: IV-2**

GRAIN SIZE DISTRIBUTION CURVE



GRAIN SIZE DISTRIBUTION

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING	SAMPLE #	DEPTH	Classification	LL	PL	PI	Cc	Cu
●	**R-18-SC-001**	**6**	**26.0**	**CLAYEY SAND with GRAVEL**					
⧗	**R-18-SC-001**	**7**	**31.0**	**CLAYEY SAND with GRAVEL**					
▲	**R-18-SC-001**	**12**	**56.0**	**Poorly graded SAND with SILT and GRAVEL**				**3.36**	**39.23**
★	**R-18-SC-001**	**15**	**81.0**	**CLAYEY SAND with GRAVEL**					
⊙	**R-18-SC-002**	**3**	**11.0**	**CLAYEY SAND with GRAVEL**					

	BORING	SAMPLE #	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**R-18-SC-001**	**6**	**26.0**	**19**	**0.861**	**0.09**		**25.0**	**47.0**	**28.0**	
⧗	**R-18-SC-001**	**7**	**31.0**	**19**	**4.557**	**0.539**		**39.3**	**45.0**	**15.7**	
▲	**R-18-SC-001**	**12**	**56.0**	**19**	**3.545**	**1.038**	**0.09**	**28.7**	**62.0**	**9.3**	
★	**R-18-SC-001**	**15**	**81.0**	**19**	**1.407**	**0.109**		**21.5**	**50.5**	**28.0**	
⊙	**R-18-SC-002**	**3**	**11.0**	**19**	**1.416**	**0.145**		**22.8**	**54.0**	**23.2**	

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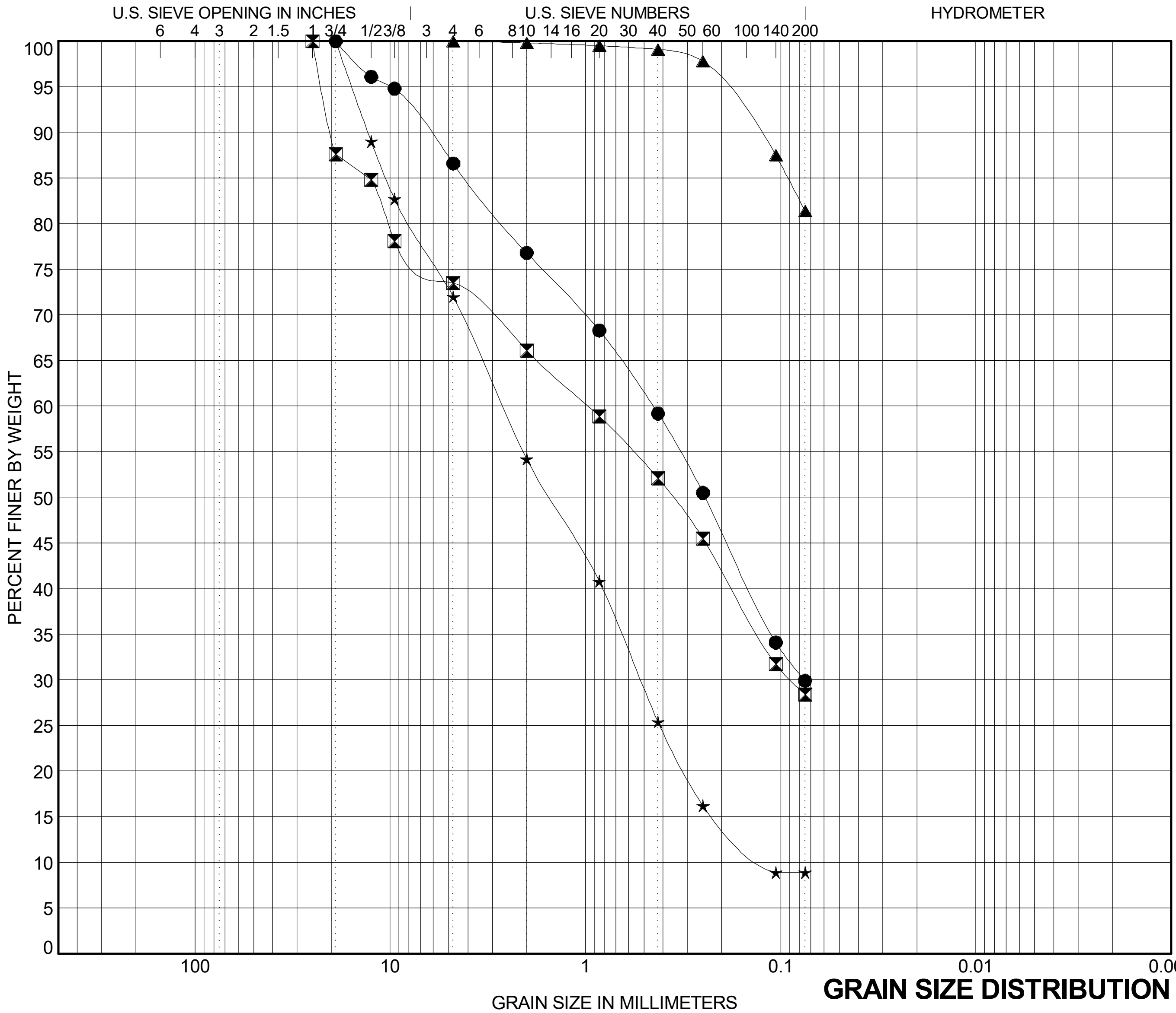
BLOSSOM HILL ROAD OVERCROSSING (WIDEN)
SAN JOSE, CALIFORNIA

JOB NO: 2016-146-BOC | **PLATE NO: IV-3A**



GRAIN SIZE DISTRIBUTION

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING	SAMPLE #	DEPTH	Classification	LL	PL	PI	Cc	Cu
●	**R-18-SC-002**	**4**	**16.0**	**SILTY SAND**					
⧗	**R-18-SC-002**	**5**	**21.0**	**CLAYEY SAND with GRAVEL**					
▲	**R-18-SC-002**	**9**	**41.0**	**SILT with SAND**					
★	**R-18-SC-002**	**14**	**71.0**	**Poorly graded SAND with SILT and GRAVEL**				**0.85**	**21.98**

	BORING	SAMPLE #	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**R-18-SC-002**	**4**	**16.0**	**19**	**0.452**	**0.076**		**13.4**	**56.7**	**29.9**	
⧗	**R-18-SC-002**	**5**	**21.0**	**25**	**0.969**	**0.089**		**26.5**	**45.1**	**28.4**	
▲	**R-18-SC-002**	**9**	**41.0**	**4.75**				**0.0**	**18.6**	**81.4**	
★	**R-18-SC-002**	**14**	**71.0**	**19**	**2.651**	**0.523**	**0.121**	**28.0**	**63.1**	**8.9**	

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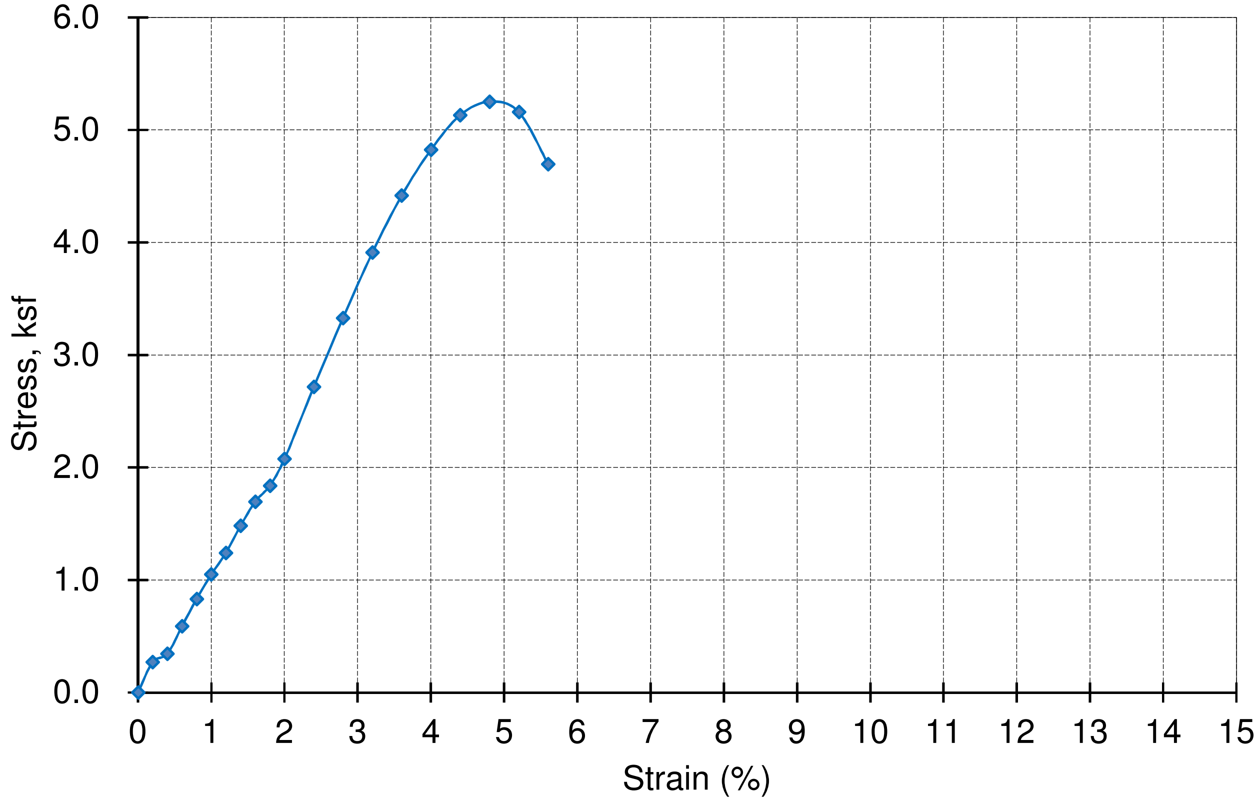
BLOSSOM HILL ROAD OVERCROSSING (WIDEN)
SAN JOSE, CALIFORNIA

JOB NO: 2016-146-BOC | **PLATE NO: IV-3B**

UNCONFINED COMPRESSION TEST

UNCONFINED COMPRESSION TEST



Boring No.:	R-18-SC-001
Sample No. :	4
Depth (feet):	16
Sample Type:	MC - 2.416 inch dia.
Test Method	ASTM D2166
Material Type:	CL
Material Description:	Sandy Lean Clay

Unconfined Compressive Strength (ksf):	5.25
Shear Strength (ksf)	2.63
Strain @ Failure (%):	4.8
Initial Dry Density (pcf):	100
Water Content (%):	22.2

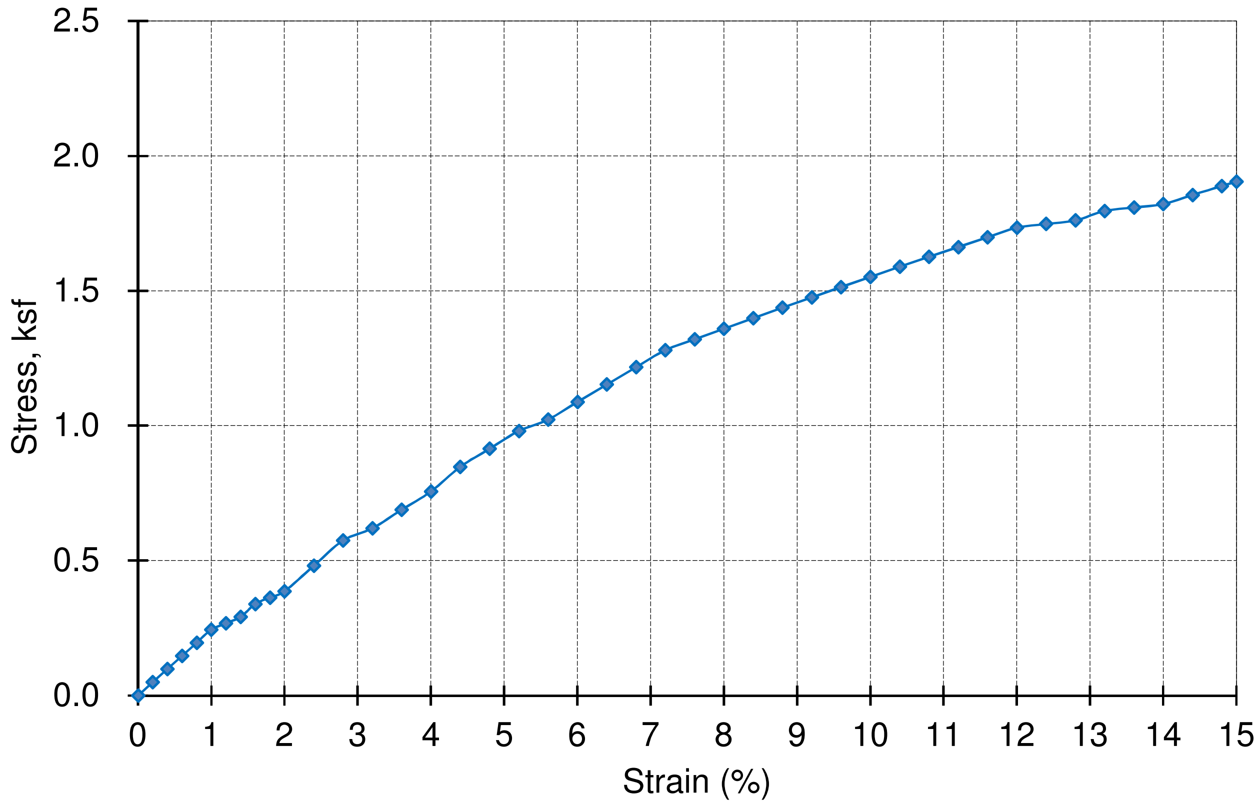
Initial Height (inch):	5.00
Initial Diameter (inch)	2.42
Initial Area (ft^2):	0.032
Strain Rate (inch/min)	0.1

Remarks:

PARIKH
Practicing in the Geosciences

BLOSSOM HILL ROAD OVERCROSSING (WIDEN) SAN JOSE, CALIFORNIA	
JOB NO.: 2016-146-BOC	PLATE NO.: IV-4A

UNCONFINED COMPRESSION TEST



Boring No.:	R-18-SC-001	**Unconfined Compressive Strength (ksf):**	1.90
Sample No. :	8	**Shear Strength (ksf)**	0.95
Depth (feet):	36	**Strain @ Failure (%):**	15.0
Sample Type:	MC - 2.416 inch dia.	**Initial Dry Density (pcf):**	109
Test Method	ASTM D2166	**Water Content (%):**	18.3
Material Type:	CL		
Material Description:	Lean Clay with Sand		

Initial Height (inch):	5.00
Initial Diameter (inch)	2.42
Initial Area (ft^2):	0.032
Strain Rate (inch/min)	0.1

Remarks:

PARIKH
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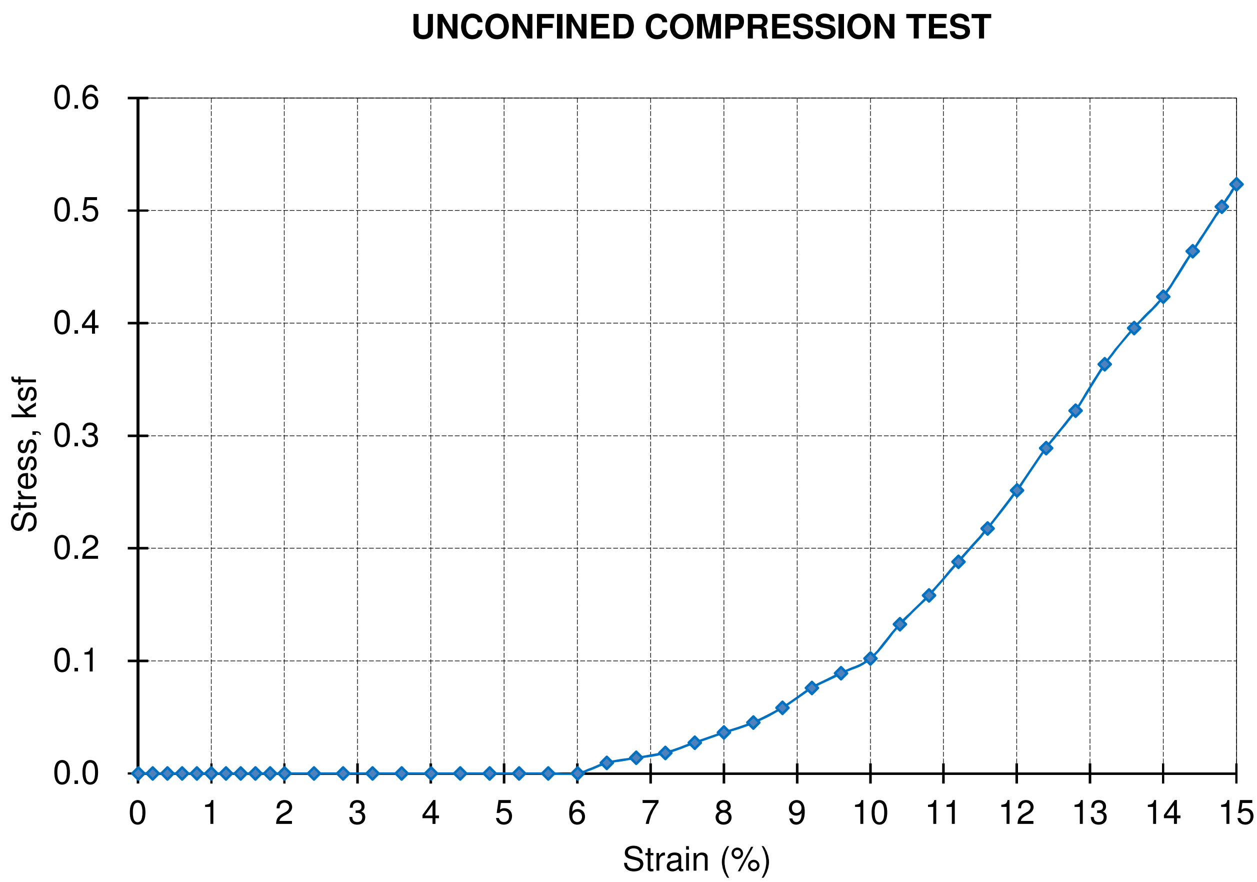
BLOSSOM HILL ROAD OVERCROSSING (WIDEN)
SAN JOSE, CALIFORNIA

JOB NO.: 2016-146-BOC	**PLATE NO.: IV-4B**



Boring No.:	R-18-SC-001	**Unconfined Compressive Strength (ksf):**	0.52
Sample No. :	14	**Shear Strength (ksf)**	0.26
Depth (feet):	71	**Strain @ Failure (%):**	15.0
Sample Type:	MC - 2.416 inch dia.	**Initial Dry Density (pcf):**	97
Test Method	ASTM D2166	**Water Content (%):**	26.6
Material Type:	ML		
Material Description:	Silt with Sand		

Initial Height (inch):	5.00
Initial Diameter (inch)	2.42
Initial Area (ft^2):	0.032
Strain Rate (inch/min)	0.1

Remarks:

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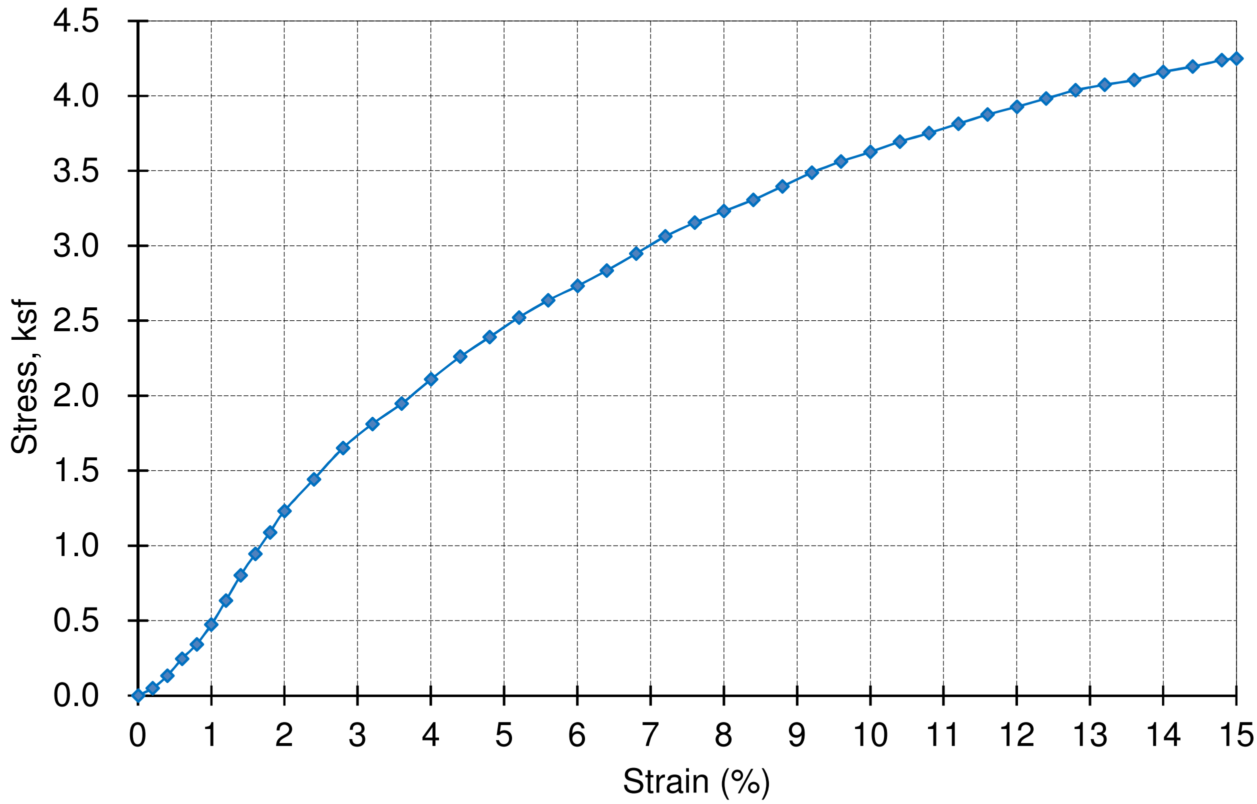
BLOSSOM HILL ROAD OVERCROSSING (WIDEN)
SAN JOSE, CALIFORNIA

JOB NO.: 2016-146-BOC | PLATE NO.: IV-4C

UNCONFINED COMPRESSION TEST



Boring No.:	R-18-SC-001	**Unconfined Compressive Strength (ksf):**	4.25
Sample No. :	16	**Shear Strength (ksf)**	2.12
Depth (feet):	91	**Strain @ Failure (%):**	15.0
Sample Type:	MC - 2.416 inch dia.	**Initial Dry Density (pcf):**	97
Test Method	ASTM D2166	**Water Content (%):**	26.8
Material Type:	CL		
Material Description:	Lean Clay		

Initial Height (inch):	5.00
Initial Diameter (inch)	2.42
Initial Area (ft^2):	0.032
Strain Rate (inch/min)	0.1

Remarks:

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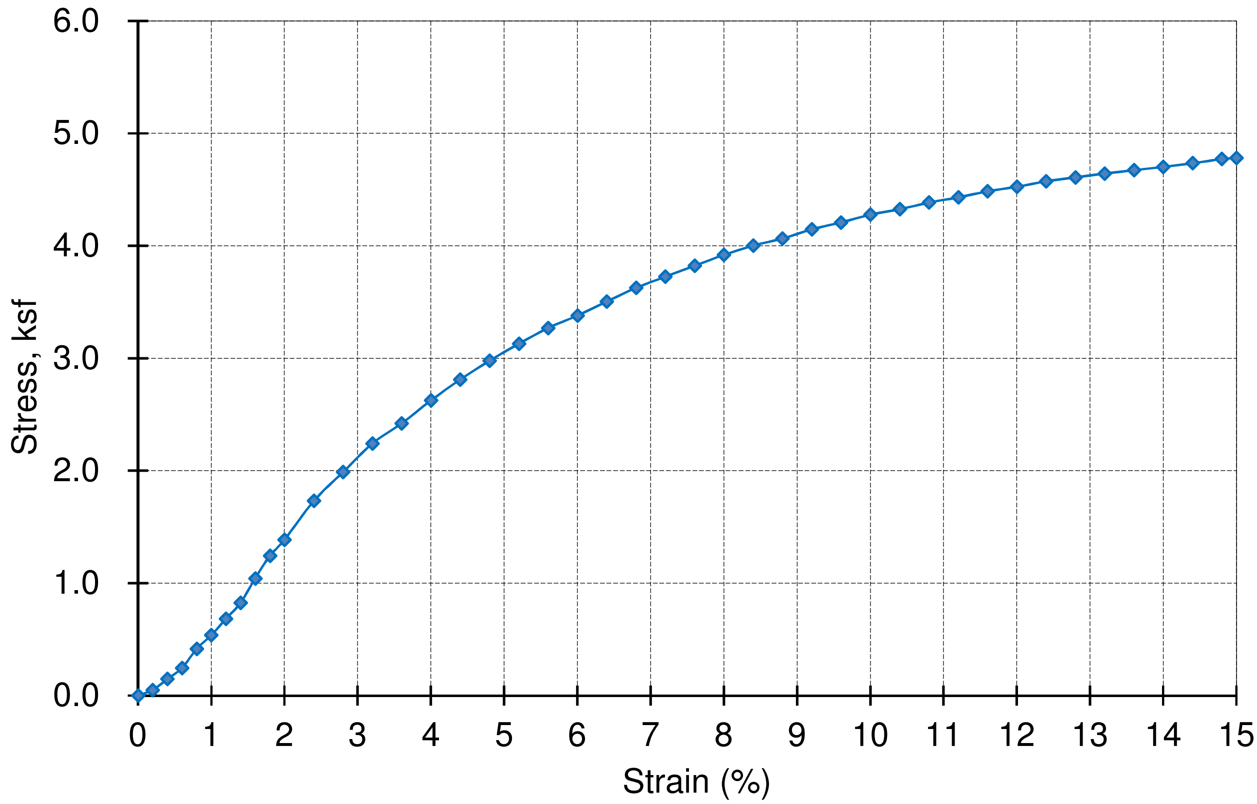
BLOSSOM HILL ROAD OVERCROSSING (WIDEN) SAN JOSE, CALIFORNIA	
JOB NO.: 2016-146-BOC	PLATE NO.: IV-4D

UNCONFINED COMPRESSION TEST



Boring No.:	R-18-SC-001	**Unconfined Compressive Strength (ksf):**	4.78
Sample No. :	17	**Shear Strength (ksf)**	2.39
Depth (feet):	101	**Strain @ Failure (%):**	15.0
Sample Type:	MC - 2.416 inch dia.	**Initial Dry Density (pcf):**	114
Test Method	ASTM D2166	**Water Content (%):**	22.8
Material Type:	CH		
Material Description:	Fat Clay		

Initial Height (inch):	5.00
Initial Diameter (inch)	2.42
Initial Area (ft^2):	0.032
Strain Rate (inch/min)	0.1

Remarks:

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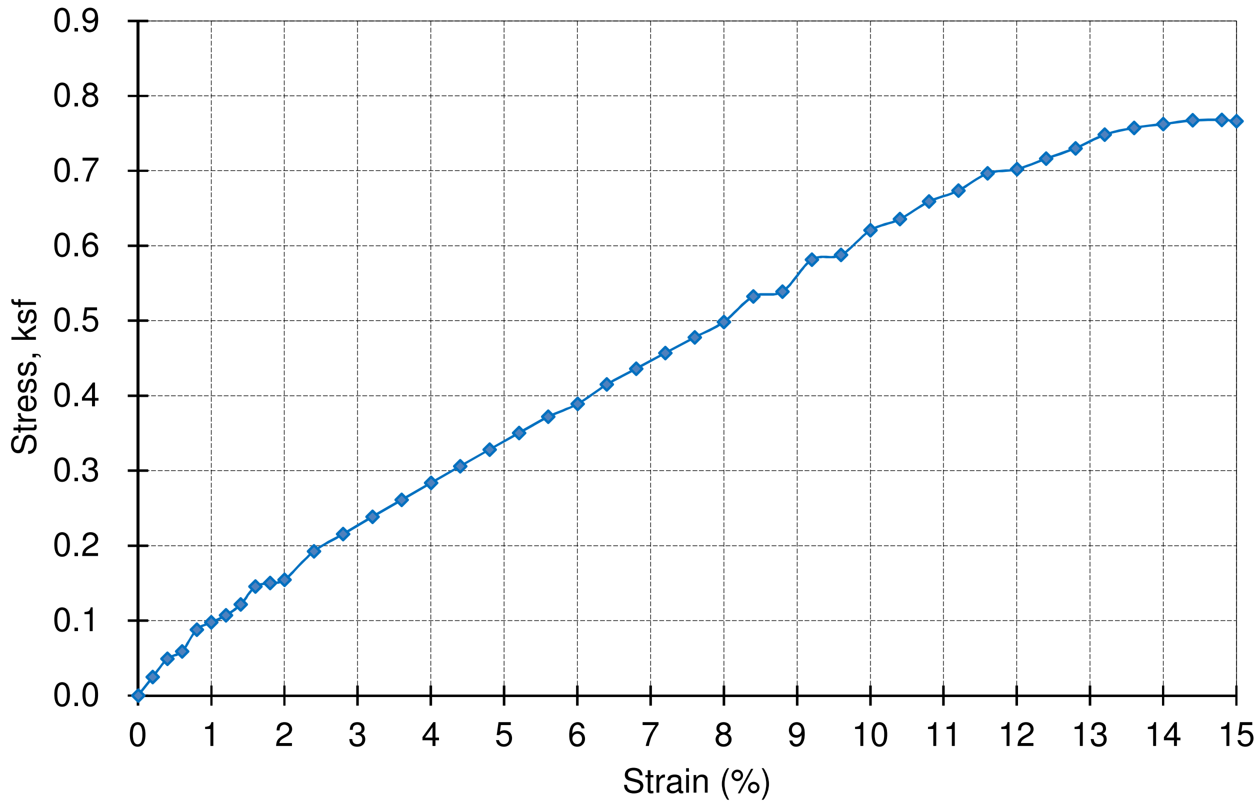
BLOSSOM HILL ROAD OVERCROSSING (WIDEN) **SAN JOSE, CALIFORNIA**	
JOB NO.: 2016-146-BOC	**PLATE NO.: IV-4E**

UNCONFINED COMPRESSION TEST



Boring No.:	R-18-SC-002	**Unconfined Compressive Strength (ksf):**	0.77
Sample No. :	7	**Shear Strength (ksf)**	0.38
Depth (feet):	31	**Strain @ Failure (%):**	14.8
Sample Type:	MC - 2.416 inch dia.	**Initial Dry Density (pcf):**	79
Test Method	ASTM D2166	**Water Content (%):**	23.2
Material Type:	ML		
Material Description:	Silt with Sand		

Initial Height (inch): 5.00
Initial Diameter (inch) 2.42
Initial Area (ft^2): 0.032
Strain Rate (inch/min) 0.1

Remarks:

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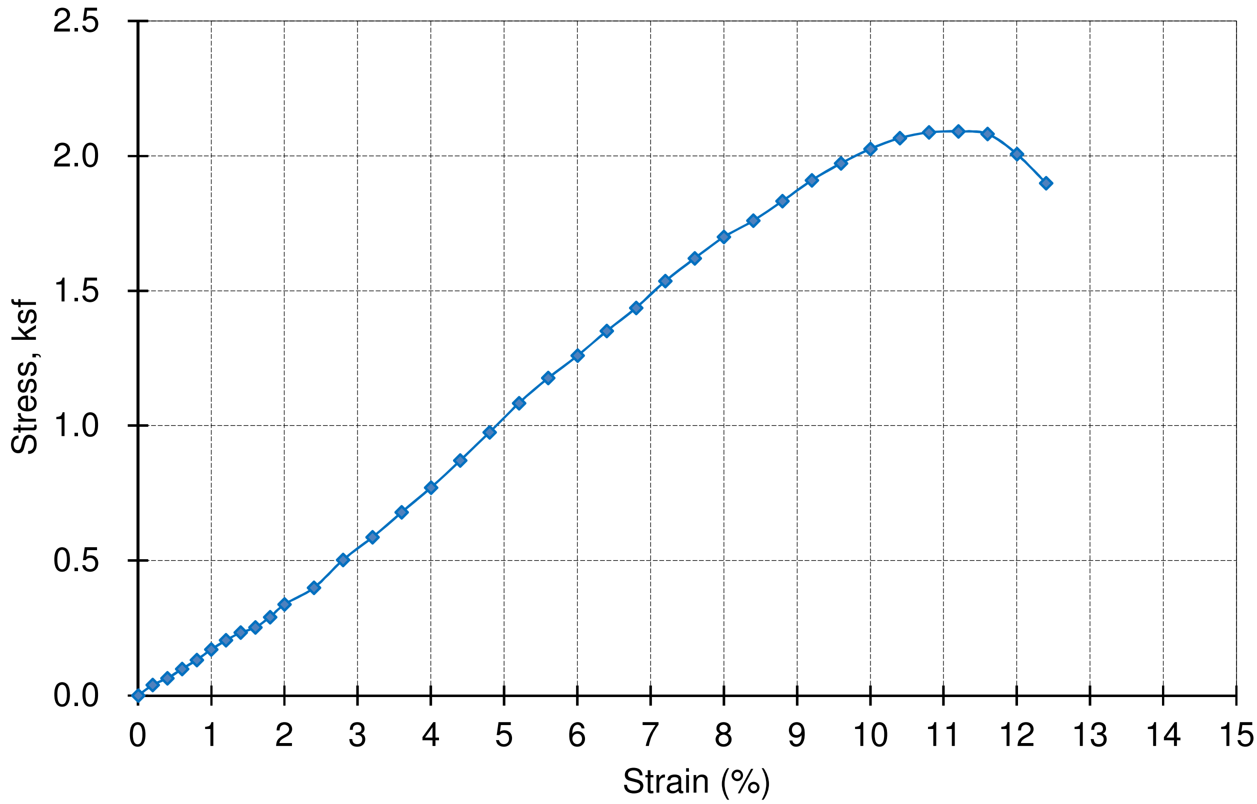
BLOSSOM HILL ROAD OVERCROSSING (WIDEN)
SAN JOSE, CALIFORNIA

JOB NO.: 2016-146-BOC | **PLATE NO.: IV-4F**

UNCONFINED COMPRESSION TEST



Boring No.:	R-18-SC-002	**Unconfined Compressive Strength (ksf):**	2.09
Sample No. :	8	**Shear Strength (ksf)**	1.05
Depth (feet):	36	**Strain @ Failure (%):**	11.2
Sample Type:	MC - 2.416 inch dia.	**Initial Dry Density (pcf):**	106
Test Method	ASTM D2166	**Water Content (%):**	18.6
Material Type:	ML		
Material Description:	Silt with Sand		

Initial Height (inch): 5.00
Initial Diameter (inch) 2.42
Initial Area (ft^2): 0.032
Strain Rate (inch/min) 0.1

Remarks:

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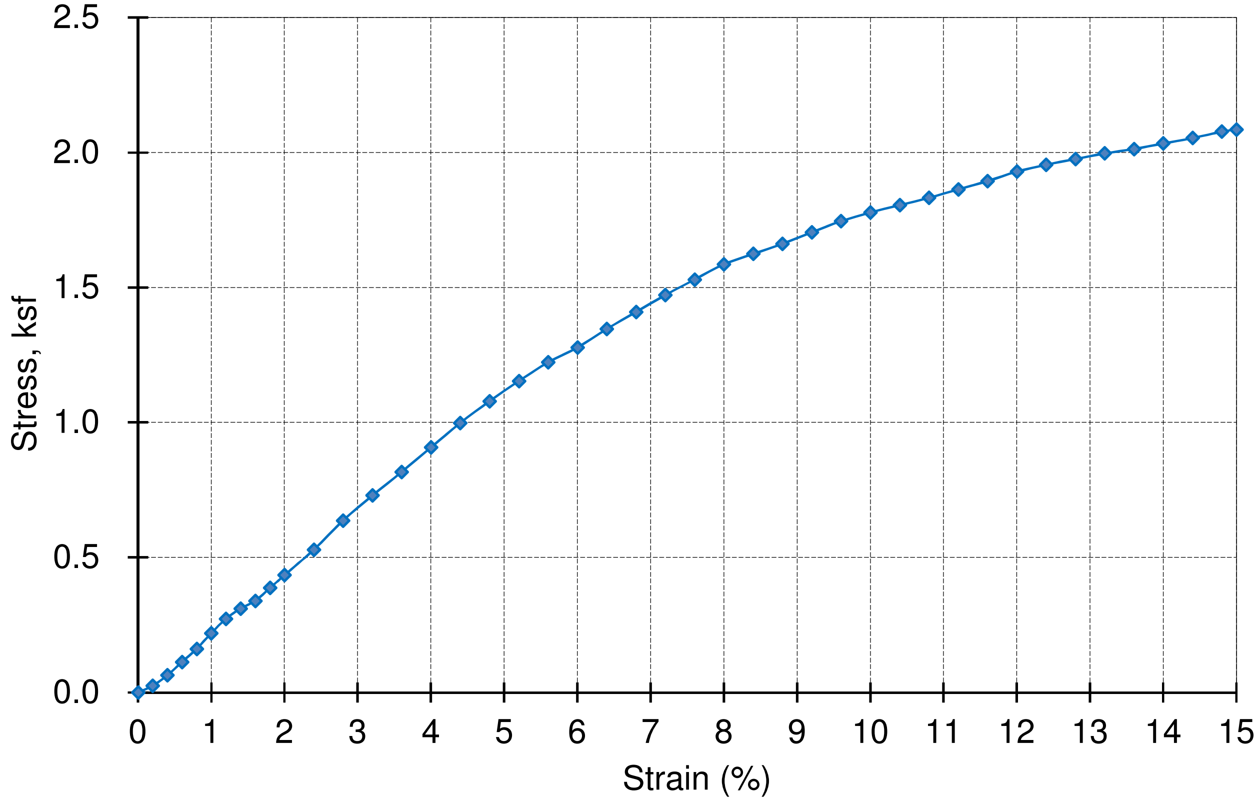
BLOSSOM HILL ROAD OVERCROSSING (WIDEN) SAN JOSE, CALIFORNIA	
JOB NO.: 2016-146-BOC	PLATE NO.: IV-4G

UNCONFINED COMPRESSION TEST



Boring No.:	R-18-SC-002	**Unconfined Compressive Strength (ksf):**	2.08
Sample No. :	13	**Shear Strength (ksf)**	1.04
Depth (feet):	61	**Strain @ Failure (%):**	15.0
Sample Type:	MC - 2.416 inch dia.	**Initial Dry Density (pcf):**	106
Test Method	ASTM D2166	**Water Content (%):**	21.8
Material Type:	ML		
Material Description:	Silt with Sand		

Initial Height (inch): 5.00
Initial Diameter (inch) 2.42
Initial Area (ft^2): 0.032
Strain Rate (inch/min) 0.1

Remarks:

PARIKH
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BLOSSOM HILL ROAD OVERCROSSING (WIDEN) **SAN JOSE, CALIFORNIA**	
JOB NO.: 2016-146-BOC	**PLATE NO.: IV-4H**

CORROSION TEST

Sunland Analytical
11419 Sunrise Gold Cir.#10
Rancho Cordova, CA 95742
(916) 852-8557

Date Reported 09/26/18
Date Submitted 09/21/18

To: Nasir Ahmad
Parikh Consultants Inc.
2360 Qume Dr. Suite A
San Jose, CA, 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following:
Location : 2016-146-BOC Site ID: R18-SC-001
Thank you for your business.

* For future reference to this analysis please use SUN # 78103 - 163332

EVALUATION FOR SOIL CORROSION

Soil pH	7.18		
Minimum Resistivity	2.68	ohm-cm (x1000)	
Chloride	4.6 ppm	0.0005	%
Sulfate-S	0.9 ppm	0.0001	%

METHODS:
pH and Min.Resistivity CA DOT Test #643 Mod.(Sm.Cell)
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

Sunland Analytical
11419 Sunrise Gold Cir.#10
Rancho Cordova, CA 95742
(916) 852-8557

Date Reported 09/26/18
Date Submitted 09/21/18

To: Nasir Ahmad
Parikh Consultants Inc.
2360 Qume Dr. Suite A
San Jose, CA, 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following:
Location : 2016-146-BOC Site ID: R18-SC-002
Thank you for your business.

* For future reference to this analysis please use SUN # 78103 - 163333

EVALUATION FOR SOIL CORROSION

Soil pH	7.36	
Minimum Resistivity	1.88	ohm-cm (x1000)
Chloride	9.4 ppm	0.0009 %
Sulfate-S	29.7 ppm	0.003 %

METHODS:
pH and Min.Resistivity CA DOT Test #643 Mod.(Sm.Cell)
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

CONSOLIDATION TEST

One Dimensional Consolidation Properties
(Oedometer)

Client	PARIKH CONSULTANTS	**Lab Ref**	
Project	Blossom Hill Road Interchange Improv. BOC	**Job**	2016-146-BOC
Borehole	R18-SC-001	**Sample**	9
Location		**Depth**	41

Test Details

Standard	ASTM D2435-96 / AASHTO T216-94	**Particle Specific Gravity**	2.65
Sample Type	Modified California Test Sample	**Lab. Temperature**	72.0 deg.F
Method of Testing (A/B)	A		
Sample Description	Silty Clay with Sand, medium stiff, light olive		
Variations from Procedure	None		

Specimen Details

Specimen Reference	A	**Description**	
Depth within Sample	0.7250 in	**Orientation within Sample**	
Specimen Mass	0.1062 lb	**Condition**	Natural Moisture
Specimen Height	0.7500 in	**Preparation**	
Comments			

Apparatus

Ring Number	3	**Ring Diameter**	2.0000 in
Ring Height	0.7500 in	**Ring Weight**	0.1378 lb
Lever Ratio	1.00 : 1	**Drainage**	Double-Sided

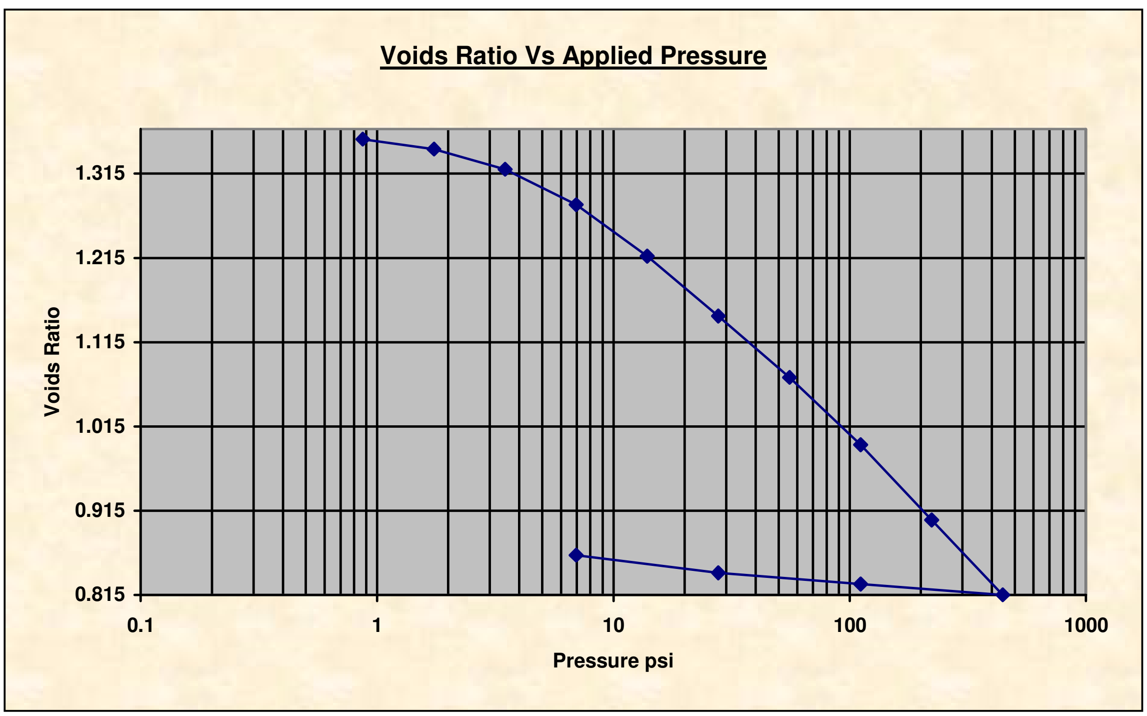


PLATE NO.: IV-6A

One Dimensional Consolidation Properties
(Oedometer)

Client	PARIKH CONSULTANTS	**Lab Ref**	
Project	Blossom Hill Road Interchange Improv. BOC	**Job**	2016-146-BOC
Borehole	R18-SC-001	**Sample**	9
Location		**Depth**	41

Initial Moisture Content*	11.5 % (trimmings: 19.9 %)	**Final Moisture Content**	37.8 %
Initial Bulk Density	77.89 lb/ft3	**Final Bulk Density**	122.39 lb/ft3
Initial Dry Density	69.86 lb/ft3	**Final Dry Density**	88.83 lb/ft3
Initial Void Ratio	1.3680	**Final Void Ratio**	0.8623
Initial Degree of Saturation	22.25%	**Final Degree of Saturation**	116.08%
Pre-consolidation Pressure	0.00 psi		

* Calculated from initial and dry weights of whole specimen

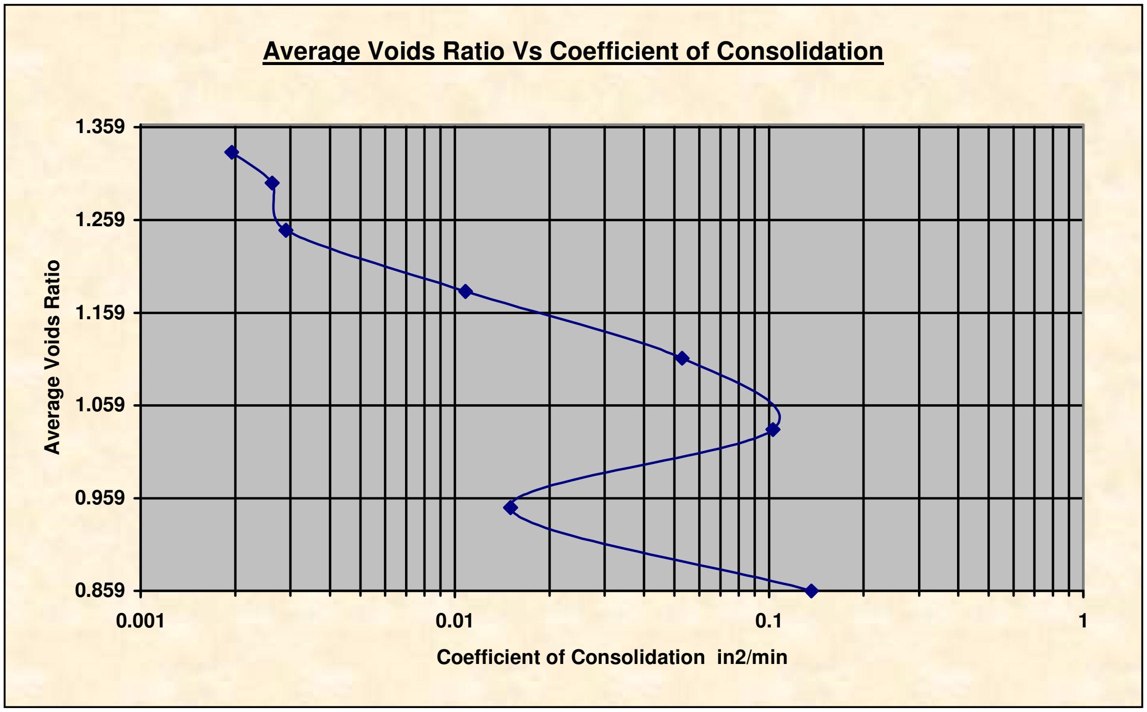
Pressure (Loading)	**Load Increment Duration**	**Deformation (Corrected)**	**d_{100} (Corrected)**	**Coefficient of Consolidation (c_v)**
0.00				
0.87 psi	190.000 min	0.0039 in	0.0025 in	---------
1.74 psi	1080.000 min	0.0076 in	0.0057 in	---------
3.48 psi	1260.000 min	0.0151 in	0.0152 in	0.00195 in2/min
6.96 psi	1260.000 min	0.0286 in	0.0285 in	0.00262 in2/min
13.92 psi	4080.000 min	0.0477 in	0.0468 in	0.00290 in2/min
27.85 psi	1440.000 min	0.0703 in	0.0671 in	0.01082 in2/min
55.55 psi	1440.000 min	0.0933 in	0.0884 in	0.05291 in2/min
111.10 psi	381.000 min	0.1186 in	0.1115 in	0.10281 in2/min
222.20 psi	960.000 min	0.1469 in	0.1441 in	0.01502 in2/min
444.40 psi	381.000 min	0.1752 in	0.1659 in	0.13649 in2/min
111.10 psi	960.000 min	0.1710 in	---------	---------
27.85 psi	381.000 min	0.1668 in	---------	---------
6.96 psi	3840.000 min	0.1602 in	---------	---------

Method of Time Fitting Used	Log Time

PLATE NO.: IV-6B

One Dimensional Consolidation Properties
(Oedometer)

Client	PARIKH CONSULTANTS	**Lab Ref**	
Project	Blossom Hill Road Interchange Improv. BOC	**Job**	2016-146-BOC
Borehole	R18-SC-001	**Sample**	9
Location		**Depth**	41



Tested By and Date:	Saman Mostafazadeh-Fard 11/26/18
Checked By and Date:	Emre Ortakci 11/28/18
Approved By and Date:	Emre Ortakci 11/28/18

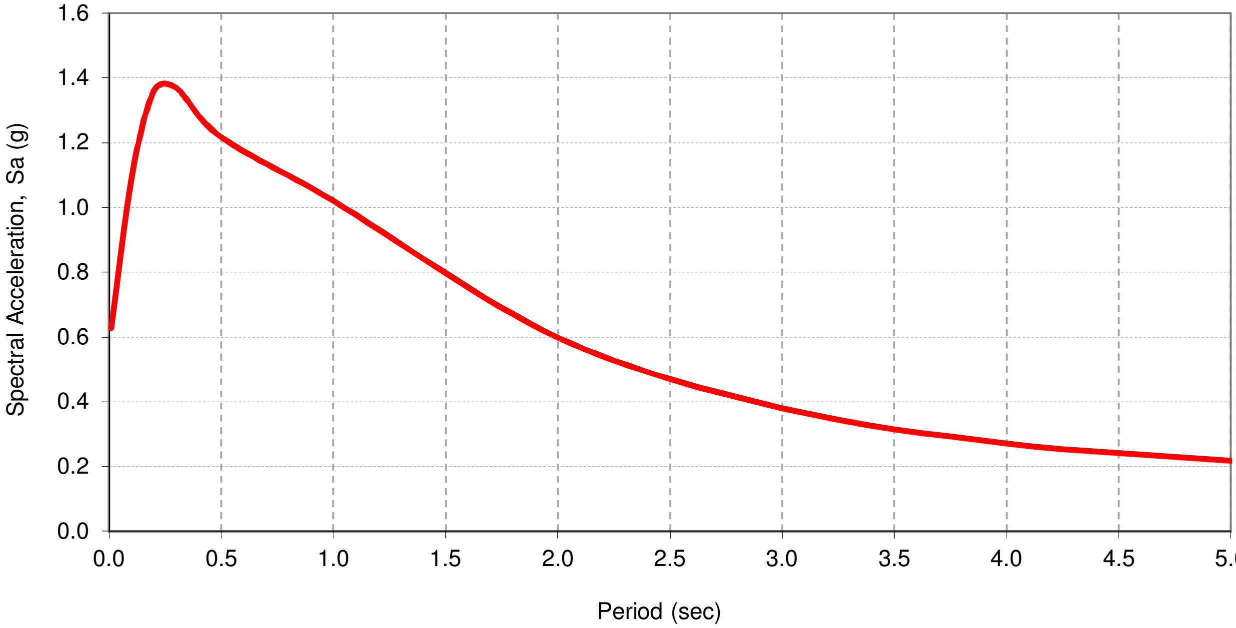
Plate No:

PLATE NO.: IV-6C

APPENDIX V

RECOMMENDED ACCELERATION RESPONSE SPECTRUM

(5% Damping)



Site Information

Latitude:	37.2572
Longitude	-121.7965
V_{S30} (m/s) =	220
$Z_{1.0}$ (m) =	N/A
$Z_{2.5}$ (km) =	N/A
Near Fault Factor, Derived from USGS Unified Hazard Tool. Dist (km) =	8.08

Governing Curve:

Caltrans Online Probabilistic ARS

Recommended Response Spectrum				
Period (sec)	Caltrans Online Probabilistic Spectral Acceleration (g)	Adjusted for Near Fault Effect	Adjusted For Basin Effect	Final Adjusted Spectral Acceleration (g)
0.0	0.627	1	1	0.627
0.1	1.092	1	1	1.092
0.2	1.36	1	1	1.360
0.3	1.369	1	1	1.369
0.5	1.217	1	1	1.217
1.0	0.85	1.2	1	1.020
2.0	0.499	1.2	1	0.599
3.0	0.317	1.2	1	0.380
4.0	0.226	1.2	1	0.271
5.0	0.181	1.2	1	0.217

Source:

1. Caltrans ARS Online tool (V.2.3.09, http://dap3.dot.ca.gov/ARS_Online/)

2. Caltrans Methodology for Developing Design Response Spectrum for Use in Seismic Design Recommendations, November 2012

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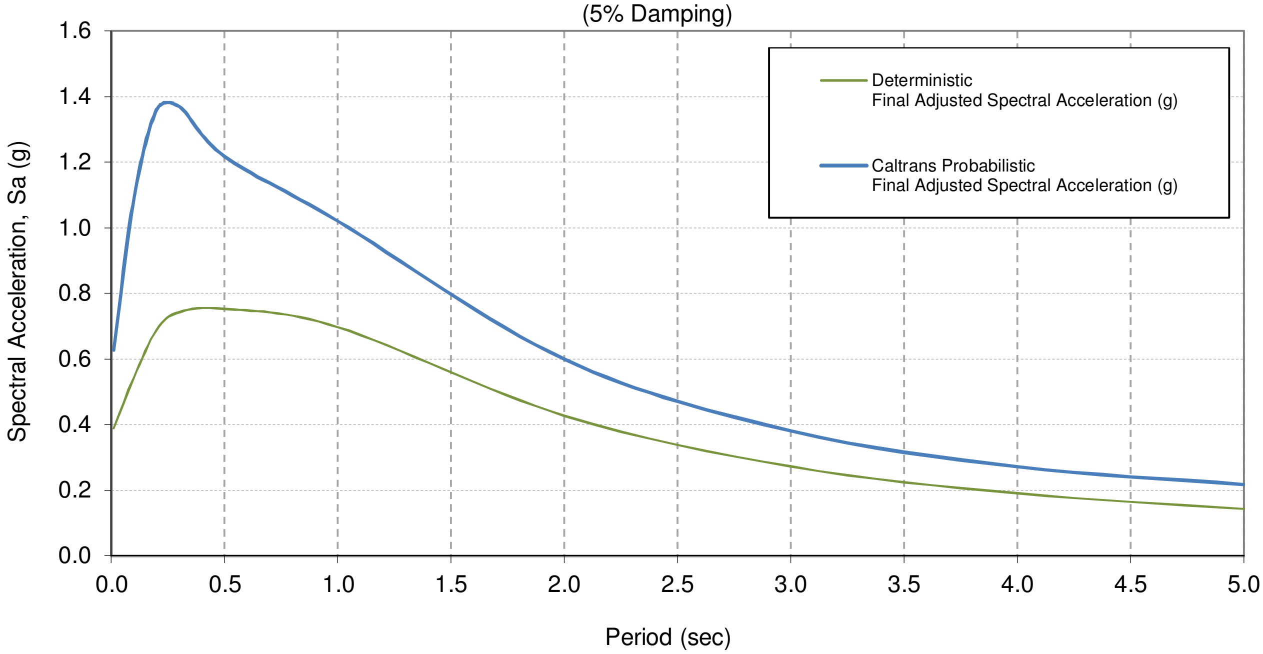
BLOSSOM HILL ROAD OVERCROSSING (WIDEN)
SAN JOSE, CALIFORNIA

Project No.: 2016-146-BOC	**APPENDIX V-1**

ACCELERATION RESPONSE SPECTRUM COMPARISON

(Deterministic & Probablistic Curves)

(5% Damping)



Site Information

Latitude:	37.2572
Longitude	-121.7965
V_{S30} (m/s) =	220
$Z_{1.0}$ (m) =	N/A
$Z_{2.5}$ (km) =	N/A
Near Fault Factor, Derived from USGS Unified Hazard Tool. Dist (km) =	8.08

Period (sec)	Deterministic Final Adjusted Spectral Acceleration (g)	Caltrans Probabilistic Final Adjusted Spectral Acceleration (g)
0.0	0.389	0.627
0.1	0.545	1.092
0.2	0.689	1.360
0.3	0.743	1.369
0.5	0.753	1.217
1.0	0.697	1.020
2.0	0.427	0.599
3.0	0.272	0.380
4.0	0.190	0.271
5.0	0.143	0.217

Source:

1. Caltrans ARS Online tool (V.2.3.09, http://dap3.dot.ca.gov/ARS_Online/)
2. USGS Unified Hazard Tool (https://earthquake.usgs.gov/hazards/interactive/)
3. Caltrans Methodology for Developing Design Response Spectrum for Use in Seismic Design Recommendations, November 2012

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BLOSSOM HILL ROAD OVERCROSSING (WIDEN)
SAN JOSE, CALIFORNIA

Project No.: 2016-146-BOC	**APPENDIX V-2**

APPENDIX VI

LIQUEFACTION ANALYSES

LIQUEFACTION POTENTIAL ANALYSIS (SPT procedures per Youd et al, 2001)

PROJECT NAME ***BLOSSOM HILL ROAD OVERCROSSING (WIDEN)***
PROJECT NO. ***2016-146-BOC***
BORING NO. ***R-18-SC-001***

SOIL GROUPS
1. GRAVELS, SANDS AND NONPLASTIC SILTS
2. CLAYS AND PLASTIC SILTS

FAULT INFO
Silver Creek Fault
a_{max} (g)= 0.63
FAULT M_w = 6.9

GW DEPTH (ft)= 30

BOREHOLE DIA (in)= 3.3
HAMMER ENERGY = 78%

CUT(-)/FILL(+) (ft) = 0
DESIGN GW DEPTH (ft)= 30 *(below OG)*

MSF = 1.24

SOIL STRATA							LIQUEFACTION RESISTANCE ($CRR_{7.5}$)												CYCLIC STRESS RATIO (CSR)				F.S.=($CRR_{7.5}$/CSR)*MSF*Ks*Ka			POST-LIQ. SETTLEMENT	
Layer Thickness from	to	Sample No	Depth (ft)	Soil Type	Blow Count	Sampler Type	SPT-$N_{eq.}$	C_E	C_R	C_S	C_B	N_{60}	σ_v' (psf)	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60,CS}$	$CRR_{7.5}$	σ_v (psf)	σ_v' (psf)	r_d	CSR	Ks	Ka	F.S.	Vol. Strain (%)	ΔD (in)
0	4.0	1	3	1	28	MC	18.2	1.3	0.75	1.0	1.00	17.7	345.0	1.7	30.2	15%	34.1		345.0	345.0	1.0	0.4	1.0	1.0			
4.0	8.0	2	6	1	27	MC	17.6	1.3	0.80	1.0	1.00	18.3	700.0	1.7	30.9	15%	34.8		700.0	700.0	1.0	0.4	1.0	1.0			
8.0	13.0	3	11	2	23	MC	15.0	1.3	0.85	1.0	1.00	16.5	1300.0	1.2	20.5												
13.0	18.0	4	16	2	22	MC	14.3	1.3	0.95	1.0	1.00	17.7	1900.0	1.0	18.1												
18.0	23.0	5	21	2	11	SPT	11.0	1.3	0.95	1.2	1.00	16.3	2500.0	0.9	14.6												
23.0	28.0	6	26	1	25	MC	16.3	1.3	1.00	1.0	1.00	21.1	3100.0	0.8	17.0	28%	23.9		3100.0	3100.0	0.9	0.4	0.9	1.0			
28.0	33.5	7	31	1	16	MC	10.4	1.3	1.00	1.0	1.00	13.5	3637.6	0.7	10.0	16%	13.2	0.1	3700.0	3637.6	0.9	0.4	0.8	1.0	(0.39)	1.91%	1.26
33.5	38.5	8	36	2	11	MC	7.2	1.3	1.00	1.0	1.00	9.3	3925.6	0.7	6.6												
38.5	43.0	9	41	2	6	MC	3.9	1.3	1.00	1.0	1.00	5.1	4213.6	0.7	3.5												
43.0	48.0	10	46	1	34	SPT	34.0	1.3	1.00	1.2	1.00	53.0	4501.6	0.7	35.4	10%	37.0		5500.00	4501.6	0.8	0.4	0.7	1.0	NON-LIQ.		
48.0	53.0	11	51	1	50	SPT	50.0	1.3	1.00	1.2	1.00	78.0	4789.6	0.6	50.4	10%	52.4		6100.00	4789.6	0.7	0.4	0.7	1.0	NON-LIQ.		
53.0	58.0	12	56	1	64	SPT	64.0	1.3	1.00	1.2	1.00	99.8	5077.6	0.6	62.7	9%	64.5		6700.00	5077.6	0.7	0.4	0.7	1.0	NON-LIQ.		
58.0	65.0	13	61	1	31	SPT	31.0	1.3	1.00	1.2	1.00	48.4	5365.6	0.6	29.5	10%	31.0		7300.00	5365.6	0.7	0.4	0.7	1.0	NON-LIQ.		
65.0	76.0	14	71	1	10	MC	6.5	1.3	1.00	1.0	1.00	8.5	5941.6	0.6	4.9	50%	10.9	0.1	8500.00	5941.6	0.6	0.3	0.8	1.0	(0.35)	2.21%	2.92
76.0	81.0	15	81	2	34	MC	22.1	1.3	1.00	1.0	1.00	28.7	6517.6	0.6	15.9												
81.0	86.5	15	81.5	1	34	MC	22.1	1.3	1.00	1.0	1.00	28.7	6546.4	0.6	15.9	28%	22.6	0.3	9760.00	6546.4	0.5	0.3	0.7	1.0	(0.64)	1.28%	0.84
86.5	95.0	16	91	2	25	MC	16.3	1.3	1.00	1.0	1.00	21.1	7093.6	0.5	11.2												
95.0	106.0	17	101	2	43	MC	28.0	1.3	1.00	1.0	1.00	36.3	7669.6	0.5	18.6												
106.0	115.0	18	111	1	34	SPT	34.0	1.3	1.00	1.2	1.00	53.0	8245.6	0.5	26.1	10%	27.6	0.4	13300.00	8245.6	0.5	0.3	0.6	1.0	NON-LIQ.		
115.0	125.0	19	121	2	43	MC	28.0	1.3	1.00	1.0	1.00	36.3	8827.6	0.5	17.3												
125.0	131.5	20	131	2	35	SPT	35.0	1.3	1.00	1.2	1.00	54.6	9419.6	0.5	25.2												

Fines Content based on visual inspection
Fines Content based on lab results

Notes:
1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner) are per Youd et al. (2001).
2. For correction of overburden, $C_N = (1/\sigma_v')^{0.5}$ with a maximum value of 1.7.
3. The influence of Fines Contents are expressed by the following correction: $(N_1)_{60cs} = a + b\ (N_1)_{60}$
   where a and b = coefficients determined from the following relationships
   for FC $\leq$ 5% a = 0, b = 1.0
   for 5% < FC < 35% a = exp(1.76-(190/FC^2)), b = (0.99+(FC$^{1.5}$/1000))
   for FC $\geq$ 35% a = 5.0, b = 1.2
4. For $(N_1)_{60,cs}$ greater than 30, clean granular soils are too dense to liquefy and are classed as non-liquefiable.

Reference:
Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER Workshops on Evaluation of Liquefaction Resistance of Soils, Youd, et al., ASCE Journal of Geotechnical and Geoenvironmental Engineering, October 2001, Vol. 127 No. 10

2/12/2019

LIQUEFACTION POTENTIAL ANALYSIS (SPT procedures per Youd et al, 2001)

PROJECT NAME	***BLOSSOM HILL ROAD OVERCROSSING (WIDEN)***	*SOIL GROUPS*		*FAULT INFO*	
PROJECT NO.	***2016-146-BOC***	1. GRAVELS, SANDS AND NONPLASTIC SILTS		*Silver Creek Fault*	
BORING NO.	***R-18-SC-002***	2. CLAYS AND PLASTIC SILTS		*a_{max} (g)=*	0.63
				FAULT M_w =	6.9
GW DEPTH (ft)=	25	*BOREHOLE DIA (in)=*	3.3	*CUT(-)/FILL(+) (ft) =* 0	*MSF =* 1.24
		HAMMER ENERGY =	78%	*DESIGN GW DEPTH (ft)=* 25 *(below OG)*	

SOIL STRATA							*LIQUEFACTION RESISTANCE ($CRR_{7.5}$)*												*CYCLIC STRESS RATIO (CSR)*				*F.S.=($CRR_{7.5}$/CSR)*MSF*Ks*Ka*			*POST-LIQ. SETTLEMENT*	
Layer Thickness from	to	Sample No	Depth (ft)	Soil Type	Blow Count	Sampler Type	SPT-$N_{eq.}$	C_E	C_R	C_S	C_B	N_{60}	σ_v' (psf)	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60,CS}$	$CRR_{7.5}$	σ_v (psf)	σ_v' (psf)	r_d	CSR	Ks	Ka	F.S.	Vol. Strain (%)	ΔD (in)
0	4.0	1	3	1	29	SPT	29.0	1.3	0.75	1.2	1.00	33.9	345.0	1.7	57.7	15%	63.0		345.0	345.0	1.0	0.4	1.0	1.0			
4.0	8.0	2	6	1	37	MC	24.1	1.3	0.80	1.0	1.00	25.0	700.0	1.7	42.3	15%	46.8		700.0	700.0	1.0	0.4	1.0	1.0			
8.0	13.5	3	11	1	29	MC	18.9	1.3	0.85	1.0	1.00	20.8	1300.0	1.2	25.8	23%	32.5		1300.0	1300.0	1.0	0.4	1.0	1.0			
13.5	18.0	4	16	1	21	MC	13.7	1.3	0.95	1.0	1.00	16.9	1900.0	1.0	17.3	30%	24.7		1900.0	1900.0	1.0	0.4	1.0	1.0			
18.0	23.0	5	21	1	22	MC	14.3	1.3	0.95	1.0	1.00	17.7	2500.0	0.9	15.8	28%	22.6		2500.0	2500.0	1.0	0.4	0.9	1.0			
23.0	28.0	6	26	2	15	SPT	15.0	1.3	1.00	1.2	1.00	23.4	3037.6	0.8	19.0												
28.0	33.0	7	31	2	6	MC	3.9	1.3	1.00	1.0	1.00	5.1	3325.6	0.8	3.9												
33.0	38.0	8	36	2	11	MC	7.2	1.3	1.00	1.0	1.00	9.3	3613.6	0.7	6.9												
38.0	43.0	9	41	2	16	MC	10.4	1.3	1.00	1.0	1.00	13.5	3901.6	0.7	9.7	81%											
43.0	48.0	10	46	2	2	MC	1.3	1.3	1.00	1.0	1.00	1.7	4189.6	0.7	1.2												
48.0	53.0	11	51	2	14	MC	9.1	1.3	1.00	1.0	1.00	11.8	4477.6	0.7	7.9												
53.0	58.0	12	56	2	14	MC	9.1	1.3	1.00	1.0	1.00	11.8	4765.6	0.6	7.7												
58.0	64.5	13	61	2	17	MC	11.1	1.3	1.00	1.0	1.00	14.4	5053.6	0.6	9.0												
64.5	77.0	14	71	1	33	MC	21.5	1.3	1.00	1.0	1.00	27.9	5629.6	0.6	16.6	9%	17.4	0.2	8500.00	5629.6	0.6	0.4	0.7	1.0	(0.45)	1.55%	2.33
77.0	86.0	15	81	2	18	SPT	18.0	1.3	1.00	1.2	1.00	28.1	6205.6	0.6	15.9												
86.0	96.0	16	91	1	70	SPT	70.0	1.3	1.00	1.2	1.00	109.2	6781.6	0.5	59.3	15%	64.7		10900.00	6781.6	0.5	0.3	0.6	1.0	NON-LIQ.		
96.0	105.0	17	101	1	55	SPT	55.0	1.3	1.00	1.2	1.00	85.8	7357.6	0.5	44.7	15%	49.4		12100.00	7357.6	0.5	0.3	0.6	1.0	NON-LIQ.		
105.0	115.5	18	111	2	18	SPT	18.0	1.3	1.00	1.2	1.00	28.1	7933.6	0.5	14.1												
115.5	121.5	19	121	2	20	SPT	20.0	1.3	1.00	1.2	1.00	31.2	8509.6	0.5	15.1												

Fines Content based on visual inspection
Fines Content based on lab results

Notes:
1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner) are per Youd et al. (2001).
2. For correction of overburden, $C_N = (1/\sigma_v')^{0.5}$ with a maximum value of 1.7.
3. The influence of Fines Contents are expressed by the following correction: $(N_1)_{60cs} = a + b\,(N_1)_{60}$
where a and b = coefficients determined from the following relationships
for FC $\leq$ 5% a = 0, b = 1.0
for 5% < FC < 35% $a = \exp(1.76-(190/FC^2))$, $b = (0.99+(FC^{1.5}/1000))$
for FC $\geq$ 35% a = 5.0, b = 1.2
4. For $(N_1)_{60,cs}$ greater than 30, clean granular soils are too dense to liquefy and are classed as non-liquefiable.

Reference:
Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER Workshops on Evaluation of Liquefaction Resistance of Soils, Youd, et al., ASCE Journal of Geotechnical and Geoenvironmental Engineering, October 2001, Vol. 127 No. 10

2/12/2019

LIQUEFACTION POTENTIAL ANALYSIS (SPT procedures per Youd et al, 2001)

PROJECT NAME	***BLOSSOM HILL ROAD OVERCROSSING (WIDEN)***	*SOIL GROUPS*	*FAULT INFO*
PROJECT NO.	***2016-146-BOC***	1. GRAVELS, SANDS AND NONPLASTIC SILTS	*SILVER CREEK FAULT*
BORING NO.	***BL-1***	2. CLAYS AND PLASTIC SILTS	*a_{max} (g)=* 0.63
			FAULT M_w = 6.9

GW DEPTH (ft)=	54	*BOREHOLE DIA (in)=*	4	*CUT(-)/FILL(+) (ft) =*	0		*MSF =* 1.24
		HAMMER ENERGY =	84%	*DESIGN GW DEPTH (ft)=*	54	*(below OG)*	

SOIL STRATA							*LIQUEFACTION RESISTANCE ($CRR_{7.5}$)*												*CYCLIC STRESS RATIO (CSR)*				*F.S.=($CRR_{7.5}$/CSR)*MSF*Ks*Ka*			*POST-LIQ. SETTLEMENT*	
Layer Thickness from	to	Sample No	Depth (ft)	Soil Type	Blow Count	Sampler Type	SPT-$N_{eq.}$	C_E	C_R	C_S	C_B	N_{60}	σ_v' (psf)	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60,CS}$	$CRR_{7.5}$	σ_v (psf)	σ_v' (psf)	r_d	CSR	Ks	Ka	F.S.	Vol. Strain (%)	ΔD (in)
0	7.4	1	6.6	2	9	MC	5.9	1.4	0.80	1.0	1.00	6.6	759.0	1.6	10.6										Cohesive		
7.4	12.3	2	9.85	2	21	MC	13.7	1.4	0.85	1.0	1.00	16.2	1145.0	1.3	21.5										Plastic		
12.3	16.4	3	14.8	2	19	MC	12.4	1.4	0.85	1.0	1.00	14.7	1739.0	1.1	15.8										Plastic		
16.4	22.2	4	19.7	2	15	MC	9.8	1.4	0.95	1.0	1.00	13.0	2327.0	0.9	12.0										Plastic		
22.2	25.6	5	24.6	2	10	SPT	10.0	1.4	0.95	1.2	1.00	16.0	2915.0	0.8	13.2										Plastic		
25.6	31.5	6	29.5	2	25	MC	16.3	1.4	1.00	1.0	1.00	22.8	3506.9	0.8	17.2										Plastic		
31.5	37.8	7	34.5	1	17	MC	11.1	1.4	1.00	1.0	1.00	15.5	4114.9	0.7	10.8	50%	17.9		4114.9	4114.9	0.89	0.4	0.8	1.0	Above GW		
37.8	40.7	8	39.4	1	28	SPT	28.0	1.4	1.00	1.2	1.00	47.0	4714.3	0.7	30.6	50%	41.8		4714.3	4714.3	0.86	0.4	0.7	1.0	Above GW		
40.7	46.3	9	44.3	1	43	SPT	43.0	1.4	1.00	1.2	1.00	72.2	5320.6	0.6	44.3	10%	46.1		5320.6	5320.6	0.81	0.3	0.7	1.0	Above GW		
46.3	51.0	10	49.25	1	25	SPT	25.0	1.4	1.00	1.2	1.00	42.0	5937.4	0.6	24.4	5%	24.4		5937.4	5937.4	0.76	0.3	0.7	1.0	Above GW		
51.0	55.8	11	54.2	1	39	SPT	39.0	1.4	1.00	1.2	1.00	65.5	6546.8	0.6	36.2	10%	37.9		6559.3	6546.8	0.71	0.3	0.6	1.0	NON-LIQ.		
55.8	68.0	12	59.1	1	29	SPT	29.0	1.4	1.00	1.2	1.00	48.7	6845.3	0.5	26.3	50%	36.6		7163.5	6845.3	0.67	0.3	0.7	1.0	NON-LIQ.		
68.0	72.4	13	68.95	1	25	MC	16.3	1.4	1.00	1.0	1.00	22.8	7433.3	0.5	11.8	34%	19.0	0.2	8366.2	7433.3	0.60	0.3	0.7	1.0	(0.64)	1.45%	0.77
72.4	83.7	14	78.8	2	28	MC	18.2	1.4	1.00	1.0	1.00	25.5	8036.6	0.5	12.7										Plastic		
83.7	93.6	15	88.65	2	48	MC	31.2	1.4	1.00	1.0	1.00	43.7	8648.3	0.5	21.0										Plastic		
93.6	100.0	16	98.5	2	29	MC	18.9	1.4	1.00	1.0	1.00	26.4	9269.8	0.5	12.3										Plastic		

Fines Content based on visual inspection

Fines Content based on lab results

Notes:

1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner) are per Youd et al. (2001).
2. For correction of overburden, $C_N = (1/\sigma_v')^{0.5}$ with a maximum value of 1.7.
3. The influence of Fines Contents are expressed by the following correction: $(N_1)_{60cs} = a + b\,(N_1)_{60}$
   where a and b = coefficients determined from the following relationships
   for FC $\leq$ 5% a = 0, b = 1.0
   for 5% < FC < 35% a = exp(1.76-(190/FC^2)), b = (0.99+(FC$^{1.5}$/1000))
   for FC $\geq$ 35% a = 5.0, b = 1.2
4. For $(N_1)_{60,cs}$ greater than 25, clean granular soils are too dense to liquefy and are classed as non-liquefiable.

Reference:

Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER Workshops on Evaluation of Liquefaction Resistance of Soils, Youd, et al., ASCE Journal of Geotechnical and Geoenvironmental Engineering, October 2001, Vol. 127 No. 10

LIQUEFACTION POTENTIAL ANALYSIS (SPT procedures per Youd et al, 2001)

PROJECT NAME	***BLOSSOM HILL ROAD OVERCROSSING (WIDEN)***	*SOIL GROUPS*	*FAULT INFO*
PROJECT NO.	***2016-146-BOC***	1. GRAVELS, SANDS AND NONPLASTIC SILTS	*SILVER CREEK FAULT*
BORING NO.	***BL-2***	2. CLAYS AND PLASTIC SILTS	*a_{max} (g)=* 0.63
			FAULT M_w = 6.9

GW DEPTH (ft)=	54	*BOREHOLE DIA (in)=*	4	*CUT(-)/FILL(+) (ft) =*	0		*MSF =* 1.24
		HAMMER ENERGY =	84%	*DESIGN GW DEPTH (ft)=*	54	*(below OG)*	

SOIL STRATA							*LIQUEFACTION RESISTANCE ($CRR_{7.5}$)*												*CYCLIC STRESS RATIO (CSR)*				*F.S.=($CRR_{7.5}$/CSR)*MSF*Ks*Ka*			*POST-LIQ. SETTLEMENT*	
Layer Thickness from	to	Sample No	Depth (ft)	Soil Type	Blow Count	Sampler Type	SPT-$N_{eq.}$	C_E	C_R	C_S	C_B	N_{60}	σ_v' (psf)	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60,CS}$	$CRR_{7.5}$	σ_v (psf)	σ_v' (psf)	r_d	CSR	Ks	Ka	F.S.	Vol. Strain (%)	ΔD (in)
0	4.9	1	3.2	2	62	MC	40.3	1.4	0.75	1.0	1.00	42.3	368.0	1.7	71.9										Cohesive		
4.9	9.9	2	6.6	2	27	MC	17.6	1.4	0.80	1.0	1.00	19.7	767.4	1.6	31.7										Plastic		
9.9	14.8	3	11.5	2	24	MC	15.6	1.4	0.85	1.0	1.00	18.6	1355.4	1.2	22.6										Plastic		
14.8	18.9	4	16.4	1	34	MC	22.1	1.4	0.95	1.0	1.00	29.4	1943.4	1.0	29.8	3%	29.8		1943.4	1943.4	0.97	0.4	1.0	1.0	Above GW		
18.9	23.0	5	21.3	1	40	SPT	40.0	1.4	0.95	1.2	1.00	63.8	2531.4	0.9	56.7	10%	58.8		2531.4	2531.4	0.95	0.4	0.9	1.0	Above GW		
23.0	27.9	6	26.2	1	35	SPT	35.0	1.4	1.00	1.2	1.00	58.8	3122.6	0.8	47.1	10%	48.9		3122.6	3122.6	0.94	0.4	0.8	1.0	Above GW		
27.9	32.8	7	31.1	1	49	SPT	49.0	1.4	1.00	1.2	1.00	82.3	3718.7	0.7	60.4	9%	62.0		3718.7	3718.7	0.91	0.4	0.8	1.0	Above GW		
32.8	37.8	8	36	1	50	SPT	50.0	1.4	1.00	1.2	1.00	84.0	4319.7	0.7	57.2	10%	59.3		4319.7	4319.7	0.88	0.4	0.7	1.0	Above GW		
37.8	42.7	9	41	1	58	SPT	58.0	1.4	1.00	1.2	1.00	97.4	4937.9	0.6	62.0	10%	64.2		4937.9	4937.9	0.84	0.3	0.7	1.0	Above GW		
42.7	47.6	10	45.9	1	41	SPT	41.0	1.4	1.00	1.2	1.00	68.9	5548.7	0.6	41.4	7%	41.9		5548.7	5548.7	0.79	0.3	0.7	1.0	Above GW		
47.6	54.2	11	50.8	2	25	MC	16.3	1.4	1.00	1.0	1.00	22.8	6164.4	0.6	13.0										Plastic		
54.2	59.9	12	55.8	2	21	MC	13.7	1.4	1.00	1.0	1.00	19.1	6675.7	0.5	10.5										Plastic		
59.9	62.0	13	60.7	1	36	MC	23.4	1.4	1.00	1.0	1.00	32.8	6968.5	0.5	17.6	26%	24.0	0.3	7386.6	6968.5	0.65	0.3	0.7	1.0	(0.80)	1.22%	0.31
62.0	72.2	14	72.2	1	59	MC	38.4	1.4	1.00	1.0	1.00	53.7	7675.6	0.5	27.4	15%	31.2		8811.3	7675.6	0.58	0.3	0.6	1.0	NON-LIQ.		
72.2	80.4	15	82	1	64	SPT	64.0	1.4	1.00	1.2	1.00	107.5	8289.1	0.5	52.8	15%	57.9		10036.3	8289.1	0.54	0.3	0.6	1.0	NON-LIQ.		
80.4	96.0	16	91.8	2	60	MC	39.0	1.4	1.00	1.0	1.00	54.6	8914.0	0.5	25.9										Plastic		
96.0	103.4	17	101.7	2	39	MC	25.4	1.4	1.00	1.0	1.00	35.5	9549.3	0.5	16.2										Plastic		

Fines Content based on visual inspection

Fines Content based on lab results

Notes:

1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner) are per Youd et al. (2001).
2. For correction of overburden, $C_N = (1/\sigma_v')^{0.5}$ with a maximum value of 1.7.
3. The influence of Fines Contents are expressed by the following correction: $(N_1)_{60cs} = a + b\,(N_1)_{60}$
   where a and b = coefficients determined from the following relationships
   for FC $\leq$ 5% a = 0, b = 1.0
   for 5% < FC < 35% a = exp(1.76-(190/FC^2)), b = (0.99+(FC$^{1.5}$/1000))
   for FC $\geq$ 35% a = 5.0, b = 1.2
4. For $(N_1)_{60,cs}$ greater than 25, clean granular soils are too dense to liquefy and are classed as non-liquefiable.

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:: Liquefaction Potential Index calculation data ::

Depth (ft)	FS	F_L	w_z	d_z	LPI	Depth (ft)	FS	F_L	w_z	d_z	LPI
0.16	2.00	0.00	9.97	0.16	0.00	0.33	2.00	0.00	9.95	0.16	0.00
0.49	2.00	0.00	9.92	0.16	0.00	0.66	2.00	0.00	9.90	0.16	0.00
0.82	2.00	0.00	9.87	0.16	0.00	0.98	2.00	0.00	9.85	0.16	0.00
1.15	2.00	0.00	9.82	0.16	0.00	1.31	2.00	0.00	9.80	0.16	0.00
1.48	2.00	0.00	9.77	0.16	0.00	1.64	2.00	0.00	9.75	0.16	0.00
1.80	2.00	0.00	9.72	0.16	0.00	1.97	2.00	0.00	9.70	0.16	0.00
2.13	2.00	0.00	9.67	0.16	0.00	2.30	2.00	0.00	9.65	0.16	0.00
2.46	2.00	0.00	9.62	0.16	0.00	2.62	2.00	0.00	9.60	0.16	0.00
2.79	2.00	0.00	9.57	0.16	0.00	2.95	2.00	0.00	9.55	0.16	0.00
3.12	2.00	0.00	9.52	0.16	0.00	3.28	2.00	0.00	9.50	0.16	0.00
3.44	2.00	0.00	9.47	0.16	0.00	3.61	2.00	0.00	9.45	0.16	0.00
3.77	2.00	0.00	9.42	0.16	0.00	3.94	2.00	0.00	9.40	0.16	0.00
4.10	2.00	0.00	9.37	0.16	0.00	4.27	2.00	0.00	9.35	0.16	0.00
4.43	2.00	0.00	9.32	0.16	0.00	4.59	2.00	0.00	9.30	0.16	0.00
4.76	2.00	0.00	9.27	0.16	0.00	4.92	2.00	0.00	9.25	0.16	0.00
5.09	2.00	0.00	9.22	0.16	0.00	5.25	2.00	0.00	9.20	0.16	0.00
5.41	2.00	0.00	9.17	0.16	0.00	5.58	2.00	0.00	9.15	0.16	0.00
5.74	2.00	0.00	9.12	0.16	0.00	5.91	2.00	0.00	9.10	0.16	0.00
6.07	2.00	0.00	9.07	0.16	0.00	6.23	2.00	0.00	9.05	0.16	0.00
6.40	2.00	0.00	9.02	0.16	0.00	6.56	2.00	0.00	9.00	0.16	0.00
6.73	2.00	0.00	8.97	0.16	0.00	6.89	2.00	0.00	8.95	0.16	0.00
7.05	2.00	0.00	8.92	0.16	0.00	7.22	2.00	0.00	8.90	0.16	0.00
7.38	2.00	0.00	8.87	0.16	0.00	7.55	2.00	0.00	8.85	0.16	0.00
7.71	2.00	0.00	8.82	0.16	0.00	7.87	2.00	0.00	8.80	0.16	0.00
8.04	2.00	0.00	8.77	0.16	0.00	8.20	2.00	0.00	8.75	0.16	0.00
8.37	2.00	0.00	8.72	0.16	0.00	8.53	2.00	0.00	8.70	0.16	0.00
8.69	2.00	0.00	8.67	0.16	0.00	8.86	2.00	0.00	8.65	0.16	0.00
9.02	2.00	0.00	8.62	0.16	0.00	9.19	2.00	0.00	8.60	0.16	0.00
9.35	2.00	0.00	8.57	0.16	0.00	9.51	2.00	0.00	8.55	0.16	0.00
9.68	2.00	0.00	8.52	0.16	0.00	9.84	2.00	0.00	8.50	0.16	0.00
10.01	2.00	0.00	8.47	0.16	0.00	10.17	2.00	0.00	8.45	0.16	0.00
10.33	2.00	0.00	8.42	0.16	0.00	10.50	2.00	0.00	8.40	0.16	0.00
10.66	2.00	0.00	8.37	0.16	0.00	10.83	2.00	0.00	8.35	0.16	0.00
10.99	2.00	0.00	8.32	0.16	0.00	11.15	2.00	0.00	8.30	0.16	0.00
11.32	2.00	0.00	8.27	0.16	0.00	11.48	2.00	0.00	8.25	0.16	0.00
11.65	2.00	0.00	8.22	0.16	0.00	11.81	2.00	0.00	8.20	0.16	0.00
11.98	2.00	0.00	8.17	0.16	0.00	12.14	2.00	0.00	8.15	0.16	0.00
12.30	2.00	0.00	8.12	0.16	0.00	12.47	2.00	0.00	8.10	0.16	0.00
12.63	2.00	0.00	8.07	0.16	0.00	12.80	2.00	0.00	8.05	0.16	0.00
12.96	2.00	0.00	8.02	0.16	0.00	13.12	2.00	0.00	8.00	0.16	0.00
13.29	2.00	0.00	7.97	0.16	0.00	13.45	2.00	0.00	7.95	0.16	0.00
13.62	2.00	0.00	7.92	0.16	0.00	13.78	2.00	0.00	7.90	0.16	0.00
13.94	2.00	0.00	7.87	0.16	0.00	14.11	2.00	0.00	7.85	0.16	0.00
14.27	2.00	0.00	7.82	0.16	0.00	14.44	2.00	0.00	7.80	0.16	0.00
14.60	2.00	0.00	7.77	0.16	0.00	14.76	2.00	0.00	7.75	0.16	0.00
14.93	2.00	0.00	7.72	0.16	0.00	15.09	2.00	0.00	7.70	0.16	0.00
15.26	2.00	0.00	7.67	0.16	0.00	15.42	2.00	0.00	7.65	0.16	0.00
15.58	2.00	0.00	7.62	0.16	0.00	15.75	2.00	0.00	7.60	0.16	0.00

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

Depth (ft)	FS	F_L	w_z	d_z	LPI	Depth (ft)	FS	F_L	w_z	d_z	LPI
15.91	2.00	0.00	7.57	0.16	0.00	16.08	2.00	0.00	7.55	0.16	0.00
16.24	2.00	0.00	7.52	0.16	0.00	16.40	2.00	0.00	7.50	0.16	0.00
16.57	2.00	0.00	7.47	0.16	0.00	16.73	2.00	0.00	7.45	0.16	0.00
16.90	2.00	0.00	7.42	0.16	0.00	17.06	2.00	0.00	7.40	0.16	0.00
17.22	2.00	0.00	7.37	0.16	0.00	17.39	2.00	0.00	7.35	0.16	0.00
17.55	2.00	0.00	7.32	0.16	0.00	17.72	2.00	0.00	7.30	0.16	0.00
17.88	2.00	0.00	7.27	0.16	0.00	18.04	2.00	0.00	7.25	0.16	0.00
18.21	2.00	0.00	7.22	0.16	0.00	18.37	2.00	0.00	7.20	0.16	0.00
18.54	2.00	0.00	7.17	0.16	0.00	18.70	2.00	0.00	7.15	0.16	0.00
18.86	2.00	0.00	7.12	0.16	0.00	19.03	2.00	0.00	7.10	0.16	0.00
19.19	2.00	0.00	7.07	0.16	0.00	19.36	2.00	0.00	7.05	0.16	0.00
19.52	2.00	0.00	7.02	0.16	0.00	19.69	2.00	0.00	7.00	0.16	0.00
19.85	2.00	0.00	6.97	0.16	0.00	20.01	2.00	0.00	6.95	0.16	0.00
20.18	2.00	0.00	6.92	0.16	0.00	20.34	2.00	0.00	6.90	0.16	0.00
20.51	2.00	0.00	6.87	0.16	0.00	20.67	2.00	0.00	6.85	0.16	0.00
20.83	2.00	0.00	6.82	0.16	0.00	21.00	2.00	0.00	6.80	0.16	0.00
21.16	2.00	0.00	6.77	0.16	0.00	21.33	2.00	0.00	6.75	0.16	0.00
21.49	2.00	0.00	6.72	0.16	0.00	21.65	2.00	0.00	6.70	0.16	0.00
21.82	2.00	0.00	6.67	0.16	0.00	21.98	2.00	0.00	6.65	0.16	0.00
22.15	2.00	0.00	6.62	0.16	0.00	22.31	2.00	0.00	6.60	0.16	0.00
22.47	2.00	0.00	6.57	0.16	0.00	22.64	2.00	0.00	6.55	0.16	0.00
22.80	2.00	0.00	6.52	0.16	0.00	22.97	2.00	0.00	6.50	0.16	0.00
23.13	2.00	0.00	6.47	0.16	0.00	23.29	2.00	0.00	6.45	0.16	0.00
23.46	2.00	0.00	6.42	0.16	0.00	23.62	2.00	0.00	6.40	0.16	0.00
23.79	2.00	0.00	6.37	0.16	0.00	23.95	2.00	0.00	6.35	0.16	0.00
24.11	2.00	0.00	6.32	0.16	0.00	24.28	2.00	0.00	6.30	0.16	0.00
24.44	2.00	0.00	6.27	0.16	0.00	24.61	2.00	0.00	6.25	0.16	0.00
24.77	2.00	0.00	6.22	0.16	0.00	24.93	2.00	0.00	6.20	0.16	0.00
25.10	2.00	0.00	6.17	0.16	0.00	25.26	2.00	0.00	6.15	0.16	0.00
25.43	2.00	0.00	6.12	0.16	0.00	25.59	2.00	0.00	6.10	0.16	0.00
25.75	2.00	0.00	6.07	0.16	0.00	25.92	2.00	0.00	6.05	0.16	0.00
26.08	2.00	0.00	6.02	0.16	0.00	26.25	2.00	0.00	6.00	0.16	0.00
26.41	1.03	0.00	5.97	0.16	0.00	26.57	0.66	0.34	5.95	0.16	0.10
26.74	0.44	0.56	5.92	0.16	0.17	26.90	0.32	0.68	5.90	0.16	0.20
27.07	0.34	0.66	5.87	0.16	0.19	27.23	0.33	0.67	5.85	0.16	0.20
27.40	0.34	0.66	5.82	0.16	0.19	27.56	0.36	0.64	5.80	0.16	0.18
27.72	0.43	0.57	5.77	0.16	0.16	27.89	0.48	0.52	5.75	0.16	0.15
28.05	0.49	0.51	5.72	0.16	0.15	28.22	0.54	0.46	5.70	0.16	0.13
28.38	0.68	0.32	5.67	0.16	0.09	28.54	0.97	0.03	5.65	0.16	0.01
28.71	1.26	0.00	5.62	0.16	0.00	28.87	1.50	0.00	5.60	0.16	0.00
29.04	1.72	0.00	5.57	0.16	0.00	29.20	2.00	0.00	5.55	0.16	0.00
29.36	2.00	0.00	5.52	0.16	0.00	29.53	2.00	0.00	5.50	0.16	0.00
29.69	2.00	0.00	5.47	0.16	0.00	29.86	2.00	0.00	5.45	0.16	0.00
30.02	2.00	0.00	5.42	0.16	0.00	30.18	2.00	0.00	5.40	0.16	0.00
30.35	2.00	0.00	5.37	0.16	0.00	30.51	2.00	0.00	5.35	0.16	0.00
30.68	2.00	0.00	5.32	0.16	0.00	30.84	2.00	0.00	5.30	0.16	0.00
31.00	1.86	0.00	5.27	0.16	0.00	31.17	1.32	0.00	5.25	0.16	0.00
31.33	0.94	0.06	5.22	0.16	0.01	31.50	0.76	0.24	5.20	0.16	0.06

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

Depth (ft)	FS	F_L	w_z	d_z	LPI	Depth (ft)	FS	F_L	w_z	d_z	LPI
31.66	0.69	0.31	5.17	0.16	0.08	31.82	0.67	0.33	5.15	0.16	0.08
31.99	0.75	0.25	5.12	0.16	0.06	32.15	0.78	0.22	5.10	0.16	0.06
32.32	0.82	0.18	5.07	0.16	0.05	32.48	0.81	0.19	5.05	0.16	0.05
32.64	0.90	0.10	5.02	0.16	0.03	32.81	0.99	0.01	5.00	0.16	0.00
32.97	1.14	0.00	4.97	0.16	0.00	33.14	0.94	0.06	4.95	0.16	0.02
33.30	0.68	0.32	4.92	0.16	0.08	33.46	0.44	0.56	4.90	0.16	0.14
33.63	0.39	0.61	4.87	0.16	0.15	33.79	0.41	0.59	4.85	0.16	0.14
33.96	0.44	0.56	4.82	0.16	0.13	34.12	0.44	0.56	4.80	0.16	0.13
34.28	0.39	0.61	4.77	0.16	0.14	34.45	0.34	0.66	4.75	0.16	0.16
34.61	0.30	0.70	4.72	0.16	0.17	34.78	0.29	0.71	4.70	0.16	0.17
34.94	2.00	0.00	4.67	0.16	0.00	35.10	2.00	0.00	4.65	0.16	0.00
35.27	2.00	0.00	4.62	0.16	0.00	35.43	2.00	0.00	4.60	0.16	0.00
35.60	2.00	0.00	4.57	0.16	0.00	35.76	2.00	0.00	4.55	0.16	0.00
35.93	2.00	0.00	4.52	0.16	0.00	36.09	2.00	0.00	4.50	0.16	0.00
36.25	2.00	0.00	4.47	0.16	0.00	36.42	2.00	0.00	4.45	0.16	0.00
36.58	2.00	0.00	4.42	0.16	0.00	36.75	2.00	0.00	4.40	0.16	0.00
36.91	2.00	0.00	4.37	0.16	0.00	37.07	2.00	0.00	4.35	0.16	0.00
37.24	2.00	0.00	4.32	0.16	0.00	37.40	2.00	0.00	4.30	0.16	0.00
37.57	2.00	0.00	4.27	0.16	0.00	37.73	2.00	0.00	4.25	0.16	0.00
37.89	2.00	0.00	4.22	0.16	0.00	38.06	2.00	0.00	4.20	0.16	0.00
38.22	2.00	0.00	4.17	0.16	0.00	38.39	2.00	0.00	4.15	0.16	0.00
38.55	2.00	0.00	4.12	0.16	0.00	38.71	2.00	0.00	4.10	0.16	0.00
38.88	2.00	0.00	4.07	0.16	0.00	39.04	2.00	0.00	4.05	0.16	0.00
39.21	2.00	0.00	4.02	0.16	0.00	39.37	2.00	0.00	4.00	0.16	0.00
39.53	2.00	0.00	3.97	0.16	0.00	39.70	2.00	0.00	3.95	0.16	0.00
39.86	2.00	0.00	3.92	0.16	0.00	40.03	2.00	0.00	3.90	0.16	0.00
40.19	2.00	0.00	3.87	0.16	0.00	40.35	2.00	0.00	3.85	0.16	0.00
40.52	2.00	0.00	3.82	0.16	0.00	40.68	2.00	0.00	3.80	0.16	0.00
40.85	2.00	0.00	3.77	0.16	0.00	41.01	2.00	0.00	3.75	0.16	0.00
41.17	2.00	0.00	3.72	0.16	0.00	41.34	2.00	0.00	3.70	0.16	0.00
41.50	2.00	0.00	3.67	0.16	0.00	41.67	2.00	0.00	3.65	0.16	0.00
41.83	2.00	0.00	3.62	0.16	0.00	41.99	2.00	0.00	3.60	0.16	0.00
42.16	2.00	0.00	3.57	0.16	0.00	42.32	2.00	0.00	3.55	0.16	0.00
42.49	2.00	0.00	3.52	0.16	0.00	42.65	2.00	0.00	3.50	0.16	0.00
42.81	2.00	0.00	3.47	0.16	0.00	42.98	2.00	0.00	3.45	0.16	0.00
43.14	2.00	0.00	3.42	0.16	0.00	43.31	2.00	0.00	3.40	0.16	0.00
43.47	2.00	0.00	3.37	0.16	0.00	43.64	2.00	0.00	3.35	0.16	0.00
43.80	2.00	0.00	3.32	0.16	0.00	43.96	2.00	0.00	3.30	0.16	0.00
44.13	2.00	0.00	3.27	0.16	0.00	44.29	2.00	0.00	3.25	0.16	0.00
44.46	2.00	0.00	3.22	0.16	0.00	44.62	2.00	0.00	3.20	0.16	0.00
44.78	2.00	0.00	3.17	0.16	0.00	44.95	2.00	0.00	3.15	0.16	0.00
45.11	2.00	0.00	3.12	0.16	0.00	45.28	2.00	0.00	3.10	0.16	0.00
45.44	2.00	0.00	3.07	0.16	0.00	45.60	2.00	0.00	3.05	0.16	0.00
45.77	2.00	0.00	3.02	0.16	0.00	45.93	2.00	0.00	3.00	0.16	0.00
46.10	2.00	0.00	2.97	0.16	0.00	46.26	2.00	0.00	2.95	0.16	0.00
46.42	2.00	0.00	2.92	0.16	0.00	46.59	2.00	0.00	2.90	0.16	0.00
46.75	2.00	0.00	2.87	0.16	0.00	46.92	2.00	0.00	2.85	0.16	0.00
47.08	2.00	0.00	2.82	0.16	0.00	47.24	2.00	0.00	2.80	0.16	0.00

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

Depth (ft)	FS	F_L	w_z	d_z	LPI	Depth (ft)	FS	F_L	w_z	d_z	LPI
47.41	2.00	0.00	2.77	0.16	0.00	47.57	2.00	0.00	2.75	0.16	0.00
47.74	2.00	0.00	2.72	0.16	0.00	47.90	2.00	0.00	2.70	0.16	0.00
48.06	2.00	0.00	2.67	0.16	0.00	48.23	2.00	0.00	2.65	0.16	0.00
48.39	2.00	0.00	2.62	0.16	0.00	48.56	0.34	0.66	2.60	0.16	0.09
48.72	0.35	0.65	2.57	0.16	0.08	48.88	0.39	0.61	2.55	0.16	0.08
49.05	0.41	0.59	2.52	0.16	0.07	49.21	0.41	0.59	2.50	0.16	0.07
49.38	2.00	0.00	2.47	0.16	0.00	49.54	2.00	0.00	2.45	0.16	0.00
49.70	2.00	0.00	2.42	0.16	0.00	49.87	2.00	0.00	2.40	0.16	0.00
50.03	2.00	0.00	2.37	0.16	0.00	50.20	2.00	0.00	2.35	0.16	0.00
50.36	2.00	0.00	2.32	0.16	0.00	50.52	2.00	0.00	2.30	0.16	0.00
50.69	2.00	0.00	2.27	0.16	0.00	50.85	2.00	0.00	2.25	0.16	0.00
51.02	2.00	0.00	2.22	0.16	0.00	51.18	2.00	0.00	2.20	0.16	0.00
51.35	2.00	0.00	2.17	0.16	0.00	51.51	2.00	0.00	2.15	0.16	0.00
51.67	2.00	0.00	2.12	0.16	0.00	51.84	2.00	0.00	2.10	0.16	0.00
52.00	2.00	0.00	2.07	0.16	0.00	52.17	2.00	0.00	2.05	0.16	0.00
52.33	2.00	0.00	2.02	0.16	0.00	52.49	2.00	0.00	2.00	0.16	0.00
52.66	2.00	0.00	1.97	0.16	0.00	52.82	2.00	0.00	1.95	0.16	0.00
52.99	2.00	0.00	1.92	0.16	0.00	53.15	2.00	0.00	1.90	0.16	0.00
53.31	2.00	0.00	1.87	0.16	0.00	53.48	2.00	0.00	1.85	0.16	0.00
53.64	0.29	0.71	1.82	0.16	0.07	53.81	0.30	0.70	1.80	0.16	0.06
53.97	2.00	0.00	1.77	0.16	0.00	54.13	2.00	0.00	1.75	0.16	0.00
54.30	2.00	0.00	1.72	0.16	0.00	54.46	2.00	0.00	1.70	0.16	0.00
54.63	2.00	0.00	1.67	0.16	0.00	54.79	2.00	0.00	1.65	0.16	0.00
54.95	2.00	0.00	1.62	0.16	0.00	55.12	2.00	0.00	1.60	0.16	0.00
55.28	2.00	0.00	1.57	0.16	0.00	55.45	2.00	0.00	1.55	0.16	0.00
55.61	2.00	0.00	1.52	0.16	0.00	55.77	2.00	0.00	1.50	0.16	0.00
55.94	2.00	0.00	1.47	0.16	0.00	56.10	2.00	0.00	1.45	0.16	0.00
56.27	2.00	0.00	1.42	0.16	0.00	56.43	2.00	0.00	1.40	0.16	0.00
56.59	2.00	0.00	1.37	0.16	0.00	56.76	2.00	0.00	1.35	0.16	0.00
56.92	2.00	0.00	1.32	0.16	0.00	57.09	2.00	0.00	1.30	0.16	0.00
57.25	2.00	0.00	1.27	0.16	0.00	57.41	2.00	0.00	1.25	0.16	0.00
57.58	2.00	0.00	1.22	0.16	0.00	57.74	2.00	0.00	1.20	0.16	0.00
57.91	2.00	0.00	1.17	0.16	0.00	58.07	2.00	0.00	1.15	0.16	0.00
58.23	2.00	0.00	1.12	0.16	0.00	58.40	2.00	0.00	1.10	0.16	0.00
58.56	2.00	0.00	1.07	0.16	0.00	58.73	2.00	0.00	1.05	0.16	0.00
58.89	2.00	0.00	1.02	0.16	0.00	59.06	2.00	0.00	1.00	0.16	0.00
59.22	2.00	0.00	0.97	0.16	0.00	59.38	2.00	0.00	0.95	0.16	0.00
59.55	2.00	0.00	0.92	0.16	0.00	59.71	2.00	0.00	0.90	0.16	0.00
59.88	2.00	0.00	0.87	0.16	0.00	60.04	2.00	0.00	0.85	0.16	0.00
60.20	2.00	0.00	0.82	0.16	0.00	60.37	2.00	0.00	0.80	0.16	0.00
60.53	2.00	0.00	0.77	0.16	0.00	60.70	2.00	0.00	0.75	0.16	0.00
60.86	2.00	0.00	0.72	0.16	0.00	61.02	2.00	0.00	0.70	0.16	0.00
61.19	2.00	0.00	0.67	0.16	0.00	61.35	2.00	0.00	0.65	0.16	0.00
61.52	2.00	0.00	0.62	0.16	0.00	61.68	2.00	0.00	0.60	0.16	0.00
61.84	2.00	0.00	0.57	0.16	0.00	62.01	2.00	0.00	0.55	0.16	0.00
62.17	2.00	0.00	0.52	0.16	0.00	62.34	2.00	0.00	0.50	0.16	0.00
62.50	2.00	0.00	0.47	0.16	0.00	62.66	2.00	0.00	0.45	0.16	0.00
62.83	2.00	0.00	0.42	0.16	0.00	62.99	2.00	0.00	0.40	0.16	0.00

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

Depth (ft)	FS	F_L	w_z	d_z	LPI	Depth (ft)	FS	F_L	w_z	d_z	LPI
63.16	2.00	0.00	0.37	0.16	0.00	63.32	2.00	0.00	0.35	0.16	0.00
63.48	2.00	0.00	0.32	0.16	0.00	63.65	2.00	0.00	0.30	0.16	0.00
63.81	2.00	0.00	0.27	0.16	0.00	63.98	0.43	0.57	0.25	0.16	0.01
64.14	0.40	0.60	0.22	0.16	0.01	64.30	0.38	0.62	0.20	0.16	0.01
64.47	0.35	0.65	0.17	0.16	0.01	64.63	0.34	0.66	0.15	0.16	0.00
64.80	2.00	0.00	0.12	0.16	0.00	64.96	2.00	0.00	0.10	0.16	0.00
65.12	2.00	0.00	0.07	0.16	0.00	65.29	2.00	0.00	0.05	0.16	0.00
65.45	2.00	0.00	0.02	0.16	0.00	65.62	2.00	0.00	0.00	0.00	0.00
65.78	2.00	0.00	0.00	0.00	0.00	65.94	2.00	0.00	0.00	0.00	0.00
66.11	2.00	0.00	0.00	0.00	0.00	66.27	2.00	0.00	0.00	0.00	0.00
66.44	2.00	0.00	0.00	0.00	0.00	66.60	2.00	0.00	0.00	0.00	0.00
66.77	2.00	0.00	0.00	0.00	0.00	66.93	2.00	0.00	0.00	0.00	0.00
67.09	2.00	0.00	0.00	0.00	0.00	67.26	2.00	0.00	0.00	0.00	0.00
67.42	2.00	0.00	0.00	0.00	0.00	67.59	2.00	0.00	0.00	0.00	0.00
67.75	2.00	0.00	0.00	0.00	0.00	67.91	2.00	0.00	0.00	0.00	0.00
68.08	0.95	0.00	0.00	0.00	0.00	68.24	1.26	0.00	0.00	0.00	0.00
68.41	2.00	0.00	0.00	0.00	0.00	68.57	2.00	0.00	0.00	0.00	0.00
68.73	2.00	0.00	0.00	0.00	0.00	68.90	2.00	0.00	0.00	0.00	0.00
69.06	2.00	0.00	0.00	0.00	0.00	69.23	2.00	0.00	0.00	0.00	0.00
69.39	2.00	0.00	0.00	0.00	0.00	69.55	2.00	0.00	0.00	0.00	0.00
69.72	2.00	0.00	0.00	0.00	0.00	69.88	2.00	0.00	0.00	0.00	0.00
70.05	2.00	0.00	0.00	0.00	0.00	70.21	2.00	0.00	0.00	0.00	0.00

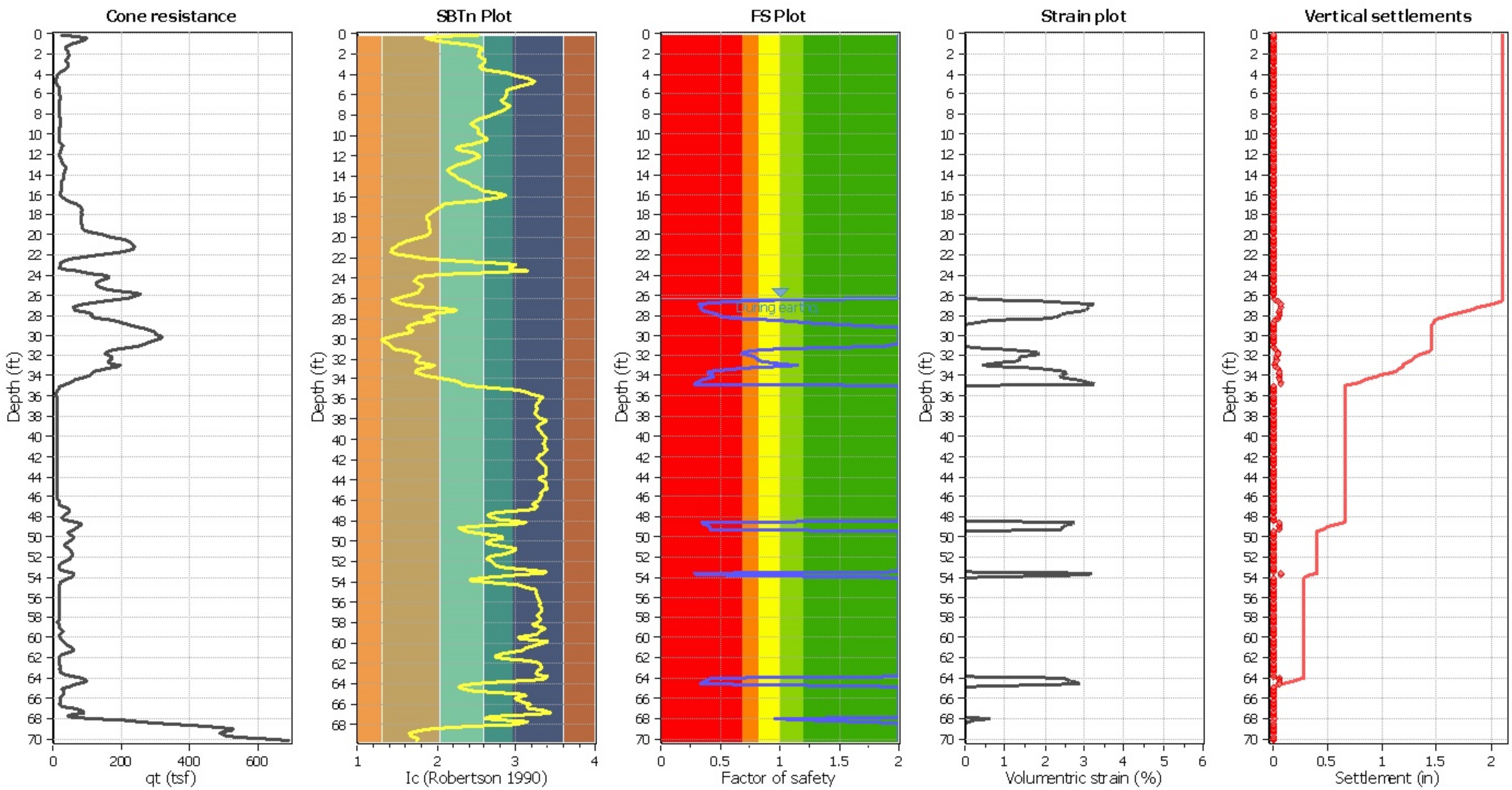
Overall liquefaction potential: 4.40

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

Abbreviations

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

Estimation of post-earthquake settlements



Abbreviations

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

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

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
26.41	141.42	1.03	0.64	1.00	0.01	26.57	114.99	0.66	2.02	1.00	0.04
26.74	89.57	0.44	2.56	1.00	0.05	26.90	66.77	0.32	3.25	1.00	0.06
27.07	71.41	0.34	3.08	1.00	0.06	27.23	70.41	0.33	3.12	1.00	0.06
27.40	72.38	0.34	3.05	1.00	0.06	27.56	77.47	0.36	2.88	1.00	0.06
27.72	89.46	0.43	2.56	1.00	0.05	27.89	96.48	0.48	2.41	1.00	0.05
28.05	97.97	0.49	2.38	1.00	0.05	28.22	104.23	0.54	2.26	1.00	0.04
28.38	118.32	0.68	1.94	1.00	0.04	28.54	139.88	0.97	0.65	1.00	0.01
28.71	156.84	1.26	0.21	1.00	0.00	28.87	168.26	1.50	0.00	1.00	0.00
29.04	177.62	1.72	0.00	1.00	0.00	29.20	194.23	2.00	0.00	1.00	0.00
29.36	209.87	2.00	0.00	1.00	0.00	29.53	217.14	2.00	0.00	1.00	0.00
29.69	224.14	2.00	0.00	1.00	0.00	29.86	228.91	2.00	0.00	1.00	0.00
30.02	237.57	2.00	0.00	1.00	0.00	30.18	241.54	2.00	0.00	1.00	0.00
30.35	232.80	2.00	0.00	1.00	0.00	30.51	222.34	2.00	0.00	1.00	0.00
30.68	210.19	2.00	0.00	1.00	0.00	30.84	204.26	2.00	0.00	1.00	0.00
31.00	185.15	1.86	0.00	1.00	0.00	31.17	162.11	1.32	0.21	1.00	0.00
31.33	141.19	0.94	0.94	1.00	0.02	31.50	127.91	0.76	1.42	1.00	0.03
31.66	122.46	0.69	1.84	1.00	0.04	31.82	121.20	0.67	1.87	1.00	0.04
31.99	127.49	0.75	1.74	1.00	0.03	32.15	130.36	0.78	1.38	1.00	0.03
32.32	133.15	0.82	1.34	1.00	0.03	32.48	132.80	0.81	1.34	1.00	0.03
32.64	139.13	0.90	0.96	1.00	0.02	32.81	145.50	0.99	0.62	1.00	0.01
32.97	154.36	1.14	0.42	1.00	0.01	33.14	141.98	0.94	0.93	1.00	0.02
33.30	122.49	0.68	1.84	1.00	0.04	33.46	96.32	0.44	2.41	1.00	0.05
33.63	89.41	0.39	2.56	1.00	0.05	33.79	91.47	0.41	2.51	1.00	0.05
33.96	96.88	0.44	2.40	1.00	0.05	34.12	97.04	0.44	2.40	1.00	0.05
34.28	89.86	0.39	2.55	1.00	0.05	34.45	79.54	0.34	2.82	1.00	0.06
34.61	70.00	0.30	3.13	1.00	0.06	34.78	66.61	0.29	3.26	1.00	0.06
34.94	62.58	2.00	0.00	1.00	0.00	35.10	56.95	2.00	0.00	1.00	0.00
35.27	51.31	2.00	0.00	1.00	0.00	35.43	47.10	2.00	0.00	1.00	0.00
35.60	43.34	2.00	0.00	1.00	0.00	35.76	41.36	2.00	0.00	1.00	0.00
35.93	41.21	2.00	0.00	1.00	0.00	36.09	42.25	2.00	0.00	1.00	0.00
36.25	42.64	2.00	0.00	1.00	0.00	36.42	43.12	2.00	0.00	1.00	0.00
36.58	43.31	2.00	0.00	1.00	0.00	36.75	43.73	2.00	0.00	1.00	0.00
36.91	43.90	2.00	0.00	1.00	0.00	37.07	43.96	2.00	0.00	1.00	0.00
37.24	43.91	2.00	0.00	1.00	0.00	37.40	42.62	2.00	0.00	1.00	0.00
37.57	41.72	2.00	0.00	1.00	0.00	37.73	41.56	2.00	0.00	1.00	0.00
37.89	43.21	2.00	0.00	1.00	0.00	38.06	45.45	2.00	0.00	1.00	0.00
38.22	48.16	2.00	0.00	1.00	0.00	38.39	50.29	2.00	0.00	1.00	0.00
38.55	50.57	2.00	0.00	1.00	0.00	38.71	49.76	2.00	0.00	1.00	0.00
38.88	48.39	2.00	0.00	1.00	0.00	39.04	47.63	2.00	0.00	1.00	0.00
39.21	46.42	2.00	0.00	1.00	0.00	39.37	45.02	2.00	0.00	1.00	0.00
39.53	43.69	2.00	0.00	1.00	0.00	39.70	42.89	2.00	0.00	1.00	0.00
39.86	44.10	2.00	0.00	1.00	0.00	40.03	45.21	2.00	0.00	1.00	0.00
40.19	45.98	2.00	0.00	1.00	0.00	40.35	44.79	2.00	0.00	1.00	0.00
40.52	43.10	2.00	0.00	1.00	0.00	40.68	41.36	2.00	0.00	1.00	0.00
40.85	41.16	2.00	0.00	1.00	0.00	41.01	43.93	2.00	0.00	1.00	0.00
41.17	47.56	2.00	0.00	1.00	0.00	41.34	51.54	2.00	0.00	1.00	0.00
41.50	53.55	2.00	0.00	1.00	0.00	41.67	53.77	2.00	0.00	1.00	0.00
41.83	51.41	2.00	0.00	1.00	0.00	41.99	47.98	2.00	0.00	1.00	0.00

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

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
42.16	45.24	2.00	0.00	1.00	0.00	42.32	43.40	2.00	0.00	1.00	0.00
42.49	42.22	2.00	0.00	1.00	0.00	42.65	41.91	2.00	0.00	1.00	0.00
42.81	41.77	2.00	0.00	1.00	0.00	42.98	42.11	2.00	0.00	1.00	0.00
43.14	43.52	2.00	0.00	1.00	0.00	43.31	44.94	2.00	0.00	1.00	0.00
43.47	46.37	2.00	0.00	1.00	0.00	43.64	46.27	2.00	0.00	1.00	0.00
43.80	46.63	2.00	0.00	1.00	0.00	43.96	48.44	2.00	0.00	1.00	0.00
44.13	50.16	2.00	0.00	1.00	0.00	44.29	50.76	2.00	0.00	1.00	0.00
44.46	48.75	2.00	0.00	1.00	0.00	44.62	46.30	2.00	0.00	1.00	0.00
44.78	43.60	2.00	0.00	1.00	0.00	44.95	42.47	2.00	0.00	1.00	0.00
45.11	41.11	2.00	0.00	1.00	0.00	45.28	40.68	2.00	0.00	1.00	0.00
45.44	40.05	2.00	0.00	1.00	0.00	45.60	39.95	2.00	0.00	1.00	0.00
45.77	41.30	2.00	0.00	1.00	0.00	45.93	42.36	2.00	0.00	1.00	0.00
46.10	44.84	2.00	0.00	1.00	0.00	46.26	46.62	2.00	0.00	1.00	0.00
46.42	50.40	2.00	0.00	1.00	0.00	46.59	56.22	2.00	0.00	1.00	0.00
46.75	66.22	2.00	0.00	1.00	0.00	46.92	78.02	2.00	0.00	1.00	0.00
47.08	82.09	2.00	0.00	1.00	0.00	47.24	84.90	2.00	0.00	1.00	0.00
47.41	83.07	2.00	0.00	1.00	0.00	47.57	81.45	2.00	0.00	1.00	0.00
47.74	78.07	2.00	0.00	1.00	0.00	47.90	77.80	2.00	0.00	1.00	0.00
48.06	84.23	2.00	0.00	1.00	0.00	48.23	89.54	2.00	0.00	1.00	0.00
48.39	86.84	2.00	0.00	1.00	0.00	48.56	82.73	0.34	2.73	1.00	0.05
48.72	84.18	0.35	2.69	1.00	0.05	48.88	91.20	0.39	2.52	1.00	0.05
49.05	94.37	0.41	2.45	1.00	0.05	49.21	95.26	0.41	2.43	1.00	0.05
49.38	97.07	2.00	0.00	1.00	0.00	49.54	98.38	2.00	0.00	1.00	0.00
49.70	100.62	2.00	0.00	1.00	0.00	49.87	101.85	2.00	0.00	1.00	0.00
50.03	102.49	2.00	0.00	1.00	0.00	50.20	101.56	2.00	0.00	1.00	0.00
50.36	97.22	2.00	0.00	1.00	0.00	50.52	94.96	2.00	0.00	1.00	0.00
50.69	94.51	2.00	0.00	1.00	0.00	50.85	97.60	2.00	0.00	1.00	0.00
51.02	97.39	2.00	0.00	1.00	0.00	51.18	96.11	2.00	0.00	1.00	0.00
51.35	92.19	2.00	0.00	1.00	0.00	51.51	90.61	2.00	0.00	1.00	0.00
51.67	91.21	2.00	0.00	1.00	0.00	51.84	93.33	2.00	0.00	1.00	0.00
52.00	94.26	2.00	0.00	1.00	0.00	52.17	91.01	2.00	0.00	1.00	0.00
52.33	83.93	2.00	0.00	1.00	0.00	52.49	74.10	2.00	0.00	1.00	0.00
52.66	64.61	2.00	0.00	1.00	0.00	52.82	59.39	2.00	0.00	1.00	0.00
52.99	61.81	2.00	0.00	1.00	0.00	53.15	68.18	2.00	0.00	1.00	0.00
53.31	70.81	2.00	0.00	1.00	0.00	53.48	67.65	2.00	0.00	1.00	0.00
53.64	68.14	0.29	3.20	1.00	0.06	53.81	71.75	0.30	3.07	1.00	0.06
53.97	75.15	2.00	0.00	1.00	0.00	54.13	74.68	2.00	0.00	1.00	0.00
54.30	73.47	2.00	0.00	1.00	0.00	54.46	68.60	2.00	0.00	1.00	0.00
54.63	62.48	2.00	0.00	1.00	0.00	54.79	57.94	2.00	0.00	1.00	0.00
54.95	56.82	2.00	0.00	1.00	0.00	55.12	56.24	2.00	0.00	1.00	0.00
55.28	55.94	2.00	0.00	1.00	0.00	55.45	56.24	2.00	0.00	1.00	0.00
55.61	57.03	2.00	0.00	1.00	0.00	55.77	57.58	2.00	0.00	1.00	0.00
55.94	57.43	2.00	0.00	1.00	0.00	56.10	56.58	2.00	0.00	1.00	0.00
56.27	54.38	2.00	0.00	1.00	0.00	56.43	51.79	2.00	0.00	1.00	0.00
56.59	49.72	2.00	0.00	1.00	0.00	56.76	48.83	2.00	0.00	1.00	0.00
56.92	48.88	2.00	0.00	1.00	0.00	57.09	49.03	2.00	0.00	1.00	0.00
57.25	49.12	2.00	0.00	1.00	0.00	57.41	48.97	2.00	0.00	1.00	0.00
57.58	49.52	2.00	0.00	1.00	0.00	57.74	49.64	2.00	0.00	1.00	0.00

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

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
57.91	48.99	2.00	0.00	1.00	0.00	58.07	46.82	2.00	0.00	1.00	0.00
58.23	45.50	2.00	0.00	1.00	0.00	58.40	46.48	2.00	0.00	1.00	0.00
58.56	48.13	2.00	0.00	1.00	0.00	58.73	52.91	2.00	0.00	1.00	0.00
58.89	62.32	2.00	0.00	1.00	0.00	59.06	70.87	2.00	0.00	1.00	0.00
59.22	76.21	2.00	0.00	1.00	0.00	59.38	72.16	2.00	0.00	1.00	0.00
59.55	67.99	2.00	0.00	1.00	0.00	59.71	65.08	2.00	0.00	1.00	0.00
59.88	63.64	2.00	0.00	1.00	0.00	60.04	72.74	2.00	0.00	1.00	0.00
60.20	79.31	2.00	0.00	1.00	0.00	60.37	86.74	2.00	0.00	1.00	0.00
60.53	92.10	2.00	0.00	1.00	0.00	60.70	102.14	2.00	0.00	1.00	0.00
60.86	110.58	2.00	0.00	1.00	0.00	61.02	110.09	2.00	0.00	1.00	0.00
61.19	101.92	2.00	0.00	1.00	0.00	61.35	89.85	2.00	0.00	1.00	0.00
61.52	79.15	2.00	0.00	1.00	0.00	61.68	69.65	2.00	0.00	1.00	0.00
61.84	61.14	2.00	0.00	1.00	0.00	62.01	56.98	2.00	0.00	1.00	0.00
62.17	55.77	2.00	0.00	1.00	0.00	62.34	55.91	2.00	0.00	1.00	0.00
62.50	56.97	2.00	0.00	1.00	0.00	62.66	57.95	2.00	0.00	1.00	0.00
62.83	57.97	2.00	0.00	1.00	0.00	62.99	56.76	2.00	0.00	1.00	0.00
63.16	58.35	2.00	0.00	1.00	0.00	63.32	68.94	2.00	0.00	1.00	0.00
63.48	82.85	2.00	0.00	1.00	0.00	63.65	95.87	2.00	0.00	1.00	0.00
63.81	97.33	2.00	0.00	1.00	0.00	63.98	94.33	0.43	2.45	1.00	0.05
64.14	88.95	0.40	2.57	1.00	0.05	64.30	86.08	0.38	2.64	1.00	0.05
64.47	80.08	0.35	2.80	1.00	0.06	64.63	77.14	0.34	2.89	1.00	0.06
64.80	73.89	2.00	0.00	1.00	0.00	64.96	72.18	2.00	0.00	1.00	0.00
65.12	69.80	2.00	0.00	1.00	0.00	65.29	67.13	2.00	0.00	1.00	0.00
65.45	64.55	2.00	0.00	1.00	0.00	65.62	62.21	2.00	0.00	1.00	0.00
65.78	58.39	2.00	0.00	1.00	0.00	65.94	53.25	2.00	0.00	1.00	0.00
66.11	49.40	2.00	0.00	1.00	0.00	66.27	47.79	2.00	0.00	1.00	0.00
66.44	48.96	2.00	0.00	1.00	0.00	66.60	59.05	2.00	0.00	1.00	0.00
66.77	73.20	2.00	0.00	1.00	0.00	66.93	99.25	2.00	0.00	1.00	0.00
67.09	121.03	2.00	0.00	1.00	0.00	67.26	127.52	2.00	0.00	1.00	0.00
67.42	122.58	2.00	0.00	1.00	0.00	67.59	111.55	2.00	0.00	1.00	0.00
67.75	114.32	2.00	0.00	1.00	0.00	67.91	125.45	2.00	0.00	1.00	0.00
68.08	141.80	0.95	0.64	1.00	0.01	68.24	159.26	1.26	0.21	1.00	0.00
68.41	195.03	2.00	0.00	1.00	0.00	68.57	225.52	2.00	0.00	1.00	0.00
68.73	261.09	2.00	0.00	1.00	0.00	68.90	291.27	2.00	0.00	1.00	0.00
69.06	315.71	2.00	0.00	1.00	0.00	69.23	317.85	2.00	0.00	1.00	0.00
69.39	304.60	2.00	0.00	1.00	0.00	69.55	296.65	2.00	0.00	1.00	0.00
69.72	-1.00	2.00	0.00	1.00	0.00	69.88	-1.00	2.00	0.00	1.00	0.00
70.05	-1.00	2.00	0.00	1.00	0.00	70.21	-1.00	2.00	0.00	1.00	0.00

Total estimated settlement: 2.11

Abbreviations

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

CALCULATIONS OF SHEAR WAVE VELOCITY

SOIL STRENGTH PARAMETERS & V_{s30}

Calc By: JZ
Date: 10/10/18

PROJECT NAME: ***BLOSSOM HILL ROAD OVERCROSSING (WIDEN)***
PROJECT NO.: ***2016-146-BOC***
STRUCTURE:
BORING NO.: ***R-18-SC-001***

BOREHOLE DIA (in)= 3.3
GW DEPTH (ft)= 30

HAMMER ENERGY = 78%
DRILLING RODS (Y/N)= Y

SOIL GROUPS
1. SANDS & GRAVELS
2. CLAYS AND PLASTIC SILTS
3. NON TO LOW PLASTIC SILTS
4. YOUNG SEDIMENTARY ROCKS
5. LIQUEFIABLE SANDS (RESIDUAL STRENGTH)
6. LIQUEFIABLE SILTS (RESIDUAL STRENGTH)

Nd
N_{30} 17

V_{sd} (m/s)
V_{s30} (m/s) *202*

Correlation 1) Caltrans

Sample No	Layer Thickness from	Layer Thickness to	Sample Depth (ft)	Soil Type	Field Blow Count	Sampler Type	Unit Weight (pcf)	σ_v (psf)	σ_v' (psf)	SPT-$N_{eq.}$	N_{60} CE Corr.	N_{60} CR,CB,CS Corr.	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60,CS}$	Correlated Strength Parameters ϕ (°)	Correlated Strength Parameters c (psf)	Correlated Strength Parameters S_r (psf)	Lab Test Results c (psf)	Vs (m/s)
1	0.0	4.0	3	1	28	MC	125	375	375	18	23.7	17.7	1.70	30.2		30.2	41				153
2	4.0	8.0	6	1	27	MC	125	750	750	18	22.8	18.3	1.63	29.8		29.8	40				180
3	8.0	13.0	11	2	23	MC	125	1375	1375	15	19.4	16.5	1.21	19.9				2429			214
4	13.0	18.0	16	2	22	MC	125	2000	2000	14	18.6	17.7	1.00	17.7				2324		2600	230
5	18.0	23.0	21	2	11	SPT	125	2625	2625	11	14.3	15.4	0.87	13.5				1788			222
6	23.0	28.0	26	1	25	MC	125	3250	3250	16	21.1	21.1	0.78	16.6	28%	23.4	35				252
7	28.0	33.5	31	1	16	MC	125	3875	3813	10	13.5	13.5	0.72	9.8	16%	13.0	33				251
8	33.5	38.5	36	2	11	MC	125	4500	4126	7	9.3	9.3	0.70	6.5				1162		950	143
9	38.5	43.0	41	2	6	MC	125	5125	4439	4	5.1	5.1	0.67	3.4				634			190
10	43.0	48.0	46	1	34	SPT	125	5750	4752	34	44.2	57.5	0.65	37.3		37.3	37				296
11	48.0	53.0	51	1	50	SPT	125	6375	5065	50	65.0	84.5	0.63	53.1		53.1	39				312
12	53.0	58.0	56	1	64	SPT	125	7000	5378	64	83.2	108.2	0.61	66.0	9%	67.8	40				324
13	58.0	65.0	61	1	31	SPT	125	7625	5691	31	40.3	52.4	0.59	31.1		31.1	36				306
14	65.0	76.0	71	3	10	MC	125	8875	6317	7	8.5	8.5	0.56	4.8	75%			845		260	100
15	76.0	81.0	81	2	34	MC	125	10125	6943	22	28.7	28.7	0.54	15.4				3591			305
15	81.0	86.5	81.5	1	34	MC	125	10188	6974	22	28.7	28.7	0.54	15.4	28%	22.1	33				311
16	86.5	95.0	91	2	25	MC	125	11375	7569	16	21.1	21.1	0.51	10.9				2641		2120	209
17	95.0	106.0	101	2	43	MC	125	12625	8195	28	36.3	36.3	0.49	18.0				4542		2400	221
18	106.0	115.0	111	1	34	SPT	125	13875	8821	34	44.2	56.0	0.48	26.7		26.7	34				342
19	115.0	125.0	121	2	43	MC	125	15125	9447	28	36.3	36.3	0.46	16.7				4542			339
20	125.0	131.5	131	2	35	SPT	125	16375	10073	35	45.5	57.1	0.45	25.4				5688			360

Note:
1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner), C_N (Overburden) are per Youd 2001
2. For fine-grained materials, the correlation between blow-counts and shear is based on NAVFAC DM 7.1.
3. The phi angle was estimated based on Meyerhof (1956).
4. Residual Strength (Sr) is based on Caltrans "Guidelines on Foundation Loading and Deformation Due to Liquefaction Induced Lateral Spreading", Caltrans 2011
5. The Vs were correlated based on N_{60} for Soil Types 1,3, 4; based on N_{60} or c_{lab} for Soil Type 2 and based on Sr for Soil Types 5 & 6 per Caltrans Guidelines (2012).
6. Spreadsheet Revision Date: 10/29/13

SOIL STRENGTH PARAMETERS & V_{s30}

Calc By: JZ
Date: 10/10/18

PROJECT NAME: ***BLOSSOM HILL ROAD OVERCROSSING (WIDEN)***
PROJECT NO.: ***2016-146-BOC***
STRUCTURE:
BORING NO.: ***R-18-SC-002***

BOREHOLE DIA (in)= 3.3 | *HAMMER ENERGY =* 78%
GW DEPTH (ft)= 25 | *DRILLING RODS (Y/N)=* Y

SOIL GROUPS
1. SANDS & GRAVELS
2. CLAYS AND PLASTIC SILTS
3. NON TO LOW PLASTIC SILTS
4. YOUNG SEDIMENTARY ROCKS
5. LIQUEFIABLE SANDS (RESIDUAL STRENGTH)
6. LIQUEFIABLE SILTS (RESIDUAL STRENGTH)

Nd | V_{sd} (m/s)
N_{30} 12 | V_{s30} (m/s) *204*

Correlation: 1) Caltrans

Sample No	Layer Thickness from	Layer Thickness to	Sample Depth (ft)	Soil Type	Field Blow Count	Sampler Type	Unit Weight (pcf)	σ_v (psf)	σ_v' (psf)	SPT-$N_{eq.}$	N_{60} CE Corr.	N_{60} CR,CB,CS Corr.	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60, CS}$	Correlated Strength Parameters ϕ (°)	Correlated Strength Parameters c (psf)	Correlated Strength Parameters S_r (psf)	Lab Test Results c (psf)	Vs (m/s)
1	0.0	4.0	3	1	29	SPT	125	375	375	29	37.7	36.8	1.70	62.5		62.5	46				160
2	4.0	8.0	6	1	37	MC	125	750	750	24	31.3	25.0	1.63	40.8		40.8	42				185
3	8.0	13.5	11	1	29	MC	125	1375	1375	19	24.5	20.8	1.21	25.1	23%	31.8	38				209
4	13.5	18.0	16	1	21	MC	125	2000	2000	14	17.7	16.9	1.00	16.9	30%	24.1	36				221
5	18.0	23.0	21	1	22	MC	125	2625	2625	14	18.6	17.7	0.87	15.4	28%	22.2	35				237
6	23.0	28.0	26	2	15	SPT	125	3250	3188	15	19.5	23.1	0.79	18.3				2438			246
7	28.0	33.0	31	2	6	MC	125	3875	3501	4	5.1	5.1	0.76	3.8				634		400	100
8	33.0	38.0	36	2	11	MC	125	4500	3814	7	9.3	9.3	0.72	6.7				1162		1000	146
9	38.0	43.0	41	2	16	MC	125	5125	4127	10	13.5	13.5	0.70	9.4	81%			1690			236
10	43.0	48.0	46	2	2	MC	125	5750	4440	1	1.7	1.7	0.67	1.1				211			100
11	48.0	53.0	51	2	14	MC	125	6375	4753	9	11.8	11.8	0.65	7.7				1479			234
12	53.0	58.0	56	2	14	MC	125	7000	5066	9	11.8	11.8	0.63	7.4				1479			236
13	58.0	64.5	61	2	17	MC	125	7625	5379	11	14.4	14.4	0.61	8.8				1796		1000	146
14	64.5	77.0	71	1	33	MC	125	8875	6005	21	27.9	27.9	0.58	16.1	9%	16.9	34				299
15	77.0	86.0	81	2	18	SPT	125	10125	6631	18	23.4	26.9	0.55	14.7				2925			289
16	86.0	96.0	91	1	70	SPT	125	11375	7257	70	91.0	118.3	0.52	62.1		62.1	39				350
17	96.0	105.0	101	1	55	SPT	125	12625	7883	55	71.5	93.0	0.50	46.8		46.8	37				349
18	105.0	115.5	111	2	18	SPT	125	13875	8509	18	23.4	26.4	0.48	12.8				2925			301
19	115.5	121.5	121	2	20	SPT	125	15125	9135	20	26.0	29.6	0.47	13.9				3250			312

Note:
1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner), C_N (Overburden) are per Youd 2001
2. For fine-grained materials, the correlation between blow-counts and shear is based on NAVFAC DM 7.1.
3. The phi angle was estimated based on Meyerhof (1956).
4. Residual Strength (Sr) is based on Caltrans "Guidelines on Foundation Loading and Deformation Due to Liquefaction Induced Lateral Spreading", Caltrans 2011
5. The Vs were correlated based on N_{60} for Soil Types 1,3, 4; based on N_{60} or c_{lab} for Soil Type 2 and based on Sr for Soil Types 5 & 6 per Caltrans Guidelines (2012).
6. Spreadsheet Revision Date: 10/29/13

SOIL STRENGTH PARAMETERS & V_{s30}

Calc By: JZ
Date: 10/10/18

PROJECT NAME: ***BLOSSOM HILL ROAD OVERCROSSING (WIDEN)***
PROJECT NO.: ***2016-146-BOC***
STRUCTURE:
BORING NO.: ***03-BL-1***

BOREHOLE DIA (in)= 4
GW DEPTH (ft)= 54

HAMMER ENERGY = 84%
DRILLING RODS (Y/N)= Y

SOIL GROUPS
1. SANDS & GRAVELS
2. CLAYS AND PLASTIC SILTS
3. NON TO LOW PLASTIC SILTS
4. YOUNG SEDIMENTARY ROCKS
5. LIQUEFIABLE SANDS (RESIDUAL STRENGTH)
6. LIQUEFIABLE SILTS (RESIDUAL STRENGTH)

Nd 21
N_{30} 21

V_{sd} (m/s) *257*
V_{s30} (m/s) *257*

Correlation 1) Caltrans

Sample No	Layer Thickness from	Layer Thickness to	Sample Depth (ft)	Soil Type	Field Blow Count	Sampler Type	Unit Weight (pcf)	σ_v (psf)	σ_v' (psf)	SPT-$N_{eq.}$	N_{60} CE Corr.	N_{60} CR,CB,CS Corr.	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60, CS}$	Correlated Strength Parameters ϕ (°)	Correlated Strength Parameters c (psf)	Correlated Strength Parameters S_r (psf)	Lab Test Results c (psf)	Vs (m/s)
1	0.0	7.4	6.6	2	9	MC	125	825	825	6	8.2	6.6	1.56	10.2				1024			158
2	7.4	12.3	9.85	2	21	MC	125	1231.3	1231	14	19.1	16.2	1.27	20.7				2389			206
3	12.3	16.4	14.8	2	19	MC	125	1850	1850	12	17.3	14.7	1.04	15.3				2161			215
4	16.4	22.2	19.7	2	15	MC	125	2462.5	2463	10	13.7	13.0	0.90	11.7				1706			213
5	22.2	25.6	24.6	2	10	SPT	125	3075	3075	10	14.0	14.9	0.81	12.0				1750			222
6	25.6	31.5	29.5	2	25	MC	125	3687.5	3688	16	22.8	22.8	0.74	16.8				2844			253
7	31.5	37.8	34.5	1	17	MC	125	4312.5	4313	11	15.5	15.5	0.68	10.5		10.5	33				251
8	37.8	40.7	39.4	1	28	SPT	125	4925	4925	28	39.2	51.0	0.64	32.5		32.5	37				279
9	40.7	46.3	44.3	1	43	SPT	125	5537.5	5538	43	60.2	78.3	0.60	47.0		47.0	38				296
10	46.3	51.0	49.25	1	25	SPT	125	6156.3	6156	25	35.0	43.7	0.57	24.9	5%	25.0	35				286
11	51.0	55.8	54.2	1	39	SPT	125	6775	6763	39	54.6	71.0	0.54	38.6		38.6	37				303
12	55.8	68.0	59.1	1	29	SPT	125	7387.5	7069	29	40.6	51.8	0.53	27.5		27.5	35				298
13	68.0	72.4	68.95	1	25	MC	125	8618.8	7686	16	22.8	22.8	0.51	11.6	34%	18.8	32				290
14	72.4	83.7	78.8	2	28	MC	125	9850	8302	18	25.5	25.5	0.49	12.5				3185			289
15	83.7	93.6	88.65	2	48	MC	125	11081	8919	31	43.7	43.7	0.47	20.7				5460			332
16	93.6	100.0	98.5	2	29	MC	125	12313	9536	19	26.4	26.4	0.46	12.1				3299			299

Note:
1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner), C_N (Overburden) are per Youd 2001
2. For fine-grained materials, the correlation between blow-counts and shear is based on NAVFAC DM 7.1.
3. The phi angle was estimated based on Meyerhof (1956).
4. Residual Strength (Sr) is based on Caltrans "Guidelines on Foundation Loading and Deformation Due to Liquefaction Induced Lateral Spreading", Caltrans 2011
5. The Vs were correlated based on N_{60} for Soil Types 1,3, 4; based on N_{60} or c_{lab} for Soil Type 2 and based on Sr for Soil Types 5 & 6 per Caltrans Guidelines (2012).
6. Spreadsheet Revision Date: 10/29/13

SOIL STRENGTH PARAMETERS & V_{s30}

Calc By: JZ
Date: 10/10/18

PROJECT NAME: ***BLOSSOM HILL ROAD OVERCROSSING (WIDEN)***
PROJECT NO.: ***2016-146-BOC***
STRUCTURE:
BORING NO.: ***03-BL-2***

BOREHOLE DIA (in)= 4 *HAMMER ENERGY =* 84%
GW DEPTH (ft)= 54 *DRILLING RODS (Y/N)=* Y

SOIL GROUPS
1. SANDS & GRAVELS
2. CLAYS AND PLASTIC SILTS
3. NON TO LOW PLASTIC SILTS
4. YOUNG SEDIMENTARY ROCKS
5. LIQUEFIABLE SANDS (RESIDUAL STRENGTH)
6. LIQUEFIABLE SILTS (RESIDUAL STRENGTH)

Nd / N_{30}: 41
V_{sd} (m/s) / V_{s30} (m/s): *294*
Correlation: 1) Caltrans

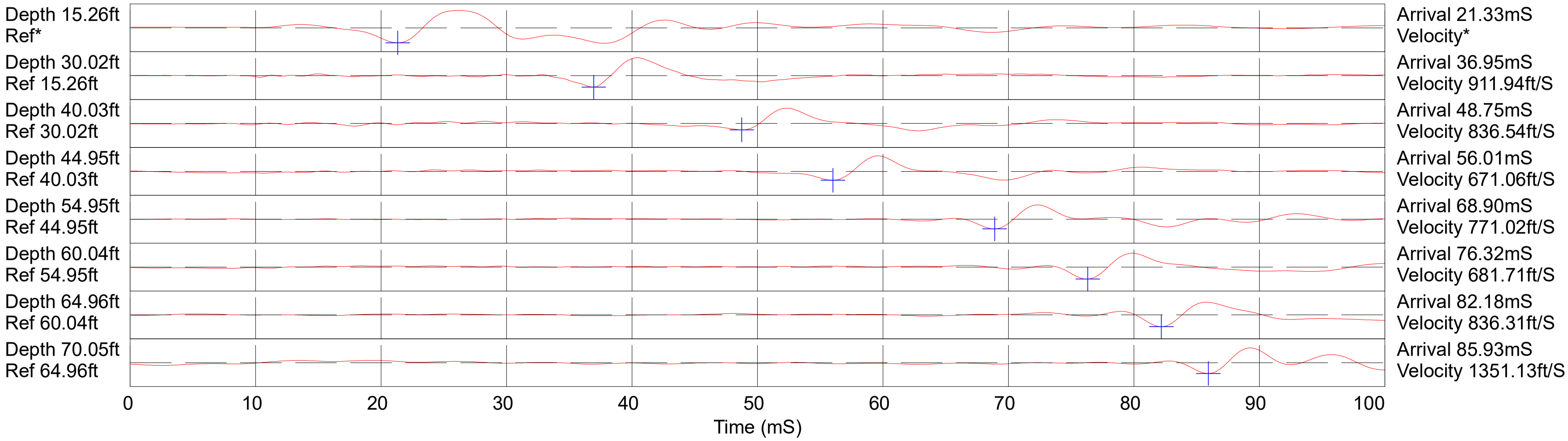
Sample No	Layer Thickness from	Layer Thickness to	Sample Depth (ft)	Soil Type	Field Blow Count	Sampler Type	Unit Weight (pcf)	σ_v (psf)	σ_v' (psf)	SPT-$N_{eq.}$	N_{60} CE Corr.	N_{60} CR,CB,CS Corr.	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60,CS}$	Correlated Strength Parameters ϕ (°)	Correlated Strength Parameters c (psf)	Correlated Strength Parameters S_r (psf)	Lab Test Results c (psf)	Vs (m/s)
1	0.0	4.9	3.2	2	62	MC	125	400	400	40	56.4	42.3	1.70	71.9				7053			223
2	4.9	9.9	6.6	2	27	MC	125	825	825	18	24.6	19.7	1.56	30.6				3071			208
3	9.9	14.8	11.5	2	24	MC	125	1437.5	1438	16	21.8	18.6	1.18	21.9				2730			221
4	14.8	18.9	16.4	1	34	MC	125	2050	2050	22	30.9	29.4	0.99	29.0	3%	29.0	38				234
5	18.9	23.0	21.3	1	40	SPT	125	2662.5	2663	40	56.0	69.2	0.87	59.9		59.9	42				264
6	23.0	27.9	26.2	1	35	SPT	125	3275	3275	35	49.0	63.7	0.78	49.8		49.8	40				274
7	27.9	32.8	31.1	1	49	SPT	125	3887.5	3888	49	68.6	89.2	0.72	64.0	9%	65.7	41				294
8	32.8	37.8	36	1	50	SPT	125	4500	4500	50	70.0	91.0	0.67	60.7		60.7	40				305
9	37.8	42.7	41	1	58	SPT	125	5125	5125	58	81.2	105.6	0.62	65.9		65.9	40				319
10	42.7	47.6	45.9	1	41	SPT	125	5737.5	5738	41	57.4	74.6	0.59	44.1	7%	44.6	38				317
11	47.6	54.2	50.8	2	25	MC	125	6350	6350	16	22.8	22.8	0.56	12.8				2844			285
12	54.2	59.9	55.8	2	21	MC	125	6975	6863	14	19.1	19.1	0.54	10.3				2389			277
13	59.9	62.0	60.7	1	36	MC	125	7587.5	7169	23	32.8	32.8	0.53	17.3	26%	23.8	33				317
14	62.0	72.2	72.2	1	59	MC	125	9025	7889	38	53.7	53.7	0.50	27.0		27.0	35				340
15	72.2	80.4	82	1	64	SPT	125	10250	8503	64	89.6	116.5	0.48	56.5		56.5	38				363
16	80.4	96.0	91.8	2	60	MC	125	11475	9116	39	54.6	54.6	0.47	25.6				6825			370
17	96.0	103.4	101.7	2	39	MC	125	12713	9736	25	35.5	35.5	0.45	16.1				4436			339

Note:
1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner), C_N (Overburden) are per Youd 2001
2. For fine-grained materials, the correlation between blow-counts and shear is based on NAVFAC DM 7.1.
3. The phi angle was estimated based on Meyerhof (1956).
4. Residual Strength (Sr) is based on Caltrans "Guidelines on Foundation Loading and Deformation Due to Liquefaction Induced Lateral Spreading", Caltrans 2011
5. The Vs were correlated based on N_{60} for Soil Types 1,3, 4; based on N_{60} or c_{lab} for Soil Type 2 and based on Sr for Soil Types 5 & 6 per Caltrans Guidelines (2012).
6. Spreadsheet Revision Date: 10/29/13

CPT-18-SC-003

Parikh Consultants

US 101 Blossom Hill Rd IC Improvement Project

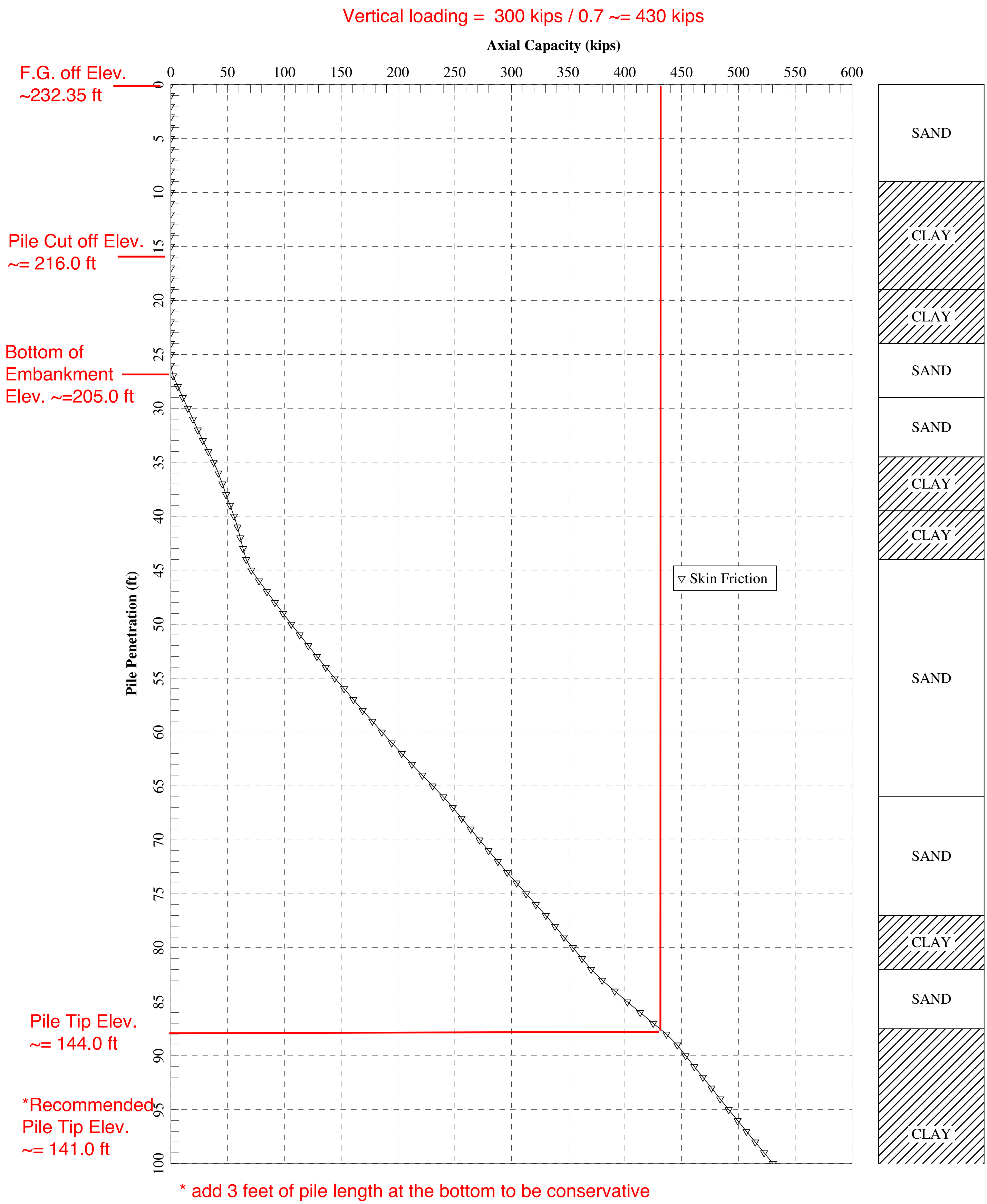


Hammer to Rod String Distance (ft): 5.83
* = Not Determined

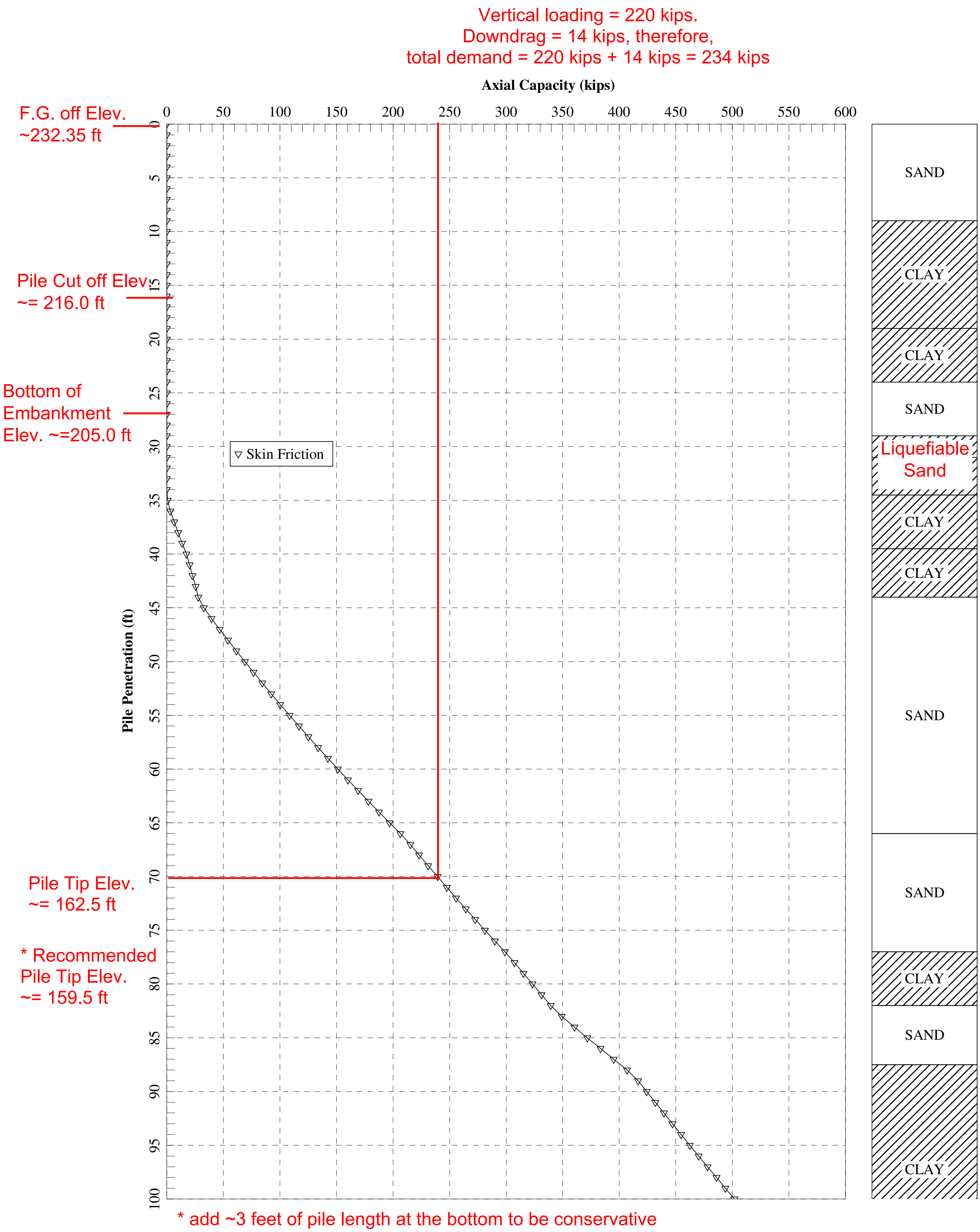
COMMENT:

Average Vs30 = 258m/s

VERTICAL PILE CAPACITY ANALYSIS (A-PILE ANALYSIS RESULTS)



Abutment 1_Class 200 Alt W Pipe Pile_Strength Limit State



Abutment 1 _Class 200 Alt W Pipe Pile_Extreme Limit State

Downdrag Forces on Circular Piles

Project No	2016-146-BOC
Project	Blossom Hill Road OC (Widen)
Location	Abutment 1 -2 rows
Boring	R-18-SC-001
Single Pile Dia. (ft)	1.33
GW Depth (ft)	31
Bulk Unit Weight (pcf)	125
Pile Length (ft)	100
# of Equiv. Pile Circumference	7

FG Elev.	232.35
Pile Cut-off.	216

Analysis By:	JZ
Date:	11/30/2018

Layer Number	Layer Thickness (ft)	Soil Type	Beta	Consider downdrag (y/n)	Total Depth (ft)	Layer Mid-Point Depth (ft)	Effective Stress (psf)	Contributing Thickness (ft)	Unit Negative Friction (ft)	Downdrag Force per Section (ton)	Total Downdrag Force (ton)	Remarks
1	8.25			n	8.25	4.13	516	8.3	0	0.0		Above Cut-off
2	2.50	CL	0.20	y	10.75	9.50	1188	2.5	238	8.7	8.7	Non-Liquefied Contribute to Downdrag
3	5.00	CL	0.20	y	15.75	13.25	1656	5.0	331	24.2	32.9	
4	5.00	SC	0.30	y	20.75	18.25	2281	5.0	684	50.0	82.9	
5	5.50	SC	0.30	n	26.25	23.50	2938	5.5	881	0.0		Liquefied
6	5.00	CL	0.20	n	31.25	28.75	3594	5.0	719	0.0		
7	4.50	CL-ML	0.20	n	35.75	33.50	4032	4.5	806	0.0		
8	22.00	SP-SM	0.35	n	57.75	46.75	4861	22.0	1701	0.0		
9	11.00	SM	0.30	n	68.75	63.25	5894	11.0	1768	0.0		
10	5.00	CL	0.20	n	73.75	71.25	6395	5.0	1279	0.0		Below Liquefied
11	5.50	SC	0.30	n	79.25	76.50	6723	5.5	2017	0.0		
12	19.50	CL	0.20	n	98.75	89.00	7506	19.5	1501	0.0		
13	9.00	SP-SM	0.35	n	107.75	103.25	8398	1.3	2939	0.0		
14	16.50	CL	0.20	n	124.25	116.00	9196	0.0	1839	0.0		

Notes Area

Layer 1 is above cut-off elevation at Abutment 1. Half thickness (16.5/2=8.25ft) assumed for effective stress estimation due to sloping ground.

Assume total of 12 piles in 2 rows

Assume the calculated downdrag load ~83 tons is acting on 12 equivalent pile circumference

12 piles with 83 tons of downdrag, then ~7 tons of downdrag load is acting on each pile.

PILE GROUP SETTLEMENT ANALYSIS

PROJECT NAME ***BLOSSOM HILL ROAD OVERCROSSING (WIDEN)***
PROJECT NO. ***2016-146-BOC***
STRUCTURE ***Abutment 1***
REFERENCE BORIN ***R-18-SC-001***
Hammer Energy = 78%
GW Level (ft)= 29

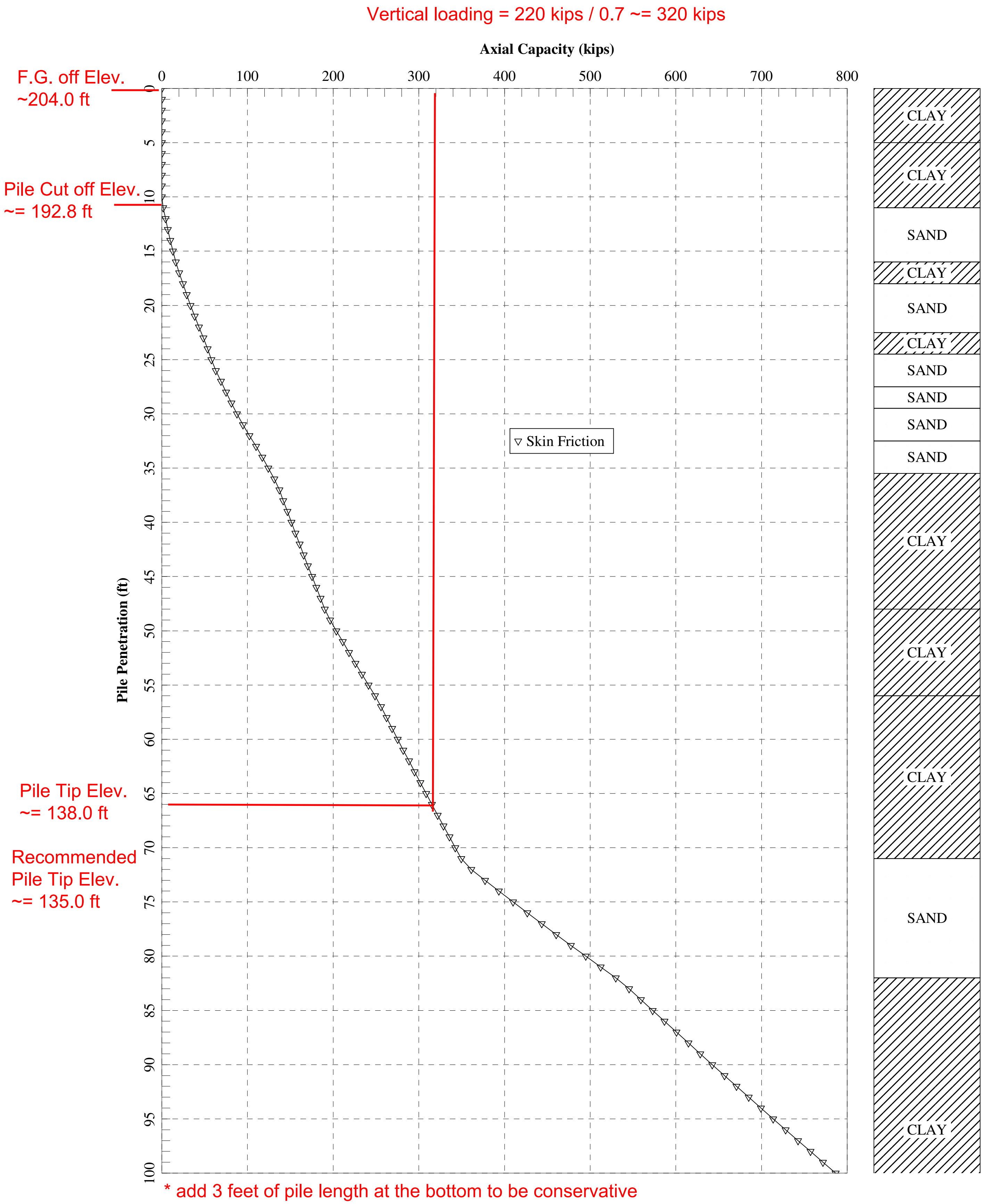
Finish Grade Elev. (ft) = 232.35
Pile Cut-off Elev. (ft) = 216
Footing Depth (ft) = 16.35
Pile Length (ft)= 40
Width of Pile Group, B (ft)= 6.33
Length of Pile Group, L (ft)= 42
Permanent Load Pressure (kip)= 1500

Cr/Cc= 25.0%

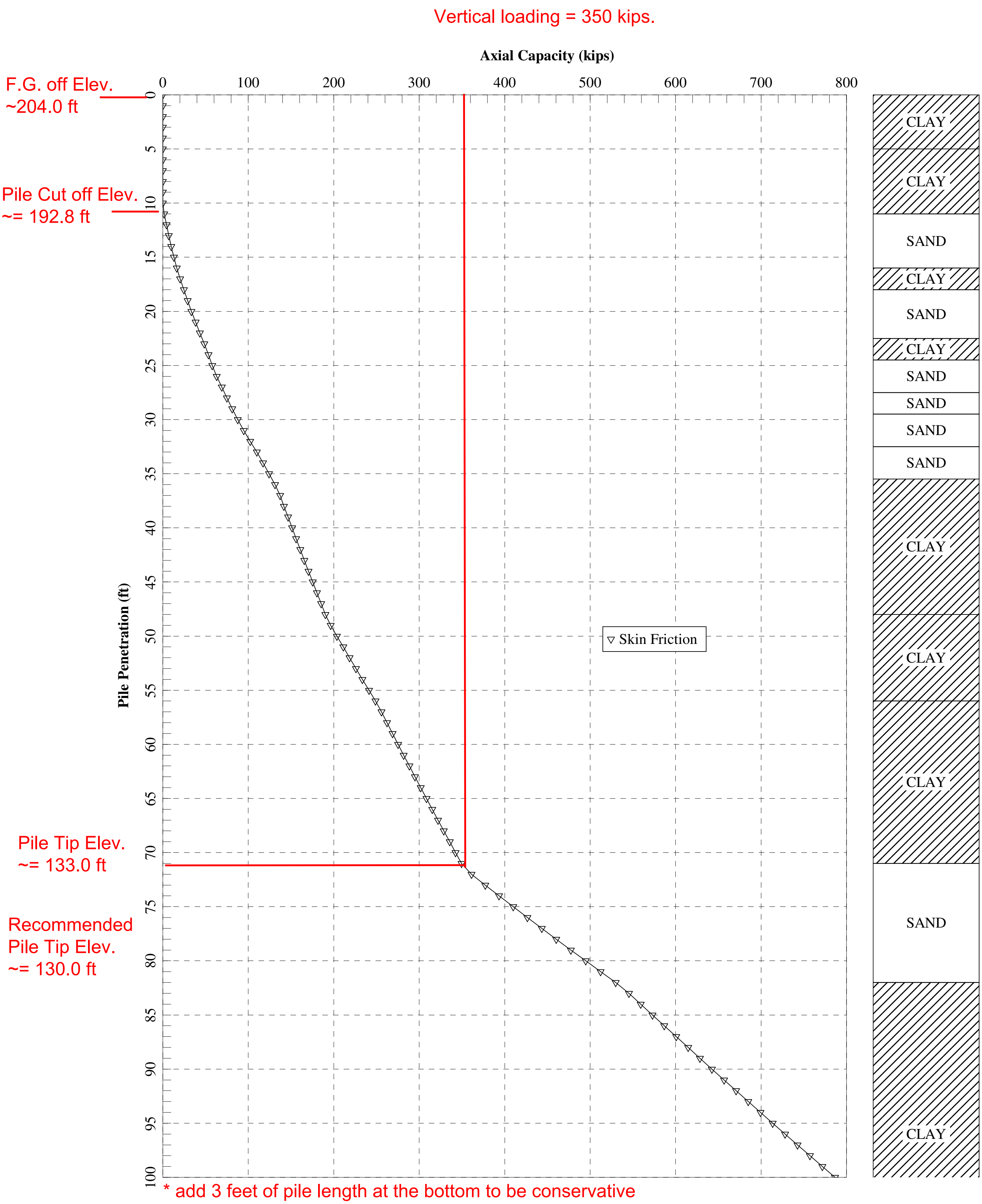
GROUPS
1. SANDS, GRAVELS AND NON-PLASTIC SILT
2. SATURATED CLAYS AND PLASTIC SILTS
3. OC CLAYS, NON-SATURATED CLAYS, AND NON-SATURATED PLASTIC SILTS

Depth from FG		Soil	BLOW	SAMPLER	AVG	γ_T	γ'	ω	σ_v'	σ_v'	$\Delta\sigma_v'$	Su	Lab Su	Pp	OCR	E	$Cr/1+e_0$	$Cc/1+e_0$	C'	Settlements (in)				
From	To	Type	COUNT	TYPE	$SPT\text{-}N_{60}$	(pcf)	(pcf)		(psf)	(psf)	(psf)	(psf)	(psf)	(psf)		(psf)			(Hough Method)	Elastic	OC	NC	SAND	Sum
0	5	1	28	MC	24	125.0	125.0	23.2%	625	313														
5	9	1	27	MC	23	125.0	125.0	30.1%	500	875														
9	14	2	23	MC	19	125.0	125.0	26.2%	625	1438														
14	19	3	22	MC	19	125.0	125.0	22.2%	625	2063			2600	10400	5.0	813313								
19	24	2	11	SPT	14	125.0	125.0	25.4%	625	2688														
24	29	1	25	MC	21	125.0	125.0	28.9%	625	3313														
29	34.5	1	16	MC	14	125.0	62.6	11.1%	344	3797														
34.5	39.5	2	11	MC	9	125.0	62.6	18.3%	313	4126			950	3800	0.9									
39.5	44	2	6	MC	5	125.0	62.6	19.4%	282	4423														
44	49	1	34	SPT	44	125.0	62.6	6.8%	313	4721	1101.8								75				0.073	0.073
49	54	1	50	SPT	65	125.0	62.6	8.3%	313	5034	835.1								98				0.041	0.041
54	59	1	64	SPT	83	125.0	62.6	11.6%	313	5347	657.6								119				0.025	0.025
59	66	1	31	SPT	40	125.0	62.6	12.5%	438	5722	512.2								66				0.047	0.047
66	77	3	10	MC	8	125.0	62.6	26.6%	689	6286	371.7	1056	260	1040	0.2	369688				0.133				0.133
77	82	2	34	MC	29	125.0	62.6	26.6%	313	6786	291.0	3591		14365	2.1		0.0285	0.1141			0.031			0.031
82	87.5	1	34	MC	29	125.0	62.6	15.6%	344	7115	251.7								51				0.020	0.020
87.5	96	2	25	MC	21	125.0	62.6	26.8%	532	7553	210.7	2641	2120	8480	1.1		0.0330	0.1322			0.040			0.040
96	107	2	43	MC	36	125.0	62.6	22.8%	689	8164	168.6	4542	2400	9600	1.2		0.0250	0.1000			0.029			0.029
107	116	1	34	SPT	44	125.0	62.6	8.2%	563	8790	137.4								61				0.012	0.012
																			Estimated Settlement (in)=	*0.1*	*0.1*	*0.0*	*0.2*	*0.5*

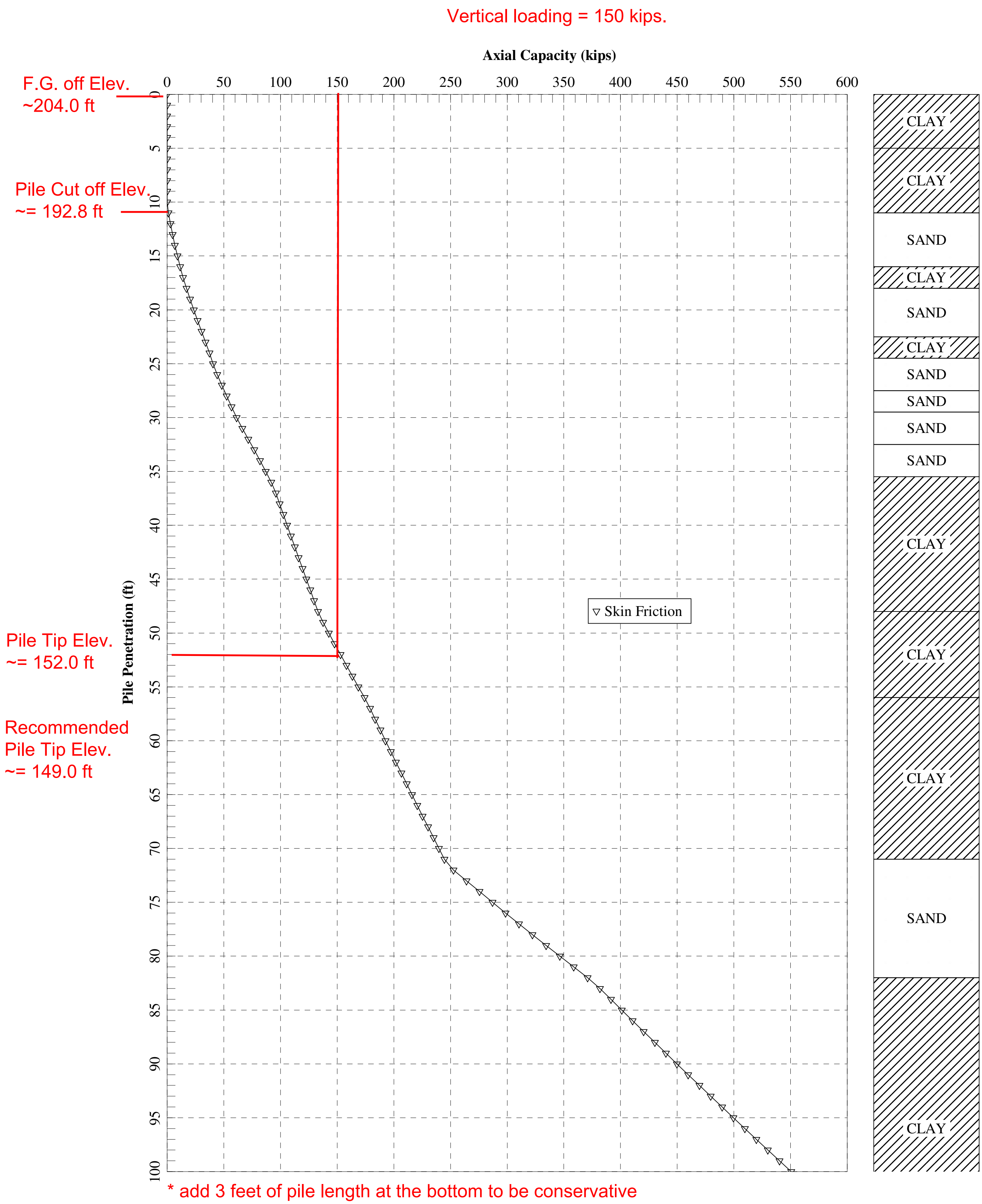
Note:
1. Cc is estiamted using empirical equation from "Soil Mechanics" by T. William lambe and Robert V. Whitman, unless there is existing consolidation lab results for Cc and Cr, which is in red font and applied in settlement calculation if soil type falls in Group 2, saturated clays and plastic silts.
2. Cr/Cc ratio of 25% was estimated based on the previous project experience.
3. OCR is calculated based on Su correlations.
4. Clays with OCR>=2.5 is considered as settling elasticly.
5. Soil profile starts from finish grade.



Bent 2_Class 200 Alt W Pipe Pile_Strength Limit State



Bent 2_Class 200 Alt W Pipe Pile_Extreme Limit State



Bent 2_Class 200 Alt W Pipe Pile_Extreme Limit State_Tension

PILE GROUP SETTLEMENT ANALYSIS

PROJECT NAME	***BLOSSOM HILL ROAD OVERCROSSING (WIDEN)***
PROJECT NO.	***2016-146-BOC***
STRUCTURE	***Bent 2***
REFERENCE BORIN	***CPT-18-SC-003***
Hammer Energy =	78%
GW Level (ft)=	27

Finish Grade Elev. (ft) =	204
Pile Cut-off Elev. (ft) =	192.8
Footing Depth (ft) =	11.2
Pile Length (ft)=	50
Width of Pile Group, B (ft)=	26
Length of Pile Group, L (ft)=	32
Permanent Load Pressure (kip)=	3900

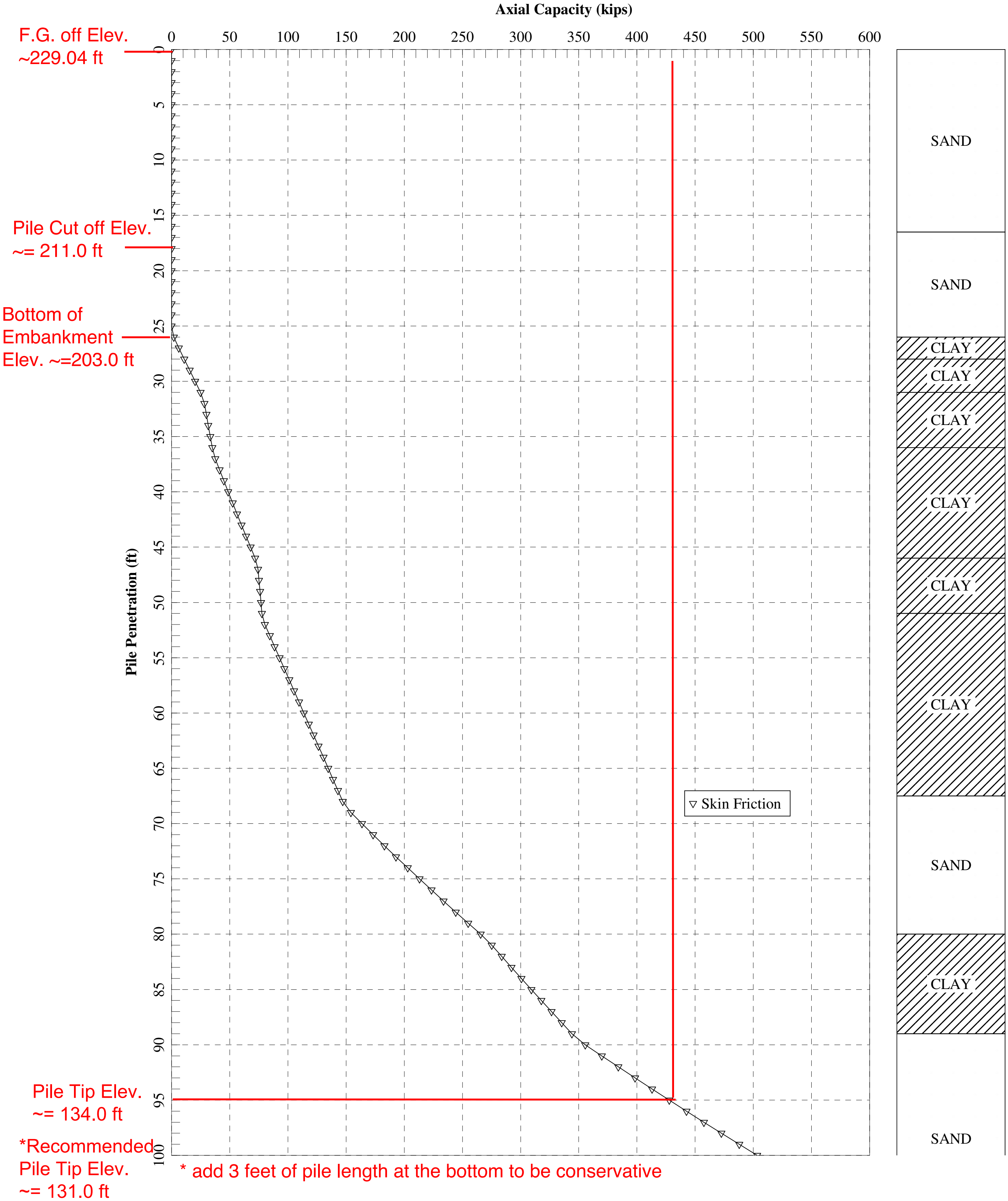
Cr/Cc= 25.0%

GROUPS
1. SANDS, GRAVELS AND NON-PLASTIC SILT
2. SATURATED CLAYS AND PLASTIC SILTS
3. OC CLAYS, NON-SATURATED CLAYS, AND NON-SATURATED PLASTIC SILTS

Depth from FG From	To	Soil Type	BLOW COUNT	SAMPLER TYPE	AVG SPT-N_{60}	γ_T (pcf)	γ' (pcf)	ω	σ_v' (psf)	σ_v' (psf)	$\Delta\sigma_v'$ (psf)	Su (psf)	Lab Su (psf)	Pp (psf)	OCR	E (psf)	$Cr/1+e_0$	$Cc/1+e_0$	C' (Hough Method)	Settlements (in) Elastic	OC	NC	SAND	Sum
0	5	2	25	SPT	33	125.0	125.0	25.0%	625	313														
5	11	2	10	SPT	13	125.0	125.0	25.0%	750	1000														
11	16	1	13	SPT	17	125.0	125.0	15.0%	625	1688														
16	18	2	15	SPT	20	125.0	125.0	25.0%	250	2125														
18	22.5	1	17	SPT	22	125.0	125.0	15.0%	563	2531														
22.5	24.5	2	8	SPT	10	125.0	125.0	25.0%	250	2938														
24.5	29.5	1	15	SPT	20	125.0	62.6	15.0%	313	3219														
29.5	32.5	1	22	SPT	29	125.0	62.6	15.0%	188	3469														
32.5	35.5	1	15	SPT	20	125.0	62.6	15.0%	188	3657														
35.5	48	2	8	SPT	10	125.0	62.6	25.0%	783	4142														
48	56	3	20	SPT	26	125.0	62.6	25.0%	501	4784	1335.0	3250		13000	2.7	1137500				0.113				0.113
56	71	2	15	SPT	20	125.0	62.6	25.0%	939	5504	907.2	2438		9750	1.8		0.0282	0.1126			0.336			0.336
71	82	1	42	SPT	55	125.0	62.6	15.0%	689	6318	631.7								78				0.070	0.070
82	99	3	60	SPT	78	125.0	62.6	25.0%	1064	7194	455.0	9750		39000	5.4	3412500				0.027				0.027
																			Estimated Settlement (in)=	*0.1*	*0.3*	*0.0*	*0.1*	*0.5*

Note:
1. Cc is estiamted using empirical equation from "Soil Mechanics" by T. William lambe and Robert V. Whitman, unless there is existing consolidation lab results for Cc and Cr, which is in red font and applied in settlement calculation if soil type falls in Group 2, saturated clays and plastic silts.
2. Cr/Cc ratio of 25% was estimated based on the previous project experience.
3. OCR is calculated based on Su correlations.
4. Clays with OCR>=2.5 is considered as settling elastically.
5. Soil profile starts from finish grade.
6. 25% and 15% moisture contentes are used for fine grained materials and coarse grained materials respectively, in this analysis.

Vertical loading = 300 kips / 0.7 ~=430 kips



* add 3 feet of pile length at the bottom to be conservative

Abutment 3_Class 200 Alt W Pipe Pile_Strength Limit State

PILE GROUP SETTLEMENT ANALYSIS

PROJECT NAME	***BLOSSOM HILL ROAD OVERCROSSING (WIDEN)***	*Finish Grade Elev. (ft) =*	229.04
		Pile Cut-off Elev. (ft) =	211
PROJECT NO.	***2016-146-BOC***	*Footing Depth (ft) =*	18.04
STRUCTURE	***Abutment 3***	*Pile Length (ft)=*	48
REFERENCE BORIN	***R-18-SC-002***	*Width of Pile Group, B (ft)=*	6.33
Hammer Energy =	78%	*Length of Pile Group, L (ft)=*	42
GW Level (ft)=	28	*Permanent Load Pressure (kip)=*	1500

GROUPS
1. SANDS, GRAVELS AND NON-PLASTIC SILT
2. SATURATED CLAYS AND PLASTIC SILTS
3. OC CLAYS, NON-SATURATED CLAYS, AND NON-SATURATED PLASTIC SILTS

Cr/Cc= 25.0%

Depth from FG From	To	Soil Type	BLOW COUNT	SAMPLER TYPE	AVG SPT-N_{60}	γ_T (pcf)	γ' (pcf)	ω	σ_v' (psf)	σ_v' (psf)	$\Delta\sigma_v'$ (psf)	Su (psf)	Lab Su (psf)	Pp (psf)	OCR	E (psf)	$Cr/1+e_0$	$Cc/1+e_0$	C' (Hough Method)	Settlements (in) Elastic	OC	NC	SAND	Sum
0	7	1	29	SPT	38	125.0	125.0	6.7%	875	438														
7	11	1	37	MC	31	125.0	125.0	20.9%	500	1125														
11	16.5	1	29	MC	25	125.0	125.0	20.3%	688	1719														
16.5	21	1	21	MC	18	125.0	125.0	24.2%	563	2344														
21	26	1	22	MC	19	125.0	125.0	25.8%	625	2938														
26	31	2	15	SPT	20	125.0	62.6	18.6%	313	3407														
31	36	2	6	MC	5	125.0	62.6	23.2%	313	3720			400	1600	0.4									
36	41	2	11	MC	9	125.0	62.6	18.6%	313	4033			1000	4000	1.0									
41	46	2	16	MC	14	125.0	62.6	17.8%	313	4346														
46	51	2	2	MC	2	125.0	62.6	17.8%	313	4659														
51	56	2	14	MC	12	125.0	62.6	28.2%	313	4972	946.3	1479		5915	1.2		0.0345	0.1379			0.156	0.002		0.158
56	61	2	14	MC	12	125.0	62.6	25.1%	313	5285	733.0	1479		5915	1.1		0.0324	0.1297			0.095	0.058		0.153
61	67.5	2	17	MC	14	125.0	62.6	21.8%	407	5644	568.5	1796	1000	4000	0.7		0.0260	0.1038				0.337		0.337
67.5	80	1	33	MC	28	125.0	62.6	11.5%	783	6239	398.7								52				0.078	0.078
80	89	2	18	SPT	23	125.0	62.6	26.0%	563	6912	285.7	2925		11700	1.7		0.0250	0.1000			0.047			0.047
89	99	1	70	SPT	91	125.0	62.6	8.3%	626	7507	221.9								111				0.014	0.014
99	108	1	55	SPT	72	125.0	62.6	9.7%	563	8102	177.6								87				0.012	0.012
108	118.5	2	18	SPT	23	125.0	62.6	26.7%	657	8712	144.7	2925		11700	1.3		0.0343	0.1374			0.031			0.031
118.5	124.5	2	20	SPT	26	125.0	62.6	24.9%	376	9228	123.5	3250		13000	1.4		0.0250	0.1000			0.010			0.010
																			Estimated Settlement (in)=	*0.0*	*0.3*	*0.4*	*0.1*	*0.8*

Note:
1. Cc is estiamted using empirical equation from "Soil Mechanics" by T. William lambe and Robert V. Whitman, unless there is existing consolidation lab results for Cc and Cr, which is in red font and applied in settlement calculation if soil type falls in Group 2, saturated clays and plastic silts.
2. Cr/Cc ratio of 25% was estimated based on the previous project experience.
3. OCR is calculated based on Su correlations.
4. Clays with OCR>=2.5 is considered as settling elasticly.
5. Soil profile starts from finish grade.

GEOTECHNICAL LPILE PARAMETERS

BLOSSOM HILL ROAD OVERCROSSING (WIDEN)
LPILE PARAMETERS

Boring ID: R-18-SC-001 **Date:** 1/28/2019
Station: "A" Line 56+35 **By:** JZ

Approx. Ground Surface Elevation: 231.0

Structure ID: Abutment 1

Depth (ft)	Elevation (ft)	LPILE Soil Type	c (psf)	Phi (degrees)	Effective Unit Weight γ' (pcf)
0 to 8	231 to 223	Sand (Reese)	-	34	125
8 to 18	223 to 213	Stiff Clay w/o Free Water (Reese)	2500	-	125
18 to 23	213 to 208	Stiff Clay w/o Free Water (Reese)	1750	-	125
23 to 28	208 to 203	Sand (Reese)	-	34	125
28 to 33.5	203 to 197.5	Case I) Sand (Reese)	-	32	65
		Case II) Soft Clay (Matlock)	Sr=350	-	65
33.5 to 38.5	197.5 to 192.5	Soft Clay (Matlock)	900	-	65
38.5 to 43	192.5 to 188	Soft Clay (Matlock)	600	-	65
43 to 65	188 to 166	Sand (Reese)	-	35	65
65 to 76	166 to 155	Sand (Reese)	-	30	65
76 to 81	155 to 150	Stiff Clay w/o Free Water (Reese)	2500	-	65
81 to 86.5	150 to 144.5	Sand (Reese)	-	34	65
86.5 to 106	144.5 to 125	Stiff Clay w/o Free Water (Reese)	2000	-	65
106 to 115	125 to 116	Sand (Reese)	-	34	65
115 to 131.5	116 to 99.5	Stiff Clay w/o Free Water (Reese)	4000	-	65

Default values can be used for e_{50} and K except for the liquefied soils (Case II) where e_{50} of 0.05 should be used.

Groundwater was measured at the depth of 30.0 feet below existing ground during drilling at Elevation +201.0 feet. Groundwater was assumed at the depth of 28 feet below existing ground at Elev. +203 feet to be consistent with the top elevation of the potential liquefiable soil layer.

Soil unit weights of 125 pcf and 65 pcf can be used above and below groundwater level, respectively.

BLOSSOM HILL ROAD OVERCROSSING (WIDEN)
LPILE PARAMETERS

Boring ID: CPT-18-SC-003 / 03-BL-1 & 03-BL-2 **Date:** 1/28/2019
Station: "A" Line 58+05 **By:** EO/JZ

Approx. Ground Surface Elevation: 203.0
Structure ID: Bent 2

Depth (ft)	Elevation (ft)	LPILE Soil Type	c (psf)	Phi (degrees)	Effective Unit Weight γ' (pcf)
0 to 4	203 to 199	Stiff Clay w/o Free Water (Reese)	3000	-	125
4 to 10	199 to 193	Stiff Clay w/o Free Water (Reese)	1500	-	125
10 to 15	193 to 188	Sand (Reese)	-	32	125
15 to 17	188 to 186	Stiff Clay w/o Free Water (Reese)	2000	-	125
17 to 21.5	186 to 181.5	Sand (Reese)	-	34	125
21.5 to 23.5	181.5 to 179.5	Soft Clay (Matlock)	1500	-	125
23.5 to 26.3	179.5 to 176.7	Sand (Reese)	-	33	125
26.3 to 28.5	176.7 to 174.5	Sand (Reese)	-	33	65
28.5 to 31.5	174.5 to 171.5	Sand (Reese)	-	36	65
31.5 to 34.5	171.5 to 168.5	Sand (Reese)	-	33	65
34.5 to 47	168.5 to 156	Soft Clay (Matlock)	1200	-	65
47 to 55	156 to 148	Stiff Clay w/o Free Water (Reese)	2500	-	65
55 to 70	148 to 133	Stiff Clay w/o Free Water (Reese)	1750	-	65
70 to 81	133 to 122	Sand (Reese)	-	42	65
81 to 98	122 to 105	Stiff Clay w/o Free Water (Reese)	6000	-	65

Default values can be used for e_{50} and K except for the liquefied soils (Case II) where e_{50} of 0.05 should be used.
Groundwater was measured at the depth of 26.3 feet below existing ground during drilling at Elevation +176.7 feet.
Soil unit weights of 125 pcf and 65 pcf can be used above and below groundwater level, respectively.

BLOSSOM HILL ROAD OVERCROSSING (WIDEN)
LPILE PARAMETERS

Boring ID: R-18-SC-002 **Date:** 1/28/2019
Station: "A" Line 61+20 **By:** JZ

Approx. Ground Surface Elevation: 226.0

Structure ID: Abutment 3

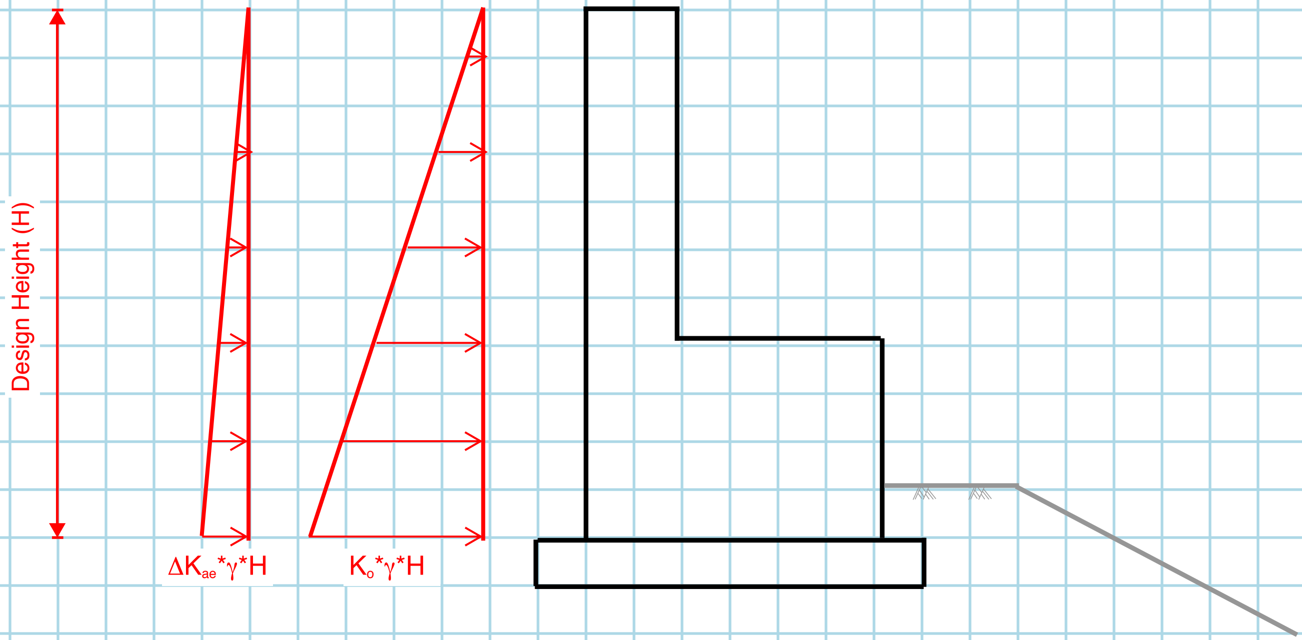
Depth (ft)	Elevation (ft)	LPILE Soil Type	c (psf)	Phi (degrees)	Effective Unit Weight γ' (pcf)
0 to 13.5	226 to 212.5	Sand (Reese)	-	36	125
13.5 to 23	212.5 to 203	Sand (Reese)	-	34	125
23 to 25	203 to 201	Stiff Clay w/o Free Water (Reese)	2000	-	125
25 to 28	201 to 198	Stiff Clay w/o Free Water (Reese)	2000	-	65
28 to 33	198 to 193	Soft Clay (Matlock)	400	-	65
33 to 43	193 to 183	Stiff Clay w/o Free Water (Reese)	1000	-	65
43 to 48	183 to 178	Soft Clay (Matlock)	200	-	65
48 to 64.5	178 to 161.5	Stiff Clay w/o Free Water (Reese)	1000	-	65
64.5 to 77	161.5 to 149	Sand (Reese)	-	34	65
77 to 86	149 to 140	Stiff Clay w/o Free Water (Reese)	2750	-	65
86 to 105	140 to 121	Sand (Reese)	-	38	65
105 to 121.5	121 to 104.5	Stiff Clay w/o Free Water (Reese)	2750	-	65

Default values can be used for e_{50} and K except for the liquefied soils (Case II) where e_{50} of 0.05 should be used.
Groundwater was measured at the depth of 25.0 feet below existing ground during drilling at Elevation +201.0 feet.
Soil unit weights of 125 pcf and 65 pcf can be used above and below groundwater level, respectively.

ABUTMENT INCREMENTAL SEISMIC FORCE

By: EO
Date: 1/17/18

Abutment Lateral Soil Loading for Blossom Hill Road Bridge



Illustrative purposes only / Not to Scale

The abutment foundations are on marginal soil per CT SDC 1.7 and per AASHTO LRFD C11.6.5, they are not exempt from Extreme Event (Seismic) design.

Recommended values for lateral soil pressures/coefficients for rigid foundations are shown below:
γ = 125 psf
K_o = 0.44 (In-Situ Lateral Coefficient)
K_{ae} = 0.82 (Log-Spiral Seismic Active Coefficient)
ΔK_{ae} = 0.38 (Incremental Seismic Active Coefficient)
Based on the above, Incremental Seismic Force can be calculated as $0.5*H*(\Delta K_{ae}*\gamma*H) = 23.75*H^2$ lb/ft

PARIKH
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SETTLEMENT ANALYSES

SETTLEMENT ANALYSIS

PROJECT NAME	***BLOSSOM HILL ROAD OVERCROSSING (W***	*Footing Depth (ft) =*	0
PROJECT NO.	***2016-146-BOC***	*Fill Height (ft)=*	10
STRUCTURE	***Abutment 1***	*Base Width, B (ft)=*	42
REFERENCE BORII	***R-18-SC-001***	*Side Slope (XH:1V)=*	-
Hammer Energy =	78%	*Effective Width, B' (ft)=*	42
GW Level (ft)=	29	*Length, L (ft)=*	20 (Assume 2:1 slope)
		Plane Strain? (Y/N)	N
		Contact Pressure (psf)=	1250

Cr/Cc= 25.0%

GROUPS

1. SANDS, GRAVELS AND NON-PLASTIC SILT
2. SATURATED CLAYS AND PLASTIC SILTS
3. OC CLAYS, NON-SATURATED CLAYS, AND NON-SATURATED PLASTIC SILTS

Depth from FG From	To	Soil Type	BLOW COUNT	SAMPLER TYPE	AVG $SPT\text{-}N_{60}$	γ_T (pcf)	γ' (pcf)	ω	σ_v' (psf)	$\Delta\sigma_v'$ (psf)	Su (psf)	Lab Su (psf)	Pp (psf)	OCR
0	5	1	28	MC	24	125.0	125.0	23.2%	313	1048.7				
5	9	1	27	MC	23	125.0	125.0	30.1%	875	793.7				
9	14	3	23	MC	19	125.0	125.0	26.2%	1438	623.1	2429		9718	6.8
14	19	3	22	MC	19	125.0	125.0	22.2%	2063	491.7	2324	2600	10400	5.0
19	24	3	11	SPT	14	125.0	125.0	25.4%	2688	398.4	1788		7150	2.7
24	29	1	25	MC	21	125.0	125.0	28.9%	3313	329.6				
29	34.5	1	16	MC	14	125.0	62.6	11.1%	3797	275.1				
34.5	39.5	2	11	MC	9	125.0	62.6	18.3%	4126	233.2	1162	950	3800	0.9
39.5	44	2	6	MC	5	125.0	62.6	19.4%	4423	203.0	634		1500	0.3
44	49	1	34	SPT	44	125.0	62.6	6.8%	4721	178.4				
49	54	1	50	SPT	65	125.0	62.6	8.3%	5034	157.1				
54	59	1	64	SPT	83	125.0	62.6	11.6%	5347	139.3				
59	66	1	31	SPT	40	125.0	62.6	12.5%	5722	121.8				
66	77	2	10	MC	8	125.0	62.6	26.6%	6286	101.1	1056	260	1040	0.2
77	82	3	34	MC	29	125.0	62.6	26.6%	6786	86.9	3591		14365	2.1
82	87.5	1	34	MC	29	125.0	62.6	15.6%	7115	79.1				
87.5	96	2	25	MC	21	125.0	62.6	26.8%	7553	70.3	2641	2120	8480	1.1
96	107	2	43	MC	36	125.0	62.6	22.8%	8164	60.2	4542	2400	9600	1.2
107	116	1	34	SPT	44	125.0	62.6	8.2%	8790	52.0				

Depth from FG From	To	E (psf)	$Cr/1+e_0$	$Cc/1+e_0$	C' (Hough Method)	Settlements (in) Elastic	OC	NC	SAND	Sum
0	5				97				0.396	0.396
5	9				85				0.157	0.157
9	14	850281				0.044				0.044
14	19	813313				0.036				0.036
19	24	625625				0.038				0.038
24	29				38				0.066	0.066
29	34.5				30				0.068	0.068
34.5	39.5		0.0309	0.1237				0.177		0.177
39.5	44		0.0100	0.1250				0.132		0.132
44	49				75				0.013	0.013
49	54				98				0.008	0.008
54	59				119				0.006	0.006
59	66				66				0.012	0.012
66	77		0.0354	0.1416				0.130		0.130
77	82	1256938				0.004				0.004
82	87.5				51				0.006	0.006
87.5	96		0.0330	0.1322			0.014			0.014
96	107		0.0250	0.1000			0.011			0.011
107	116				61				0.005	0.005
Estimated Settlement (in)=						*0.1*	*0.0*	*0.4*	*0.3*	*0.9*

Note:
1. Cc is estiamted using empirical equation from "Soil Mechanics" by T. William lambe and Robert V. Whitman, unless there is existing consolidation lab results for Cc and Cr, which is in red font and applied in settlement calculation if soil type falls in Group 2, saturated clays and plastic silts.
2. Cr/Cc ratio of 25% was estimated based on the previous project experience.
3. OCR is calculated based on Su correlations.
4. Clays with OCR>=2.5 is considered as settling elasticly.
5. Soil profile starts from finish grade.

SETTLEMENT ANALYSIS

PROJECT NAME	**BLOSSOM HILL ROAD OVERCROSSING (WIDE**	Footing Depth (ft) =	0
PROJECT NO.	**2016-146-BOC**	Fill Height (ft)=	10
STRUCTURE	**Abutment 3**	Base Width, B (ft)=	42
REFERENCE BORI	**R-18-SC-002**	Side Slope (XH:1V)=	-
Hammer Energy =	78%	Effective Width, B' (ft)=	42
GW Level (ft)=	28	Length, L (ft)=	20 (Assume 2:1 slope)
		Plane Strain? (Y/N)	N
		Contact Pressure (psf)=	1250

Cr/Cc= 25.0%

GROUPS
1. SANDS, GRAVELS AND NON-PLASTIC SILT
2. SATURATED CLAYS AND PLASTIC SILTS
3. OC CLAYS, NON-SATURATED CLAYS, AND NON-SATURATED PLASTIC SILTS

Depth from FG From	To	Soil Type	BLOW COUNT	SAMPLER TYPE	AVG $SPT-N_{60}$	γ_T (pcf)	γ' (pcf)	ω	σ_v' (psf)	$\Delta\sigma_v'$ (psf)	Su (psf)	Lab Su (psf)	Pp (psf)	OCR	E (psf)	$Cr/1+e_0$	$Cc/1+e_0$	C' (Hough Method)	Settlements (in) Elastic	OC	NC	SAND	Sum
0	7	1	29	SPT	38	125.0	125.0	6.7%	438	982.0								150				0.287	0.287
7	11	1	37	MC	31	125.0	125.0	20.9%	1125	709.9								100				0.102	0.102
11	16.5	1	29	MC	25	125.0	125.0	20.3%	1719	558.0								71				0.114	0.114
16.5	21	1	21	MC	18	125.0	125.0	24.2%	2344	446.0								53				0.077	0.077
21	26	1	22	MC	19	125.0	125.0	25.8%	2938	368.5								36				0.085	0.085
26	31	3	15	SPT	20	125.0	62.6	18.6%	3407	307.1	2438		9750	2.9	853125				0.022				0.022
31	36	2	6	MC	5	125.0	62.6	23.2%	3720	259.9	634	400	1600	0.4		0.0304	0.1217				0.214		0.214
36	41	2	11	MC	9	125.0	62.6	18.6%	4033	223.0	1162	1000	4000	1.0		0.0299	0.1197				0.168		0.168
41	46	2	16	MC	14	125.0	62.6	17.8%	4346	193.4	1690		6760	1.6		0.0299	0.1197			0.034			0.034
46	51	2	2	MC	2	125.0	62.6	17.8%	4659	169.4	211		4659	1.0		0.0364	0.1456				0.135		0.135
51	56	2	14	MC	12	125.0	62.6	28.2%	4972	149.6	1479		5915	1.2		0.0345	0.1379			0.027			0.027
56	61	2	14	MC	12	125.0	62.6	25.1%	5285	133.1	1479		5915	1.1		0.0324	0.1297			0.021			0.021
61	67.5	2	17	MC	14	125.0	62.6	21.8%	5644	117.3	1796	1000	4000	0.7		0.0260	0.1038				0.072		0.072
67.5	80	1	33	MC	28	125.0	62.6	11.5%	6239	96.8								52				0.019	0.019
80	89	2	18	SPT	23	125.0	62.6	26.0%	6912	79.4	2925		11700	1.7		0.0250	0.1000			0.013			0.013
89	99	1	70	SPT	91	125.0	62.6	8.3%	7507	67.7								111				0.004	0.004
99	108	1	55	SPT	72	125.0	62.6	9.7%	8102	58.4								87				0.004	0.004
108	118.5	2	18	SPT	23	125.0	62.6	26.7%	8712	50.8	2925		11700	1.3		0.0343	0.1374			0.011			0.011
118.5	124.5	3	20	SPT	26	125.0	62.6	24.9%	9228	45.4	3250		13000	1.4	1137500				0.003				0.003
																		Estimated Settlement (in)=	*0.0*	*0.1*	*0.6*	*0.4*	*1.1*

Note:
1. Cc is estiamted using empirical equation from "Soil Mechanics" by T. William lambe and Robert V. Whitman, unless there is existing consolidation lab results for Cc and Cr, which is in red font and applied in settlement calculation if soil type falls in Group 2, saturated clays and plastic silts.
2. Cr/Cc ratio of 25% was estimated based on the previous project experience.
3. OCR is calculated based on Su correlations.
4. Clays with OCR>=2.5 is considered as settling elasticly.
5. Soil profile starts from finish grade.

APPENDIX VII

The appendix for
‘Exceptions to Policy’
is not applicable to this report.

APPENDIX VIII

Office of Special Funded Projects
Comment & Response Form
(Revised 08/2011)

General Project Information (OSFP Liaison to complete)		**Review Phase** (OSFP Liaison to complete)	**Reviewer Information** (Reviewer Liaison to complete)	
Dist:	**04**	☐ PSR/PDS (Review No.)	Reviewer Name:	**R. Nashed/ J. Anderson**
Proj ID (Phase):	**0416000224**	☐ APS/PSR (Review No.)	Functional Unit:	**Geotechnical Design- West**
EA:	**1K2801**	☐ APS/PR (Review No.)	Cost Center:	**59-3660**
Project Name:	**Blossom Hill Rd Interchange Improvement**	☐ Type Selection	Phone Number:	**510-622-1773**
OSFP Liaison:	**Shu-Shang Liu**	☐ 65% PS&E Unchecked Details	e-mail:	**Rifaat.nashed@ dot.ca.gov**
Phone:	**916-227-8919**	☐ PS&E (Review No. 1)	Date of Review:	**12/ 20/2018**
E-mail:	**Shu-shang.liu@dot.ca.gov**	☐ Construction	Structure Name*:	**Blossom Hill Road OC**
		☑ Other: FR	Br No*:	**37-0348 L/R**
			(*Use if necessary to when comment sheets are by individual structure)	

Consultant Information (to be filled in by Consultant)

Consultant Lead (First and Last Name)	Consultant Firm	Phone Number	E-mail	Response Date

#	Doc. (See Note 1)	Page, Section, or SSP	Review Comments	Consultant Responses	Caltrans Responses
	FR	N/A	Review of Geology and subsurface and Related sections items Foundation Report (DRAFT) by Parikh consultants prepared for HMH Engineers dated December 4, 2018		
1	FR	Section 8 Subsurface Conditions Page 10	Table-4 Please describe the subsurface soils of Borings R-18-SC-001 and R-18-SC-002 more preciously. -FN	Comment incorporated. Approximate depth of different soil strata have been added to the description of the subsurface soil conditions of Table 4	

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓= Comment Resolved (for Reviewer's use)

2	FR	Section12.0 Site Seismicity and Analysis	Table 3- ARS DATA 1- Site-to-fault distances are in kilometer. Please convert them to miles. 2- Please add the "Spectral Acceleration" (SA) column including the deterministic data for each listed fault. -FN	1. The Site-to-fault distances will be converted to miles. 2. The "Spectral Acceleration" (SA) column including the deterministic data for each listed fault will be added to Table 3 – ARS DATA.	
3	FR	Section 8.0 Subsurface conditions	Please keep subsurface conditions as a single format across all documents. This document alone has three separate formats (paragraph, list, table). - JA	Comment incorporated. The description of the subsurface soil conditions of each of the boring and CPT are listed in Section 8.0 of the foundation report.	
4	FR	Table 5	The data in Appendix 3 says CPT-18-SC-003 has a groundwater depth of 30.0 ft. The table lists this as 26.3 feet. Which is it? - JA	The groundwater depth should be 26.3 feet. The data in Appendix has been corrected by the CPT contractor.	
5	FR	Table 8	The Vs30 calculations for 03-BL-1 and 03-BL-2 were not included in the Appendix. Please include -JA	The Vs30 calculations for 03-BL-1 and 03-BL-2 have been included in the Appendix.	
6	FR	Section 13.2 - Output	Bullet point 1 under "output" is unclear. Please revise -JA	Bullet Point 1 under "Output" has been revised to "The recommended ARS curve is based on the maximum of the comparison of the deterministic data and Caltrans Probabilistic data. The recommended ARS curve at this site is based on the Probabilistic curve".	

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)

P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
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✓= Comment Resolved (for Reviewer's use)

7	FR	Table 9	Some of the liquefiable layers are very deep (>60 ft). Do you expect these layers will have any effect? -JA	Liquefiable layers deeper than 60 feet are not expected to have any effect on the pile foundation recommendations.	
8	FR	Table 13	Calculations for Abutment 3 were not included. Please include these. -JA	There is no demand for compression and tension under Extreme Event for Abutment 3.	
9	FR	Table 15B & Table 15C	Please make sure the LPILE Parameters in table 15B match the parameters in the appendix. -JA	The LPILE Parameters in table 15B has been checked to match the parameters in the appendix.	
10	FR	Section 13.6 & Settlement Calculations	The effective vertical stress and total unit weight need correction for the settlement analyses -JA	The effective vertical stress and total unit weight have been corrected for the settlement analyses.	
11	FR	Appendix VI - Liquefaction Analyses	Every layer should have a fines content. Estimate any missing data based on visual inspection of the soil samples. Please correct. -JA	Estimated fine content has been added to the sand layer(s) (without any sieve analyses) based on the visual inspection of the soil samples.	
12	FR	Appendix II – LOTB 2018	All UC values currently show as tsf. However, the values are actually in ksf. Please correct. -JA	The UC values are in the unit of ksf based on the laboratory test result. The UC values are in the unit of tsf in the Log of Test Borings.	
13	FR	All Sections	Please review report for grammar and consistent formatting/structure across all reports. -JA	Comment incorporated.	

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
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RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓= Comment Resolved
(for Reviewer's use)

Office of Special Funded Projects
Comment & Response Form

(Revised 08/2011)

General Project Information (OSFP Liaison to complete)		**Review Phase** (OSFP Liaison to complete)	**Reviewer Information** (Reviewer Liaison to complete)	
Dist:	**04**	☐ PSR/PDS (Review No.)	Reviewer Name:	**R. Nashed**
Proj ID (Phase):	**0416000224**	☐ APS/PSR (Review No.)	Functional Unit:	**Geotechnical Design- West**
EA:	**1K2801**	☐ APS/PR (Review No.)	Cost Center:	**59-3660**
Project Name:	**Blossom Hill Rd Interchange Improvement**	☐ Type Selection	Phone Number:	**510-622-1773**
OSFP Liaison:	**Shu-Shang Liu**	☐ 65% PS&E Unchecked Details	e-mail:	**Rifaat.nashed@ dot.ca.gov**
Phone:	**916-227-8919**	☐ PS&E (Review No. 1)	Date of Review:	**05/01/2019**
E-mail:	**Shu-shang.liu@dot.ca.gov**	☐ Construction	Structure Name*:	**Blossom Hill Road OC**
		☑ Other: FR	Br No*:	**37-0348 L/R**
			(*Use if necessary to when comment sheets are by individual structure)	

Consultant Information (to be filled in by Consultant)

Consultant Lead (First and Last Name)	Consultant Firm	Phone Number	E-mail	Response Date

#	Doc. (See Note 1)	Page, Section, or SSP	Review Comments	Consultant Responses	Caltrans Responses
	FR	N/A	Review of Geology and subsurface and Related sections items Foundation Report (DRAFT) by Parikh consultants prepared for HMH Engineers dated April 16, 2019		
1	FR	Section 8 Subsurface Conditions Page 10	Table-4 Please describe the subsurface soils of Borings R-18-SC-001 and R-18-SC-002 more preciously.	Comment incorporated. Approximate depth of different soil strata have been added to the description of the subsurface soil conditions of Table 4	For Boring R-18-SC-001, the 2nd layer at elevation 222 ft is **hard** to very stiff sandy lean clay. Comment incorporated. For Boring R-18-SC-002, the bottom layer at elevation 110 ft is lean clay to fat clay. Please correct. Comment incorporated.

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓= Comment Resolved (for Reviewer's use)

2	FR	Section12.0 Site Seismicity and Analysis (Page 13)	Table 6- ARS DATA 1- Site-to-fault distances are in kilometer. Please convert them to miles. 2- Please add the "Spectral Acceleration" (SA) column including the deterministic data for each listed fault.	1. The Site-to-fault distances will be converted to miles. 2. The "Spectral Acceleration" (SA) column including the deterministic data for each listed fault will be added to Table 3 – ARS DATA.	Our comments dated 12/20/2012 have been adequately addressed.

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓= Comment Resolved
(for Reviewer's use)

FOUNDATION REPORT

NB 101 ON-RAMP PEDESTRIAN OVERCROSSING
(BRIDGE NO. – 37-676)
SAN JOSE, CALIFORNIA
04-SCl-101, R28.4/R28.9 EA 04-1K280

Prepared For:

HMH Engineers
1570 Oakland Road
San Jose, CA 95131

PARIKH CONSULTANTS, INC.
2360 Qume Drive, Suite A, San Jose, CA 95131
(408) 452-9000

October 15, 2019 Job No.: 2016-146-NOC

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Vertical Pile Capacity Analyses (Shaft Analysis Results)

APPENDIX VII

Exceptions to Policy – Not Applicable

APPENDIX VIII

Office of Special Funded Projects Comment & Response Form - Parikh Consultants, Inc. Response to Caltrans Review Comments.

FOUNDATION REPORT
NB 101 ON-RAMP PEDESTRIAN OVERCROSSING
(BRIDGE NO. 37-676)
SAN JOSE, CALIFORNIA
04-SCl-101, R28.4/R28.9 EA 04-1K280

1.0 INTRODUCTION

This foundation report presents the results of our geotechnical engineering investigation for the proposed "US 101/Blossom Hill Road Interchange Improvement Project – NB 101 On-Ramp Pedestrian Overcrossing" in San Jose, California, hereinafter referred to as "PROJECT". The work was performed in general accordance with the scope of work outlined in our proposal to HMH Engineers (Designer).

The geotechnical recommendations presented in this report are intended for design input and are not intended to be used as specifications. In addition, the data provided in this report including these geotechnical recommendations should not be used for bidding purposes or for construction cost estimates. If the report is provided as a reference document, any interpretation of the data and recommendations should be the sole responsibility of the user and PARIKH Consultants, Inc. (PARIKH) shall not be liable for any consequences.

2.0 SCOPE OF WORK

The purpose of this investigation was to evaluate the general subsurface conditions at the project site, to evaluate their engineering properties, and to provide geotechnical recommendations for the foundation design of the proposed project.

The scope of work performed for this investigation included a review of the readily available soils and geologic literature pertaining to the project site including review of boring data, laboratory testing of the representative soil samples, performing engineering analyses based on the field and laboratory data, and preparation of this foundation report. The recommendations in this report are based on the field exploration performed by Parikh, general plan and foundation plan and loading information provided by the designer and Biggs Cardosa Associates (Structural Designer). This foundation report supersedes the preliminary foundation report for "NB 101 On-Ramp Pedestrian Overcrossing" dated July 6, 2018.

3.0 PROJECT DESCRIPTION

The project proposes to modify the US 101/ Blossom Hill Road Interchange to improve traffic operations and connectivity for pedestrians and bicyclists along Blossom Hill Road. The existing Blossom Hill Road Interchange consists of two separate overcrossing structures over US 101 with partial cloverleaf ramps. The project is located within the City of San Jose, in Santa Clara County. It will be implemented as a locally-funded project with the City of San Jose performing advertisement, award and administration (AAA) of the construction contract through a Caltrans encroachment permit.

Blossom Hill Road is a key connector between job locations, mixed-use housing, commercial development and recreational opportunities in an area where San Jose is focused on developing greater internalization of automobile trips, increased use of transit and expanded active transportation. The level-of-service for existing and forecasted traffic is deficient for existing developments and nearby proposed projects. The configuration of the existing interchange and ramp intersections along Blossom Hill Road are not consistent with the latest standards for accommodating balanced use by vehicles, bicyclists and pedestrians.

The proposed project improvements will occur along Blossom Hill Road from east of the Monterey Road / Blossom Hill Road grade separation to the US 101 Northbound Off-Ramp / Coyote Road intersection. All improvements will be constructed within existing Caltrans and City of San Jose rights-of-way.

In addition, the existing 5-foot sidewalk on the north side of Blossom Hill Road will be replaced with a 10-foot to 12-foot wide Class I Bike/Pedestrian path. The Class I Bike/Pedestrian path will cross over the northbound diagonal on-ramp by constructing a truss type pedestrian overcrossing, with an easterly approach consisting of a short span concrete slab bridge and mechanically stabilized embankment (MSE) walls, and will connect to the existing sidewalk and bike lanes at the US 101/Northbound Off-Ramp / Coyote Road intersection.

The following bridge structures and retaining walls would be modified or constructed in association with the “US 101/Blossom Hill Road Interchange Improvement Project” and path:

1. Blossom Hill Road Overcrossing (OC) (Widen) (Bridge No. 37-0348)
2. NB 101 On-Ramp Pedestrian Overcrossing (POC) (Bridge No. 37-676)

3. SB 101 Off-Ramp Pedestrian Undercrossing (PUC) (Bridge No. 37-675J)
4. SB 101 On-Ramp PUC (Bridge No. 37-675K)
5. Retaining Wall No. 1 (Soil Nail Wall) (Bridge No. 37E0125)
6. Retaining Wall No. 2 (MSE Wall)(Bridge No. 37E0126)

This foundation report is for the "NB101 On-Ramp POC". A map showing the project location and its vicinity is presented in Appendix I. The following foundation reports will be separately submitted:

1. Foundation Report for Blossom Hill Road OC (Widen) (Bridge No. 37-0348).
2. Foundation Report for SB 101 Off-Ramp PUC (Bridge No. 37-675J).
3. Foundation Report for SB 101 On-Ramp PUC (Bridge No. 37-675K).
4. Foundation Report for Retaining Wall No. 1 (Soil Nail Wall)(Bridge No. 37E0125).
5. Foundation Report for Retaining Wall No. 2 (MSE Wall)(Bridge No, 37E0126).

Proposed Bridge Structure

Based on the General Plan and Foundation Plan provided by the structural designer, the new bridge structure generally consists of the following:

a) A five-span bridge structure with Abutment 1 in the west and Abutment 6 in the east.

b) The new bridge will be from "BP" Line Station 34+80.71 to "BP" Line Station 37+33.30 with a total length of 252 feet 7 inches along the "BP" Line.

c) The bridge accommodates the pedestrian/bike path which includes 6-foot wide lanes in each direction and a total width of 14 feet.

d) The proposed bridge will be a CIP Reinforced Concrete Slab Structure from Abutment 1 to Bent 2 and from Bent 3 to Abutment 6. The proposed bridge will be a steel truss from Bent 2 to Bent 3.

e) The foundation will consist of a 36-inch diameter Cast-In-Drilled Hole (CIDH) Concrete pile at Abutment 1, 72-inch diameter CIDH Concrete piles at Bent 2 through Abutment 6.

f) The new MSE retaining walls supporting the path will be from "BP" Line Station 37+39.67 to Station 40+00.00 with a total length of 260 feet 4 inches along the "BP" Line.

All elevations referenced within this report are based on the North American Vertical Datum of 1988 (NAVD 88), unless otherwise noted. To convert elevation at this site from National Geodetic Vertical Datum of 1929 (NGVD 29) to NAVD 88, we added 1.8 feet to the NGVD 29 elevation.

Our recommendations in this report are based on the above information. Any major deviation should be reported to this office for consideration.

4.0 EXCEPTION TO POLICIES AND PROCEDURES

No exception to policies and produces are needed for the preparation of this report. Normal procedures were assumed for construction of the bridge structure throughout our analyses and represent one of the bases of recommendations presented herein. The investigation of the proposed foundations has followed Caltrans policy.

5.0 SITE CONDITIONS

The general project area is the existing interchange of Blossom Hill Road at Route 101 in San Jose, Santa Clara County, California. The existing NB101 On-Ramp starts with one lane and then increased to two lanes (with an additional lane for the HOV lane). The elevation decreased from approximate Elev. 210 feet at the beginning of on-ramp to approximate Elev. 195 feet where the on-ramp merges with Route 101. The existing slope gradient of the slope between the on-ramp and Route 101 ranges is approximately 2(H):1(V).

6.0 FIELD INVESTIGATION AND FIELD TESTING PROGRAM

Field Exploration

Borings R-18-NO-001 through R-18-NO-003 were drilled along the alignment of the proposed POC in August 2018. Cone Penetration Test (CPT) CPT-18-NO-004 and CPT-18-NO-005 were pushed in at the same location at R-18-NO-002 and R-18-NO-003 respectively in

September 2018 to confirm the extent of potential liquefiable soil stratum after the review of the boring data from these two borings. The field exploration was performed by the drilling contractor, Geo-Ex Subsurface Exploration and CPT contractor Middle Earth Geo Testing, Inc. The location, approximate ground elevation and depth of these borings are summarized in the table below.

TABLE 1 – SUBSURFACE INVESTIGATION SUMMARY

Boring No.	Completion Date	Drill Rig Type	Hammer Type	Hammer Efficiency (%)	Approx. Ground Elev. (ft)	Boring/CPT Depth (ft)
R-18-NO-001	8/29/2018	CME 75	Automatic	78	223.0	111.5
R-18-NO-002	8/28/2018	CME 75	Automatic	78	223.0	104.7
CPT-18-NO-004	9/26/2018	N/A	N/A	N/A	223.0	59.9
R-18-NO-003	8/28/2018	CME 75	Automatic	78	215.0	111.5
CPT-18-NO-005	9/26/2018	N/A	N/A	N/A	215.0	71.4

TABLE 2 - SUMMARY OF BORINGS

Boring/CPT No.	"BP" Line Station (ft)	Offset (ft)	Boring/CPT Depth (ft)	Approx. Ground Elev. (ft)
R-18-NO-001	34+90	19.0 Lt.	111.5	223.0
R-18-NO-002	35+85	28.0 Rt.	104.7	223.0
CPT-18-NO-004	35+85	28.0 Rt.	59.9	223.0
R-18-NO-003	37+90	13.0 Rt.	111.5	215.0
CPT-18-NO-005	37+90	13.0 Rt.	71.4	215.0

(1) Boring/CPT location stations and offset and elevations are stated to the nearest foot to be consistent with the LOTB, however they were not surveyed.

The approximate locations of the soil borings and Cone Penetration Test are shown on the "Boring Location Map", Plate 1. The descriptions of the soil materials encountered in the field exploration and relevant boring information are presented on the LOTB included in Appendix II.

Field Testing

a) The current investigation borings (by Parikh) were advanced using a truck-mounted CME-75 drill rig with 8-inch hollow-stem auger and 3 ¼ inch rotary wash drilling method. The soil samples were obtained from the borings during drilling at various depths by driving a 2.5-inch Inside Diameter (I. D.) Modified California Sampler or a 1.375-inch I.D. Standard Penetration Sampler (ASTM Test Method No. 1586). The sampler was driven into the subsurface soils under the impact of a 140 pounds hammer having a free fall of 30 inches. The blow counts required to drive the sampler for the last 12 inches are presented on the LOTB, Appendix II. (When correlating standard penetration data in similar soils, the blow counts for the Modified California sampler can be converted to equivalent Standard Penetration Test sampler by multiplying a factor of safety of 0.65);

b) Pocket penetration tests were also performed on clay samples to evaluate their consistency.

Details of Field Exploration

All the test borings were drilled with a truck-mounted drill rig using 8-inch hollow-stem auger and rotary-wash drilling method. The borings were drilled under the technical supervision of our engineers, who classified and continuously logged the soils encountered during drilling and supervised the collection of soil samples at various depths for visual examination and laboratory testing. The soil samples were visually classified in the field according to the Unified Soil Classification System and then transported to our laboratory for further evaluation and testing. Upon completion of drilling, the boreholes were backfilled with cement grout.

The logs presented in Appendix II were prepared from the field logs which were edited after visual re-examination of the soil samples in the laboratory and results of classification tests on selected soil samples as indicated on the logs.

It should be noted that the descriptions of the soils encountered and relevant boring information presented on the LOTB depict subsurface conditions only at the locations indicated on the plan and on the particular date noted on the LOTB. Because of the variability from place to place within soil/rock in general, subsurface conditions at other locations may differ from conditions occurring at the boring locations explored. The abrupt stratum changes shown on the logs may be gradational and relatively minor changes in soil types within a stratum may not be noted on the logs due to field limitations. Also, the passage of time may result in a change in the soil conditions at these locations due to environmental changes.

7.0 LABORATORY TESTING PROGRAM

The following laboratory tests were performed on selected soil samples collected during field exploration to evaluate the physical and engineering properties of the subsurface soils at the project site to support the foundation recommendations:

a) Laboratory determination of Moisture Contents (ASTM D-2216);
b) Atterberg Limits (ASTM D-4318);
c) Particle Size Analysis (ASTM D-422);
d) Unconfined Compression Test (ASTM D-2166);
e) Corrosivity Test (California Test Method T-643, T-422, and T-417).

The laboratory test methods and test results are presented on plates included in Appendix IV. Laboratory test results for moisture content, total unit weight, unconfined compression, Plasticity Index and grain size classification of the soil samples are summarized in the table in Appendix IV.

8.0 SITE GEOLOGY AND SUBSURFACE CONDITIONS

Geology

General geologic features pertaining to the project site were evaluated by reference to the "Dibblee, T.W.; and Minch, J.A., 2005, Geologic Maps of the San Jose East Quadrangle, Santa Clara County, California; Dibblee Geological Foundation DF-155, scale 1:24,000" and "Dibblee, T.W.; and Minch, J.A., 2005, Geologic Maps of the Santa Teresa Hills Quadrangle, Santa Clara County, California; Dibblee Geological Foundation DF-158, scale 1:24,000".

Based on the geologic map, the project site subsurface soils consist of mainly Holocene surficial sediments with alluvial gravel, sand and clay soil of valley areas (Qa). The general geology of the project area is shown on the "Geologic Map", Plate No. 2.

The descriptions of the subsurface soils encountered in the geotechnical explorations are consistent with the published geologic maps.

Subsurface Conditions

Based on Borings R-18-NO-001 through R-18-NO-003 and Cone Penetration Probe CPT-18-NO-004 and CPT-18-NO-005 data, the descriptions of the subsurface soil materials encountered in each of the exploratory boring and the material interpretation of the CPT are summarized in the table below. Detailed soil descriptions and location of the borings are presented on the LOTBs.

TABLE 3 - SUMMARY OF SUBSURFACE SOIL CONDITIONS

Boring/CPT No.	Support	Soil Description/Material Interpretation (Approximate thickness)
R-18-NO-001	Abut 1 and Bent 2	Approximately 22 feet of medium dense silty sand, underlain by medium stiff to very stiff lean clay, underlain by medium dense to dense silty sand/silty gravel, underlain by a very thin pocket/lens of stiff lean clay, underlain by medium dense silty sand and stiff lean clay to very stiff fat clay from Elevation 119 feet to the bottom of bore hole.
R-18-NO-002	Bent 3 and Bent 4	Medium stiff to very stiff lean clay/silt with interbedded layer of medium dense silty sand, underlain by medium dense to dense silty sand/clayey sand/poorly graded sand to the boring depth of 104.7 feet.
CPT-18-SC-004		Medium stiff to stiff lean clay with intermittent pocket/lens/layer of medium dense sand to the CPT depth of approximately 60 feet.
R-18-NO-003	Bent 5 and Abut 6	Medium dense silty/clayey sand, underlain by medium stiff to stiff clay, underlain by medium dense sand/medium stiff silt, underlain by interbedded layers of medium stiff to very stiff lean clay and dense to very dense silty sand/poorly graded sand to the boring depth of 111.5 feet.
CPT-18-SC-005		Medium dense sand, underlain by medium stiff to very stiff lean clay, underlain by medium dense sand to the CPT depth of 71.4 feet.

Due to limitations inherent in geotechnical investigations, it is neither uncommon to encounter unforeseen variations in the subsurface soil conditions during construction nor is it practical to determine all such variations during an acceptable program of drilling and sampling for a project of this scope. Such variations, when encountered, generally require additional engineering services to attain properly constructed project. We, therefore, recommend that a contingency fund be provided to accommodate any additional charges resulting from technical services that may be required during construction.

9.0 GROUNDWATER

Groundwater measured during the field exploration is summarized in the table below.

TABLE 4 - SUMMARY OF MEASURED GROUNDWATER LEVEL

Boring/CPT No.	Date	Depth (feet)	Elevation (feet)
R-18-NO-001	8/31/2018	30.0	193.0
R-18-NO-002	8/15/2018	25.0	198.0
CPT-18-NO-004	9/26/2018	25.0	198.0
R-18-NO-003	9/11/2018	32.0	183.0
CPT-18-NO-005	9/26/2018	26.3	188.7

Groundwater level is anticipated to vary with the passage of time due to seasonal groundwater fluctuations, variations in yearly rainfall, water elevations in the nearby creeks, surface and subsurface flows, ground surface run-off, and other environmental factors that may not be present at the time of the investigation.

Based on the summary of measured groundwater level and ground elevation, the relatively high groundwater level measured in Borings R-18-NO-001 and R-18-NO-002 appears to be perched groundwater table. Measured groundwater has been used for engineering design purposes.

10.0 AS-BUILT FOUNDATION DATA

There is no as-built foundation data available for the proposed bridge structure since it is a new bridge structure.

11.0 SCOUR EVALUATION

There is no significant drainage or flowing bodies of water passing through or adjacent to the site. Therefore, scour should not be a design concern and was not considered for foundation design.

12.0 CORROSION

The corrosion investigation for this project was performed on the selected samples from borings drilled in 2018 in general accordance with the provisions of California Test Methods 417, 422 and 643. A summary of the corrosion test results is presented in the table below, and the test results are presented in Appendix IV.

TABLE 5 - SUMMARY OF CORROSION TEST RESULT

Boring	Approx. Sample Depth (feet)	Minimum Resistivity (ohms-cm)	PH	Water-soluble Chloride (ppm)	Water-soluble Sulfate (ppm)
R-18-NO-001	31.0	2,090	7.98	8.8	25.4
R-18-NO-002	16.0	1,230	7.23	5.1	125.4
R-18-NO-003	31.0	4,820	7.58	10.6	42.3

According to the Section 10.7.5 of the AASHTO LRFD Bridge Design Specifications (BDS) – Sixth Edition (2012) with Caltrans Amendment, the following soil, water or site conditions shall be considered as indicators of potential pile corrosion or deterioration:

- Minimum resistivity equal to or less than 1,000 ohm-cm,
- Chloride concentration equal to or greater than 500 ppm,
- Sulfate concentration equal to or greater than 2,000 ppm,
- pH equals to or less than 5.5
- Landfills and cinder fills,
- Mines or industrial drainage,
- Suspected chemical wastes, and
- Stray currents.

Per Caltrans Corrosion Guidelines (Version 3.0, March 2018), Caltrans considers a project site to be corrosive for structural elements if one or more of the following conditions exist for the representative soil and/or water samples taken at the project site:

- Chloride concentration equal to or greater than 500 ppm, or
- Sulfate concentration equal to or greater than 1,500 ppm, or
- pH equals to or less than 5.5.

Therefore the on-site soil materials should be non-corrosive according to the criteria above.

13.0 SITE SEISMICITY AND ANALYSIS

13.1 Seismic Sources

The project is located in a seismically active part of northern California. Many faults exist in the regional area. These faults are capable of producing earthquakes and may cause strong ground shaking at the site.

Maximum magnitudes (M_{max}) of some of the closest faults in the area are based on Caltrans ARS Online Website. These maximum moment magnitudes represent the largest earthquake a fault is capable of generating and is related to the seismic moment. The earthquake data of the active faults in the project vicinity are summarized in the table below.

TABLE 6- ARS DATA

Fault (Fault ID)	Maximum Moment Magnitude of Fault, M_{Max}	Fault Type	Site-to-Fault Distance, R_{rup}* (miles)	Peak Ground Acceleration (PGA) Based on Deterministic Data (g)
Silver Creek (148)	6.9	Strike Slip	2.09	0.391
Cascade fault (153)	6.7	Reverse	3.17	0.411
Hayward (Southern extension) (149)	6.7	Strike Slip	3.99	0.319
Monte Vista-Shannon (154)	6.4	Reverse	4.85	0.287
Calaveras (Central) 2011 CFM (151)	6.9	Strike Slip	6.64	0.261
San Andreas (Santa Cruz Mts) 2011 CFM (158)	8.0	Strike Slip	11.91	0.246

*Closest distance (mi) to the fault rupture plane as obtained from Caltrans ARS Online Website.

13.2 Seismic Design Criteria

The development of the Acceleration Response Spectrum (ARS) followed the standard Caltrans procedure by using Caltrans ARS Online webtool (Ver. 2.3.09). The ARS curve is based on several input parameters, including site location (longitude/latitude), average shear wave velocity for the top 100 feet (Vs_{30m}), and other site parameters, such as fault characteristics and site-to-fault distances.

Average shear wave velocities (Vs_{30m}) for the top 100 feet at the project site was calculated by using established correlations and the procedure provided in the "Caltrans Design Manual (Version 2.0, 2012)". The design method incorporates both deterministic and probabilistic seismic hazards to produce the design response spectrum.

Based on all the available boring/CPT data, we have calculated the $Vs_{30m.}$ The Vs_{30m} are summarized in the following table.

TABLE 7- SUMMARY OF CALCULATED V_{S30m}

Boring/CPT No.	Boring/CPT Depth	Rock Depth (ft)	V_{S30m} (m/s)
R-18-NO-001	111.5	Not encountered	204
R-18-NO-002	104.7	Not encountered	218
CPT-18-NO-004	59.9	Not encountered	Not measured
R-18-NO-003	111.5	Not encountered	227
CPT-18-NO-005	71.4	Not encountered	283

The ARS was developed based on the shear wave velocity of 220 m/s. Average shear wave velocity calculation is included in Appendix VI.

The site location and the relevant parameters are summarized as follows, and the recommended design curve is presented on Appendix V.

Input

- Site Location: 37.2579ºN/121.7960ºW
- Average V_{S30m}: 220 m/s
- Depth to rock with a shear wave velocity of 1.0 km/sec ($Z_{1.0}$) = N/A
- Depth to rock with a shear wave velocity of 2.5 km/sec ($Z_{2.5}$) = N/A

Output

- The recommended ARS curve is based on the maximum of the comparison of the deterministic data and Caltrans Probabilistic data. The recommended ARS curve at this site is based on the Probabilistic curve.
- An adjustment factor for the near-fault effect was applied to the calculated spectral acceleration values. The increase of 20% to the spectral acceleration values corresponds to period longer than 1 second and linearly tapes to zero at a period of 0.5 seconds.
- Anticipated Peak Ground Acceleration (PGA): 0.628 g
- Near Fault Effect: Yes
- Basin Effect: No. The project site is not located within the limit of the $Z_{2.5}$ contour map for Northern California.
- Governing Fault is the Silver Creek Fault (Fault I.D.=148, Mmax=6.9)

13.3 Seismic Hazards/Liquefaction Potential

Potential seismic hazards may arise from three sources: surface fault rupture, ground shaking and liquefaction. Since no active faults pass through the site, the potential for fault rupture does not exist at the site. As shown on the ARS Online Map, Plate No. 3, the closest active fault is Silver Creek fault, which is located approximately 2.1 miles northeast from the project site.

13.3.1 Seismic Hazards

Potential seismic hazards may arise from three sources: surface fault rupture, ground shaking and liquefaction.

13.3.2 Seismic Ground Shaking

Based on available geological and seismic data, the project site is expected to experience strong ground shaking. PGA of 0.628 g was estimated for the site which is discussed in Section 13.2.

13.3.3 Surface Fault Rupture

Since no known active fault passes through the project site and the project site is not within a state Alquist-Priolo Zone, the potential for fault rupture does not exist.

13.3.4 Liquefaction Potential

Liquefaction is a phenomenon in which saturated cohesionless soils are subject to a temporary but essentially total loss of shear strength under the reversing, cyclic shear stresses associated with earthquake shaking. Submerged cohesionless sands and silts of low relative density are the type of soils, which usually are susceptible to liquefaction. Clays are generally not susceptible to liquefaction.

The liquefaction potential was evaluated in accordance with the methods proposed by Youd, et al. (2001). The evaluation was done using the boring data from all the available borings using a Magnitude 6.9 earthquake and a peak ground acceleration of 0.628 g (Caltrans Online Probabilistic ARS). This method compares the estimates of the earthquake-induced shear stress to the susceptibility of soil liquefaction.

According to Bray (2006), liquefaction appears to occur in soils where these fines are either non-plastic or are low plasticity silts and/or silty clays (PI<12%, and LL<37%), and with high water content relative to their liquid limit (w>0.85 LL). Estimated fine content has been added to the sand layers (without any sieve analyses) based on the visual inspection and soil classification of the soil sample.

Based on the results of the liquefaction analyses, liquefaction potential may exist at the project site at the isolated locations for the loose to medium dense cohesionless soil encountered in the borings/CPT with the following estimated post-liquefaction settlements.

TABLE 8 - SUMMARY OF ESTIMATED POST-LIQUEFACTION SETTLEMENT

Support No.	Boring/CPT No.	Estimated liquefiable Soil Depth (ft)	Approx. Thickness (ft)	Estimated liquefiable Soil Top Elev.(ft)	Estimated liquefiable Soil Bottom Elev.(ft)	$(N_1)_{60,CS}$	Estimated Post-liquefaction Settlement (inches)
Abut 1 & Bent 2	R-18-NO-001	-	-	-	-	-	-
Bent 3 & Bent 4	R-18-NO-002	58.5	6.5	164.5	158.0	21.0	1.0
	CPT-18-NO-004	-	-	-	-	-	-
Bent 5 & Abut 6	R-18-NO-003	34.0	14.5	181.0	166.5	6.9	3.4
		48.5	8.0	166.5	158.5	19.8	1.3
		56.5	8.5	158.5	150.0	7.5	1.9
	CPT-18-NO-005	52.5	6.5	162.5	156.0	-	2.5

The post-liquefaction settlement due to the potential liquefiable soil encountered in Boring R-18-NO-002 for Bent 3 and Bent 4 and in Boring R-18-NO-003 and CPT-18-NO-005 for Bent 5 and Abutment 6 might cause downdrag and reduce the load carrying capacity of the piles. Downdrag loads have been considered in the calculations of the vertical capacities for Bent 3 through Abutment 6.

Liquefaction analyses are included in Appendix VI.

Lateral Spreading

Liquefaction-induced spreading has been defined as the *"lateral displacement of large surficial blocks of soil as a result of liquefaction in a subsurface layer"*. Lateral spreading refers to the more moderate movements of gently sloping ground due to soil liquefaction. As described by Bartlett and Youd (1992a; 1992b), liquefaction-induced lateral spreading occurs on mild slopes of 0.3% to 5% underlain by loose sand and shallow water. The geologic conditions conducive to lateral spreading (gentle surface slope, shallow water table, and liquefiable cohesionless soils) are frequently found along streams and other waterfronts in recent alluvial or deltaic deposits, as well as in loosely-packed, saturated, sandy fills.

In our opinion, the potential for lateral spreading does not exist because it appears that there is no continuous layer of liquefiable soil and stream/water course at the project site.

14.0 FOUNDATION RECOMMENDATIONS

14.1 General

Based on the findings of our investigation, no major adverse condition was noted for the planned structure provided the recommendations presented in this report are incorporated into the final design and construction. Bridge plans should be reviewed by our office prior to finalizing the plans to see that the intent of our recommendations is included in the plans.

This report was prepared specifically for the proposed project according to the plans provided to us. Normal construction procedures were assumed throughout our analysis and represent one of the bases of recommendations presented herein. Our design recommendations have been based upon the materials and subsurface soil conditions encountered in the soil borings at the project site. Therefore, we should be notified in the event that these conditions are changed, so as to modify or amend our recommendations.

The following foundation recommendations were designed in accordance with the 2012 AASHTO LRFD Bridge Design Specifications (6^{th} Edition) with Caltrans Amendments.

14.2 Earthwork and Grading

All grading operations should be performed in accordance with the project specifications and Caltrans Standard Specifications for Earthwork (Section 19). A representative from

PARIKH or regulating agency should observe all excavated areas during grading and perform moisture and density tests on prepared subgrade and compacted fill materials.

14.3 Deep Foundations

Recommended Foundation Type

1. Based on the available boring information and considering the drivability through the significant strata of medium dense to dense sand, Cast-In-Drilled-Hole (CIDH) Concrete piles appear to be the recommended foundation system for the proposed bridge structure.

2. Caltrans Standard Class 200 Alternate "W" piles is feasible but not preferred considering large demand on the column due to the collision impact load. Caltrans Standard Class 200 Alternate "W" piles is not cost effective as the CIDH Concrete pile for this project.

3. Shallow foundation is not recommended considering the magnitude of the demand load, medium stiff to stiff subsurface soils at shallow depth and potentially liquefiable soil was encountered in Borings R-18-NO-002 and R-18-NO-003 for Bent 3 through Abutment 6.

4. Bents 2 through 5 and Abutment 6 foundations will use a Type-II CIDH Shaft. Per section 49-3.02C(7) of the Caltrans standard specs and special provisions the contractor may place a permanent steel casing to at least 5' below the optional construction joint. Based on this, the pile frictional capacities are ignored from the cut-off elevation to the bottom of the steel casing tip elevation, which are provided by the Designer.

CIDH Concrete piles may be designed for the foundation loads at the abutments and bents to the indicated pile tip elevations as shown in Table 12. Pertinent foundation design information provided by the structural designer, including Foundation Design Data and Foundation Loads, are presented in the following tables.

TABLE 9 - FOUNDATION DESIGN DATA

Support No	Design Method	Pile Type	Finish Grade Elev. (ft)	Pile Cut-off Elev. or Bottom of Footing Elev. (ft)	Pile Cap Size (ft)		Permissible Settlement (in)	No. of Piles per Support
					B	L		
Abut 1	LRFD	36” Dia. CIDH	228.00	222.45	N/A	N/A	1.00	1
Bent 2	LRFD	72” Dia. CIDH	206.72	204.70	N/A	N/A	1.00	1
Bent 3	LRFD	72” Dia. CIDH	209.24	207.20	N/A	N/A	1.00	1
Bent 4	LRFD	72” Dia. CIDH	213.60	211.20	N/A	N/A	1.00	1
Bent 5	LRFD	72” Dia. CIDH	211.60	209.00	N/A	N/A	1.00	1
Abut 6	LRFD	72” Dia. CIDH	212.70	207.00	N/A	N/A	1.00	1

TABLE 10 - FOUNDATION DESIGN LOADS

Support No.	Service-I Limit State (kips)			Strength Limit State (Controlling Group, kips)				Extreme Limit State (Controlling Group, kips)			
	Total Load		Permanent Loads	Compression		Tension		Compression		Tension	
	Per Footing	Max Per Pile	Per Footing	Per Footing	Max. Per Pile	Per Footing	Max. Per Pile	Per Support	Max. Per Pile	Per Support	Max. Per Pile
Abut 1	165	165	140	N/A	220	N/A	0	N/A	140	N/A	0
Bent 2	300	300	230	N/A	410	N/A	0	N/A	230	N/A	0
Bent 3	295	295	220	N/A	405	N/A	0	N/A	220	N/A	0
Bent 4	295	295	240	N/A	395	N/A	0	N/A	240	N/A	0
Bent 5	295	295	240	N/A	395	N/A	0	N/A	240	N/A	0
Abut 6	165	165	140	N/A	220	N/A	0	N/A	140	N/A	0

Load and Resistance Factor Design (LRFD) was used for both bent and abutment foundations, per AASHTO LRFD Bridge Design Specifications–6th Edition, with Caltrans Amendments.

The pile cut-off elevations or bottom of footing elevations are shown in Table 9. The evaluation of Load Demands on the piles, based upon LRFD is presented in Table 10 above. The estimated specified tip elevations for the anticipated design loading of the piles are shown in Table 11 below.

TABLE 11 – FOUNDATION DESIGN RECOMMENDATIONS

Location	Cut-off Elev. Or Bottom of Footing Elev. (ft)	Service-I Limit State Load per Footing (kips)		Total Permissible Footing Settlement (inches)	Nominal Resistance[iii), (iv)] (kips)				Design Tip Elev.[(i)] (ft)	Specified Tip Elev. (ft)	Steel Casing Specified Tip Elevation (ft)
					Strength Limit (φ_{qs}&φ_{qp} = 0.7)		Extreme Event (φ_{qs}&φ_{qp} = 1.0)				
		Total	Permanent		Comp.	Tension	Comp.	Tension			
Abut 1	222.45	165	140	1	320	0	140	0	181.0[(vi)] (a-I) 198.0 (a-II) 205.0 (c), 176.0 (d)	176.0	N/A
Bent 2	204.70	300	230	1	590	0	230	0	135.5 (a-I) 169.5 (a-II) 178.0 (c), 136.0 (d)	135.5	190
Bent 3	207.20	295	220	1	580	0	496	0	147.0 (a-I) 133.0 (a-II) 177.0 (c), 140.0 (d)	133.0	193
Bent 4	211.20	295	240	1	570	0	616	0	149.5 (a-I) 130.5 (a-II) 180.0 (c), 138.0 (d)	130.5	197
Bent 5	209.00	295	240	1	570	0	380	0	164.0 (a-I) 122.5 (a-II) 174.0 (c), 138.0 (d)	122.5	195
Abut 6	207.00	165	140	1	320	0	284	0	168.5 (a-I) 124.5 (a-II) 179.0 (c), 127.0 (d)	124.5	193

(i) Design tip elevations are controlled by (a-I) Compression (Strength Limit), (a-II) Compression (Extreme Event), (c) Settlement, (d) Lateral Load.
(ii) Column heading modified from *Required Factored Nominal Resistance* to **Nominal Resistance**
(iii) *Resistance* factor for φ_{qs} is for skin friction and φ_{qp} is for end bearing.
(iv) The nominal resistances for extreme event include the additional downdrag induced loads, 274 kips for Bent 3, 376 kips for Bent 4, 140 kips for Bent 5 and 144 kips for Abutment 6.
(v) Lateral Pile Capacity Analysis was performed by the structural designer.
(vi) Capacity of the pile to the bottom elevation of soil nail wall of Abutment 1 was reduced by 50% to take into account the stress relief due to the excavation in front of the soil nail wall.

TABLE 12 - PILE DATA TABLE

Location	Pile Type	Cut-off Elev. Or Bottom of Footing Elev. (ft)	Steel Casing Specified Tip Elevation (ft)	Nominal Resistance (kips)		Design Tip Elev. (ft)	Specified Tip Elev. (ft)
				Compression	Tension		
Abut 1	36" Dia. CIDH	222.45	N/A	320	0	181.0 (a) (iii), 205.0 (c), 176.0 (d)	176.0
Bent 2	72" Dia. CIDH w/ Permanent Steel Casing	204.70	190.0	590	0	135.5 (a), 178.0 (c), 136.0 (d)	135.5
Bent 3	72" Dia. CIDH w/ Permanent Steel Casing	207.20	193.0	580	0	133.0 (a), 177.0 (c), 140.0 (d)	133.0
Bent 4	72" Dia. CIDH w/ Permanent Steel Casing	211.20	197.0	570	0	130.5 (a), 180.0 (c), 138.0 (d)	130.5
Bent 5	72" Dia. CIDH w/ Permanent Steel Casing	209.00	195.0	570	0	122.5 (a), 174.0 (c), 138.0 (d)	122.5
Abut 6	72" Dia. CIDH w/ Permanent Steel Casing	207.00	193.0	320	0	124.5 (a), 179.0 (c), 127.0 (d)	124.5

i. Design tip elevations for Abutments and Bents are controlled by: (a) Compression, (c) Settlement, (d) Lateral Load
ii. Lateral Pile Capacity Analysis was performed by the structural designer.
iii. Capacity of the pile to the bottom elevation of soil nail wall of Abutment 1 was reduced by 50% to take into account the stress relief due to the excavation in front of the soil nail wall.

The estimation of the capacity of CIDH concrete pile will be based on latest procedures published by AASHTO LRFD Bridge Design Specifications – Sixth Edition (Section 10.8) with Caltrans Amendments. Per these specifications, resistance through skin friction of the top five feet and the bottom one diameter of CIDH pile will not be considered in pile capacity calculations. Moreover, the pile capacity of the CIDH pile will be derived primarily from frictional resistance along the pile shafts, and end bearing capacity will not be included when estimating the pile capacity.

The estimated design tip elevations and specified tip elevations are based on the general plan, foundation plan, "Foundation Design Data" and "Foundation Design Loads" provided by the structural designer. In the event that these footing bottom elevations are changed, the design pile tip elevations may have to be revised accordingly. The axial pile capacity calculations are presented in Appendix VI.

The piles should not be spaced closer than 3 times the pile diameter measured center-to-center. For piles spaced at center-to-center distance greater than or equal to 3 times the pile diameter, there is no group effect for pile vertical capacity.

14.4 Lateral Design for Piles

The piles under the lateral demand using L-PILE software was performed by the structural designer. The L-PILE results will be provided by the structural designer. The recommended L-PILE parameters are included in Appendix VI and in the tables below.

TABLE 13A–GEOTECHNICAL PARAMETERS FOR LPILE ANALYSIS ABUTMENT 1 AND BENT 2 (Boring R-18-NO-001)

Approx. Depth (ft)	Elevation (ft.)	LPILE Soil Type	c (psf)	Phi (degrees)	Effective Unit Weight γ' (pcf)
0 to 8	223 to 215	Sand (Reese)	-	$\phi = 36°$	125
8 to 18	215 to 205	Sand (Reese)	-	$\phi = 34°$	125
18 to 21.5	205 to 201.5	Sand (Reese)	-	$\phi = 32°$	125
21.5 to 28	201.5 to 195	Stiff Clay w/o Free Water (Reese)	c=1750 psf	-	125
28 to 30	195 to 193	Stiff Clay w/o Free Water (Reese)	c=1200 psf	-	125
30 to 33	193 to 190	Stiff Clay w/o Free Water (Reese)	c=1200 psf	-	65
33 to 43	190 to 180	Stiff Clay w/o Free Water (Reese)	c=1600 psf	-	65
43 to 53.5	180 to 169.5	Soft Clay (Matlock)	c=400 psf	-	65
53.5 to 58	169.5 to 165	Soft Clay (Matlock)	c=800 psf	-	65
58 to 75	165 to 148	Stiff Clay w/o Free Water (Reese)	c=1350 psf	-	65
75 to 81.5	148 to 141.5	Stiff Clay w/o Free Water (Reese)	c=3500 psf	-	65
81.5 to 108	141.5 to 115	Sand (Reese)	$\phi = 36°$	$\phi = 36°$	65
108 to 111.5	115 to 111.5	Stiff Clay w/o Free Water (Reese)	c=4000 psf	-	65

(1) Groundwater was measured at the depth of 30 feet below existing ground during drilling at Elevation +193.0 feet.
(2) Default values of soil modulus (k) and soil strain (ε_{50}) can be used for all layers

TABLE 13B–GEOTECHNICAL PARAMETERS FOR LPILE ANALYSIS BENT 3 AND BENT 4 (Boring R-18-NO-002)

Approx. Depth (ft)	Elevation (ft.)	LPILE Soil Type	c (psf)	Phi (degrees)	Effective Unit Weight γ' (pcf)
0 to 3.3	223 to 219.7	Stiff Clay w/o Free Water (Reese)	c=2000 psf	-	125
3.3 to 13	219.7 to 210	Sand (Reese)	-	$\phi = 35°$	125
13 to 19	210 to 204	Stiff Clay w/o Free Water (Reese)	c=1000 psf	-	125
19 to 23.5	204 to 199.5	Sand (Reese)	-	$\phi = 32°$	125
23.5 to 25	199.5 to 198	Stiff Clay w/o Free Water (Reese)	c=1000 psf	-	125
25 to 58.5	198 to 164.5	Stiff Clay w/o Free Water (Reese)	c=1000 psf	-	65
58.5 to 65	164.5 to 158	Case I) Sand (Reese)	-	$\phi = 33°$	65
		Case II) Stiff Clay with/o Free Water (Reese)	c=1200 psf	-	65
65 to 76	158 to 147	Stiff Clay w/o Free Water (Reese)	c=2000 psf	-	65
76 to 104.7	147 to 118.3	Sand (Reese)	-	$\phi = 38°$	65

(1) Default values of soil modulus (k) and soil strain (ε_{50}) can be used for all layers
(2) Groundwater was measured at the depth of 25 feet below existing ground during drilling at Elevation +198.0 feet.

TABLE 13C–GEOTECHNICAL PARAMETERS FOR LPILE ANALYSIS BENT 5 AND ABUTMENT 6 (Boring R-18-NO-003)

Approx. Depth (ft)	Elevation (ft.)	LPILE Soil Type	c (psf)	Phi (degrees)	Effective Unit Weight γ' (pcf)
0 to 8	215 to 207	Sand (Reese)	-	$\phi = 38°$	125
8 to 11.5	207 to 203.5	Sand (Reese)	-	$\phi = 36°$	125
11.5 to 18.5	203.5 to 196.5	Stiff Clay w/o Free Water (Reese)	c=2000 psf	-	125
18.5 to 23	196.5 to 192	Soft Clay (Matlock)	c=900 psf	-	125
23 to 32	192 to 183	Stiff Clay w/o Free Water (Reese)	c=1500 psf	-	125
32 to 34	183 to 181	Stiff Clay w/o Free Water (Reese)	c=1500 psf	-	65
34 to 48.5	181 to 166.5	Case I) Sand (Reese)		$\phi = 30°$	65
		Case II) Soft Clay (Matlock)	c=300 psf	-	65
48.5 to 56.5	166.5 to 158.5	Case I) Sand (Reese)	-	$\phi = 32°$	65
		Case II) Soft Clay (Matlock)	c=600 psf		65
56.5 to 65	158.5 to 150	Case I) Sand (Reese)	-	$\phi = 30°$	65
		Case II) Soft Clay (Matlock)	c=300 psf	-	65
65 to 75	150 to 140	Soft Clay (Matlock)	c=800 psf	-	65
75 to 85	140 to 130	Sand (Reese)	-	$\phi = 36°$	65
85 to 106	130 to 100	Sand (Reese)	-	$\phi = 38°$	65
106 to 111.5	100 to 103.5	Stiff Clay w/o Free Water (Reese)	c=2500 psf		65

(1) Default values of soil modulus (k) and soil strain (ε_{50}) can be used for all layers
(2) Groundwater was measured at the depth of 32.0 feet below existing ground during drilling at Elevation +183.0 feet.

14.5 Lateral Earth Pressures

Abutment retaining walls should be designed to resist the following Applied Lateral Earth Pressures (Equivalent Fluid Pressures-EFP) and live load. These values assume no hydrostatic pore pressure buildup behind the wall and are based on well-drained backfill behind the walls supported in native soil. If hydrostatic pressures are allowed to build up behind the walls, additional lateral loads should be considered in the design.

Applied Lateral Earth Pressure

(a) Active Condition — Recommended active pressure is 36 pcf EFP for the engineered backfill.

(b) At-Rest Condition — Recommended at-rest pressure is 55 pcf EFP for the engineered backfill.

(c) Passive Resistance — 5.0 ksf (ultimate) for seismic design of the abutment backwall (5.5 feet or greater); for activated height less than 5.5 feet, modify proportionally i.e. 5.0x (H/5.5) ksf per. A minimum lateral wall movement of 2% of wall height to mobilize the full ultimate passive resistance is required.

Cantilever walls, which are free to rotate by at least 0.005 radian, may be assumed flexible and designed for the active condition. Walls that are not capable of this movement should be assumed rigid and designed for the at-rest condition. The effect of any surcharge (dead, live, or traffic load) should be added to the preceding lateral earth pressures. A coefficient of 0.4 and 0.5 may be used to determine the additional lateral earth pressures resulting from the surcharge for cantilever walls and rigid walls, respectively.

14.6 Abutment Seismic Design

The foundation soil at Abutment 1 is considered “Marginal” according to Caltrans SDC 1.7 and per AASHTO LRFD C11.6.5. However, the abutment is confined on both sides with soil (due to the soil nail wall in front for Abutment 1). It is considered that active lateral seismic forces do not develop for this kind of geometry. The foundation soil at Abutment 6 is “Competent” based on Boring R-18-No-003. Also, Abutment 6 is a pile-column extension and "bent-like" based on the General Plan, so no lateral soil loading should be developed on Abutment 6. It is our opinion that no incremental lateral seismic load is needed.

14.7 Fill Settlement

Fill up to approximately 2 feet maximum high is anticipated to be placed on the original ground at Abutment 1. The settlement due to this shallow fill is considered negligible for practical purposes. The fill settlement due to MSE wall near Abutment 6 is addressed in a separate foundation report titled “Blossom Hill Road Interchange Improvement - Retaining Wall No. 2 San Jose, California”.

15.0 CONSTRUCTION CONSIDERATIONS

15.1 General

To a degree, the performance of any structure is dependent upon construction procedures and quality. Hence, observation of foundation construction should be carried out by the responsible Agency. If the encountered subsurface conditions differ from the basis of our recommendations, Parikh should be informed in order to assess the need for design changes. Therefore, the recommendations presented in this report are contingent upon good quality control and these geotechnical observations during construction.

A safe working distance from underground and overhead utilities should be provided during construction work. If this is not possible, the utility lines may need to be cleared from the site before the start of construction work.

15.2 Cast-In-Drilled-Hole (CIDH) Concrete Pile

a) Caltrans standard specifications and standard special provisions (SSP) for "Cast-in-Place Concrete Piling" should be used for the construction of CIDH concrete piles. Access tubes for acceptance testing should be provided in all CIDH concrete piles that are 24 inches in diameter or larger for construction quality control, except when the holes are dry or when the holes are dewatered without the use of temporary casing to control groundwater. The acceptance test should include Gamma- Gamma Logging and may also include cross-hole sonic logging for verification. Gamma-Gamma Logging should be performed in accordance with California Test 233 Standard (CT233) to check the homogeneity of CIDH concrete piles.

b) Due to the presence of granular material and groundwater, raveling or caving is anticipated, which may require additional drilling and cleaning effort and may increase the concrete volume for the piles. It is prudent to make the contractor aware of these conditions so that appropriate steps can be taken to comply with the standards and maintain the integrity of the CIDH concrete pile.

c) The use of temporary steel casing and slurry displacement method of construction should be expected during pile foundation construction. This should be consistent with any other special conditions required by the Regulatory Agency. Caltrans Standard Specifications and SSPs should be used for construction and quality assurance procedures.

d) It is recommended that the specifications set certain criteria for qualifications and previous work experience requirements to pre-qualify the potential contractors. The intent is to help select qualified contractors to reduce construction issues.

e) All pile excavations should be observed by the geotechnical engineer or regulatory agency prior to the placement of reinforcement and concrete so that if conditions differ from those anticipated, appropriate recommendations can be made.

f) The slurry backfill must comply with Caltrans Standard Specifications Section 19-3.02E “Slurry Cement Backfill”.

16.0 NOTES TO DESIGNER

Should the specified pile tip elevation required to meet lateral load demands exceed the specified pile tip elevation given within this report, the Geotechnical Engineer must be contacted for further recommendations.

17.0 PLAN REVIEW

This report is prepared for the proposed “NB 101 On-Ramp POC) (Bridge No. 37-676)”. We recommend that final foundation plans for the proposed project to be reviewed by PARIKH prior to construction so that the intent of our recommendations is included in the project plans and specifications and to further see that no misunderstandings or misinterpretations have occurred. However, design-build elements should be reviewed only from overall compliance standpoint.

18.0 CONSTRUCTION OBSERVATION

To a degree, the performance of any structure is dependent upon construction procedures and quality control measures. Hence, geotechnical observation and testing of grading operations, foundation excavations, and observation of pile installations should be carried out by the Geotechnical Engineer. If the subsurface conditions different from those forming the basis of our recommendations are encountered, this office should be informed in order to assess the need for design changes. Therefore, the recommendations presented in this report are contingent upon good quality control and these geotechnical observations during construction.

19.0 INVESTIGATION LIMITATIONS

Our services consist of professional opinions and recommendations made in accordance with generally accepted geotechnical engineering principles and practices and are based on our site reconnaissance and the assumption that the subsurface conditions do not deviate from observed conditions. All work done is in accordance with generally accepted geotechnical engineering principles and practices. No warranty, expressed or implied, of merchantability or fitness, is made or intended in connection with our work or by the furnishing of oral or written reports or findings.

The scope of our services did not include any environmental assessment or investigation for the presence or absence of hazardous or toxic materials in structures, soil, surface water, groundwater or air, below or around this site. Unanticipated soil conditions are commonly encountered and cannot be fully determined by taking soil samples and excavating test borings; different soil conditions may require that additional expenditures be made during construction to attain a properly constructed project. Some contingency fund is thus recommended to accommodate these possible extra costs.

This report has been prepared for the proposed project as described earlier, to assist the engineer in the design of this project. In the event any changes in the design or location of the facilities are planned, or if any variations or undesirable conditions are encountered during construction, our conclusions and recommendations shall not be considered valid unless the changes or variations are reviewed and our recommendations modified or approved by us in writing.

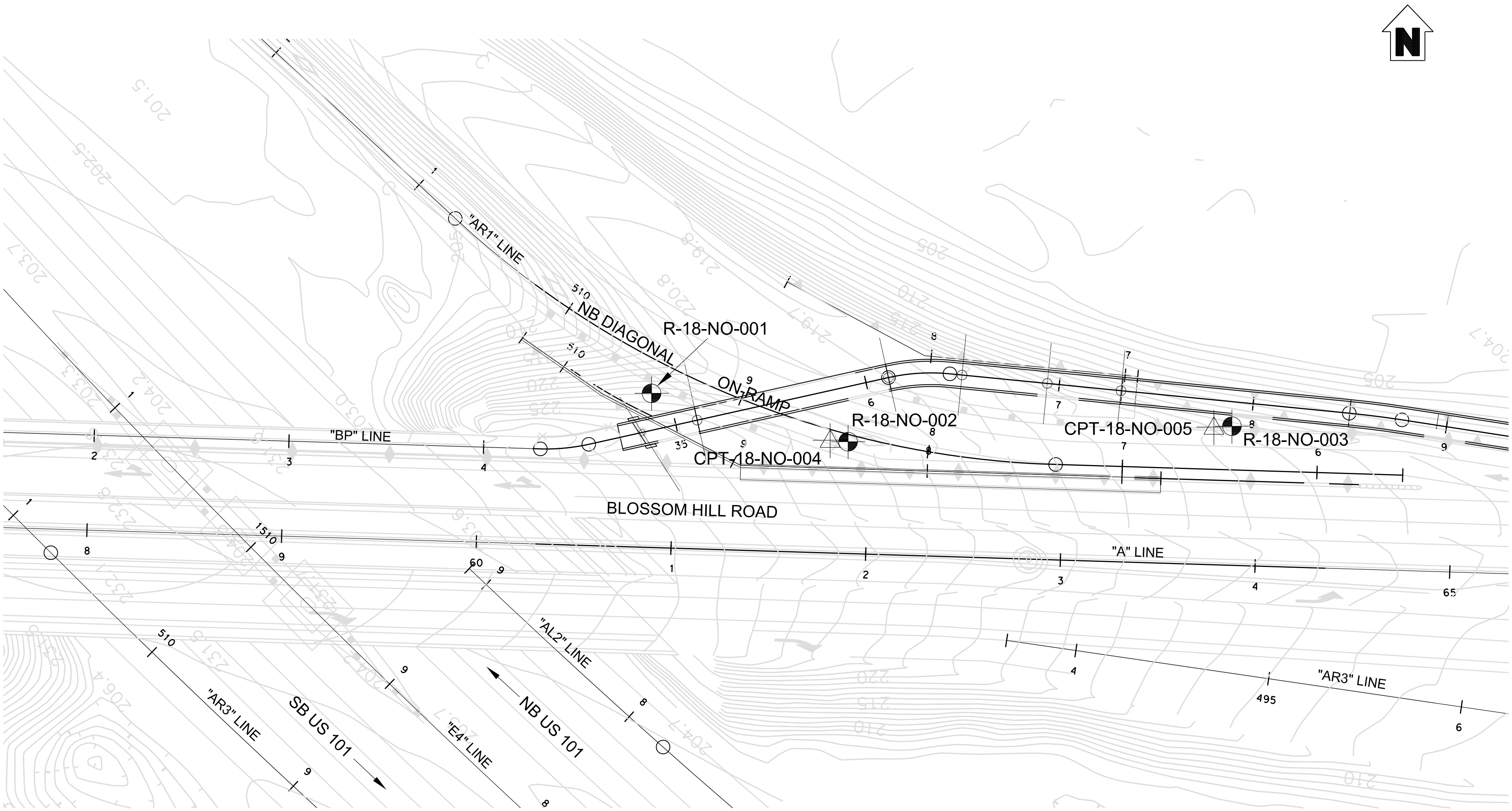
This report is issued with the understanding that it is the designer's responsibility to ensure that the information and recommendations contained herein are incorporated into the project and that necessary steps are also taken to see that the recommendations are carried out in the field. The findings in this report are valid as of the present date. However, changes in the subsurface conditions can occur with the passage of time, whether they are due to natural processes or to the works of man, on this or adjacent properties. In addition, changes in applicable or appropriate standards occur, whether they result from legislation or from the broadening of knowledge. Accordingly, the findings in this report might be invalidated, wholly or partially, by changes outside of our control.

Respectfully submitted,
PARIKH CONSULTANTS, INC.

REGISTERED PROFESSIONAL ENGINEER
Y. DAVID WANG
No. P.E. 52911
Exp. 12/31/20
CIVIL
STATE OF CALIFORNIA

Alston Lam, P.E., G.E. 2605	Y. David Wang, Ph.D., P.E., 52911
Project Engineer	Senior Engineer

T:\Ongoing Projects\2016\2016-146-NOC NB101 On-Ramp POC\FR (Final) (Words)\NB101 On-Ramp POC Foundation Report (10-2019).docx



LEGEND

R-18-NO-001
Approx. Boring Location (Drilled by PARIKH in 2018)

CPT-18-NO-004
Approx. CPT Location (Pushed by PARIKH in 2018)

SCALE: 1 inch = 100 feet

Note: All units are in feet unless otherwise specified
Reference Map was provided by HMH Engineers.

BORING LOCATION MAP

PARIKH
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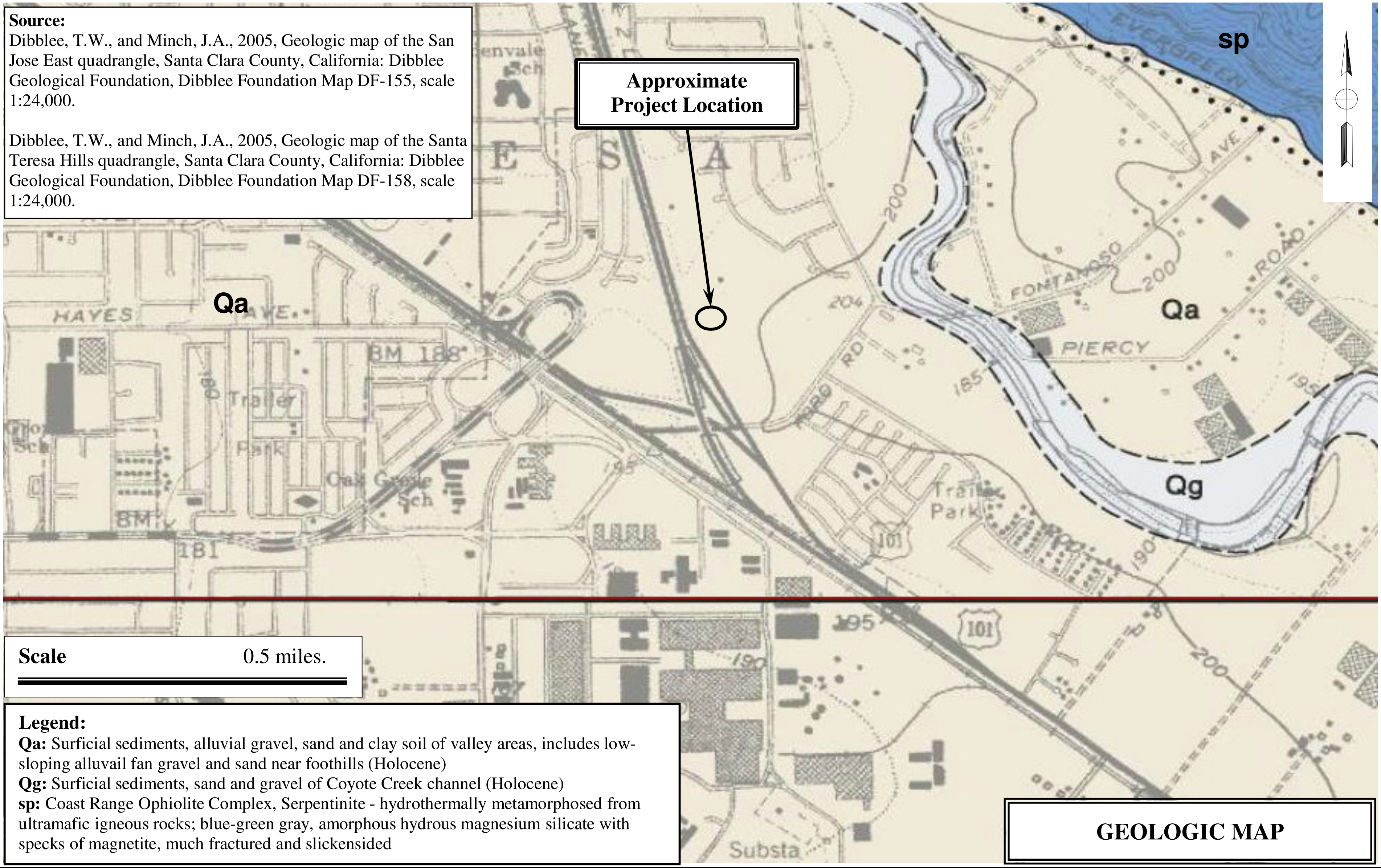
NB101 ON-RAMP POC
SAN JOSE, CALIFORNIA

JOB NO.:2016-146-NOC

PLATE NO: 1



Source:
Dibblee, T.W., and Minch, J.A., 2005, Geologic map of the San Jose East quadrangle, Santa Clara County, California: Dibblee Geological Foundation, Dibblee Foundation Map DF-155, scale 1:24,000.

Dibblee, T.W., and Minch, J.A., 2005, Geologic map of the Santa Teresa Hills quadrangle, Santa Clara County, California: Dibblee Geological Foundation, Dibblee Foundation Map DF-158, scale 1:24,000.

Scale 0.5 miles.

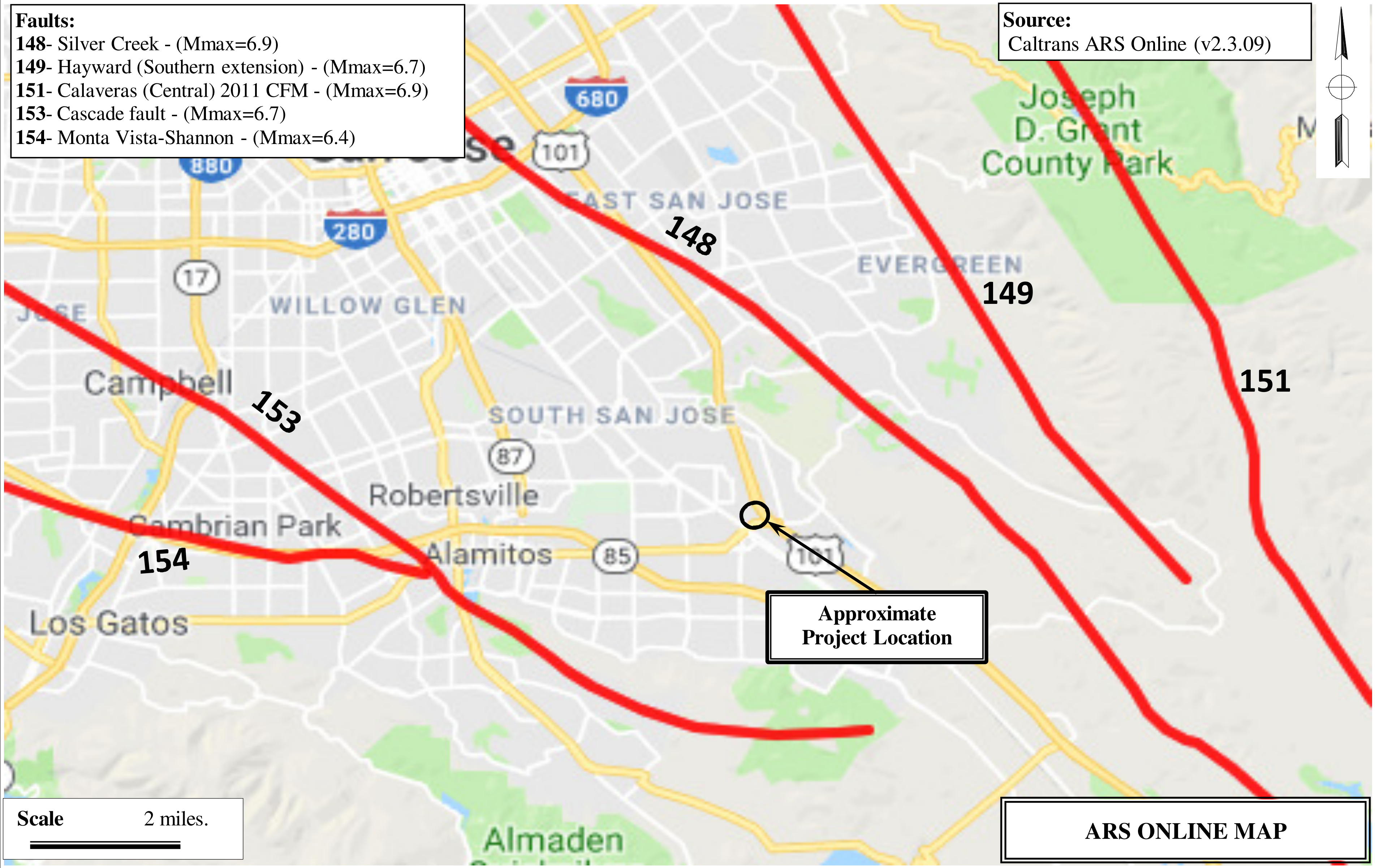
Legend:
Qa: Surficial sediments, alluvial gravel, sand and clay soil of valley areas, includes low-sloping alluvail fan gravel and sand near foothills (Holocene)
Qg: Surficial sediments, sand and gravel of Coyote Creek channel (Holocene)
sp: Coast Range Ophiolite Complex, Serpentinite - hydrothermally metamorphosed from ultramafic igneous rocks; blue-green gray, amorphous hydrous magnesium silicate with specks of magnetite, much fractured and slickensided

GEOLOGIC MAP

PARIKH
Practicing in the Geosciences

NORTHBOUND 101 ON-RAMP PEDESTRIAN OVERCROSSING
SAN JOSE, CALIFORNIA

JOB NO.: 2016-146-NOC | **PLATE NO.: 2**



PARIKH
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NORTHBOUND 101 ON-RAMP PEDESTRIAN OVERCROSSING
SAN JOSE, CALIFORNIA

JOB NO.: 2016-146-NOC | PLATE NO.: 3

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	SCI	101	R28.4/R28.9		

REGISTERED STRUCTURAL ENGINEER DATE

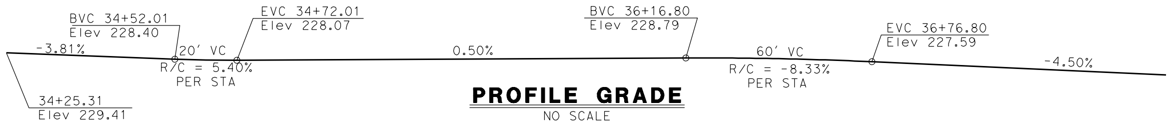
PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of scanned copies of this plan sheet.

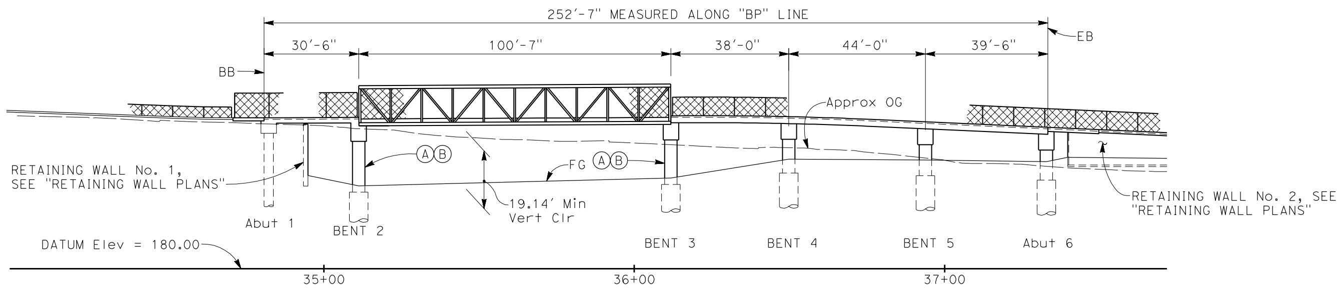
REGISTERED PROFESSIONAL ENGINEER MAHVASH M. HARMS No. 2639 Exp. 12/31/20 STRUCTURAL STATE OF CALIFORNIA

CITY OF SAN JOSE DOT
200 E. SANTA CLARA St., 8th FLOOR
SAN JOSE, CA 95113

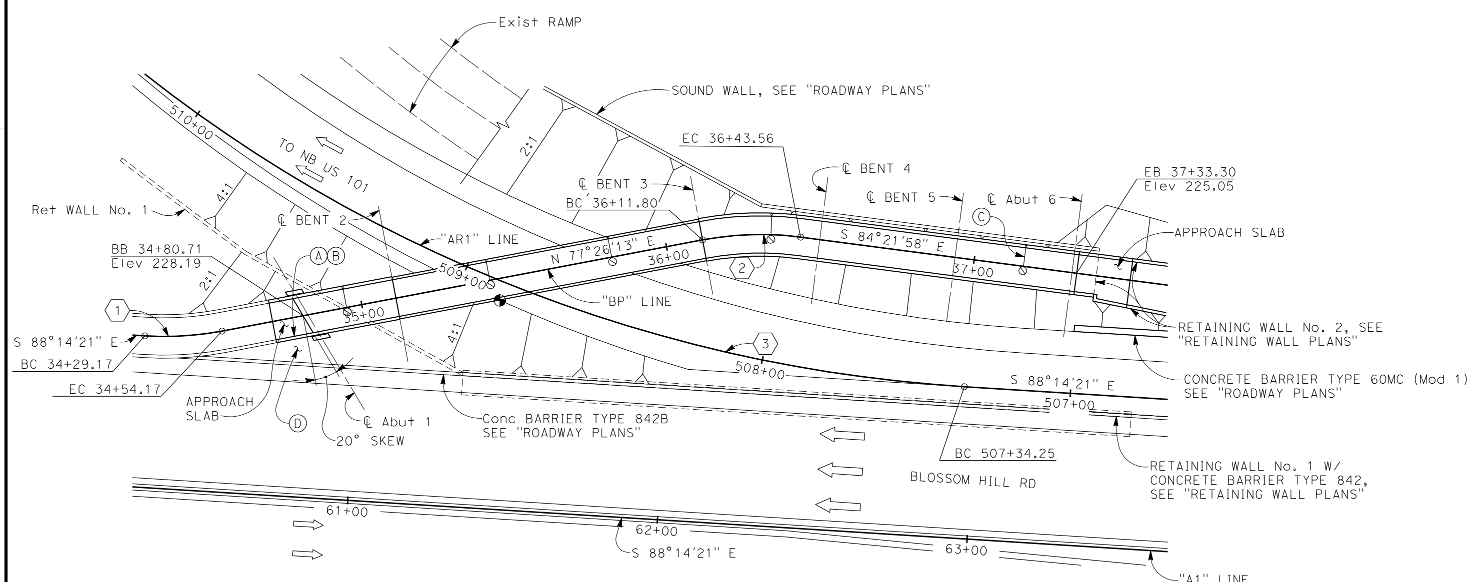
BIGGS CARDOSA ASSOCIATES INC.
865 THE ALAMEDA
SAN JOSE, CALIFORNIA 95126



PROFILE GRADE
NO SCALE



DEVELOPED ELEVATION
1" = 20'



PLAN
1" = 20'

NOTES:
(A) Paint "BRIDGE NO. 37-0676"
(B) PAINT "NB 101 ON-RAMP POC"
(C) Electrolier, see "Roadway Plans" & "SCHEDULE OF ELECTROLIER LOCATIONS"
(D) Slope Paving, see "Roadway Plans"

LEGEND:
Indicates Point of Minimum Vertical Clearance
Indicates Traffic Direction

CURVE DATA				
CURVE	R	Δ	T	L
1	100.00'	14°19'26"	12.57'	25.00'
2	100.00'	18°11'49"	16.01'	31.76'
3	475.00'	41°03'27"	177.87'	340.38'

SCHEDULE OF ELECTROLIER LOCATIONS
"BP" LINE 37+98.00
"BP" LINE 35+42.00
"BP" LINE 35+82.00
"BP" LINE 36+34.00
"BP" LINE 37+16.00

NOTE:
THE CONTRACTOR MUST VERIFY ALL CONTROLLING FIELD DIMENSIONS BEFORE ORDERING OR FABRICATING ANY MATERIAL

PLAN CHECK SET/NOT FOR CONSTRUCTION (9/19/19)

DESIGN OVERSIGHT	DESIGN	BY G. TOLAN	CHECKED P. GONGIDI	LOAD & RESISTANCE FACTOR DESIGN	LIVE LOADING: 90 PSF PEDESTRIAN LOAD AND H10 MAINTENANCE VEHICLE		
	DETAILS	BY G. TOLAN	CHECKED P. GONGIDI	LAYOUT	BY G. KENNING	CHECKED A. NOTARO	
SIGN OFF DATE	QUANTITIES	BY A. VASQUEZ	CHECKED F. KIANMOFRAD	SPECIFICATIONS	BY G. KENNING	PLANS AND SPECS COMPARED A. NOTARO	

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

G. KENNING
PROJECT ENGINEER

BRIDGE NO. 37-0676
POST MILES R28.61

NB 101 ON-RAMP POC
GENERAL PLAN No. 1

DESIGN GENERAL PLAN SHEET (ENGLISH) (REV. 7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0000
PROJECT NUMBER & PHASE: 04160002241 CONTRACT NO.: 04-1K2804

DISREGARD PRINTS BEARING EARLIER REVISION DATES — REVISION DATES 7/11/18 12/5/18 4/17/19

SHEET 1 OF 30

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME 2016309 (2016309DS1_TS)

FOR ACCURATE RIGHT OF WAY AND ACCESS DATA, CONTACT RIGHT OF WAY ENGINEERING AT THE DISTRICT OFFICE

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	SCI	101	R28.4/R28.9		

REGISTERED STRUCTURAL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER MAHVASH M. HARMS No. 2639 Exp. 12/31/20 STRUCTURAL STATE OF CALIFORNIA

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CITY OF SAN JOSE DOT
200 E. SANTA CLARA St., 8th FLOOR
SAN JOSE, CA 95113

BIGGS CARDOSA ASSOCIATES INC.
865 THE ALAMEDA
SAN JOSE, CALIFORNIA 95126

LEGEND:
- (box) Indicates Bottom of Footing Elevation
- 29.6 Indicates Spot Elevation
- (circle) Indicates Pile

NOTE:
Verify utility locations with "ROADWAY PLANS"

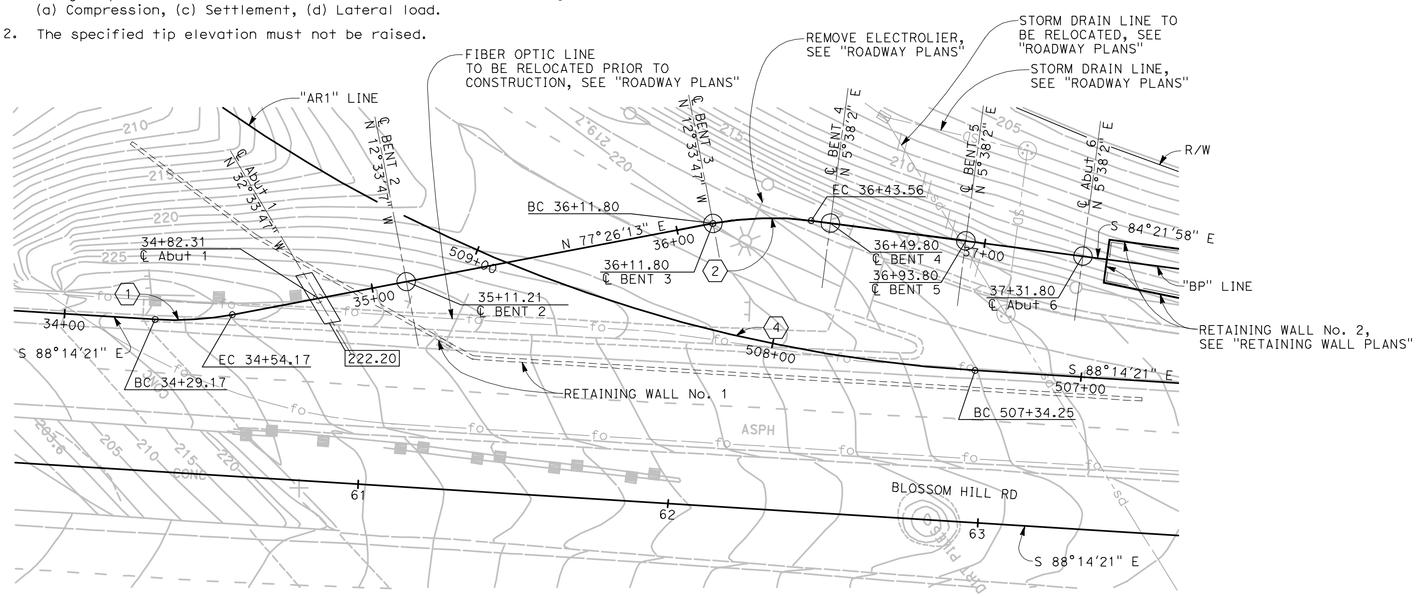
BENCH MARK AND DATUM

MONUMENT	COORDINATES		ELEVATION	DESCRIPTION/LOCATION
	NORTHING	EASTING		
107	1,918,675.697	6,184,775.266	220.36	SET MAG NAIL & SHINER ± 70' EAST OF SILVER CREEK VALLEY Rd OVERPASS.
118	1,919,879.851	6,183,487.929	197.17	SET MAG NAIL & SHINER AT 101 SOUTHBOUND SHOULDER.

PILE DATA TABLE

LOCATION	PILE TYPE	CUT-OFF Elev (ft)	NOMINAL RESISTANCE		DESIGN TIP Elev (ft)	SPECIFIED TIP Elev (ft)
			COMPRESSION	TENSION		
Abut 1	36" Dia CIDH	222.45	320	--	181.0(a), 205.0(c), 176.0(d)	176.0
BENT 2	72" Dia CIDH	204.70	590	--	135.5(a), 196.0(c), 136.0(d)	135.5
BENT 3	72" Dia CIDH	207.20	580	--	133.0(a), 177.0(c), 140.0(d)	133.0
BENT 4	72" Dia CIDH	211.20	570	--	130.5(a), 182.0(c), 138.0(d)	130.5
BENT 5	72" Dia CIDH	209.00	570	--	122.5(a), 174.0(c), 138.0(d)	122.5
Abut 6	72" Dia CIDH	207.00	320	--	124.5(a), 179.0(c), 127.0(d)	124.5

NOTES:
1. Design tip elevations for Abutments and Bents are controlled by:
   (a) Compression, (c) Settlement, (d) Lateral load.
2. The specified tip elevation must not be raised.



FOUNDATION PLAN

1" = 20'

NOTE:
THE CONTRACTOR MUST VERIFY ALL CONTROLLING FIELD DIMENSIONS BEFORE ORDERING OR FABRICATING ANY MATERIAL

GEOTECHNICAL PROFESSIONAL APPROVAL DATE

PLAN CHECK SET/NOT FOR CONSTRUCTION (9/6/19)

DESIGN OVERSIGHT	SCALE: AS SHOWN	VERT.DATUM NAVD88	HORZ.DATUM CCS83 ZONE 3	DESIGN BY G. TOLAN	CHECKED P. GONGIDI	
	PHOTOGRAMMETRY AS OF: JULY 2016	ALIGNMENT TIES		DETAILS BY G. TOLAN	CHECKED P. GONGIDI	
	SURVEYED BY HMH	DRAFTED BY RADMAN AERIAL		QUANTITIES BY A. VASQUEZ	CHECKED F. KIANMOFRAD	
SIGN OFF DATE	FIELD CHECKED BY RADMAN AERIAL	CHECKED BY RADMAN AERIAL				

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

G. KENNING
PROJECT ENGINEER

BRIDGE NO. 37-0676
POST MILES R28.61

NB 101 ON-RAMP POC
FOUNDATION PLAN

FOUNDATION PLAN SHEET (ENGLISH) (REV. 03-14-12)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0000
PROJECT NUMBER & PHASE: 04160002241
CONTRACT NO.: 04-1K2804
FILE => $REQUEST

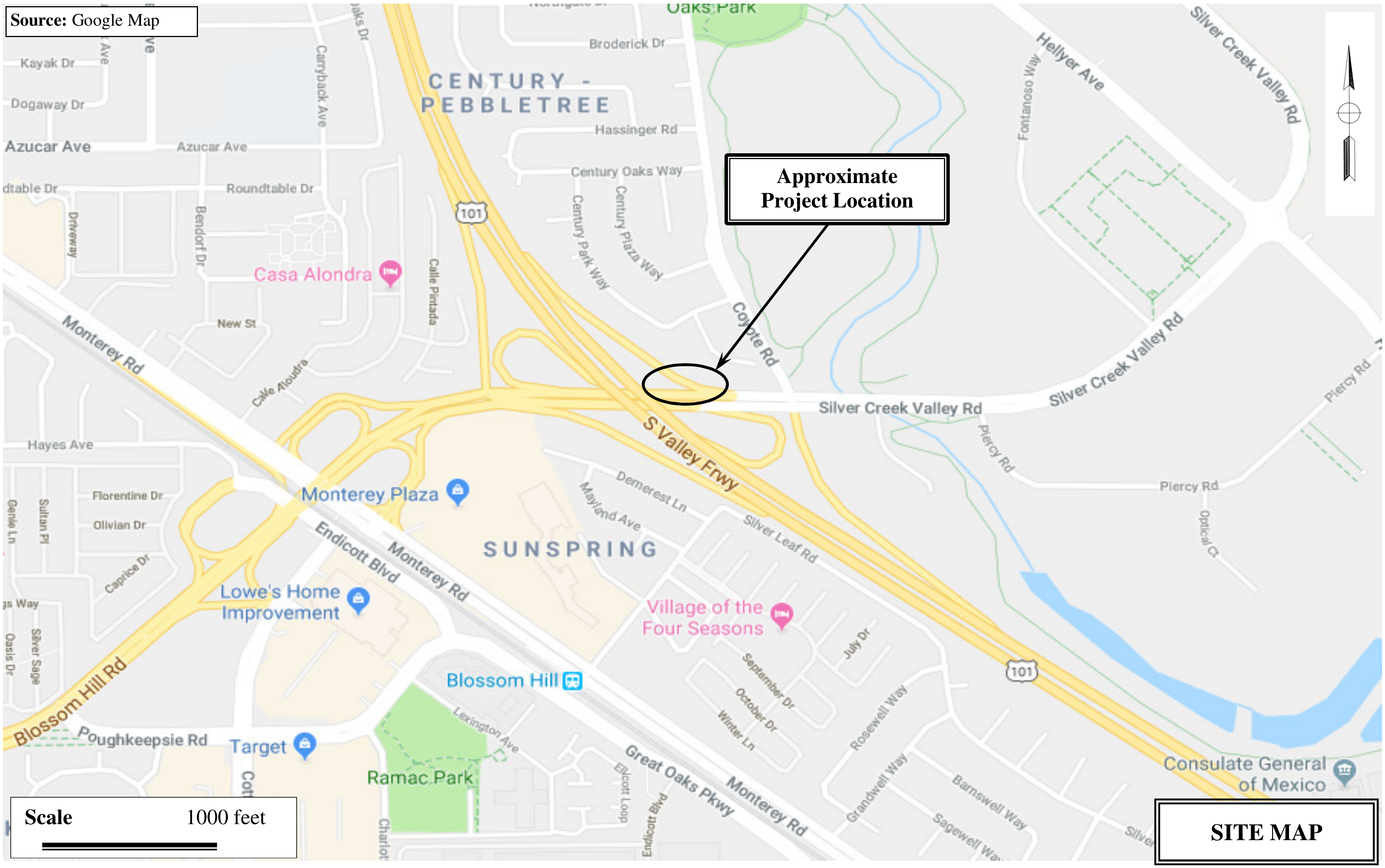
DISREGARD PRINTS BEARING EARLIER REVISION DATES → REVISION DATES 7/11/18 12/5/18 4/17/19

SHEET 5 OF 30

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

2016309 (2016309DS5)

APPENDIX I



SITE MAP

PARIKH Practicing in the Geosciences	NORTHBOUND 101 ON-RAMP PEDESTRIAN OVERCROSSING SAN JOSE, CALIFORNIA	
	JOB NO.: 2016-146-NOC	APPENDIX I

APPENDIX II

APPENDIX II

FIELD EXPLORATION

All the test borings were drilled with a truck-mounted drill rig using 8-inch diameter hollow-stem auger and switched to rotary-wash drilling method with 3.3-inch / 4.3-inch diameter drilling bits. The soil samples were obtained from the borings during drilling at various depths by driving a 2.5 inches Inside Diameter (I. D.) Modified California Sampler or a 1.375 inches I.D. Standard Penetration Sampler (ASTM Test Method No. 1586). The sampler was driven into the subsurface soils under the impact of a 140 pounds hammer having a free fall of 30 inches. The blow counts required to drive the sampler for the last 12 inches are presented on the Logs of Test Borings, Appendix II. (When correlating standard penetration data in similar soils, the blow counts for the Modified California sampler can be converted to equivalent Standard Penetration Test sampler by multiplying a factor of 0.65). Pocket penetration tests were also performed on clay samples to evaluate their consistency. Upon completion of drilling, the boreholes were backfilled with cement grout.

The borings were drilled under the technical supervision of our engineers, who classified and continuously logged the soils encountered during drilling and supervised the collection of soil samples at various depths for visual examination and laboratory testing. The soil samples were visually classified in the field according to the Caltrans "Soil and Rock Logging, Classification and Presentation Manual" (2010 Edition) and then transported to our laboratory for further evaluation and testing.

The descriptions of the soils encountered and relevant boring information are presented on the Log of Test Borings attached in Appendix II. The laboratory test methods and results are presented in Appendix IV. The logs presented in Appendix II were prepared from the field logs which were edited after visual re-examination of the soil samples in the laboratory and results of classification tests on selected soil samples as indicated on the logs.

The descriptions and related information presented on these logs of test borings depict subsurface conditions only at the locations indicated on the plan and on the particular date noted on the logs. Because of the variability from place to place within soil/rock in general, subsurface conditions at other locations may differ from conditions occurring at the location explored. The abrupt stratum changes shown on the logs may be gradational and relatively minor changes in soil types within a stratum may not be noted on the logs due to field limitations. Also, the passage of time may result in a change in the soil conditions at these locations due to environmental changes.

NOTES:

Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2" Modified California Sampler: I.D. = 2.5"; O.D. = 3" Hammer Assembly: A 140 lb hammer with a 30" drop (Automatic Hammer)

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock, Logging, Classification, and Presentation Manual (2010)

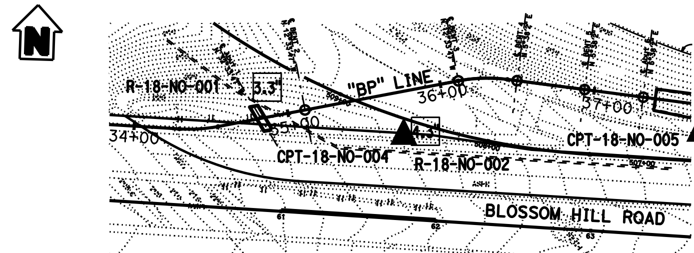
See Caltrans 2015 Standard Plans A10F, A10G and A10H for Soil and Rock Legend.

All dimensions are in feet unless otherwise shown

BENCH MARK:

NGS QQ453 (HS 2787)
Elev. 190.83
4.7 miles northwest along the southern Pacific Company Railroad from the station at Coyote.

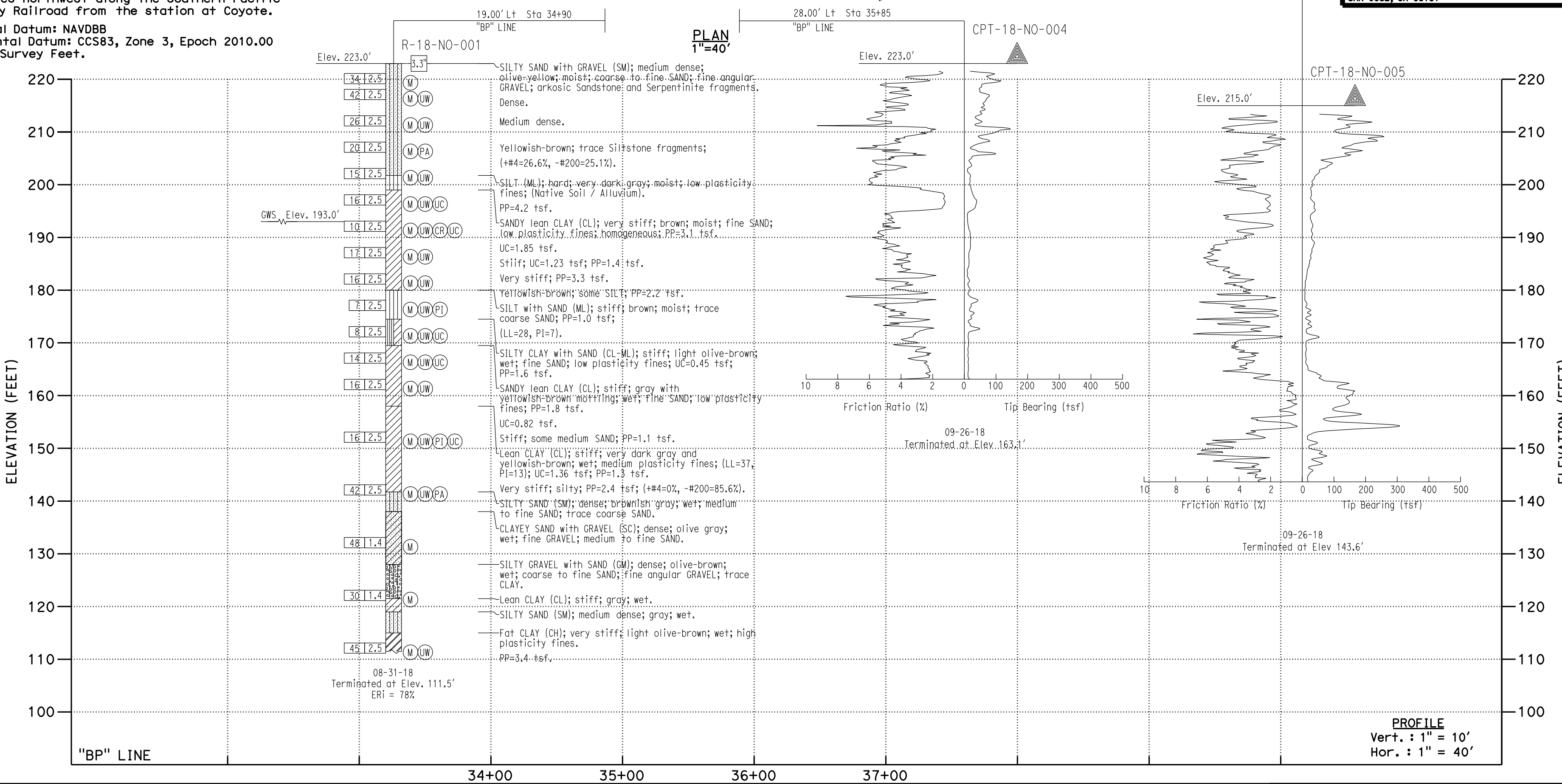
Vertical Datum: NAVDBB
Horizontal Datum: CCS83, Zone 3, Epoch 2010.00 in U.S Survey Feet.



PLAN
1"=40'

BOREHOLE LOCATION TABLE

Hole ID	Alignment Name	Station and Offset
R-18-NO-001	"BP" Line	34+90 19' Lt.
R-18-NO-002	"BP" Line	35+85 28' Rt.
R-18-NO-003	"BP" Line	37+90 13' Rt.
CPT-18-NO-004	"BP" Line	35+85 28' Rt.
CPT-18-NO-005	"BP" Line	37+90 13' Rt.



PROFILE
Vert. : 1" = 10'
Hor. : 1" = 40'

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	SCI	101	R28.4/R28.9	29	30

GEOTECHNICAL PROFESSIONAL 10-15-19 DATE

REGISTERED PROFESSIONAL ENGINEER GARY PARIKH No. 666 Exp. 12/31/19 GEOTECHNICAL STATE OF CALIFORNIA

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of scanned copies of this plan sheet.

CITY OF SAN JOSE DOT
200 E. SANTA CLARA St., 8th FLOOR
SAN JOSE, CA 95113

PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131

DESIGN OVERSIGHT
SIGN OFF DATE
DRAWN BY: KIM OUYANG
CHECKED BY: ALSTON LAM
L.S. BHANGOO
FIELD INVESTIGATION BY:
DATE: AUGUST 2018 TO SEPTEMBER 2018

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

ALSTON LAM
PROJECT ENGINEER

BRIDGE NO. 37-676
POST MILES R28.61

NB 101 ON-RAMP POC
LOG OF TEST BORINGS 1 OF 2

GS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 03/14/12)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0000
PROJECT NUMBER & PHASE: 04160002241 CONTRACT NO.: 04-1K2804

DISREGARD PRINTS BEARING EARLIER REVISION DATES
REVISION DATES 7-11-18 4-9-19 10-15-19
SHEET 29 OF 30

FILE => NB101 on ramp poc-ltb01.dgn

USERNAME => ogouthier DATE PLOTTED => 17-SEP-2019 TIME PLOTTED => 18:55

NOTES:

Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2" Modified California Sampler: I.D. = 2.5"; O.D. = 3" Hammer Assembly: A 140 lb hammer with a 30" drop (Automatic Hammer)

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock, Logging, Classification, and Presentation Manual (2010)

See Caltrans 2015 Standard Plans A10F, A10G and A10H for Soil and Rock Legend.

All dimensions are in feet unless otherwise shown

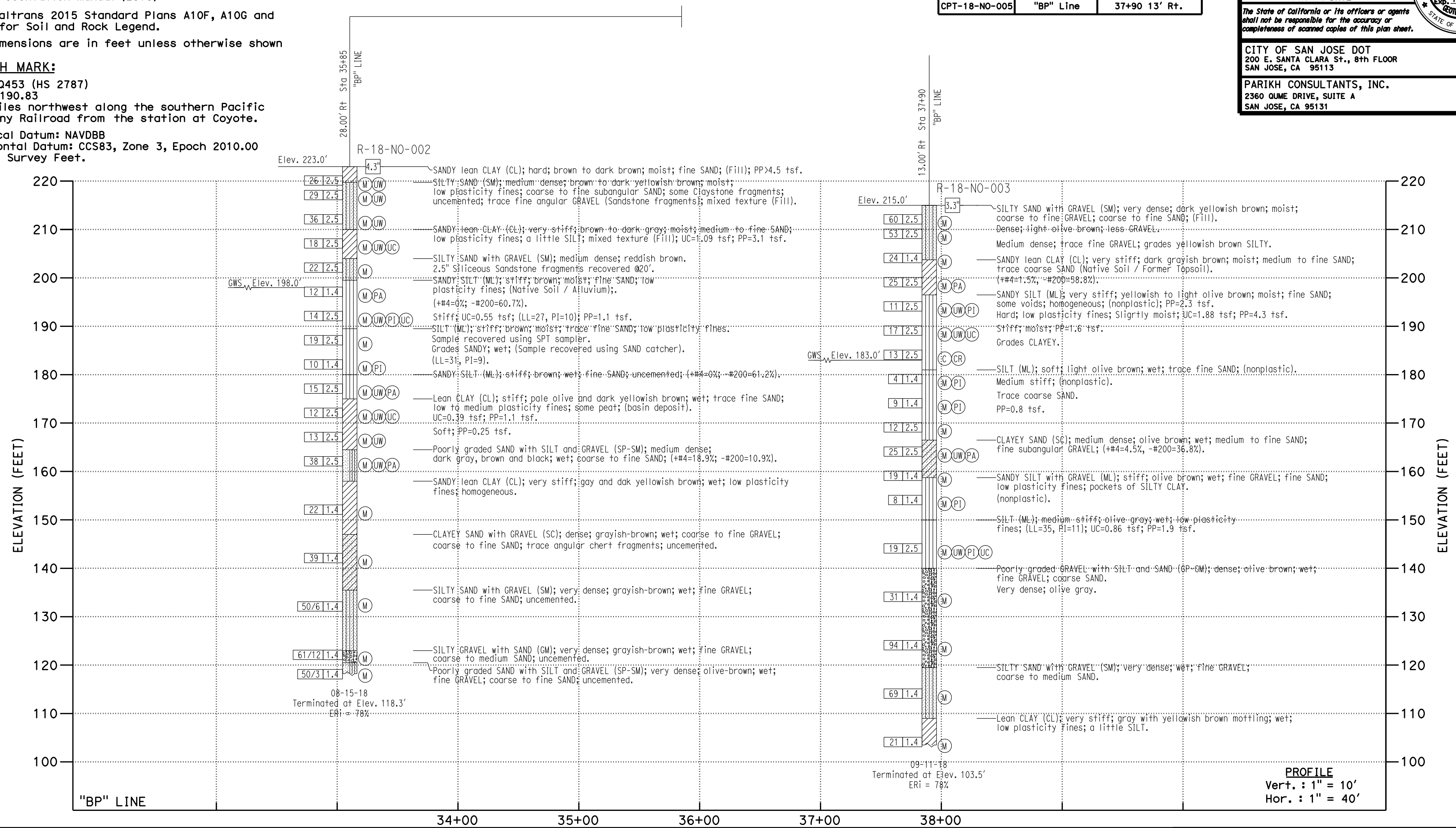
BENCH MARK:

NGS QQ453 (HS 2787)
Elev. 190.83
4.7 miles northwest along the southern Pacific Company Railroad from the station at Coyote.

Vertical Datum: NAVDBB
Horizontal Datum: CCS83, Zone 3, Epoch 2010.00 in U.S Survey Feet.

BOREHOLE LOCATION TABLE

Hole ID	Alignment Name	Station and Offset
R-18-NO-001	"BP" Line	34+90 19' Lt.
R-18-NO-002	"BP" Line	35+85 28' Rt.
R-18-NO-003	"BP" Line	37+90 13' Rt.
CPT-18-NO-004	"BP" Line	35+85 28' Rt.
CPT-18-NO-005	"BP" Line	37+90 13' Rt.



DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	SCI	101	R28.4/R28.9		

GEOTECHNICAL PROFESSIONAL DATE 10-15-19

REGISTERED PROFESSIONAL ENGINEER GARY PARIKH No. 666 Exp. 12/31/19 GEOTECHNICAL STATE OF CALIFORNIA

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of scanned copies of this plan sheet.

CITY OF SAN JOSE DOT
200 E. SANTA CLARA St., 8th FLOOR
SAN JOSE, CA 95113

PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131

DESIGN OVERSIGHT
SIGN OFF DATE
DRAWN BY: KIM OUYANG
CHECKED BY: ALSTON LAM
L.S. BHANGOO
FIELD INVESTIGATION BY:
DATE: AUGUST 2018 TO SEPTEMBER 2018

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

ALSTON LAM
PROJECT ENGINEER

BRIDGE NO. 37-676
POST MILES R28.61

NB 101 ON-RAMP POC
LOG OF TEST BORINGS 2 OF 2

GS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 03/14/12)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0000
PROJECT NUMBER & PHASE: 04160002241
CONTRACT NO.: 04-1K2804

DISREGARD PRINTS BEARING EARLIER REVISION DATES
REVISION DATES 7-11-18 4-9-19 10-15-19
SHEET 30 OF 30

FILE => NB101 on ramp poc-ltb02.dgn

USERNAME => ogouthier DATE PLOTTED => 17-SEP-2019 TIME PLOTTED => 18:56

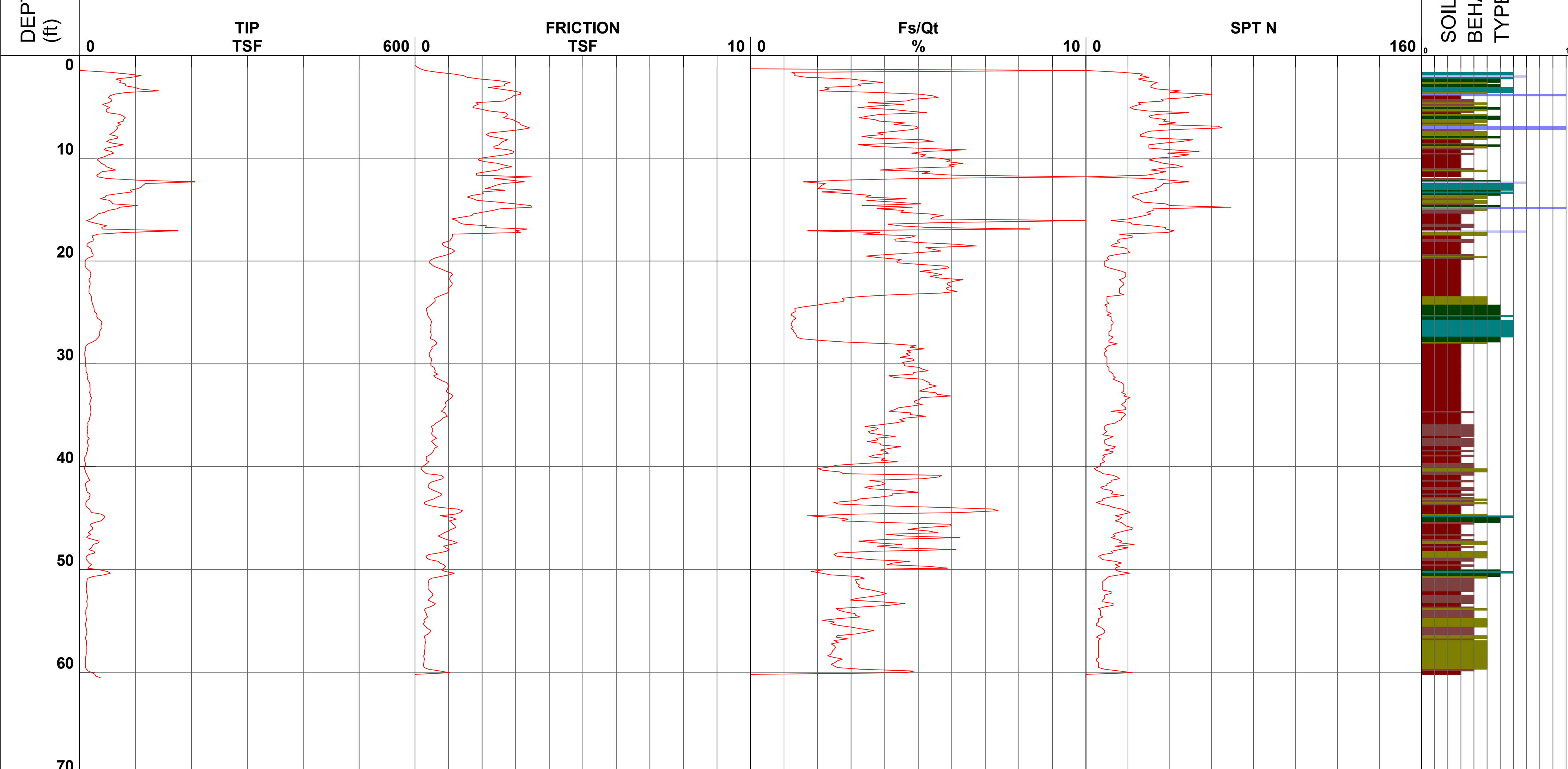
APPENDIX III

Parikh Consultants

Project	US 101 Blossom Hill Rd IC Improvement Pr	Operator	RB-JM	Filename	SDF(111).cpt
Job Number	2016-146	Cone Number	DDG1418	GPS	
Hole Number	CPT-18-NO-004	Date and Time	9/26/2018 10:04:00 AM	Maximum Depth	60.53 ft
EST GW Depth During Test		30.00 ft			

Net Area Ratio .8

CPT DATA



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

Cone Size 15cm squared

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

US 101 Blossom Hill Rd IC Improvement Project

Project ID: Parikh Consultants
Data File: SDF(111).cpt
CPT Date: 9/26/2018 10:04:00 AM
GW During Test: 30 ft

Sounding ID: CPT-18-NO-004
Project No: 2016-146
Cone/Rig: DDG1418

. Depth ft	. qc PS tsf	* qc1n PS -	. q1ncs PS -	* qt PS tsf	. Slv Stss tsf	. pore prss (psi)	. Frct Rato %	* Mat Typ Zon	* Material Behavior Description	. Unit Wght pcf	. Qc to N	* SPT R-N1 60%	. SPT R-N 60%	* SPT IcN1 60%	* Rel Den %	* Ftn Ang deg	. Und Shr tsf	. OCR -	* Fin Ic %	* Ic SBT Indx	* Nk -
0.33	1.1	0.0	-	1.1	0.0	0.0	0.1	1	sensitive fine SOIL	115	2.0	1	1	1	-	-	0.1	9.9	95	3.48	15
0.49	1.1	0.0	-	1.1	0.0	0.0	0.1	1	sensitive fine SOIL	115	2.0	1	1	1	-	-	0.1	9.9	95	3.48	15
0.66	1.1	0.0	-	1.1	0.0	0.0	0.1	1	sensitive fine SOIL	115	2.0	1	1	1	-	-	0.1	9.3	95	3.48	15
0.82	1.1	-0.1	-	1.1	0.0	0.0	0.1	1	sensitive fine SOIL	115	2.0	1	1	1	-	-	0.1	7.4	95	3.48	15
0.98	1.1	0.0	-	1.1	0.0	0.0	0.1	1	sensitive fine SOIL	115	2.0	1	1	1	-	-	0.1	6.1	95	3.48	15
1.15	1.1	-0.2	-	1.1	0.1	0.0	0.1	1	sensitive fine SOIL	115	2.0	1	1	1	-	-	0.1	5.2	95	3.48	15
1.31	1.1	0.0	-	1.1	0.2	0.0	0.1	1	sensitive fine SOIL	115	2.0	1	1	1	-	-	0.1	4.5	95	3.48	15
1.48	1.1	1.8	-	1.1	0.3	0.0	9.9	2	Organic SOILS - Peats	100	1.0	2	1	1	-	-	0.1	4.1	95	3.94	10
1.64	54.6	87.6	115.4	54.6	0.7	0.1	1.2	6	clean SAND to silty SAND	125	5.0	18	11	17	63	48	-	-	13	2.01	16
1.80	85.1	136.5	161.6	85.1	1.1	-0.1	1.3	6	clean SAND to silty SAND	125	5.0	27	17	26	77	48	-	-	10	1.89	16
1.97	110.0	176.4	197.1	110.0	1.4	0.0	1.3	6	clean SAND to silty SAND	125	5.0	35	22	32	86	48	-	-	8	1.81	16
2.13	92.7	148.7	183.1	92.7	1.6	0.1	1.7	6	clean SAND to silty SAND	125	5.0	30	19	29	80	48	-	-	11	1.94	16
2.30	64.5	103.5	181.9	64.5	1.9	0.3	3.0	5	silty SAND to sandy SILT	120	4.0	26	16	22	68	48	-	-	20	2.24	16
2.46	73.5	117.9	209.4	73.5	2.5	0.3	3.4	5	silty SAND to sandy SILT	120	4.0	29	18	26	72	48	-	-	20	2.24	16
2.62	71.5	114.7	224.0	71.5	2.8	0.1	4.0	8	stiff SAND to clayy SAND	115	1.0	100	72	25	-	-	4.7	9.9	23	2.30	16
2.79	82.9	132.9	218.5	82.9	2.7	-0.1	3.2	5	silty SAND to sandy SILT	120	4.0	33	21	28	76	48	-	-	19	2.19	16
2.95	81.3	130.4	218.3	81.3	2.7	0.2	3.3	5	silty SAND to sandy SILT	120	4.0	33	20	28	76	48	-	-	19	2.20	16
3.12	98.3	157.7	209.0	98.2	2.2	-4.6	2.2	5	silty SAND to sandy SILT	120	4.0	39	25	31	82	48	-	-	13	2.02	16
3.28	107.4	172.2	227.2	107.3	2.5	-3.4	2.4	5	silty SAND to sandy SILT	120	4.0	43	27	34	85	48	-	-	13	2.01	16
3.45	141.6	227.2	269.0	141.6	2.9	0.0	2.1	6	clean SAND to silty SAND	125	5.0	45	28	43	94	48	-	-	10	1.89	16
3.61	82.7	132.6	239.0	82.7	3.2	0.4	3.8	8	stiff SAND to clayy SAND	115	1.0	100	83	29	-	-	5.5	9.9	21	2.25	16
3.77	62.3	99.8	240.7	62.3	3.1	2.3	5.1	9	very stiff fine SOIL	120	2.0	50	31	23	67	46	-	-	27	2.42	30
3.94	53.9	86.4	233.8	54.0	2.9	6.2	5.5	9	very stiff fine SOIL	120	2.0	43	27	21	62	45	-	-	30	2.49	30
4.10	51.3	82.3	232.3	51.5	2.9	8.9	5.6	9	very stiff fine SOIL	120	2.0	41	26	20	61	44	-	-	31	2.51	30
4.27	56.3	90.3	223.3	56.5	2.7	7.3	4.9	9	very stiff fine SOIL	120	2.0	45	28	21	64	45	-	-	28	2.44	30
4.43	57.4	92.0	219.5	57.5	2.7	3.9	4.7	9	very stiff fine SOIL	120	2.0	46	29	22	64	44	-	-	27	2.42	30
4.59	51.7	82.9	176.8	51.7	1.8	1.8	3.5	4	clayy SILT to silty CLAY	115	2.0	41	26	19	-	-	3.6	9.9	25	2.35	15
4.76	41.3	66.2	184.7	41.3	1.9	0.5	4.6	4	clayy SILT to silty CLAY	115	2.0	33	21	16	-	-	2.9	9.9	31	2.50	15
4.92	47.2	75.7	175.0	47.2	1.8	-0.2	3.8	4	clayy SILT to silty CLAY	115	2.0	38	24	18	-	-	3.3	9.9	26	2.40	15
5.09	53.8	86.4	171.6	53.8	1.7	-0.4	3.2	5	silty SAND to sandy SILT	120	4.0	22	13	19	62	44	-	-	23	2.31	16
5.25	47.6	76.3	187.9	47.6	2.0	0.6	4.2	4	clayy SILT to silty CLAY	115	2.0	38	24	18	-	-	3.3	9.9	28	2.44	15
5.41	47.3	75.9	201.0	47.3	2.2	0.7	4.7	4	clayy SILT to silty CLAY	115	2.0	38	24	18	-	-	3.3	9.9	30	2.48	15
5.58	51.2	82.1	223.4	51.2	2.7	0.6	5.3	9	very stiff fine SOIL	120	2.0	41	26	20	60	43	-	-	30	2.49	30
5.74	71.4	114.6	221.6	71.5	2.8	2.1	3.9	8	stiff SAND to clayy SAND	115	1.0	100	71	25	-	-	4.7	9.9	22	2.30	16
5.91	78.0	125.1	220.9	77.9	2.7	-1.4	3.5	5	silty SAND to sandy SILT	120	4.0	31	19	27	74	45	-	-	20	2.24	16
6.07	81.6	130.8	217.7	81.5	2.6	-3.0	3.2	5	silty SAND to sandy SILT	120	4.0	33	20	28	76	45	-	-	19	2.20	16
6.23	78.7	126.1	228.4	78.7	2.9	-1.2	3.7	8	stiff SAND to clayy SAND	115	1.0	100	79	27	-	-	5.2	9.9	21	2.25	16
6.40	77.7	122.9	230.4	77.7	3.0	-0.3	3.9	8	stiff SAND to clayy SAND	115	1.0	100	78	27	-	-	5.1	9.9	22	2.28	16
6.56	67.7	105.7	235.4	67.7	3.1	1.1	4.6	9	very stiff fine SOIL	120	2.0	53	34	24	69	43	-	-	26	2.38	30
6.73	73.2	112.9	233.2	73.2	3.1	1.5	4.3	9	very stiff fine SOIL	120	2.0	56	37	25	71	44	-	-	24	2.33	30
6.89	66.3	101.0	239.6	66.2	3.3	-0.9	5.0	9	very stiff fine SOIL	120	2.0	50	33	24	67	43	-	-	27	2.41	30
7.05	68.3	102.8	243.8	68.3	3.4	-1.0	5.0	9	very stiff fine SOIL	120	2.0	51	34	24	68	43	-	-	27	2.41	30
7.22	65.5	97.5	231.5	65.4	3.2	-2.9	4.8	9	very stiff fine SOIL	120	2.0	49	33	23	66	43	-	-	27	2.41	30
7.38	62.6	92.2	210.7	62.6	2.7	-2.6	4.3	4	clayy SILT to silty CLAY	115	2.0	46	31	21	-	-	4.4	9.9	26	2.39	15
7.55	58.6	85.3	187.6	58.5	2.2	-3.8	3.8	4	clayy SILT to silty CLAY	115	2.0	43	29	20	-	-	4.1	9.9	25	2.37	15
7.71	53.7	77.4	183.2	53.7	2.1	-1.0	4.0	4	clayy SILT to silty CLAY	115	2.0	39	27	18	-	-	3.8	9.9	27	2.41	15
7.87	67.1	95.7	185.0	67.1	2.2	-0.1	3.3	5	silty SAND to sandy SILT	120	4.0	24	17	21	66	42	-	-	22	2.30	16
8.04	68.3	96.4	196.8	68.3	2.5	0.0	3.7	5	silty SAND to sandy SILT	120	4.0	24	17	22	66	42	-	-	24	2.33	16
8.20	53.7	75.0	211.5	53.7	2.8	0.3	5.2	4	clayy SILT to silty CLAY	115	2.0	37	27	18	-	-	3.8	9.9	31	2.51	15
8.37	48.2	66.6	207.0	48.2	2.6	-0.4	5.5	4	clayy SILT to silty CLAY	115	2.0	33	24	17	-	-	3.4	9.9	34	2.56	15
8.53	57.9	79.3	197.9	57.9	2.5	0.0	4.4	4	clayy SILT to silty CLAY	115	2.0	40	29	19	-	-	4.1	9.9	28	2.44	15
8.69	78.0	105.9	192.4	78.0	2.5	0.0	3.2	5	silty SAND to sandy SILT	120	4.0	26	20	23	69	43	-	-	21	2.26	16
8.86	63.1	84.9	185.5	63.1	2.4	-0.7	3.8	4	clayy SILT to silty CLAY	115	2.0	42	32	19	-	-	4.4	9.9	25	2.37	15
9.02	47.7	63.5	191.1	47.7	2.4	-0.3	5.0	4	clayy SILT to silty CLAY	115	2.0	32	24	16	-	-	3.3	9.9	33	2.55	15
9.19	43.3	69.5	-	43.3	2.8	-0.1	6.5	9	very stiff fine SOIL	120	2.0	35	22	18	55	39	-	-	36	2.61	30
9.35	56.5	73.9	211.9	56.5	2.9	1.1	5.3	4	clayy SILT to silty CLAY	115	2.0	37	28	18	-	-	4.0	9.9	32	2.52	15
9.51	60.6	78.6	207.9	60.6	2.9	-0.9	4.9	4	clayy SILT to silty CLAY	115	2.0	39	30	19	-	-	4.2	9.9	30	2.47	15
9.68	51.4	66.1	201.4	51.3	2.7	-1.1	5.3	4	clayy SILT to silty CLAY	115	2.0	33	26	16	-	-	3.6	9.9	33	2.55	15
9.84	44.9	57.3	185.2	44.8	2.3	-2.5	5.1	4	clayy SILT to silty CLAY	115	2.0	29	22	15	-	-	3.1	9.9	35	2.58	15
10.01	34.5	55.4	-	34.4	1.9	-3.5	5.7	3	silty CLAY to CLAY	115	1.5	37	23	14	-	-	2.4	9.9	37	2.63	15
10.17	31.4	50.4	-	31.4	1.9	-3.2	6.1	3	silty CLAY to CLAY	115	1.5	34	21	13	-	-	2.2	9.9	39	2.68	15
10.34	35.5	57.0	-	35.5	2.1	-0.3	5.9	3	silty CLAY to CLAY	115	1.5	38	24	15	-	-	2.5	9.9	37	2.63	15
10.50	38.8	62.2	-	38.8	2.5	3.0	6.4	3	silty CLAY to CLAY	115	1.5	41	26	16	-	-	2.7	9.9	37	2.64	15
10.66	44.9	61.2	-	44.9	2.7	3.5	6.0	3	silty CLAY to CLAY	115	1.5	41	30	16	-	-	3.1	9.9	36	2.62	15
10.83	47.5	64.1	-	47.6	2.9	3.3	6.1	9	very stiff fine SOIL	120	2.0	32	24	16	52	39	-	-	36	2.61	30
10.99	56.2	68.0	188.5	56.3	2.6	3.7	4.6	4	clayy SILT to silty CLAY	115	2.0	34	28	17	-	-	3.9	9.9	31	2.50	15
11.16	64.1	77.0	180.6	64.2	2.5	3.2	3.9	4	clayy SILT to silty CLAY	115	2.0	38	32	18	-	-	4.5	9.9	27	2.41	15
11.32	39.9	52.2	-	39.8	2.1	-0.8	5.4	4	clayy SILT to silty CLAY	115	2.0	26	20	14	-	-	2.8	9.9	37	2.63	15
11.48	35.7	53.0	-	35.7	1.8	-1.1	5.2	4	clayy SILT to silty CLAY	115	2.0	26	18	14	-	-	2.5	9.9	36	2.61	15
11.65	30.4	44.5	-	30.4	1.8	-0.8	6.2	3	silty CLAY to CLAY	115	1.5	30	20	12	-	-	2.1	9.9	41	2.72	15
11.81	32.9	47.5	-	32.9	3.5	-0.7	9.9	3	silty CLAY to CLAY	115	1.5	32	22	14	-	-	2.3	9.9	49	2.86	15
11.98	48.3	56.0	179.5	48.2	2.4	-0.8	5.0	4	clayy SILT to silty CLAY	115	2.0	28	24	14	-	-	3.4	9.9	34	2.58	15
12.14	105.0	120.9	191.6	105.0	2.9	1.6	2.7	5	silty SAND to sandy SILT	120	4.0	30	26	25	73	43	-	-	18	2.16	16
12.30	206.3	236.0	260.4	206.3	3.3	-1.0	1.6	6	clean SAND to silty SAND	125	5.0	47	41	43	95	46	-	-	8	1.80	16
12.47	117.3	133.3	187.1	117.3	2.6	0.0	2.2	5	silty SAND to sandy SILT	120	4.0	33	29	27	76	43	-	-	15	2.07	16
12.63	113.2	127.8	178.5	113.2	2.4	0.6	2.1	5	silty SAND to sandy SILT	120	4.0	32	28	26	75	43	-	-	15	2.07	16
12.80	110.2	123.5	172.6	110.2	2.3	0.7	2.1	5	silty SAND to sandy SILT	120	4.0	31	28	25	74	43	-	-	15	2.07	16
12.96	104.2	116.0	164.3	104.2	2.1	-0.1	2.0	5	silty SAND to sandy SILT	120	4.0	29	26	23	72	42	-	-	15	2.08	16
13.12	89.9	99.5	178.6	89.9	2.7	0.2	3.0	5	silty SAND to sandy SILT	120	4.0	25	22	22	67	41	-	-	21	2.25	16
13.29	94.0	103.4	156.6	94.0	2.0	-0.3	2.2	5	silty SAND to sandy SILT	120	4.0	26	24	21	68	41	-	-	17	2.13	16
13.45	68.4	74.8	154.4	68.4	2.0	0.5	3.0	5	silty SAND to sandy SILT	120	4.0	19	17	17	57	40	-	-	24	2.33	16
13.62	47.5	51.6	145.0	47.6	1.7	1.2	3.6	4	clayy SILT to silty CLAY	115	2.0	26	24	13	-	-	3.3	9.9	31	2.51	15
13.78	45.3	48.8	138.1	45.3	1.6	0.2	3.5	4	clayy SILT to silty CLAY	115	2.0	24	23	12	-	-	3.1	9.9	31	2.51	15
13.94	37.2	45.4	-	37.2	1.7	0.5	4.8	4	clayy SILT to silty CLAY	115	2.0	23	19	12	-	-	2.6	9.9	37	2.63	15
14.11	53.3	56.9	148.3	53.3	1.8	0.3	3.5	4	clayy SILT to silty CLAY	115	2.0	28	27	14	-	-	3.7	9.9	29	2.47	15
14.27	57.2	60.7	172.5	57.2	2.5	0.3	4.4	4	clayy SILT to silty CLAY	115	2.0	30	29	15	-	-	4.0	9.9	31	2.51	15
14.44	59.0	62.3	192.8	59.0	3.0	1.4	5.1	4	clayy SILT to silty CLAY	115	2.0	31	29	16	-	-	4.1	9.9	33	2.56	15
14.60	103.2	108.3	198.8	103.2	3.4	2.0	3.4	5	silty SAND to sandy SILT	120	4.0	27	26	24	70	41	-	-	21	2.26	16
14.76	72.1	75.2	204.4	72.1	3.5	1.3	4.9	4	clayy SILT to silty CLAY	115	2.0	38	36	18	-	-	5.0	9.9	30	2.49	15
14.93	67.0	69.6	170.4	67.1	2.5	2.0	3.8	4	clayy SILT to silty CLAY	115	2.0	35	34	16	-	-	4.7	9.9	28	2.43	15
15.09	50.7	52.3	167.6	50.8	2.3	2.7	4.6	4	clayy SILT to silty CLAY	115	2.0	26	25	13	-	-	3.5	9.9	34	2.58	15
15.26	44.8	47.5	-	44.8	2.0	3.6	4.6	4	clayy SILT to silty CLAY	115	2.0	24	22	12	-	-	3.1	9.9	36	2.60	15
15.42	32.6	36.0	-	32.6	1.7	1.8	5.5	3	silty CLAY to CLAY	115	1.5	24	22	10	-	-	2.2	9.9	43	2.75	15

* Indicates the parameter was calculated using the normalized point stress.
The parameters listed above were determined using empirical correlations.
A Professional Engineer must determine their suitability for analysis and design.

Middle Earth Geo Testing

. Depth ft	. qc PS tsf	* qc1n PS -	. q1ncs PS -	* qt PS tsf	. Slv Stss tsf	. pore prss (psi)	. Frct Rato %	* Mat Typ Zon	* Material Behavior Description	. Unit Wght pcf	. Qc to N	* SPT R-N1 60%	. SPT R-N 60%	* SPT IcN1 60%	* Rel Den %	* Ftn Ang deg	. Und Shr tsf	. OCR -	* Fin Ic %	* Ic SBT Indx	* Nk -
15.58	29.5	32.3	-	29.5	1.7	2.0	5.9	3	silty CLAY to CLAY	115	1.5	22	20	9	-	-	2.0	9.9	46	2.81	15
15.75	25.3	27.4	-	25.4	1.4	1.4	5.6	3	silty CLAY to CLAY	115	1.5	18	17	8	-	-	1.7	8.7	48	2.84	15
15.91	20.4	21.8	-	20.4	1.1	0.5	5.6	3	silty CLAY to CLAY	115	1.5	15	14	7	-	-	1.4	6.9	53	2.92	15
16.08	12.5	13.3	-	12.6	1.3	1.1	9.9	3	silty CLAY to CLAY	115	1.5	9	8	5	-	-	0.8	4.1	77	3.25	15
16.24	22.1	23.3	-	22.2	1.3	2.3	6.2	3	silty CLAY to CLAY	115	1.5	16	15	7	-	-	1.5	7.3	53	2.92	15
16.40	35.0	36.4	-	35.1	1.4	4.4	4.2	4	clayy SILT to silty CLAY	115	2.0	18	18	10	-	-	2.4	9.9	39	2.66	15
16.57	48.2	48.3	159.3	48.2	2.1	1.7	4.5	4	clayy SILT to silty CLAY	115	2.0	24	24	12	-	-	3.3	9.9	35	2.59	15
16.73	39.6	40.4	-	39.6	2.1	0.1	5.4	3	silty CLAY to CLAY	115	1.5	27	26	11	-	-	2.7	9.9	41	2.71	15
16.90	40.1	40.5	-	40.1	3.3	-0.1	8.5	3	silty CLAY to CLAY	115	1.5	27	27	12	-	-	2.8	9.9	49	2.85	15
17.06	175.6	170.7	204.6	175.6	3.0	-0.8	1.7	6	clean SAND to silty SAND	125	5.0	34	35	32	85	43	-	-	11	1.91	16
17.23	81.7	79.0	183.1	81.6	3.1	-0.7	3.9	4	clayy SILT to silty CLAY	115	2.0	39	41	18	-	-	5.7	9.9	26	2.40	15
17.39	33.2	32.6	-	33.2	1.1	-0.6	3.5	4	clayy SILT to silty CLAY	115	2.0	16	17	8	-	-	2.3	9.9	37	2.64	15
17.55	22.6	22.0	-	22.6	1.1	-0.4	5.2	3	silty CLAY to CLAY	115	1.5	15	15	7	-	-	1.5	6.9	51	2.89	15
17.72	23.2	22.4	-	23.2	1.1	0.2	5.0	3	silty CLAY to CLAY	115	1.5	15	15	7	-	-	1.6	7.1	50	2.87	15
17.88	24.7	23.6	-	24.7	1.1	0.8	4.5	3	silty CLAY to CLAY	115	1.5	16	16	7	-	-	1.7	7.5	47	2.83	15
18.05	24.1	22.8	-	24.1	1.0	0.0	4.5	3	silty CLAY to CLAY	115	1.5	15	16	7	-	-	1.6	7.2	48	2.84	15
18.21	16.3	15.3	-	16.3	0.8	-0.1	5.5	3	silty CLAY to CLAY	115	1.5	10	11	5	-	-	1.1	4.7	61	3.03	15
18.37	13.3	12.4	-	13.3	0.8	0.1	6.7	3	silty CLAY to CLAY	115	1.5	8	9	4	-	-	0.9	3.8	70	3.16	15
18.54	12.9	11.9	-	12.9	0.9	0.7	7.4	3	silty CLAY to CLAY	115	1.5	8	9	4	-	-	0.8	3.6	73	3.21	15
18.70	18.7	17.1	-	18.7	1.0	2.4	5.6	3	silty CLAY to CLAY	115	1.5	11	12	5	-	-	1.2	5.3	58	3.00	15
18.87	20.5	18.6	-	20.6	1.1	2.1	5.8	3	silty CLAY to CLAY	115	1.5	12	14	6	-	-	1.4	5.8	57	2.98	15
19.03	20.8	18.7	-	20.8	1.2	1.5	6.0	3	silty CLAY to CLAY	115	1.5	12	14	6	-	-	1.4	5.8	58	2.99	15
19.19	22.2	19.8	-	22.2	1.1	1.0	5.3	3	silty CLAY to CLAY	115	1.5	13	15	6	-	-	1.5	6.2	54	2.93	15
19.36	24.1	21.3	-	24.2	1.0	0.7	4.3	3	silty CLAY to CLAY	115	1.5	14	16	6	-	-	1.6	6.7	49	2.85	15
19.52	23.9	21.0	-	23.9	0.8	0.3	3.6	3	silty CLAY to CLAY	115	1.5	14	16	6	-	-	1.6	6.6	46	2.81	15
19.69	16.1	14.0	-	16.0	0.6	-0.7	4.2	3	silty CLAY to CLAY	115	1.5	9	11	4	-	-	1.1	4.3	58	2.99	15
19.85	11.1	9.5	-	11.0	0.5	-1.1	5.0	3	silty CLAY to CLAY	115	1.5	6	7	3	-	-	0.7	2.8	72	3.18	15
20.01	9.8	8.4	-	9.8	0.4	-1.3	4.9	3	silty CLAY to CLAY	115	1.5	6	7	3	-	-	0.6	2.4	75	3.23	15
20.18	9.6	8.1	-	9.5	0.4	-1.2	5.0	3	silty CLAY to CLAY	115	1.5	5	6	3	-	-	0.6	2.3	77	3.25	15
20.34	9.8	8.2	-	9.7	0.5	-1.1	5.8	3	silty CLAY to CLAY	115	1.5	5	7	3	-	-	0.6	2.4	79	3.28	15
20.51	9.6	8.0	-	9.5	0.6	-1.3	6.7	3	silty CLAY to CLAY	115	1.5	5	6	3	-	-	0.6	2.3	83	3.33	15
20.67	11.6	9.6	-	11.6	0.7	-1.1	6.6	3	silty CLAY to CLAY	115	1.5	6	8	4	-	-	0.7	2.8	77	3.25	15
20.83	14.9	12.2	-	14.8	0.8	-0.7	6.0	3	silty CLAY to CLAY	115	1.5	8	10	4	-	-	1.0	3.7	68	3.14	15
21.00	18.2	14.9	-	18.2	0.9	-0.2	5.4	3	silty CLAY to CLAY	115	1.5	10	12	5	-	-	1.2	4.6	61	3.04	15
21.16	19.8	16.1	-	19.8	1.1	-0.2	5.8	3	silty CLAY to CLAY	115	1.5	11	13	5	-	-	1.3	5.0	61	3.03	15
21.33	19.7	15.8	-	19.7	1.1	-0.3	6.1	3	silty CLAY to CLAY	115	1.5	11	13	5	-	-	1.3	4.9	62	3.05	15
21.49	19.6	15.7	-	19.6	1.1	-0.5	5.7	3	silty CLAY to CLAY	115	1.5	10	13	5	-	-	1.3	4.8	61	3.04	15
21.65	18.4	14.6	-	18.4	1.0	-0.7	6.1	3	silty CLAY to CLAY	115	1.5	10	12	5	-	-	1.2	4.5	64	3.08	15
21.82	16.4	12.9	-	16.4	1.0	-0.9	6.9	3	silty CLAY to CLAY	115	1.5	9	11	5	-	-	1.1	3.9	70	3.16	15
21.98	17.6	13.7	-	17.6	1.1	-0.2	6.5	3	silty CLAY to CLAY	115	1.5	9	12	5	-	-	1.2	4.2	67	3.12	15
22.15	18.9	14.7	-	18.9	1.1	-0.1	6.3	3	silty CLAY to CLAY	115	1.5	10	13	5	-	-	1.2	4.5	64	3.09	15
22.31	18.7	14.4	-	18.7	1.1	-0.1	6.3	3	silty CLAY to CLAY	115	1.5	10	12	5	-	-	1.2	4.4	65	3.09	15
22.47	17.6	13.4	-	17.5	1.1	-2.0	6.5	3	silty CLAY to CLAY	115	1.5	9	12	5	-	-	1.2	4.1	67	3.13	15
22.64	16.9	12.8	-	16.9	1.0	-2.3	6.3	3	silty CLAY to CLAY	115	1.5	9	11	4	-	-	1.1	3.9	68	3.14	15
22.80	16.7	12.6	-	16.7	1.0	-2.4	6.4	3	silty CLAY to CLAY	115	1.5	8	11	4	-	-	1.1	3.8	69	3.15	15
22.97	16.4	12.2	-	16.3	1.0	-2.3	6.7	3	silty CLAY to CLAY	115	1.5	8	11	4	-	-	1.1	3.7	71	3.17	15
23.13	17.0	12.6	-	16.9	1.0	-2.2	6.1	3	silty CLAY to CLAY	115	1.5	8	11	4	-	-	1.1	3.8	68	3.13	15
23.30	19.2	14.2	-	19.2	0.8	-2.1	4.5	3	silty CLAY to CLAY	115	1.5	9	13	5	-	-	1.3	4.3	59	3.01	15
23.46	21.1	15.4	-	21.0	0.7	-1.8	3.5	3	silty CLAY to CLAY	115	1.5	10	14	5	-	-	1.4	4.8	52	2.91	15
23.62	21.4	15.6	-	21.4	0.6	-2.1	2.9	3	silty CLAY to CLAY	115	1.5	10	14	5	-	-	1.4	4.8	49	2.86	15
23.79	21.4	15.4	-	21.4	0.6	-2.0	3.0	3	silty CLAY to CLAY	115	1.5	10	14	5	-	-	1.4	4.8	50	2.87	15
23.95	21.6	15.5	-	21.5	0.6	-2.0	2.9	3	silty CLAY to CLAY	115	1.5	10	14	5	-	-	1.4	4.8	50	2.86	15
24.12	22.6	16.1	-	22.5	0.5	-1.4	2.5	4	clayy SILT to silty CLAY	115	2.0	8	11	5	-	-	1.5	5.0	46	2.80	15
24.28	23.5	16.6	-	23.5	0.5	-1.5	2.1	4	clayy SILT to silty CLAY	115	2.0	8	12	5	-	-	1.6	5.2	43	2.75	15
24.44	25.3	17.8	-	25.3	0.4	-1.6	1.7	4	clayy SILT to silty CLAY	115	2.0	9	13	5	-	-	1.7	5.5	39	2.67	15
24.61	25.7	17.9	-	25.7	0.3	-1.2	1.4	4	clayy SILT to silty CLAY	115	2.0	9	13	5	-	-	1.7	5.6	37	2.63	15
24.77	25.8	17.9	-	25.8	0.3	-1.1	1.4	4	clayy SILT to silty CLAY	115	2.0	9	13	5	-	-	1.7	5.6	37	2.63	15
24.94	26.3	18.1	-	26.3	0.4	-1.1	1.4	4	clayy SILT to silty CLAY	115	2.0	9	13	5	-	-	1.8	5.7	36	2.62	15
25.10	30.1	24.2	66.3	30.1	0.4	-1.1	1.3	5	silty SAND to sandy SILT	120	4.0	6	8	6	20	31	-	-	30	2.49	16
25.26	31.1	24.9	66.3	31.1	0.4	-1.1	1.3	5	silty SAND to sandy SILT	120	4.0	6	8	6	21	31	-	-	30	2.48	16
25.43	30.7	24.5	68.2	30.7	0.4	-1.0	1.4	5	silty SAND to sandy SILT	120	4.0	6	8	6	21	31	-	-	31	2.50	16
25.59	32.3	25.7	70.1	32.3	0.4	-1.0	1.4	5	silty SAND to sandy SILT	120	4.0	6	8	6	22	31	-	-	30	2.49	16
25.76	37.0	29.4	71.0	37.0	0.5	-1.1	1.3	5	silty SAND to sandy SILT	120	4.0	7	9	7	27	32	-	-	27	2.43	16
25.92	39.8	31.4	71.9	39.7	0.5	-1.0	1.3	5	silty SAND to sandy SILT	120	4.0	8	10	7	29	33	-	-	26	2.39	16
26.08	39.2	30.9	70.8	39.2	0.5	-1.0	1.3	5	silty SAND to sandy SILT	120	4.0	8	10	7	28	32	-	-	26	2.40	16
26.25	38.3	30.1	70.1	38.3	0.5	-1.0	1.3	5	silty SAND to sandy SILT	120	4.0	8	10	7	27	32	-	-	27	2.41	16
26.41	38.2	29.9	71.0	38.1	0.5	-1.0	1.3	5	silty SAND to sandy SILT	120	4.0	7	10	7	27	32	-	-	27	2.42	16
26.58	38.7	30.2	70.2	38.6	0.5	-1.0	1.3	5	silty SAND to sandy SILT	120	4.0	8	10	7	27	32	-	-	27	2.40	16
26.74	36.6	28.5	71.0	36.6	0.5	-1.0	1.4	5	silty SAND to sandy SILT	120	4.0	7	9	7	26	32	-	-	28	2.44	16
26.90	35.7	27.7	70.2	35.7	0.5	-0.9	1.3	5	silty SAND to sandy SILT	120	4.0	7	9	7	25	32	-	-	29	2.45	16
27.07	35.6	27.5	71.4	35.6	0.5	-1.0	1.4	5	silty SAND to sandy SILT	120	4.0	7	9	7	24	32	-	-	29	2.46	16
27.23	35.5	27.4	71.8	35.5	0.5	-1.0	1.4	5	silty SAND to sandy SILT	120	4.0	7	9	7	24	31	-	-	29	2.47	16
27.40	33.4	25.7	71.0	33.4	0.5	-1.0	1.5	5	silty SAND to sandy SILT	120	4.0	6	8	6	22	31	-	-	31	2.50	16
27.56	30.8	19.1	-	30.8	0.5	-1.0	1.6	4	clayy SILT to silty CLAY	115	2.0	10	15	5	-	-	2.1	6.0	37	2.63	15
27.72	28.0	17.3	-	27.9	0.6	-1.0	2.2	4	clayy SILT to silty CLAY	115	2.0	9	14	5	-	-	1.9	5.4	43	2.75	15
27.89	22.4	13.8	-	22.4	0.6	-1.0	3.0	3	silty CLAY to CLAY	115	1.5	9	15	4	-	-	1.5	4.2	53	2.91	15
28.05	15.4	9.4	-	15.4	0.6	-1.0	4.7	3	silty CLAY to CLAY	115	1.5	6	10	3	-	-	1.0	2.8	71	3.17	15
28.22	11.6	7.1	-	11.6	0.6	-1.1	5.7	3	silty CLAY to CLAY	115	1.5	5	8	3	-	-	0.7	2.0	84	3.34	15
28.38	10.5	6.3	-	10.5	0.5	-0.2	5.6	3	silty CLAY to CLAY	115	1.5	4	7	3	-	-	0.6	1.8	88	3.38	15
28.54	9.9	5.9	-	9.9	0.5	0.0	6.2	3	silty CLAY to CLAY	115	1.5	4	7	3	-	-	0.6	1.6	92	3.43	15
28.71	10.0	5.9	-	10.0	0.5	0.2	5.6	3	silty CLAY to CLAY	115	1.5	4	7	3	-	-	0.6	1.6	90	3.40	15
28.87	9.3	5.5	-	9.3	0.4	0.6	5.8	3	silty CLAY to CLAY	115	1.5	4	6	2	-	-	0.5	1.5	94	3.44	15
29.04	9.0	5.3	-	9.0	0.4	0.8	5.7	3	silty CLAY to CLAY	115	1.5	4	6	2	-	-	0.5	1.4	95	3.46	15
29.20	9.0	5.3	-	9.1	0.4	1.2	5.9	3	silty CLAY to CLAY	115	1.5	4	6	2	-	-	0.5	1.4	95	3.46	15
29.36	10.0	5.8	-	10.0	0.4	1.7	5.4	3	silty CLAY to CLAY	115	1.5	4	7	2	-	-	0.6	1.6	90	3.40	15
29.53	10.2	5.9	-	10.3	0.5	2.5	5.8	3	silty CLAY to CLAY	115	1.5	4	7	3	-	-	0.6	1.6	91	3.41	15
29.69	10.0	5.8	-	10.1	0.5	2.8	5.9	3	silty CLAY to CLAY	115	1.5	4	7	3	-	-	0.6	1.6	92	3.43	15
29.86	10.5	6.0	-	10.5	0.5	3.1	5.4	3	silty CLAY to CLAY	115	1.5	4	7	3	-	-	0.6	1.7	89	3.39	15
30.02	10.2	5.9	-	10.3	0.5	3.2	5.5	3	silty CLAY to CLAY	115	1.5	4	7	3	-	-	0.6	1.6	90	3.40	15
30.19	10.3	5.9	-	10.4	0.5	3.6	5.5	3	silty CLAY to CLAY	115	1.5	4	7	3	-	-	0.6	1.6	90	3.40	15
30.35	11.3	6.5	-	11.4	0.6	3.8	6.0	3	silty CLAY to CLAY	115	1.5	4	8	3	-	-	0.7	1.8	88	3.38	15
30.51	11.4	6.5	-	11.4	0.6	4.0	6.1	3	silty CLAY to CLAY	115	1.5	4	8	3	-	-	0.7	1.8	89	3.39	15
30.68	11.3	6.4	-	11.4	0.6	4.1	6.3	3	silty CLAY to CLAY	115	1.5	4	8	3	-	-	0.7	1.8	90	3.40	15
30.84	12.0	6.8	-	12.1	0.6	4.5	5.7	3	silty CLAY to CLAY	115	1.5	5	8	3	-	-	0.7	1.9	86	3.35	15

* Indicates the parameter was calculated using the normalized point stress.
The parameters listed above were determined using empirical correlations.
A Professional Engineer must determine their suitability for analysis and design.

US 101 Blossom Hill Rd IC Improvement Project

Project ID: Parikh Consultants
Data File: SDF(111).cpt
CPT Date: 9/26/2018 10:04:00 AM
GW During Test: 30 ft

Sounding ID: CPT-18-NO-004
Project No: 2016-146
Cone/Rig: DDG1418

Depth ft	qc PS tsf	* qc1n PS -	q1ncs PS -	* qt PS tsf	Slv Stss tsf	pore prss (psi)	Frct Rato %	* Mat Typ Zon	* Material Behavior Description	Unit Wght pcf	Qc to N	* SPT R-N1 60%	SPT R-N 60%	* SPT IcN1 60%	* Rel Den %	* Ftn Ang deg	Und Shr tsf	OCR -	* Fin Ic %	* Ic SBT Indx	* Nk -
31.01	13.9	7.9	-	14.0	0.7	4.3	5.6	3	silty CLAY to CLAY	115	1.5	5	9	3	-	-	0.9	2.3	80	3.29	15
31.17	13.4	7.6	-	13.5	0.6	3.5	4.8	3	silty CLAY to CLAY	115	1.5	5	9	3	-	-	0.8	2.2	78	3.26	15
31.33	14.2	8.0	-	14.3	0.6	3.9	4.9	3	silty CLAY to CLAY	115	1.5	5	9	3	-	-	0.9	2.3	77	3.25	15
31.50	13.9	7.8	-	14.0	0.7	4.0	5.9	3	silty CLAY to CLAY	115	1.5	5	9	3	-	-	0.9	2.2	82	3.31	15
31.66	15.6	8.7	-	15.7	0.8	5.1	5.9	3	silty CLAY to CLAY	115	1.5	6	10	3	-	-	1.0	2.5	78	3.26	15
31.83	17.7	9.9	-	17.8	0.9	5.2	6.0	3	silty CLAY to CLAY	115	1.5	7	12	4	-	-	1.1	2.9	74	3.22	15
31.99	18.4	10.2	-	18.5	1.0	5.5	5.9	3	silty CLAY to CLAY	115	1.5	7	12	4	-	-	1.2	3.0	73	3.20	15
32.15	18.2	10.1	-	18.3	1.0	5.6	6.2	3	silty CLAY to CLAY	115	1.5	7	12	4	-	-	1.2	3.0	74	3.22	15
32.32	18.3	10.1	-	18.4	1.0	5.5	6.0	3	silty CLAY to CLAY	115	1.5	7	12	4	-	-	1.2	3.0	74	3.21	15
32.48	18.7	10.3	-	18.8	1.0	5.9	5.8	3	silty CLAY to CLAY	115	1.5	7	12	4	-	-	1.2	3.1	72	3.19	15
32.65	18.4	10.2	-	18.5	0.9	5.9	5.6	3	silty CLAY to CLAY	115	1.5	7	12	4	-	-	1.2	3.0	72	3.19	15
32.81	17.6	9.7	-	17.7	1.0	5.5	6.2	3	silty CLAY to CLAY	115	1.5	6	12	4	-	-	1.1	2.8	76	3.24	15
32.97	19.6	10.7	-	19.7	1.1	6.2	6.2	3	silty CLAY to CLAY	115	1.5	7	13	4	-	-	1.3	3.2	73	3.20	15
33.14	18.8	10.3	-	18.9	1.1	6.1	6.6	3	silty CLAY to CLAY	115	1.5	7	13	4	-	-	1.2	3.0	76	3.23	15
33.30	21.5	11.7	-	21.5	1.1	3.8	5.6	3	silty CLAY to CLAY	115	1.5	8	14	4	-	-	1.4	3.5	68	3.14	15
33.47	20.0	10.9	-	20.1	1.0	4.7	5.6	3	silty CLAY to CLAY	115	1.5	7	13	4	-	-	1.3	3.2	70	3.16	15
33.63	19.3	10.5	-	19.4	0.9	5.3	5.4	3	silty CLAY to CLAY	115	1.5	7	13	4	-	-	1.2	3.1	71	3.17	15
33.79	18.3	9.9	-	18.4	0.9	5.4	5.5	3	silty CLAY to CLAY	115	1.5	7	12	4	-	-	1.2	2.9	73	3.20	15
33.96	18.0	9.8	-	18.2	0.9	5.8	5.8	3	silty CLAY to CLAY	115	1.5	7	12	4	-	-	1.1	2.9	74	3.21	15
34.12	19.2	10.4	-	19.3	0.9	6.5	5.3	3	silty CLAY to CLAY	115	1.5	7	13	4	-	-	1.2	3.1	71	3.17	15
34.29	19.8	10.6	-	19.9	0.9	6.6	4.9	3	silty CLAY to CLAY	115	1.5	7	13	4	-	-	1.3	3.2	68	3.14	15
34.45	19.5	10.5	-	19.6	0.8	6.6	4.8	3	silty CLAY to CLAY	115	1.5	7	13	4	-	-	1.2	3.1	68	3.14	15
34.61	18.8	10.1	-	18.9	0.8	7.0	4.6	3	silty CLAY to CLAY	115	1.5	7	13	4	-	-	1.2	3.0	69	3.14	15
34.78	18.7	10.0	-	18.8	0.9	8.6	5.4	3	silty CLAY to CLAY	115	1.5	7	12	4	-	-	1.2	2.9	72	3.19	15
34.94	19.4	10.3	-	19.5	0.9	8.9	5.3	3	silty CLAY to CLAY	115	1.5	7	13	4	-	-	1.2	3.1	71	3.17	15
35.11	18.5	9.8	-	18.7	1.0	8.6	5.9	3	silty CLAY to CLAY	115	1.5	7	12	4	-	-	1.2	2.9	74	3.22	15
35.27	17.9	9.5	-	18.0	0.8	9.1	5.2	3	silty CLAY to CLAY	115	1.5	6	12	3	-	-	1.1	2.8	73	3.20	15
35.43	17.6	9.3	-	17.8	0.8	9.5	5.0	3	silty CLAY to CLAY	115	1.5	6	12	3	-	-	1.1	2.7	73	3.20	15
35.60	15.6	8.3	-	15.8	0.7	9.8	5.3	3	silty CLAY to CLAY	115	1.5	6	10	3	-	-	1.0	2.4	78	3.26	15
35.76	14.4	7.6	-	14.6	0.6	9.9	5.0	3	silty CLAY to CLAY	115	1.5	5	10	3	-	-	0.9	2.1	79	3.28	15
35.93	14.9	7.8	-	15.1	0.6	10.5	4.5	3	silty CLAY to CLAY	115	1.5	5	10	3	-	-	0.9	2.2	76	3.24	15
36.09	14.2	7.4	-	14.4	0.5	11.0	4.0	3	silty CLAY to CLAY	115	1.5	5	9	3	-	-	0.9	2.1	75	3.23	15
36.26	13.5	7.1	-	13.7	0.5	11.3	4.5	3	silty CLAY to CLAY	115	1.5	5	9	3	-	-	0.8	2.0	80	3.28	15
36.42	13.8	7.2	-	14.0	0.5	11.8	4.4	3	silty CLAY to CLAY	115	1.5	5	9	3	-	-	0.8	2.0	79	3.27	15
36.58	14.7	7.7	-	14.9	0.5	12.3	4.1	3	silty CLAY to CLAY	115	1.5	5	10	3	-	-	0.9	2.2	75	3.23	15
36.75	13.9	7.2	-	14.2	0.5	12.6	4.2	3	silty CLAY to CLAY	115	1.5	5	9	3	-	-	0.8	2.0	77	3.25	15
36.91	13.1	6.8	-	13.3	0.5	12.9	4.6	3	silty CLAY to CLAY	115	1.5	5	9	3	-	-	0.8	1.9	82	3.31	15
37.08	13.2	6.9	-	13.5	0.6	13.2	5.2	3	silty CLAY to CLAY	115	1.5	5	9	3	-	-	0.8	1.9	84	3.33	15
37.24	17.3	8.9	-	17.5	0.6	12.9	4.3	3	silty CLAY to CLAY	115	1.5	6	12	3	-	-	1.1	2.6	71	3.17	15
37.40	14.4	7.4	-	14.6	0.5	11.2	4.5	3	silty CLAY to CLAY	115	1.5	5	10	3	-	-	0.9	2.1	78	3.26	15
37.57	14.1	7.3	-	14.3	0.5	11.6	4.1	3	silty CLAY to CLAY	115	1.5	5	9	3	-	-	0.9	2.0	77	3.25	15
37.73	14.1	7.2	-	14.3	0.5	12.6	4.6	3	silty CLAY to CLAY	115	1.5	5	9	3	-	-	0.9	2.0	79	3.28	15
37.90	15.3	7.9	-	15.6	0.6	13.0	4.5	3	silty CLAY to CLAY	115	1.5	5	10	3	-	-	0.9	2.2	76	3.24	15
38.06	14.9	7.6	-	15.2	0.7	13.3	5.3	3	silty CLAY to CLAY	115	1.5	5	10	3	-	-	0.9	2.1	80	3.29	15
38.22	13.8	7.1	-	14.1	0.6	13.6	4.9	3	silty CLAY to CLAY	115	1.5	5	9	3	-	-	0.8	2.0	82	3.31	15
38.39	14.5	7.4	-	14.8	0.6	14.2	4.6	3	silty CLAY to CLAY	115	1.5	5	10	3	-	-	0.9	2.1	78	3.27	15
38.55	13.1	6.6	-	13.4	0.5	14.6	4.9	3	silty CLAY to CLAY	115	1.5	4	9	3	-	-	0.8	1.8	84	3.33	15
38.72	12.0	6.1	-	12.3	0.5	15.0	5.1	3	silty CLAY to CLAY	115	1.5	4	8	3	-	-	0.7	1.6	88	3.38	15
38.88	11.6	5.8	-	11.9	0.4	15.3	4.6	3	silty CLAY to CLAY	115	1.5	4	8	2	-	-	0.7	1.6	87	3.37	15
39.04	9.5	4.8	-	9.8	0.3	15.0	4.6	3	silty CLAY to CLAY	115	1.5	3	6	2	-	-	0.5	1.2	95	3.47	15
39.21	8.3	4.2	-	8.6	0.3	15.7	5.5	3	silty CLAY to CLAY	115	1.5	3	6	2	-	-	0.4	1.0	95	3.57	15
39.37	8.4	4.2	-	8.7	0.3	16.1	5.4	3	silty CLAY to CLAY	115	1.5	3	6	2	-	-	0.5	1.0	95	3.56	15
39.54	9.4	4.7	-	9.7	0.4	16.6	5.8	3	silty CLAY to CLAY	115	1.5	3	6	2	-	-	0.5	1.2	95	3.53	15
39.70	10.5	5.3	-	10.8	0.4	17.1	4.3	3	silty CLAY to CLAY	115	1.5	4	7	2	-	-	0.6	1.4	90	3.41	15
39.86	10.6	5.3	-	11.0	0.3	17.2	3.3	3	silty CLAY to CLAY	115	1.5	4	7	2	-	-	0.6	1.4	84	3.34	15
40.03	9.2	4.6	-	9.5	0.2	18.3	3.1	3	silty CLAY to CLAY	115	1.5	3	6	2	-	-	0.5	1.1	90	3.40	15
40.19	8.6	4.3	-	9.0	0.2	19.5	2.7	3	silty CLAY to CLAY	115	1.5	3	6	2	-	-	0.5	1.0	90	3.41	15
40.36	9.8	4.9	-	10.2	0.2	20.7	2.8	3	silty CLAY to CLAY	115	1.5	3	7	2	-	-	0.6	1.2	85	3.35	15
40.52	10.3	5.1	-	10.7	0.3	21.4	3.5	3	silty CLAY to CLAY	115	1.5	3	7	2	-	-	0.6	1.3	87	3.37	15
40.68	12.1	6.0	-	12.6	0.3	22.7	3.4	3	silty CLAY to CLAY	115	1.5	4	8	2	-	-	0.7	1.6	81	3.29	15
40.85	13.6	6.7	-	14.1	0.8	23.3	6.9	3	silty CLAY to CLAY	115	1.5	4	9	3	-	-	0.8	1.8	91	3.42	15
41.01	15.0	7.4	-	15.5	0.8	23.9	6.7	3	silty CLAY to CLAY	115	1.5	5	10	3	-	-	0.9	2.0	87	3.37	15
41.18	16.1	7.9	-	16.6	0.8	24.5	6.0	3	silty CLAY to CLAY	115	1.5	5	11	3	-	-	1.0	2.2	82	3.32	15
41.34	18.3	9.0	-	18.6	0.7	16.6	4.1	3	silty CLAY to CLAY	115	1.5	6	12	3	-	-	1.1	2.6	70	3.16	15
41.50	12.5	6.1	-	12.8	0.5	14.4	4.9	3	silty CLAY to CLAY	115	1.5	4	8	3	-	-	0.7	1.6	87	3.37	15
41.67	10.3	5.0	-	10.6	0.4	15.7	5.3	3	silty CLAY to CLAY	115	1.5	3	7	2	-	-	0.6	1.3	95	3.48	15
41.83	10.6	5.1	-	10.9	0.4	15.9	5.0	3	silty CLAY to CLAY	115	1.5	3	7	2	-	-	0.6	1.3	95	3.45	15
42.00	11.3	5.5	-	11.6	0.4	17.5	4.3	3	silty CLAY to CLAY	115	1.5	4	8	2	-	-	0.6	1.4	89	3.39	15
42.16	12.5	6.1	-	12.9	0.5	18.1	4.5	3	silty CLAY to CLAY	115	1.5	4	8	2	-	-	0.7	1.6	86	3.35	15
42.32	12.4	6.0	-	12.8	0.6	17.7	5.6	3	silty CLAY to CLAY	115	1.5	4	8	3	-	-	0.7	1.6	91	3.41	15
42.49	13.7	6.6	-	14.0	0.7	18.8	6.1	3	silty CLAY to CLAY	115	1.5	4	9	3	-	-	0.8	1.8	89	3.39	15
42.65	18.6	9.0	-	19.0	0.8	19.4	4.9	3	silty CLAY to CLAY	115	1.5	6	12	3	-	-	1.2	2.6	74	3.21	15
42.82	18.3	8.8	-	18.5	0.8	12.7	4.9	3	silty CLAY to CLAY	115	1.5	6	12	3	-	-	1.1	2.5	74	3.22	15
42.98	16.9	8.1	-	17.1	0.6	12.8	4.5	3	silty CLAY to CLAY	115	1.5	5	11	3	-	-	1.0	2.3	75	3.23	15
43.15	17.1	8.2	-	17.4	0.6	13.8	3.8	3	silty CLAY to CLAY	115	1.5	5	11	3	-	-	1.1	2.3	72	3.18	15
43.31	12.8	6.1	-	13.1	0.4	13.8	3.9	3	silty CLAY to CLAY	115	1.5	4	9	2	-	-	0.8	1.6	83	3.32	15
43.47	11.0	5.2	-	11.3	0.3	15.1	3.2	3	silty CLAY to CLAY	115	1.5	3	7	2	-	-	0.6	1.3	85	3.34	15
43.64	10.9	5.2	-	11.3	0.3	16.5	3.4	3	silty CLAY to CLAY	115	1.5	3	7	2	-	-	0.6	1.3	86	3.36	15
43.80	11.3	5.4	-	11.7	0.4	17.5	5.0	3	silty CLAY to CLAY	115	1.5	4	8	2	-	-	0.7	1.4	93	3.44	15
43.97	13.1	6.2	-	13.5	0.7	18.5	7.0	3	silty CLAY to CLAY	115	1.5	4	9	3	-	-	0.8	1.6	95	3.46	15
44.13	17.5	8.3	-	17.9	1.3	19.5	8.5	3	silty CLAY to CLAY	115	1.5	6	12	3	-	-	1.1	2.3	89	3.39	15
44.29	19.1	9.0	-	19.4	1.4	15.5	8.5	3	silty CLAY to CLAY	115	1.5	6	13	4	-	-	1.2	2.6	86	3.36	15
44.46	21.3	10.0	-	21.6	1.3	16.1	7.2	3	silty CLAY to CLAY	115	1.5	7	14	4	-	-	1.4	2.9	78	3.27	15
44.62	37.9	17.8	-	37.9	1.2	1.0	3.4	3	silty CLAY to CLAY	115	1.5	12	25	5	-	-	2.5	5.5	49	2.85	15
44.79	43.9	20.6	-	43.9	0.7	0.0	1.8	4	clayy SILT to silty CLAY	115	2.0	10	22	5	-	-	2.9	6.4	37	2.64	15
44.95	44.0	20.6	-	44.0	1.1	-2.6	2.6	4	clayy SILT to silty CLAY	115	2.0	10	22	6	-	-	3.0	6.4	42	2.73	15
45.11	42.0	19.6	-	41.9	1.2	-3.0	3.1	4	clayy SILT to silty CLAY	115	2.0	10	21	6	-	-	2.8	6.1	46	2.79	15
45.28	37.6	17.5	-	37.5	1.0	-1.9	2.9	4	clayy SILT to silty CLAY	115	2.0	9	19	5	-	-	2.5	5.4	47	2.82	15
45.44	26.2	12.2	-	26.2	1.1	-2.0	4.6	3	silty CLAY to CLAY	115	1.5	8	17	4	-	-	1.7	3.6	64	3.07	15
45.61	19.2	8.9	-	19.2	1.1	-1.3	6.9	3	silty CLAY to CLAY	115	1.5	6	13	4	-	-	1.2	2.5	82	3.31	15
45.77	19.9	9.2	-	19.9	1.2	-0.5	6.9	3	silty CLAY to CLAY	115	1.5	6	13	4	-	-	1.3	2.6	80	3.29	15
45.93	23.4	10.8	-	23.4	1.2	-0.2	5.8	3	silty CLAY to CLAY	115	1.5	7	16	4	-	-	1.5	3.2	72	3.18	15
46.10	23.1	10.6	-	23.1	1.1	-0.3	5.3	3	silty CLAY to CLAY	115	1.5	7	15	4	-	-	1.5	3.1	70	3.17	15
46.26	18.4	8.5	-	18.4	1.0	0.0	6.2	3	silty CLAY to CLAY	115	1.5	6	12	3	-	-	1.1	2.4	81	3.30	15

* Indicates the parameter was calculated using the normalized point stress.
The parameters listed above were determined using empirical correlations.
A Professional Engineer must determine their suitability for analysis and design.

Middle Earth Geo Testing

US 101 Blossom Hill Rd IC Improvement Project

Project ID: Parikh Consultants
Data File: SDF(111).cpt
CPT Date: 9/26/2018 10:04:00 AM
GW During Test: 30 ft

Sounding ID: CPT-18-NO-004
Project No: 2016-146
Cone/Rig: DDG1418

. Depth ft	. qc PS tsf	* qc1n PS -	. q1ncs PS -	* qt PS tsf	. Slv Stss tsf	. pore prss (psi)	. Frct Rato %	* Mat Typ Zon	* Material Behavior Description	. Unit Wght pcf	. Qc to N	* SPT R-N1 60%	. SPT R-N 60%	* SPT IcN1 60%	* Rel Den %	* Ftn Ang deg	. Und Shr tsf	. OCR -	* Fin Ic %	* Ic SBT Indx	* Nk -
46.43	15.6	7.1	-	15.6	0.9	0.4	6.7	3	silty CLAY to CLAY	115	1.5	5	10	3	-	-	0.9	2.0	89	3.39	15
46.59	19.6	9.0	-	19.6	0.8	1.1	4.7	3	silty CLAY to CLAY	115	1.5	6	13	3	-	-	1.2	2.5	73	3.20	15
46.75	15.0	6.9	-	15.1	0.7	0.9	5.6	3	silty CLAY to CLAY	115	1.5	5	10	3	-	-	0.9	1.9	86	3.36	15
46.92	12.7	5.8	-	12.8	0.8	1.6	7.9	2	Organic SOILS - Peats	100	1.0	6	13	3	-	-	1.1	1.5	95	3.52	10
47.08	23.3	10.6	-	23.4	0.9	2.4	4.5	3	silty CLAY to CLAY	115	1.5	7	16	4	-	-	1.5	3.1	67	3.12	15
47.25	35.0	15.9	-	35.0	1.1	1.3	3.5	3	silty CLAY to CLAY	115	1.5	11	23	5	-	-	2.3	4.8	52	2.90	15
47.41	33.8	15.4	-	33.8	1.3	0.2	4.0	3	silty CLAY to CLAY	115	1.5	10	23	5	-	-	2.2	4.7	55	2.95	15
47.57	23.8	10.8	-	23.8	1.1	0.0	5.1	3	silty CLAY to CLAY	115	1.5	7	16	4	-	-	1.5	3.2	69	3.15	15
47.74	22.5	10.2	-	22.5	0.8	3.6	4.3	3	silty CLAY to CLAY	115	1.5	7	15	4	-	-	1.4	2.9	68	3.13	15
47.90	21.0	9.5	-	21.1	0.9	3.0	5.1	3	silty CLAY to CLAY	115	1.5	6	14	3	-	-	1.3	2.7	73	3.20	15
48.07	16.7	7.5	-	16.7	1.0	3.0	7.3	3	silty CLAY to CLAY	115	1.5	5	11	3	-	-	1.0	2.1	89	3.39	15
48.23	25.5	11.5	-	25.6	0.9	4.1	4.1	3	silty CLAY to CLAY	115	1.5	8	17	4	-	-	1.6	3.4	63	3.07	15
48.39	27.0	12.1	-	27.1	0.7	2.0	2.9	3	silty CLAY to CLAY	115	1.5	8	18	4	-	-	1.8	3.6	56	2.96	15
48.56	16.5	7.4	-	16.5	0.4	1.6	3.0	3	silty CLAY to CLAY	115	1.5	5	11	3	-	-	1.0	2.0	71	3.18	15
48.72	12.7	5.7	-	12.8	0.3	2.4	3.3	3	silty CLAY to CLAY	115	1.5	4	8	2	-	-	0.7	1.5	83	3.32	15
48.89	11.1	5.0	-	11.2	0.3	3.2	4.1	3	silty CLAY to CLAY	115	1.5	3	7	2	-	-	0.6	1.2	93	3.43	15
49.05	12.0	5.3	-	12.1	0.4	4.0	4.7	3	silty CLAY to CLAY	115	1.5	4	8	2	-	-	0.7	1.3	92	3.43	15
49.22	14.6	6.5	-	14.7	0.7	4.6	5.9	3	silty CLAY to CLAY	115	1.5	4	10	3	-	-	0.9	1.7	89	3.40	15
49.38	17.2	7.6	-	17.3	0.7	5.0	5.1	3	silty CLAY to CLAY	115	1.5	5	11	3	-	-	1.1	2.1	80	3.29	15
49.54	21.2	9.4	-	21.3	0.9	5.3	4.7	3	silty CLAY to CLAY	115	1.5	6	14	3	-	-	1.3	2.7	72	3.18	15
49.71	17.1	7.6	-	17.2	0.9	5.5	6.4	3	silty CLAY to CLAY	115	1.5	5	11	3	-	-	1.0	2.1	86	3.35	15
49.87	14.7	6.5	-	14.8	0.9	6.3	7.3	3	silty CLAY to CLAY	115	1.5	4	10	3	-	-	0.9	1.7	94	3.45	15
50.04	35.6	15.7	-	35.7	0.8	7.2	2.4	4	clayy SILT to silty CLAY	115	2.0	8	18	4	-	-	2.4	4.7	47	2.81	15
50.20	49.7	21.8	-	49.8	0.9	4.5	1.9	4	clayy SILT to silty CLAY	115	2.0	11	25	6	-	-	3.3	6.8	37	2.63	15
50.36	55.2	24.2	-	55.2	1.2	2.9	2.2	4	clayy SILT to silty CLAY	115	2.0	12	28	6	-	-	3.7	7.6	37	2.63	15
50.53	42.9	18.8	-	43.0	1.0	2.1	2.6	4	clayy SILT to silty CLAY	115	2.0	9	21	5	-	-	2.9	5.8	44	2.76	15
50.69	23.6	10.3	-	23.6	0.8	2.4	3.7	3	silty CLAY to CLAY	115	1.5	7	16	3	-	-	1.5	3.0	64	3.08	15
50.86	14.8	6.5	-	14.9	0.5	5.2	4.2	3	silty CLAY to CLAY	115	1.5	4	10	3	-	-	0.9	1.7	83	3.32	15
51.02	13.3	5.8	-	13.5	0.4	10.2	4.0	3	silty CLAY to CLAY	115	1.5	4	9	2	-	-	0.8	1.5	86	3.36	15
51.18	12.9	5.6	-	13.1	0.4	11.4	4.1	3	silty CLAY to CLAY	115	1.5	4	9	2	-	-	0.7	1.4	88	3.38	15
51.35	12.4	5.4	-	12.7	0.4	12.3	4.2	3	silty CLAY to CLAY	115	1.5	4	8	2	-	-	0.7	1.4	90	3.40	15
51.51	12.2	5.3	-	12.4	0.4	13.0	4.3	3	silty CLAY to CLAY	115	1.5	4	8	2	-	-	0.7	1.3	91	3.42	15
51.68	12.0	5.2	-	12.3	0.4	13.6	4.3	3	silty CLAY to CLAY	115	1.5	3	8	2	-	-	0.7	1.3	92	3.42	15
51.84	11.8	5.1	-	12.1	0.4	14.2	4.4	3	silty CLAY to CLAY	115	1.5	3	8	2	-	-	0.7	1.2	94	3.44	15
52.00	11.7	5.1	-	12.0	0.4	14.9	4.8	3	silty CLAY to CLAY	115	1.5	3	8	2	-	-	0.7	1.2	95	3.47	15
52.17	12.1	5.2	-	12.4	0.5	15.5	5.1	3	silty CLAY to CLAY	115	1.5	3	8	2	-	-	0.7	1.3	95	3.47	15
52.33	12.8	5.5	-	13.1	0.5	16.1	5.3	3	silty CLAY to CLAY	115	1.5	4	9	2	-	-	0.7	1.4	94	3.45	15
52.50	13.6	5.8	-	13.9	0.5	16.7	5.0	3	silty CLAY to CLAY	115	1.5	4	9	2	-	-	0.8	1.5	90	3.41	15
52.66	14.0	6.0	-	14.3	0.5	17.4	4.5	3	silty CLAY to CLAY	115	1.5	4	9	2	-	-	0.8	1.5	87	3.37	15
52.82	13.7	5.8	-	14.0	0.4	18.2	4.1	3	silty CLAY to CLAY	115	1.5	4	9	2	-	-	0.8	1.5	86	3.36	15
52.99	13.0	5.5	-	13.4	0.4	18.9	3.9	3	silty CLAY to CLAY	115	1.5	4	9	2	-	-	0.8	1.4	87	3.37	15
53.15	12.6	5.4	-	13.0	0.5	19.8	5.1	3	silty CLAY to CLAY	115	1.5	4	8	2	-	-	0.7	1.3	94	3.45	15
53.32	13.2	5.6	-	13.6	0.6	20.6	6.0	3	silty CLAY to CLAY	115	1.5	4	9	3	-	-	0.8	1.4	95	3.47	15
53.48	13.5	5.7	-	13.9	0.6	21.0	5.4	3	silty CLAY to CLAY	115	1.5	4	9	3	-	-	0.8	1.5	93	3.43	15
53.64	13.3	5.6	-	13.7	0.4	21.4	4.4	3	silty CLAY to CLAY	115	1.5	4	9	2	-	-	0.8	1.4	89	3.39	15
53.81	11.7	4.9	-	12.2	0.3	22.1	3.5	3	silty CLAY to CLAY	115	1.5	3	8	2	-	-	0.7	1.2	90	3.40	15
53.97	10.9	4.6	-	11.3	0.3	23.0	3.7	3	silty CLAY to CLAY	115	1.5	3	7	2	-	-	0.6	1.1	95	3.46	15
54.14	10.8	4.6	-	11.3	0.3	23.9	4.0	3	silty CLAY to CLAY	115	1.5	3	7	2	-	-	0.6	1.1	95	3.47	15
54.30	10.8	4.5	-	11.3	0.3	28.2	4.4	3	silty CLAY to CLAY	115	1.5	3	7	2	-	-	0.6	1.1	95	3.50	15
54.46	11.0	4.6	-	11.6	0.3	29.8	4.4	3	silty CLAY to CLAY	115	1.5	3	7	2	-	-	0.6	1.1	95	3.49	15
54.63	11.4	4.8	-	12.0	0.4	30.9	4.5	3	silty CLAY to CLAY	115	1.5	3	8	2	-	-	0.6	1.1	95	3.48	15
54.79	11.9	5.0	-	12.6	0.3	32.3	3.6	3	silty CLAY to CLAY	115	1.5	3	8	2	-	-	0.7	1.2	90	3.40	15
54.96	12.3	5.1	-	13.0	0.3	33.7	2.9	3	silty CLAY to CLAY	115	1.5	3	8	2	-	-	0.7	1.3	85	3.34	15
55.12	11.2	4.6	-	11.9	0.3	35.0	3.5	3	silty CLAY to CLAY	115	1.5	3	7	2	-	-	0.6	1.1	93	3.44	15
55.28	10.3	4.3	-	11.1	0.2	36.9	3.5	3	silty CLAY to CLAY	115	1.5	3	7	2	-	-	0.6	1.0	95	3.48	15
55.45	10.7	4.4	-	11.5	0.3	39.3	3.8	3	silty CLAY to CLAY	115	1.5	3	7	2	-	-	0.6	1.0	95	3.48	15
55.61	10.9	4.5	-	11.8	0.3	41.7	4.3	3	silty CLAY to CLAY	115	1.5	3	7	2	-	-	0.6	1.1	95	3.50	15
55.78	11.9	4.9	-	12.8	0.4	44.1	4.5	3	silty CLAY to CLAY	115	1.5	3	8	2	-	-	0.7	1.2	95	3.47	15
55.94	12.7	5.3	-	13.6	0.5	45.9	4.9	3	silty CLAY to CLAY	115	1.5	4	8	2	-	-	0.7	1.3	95	3.45	15
56.11	12.9	5.3	-	13.8	0.4	46.3	4.6	3	silty CLAY to CLAY	115	1.5	4	9	2	-	-	0.7	1.3	93	3.43	15
56.27	12.6	5.2	-	13.5	0.4	45.2	4.2	3	silty CLAY to CLAY	115	1.5	3	8	2	-	-	0.7	1.3	92	3.43	15
56.43	11.3	4.6	-	12.3	0.3	47.5	3.6	3	silty CLAY to CLAY	115	1.5	3	8	2	-	-	0.6	1.1	94	3.45	15
56.60	10.8	4.4	-	11.7	0.3	48.8	3.7	3	silty CLAY to CLAY	115	1.5	3	7	2	-	-	0.6	1.0	95	3.48	15
56.76	10.4	4.2	-	11.4	0.3	51.6	4.3	3	silty CLAY to CLAY	115	1.5	3	7	2	-	-	0.6	1.0	95	3.53	15
56.93	12.0	4.9	-	13.1	0.3	54.1	3.4	3	silty CLAY to CLAY	115	1.5	3	8	2	-	-	0.7	1.2	90	3.41	15
57.09	12.0	4.9	-	13.1	0.3	55.3	3.6	3	silty CLAY to CLAY	115	1.5	3	8	2	-	-	0.7	1.2	92	3.42	15
57.25	12.3	5.0	-	13.4	0.3	55.7	3.3	3	silty CLAY to CLAY	115	1.5	3	8	2	-	-	0.7	1.2	88	3.39	15
57.42	11.7	4.7	-	12.8	0.3	57.8	3.5	3	silty CLAY to CLAY	115	1.5	3	8	2	-	-	0.7	1.1	92	3.43	15
57.58	11.6	4.7	-	13.0	0.3	66.7	3.6	3	silty CLAY to CLAY	115	1.5	3	8	2	-	-	0.6	1.1	93	3.43	15
57.75	11.7	4.7	-	13.0	0.3	67.7	3.5	3	silty CLAY to CLAY	115	1.5	3	8	2	-	-	0.7	1.1	92	3.43	15
57.91	11.6	4.7	-	12.9	0.3	70.8	3.5	3	silty CLAY to CLAY	115	1.5	3	8	2	-	-	0.6	1.1	93	3.43	15
58.07	11.7	4.7	-	13.2	0.3	72.6	3.4	3	silty CLAY to CLAY	115	1.5	3	8	2	-	-	0.7	1.1	92	3.42	15
58.24	11.7	4.7	-	13.1	0.3	73.5	3.4	3	silty CLAY to CLAY	115	1.5	3	8	2	-	-	0.6	1.1	92	3.43	15
58.40	11.1	4.5	-	12.6	0.3	75.2	3.3	3	silty CLAY to CLAY	115	1.5	3	7	2	-	-	0.6	1.0	94	3.45	15
58.57	10.6	4.2	-	12.1	0.3	76.3	3.7	3	silty CLAY to CLAY	115	1.5	3	7	2	-	-	0.6	0.9	95	3.50	15
58.73	10.3	4.1	-	11.8	0.3	78.4	4.1	3	silty CLAY to CLAY	115	1.5	3	7	2	-	-	0.5	0.9	95	3.54	15
58.89	10.3	4.1	-	11.9	0.3	80.2	3.9	3	silty CLAY to CLAY	115	1.5	3	7	2	-	-	0.6	0.9	95	3.53	15
59.06	10.4	4.2	-	12.0	0.3	80.7	3.7	3	silty CLAY to CLAY	115	1.5	3	7	2	-	-	0.6	0.9	95	3.52	15
59.22	10.4	4.2	-	12.1	0.3	83.6	3.6	3	silty CLAY to CLAY	115	1.5	3	7	2	-	-	0.6	0.9	95	3.51	15
59.39	10.3	4.1	-	11.9	0.3	85.0	3.7	3	silty CLAY to CLAY	115	1.5	3	7	2	-	-	0.5	0.9	95	3.53	15
59.55	10.4	4.1	-	12.1	0.3	86.7	3.9	3	silty CLAY to CLAY	115	1.5	3	7	2	-	-	0.6	0.9	95	3.53	15
59.71	12.2	4.8	-	13.9	0.4	89.4	4.6	3	silty CLAY to CLAY	115	1.5	3	8	2	-	-	0.7	1.1	95	3.48	15
59.88	15.2	6.0	-	16.9	0.7	86.8	6.3	3	silty CLAY to CLAY	115	1.5	4	10	3	-	-	0.9	1.5	95	3.45	15
60.04	22.1	8.7	-	23.8	1.0	87.0	5.5	3	silty CLAY to CLAY	115	1.5	6	15	3	-	-	1.4	2.4	78	3.26	15

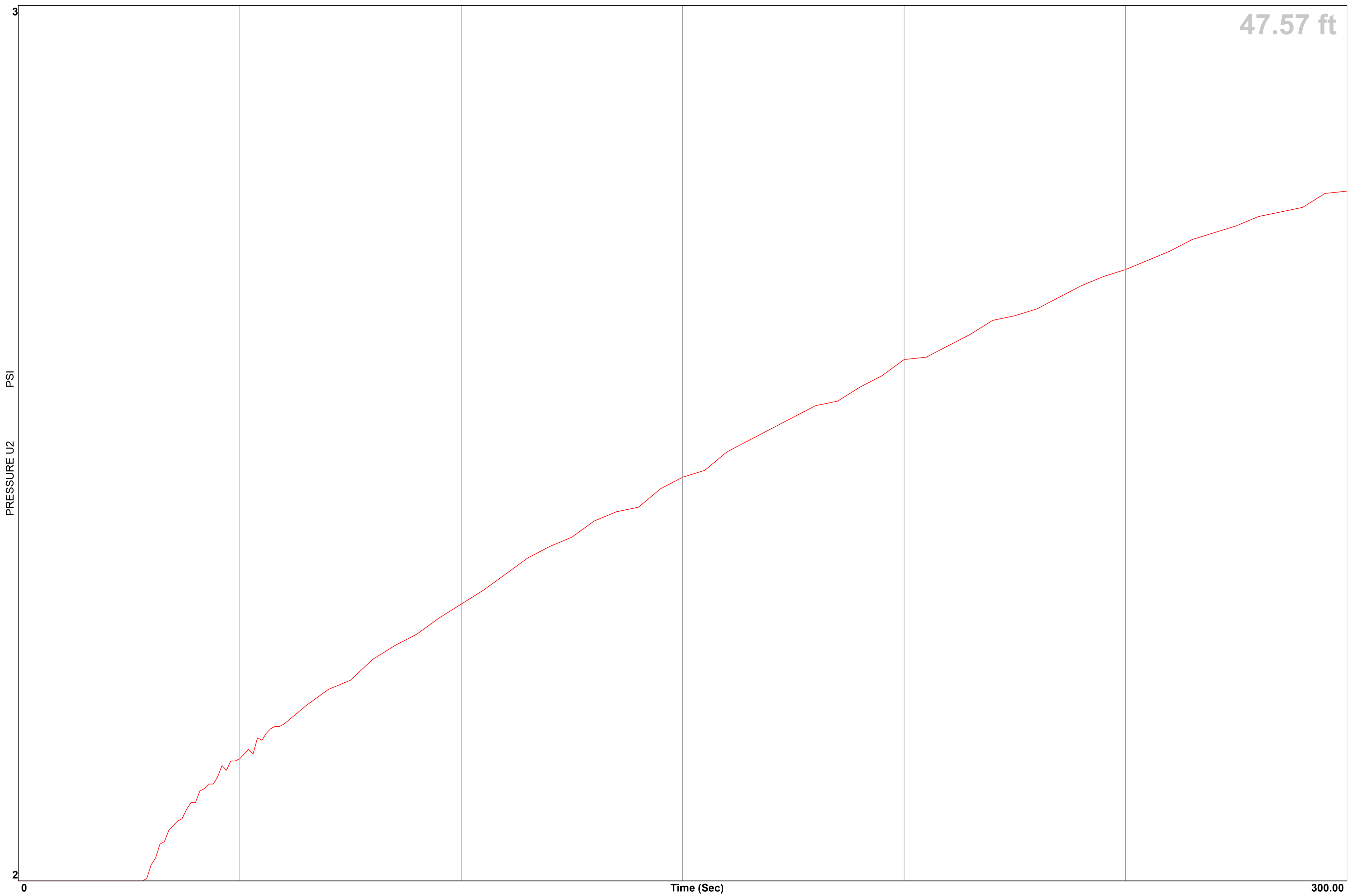
* Indicates the parameter was calculated using the normalized point stress.
The parameters listed above were determined using empirical correlations.
A Professional Engineer must determine their suitability for analysis and design.

Middle Earth Geo Testing

Parikh Consultants

Location	US 101 Blossom Hill Rd IC Improvement Pr	Operator	RB-JM
Job Number	2016-146	Cone Number	DDG1418
Hole Number	CPT-18-NO-004	Date and Time	9/26/2018 10:04:00 AM
Equilized Pressure	2.7	EST GW Depth During Test	41.1 Incomplete Test

GPS

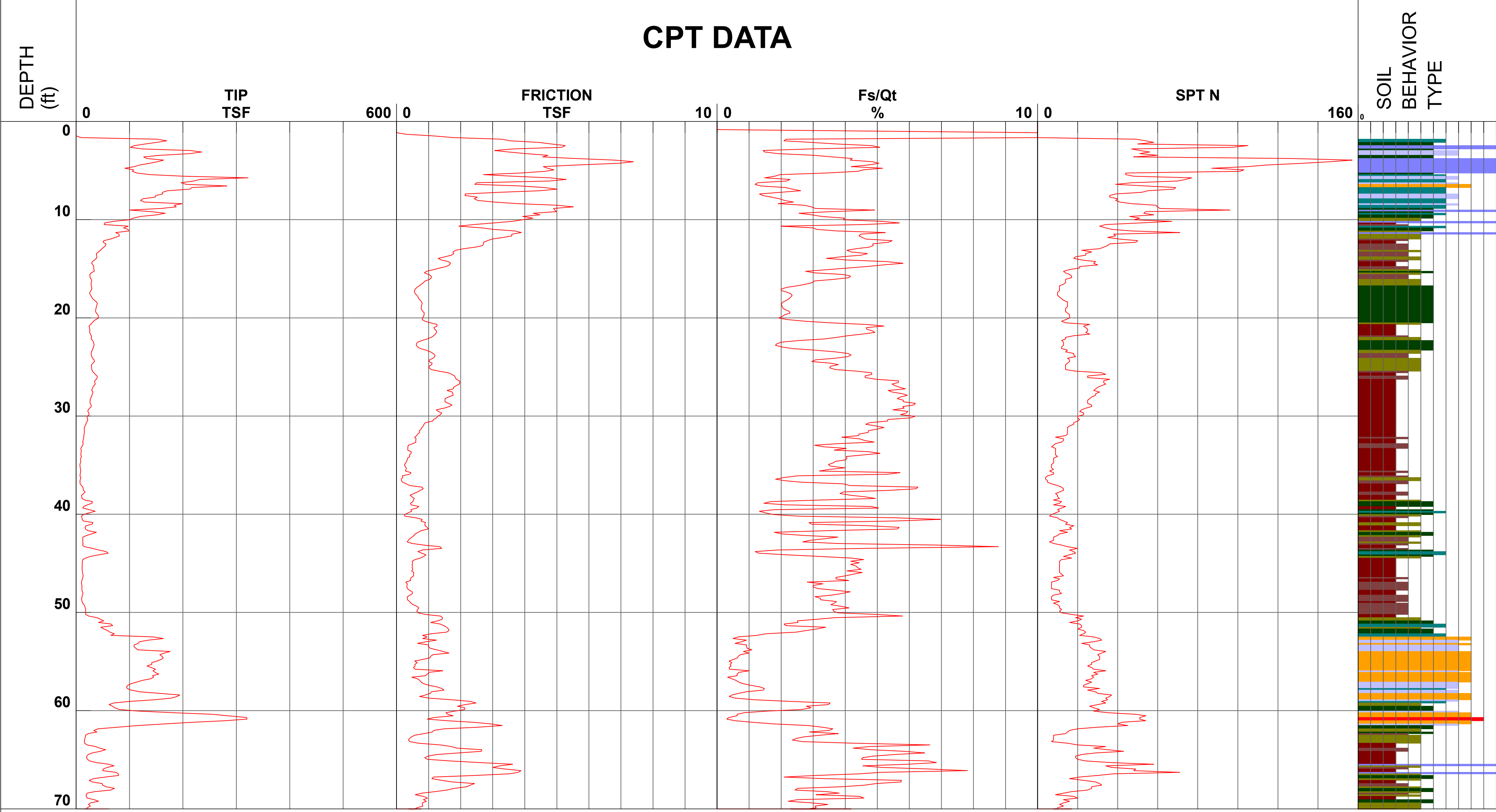


Parikh Consultants

Project	US 101 Blossom Hill Rd IC Improvement Prc	Operator	RB-JM	Filename	SDF(112).cpt
Job Number	2016-146	Cone Number	DDG1418	GPS	
Hole Number	CPT-18-NO-005	Date and Time	9/26/2018 10:57:33 AM	Maximum Depth	72.01 ft
EST GW Depth During Test		35.00 ft			

Net Area Ratio .8

CPT DATA



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

Cone Size 15cm squared

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

US 101 Blossom Hill Rd IC Improvement Project

Project ID: Parikh Consultants
Data File: SDF(112).cpt
CPT Date: 9/26/2018 10:57:33 AM
GW During Test: 35 ft

Sounding ID: CPT-18-NO-005
Project No: 2016-146
Cone/Rig: DDG1418

. Depth ft	. qc PS tsf	* qc1n PS -	. q1ncs PS -	* qt PS tsf	. Slv Stss tsf	. pore prss (psi)	. Frct Rato %	* Mat Typ Zon	* Material Behavior Description	. Unit Wght pcf	. Qc to N	* SPT R-N1 60%	. SPT R-N 60%	* SPT IcN1 60%	* Rel Den %	* Ftn Ang deg	. Und Shr tsf	. OCR -	* Fin Ic %	* Ic SBT Indx	* Nk -
0.33	1.1	0.0	-	1.1	0.0	0.0	0.1	1	sensitive fine SOIL	115	2.0	0	1	0	-	-	0.1	9.9	95	3.48	15
0.49	1.1	0.0	-	1.1	0.0	0.0	0.1	1	sensitive fine SOIL	115	2.0	0	1	0	-	-	0.1	9.9	95	3.48	15
0.66	1.1	0.0	-	1.1	0.0	0.0	0.1	1	sensitive fine SOIL	115	2.0	0	1	0	-	-	0.1	9.3	95	3.48	15
0.82	1.1	0.0	-	1.1	0.0	0.0	0.1	1	sensitive fine SOIL	115	2.0	0	1	0	-	-	0.1	7.4	95	3.48	15
0.98	1.1	0.0	-	1.1	0.0	0.0	0.1	1	sensitive fine SOIL	115	2.0	0	1	0	-	-	0.1	6.1	95	3.48	15
1.15	1.1	0.1	-	1.1	0.0	-0.1	0.1	1	sensitive fine SOIL	115	2.0	0	1	0	-	-	0.1	5.2	95	3.48	15
1.31	1.1	0.0	-	1.1	0.3	0.0	0.1	1	sensitive fine SOIL	115	2.0	0	1	0	-	-	0.1	4.5	95	3.48	15
1.48	1.1	0.0	-	1.1	1.1	0.0	0.1	1	sensitive fine SOIL	115	2.0	0	1	0	-	-	0.1	3.9	95	3.48	15
1.64	9.5	15.2	-	9.5	1.8	0.0	9.9	3	silty CLAY to CLAY	115	1.5	10	6	5	-	-	0.7	9.9	72	3.19	15
1.80	152.4	244.5	289.2	152.5	3.3	1.5	2.2	6	clean SAND to silty SAND	125	5.0	49	30	46	95	48	-	-	10	1.89	16
1.97	169.7	272.1	312.9	169.7	3.5	2.3	2.1	6	clean SAND to silty SAND	125	5.0	54	34	51	95	48	-	-	9	1.86	16
2.13	150.4	241.3	316.7	150.5	4.4	3.5	2.9	8	stiff SAND to clayy SAND	115	1.0	100	100	48	-	-	10.0	9.9	13	2.01	16
2.30	129.2	207.2	314.4	129.3	4.8	3.9	3.7	8	stiff SAND to clayy SAND	115	1.0	100	100	43	-	-	8.6	9.9	17	2.13	16
2.46	109.2	175.1	322.5	109.3	5.3	5.4	4.8	9	very stiff fine SOIL	120	2.0	88	55	38	85	48	-	-	21	2.27	30
2.62	101.5	162.8	317.9	101.6	5.2	6.4	5.1	9	very stiff fine SOIL	120	2.0	81	51	36	83	48	-	-	23	2.30	30
2.79	123.6	198.2	274.2	123.7	3.6	6.5	3.0	8	stiff SAND to clayy SAND	115	1.0	100	100	40	-	-	8.2	9.9	15	2.06	16
2.95	213.8	342.9	347.4	213.9	3.1	5.1	1.4	6	clean SAND to silty SAND	125	5.0	69	43	60	95	48	-	-	5	1.66	16
3.12	234.6	376.3	379.1	234.7	3.5	5.1	1.5	6	clean SAND to silty SAND	125	5.0	75	47	65	95	48	-	-	5	1.66	16
3.28	213.5	342.4	370.3	213.6	4.0	4.4	1.9	6	clean SAND to silty SAND	125	5.0	68	43	62	95	48	-	-	7	1.76	16
3.45	156.6	251.1	329.6	156.7	4.7	4.5	3.0	8	stiff SAND to clayy SAND	115	1.0	100	100	49	-	-	10.4	9.9	13	2.01	16
3.61	126.5	202.8	304.5	126.6	4.6	6.7	3.6	8	stiff SAND to clayy SAND	115	1.0	100	100	42	-	-	8.4	9.9	17	2.12	16
3.77	132.7	212.8	340.1	132.8	5.6	6.2	4.2	9	very stiff fine SOIL	120	2.0	100	66	45	92	48	-	-	18	2.17	30
3.94	163.8	262.7	391.1	163.9	6.8	5.8	4.2	8	stiff SAND to clayy SAND	115	1.0	100	100	54	-	-	10.8	9.9	16	2.12	16
4.10	152.2	244.1	402.7	152.3	7.4	6.6	4.9	9	very stiff fine SOIL	120	2.0	100	76	52	95	48	-	-	19	2.19	30
4.27	137.3	220.1	384.1	137.5	6.9	12.5	5.1	9	very stiff fine SOIL	120	2.0	100	69	47	93	48	-	-	20	2.23	30
4.43	118.7	190.4	335.6	119.0	5.6	12.6	4.7	9	very stiff fine SOIL	120	2.0	95	59	41	88	48	-	-	20	2.24	30
4.59	109.2	175.2	298.4	109.4	4.6	9.4	4.2	9	very stiff fine SOIL	120	2.0	88	55	37	86	47	-	-	19	2.21	30
4.76	91.1	146.1	301.6	91.4	4.7	12.4	5.2	9	very stiff fine SOIL	120	2.0	73	46	33	80	46	-	-	24	2.33	30
4.92	107.7	172.7	310.0	107.9	4.9	11.7	4.6	9	very stiff fine SOIL	120	2.0	86	54	38	85	47	-	-	21	2.25	30
5.09	105.3	169.0	299.6	105.5	4.6	9.5	4.4	9	very stiff fine SOIL	120	2.0	84	53	37	84	47	-	-	20	2.24	30
5.25	113.9	182.6	275.8	114.0	3.9	5.9	3.4	8	stiff SAND to clayy SAND	115	1.0	100	100	38	-	-	7.5	9.9	17	2.13	16
5.41	138.4	221.9	260.8	138.5	2.7	6.6	2.0	6	clean SAND to silty SAND	125	5.0	44	28	42	93	48	-	-	10	1.89	16
5.58	201.4	323.0	348.7	201.5	3.6	6.3	1.8	6	clean SAND to silty SAND	125	5.0	65	40	58	95	48	-	-	7	1.76	16
5.74	321.9	516.2	516.2	322.0	4.8	4.1	1.5	6	clean SAND to silty SAND	125	5.0	100	64	87	95	48	-	-	5	1.58	16
5.91	232.4	372.8	416.9	232.5	5.3	3.1	2.3	8	stiff SAND to clayy SAND	115	1.0	100	100	68	-	-	15.4	9.9	8	1.82	16
6.07	219.9	352.6	392.9	220.0	4.8	6.5	2.2	6	clean SAND to silty SAND	125	5.0	71	44	65	95	48	-	-	8	1.81	16
6.23	196.5	313.8	313.8	196.7	2.5	7.1	1.3	6	clean SAND to silty SAND	125	5.0	63	39	54	95	48	-	-	5	1.65	16
6.40	206.0	324.5	324.5	206.1	2.4	6.2	1.2	6	clean SAND to silty SAND	125	5.0	65	41	55	95	48	-	-	5	1.61	16
6.56	282.3	438.8	438.8	282.4	3.8	5.4	1.4	6	clean SAND to silty SAND	125	5.0	88	56	74	95	48	-	-	5	1.59	16
6.73	216.5	332.2	371.8	216.6	4.6	6.2	2.1	6	clean SAND to silty SAND	125	5.0	66	43	61	95	48	-	-	8	1.82	16
6.89	213.4	323.3	372.7	213.5	5.0	7.6	2.4	8	stiff SAND to clayy SAND	115	1.0	100	100	60	-	-	14.1	9.9	9	1.86	16
7.05	171.0	256.2	318.3	171.3	4.5	12.5	2.6	8	stiff SAND to clayy SAND	115	1.0	100	100	49	-	-	11.3	9.9	12	1.95	16
7.22	161.6	239.4	277.7	161.8	3.2	11.7	2.0	6	clean SAND to silty SAND	125	5.0	48	32	45	95	47	-	-	10	1.87	16
7.38	162.1	237.3	251.6	162.3	2.1	9.5	1.3	6	clean SAND to silty SAND	125	5.0	47	32	42	95	47	-	-	7	1.73	16
7.55	149.2	215.9	236.7	149.3	2.1	9.1	1.4	6	clean SAND to silty SAND	125	5.0	43	30	39	92	46	-	-	8	1.79	16
7.71	148.2	212.1	242.7	148.3	2.5	7.2	1.7	6	clean SAND to silty SAND	125	5.0	42	30	39	92	46	-	-	9	1.85	16
7.87	125.0	176.9	218.1	125.1	2.4	7.2	1.9	6	clean SAND to silty SAND	125	5.0	35	25	34	86	45	-	-	11	1.94	16
8.04	120.5	168.8	215.8	120.7	2.5	7.5	2.1	5	silty SAND to sandy SILT	120	4.0	42	30	33	84	45	-	-	13	1.98	16
8.20	127.8	177.2	233.5	128.1	3.0	12.4	2.4	5	silty SAND to sandy SILT	120	4.0	44	32	35	86	45	-	-	13	2.01	16
8.37	198.2	272.0	305.9	198.4	3.8	8.2	1.9	6	clean SAND to silty SAND	125	5.0	54	40	50	95	47	-	-	9	1.82	16
8.53	183.8	249.7	316.5	183.9	5.0	9.0	2.7	8	stiff SAND to clayy SAND	115	1.0	100	100	49	-	-	12.1	9.9	12	1.97	16
8.69	187.4	252.3	327.9	187.6	5.5	9.4	3.0	8	stiff SAND to clayy SAND	115	1.0	100	100	50	-	-	12.4	9.9	13	2.00	16
8.86	159.7	213.1	293.9	159.8	4.9	6.4	3.1	8	stiff SAND to clayy SAND	115	1.0	100	100	43	-	-	10.5	9.9	14	2.06	16
9.02	100.3	132.7	277.4	100.6	4.9	13.5	4.9	9	very stiff fine SOIL	120	2.0	66	50	30	76	44	-	-	24	2.34	30
9.19	140.7	184.4	283.5	141.2	5.0	24.7	3.6	8	stiff SAND to clayy SAND	115	1.0	100	100	38	-	-	9.3	9.9	17	2.14	16
9.35	166.8	216.8	277.9	167.1	4.3	16.2	2.6	5	silty SAND to sandy SILT	120	4.0	54	42	42	93	46	-	-	13	1.99	16
9.51	151.0	194.5	271.4	151.1	4.5	8.8	3.0	8	stiff SAND to clayy SAND	115	1.0	100	100	39	-	-	10.0	9.9	15	2.07	16
9.68	120.7	154.2	242.3	120.9	3.9	11.1	3.3	5	silty SAND to sandy SILT	120	4.0	39	30	32	81	44	-	-	18	2.16	16
9.84	106.9	135.4	248.3	107.1	4.3	8.1	4.0	8	stiff SAND to clayy SAND	115	1.0	100	100	30	-	-	7.0	9.9	21	2.26	16
10.01	100.0	125.7	236.3	100.2	3.9	9.3	4.0	8	stiff SAND to clayy SAND	115	1.0	100	100	28	-	-	6.6	9.9	22	2.28	16
10.17	70.0	87.3	228.5	70.1	3.6	8.5	5.2	9	very stiff fine SOIL	120	2.0	44	35	21	62	41	-	-	29	2.47	30
10.34	53.4	66.0	211.9	53.6	3.0	10.8	5.7	4	clayy SILT to silty CLAY	115	2.0	33	27	17	-	-	3.7	9.9	34	2.58	15
10.50	52.4	64.4	183.7	52.6	2.4	10.5	4.6	4	clayy SILT to silty CLAY	115	2.0	32	26	16	-	-	3.7	9.9	31	2.52	15
10.66	97.4	118.7	166.0	97.6	1.9	7.3	2.0	5	silty SAND to sandy SILT	120	4.0	30	24	24	73	43	-	-	15	2.07	16
10.83	88.8	107.4	187.1	89.0	2.7	6.0	3.0	5	silty SAND to sandy SILT	120	4.0	27	22	23	69	42	-	-	20	2.23	16
10.99	97.1	116.5	199.4	97.2	3.0	4.9	3.1	5	silty SAND to sandy SILT	120	4.0	29	24	25	72	43	-	-	20	2.22	16
11.16	98.6	117.4	221.2	98.6	3.7	4.1	3.8	8	stiff SAND to clayy SAND	115	1.0	100	99	26	-	-	6.5	9.9	22	2.28	16
11.32	74.2	87.8	231.8	74.3	3.9	7.5	5.3	9	very stiff fine SOIL	120	2.0	44	37	21	63	41	-	-	30	2.47	30
11.48	80.2	94.1	218.2	80.4	3.6	11.9	4.5	9	very stiff fine SOIL	120	2.0	47	40	22	65	41	-	-	26	2.40	30
11.65	81.2	94.6	217.2	81.3	3.6	7.8	4.5	9	very stiff fine SOIL	120	2.0	47	41	22	65	41	-	-	26	2.40	30
11.81	73.3	84.8	208.6	73.4	3.3	6.7	4.6	4	clayy SILT to silty CLAY	115	2.0	42	37	20	-	-	5.1	9.9	28	2.43	15
11.98	64.1	73.8	197.6	64.3	3.0	6.2	4.7	4	clayy SILT to silty CLAY	115	2.0	37	32	18	-	-	4.5	9.9	30	2.48	15
12.14	51.9	59.3	197.0	52.0	2.8	5.7	5.5	4	clayy SILT to silty CLAY	115	2.0	30	26	15	-	-	3.6	9.9	35	2.60	15
12.30	50.8	62.1	198.7	50.9	2.7	6.8	5.4	4	clayy SILT to silty CLAY	115	2.0	31	25	16	-	-	3.5	9.9	34	2.58	15
12.47	55.9	63.1	188.8	56.1	2.7	8.0	4.9	4	clayy SILT to silty CLAY	115	2.0	32	28	16	-	-	3.9	9.9	33	2.54	15
12.63	54.9	61.6	187.1	55.1	2.7	7.2	4.9	4	clayy SILT to silty CLAY	115	2.0	31	27	15	-	-	3.8	9.9	33	2.55	15
12.80	51.8	57.7	178.8	51.9	2.5	5.7	4.8	4	clayy SILT to silty CLAY	115	2.0	29	26	14	-	-	3.6	9.9	34	2.56	15
12.96	48.3	53.4	164.2	48.4	2.1	5.5	4.4	4	clayy SILT to silty CLAY	115	2.0	27	24	13	-	-	3.4	9.9	33	2.56	15
13.12	45.7	50.2	153.6	45.8	1.8	5.0	4.1	4	clayy SILT to silty CLAY	115	2.0	25	23	13	-	-	3.2	9.9	33	2.55	15
13.29	42.1	46.1	150.5	42.2	1.8	4.6	4.2	4	clayy SILT to silty CLAY	115	2.0	23	21	12	-	-	2.9	9.9	35	2.59	15
13.45	38.1	47.7	-	38.2	1.8	4.5	4.8	4	clayy SILT to silty CLAY	115	2.0	24	19	12	-	-	2.6	9.9	36	2.62	15
13.62	38.1	47.2	-	38.2	1.7	4.6	4.6	4	clayy SILT to silty CLAY	115	2.0	24	19	12	-	-	2.6	9.9	36	2.61	15
13.78	38.9	41.8	138.9	39.0	1.5	4.8	4.0	4	clayy SILT to silty CLAY	115	2.0	21	19	11	-	-	2.7	9.9	35	2.60	15
13.94	37.9	40.5	127.9	38.0	1.3	4.6	3.5	4	clayy SILT to silty CLAY	115	2.0	20	19	10	-	-	2.6	9.9	34	2.57	15
14.11	34.4	41.2	-	34.5	1.4	4.3	4.1	4	clayy SILT to silty CLAY	115	2.0	21	17	11	-	-	2.4	9.9	36	2.62	15
14.27	30.6	36.2	-	30.7	1.6	4.1	5.4	3	silty CLAY to CLAY	115	1.5	24	20	10	-	-	2.1	9.9	43	2.74	15
14.44	29.1	34.0	-	29.1	1.7	4.0	6.0	3	silty CLAY to CLAY	115	1.5	23	19	10	-	-	2.0	9.9	46	2.79	15
14.60	31.7	36.6	-	31.7	1.6	4.0	5.3	3	silty CLAY to CLAY	115	1.5	24	21	10	-	-	2.2	9.9	42	2.73	15
14.76	33.1	37.9	-	33.2	1.6	4.0	4.8	3	silty CLAY to CLAY	115	1.5	25	22	10	-	-	2.3	9.9	40	2.69	15
14.93	33.1	37.5	-	33.1	1.4	3.7	4.2	4	clayy SILT to silty CLAY	115	2.0	19	17	10	-	-	2.3	9.9	38	2.65	15
15.09	33.4	37.4	-	33.5	1.2	3.6	3.6	4	clayy SILT to silty CLAY	115	2.0	19	17	10	-	-	2.3	9.9	36	2.60	15
15.26	33.8	34.6	107.6	33.9	0.9	3.4	2.8	4	clayy SILT to silty CLAY	115	2.0	17	17	9	-	-	2.3	9.9	34	2.56	15
15.42	28.2	31.0	-	28.3	0.9	2.3	3.2	4	clayy SILT to silty CLAY	115	2.0	15	14	8	-	-	1.9	9.9	37	2.63	15

* Indicates the parameter was calculated using the normalized point stress.
The parameters listed above were determined using empirical correlations.
A Professional Engineer must determine their suitability for analysis and design.

Middle Earth Geo Testing

US 101 Blossom Hill Rd IC Improvement Project

. . Depth ft	. qc PS tsf	* qc1n PS -	. q1ncs PS -	* qt PS tsf	. Slv Stss tsf	. pore prss (psi)	. Frct Rato %	* Mat Typ Zon	* Material Behavior Description	. Unit Wght pcf	. Qc to N	* SPT R-N1 60%	. SPT R-N 60%	* SPT IcN1 60%	* Rel Den %	* Ftn Ang deg	. Und Shr tsf	. OCR -	* Fin Ic %	* Ic SBT Indx	* Nk -
15.58	25.5	27.7	-	25.6	1.0	2.2	4.1	4	clayy SILT to silty CLAY	115	2.0	14	13	8	-	-	1.7	8.8	43	2.74	15
15.75	25.9	27.8	-	25.9	1.1	2.3	4.3	3	silty CLAY to CLAY	115	1.5	19	17	8	-	-	1.8	8.9	44	2.76	15
15.91	26.5	28.2	-	26.5	1.1	2.4	4.3	3	silty CLAY to CLAY	115	1.5	19	18	8	-	-	1.8	9.0	43	2.75	15
16.08	28.4	29.9	-	28.4	1.0	2.4	3.8	4	clayy SILT to silty CLAY	115	2.0	15	14	8	-	-	1.9	9.5	40	2.70	15
16.24	29.2	30.5	-	29.2	0.9	2.3	3.1	4	clayy SILT to silty CLAY	115	2.0	15	15	8	-	-	2.0	9.7	37	2.64	15
16.40	28.2	29.2	-	28.3	0.8	2.3	3.1	4	clayy SILT to silty CLAY	115	2.0	15	14	8	-	-	1.9	9.3	38	2.65	15
16.57	27.9	28.6	-	28.0	0.8	2.2	2.9	4	clayy SILT to silty CLAY	115	2.0	14	14	7	-	-	1.9	9.1	37	2.63	15
16.73	28.3	28.7	-	28.3	0.7	2.1	2.6	4	clayy SILT to silty CLAY	115	2.0	14	14	7	-	-	1.9	9.1	36	2.60	15
16.90	29.3	28.5	89.7	29.3	0.6	1.7	2.3	4	clayy SILT to silty CLAY	115	2.0	14	15	7	-	-	2.0	9.4	34	2.57	15
17.06	29.3	28.4	85.5	29.3	0.6	1.6	2.1	4	clayy SILT to silty CLAY	115	2.0	14	15	7	-	-	2.0	9.3	33	2.55	15
17.23	27.7	26.7	84.4	27.8	0.6	1.5	2.1	4	clayy SILT to silty CLAY	115	2.0	13	14	7	-	-	1.9	8.7	34	2.57	15
17.39	25.7	25.1	-	25.7	0.6	1.4	2.3	4	clayy SILT to silty CLAY	115	2.0	13	13	6	-	-	1.7	7.9	36	2.62	15
17.55	25.4	24.6	-	25.4	0.6	1.2	2.4	4	clayy SILT to silty CLAY	115	2.0	12	13	6	-	-	1.7	7.8	37	2.64	15
17.72	27.3	26.2	-	27.3	0.6	1.2	2.4	4	clayy SILT to silty CLAY	115	2.0	13	14	7	-	-	1.9	8.3	36	2.62	15
17.88	29.1	27.5	90.9	29.1	0.7	1.4	2.4	4	clayy SILT to silty CLAY	115	2.0	14	15	7	-	-	2.0	8.8	35	2.60	15
18.05	31.0	29.2	91.7	31.0	0.7	1.5	2.3	4	clayy SILT to silty CLAY	115	2.0	15	16	7	-	-	2.1	9.3	34	2.57	15
18.21	34.3	32.2	93.0	34.3	0.7	1.4	2.2	4	clayy SILT to silty CLAY	115	2.0	16	17	8	-	-	2.3	9.9	32	2.52	15
18.37	38.0	35.5	93.9	38.1	0.8	1.1	2.1	5	silty SAND to sandy SILT	120	4.0	9	10	9	33	34	-	-	30	2.47	16
18.54	39.9	37.1	94.2	39.9	0.8	1.2	2.1	5	silty SAND to sandy SILT	120	4.0	9	10	9	34	35	-	-	29	2.45	16
18.70	38.6	35.8	93.1	38.6	0.8	1.1	2.1	5	silty SAND to sandy SILT	120	4.0	9	10	9	33	34	-	-	29	2.47	16
18.87	38.0	35.0	92.9	38.0	0.8	1.1	2.1	5	silty SAND to sandy SILT	120	4.0	9	9	8	32	34	-	-	30	2.48	16
19.03	37.3	34.2	92.7	37.3	0.8	1.1	2.1	5	silty SAND to sandy SILT	120	4.0	9	9	8	32	34	-	-	30	2.49	16
19.19	36.6	33.5	93.9	36.7	0.8	1.0	2.2	4	clayy SILT to silty CLAY	115	2.0	17	18	8	-	-	2.5	9.9	31	2.51	15
19.36	36.4	33.1	96.0	36.4	0.8	1.0	2.3	4	clayy SILT to silty CLAY	115	2.0	17	18	8	-	-	2.5	9.9	32	2.53	15
19.52	38.0	34.4	97.7	38.0	0.9	1.0	2.3	4	clayy SILT to silty CLAY	115	2.0	17	19	8	-	-	2.6	9.9	31	2.51	15
19.69	40.7	36.7	96.3	40.7	0.9	1.1	2.2	5	silty SAND to sandy SILT	120	4.0	9	10	9	34	34	-	-	29	2.47	16
19.85	41.6	37.4	95.1	41.6	0.8	1.1	2.1	5	silty SAND to sandy SILT	120	4.0	9	10	9	35	34	-	-	29	2.45	16
20.01	41.9	37.5	92.7	41.9	0.8	1.1	2.0	5	silty SAND to sandy SILT	120	4.0	9	10	9	35	34	-	-	28	2.44	16
20.18	36.4	32.5	94.3	36.4	0.8	0.8	2.3	4	clayy SILT to silty CLAY	115	2.0	16	18	8	-	-	2.5	9.8	32	2.53	15
20.34	32.4	27.1	-	32.4	0.9	0.8	2.9	4	clayy SILT to silty CLAY	115	2.0	14	16	7	-	-	2.2	8.6	38	2.65	15
20.51	30.0	24.8	-	30.0	1.1	0.8	3.7	4	clayy SILT to silty CLAY	115	2.0	12	15	7	-	-	2.0	7.9	43	2.75	15
20.67	27.1	22.3	-	27.2	1.3	0.9	4.9	3	silty CLAY to CLAY	115	1.5	15	18	7	-	-	1.8	7.0	50	2.87	15
20.83	24.3	19.8	-	24.3	1.3	0.9	5.5	3	silty CLAY to CLAY	115	1.5	13	16	6	-	-	1.6	6.2	55	2.94	15
21.00	24.9	20.2	-	25.0	1.2	2.1	4.9	3	silty CLAY to CLAY	115	1.5	13	17	6	-	-	1.7	6.3	52	2.90	15
21.16	25.6	20.5	-	25.6	1.2	1.6	4.9	3	silty CLAY to CLAY	115	1.5	14	17	6	-	-	1.7	6.4	52	2.90	15
21.33	25.6	20.4	-	25.6	1.2	1.5	5.1	3	silty CLAY to CLAY	115	1.5	14	17	6	-	-	1.7	6.4	53	2.91	15
21.49	25.4	20.1	-	25.4	1.2	1.2	5.2	3	silty CLAY to CLAY	115	1.5	13	17	6	-	-	1.7	6.3	53	2.92	15
21.65	26.7	21.0	-	26.7	1.2	2.1	4.8	3	silty CLAY to CLAY	115	1.5	14	18	6	-	-	1.8	6.6	51	2.88	15
21.82	28.4	22.2	-	28.5	1.2	0.9	4.3	3	silty CLAY to CLAY	115	1.5	15	19	6	-	-	1.9	7.0	48	2.83	15
21.98	28.8	22.3	-	28.8	1.1	1.4	3.9	3	silty CLAY to CLAY	115	1.5	15	19	6	-	-	1.9	7.0	46	2.81	15
22.15	28.4	21.9	-	28.5	1.0	2.1	3.5	4	clayy SILT to silty CLAY	115	2.0	11	14	6	-	-	1.9	6.9	45	2.78	15
22.31	30.9	23.6	-	30.9	0.8	2.5	2.7	4	clayy SILT to silty CLAY	115	2.0	12	15	6	-	-	2.1	7.4	39	2.68	15
22.47	32.7	24.7	-	32.7	0.7	0.8	2.1	4	clayy SILT to silty CLAY	115	2.0	12	16	6	-	-	2.2	7.8	35	2.60	15
22.64	33.4	28.1	83.0	33.4	0.6	0.9	1.9	4	clayy SILT to silty CLAY	115	2.0	14	17	7	-	-	2.3	8.0	32	2.54	15
22.80	33.7	28.3	82.4	33.7	0.6	0.8	1.9	4	clayy SILT to silty CLAY	115	2.0	14	17	7	-	-	2.3	8.0	32	2.53	15
22.97	32.6	24.2	-	32.6	0.7	0.8	2.1	4	clayy SILT to silty CLAY	115	2.0	12	16	6	-	-	2.2	7.6	36	2.61	15
23.13	31.5	23.2	-	31.5	0.7	0.8	2.4	4	clayy SILT to silty CLAY	115	2.0	12	16	6	-	-	2.1	7.3	39	2.66	15
23.30	30.3	22.2	-	30.3	0.9	0.8	3.2	4	clayy SILT to silty CLAY	115	2.0	11	15	6	-	-	2.0	7.0	43	2.75	15
23.46	28.7	20.8	-	28.7	1.1	1.0	3.9	3	silty CLAY to CLAY	115	1.5	14	19	6	-	-	1.9	6.5	48	2.83	15
23.62	28.0	20.2	-	28.0	1.1	1.1	4.3	3	silty CLAY to CLAY	115	1.5	13	19	6	-	-	1.9	6.3	50	2.87	15
23.79	28.6	20.5	-	28.6	1.2	2.1	4.4	3	silty CLAY to CLAY	115	1.5	14	19	6	-	-	1.9	6.4	50	2.87	15
23.95	29.3	20.9	-	29.4	1.2	2.6	4.3	3	silty CLAY to CLAY	115	1.5	14	20	6	-	-	2.0	6.6	49	2.85	15
24.12	30.9	21.9	-	31.0	1.1	3.5	3.9	3	silty CLAY to CLAY	115	1.5	15	21	6	-	-	2.1	6.9	46	2.81	15
24.28	33.5	23.5	-	33.6	1.0	3.5	3.2	4	clayy SILT to silty CLAY	115	2.0	12	17	6	-	-	2.3	7.4	42	2.73	15
24.44	34.2	23.9	-	34.3	1.0	2.6	3.1	4	clayy SILT to silty CLAY	115	2.0	12	17	6	-	-	2.3	7.5	41	2.72	15
24.61	31.4	21.8	-	31.5	1.1	1.3	3.7	3	silty CLAY to CLAY	115	1.5	15	21	6	-	-	2.1	6.9	46	2.80	15
24.77	28.9	19.9	-	29.0	1.1	2.2	4.0	3	silty CLAY to CLAY	115	1.5	13	19	6	-	-	1.9	6.2	49	2.85	15
24.94	28.7	19.7	-	28.8	1.0	2.6	3.7	3	silty CLAY to CLAY	115	1.5	13	19	6	-	-	1.9	6.2	48	2.84	15
25.10	29.0	19.7	-	29.0	1.0	2.5	3.7	3	silty CLAY to CLAY	115	1.5	13	19	6	-	-	1.9	6.2	48	2.83	15
25.26	29.4	19.8	-	29.4	1.1	2.2	3.9	3	silty CLAY to CLAY	115	1.5	13	20	6	-	-	2.0	6.2	49	2.84	15
25.43	30.3	20.3	-	30.4	1.3	2.3	4.6	3	silty CLAY to CLAY	115	1.5	14	20	6	-	-	2.0	6.4	51	2.88	15
25.59	33.3	22.2	-	33.4	1.6	3.4	5.0	3	silty CLAY to CLAY	115	1.5	15	22	7	-	-	2.2	7.0	51	2.88	15
25.76	35.8	23.7	-	35.8	1.7	2.4	5.0	3	silty CLAY to CLAY	115	1.5	16	24	7	-	-	2.4	7.5	49	2.86	15
25.92	39.2	25.8	-	39.3	1.8	3.6	4.8	3	silty CLAY to CLAY	115	1.5	17	26	7	-	-	2.7	8.2	47	2.81	15
26.08	39.7	26.0	-	39.7	1.8	3.6	4.8	3	silty CLAY to CLAY	115	1.5	17	26	7	-	-	2.7	8.2	47	2.81	15
26.25	37.6	24.5	-	37.7	1.9	3.6	5.2	3	silty CLAY to CLAY	115	1.5	16	25	7	-	-	2.5	7.7	49	2.85	15
26.41	34.7	22.5	-	34.8	2.0	4.9	5.9	3	silty CLAY to CLAY	115	1.5	15	23	7	-	-	2.3	7.1	53	2.92	15
26.58	34.9	22.4	-	35.0	2.0	5.0	5.9	3	silty CLAY to CLAY	115	1.5	15	23	7	-	-	2.4	7.1	53	2.92	15
26.74	35.9	22.9	-	36.0	2.0	5.0	5.7	3	silty CLAY to CLAY	115	1.5	15	24	7	-	-	2.4	7.2	52	2.90	15
26.90	33.6	21.4	-	33.7	1.9	4.9	5.8	3	silty CLAY to CLAY	115	1.5	14	22	7	-	-	2.3	6.7	54	2.93	15
27.07	31.2	19.7	-	31.3	1.8	4.0	6.0	3	silty CLAY to CLAY	115	1.5	13	21	6	-	-	2.1	6.2	57	2.97	15
27.23	30.0	18.8	-	30.1	1.8	4.1	6.2	3	silty CLAY to CLAY	115	1.5	13	20	6	-	-	2.0	5.9	58	3.00	15
27.40	29.5	18.4	-	29.6	1.6	2.5	5.6	3	silty CLAY to CLAY	115	1.5	12	20	6	-	-	2.0	5.7	57	2.98	15
27.56	31.8	19.7	-	31.9	1.7	3.3	5.8	3	silty CLAY to CLAY	115	1.5	13	21	6	-	-	2.1	6.2	56	2.96	15
27.72	30.4	18.8	-	30.5	1.8	3.1	6.1	3	silty CLAY to CLAY	115	1.5	13	20	6	-	-	2.0	5.9	58	2.99	15
27.89	29.7	18.2	-	29.8	1.8	4.6	6.3	3	silty CLAY to CLAY	115	1.5	12	20	6	-	-	2.0	5.7	59	3.01	15
28.05	28.3	17.2	-	28.4	1.6	5.0	6.1	3	silty CLAY to CLAY	115	1.5	11	19	6	-	-	1.9	5.4	60	3.02	15
28.22	27.0	16.3	-	27.1	1.5	5.8	6.0	3	silty CLAY to CLAY	115	1.5	11	18	5	-	-	1.8	5.1	61	3.03	15
28.38	26.0	15.7	-	26.1	1.5	6.2	6.2	3	silty CLAY to CLAY	115	1.5	10	17	5	-	-	1.7	4.8	63	3.06	15
28.54	26.0	15.6	-	26.1	1.5	6.2	6.2	3	silty CLAY to CLAY	115	1.5	10	17	5	-	-	1.7	4.8	63	3.06	15
28.71	26.1	15.6	-	26.3	1.6	6.5	6.6	3	silty CLAY to CLAY	115	1.5	10	17	5	-	-	1.7	4.8	64	3.08	15
28.87	28.2	16.7	-	28.3	1.7	6.6	6.5	3	silty CLAY to CLAY	115	1.5	11	19	6	-	-	1.9	5.2	62	3.05	15
29.04	28.4	16.8	-	28.6	1.6	6.6	6.2	3	silty CLAY to CLAY	115	1.5	11	19	5	-	-	1.9	5.2	61	3.03	15
29.20	25.4	14.9	-	25.5	1.5	5.9	6.3	3	silty CLAY to CLAY	115	1.5	10	17	5	-	-	1.7	4.6	64	3.08	15
29.36	22.6	13.2	-	22.7	1.2	7.0	5.9	3	silty CLAY to CLAY	115	1.5	9	15	5	-	-	1.5	4.0	66	3.11	15
29.53	21.8	12.6	-	21.9	1.3	7.6	6.5	3	silty CLAY to CLAY	115	1.5	8	15	4	-	-	1.4	3.8	69	3.15	15
29.69	23.9	13.8	-	24.0	1.4	7.9	6.4	3	silty CLAY to CLAY	115	1.5	9	16	5	-	-	1.6	4.2	66	3.11	15
29.86	23.9	13.7	-	24.1	1.4	7.0	6.2	3	silty CLAY to CLAY	115	1.5	9	16	5	-	-	1.6	4.2	66	3.10	15
30.02	20.8	11.9	-	20.9	1.3	6.8	6.7	3	silty CLAY to CLAY	115	1.5	8	14	4	-	-	1.3	3.6	72	3.18	15
30.19	20.6	11.7	-	20.8	1.2	8.3	6.6	3	silty CLAY to CLAY	115	1.5	8	14	4	-	-	1.3	3.5	72	3.18	15
30.35	21.7	12.2	-	21.9	1.2	8.3	5.8	3	silty CLAY to CLAY	115	1.5	8	14	4	-	-	1.4	3.7	68	3.13	15
30.51	21.2	11.9	-	21.3	1.1	8.4	5.8	3	silty CLAY to CLAY	115	1.5	8	14	4	-	-	1.4	3.6	68	3.14	15
30.68	18.9	10.6	-	19.1	0.9	8.8	5.2	3	silty CLAY to CLAY	115	1.5	7	13	4	-	-	1.2	3.2	70	3.16	15
30.84	18.4	10.2	-	18.6	0.9	8.9	5.1	3	silty CLAY to CLAY	115	1.5	7	12	4	-	-	1.2	3.0	70	3.16	15

US 101 Blossom Hill Rd IC Improvement Project

Project ID: Parikh Consultants
Data File: SDF(112).cpt
CPT Date: 9/26/2018 10:57:33 AM
GW During Test: 35 ft

Sounding ID: CPT-18-NO-005
Project No: 2016-146
Cone/Rig: DDG1418

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.	qc	qc1n	q1ncs	qt	Slv	pore	Frct	Mat	Material	Unit	Qc	SPT	SPT	SPT	Rel	Ftn	Und	OCR	Fin	Ic	Nk
Depth	PS	PS	PS	PS	Stss	prss	Rato	Typ	Behavior	Wght	to	R-N1	R-N	IcN1	Den	Ang	Shr	-	Ic	SBT	-
ft	tsf	-	-	tsf	tsf	(psi)	%	Zon	Description	pcf	N	60%	60%	60%	%	deg	tsf	-	%	Indx	-
31.01	17.0	9.4	-	17.1	0.8	8.7	5.5	3	silty CLAY to CLAY	115	1.5	6	11	3	-	-	1.1	2.8	74	3.22	15
31.17	15.1	8.3	-	15.3	0.8	8.9	5.9	3	silty CLAY to CLAY	115	1.5	6	10	3	-	-	0.9	2.4	79	3.28	15
31.33	15.4	8.4	-	15.6	0.8	10.4	5.7	3	silty CLAY to CLAY	115	1.5	6	10	3	-	-	1.0	2.4	78	3.26	15
31.50	15.1	8.2	-	15.3	0.7	10.9	5.4	3	silty CLAY to CLAY	115	1.5	5	10	3	-	-	0.9	2.4	78	3.26	15
31.66	15.3	8.3	-	15.5	0.7	11.2	5.4	3	silty CLAY to CLAY	115	1.5	6	10	3	-	-	0.9	2.4	78	3.26	15
31.83	15.0	8.1	-	15.2	0.7	11.6	5.1	3	silty CLAY to CLAY	115	1.5	5	10	3	-	-	0.9	2.3	77	3.25	15
31.99	14.3	7.6	-	14.5	0.6	11.8	5.1	3	silty CLAY to CLAY	115	1.5	5	10	3	-	-	0.9	2.2	79	3.27	15
32.15	14.4	7.7	-	14.7	0.6	12.2	4.5	3	silty CLAY to CLAY	115	1.5	5	10	3	-	-	0.9	2.2	76	3.24	15
32.32	13.7	7.3	-	13.9	0.6	12.6	5.2	3	silty CLAY to CLAY	115	1.5	5	9	3	-	-	0.8	2.1	81	3.30	15
32.48	13.0	6.9	-	13.2	0.6	12.9	5.4	3	silty CLAY to CLAY	115	1.5	5	9	3	-	-	0.8	1.9	84	3.33	15
32.65	12.4	6.5	-	12.6	0.6	13.1	5.8	3	silty CLAY to CLAY	115	1.5	4	8	3	-	-	0.7	1.8	87	3.37	15
32.81	13.3	7.0	-	13.6	0.5	13.6	4.4	3	silty CLAY to CLAY	115	1.5	5	9	3	-	-	0.8	2.0	79	3.28	15
32.97	12.1	6.3	-	12.4	0.4	13.7	3.6	3	silty CLAY to CLAY	115	1.5	4	8	2	-	-	0.7	1.7	79	3.27	15
33.14	10.5	5.4	-	10.8	0.4	13.9	4.1	3	silty CLAY to CLAY	115	1.5	4	7	2	-	-	0.6	1.5	87	3.36	15
33.30	8.7	4.5	-	9.0	0.4	14.1	5.2	3	silty CLAY to CLAY	115	1.5	3	6	2	-	-	0.5	1.2	95	3.51	15
33.47	9.4	4.8	-	9.7	0.3	14.2	4.6	3	silty CLAY to CLAY	115	1.5	3	6	2	-	-	0.5	1.3	94	3.45	15
33.63	9.6	4.9	-	9.9	0.5	14.2	6.0	3	silty CLAY to CLAY	115	1.5	3	6	2	-	-	0.5	1.3	95	3.50	15
33.79	9.0	4.5	-	9.2	0.5	14.1	6.5	2	Organic SOILS - Peats	100	1.0	5	9	2	-	-	0.7	1.2	95	3.56	10
33.96	8.8	4.5	-	9.1	0.4	14.3	5.9	3	silty CLAY to CLAY	115	1.5	3	6	2	-	-	0.5	1.1	95	3.54	15
34.12	10.2	5.1	-	10.5	0.4	13.4	5.0	3	silty CLAY to CLAY	115	1.5	3	7	2	-	-	0.6	1.4	93	3.44	15
34.29	8.5	4.3	-	8.8	0.3	13.8	5.3	3	silty CLAY to CLAY	115	1.5	3	6	2	-	-	0.5	1.1	95	3.54	15
34.45	8.4	4.2	-	8.7	0.3	14.1	5.3	3	silty CLAY to CLAY	115	1.5	3	6	2	-	-	0.5	1.0	95	3.55	15
34.61	8.5	4.2	-	8.8	0.3	14.5	4.8	3	silty CLAY to CLAY	115	1.5	3	6	2	-	-	0.5	1.1	95	3.52	15
34.78	8.0	3.9	-	8.2	0.3	14.6	4.9	3	silty CLAY to CLAY	115	1.5	3	5	2	-	-	0.4	1.0	95	3.56	15
34.94	7.1	3.5	-	7.4	0.2	15.0	4.9	3	silty CLAY to CLAY	115	1.5	2	5	2	-	-	0.4	0.8	95	3.62	15
35.11	7.4	3.6	-	7.7	0.3	15.4	4.9	3	silty CLAY to CLAY	115	1.5	2	5	2	-	-	0.4	0.9	95	3.60	15
35.27	7.6	3.7	-	7.9	0.3	15.6	5.5	2	Organic SOILS - Peats	100	1.0	4	8	2	-	-	0.6	0.9	95	3.61	10
35.43	8.4	4.1	-	8.7	0.3	16.1	4.6	3	silty CLAY to CLAY	115	1.5	3	6	2	-	-	0.5	1.0	95	3.52	15
35.60	8.6	4.2	-	8.9	0.3	16.3	4.2	3	silty CLAY to CLAY	115	1.5	3	6	2	-	-	0.5	1.1	95	3.49	15
35.76	7.9	3.8	-	8.2	0.5	16.6	7.7	2	Organic SOILS - Peats	100	1.0	4	8	2	-	-	0.6	0.9	95	3.68	10
35.93	7.7	3.8	-	8.1	0.4	17.0	7.3	2	Organic SOILS - Peats	100	1.0	4	8	2	-	-	0.6	0.9	95	3.68	10
36.09	7.2	3.5	-	7.6	0.2	17.3	3.5	3	silty CLAY to CLAY	115	1.5	2	5	2	-	-	0.4	0.8	95	3.55	15
36.26	9.1	4.4	-	9.4	0.2	16.2	2.7	3	silty CLAY to CLAY	115	1.5	3	6	2	-	-	0.5	1.1	87	3.37	15
36.42	7.9	3.8	-	8.3	0.1	16.9	2.5	3	silty CLAY to CLAY	115	1.5	3	5	2	-	-	0.4	0.9	92	3.43	15
36.58	7.4	3.6	-	7.7	0.2	17.4	3.0	3	silty CLAY to CLAY	115	1.5	2	5	2	-	-	0.4	0.8	95	3.50	15
36.75	7.3	3.5	-	7.6	0.2	18.0	3.7	3	silty CLAY to CLAY	115	1.5	2	5	2	-	-	0.4	0.8	95	3.56	15
36.91	7.5	3.6	-	7.9	0.3	18.5	5.5	2	Organic SOILS - Peats	100	1.0	4	8	2	-	-	0.6	0.8	95	3.63	10
37.08	10.0	4.8	-	10.3	0.4	18.9	5.3	3	silty CLAY to CLAY	115	1.5	3	7	2	-	-	0.6	1.2	95	3.49	15
37.24	12.7	6.1	-	13.1	0.8	19.0	7.6	3	silty CLAY to CLAY	115	1.5	4	8	3	-	-	0.7	1.7	95	3.47	15
37.40	13.4	6.4	-	13.7	0.8	18.1	7.4	3	silty CLAY to CLAY	115	1.5	4	9	3	-	-	0.8	1.8	94	3.45	15
37.57	13.8	6.6	-	14.2	0.7	18.3	6.4	3	silty CLAY to CLAY	115	1.5	4	9	3	-	-	0.8	1.8	89	3.40	15
37.73	16.7	8.0	-	17.0	0.7	11.2	4.5	3	silty CLAY to CLAY	115	1.5	5	11	3	-	-	1.0	2.3	75	3.23	15
37.90	14.1	6.7	-	14.3	0.5	11.3	4.5	3	silty CLAY to CLAY	115	1.5	4	9	3	-	-	0.8	1.9	82	3.31	15
38.06	10.1	4.8	-	10.4	0.4	12.7	5.3	3	silty CLAY to CLAY	115	1.5	3	7	2	-	-	0.6	1.2	95	3.49	15
38.22	10.5	5.0	-	10.8	0.5	13.8	5.9	3	silty CLAY to CLAY	115	1.5	3	7	2	-	-	0.6	1.3	95	3.50	15
38.39	11.3	5.3	-	11.6	0.6	14.1	6.2	3	silty CLAY to CLAY	115	1.5	4	8	2	-	-	0.6	1.4	95	3.48	15
38.55	16.4	7.7	-	16.7	0.5	15.1	3.7	3	silty CLAY to CLAY	115	1.5	5	11	3	-	-	1.0	2.2	73	3.19	15
38.72	30.5	14.3	-	30.8	0.5	13.6	1.8	4	clayy SILT to silty CLAY	115	2.0	7	15	4	-	-	2.0	4.4	45	2.77	15
38.88	29.7	13.9	-	29.7	0.4	1.9	1.6	4	clayy SILT to silty CLAY	115	2.0	7	15	4	-	-	1.9	4.2	43	2.75	15
39.04	21.2	9.9	-	21.2	0.5	1.7	2.4	3	silty CLAY to CLAY	115	1.5	7	14	3	-	-	1.3	2.9	58	2.99	15
39.21	14.5	6.7	-	14.5	0.7	2.7	5.7	3	silty CLAY to CLAY	115	1.5	4	10	3	-	-	0.9	1.9	86	3.36	15
39.37	12.5	5.8	-	12.6	0.6	3.8	6.2	3	silty CLAY to CLAY	115	1.5	4	8	3	-	-	0.7	1.6	93	3.44	15
39.54	25.2	11.7	-	25.3	0.5	4.7	2.0	4	clayy SILT to silty CLAY	115	2.0	6	13	3	-	-	1.6	3.5	50	2.87	15
39.70	35.6	16.5	-	35.6	0.5	2.5	1.4	4	clayy SILT to silty CLAY	115	2.0	8	18	4	-	-	2.4	5.1	38	2.66	15
39.86	23.5	10.9	-	23.5	0.4	1.4	1.7	4	clayy SILT to silty CLAY	115	2.0	5	12	3	-	-	1.5	3.2	50	2.87	15
40.03	13.9	6.4	-	13.9	0.2	2.1	2.1	3	silty CLAY to CLAY	115	1.5	4	9	2	-	-	0.8	1.8	69	3.15	15
40.19	10.1	4.7	-	10.1	0.3	3.0	3.3	3	silty CLAY to CLAY	115	1.5	3	7	2	-	-	0.6	1.2	89	3.40	15
40.36	10.8	5.0	-	10.9	0.6	4.2	7.1	2	Organic SOILS - Peats	100	1.0	5	11	2	-	-	0.9	1.3	95	3.55	10
40.52	11.4	5.2	-	11.5	0.8	5.1	8.8	2	Organic SOILS - Peats	100	1.0	5	11	3	-	-	1.0	1.4	95	3.58	10
40.68	13.6	6.2	-	13.7	0.8	5.9	6.8	3	silty CLAY to CLAY	115	1.5	4	9	3	-	-	0.8	1.7	93	3.44	15
40.85	31.5	14.4	-	31.6	0.9	4.6	3.1	3	silty CLAY to CLAY	115	1.5	10	21	4	-	-	2.1	4.4	52	2.90	15
41.01	29.8	13.6	-	29.9	0.9	1.9	3.2	3	silty CLAY to CLAY	115	1.5	9	20	4	-	-	2.0	4.1	54	2.93	15
41.18	18.7	8.5	-	18.7	0.9	1.4	5.5	3	silty CLAY to CLAY	115	1.5	6	12	3	-	-	1.2	2.5	77	3.25	15
41.34	16.8	7.6	-	16.8	1.0	2.2	6.6	3	silty CLAY to CLAY	115	1.5	5	11	3	-	-	1.0	2.2	85	3.35	15
41.50	17.6	8.0	-	17.6	1.0	2.6	6.5	3	silty CLAY to CLAY	115	1.5	5	12	3	-	-	1.1	2.3	83	3.33	15
41.67	22.1	10.0	-	22.1	0.8	3.0	3.9	3	silty CLAY to CLAY	115	1.5	7	15	3	-	-	1.4	2.9	66	3.10	15
41.83	37.9	17.1	-	38.0	0.7	2.9	1.9	4	clayy SILT to silty CLAY	115	2.0	9	19	5	-	-	2.5	5.3	41	2.72	15
42.00	29.1	13.2	-	29.1	0.6	1.3	2.2	4	clayy SILT to silty CLAY	115	2.0	7	15	4	-	-	1.9	4.0	49	2.85	15
42.16	19.9	9.0	-	19.9	0.5	1.0	3.1	3	silty CLAY to CLAY	115	1.5	6	13	3	-	-	1.2	2.6	65	3.09	15
42.32	12.8	5.8	-	12.9	0.5	1.6	4.7	3	silty CLAY to CLAY	115	1.5	4	9	2	-	-	0.8	1.5	88	3.38	15
42.49	12.2	5.5	-	12.3	0.4	2.3	4.2	3	silty CLAY to CLAY	115	1.5	4	8	2	-	-	0.7	1.4	88	3.38	15
42.65	12.7	5.7	-	12.7	0.4	2.6	3.6	3	silty CLAY to CLAY	115	1.5	4	8	2	-	-	0.7	1.5	83	3.33	15
42.82	12.4	5.5	-	12.4	0.3	3.0	3.3	3	silty CLAY to CLAY	115	1.5	4	8	2	-	-	0.7	1.5	83	3.32	15
42.98	13.0	5.8	-	13.1	0.5	3.5	4.6	3	silty CLAY to CLAY	115	1.5	4	9	2	-	-	0.8	1.6	87	3.37	15
43.15	12.3	5.5	-	12.4	0.8	3.9	8.6	2	Organic SOILS - Peats	100	1.0	5	12	3	-	-	1.1	1.4	95	3.56	10
43.31	15.4	6.9	-	15.5	1.4	4.5	9.9	2	Organic SOILS - Peats	100	1.0	7	15	3	-	-	1.4	1.9	95	3.50	10
43.47	30.8	13.7	-	30.9	1.4	4.7	5.0	3	silty CLAY to CLAY	115	1.5	9	21	5	-	-	2.0	4.1	62	3.05	15
43.64	42.5	18.8	-	42.5	0.8	1.9	2.0	4	clayy SILT to silty CLAY	115	2.0	9	21	5	-	-	2.8	5.8	40	2.69	15
43.80	56.0	36.2	74.9	56.1	0.7	1.0	1.2	5	silty SAND to sandy SILT	120	4.0	9	14	8	33	32	-	-	24	2.34	16
43.97	60.0	38.7	79.9	60.0	0.8	-0.3	1.4	5	silty SAND to sandy SILT	120	4.0	10	15	9	36	33	-	-	24	2.33	16
44.13	42.7	18.8	-	42.7	0.9	0.0	2.3	4	clayy SILT to silty CLAY	115	2.0	9	21	5	-	-	2.9	5.8	42	2.73	15
44.29	26.7	11.8	-	26.7	0.9	-0.7	3.5	3	silty CLAY to CLAY	115	1.5	8	18	4	-	-	1.7	3.5	59	3.01	15
44.46	17.6	7.7	-	17.6	0.7	-0.1	4.9	3	silty CLAY to CLAY	115	1.5	5	12	3	-	-	1.1	2.2	78	3.27	15
44.62	12.6	5.5	-	12.6	0.6	1.1	5.8	3	silty CLAY to CLAY	115	1.5	4	8	2	-	-	0.7	1.4	95	3.45	15
44.79	11.7	5.1	-	11.7	0.5	1.6	5.4	3	silty CLAY to CLAY	115	1.5	3	8	2	-	-	0.7	1.3	95	3.47	15
44.95	11.3	5.0	-	11.4	0.5	2.0	5.8	3	silty CLAY to CLAY	115	1.5	3	8	2	-	-	0.6	1.3	95	3.50	15
45.11	11.6	5.1	-	11.7	0.5	2.4	5.4	3	silty CLAY to CLAY	115	1.5	3	8	2	-	-	0.7	1.3	95	3.47	15
45.28	11.4	4.9	-	11.4	0.5	2.7	5.6	3	silty CLAY to CLAY	115	1.5	3	8	2	-	-	0.6	1.3	95	3.50	15
45.44	11.1	4.8	-	11.1	0.5	3.1	5.7	3	silty CLAY to CLAY	115	1.5	3	7	2	-	-	0.6	1.2	95	3.52	15
45.61	11.3	4.9	-	11.4	0.5	3.4	5.9	3	silty CLAY to CLAY	115	1.5	3	8	2	-	-	0.6	1.2	95	3.51	15
45.77	11.6	5.0	-	11.7	0.5	3.7	5.3	3	silty CLAY to CLAY	115	1.5	3	8	2	-	-	0.7	1.3	95	3.47	15
45.93	11.9	5.1	-	11.9	0.5	3.9	5.8	3	silty CLAY to CLAY	115	1.5	3	8	2	-	-	0.7	1.3	95	3.49	15
46.10	12.5	5.4	-	12.6	0.5	4.2	5.4	3	silty CLAY to CLAY	115	1.5	4	8	2	-	-	0.7	1.4	94	3.45	15
46.26	13.3	5.7	-	13.5	0.5	6.3	5.0	3	silty CLAY to CLAY	115	1.5	4	9	2	-	-	0.8	1.5	90	3.40	15

* Indicates the parameter was calculated using the normalized point stress.
The parameters listed above were determined using empirical correlations.
A Professional Engineer must determine their suitability for analysis and design.

US 101 Blossom Hill Rd IC Improvement Project

Project ID: Parikh Consultants
Data File: SDF(112).cpt
CPT Date: 9/26/2018 10:57:33 AM
GW During Test: 35 ft

Sounding ID: CPT-18-NO-005
Project No: 2016-146
Cone/Rig: DDG1418

Depth ft	qc PS tsf	* qc1n PS -	q1ncs PS -	* qt PS tsf	Slv Stss tsf	pore prss (psi)	Frct Rato %	* Mat Typ Zon	* Material Behavior Description	Unit Wght pcf	Qc to N	* SPT R-N1 60%	SPT R-N 60%	* SPT IcN1 60%	* Rel Den %	* Ftn Ang deg	Und Shr tsf	OCR -	* Fin Ic %	* Ic SBT Indx	* Nk -
46.43	12.5	5.4	-	12.6	0.5	6.6	4.7	3	silty CLAY to CLAY	115	1.5	4	8	2	-	-	0.7	1.4	91	3.42	15
46.59	11.6	5.0	-	11.7	0.4	6.8	4.8	3	silty CLAY to CLAY	115	1.5	3	8	2	-	-	0.7	1.3	95	3.46	15
46.75	10.8	4.6	-	10.9	0.4	7.0	5.5	3	silty CLAY to CLAY	115	1.5	3	7	2	-	-	0.6	1.1	95	3.52	15
46.92	10.2	4.4	-	10.3	0.3	7.3	3.8	3	silty CLAY to CLAY	115	1.5	3	7	2	-	-	0.6	1.1	95	3.47	15
47.08	10.2	4.3	-	10.3	0.3	7.5	4.5	3	silty CLAY to CLAY	115	1.5	3	7	2	-	-	0.6	1.0	95	3.51	15
47.25	10.9	4.6	-	11.0	0.3	8.0	4.0	3	silty CLAY to CLAY	115	1.5	3	7	2	-	-	0.6	1.1	94	3.45	15
47.41	10.7	4.5	-	10.9	0.3	10.6	4.0	3	silty CLAY to CLAY	115	1.5	3	7	2	-	-	0.6	1.1	95	3.46	15
47.57	10.8	4.6	-	11.0	0.3	11.4	4.2	3	silty CLAY to CLAY	115	1.5	3	7	2	-	-	0.6	1.1	95	3.47	15
47.74	10.9	4.6	-	11.2	0.4	12.0	4.9	3	silty CLAY to CLAY	115	1.5	3	7	2	-	-	0.6	1.1	95	3.50	15
47.90	11.8	5.0	-	12.0	0.5	12.5	5.4	3	silty CLAY to CLAY	115	1.5	3	8	2	-	-	0.7	1.3	95	3.49	15
48.07	12.8	5.4	-	13.0	0.5	13.1	5.0	3	silty CLAY to CLAY	115	1.5	4	9	2	-	-	0.7	1.4	92	3.43	15
48.23	11.9	5.0	-	12.2	0.4	13.4	4.7	3	silty CLAY to CLAY	115	1.5	3	8	2	-	-	0.7	1.3	94	3.45	15
48.39	11.0	4.6	-	11.2	0.3	13.8	4.1	3	silty CLAY to CLAY	115	1.5	3	7	2	-	-	0.6	1.1	95	3.46	15
48.56	10.5	4.4	-	10.8	0.3	14.5	4.4	3	silty CLAY to CLAY	115	1.5	3	7	2	-	-	0.6	1.1	95	3.50	15
48.72	10.5	4.4	-	10.9	0.3	15.5	4.4	3	silty CLAY to CLAY	115	1.5	3	7	2	-	-	0.6	1.1	95	3.50	15
48.89	11.0	4.6	-	11.3	0.4	15.9	5.0	3	silty CLAY to CLAY	115	1.5	3	7	2	-	-	0.6	1.1	95	3.51	15
49.05	12.2	5.1	-	12.5	0.4	16.7	4.8	3	silty CLAY to CLAY	115	1.5	3	8	2	-	-	0.7	1.3	94	3.45	15
49.22	14.8	6.1	-	15.1	0.5	17.3	4.4	3	silty CLAY to CLAY	115	1.5	4	10	2	-	-	0.9	1.6	85	3.34	15
49.38	16.4	6.8	-	16.7	0.6	17.8	4.7	3	silty CLAY to CLAY	115	1.5	5	11	3	-	-	1.0	1.9	82	3.31	15
49.54	16.9	7.0	-	17.2	0.7	18.3	5.0	3	silty CLAY to CLAY	115	1.5	5	11	3	-	-	1.0	1.9	82	3.31	15
49.71	18.2	7.5	-	18.6	0.7	18.9	4.3	3	silty CLAY to CLAY	115	1.5	5	12	3	-	-	1.1	2.1	77	3.25	15
49.87	17.4	7.2	-	17.8	0.6	18.8	4.4	3	silty CLAY to CLAY	115	1.5	5	12	3	-	-	1.1	2.0	79	3.27	15
50.04	17.8	7.4	-	18.2	0.7	19.3	4.5	3	silty CLAY to CLAY	115	1.5	5	12	3	-	-	1.1	2.0	78	3.27	15
50.20	17.9	7.4	-	18.3	0.9	19.8	6.0	3	silty CLAY to CLAY	115	1.5	5	12	3	-	-	1.1	2.0	85	3.34	15
50.36	23.6	9.7	-	24.0	1.4	22.0	6.6	3	silty CLAY to CLAY	115	1.5	6	16	4	-	-	1.5	2.8	78	3.26	15
50.53	38.8	15.9	-	39.2	1.4	21.8	4.0	3	silty CLAY to CLAY	115	1.5	11	26	5	-	-	2.6	4.9	54	2.94	15
50.69	45.4	18.6	-	45.5	1.4	5.4	3.3	3	silty CLAY to CLAY	115	1.5	12	30	5	-	-	3.0	5.7	48	2.83	15
50.86	51.6	21.1	-	51.7	1.3	4.9	2.7	4	clayy SILT to silty CLAY	115	2.0	11	26	6	-	-	3.5	6.6	42	2.72	15
51.02	42.0	17.1	-	42.1	1.1	4.8	2.7	4	clayy SILT to silty CLAY	115	2.0	9	21	5	-	-	2.8	5.3	46	2.81	15
51.18	65.1	40.4	101.4	65.2	1.4	4.3	2.2	5	silty SAND to sandy SILT	120	4.0	10	16	10	37	33	-	-	28	2.45	16
51.35	68.5	42.5	104.6	68.6	1.5	2.9	2.2	5	silty SAND to sandy SILT	120	4.0	11	17	10	39	33	-	-	28	2.44	16
51.51	46.1	18.7	-	46.3	1.6	7.8	3.6	3	silty CLAY to CLAY	115	1.5	12	31	5	-	-	3.1	5.8	49	2.85	15
51.68	51.9	21.0	-	52.1	1.6	12.5	3.3	4	clayy SILT to silty CLAY	115	2.0	11	26	6	-	-	3.5	6.5	45	2.78	15
51.84	58.9	23.8	-	59.0	1.6	6.1	2.9	4	clayy SILT to silty CLAY	115	2.0	12	29	6	-	-	4.0	7.5	41	2.71	15
52.00	63.1	25.5	-	63.1	1.6	4.5	2.6	4	clayy SILT to silty CLAY	115	2.0	13	32	7	-	-	4.3	8.0	38	2.65	15
52.17	71.5	44.1	90.1	71.5	1.1	3.2	1.6	5	silty SAND to sandy SILT	120	4.0	11	18	10	40	33	-	-	24	2.33	16
52.33	65.0	40.0	79.9	65.0	0.8	3.3	1.3	5	silty SAND to sandy SILT	120	4.0	10	16	9	37	32	-	-	23	2.31	16
52.50	145.1	89.3	102.4	145.2	1.0	2.4	0.7	6	clean SAND to silty SAND	125	5.0	18	29	17	63	37	-	-	9	1.85	16
52.66	163.5	100.5	107.2	163.6	0.8	6.1	0.5	6	clean SAND to silty SAND	125	5.0	20	33	18	67	38	-	-	7	1.74	16
52.82	135.4	83.2	104.5	135.5	1.2	4.4	0.9	6	clean SAND to silty SAND	125	5.0	17	27	16	61	37	-	-	12	1.96	16
52.99	118.8	72.9	91.8	118.8	0.9	2.9	0.8	6	clean SAND to silty SAND	125	5.0	15	24	14	57	36	-	-	12	1.97	16
53.15	116.1	71.2	84.7	116.2	0.7	4.2	0.6	6	clean SAND to silty SAND	125	5.0	14	23	13	56	36	-	-	10	1.90	16
53.32	108.8	66.6	90.8	108.8	1.0	2.4	0.9	6	clean SAND to silty SAND	125	5.0	13	22	13	54	36	-	-	14	2.04	16
53.48	108.3	66.3	90.5	108.4	1.0	1.0	0.9	6	clean SAND to silty SAND	125	5.0	13	22	13	53	36	-	-	14	2.05	16
53.64	111.7	68.3	92.8	111.7	1.1	-0.6	1.0	6	clean SAND to silty SAND	125	5.0	14	22	14	54	36	-	-	14	2.04	16
53.81	115.4	70.4	98.7	115.3	1.3	-2.7	1.1	5	silty SAND to sandy SILT	120	4.0	18	29	14	55	36	-	-	15	2.07	16
53.97	175.9	107.3	122.4	175.8	1.4	-4.8	0.8	6	clean SAND to silty SAND	125	5.0	21	35	20	69	38	-	-	9	1.84	16
54.14	165.2	100.7	121.4	165.1	1.6	-3.4	1.0	6	clean SAND to silty SAND	125	5.0	20	33	19	67	38	-	-	11	1.92	16
54.30	156.8	95.5	109.6	156.8	1.1	-2.9	0.7	6	clean SAND to silty SAND	125	5.0	19	31	18	65	38	-	-	9	1.85	16
54.46	161.1	97.9	109.8	161.0	1.1	-2.7	0.7	6	clean SAND to silty SAND	125	5.0	20	32	18	66	38	-	-	9	1.82	16
54.63	163.1	99.1	110.1	163.1	1.0	-4.2	0.6	6	clean SAND to silty SAND	125	5.0	20	33	18	67	38	-	-	8	1.81	16
54.79	159.3	96.7	104.5	159.2	0.8	-5.0	0.5	6	clean SAND to silty SAND	125	5.0	19	32	17	66	38	-	-	7	1.76	16
54.96	151.6	91.9	96.3	151.5	0.6	-4.3	0.4	6	clean SAND to silty SAND	125	5.0	18	30	16	64	38	-	-	6	1.72	16
55.12	141.4	85.7	93.9	141.3	0.6	-4.2	0.5	6	clean SAND to silty SAND	125	5.0	17	28	16	62	37	-	-	8	1.79	16
55.28	141.5	85.6	92.3	141.4	0.6	-4.6	0.4	6	clean SAND to silty SAND	125	5.0	17	28	15	62	37	-	-	7	1.76	16
55.45	132.7	80.2	88.8	132.6	0.6	-2.6	0.4	6	clean SAND to silty SAND	125	5.0	16	27	15	60	37	-	-	8	1.80	16
55.61	140.9	85.1	90.9	140.9	0.5	-2.9	0.4	6	clean SAND to silty SAND	125	5.0	17	28	15	62	37	-	-	7	1.74	16
55.78	148.7	89.7	95.0	148.6	0.6	-2.8	0.4	6	clean SAND to silty SAND	125	5.0	18	30	16	63	37	-	-	7	1.73	16
55.94	143.7	86.6	109.7	143.6	1.4	-2.7	1.0	6	clean SAND to silty SAND	125	5.0	17	29	17	62	37	-	-	12	1.97	16
56.11	147.9	89.1	103.0	147.9	1.0	-2.5	0.7	6	clean SAND to silty SAND	125	5.0	18	30	17	63	37	-	-	10	1.86	16
56.27	154.8	93.1	104.8	154.8	1.0	-1.8	0.6	6	clean SAND to silty SAND	125	5.0	19	31	17	65	38	-	-	9	1.83	16
56.43	143.2	86.0	99.0	143.1	0.9	-1.9	0.6	6	clean SAND to silty SAND	125	5.0	17	29	16	62	37	-	-	9	1.86	16
56.60	145.2	87.1	91.2	145.1	0.5	-3.1	0.3	6	clean SAND to silty SAND	125	5.0	17	29	15	62	37	-	-	6	1.71	16
56.76	139.9	83.9	92.6	139.8	0.6	-2.7	0.5	6	clean SAND to silty SAND	125	5.0	17	28	15	61	37	-	-	8	1.80	16
56.93	124.1	74.4	88.1	124.1	0.7	-2.6	0.6	6	clean SAND to silty SAND	125	5.0	15	25	14	57	36	-	-	10	1.90	16
57.09	113.3	67.8	85.2	113.2	0.8	-3.9	0.7	6	clean SAND to silty SAND	125	5.0	14	23	13	54	36	-	-	12	1.96	16
57.25	103.1	61.7	84.1	103.0	0.8	-4.8	0.8	6	clean SAND to silty SAND	125	5.0	12	21	12	51	35	-	-	14	2.05	16
57.42	96.6	57.7	87.3	96.5	1.0	-5.3	1.1	5	silty SAND to sandy SILT	120	4.0	14	24	12	49	35	-	-	17	2.13	16
57.58	94.4	56.4	94.5	94.3	1.3	-5.4	1.4	5	silty SAND to sandy SILT	120	4.0	14	24	12	48	35	-	-	19	2.20	16
57.75	95.6	57.0	99.1	95.5	1.4	-5.4	1.5	5	silty SAND to sandy SILT	120	4.0	14	24	12	48	35	-	-	20	2.23	16
57.91	102.7	61.2	101.4	102.6	1.5	-5.5	1.5	5	silty SAND to sandy SILT	120	4.0	15	26	13	51	35	-	-	19	2.20	16
58.07	119.3	71.0	94.3	119.1	1.1	-5.7	0.9	6	clean SAND to silty SAND	125	5.0	14	24	14	56	36	-	-	14	2.02	16
58.24	156.9	93.3	106.1	156.7	1.0	-5.8	0.7	6	clean SAND to silty SAND	125	5.0	19	31	17	65	38	-	-	9	1.84	16
58.40	193.9	115.2	117.6	193.8	0.9	-5.7	0.5	6	clean SAND to silty SAND	125	5.0	23	39	20	72	39	-	-	6	1.67	16
58.57	189.1	112.2	111.8	189.0	0.7	-4.6	0.4	6	clean SAND to silty SAND	125	5.0	22	38	19	71	39	-	-	5	1.64	16
58.73	178.5	105.9	113.4	178.4	1.0	-5.9	0.6	6	clean SAND to silty SAND	125	5.0	21	36	19	69	38	-	-	7	1.75	16
58.89	146.1	86.6	114.7	146.0	1.7	-6.6	1.2	6	clean SAND to silty SAND	125	5.0	17	29	17	62	37	-	-	13	2.02	16
59.06	100.5	59.5	123.6	100.4	2.3	-6.8	2.4	5	silty SAND to sandy SILT	120	4.0	15	25	13	50	35	-	-	24	2.34	16
59.22	70.3	26.5	-	70.2	2.5	-6.9	3.7	4	clayy SILT to silty CLAY	115	2.0	13	35	7	-	-	4.8	8.2	42	2.73	15
59.39	61.7	23.3	-	61.6	2.1	-6.7	3.7	4	clayy SILT to silty CLAY	115	2.0	12	31	7	-	-	4.2	7.1	45	2.78	15
59.55	68.1	25.7	-	68.0	1.9	-6.7	2.9	4	clayy SILT to silty CLAY	115	2.0	13	34	7	-	-	4.6	7.9	39	2.68	15
59.71	72.6	27.4	-	72.4	2.1	-6.7	3.1	4	clayy SILT to silty CLAY	115	2.0	14	36	7	-	-	4.9	8.4	39	2.67	15
59.88	80.5	30.4	-	80.4	2.1	-6.7	2.8	4	clayy SILT to silty CLAY	115	2.0	15	40	8	-	-	5.5	9.4	36	2.60	15
60.04	116.8	68.8	111.0	116.7	1.8	-6.6	1.6	5	silty SAND to sandy SILT	120	4.0	17	29	14	55	36	-	-	18	2.18	16
60.21	182.2	107.2	123.0	182.0	1.5	-6.5	0.9	6	clean SAND to silty SAND	125	5.0	21	36	20	69	38	-	-	9	1.85	16
60.37	255.4	150.2	151.1	255.3	1.6	-6.5	0.6	6	clean SAND to silty SAND	125	5.0	30	51	26	80	40	-	-	5	1.65	16
60.53	284.0	166.8	166.8	283.9	1.8	-6.5	0.6	6	clean SAND to silty SAND	125	5.0	33	57	29	84	41	-	-	5	1.61	16
60.70	319.3	187.3	187.3	319.1	1.2	-6.4	0.4	6	clean SAND to silty SAND	125	5.0	37	64	30	88	41	-	-	5	1.44	16
60.86	320.0	187.6	187.6	319.8	1.0	-6.3	0.3	6	clean SAND to silty SAND	125	5.0	38	64	30	88	41	-	-	5	1.39	16
61.03	279.6	163.8	163.8	279.5	1.6	-6.2	0.6	6	clean SAND to silty SAND	125	5.0	33	56	28	83	41	-	-	5	1.59	16
61.19	217.0	127.0	147.8	216.9	2.4	-3.7	1.1	6	clean SAND to silty SAND	125	5.0	25	43	24	75	39	-	-	10	1.87	16
61.35	166.0	97.1	141.2	166.0	2.9	-3.9	1.8	5	silty SAND to sandy SILT	120	4.0	24	42	20	66	38	-	-	16	2.10	16
61.52	116.4	68.0	146.4	116.3	3.3	-3.9	2.9	5	silty SAND to sandy SILT	120	4.0	17	29	15	54	36	-	-	25	2.36	16
61.68	77.4	29.2	-	77.3	2.5	-5.0	3.4	4	clayy SILT to silty CLAY	115	2.0	15	39	8	-	-	5.3	8.8	39	2.68	15

* Indicates the parameter was calculated using the normalized point stress.
The parameters listed above were determined using empirical correlations.
A Professional Engineer must determine their suitability for analysis and design.

Middle Earth Geo Testing

US 101 Blossom Hill Rd IC Improvement Project

Project ID: Parikh Consultants
Data File: SDF(112).cpt
CPT Date: 9/26/2018 10:57:33 AM
GW During Test: 35 ft

Sounding ID: CPT-18-NO-005
Project No: 2016-146
Cone/Rig: DDG1418

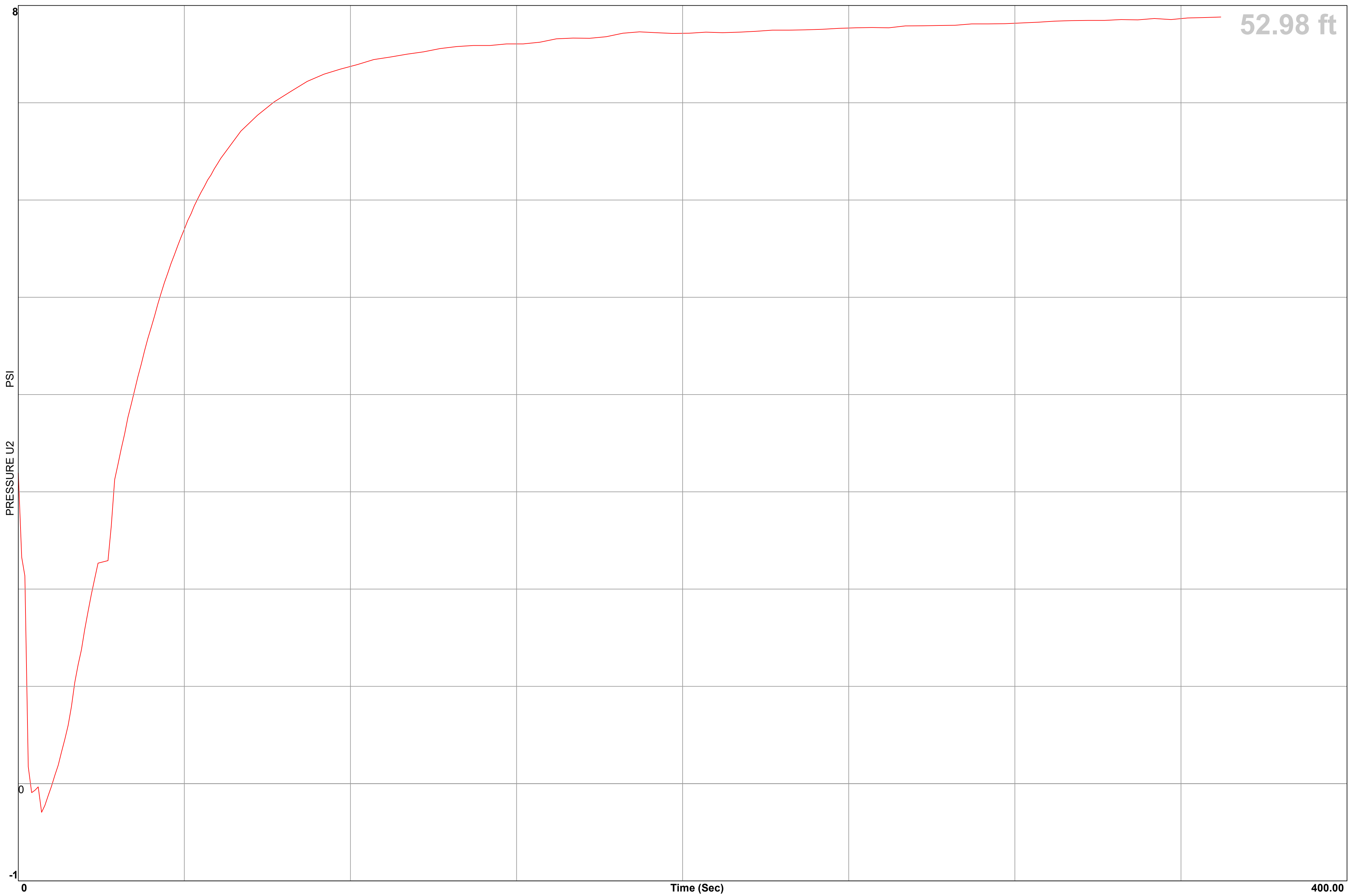
. Depth ft	. qc PS tsf	* qc1n PS -	. q1ncs PS -	* qt PS tsf	. Slv Stss tsf	. pore prss (psi)	. Frct Rato %	* Mat Typ Zon	* Material Behavior Description	. Unit Wght pcf	. Qc to N	* SPT R-N1 60%	. SPT R-N 60%	* SPT IcN1 60%	* Rel Den %	* Ftn Ang deg	. Und Shr tsf	. OCR - -	* Fin Ic %	* Ic SBT Indx	* Nk - -
61.85	41.1	15.5	-	41.0	1.5	-5.2	4.0	3	silty CLAY to CLAY	115	1.5	10	27	5	-	-	2.7	4.5	55	2.95	15
62.01	33.2	12.5	-	33.1	1.2	-5.0	3.9	3	silty CLAY to CLAY	115	1.5	8	22	4	-	-	2.1	3.5	60	3.03	15
62.17	38.8	14.6	-	38.7	1.1	-4.6	3.2	3	silty CLAY to CLAY	115	1.5	10	26	4	-	-	2.5	4.2	53	2.91	15
62.34	22.7	8.6	-	22.6	0.9	-4.7	4.5	3	silty CLAY to CLAY	115	1.5	6	15	3	-	-	1.4	2.3	74	3.22	15
62.50	17.7	6.7	-	17.6	0.6	-4.7	4.0	3	silty CLAY to CLAY	115	1.5	4	12	3	-	-	1.1	1.7	81	3.30	15
62.67	17.2	6.5	-	17.2	0.5	-4.1	3.5	3	silty CLAY to CLAY	115	1.5	4	11	3	-	-	1.0	1.6	79	3.27	15
62.83	16.4	6.2	-	16.3	0.4	-4.0	3.2	3	silty CLAY to CLAY	115	1.5	4	11	2	-	-	1.0	1.5	79	3.28	15
63.00	15.9	6.0	-	15.8	0.4	-3.9	3.1	3	silty CLAY to CLAY	115	1.5	4	11	2	-	-	0.9	1.4	80	3.28	15
63.16	15.5	5.8	-	15.4	0.4	-3.9	3.5	3	silty CLAY to CLAY	115	1.5	4	10	2	-	-	0.9	1.4	83	3.33	15
63.32	16.0	6.0	-	15.9	0.7	-3.8	5.5	3	silty CLAY to CLAY	115	1.5	4	11	3	-	-	0.9	1.4	92	3.42	15
63.49	20.6	7.8	-	20.5	1.4	-3.8	8.1	3	silty CLAY to CLAY	115	1.5	5	14	3	-	-	1.3	2.0	91	3.41	15
63.65	35.9	13.6	-	35.9	1.7	-3.7	5.3	3	silty CLAY to CLAY	115	1.5	9	24	5	-	-	2.3	3.8	64	3.08	15
63.82	44.1	16.7	-	44.1	1.9	-3.7	4.6	3	silty CLAY to CLAY	115	1.5	11	29	5	-	-	2.9	4.7	56	2.96	15
63.98	55.4	20.9	-	55.3	2.7	-3.8	5.2	3	silty CLAY to CLAY	115	1.5	14	37	6	-	-	3.7	6.0	53	2.91	15
64.14	45.3	17.1	-	45.2	2.6	-3.8	6.4	3	silty CLAY to CLAY	115	1.5	11	30	6	-	-	3.0	4.8	62	3.04	15
64.31	29.9	11.3	-	29.8	1.9	-3.9	7.4	3	silty CLAY to CLAY	115	1.5	8	20	4	-	-	1.9	3.0	76	3.24	15
64.47	22.6	8.5	-	22.6	1.3	-3.7	6.7	3	silty CLAY to CLAY	115	1.5	6	15	3	-	-	1.4	2.2	83	3.32	15
64.64	20.2	7.6	-	20.1	1.0	-3.5	6.0	3	silty CLAY to CLAY	115	1.5	5	13	3	-	-	1.2	1.9	84	3.34	15
64.80	19.4	7.3	-	19.3	0.9	-3.2	5.6	3	silty CLAY to CLAY	115	1.5	5	13	3	-	-	1.2	1.8	85	3.34	15
64.96	21.4	8.1	-	21.3	1.0	-3.1	5.5	3	silty CLAY to CLAY	115	1.5	5	14	3	-	-	1.3	2.0	81	3.29	15
65.13	25.2	9.5	-	25.1	1.7	-3.1	7.8	3	silty CLAY to CLAY	115	1.5	6	17	4	-	-	1.6	2.5	83	3.32	15
65.29	38.4	14.5	-	38.3	2.6	-2.9	7.6	3	silty CLAY to CLAY	115	1.5	10	26	5	-	-	2.5	4.0	70	3.16	15
65.46	60.9	23.0	-	60.9	3.6	-2.8	6.3	3	silty CLAY to CLAY	115	1.5	15	41	7	-	-	4.1	6.6	55	2.94	15
65.62	70.8	26.7	-	70.7	3.2	-2.8	4.8	3	silty CLAY to CLAY	115	1.5	18	47	8	-	-	4.8	7.7	47	2.81	15
65.78	58.3	22.0	-	58.2	3.0	-3.1	5.5	3	silty CLAY to CLAY	115	1.5	15	39	7	-	-	3.9	6.2	53	2.92	15
65.95	50.9	19.2	-	50.8	3.4	-2.9	7.2	3	silty CLAY to CLAY	115	1.5	13	34	6	-	-	3.4	5.4	61	3.04	15
66.11	49.7	18.8	-	49.7	3.9	-2.8	8.5	3	silty CLAY to CLAY	115	1.5	13	33	6	-	-	3.3	5.2	65	3.10	15
66.28	74.6	28.1	-	74.5	3.8	-2.6	5.4	3	silty CLAY to CLAY	115	1.5	19	50	8	-	-	5.1	8.1	47	2.82	15
66.44	79.0	29.8	-	78.9	3.5	-2.6	4.7	3	silty CLAY to CLAY	115	1.5	20	53	8	-	-	5.4	8.6	44	2.76	15
66.60	79.5	30.0	-	79.4	2.5	-2.7	3.3	4	clayy SILT to silty CLAY	115	2.0	15	40	8	-	-	5.4	8.6	38	2.66	15
66.77	55.2	20.8	-	55.2	1.2	-2.8	2.2	4	clayy SILT to silty CLAY	115	2.0	10	28	6	-	-	3.7	5.8	40	2.69	15
66.93	32.8	12.4	-	32.8	1.1	-2.8	3.8	3	silty CLAY to CLAY	115	1.5	8	22	4	-	-	2.1	3.3	60	3.03	15
67.10	24.4	9.2	-	24.4	1.4	-2.5	6.8	3	silty CLAY to CLAY	115	1.5	6	16	4	-	-	1.5	2.3	81	3.30	15
67.26	30.4	11.5	-	30.3	1.7	-2.2	6.6	3	silty CLAY to CLAY	115	1.5	8	20	4	-	-	1.9	3.0	73	3.20	15
67.42	49.0	18.5	-	48.9	2.4	-2.2	5.4	3	silty CLAY to CLAY	115	1.5	12	33	6	-	-	3.3	5.1	57	2.97	15
67.59	49.9	18.8	-	49.9	2.3	-2.6	5.0	3	silty CLAY to CLAY	115	1.5	13	33	6	-	-	3.3	5.2	55	2.94	15
67.75	56.2	21.2	-	56.1	2.2	-2.3	4.2	3	silty CLAY to CLAY	115	1.5	14	37	6	-	-	3.8	5.9	49	2.85	15
67.92	71.8	27.1	-	71.7	1.8	-2.7	2.7	4	clayy SILT to silty CLAY	115	2.0	14	36	7	-	-	4.9	7.6	37	2.64	15
68.08	64.7	24.4	-	64.6	1.6	-2.7	2.6	4	clayy SILT to silty CLAY	115	2.0	12	32	6	-	-	4.4	6.8	39	2.67	15
68.24	34.9	13.2	-	34.8	1.2	-2.9	3.9	3	silty CLAY to CLAY	115	1.5	9	23	4	-	-	2.3	3.5	59	3.01	15
68.41	20.8	7.8	-	20.7	0.8	-2.5	4.7	3	silty CLAY to CLAY	115	1.5	5	14	3	-	-	1.3	1.9	79	3.27	15
68.57	18.8	7.1	-	18.8	0.6	-2.3	3.9	3	silty CLAY to CLAY	115	1.5	5	13	3	-	-	1.1	1.7	79	3.27	15
68.74	18.8	7.1	-	18.8	0.8	-2.2	5.6	3	silty CLAY to CLAY	115	1.5	5	13	3	-	-	1.1	1.7	86	3.36	15
68.90	21.1	8.0	-	21.1	1.0	-2.0	5.7	3	silty CLAY to CLAY	115	1.5	5	14	3	-	-	1.3	1.9	82	3.31	15
69.07	33.4	12.6	-	33.4	0.8	-1.8	2.8	3	silty CLAY to CLAY	115	1.5	8	22	4	-	-	2.2	3.3	55	2.95	15
69.23	42.0	15.8	-	41.9	0.9	-2.1	2.5	4	clayy SILT to silty CLAY	115	2.0	8	21	5	-	-	2.8	4.2	47	2.82	15
69.39	27.3	10.3	-	27.3	0.8	-2.1	3.5	3	silty CLAY to CLAY	115	1.5	7	18	3	-	-	1.7	2.6	64	3.08	15
69.56	23.2	8.8	-	23.2	0.8	-1.8	4.2	3	silty CLAY to CLAY	115	1.5	6	15	3	-	-	1.4	2.1	73	3.20	15
69.72	26.8	10.1	-	26.8	0.8	-1.7	3.6	3	silty CLAY to CLAY	115	1.5	7	18	3	-	-	1.7	2.5	65	3.10	15
69.89	20.7	7.8	-	20.6	0.6	-1.7	3.9	3	silty CLAY to CLAY	115	1.5	5	14	3	-	-	1.3	1.8	75	3.23	15
70.05	19.9	7.5	-	19.9	0.6	-1.2	3.6	3	silty CLAY to CLAY	115	1.5	5	13	3	-	-	1.2	1.7	75	3.23	15
70.21	18.1	6.8	-	18.1	0.5	-1.0	3.8	3	silty CLAY to CLAY	115	1.5	5	12	3	-	-	1.1	1.5	80	3.29	15
70.38	16.3	6.2	-	16.3	0.5	-0.9	4.1	3	silty CLAY to CLAY	115	1.5	4	11	3	-	-	0.9	1.3	85	3.35	15
70.54	16.6	6.3	-	16.6	0.5	-0.8	3.9	3	silty CLAY to CLAY	115	1.5	4	11	3	-	-	1.0	1.4	84	3.33	15
70.71	16.5	6.2	-	16.5	0.4	-0.6	3.1	3	silty CLAY to CLAY	115	1.5	4	11	2	-	-	1.0	1.4	79	3.28	15
70.87	16.5	6.2	-	16.4	0.4	-0.5	3.4	3	silty CLAY to CLAY	115	1.5	4	11	2	-	-	1.0	1.4	82	3.31	15
71.03	16.5	6.2	-	16.5	0.5	-0.4	3.8	3	silty CLAY to CLAY	115	1.5	4	11	3	-	-	1.0	1.4	84	3.33	15
71.20	17.5	6.6	-	17.6	0.5	0.8	3.6	3	silty CLAY to CLAY	115	1.5	4	12	3	-	-	1.0	1.5	80	3.28	15
71.36	17.5	6.6	-	17.5	0.5	0.9	3.5	3	silty CLAY to CLAY	115	1.5	4	12	3	-	-	1.0	1.5	80	3.28	15
71.53	18.2	6.9	-	18.2	0.8	1.1	5.4	3	silty CLAY to CLAY	115	1.5	5	12	3	-	-	1.1	1.5	87	3.37	15

* Indicates the parameter was calculated using the normalized point stress.
The parameters listed above were determined using empirical correlations.
A Professional Engineer must determine their suitability for analysis and design.

Middle Earth Geo Testing

Parikh Consultants

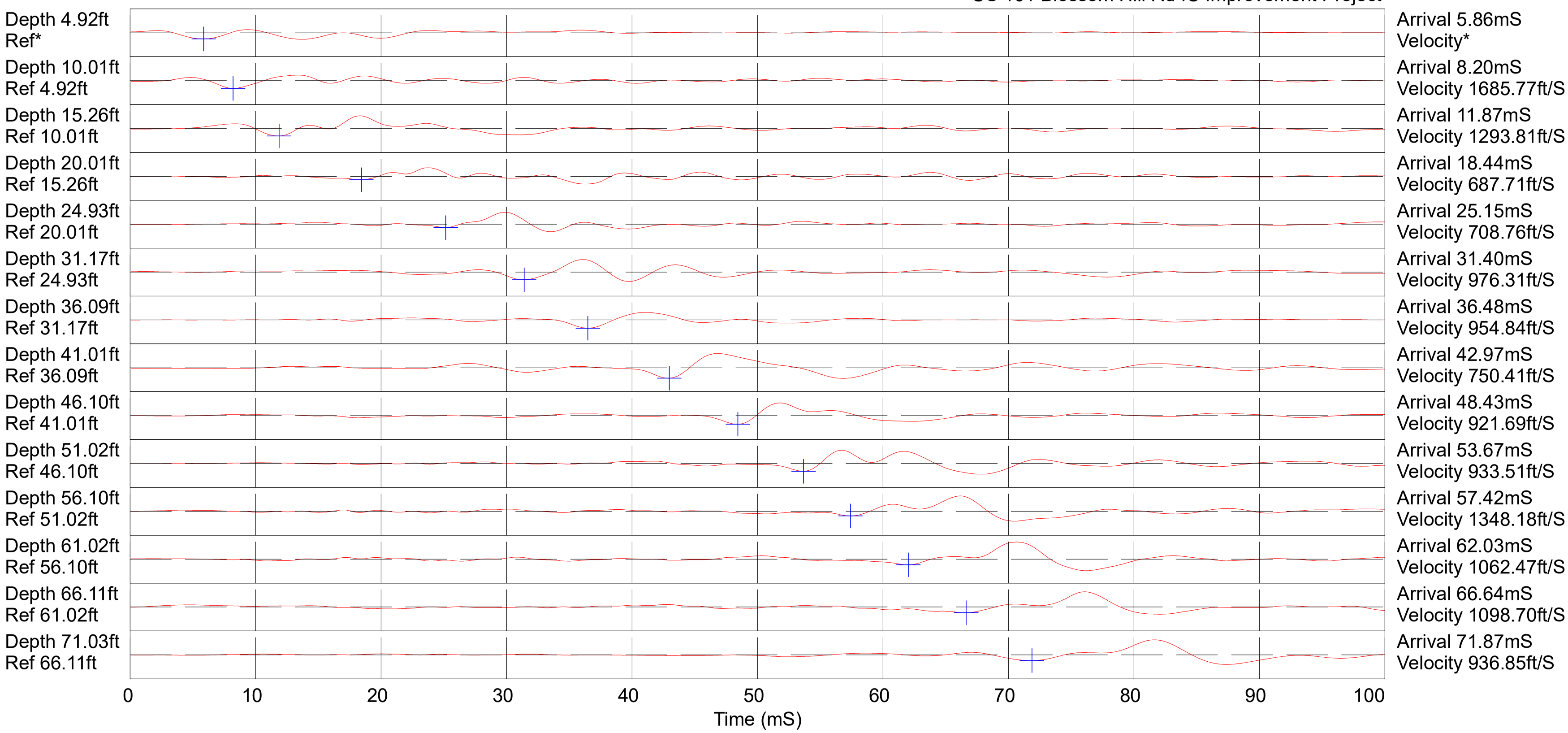
Location	US 101 Blossom Hill Rd IC Improvement Pr	Operator	RB-JM		
Job Number	2016-146	Cone Number	DDG1418	GPS	
Hole Number	CPT-18-NO-005	Date and Time	9/26/2018 10:57:33 AM		
Equilized Pressure	7.8	EST GW Depth During Test	34.8		



CPT-18-NO-005

Parikh Consultants

US 101 Blossom Hill Rd IC Improvement Project



Hammer to Rod String Distance (ft): 5.83

* = Not Determined

COMMENT:

APPENDIX IV

APPENDIX IV
LABORATORY TESTS

Classification Tests

The field classification of the samples was visually verified in the laboratory according to the Unified Soil Classification System. The results are presented on “Log of Test Borings”, Appendix II.

Moisture-Density

The natural moisture contents were determined for selected undisturbed samples of the soils in accordance with American Standard Test Method (ASTM) D-2216 and dry unit weights were calculated based on natural moisture contents and total unit weights. This information was used to classify and correlate the soils. The results are presented on Plate IV-1, "Laboratory Test Summary ", Appendix IV.

Atterberg Limits

The Atterberg Limits were determined for selected samples of the fine-grained materials. These results were used to classify the soils, as well as to obtain an indication of the expansion potential with variations in moisture content. The Atterberg Limits were determined in accordance with ASTM D-4318. The results of the test are presented on Plate IV-2, "Plasticity Chart", Appendix IV.

Grain Size Classification

Grain size classification tests (ASTM D-422) were performed on selected samples of granular soil to aid in the classification. The results are presented on Plates IV-3A and IV-3B, "Grain Size Distribution Curves", Appendix IV.

Unconfined Compression Tests

Strength tests were performed on selected undisturbed samples using unconfined compression machine. Unconfined compression tests were performed in accordance with ASTM D 2166. The results are presented on Plates IV-4A through IV-4J, "Unconfined Compression Test", Appendix IV.

Corrosion Tests

Corrosion tests were performed on selected samples to determine the corrosion potential of the soils. The pH and minimum resistivity tests were performed according to California Test Method CT-643. Sulfate (California Test Method CT-417) and chloride (California Test Method CT-422) tests were performed by Sunland Analytical. The test results are presented on Plates IV-5A through IV-5C, Appendix IV.

LABORATORY TEST SUMMARY

Borehole	Sample Number	Depth	Classi-fication	Water Content	Dry Density	Liquid Limit	Plastic Limit	Plasticity Index	% > Sieve 4	% < Sieve 200	Unconfined Shear Strength (tsf)
R-18-NO-001	1	3.0	SM	22.4	-						
R-18-NO-001	2	6.0	SM	20.4	92.7						
R-18-NO-001	3	11.0	SM	20.2	108.0						
R-18-NO-001	4	16.0	SM	12.1	-				26.6	25.1	
R-18-NO-001	5	21.0	SM	27.5	91.8						
R-18-NO-001	6	26.0	CL	18.2	109.7						0.93
R-18-NO-001	7	31.0	CL	10.3	108.5						0.62
R-18-NO-001	8	36.0	CL	26.7	102.0						
R-18-NO-001	9	41.0	CL	19.6	114.5						
R-18-NO-001	10	46.0	ML	26.0	99.0	28	21	7			
R-18-NO-001	11	51.0	CL-ML	27.3	102.5						0.23
R-18-NO-001	12	56.0	CL	22.2	104.1						0.41
R-18-NO-001	13	61.0	CL	22.6	104.4						
R-18-NO-001	14	71.0	CL	28.3	94.2	37	24	13			0.68
R-18-NO-001	15	81.0	CL	25.2	99.0					85.6	
R-18-NO-001	16	91.0	SC	11.2	-						
R-18-NO-001	17	101.0	GM	8.8	-						
R-18-NO-001	18	111.0	CH	23.3	105.4						
R-18-NO-002	1	3.0	CL	15.9	113.0						
R-18-NO-002	2	6.0	SM	22.0	98.9						
R-18-NO-002	3	11.0	SM	24.2	96.6						
R-18-NO-002	4	16.0	CL	19.0	105.2						0.55
R-18-NO-002	5	21.0	SM	0.4	-						
R-18-NO-002	6	26.0	ML	16.2	-				0.0	60.7	
R-18-NO-002	7	31.0	ML	19.9	101.1	27	17	10			0.28
R-18-NO-002	8	36.0	ML	31.0	-						
R-18-NO-002	9	41.0	ML	21.6	-	31	22	9			
R-18-NO-002	10	46.0	ML	24.5	96.2				0.0	61.2	
R-18-NO-002	11	51.0	CL	10.2	111.8						0.2
R-18-NO-002	12	56.0	CL	25.2	96.8						
R-18-NO-002	13	61.0	SP-SM	12.6	111.1				18.9	10.9	
R-18-NO-002	14	71.0	CL	12.3	-						
R-18-NO-002	15	81.0	SC	31.1	-						
R-18-NO-002	16	90.0	SM	3.9	-						
R-18-NO-002	17	101.0	GM	7.0	-						
R-18-NO-002	18	104.5	SP-SM	7.5	-						
R-18-NO-003	1	3.0	SM	6.6	-						
R-18-NO-003	2	6.0	SM	18.6	-						
R-18-NO-003	3	11.0	SM	18.8	-						
R-18-NO-003	4	16.0	CL	14.5	-				1.5	58.8	
R-18-NO-003	5	21.0	ML	23.2	71.5	NP	NP	NP			
R-18-NO-003	6	26.0	ML	15.7	114.5						0.94
R-18-NO-003	7	31.0	ML	-	-						

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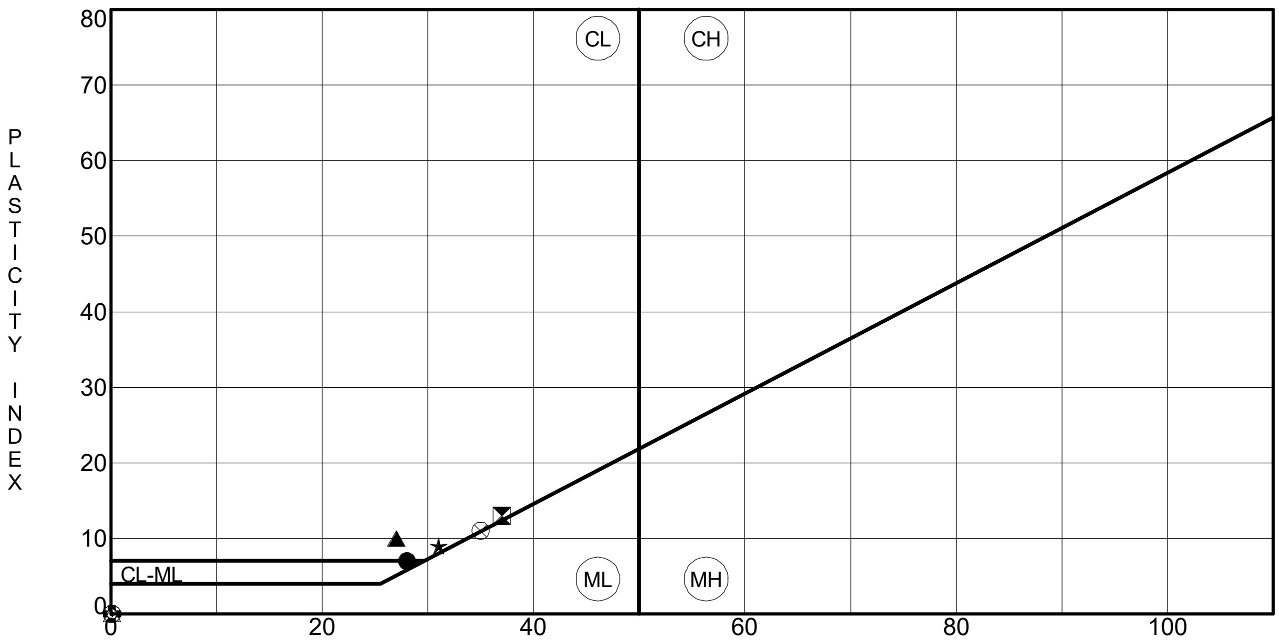
NORTHBOUND 101 ON-RAMP PEDESTRIAN OVERCROSSING
SAN JOSE, CALIFORNIA

JOB NO: 2016-146-NOC | **PLATE NO: IV-1A**

Borehole	Sample Number	Depth	Classi-fication	Water Content	Dry Density	Liquid Limit	Plastic Limit	Plasticity Index	% > Sieve 4	% < Sieve 200	Unconfined Shear Strength (tsf)
R-18-NO-003	8	36.0	ML	23.0	-	NP	NP	NP			
R-18-NO-003	9	41.0	ML	29.2	-	NP	NP	NP			
R-18-NO-003	10	46.0	ML	25.9	-						
R-18-NO-003	11	51.0	SC	21.0	106.3				4.5	36.8	
R-18-NO-003	12	56.0	SC	16.8	-						
R-18-NO-003	13	61.0	ML	15.8	-	NP	NP	NP			
R-18-NO-003	14	71.0	ML	28.2	93.2	35	24	11			0.43
R-18-NO-003	15	81.0	GP-GM	6.4	-						
R-18-NO-003	16	91.0	GP-GM	8.8	-						
R-18-NO-003	17	101.0	SM	8.8	-						
R-18-NO-003	18	111.0	CL	26.5	-						

ATTERBERG LIMITS



PLASTICITY

	BOREHOLE	SAMPLE #	DEPTH	LL	PL	PI	Fines	Classification
●	R-18-NO-001	10	46.0	28	21	7		SILT with SAND
⧗	R-18-NO-001	14	71.0	37	24	13		Lean CLAY
▲	R-18-NO-002	7	31.0	27	17	10		SANDY SILT
★	R-18-NO-002	9	41.0	31	22	9		SILT
⊙	R-18-NO-003	5	21.0	NP	NP	NP		SANDY SILT
✿	R-18-NO-003	8	36.0	NP	NP	NP		SILT
○	R-18-NO-003	9	41.0	NP	NP	NP		SILT
△	R-18-NO-003	13	61.0	NP	NP	NP		SANDY SILT with GRAVEL
⊗	R-18-NO-003	14	71.0	35	24	11		SILT

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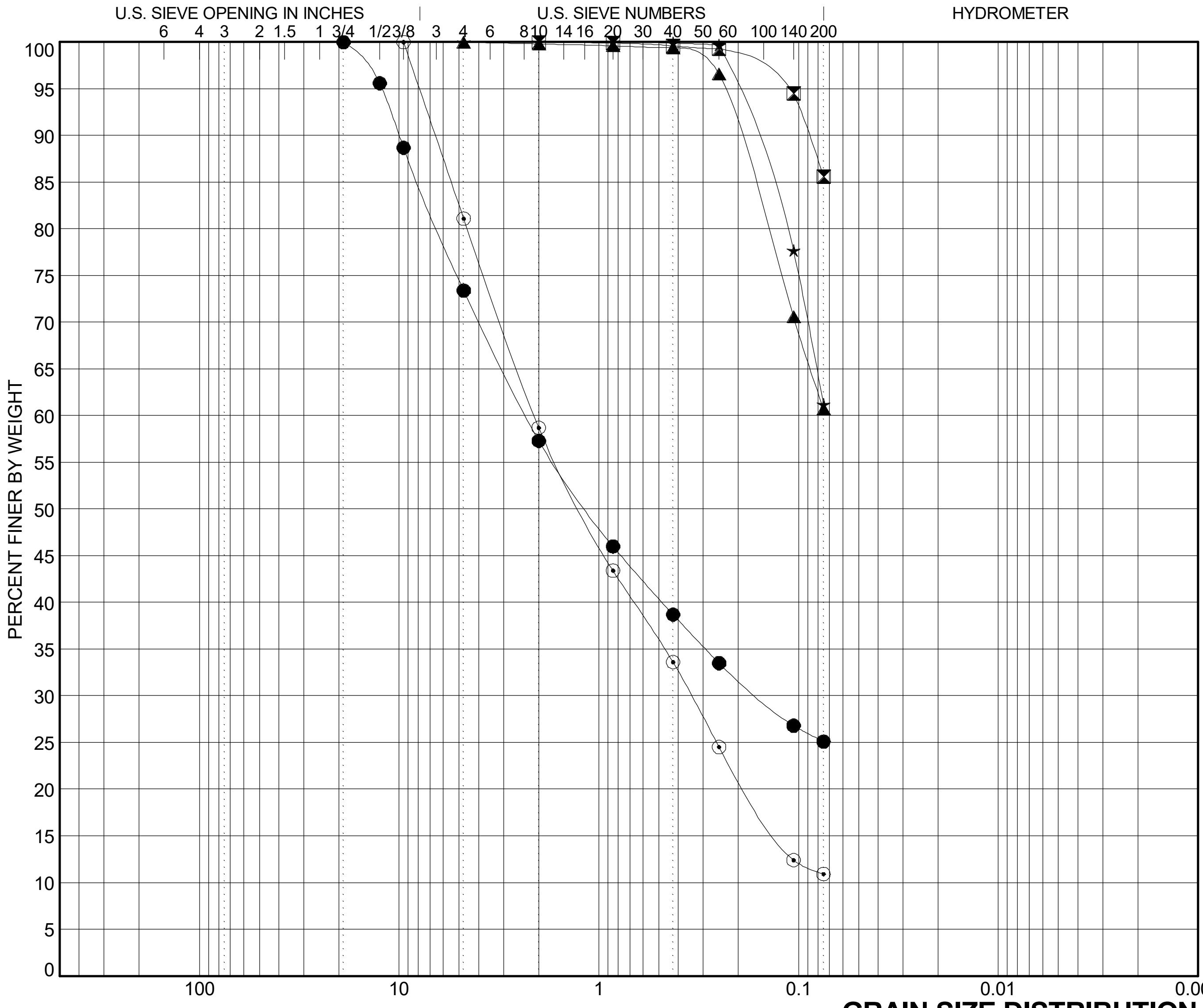
NORTHBOUND 101 ON-RAMP PEDESTRIAN OVERCROSSING
SAN JOSE, CALIFORNIA

JOB NO: 2016-146-NOC | PLATE NO: IV-2

GRAIN SIZE DISTRIBUTION CURVE



GRAIN SIZE DISTRIBUTION

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING	SAMPLE #	DEPTH	Classification	LL	PL	PI	Cc	Cu
●	**R-18-NO-001**	**4**	**16.0**	**SILTY SAND with GRAVEL**					
⧗	**R-18-NO-001**	**15**	**81.0**	**Lean CLAY**					
▲	**R-18-NO-002**	**6**	**26.0**	**SANDY SILT**					
★	**R-18-NO-002**	**10**	**46.0**	**SANDY SILT**					
⊙	**R-18-NO-002**	**13**	**61.0**	**Poorly graded SAND with SILT**				**0.93**	**34.51**

	BORING	SAMPLE #	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt / %Clay
●	**R-18-NO-001**	**4**	**16.0**	**19**	**2.312**	**0.16**		**26.6**	**48.3**	**25.1**
⧗	**R-18-NO-001**	**15**	**81.0**	**2**				**0.0**	**14.4**	**85.6**
▲	**R-18-NO-002**	**6**	**26.0**	**4.75**				**0.0**	**39.3**	**60.7**
★	**R-18-NO-002**	**10**	**46.0**	**4.75**				**0.0**	**38.8**	**61.2**
⊙	**R-18-NO-002**	**13**	**61.0**	**9.5**	**2.103**	**0.345**		**18.9**	**70.2**	**10.9**

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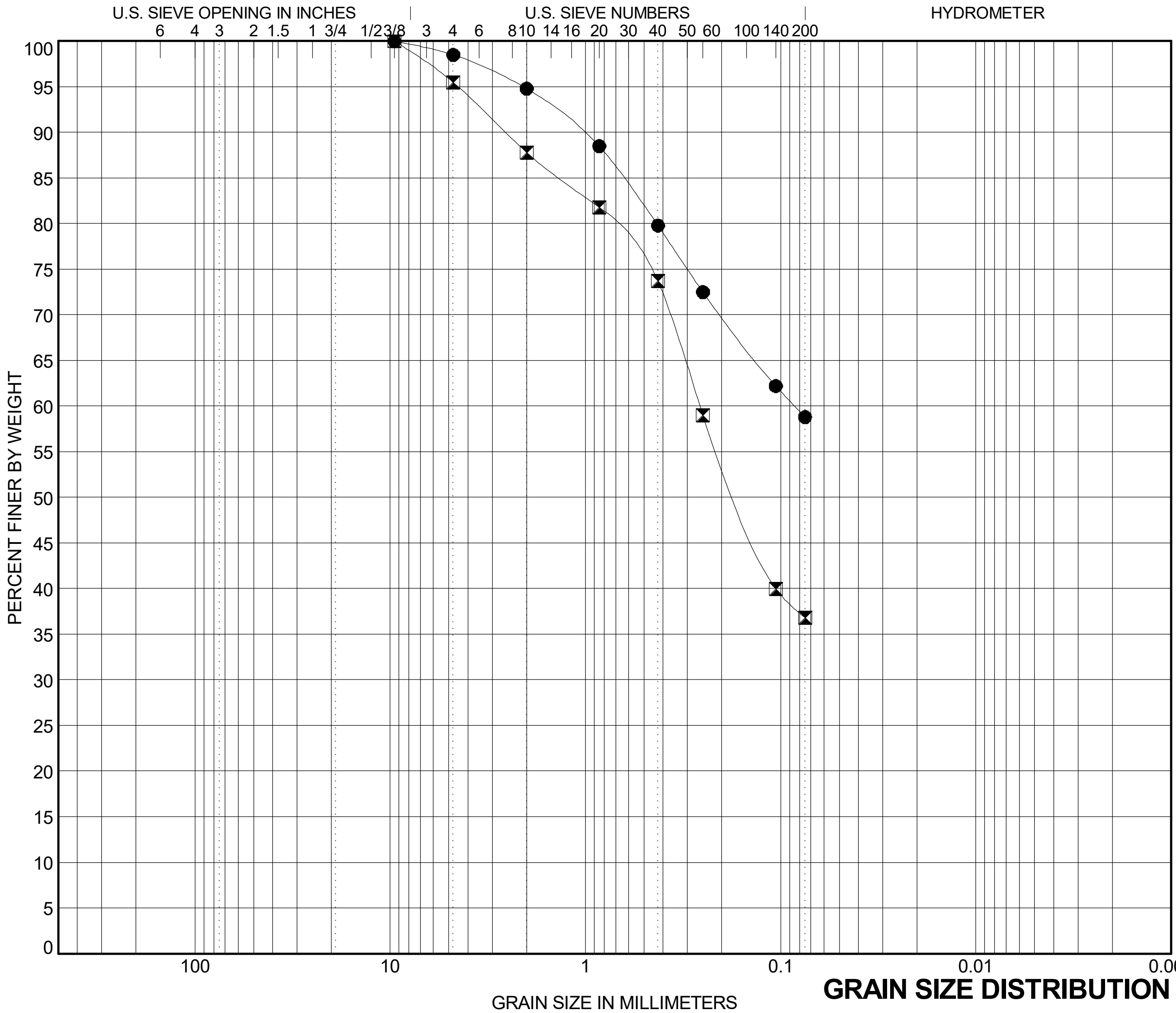
NORTHBOUND 101 ON-RAMP PEDESTRIAN OVERCROSSING
SAN JOSE, CALIFORNIA

JOB NO: 2016-146-NOC | **PLATE NO: IV-3A**



GRAIN SIZE DISTRIBUTION

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING	SAMPLE #	DEPTH	Classification	LL	PL	PI	Cc	Cu
●	**R-18-NO-003**	**4**	**16.0**	**SANDY lean CLAY**					
⧗	**R-18-NO-003**	**11**	**51.0**	**CLAYEY SAND**					

	BORING	SAMPLE #	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**R-18-NO-003**	**4**	**16.0**	**9.5**	**0.085**			**1.5**	**39.7**	**58.8**	
⧗	**R-18-NO-003**	**11**	**51.0**	**9.5**	**0.259**			**4.5**	**58.7**	**36.8**	

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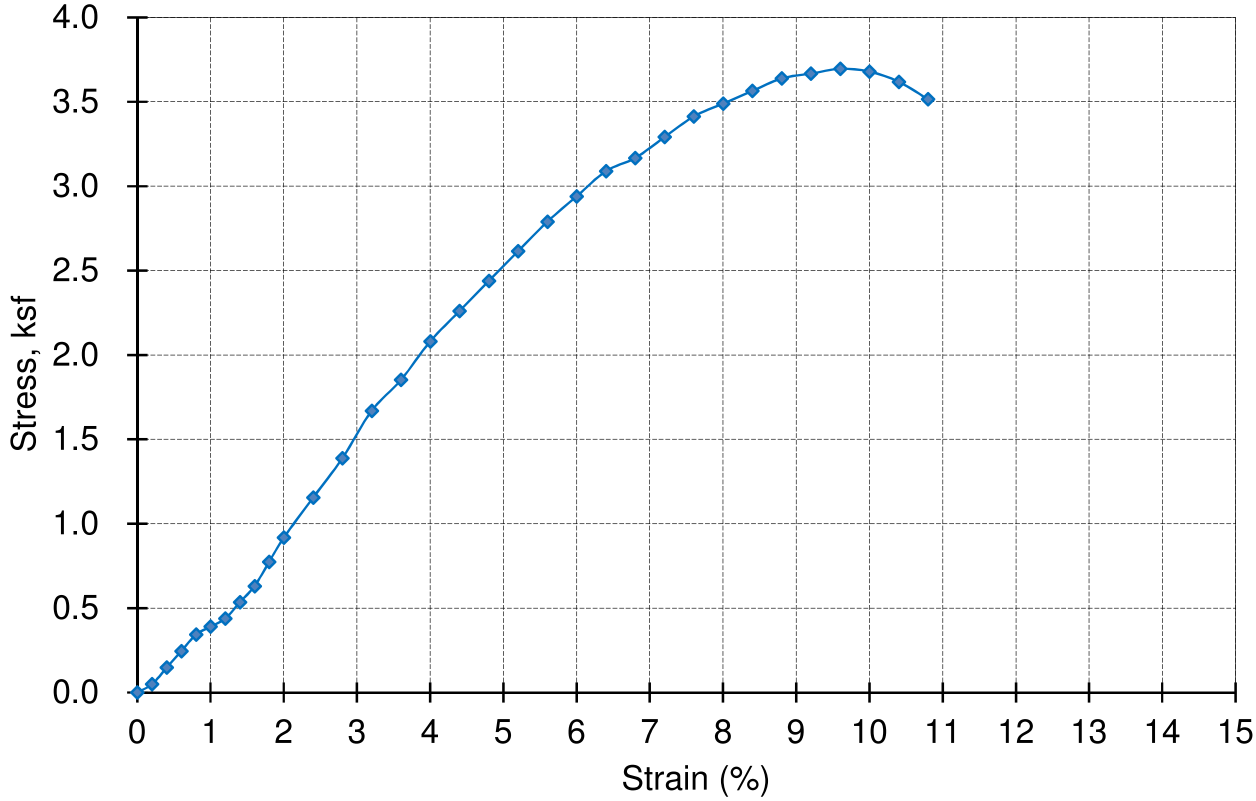
NORTHBOUND 101 ON-RAMP PEDESTRIAN OVERCROSSING
SAN JOSE, CALIFORNIA

JOB NO: 2016-146-NOC | **PLATE NO: IV-3B**

UNCONFINED COMPRESSION TEST

UNCONFINED COMPRESSION TEST

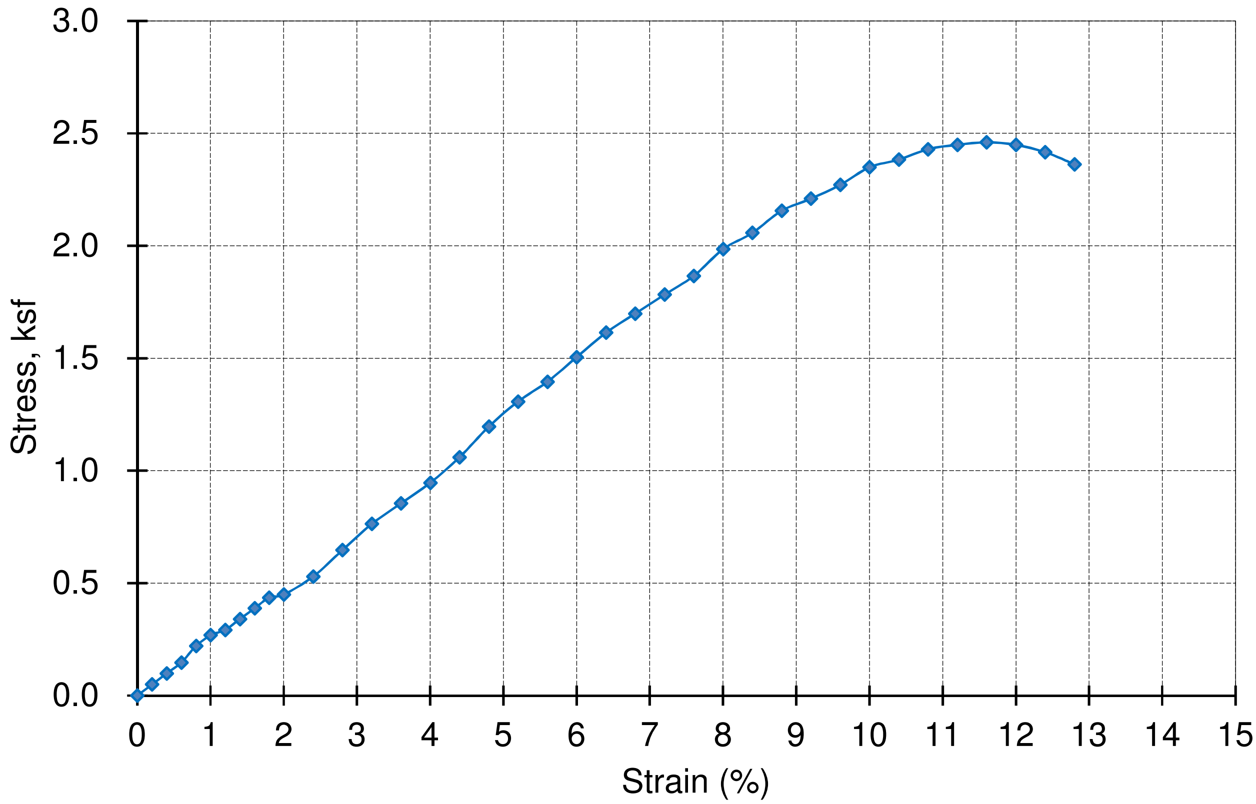


Boring No.:	R-18-NO-001	**Unconfined Compressive Strength (ksf):**	3.70
Sample No. :	6	**Shear Strength (ksf)**	1.85
Depth (feet):	26	**Strain @ Failure (%):**	9.6
Sample Type:	MC - 2.416 inch dia.	**Initial Dry Density (pcf):**	110
Test Method	ASTM D2166	**Water Content (%):**	18.2
Material Type:	CL		
Material Description:	SANDY LEAN CLAY		

Initial Height (inch): 5.00
Initial Diameter (inch) 2.42
Initial Area (ft^2): 0.032
Strain Rate (inch/min) 0.1

Remarks:

UNCONFINED COMPRESSION TEST



Boring No.:	R-18-NO-001	**Unconfined Compressive Strength (ksf):**	2.46
Sample No. :	7	**Shear Strength (ksf)**	1.23
Depth (feet):	31	**Strain @ Failure (%):**	11.6
Sample Type:	MC - 2.416 inch dia.	**Initial Dry Density (pcf):**	109
Test Method	ASTM D2166	**Water Content (%):**	10.3
Material Type:	CL		
Material Description:	SANDY LEAN CLAY		

Initial Height (inch):	5.00
Initial Diameter (inch)	2.42
Initial Area (ft^2):	0.032
Strain Rate (inch/min)	0.1

Remarks:

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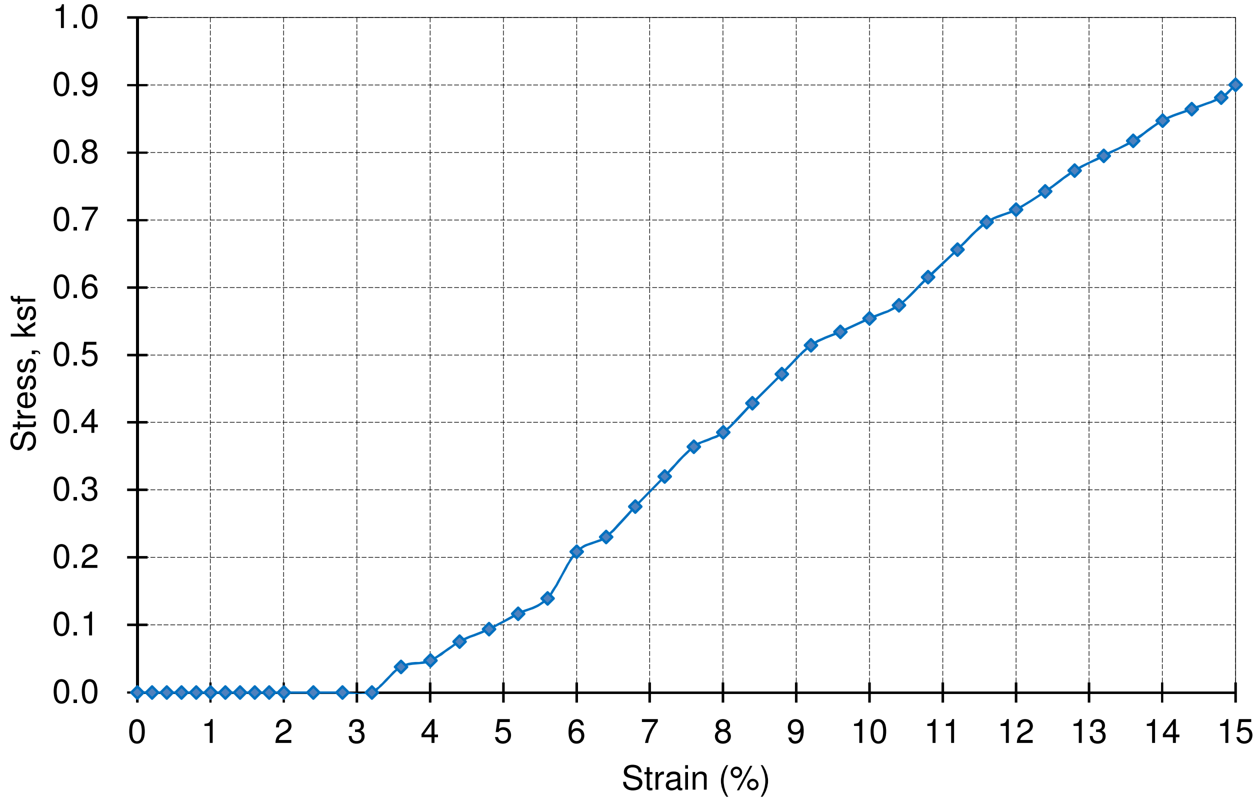
NORTHBOUND 101 ON-RAMP PEDESTRIAN OVERCROSSING
SAN JOSE. CALIFORNIA

JOB NO.: 2016-146-NOC | **PLATE NO.: IV-4B**

UNCONFINED COMPRESSION TEST



Boring No.:	R-18-NO-001	**Unconfined Compressive Strength (ksf):**	0.90
Sample No. :	11	**Shear Strength (ksf)**	0.45
Depth (feet):	51	**Strain @ Failure (%):**	15.0
Sample Type:	MC - 2.416 inch dia.	**Initial Dry Density (pcf):**	103
Test Method	ASTM D2166	**Water Content (%):**	27.3
Material Type:	CL-ML		
Material Description:	SILTY CLAY WITH SAND		

Initial Height (inch):	5.00
Initial Diameter (inch)	2.42
Initial Area (ft^2):	0.032
Strain Rate (inch/min)	0.1

Remarks:

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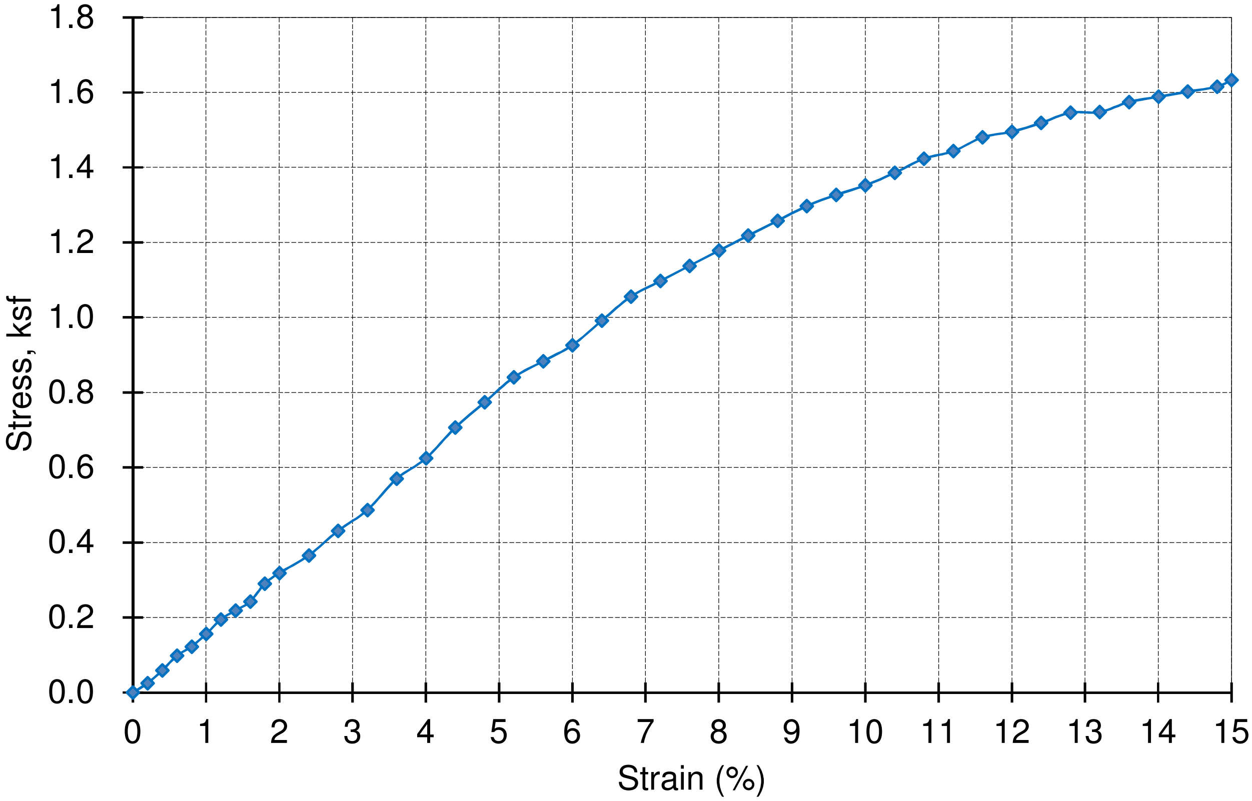
NORTHBOUND 101 ON-RAMP PEDESTRIAN OVERCROSSING SAN JOSE. CALIFORNIA	
JOB NO.: 2016-146-NOC	**PLATE NO.: IV-4C**

UNCONFINED COMPRESSION TEST



Boring No.:	R-18-NO-001
Sample No. :	12
Depth (feet):	56
Sample Type:	MC - 2.416 inch dia.
Test Method	ASTM D2166
Material Type:	CL
Material Description:	SANDY LEAN CLAY

Unconfined Compressive Strength (ksf):	1.63
Shear Strength (ksf)	0.82
Strain @ Failure (%):	15.0
Initial Dry Density (pcf):	104
Water Content (%):	22.2

Initial Height (inch):	5.00
Initial Diameter (inch)	2.42
Initial Area (ft^2):	0.032
Strain Rate (inch/min)	0.1

Remarks:

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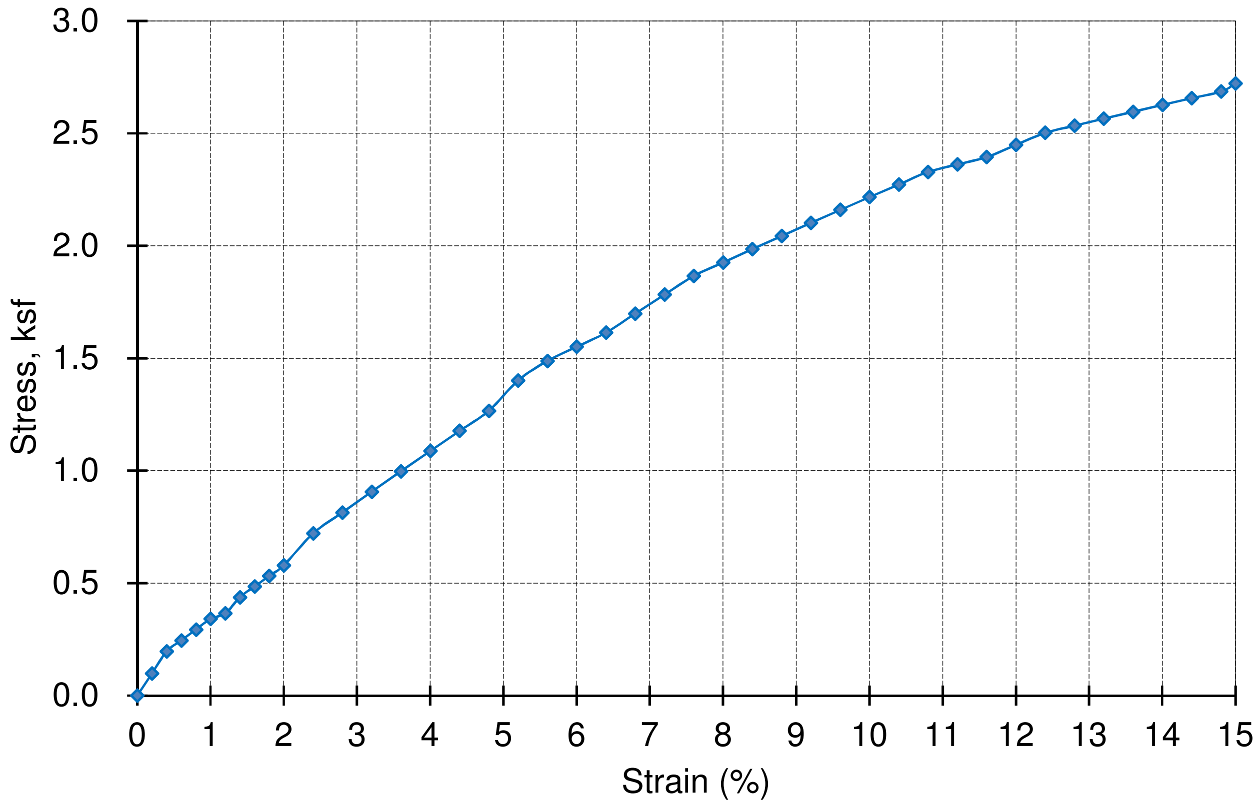
NORTHBOUND 101 ON-RAMP PEDESTRIAN OVERCROSSING
SAN JOSE. CALIFORNIA

JOB NO.: 2016-146-NOC | **PLATE NO.: IV-4D**

UNCONFINED COMPRESSION TEST



Boring No.:	R-18-NO-001	**Unconfined Compressive Strength (ksf):**	2.72
Sample No. :	14	**Shear Strength (ksf)**	1.36
Depth (feet):	71	**Strain @ Failure (%):**	15.0
Sample Type:	MC - 2.416 inch dia.	**Initial Dry Density (pcf):**	94
Test Method	ASTM D2166	**Water Content (%):**	28.3
Material Type:	CL		
Material Description:	LEAN CLAY		

Initial Height (inch):	5.00
Initial Diameter (inch)	2.42
Initial Area (ft^2):	0.032
Strain Rate (inch/min)	0.1

Remarks:

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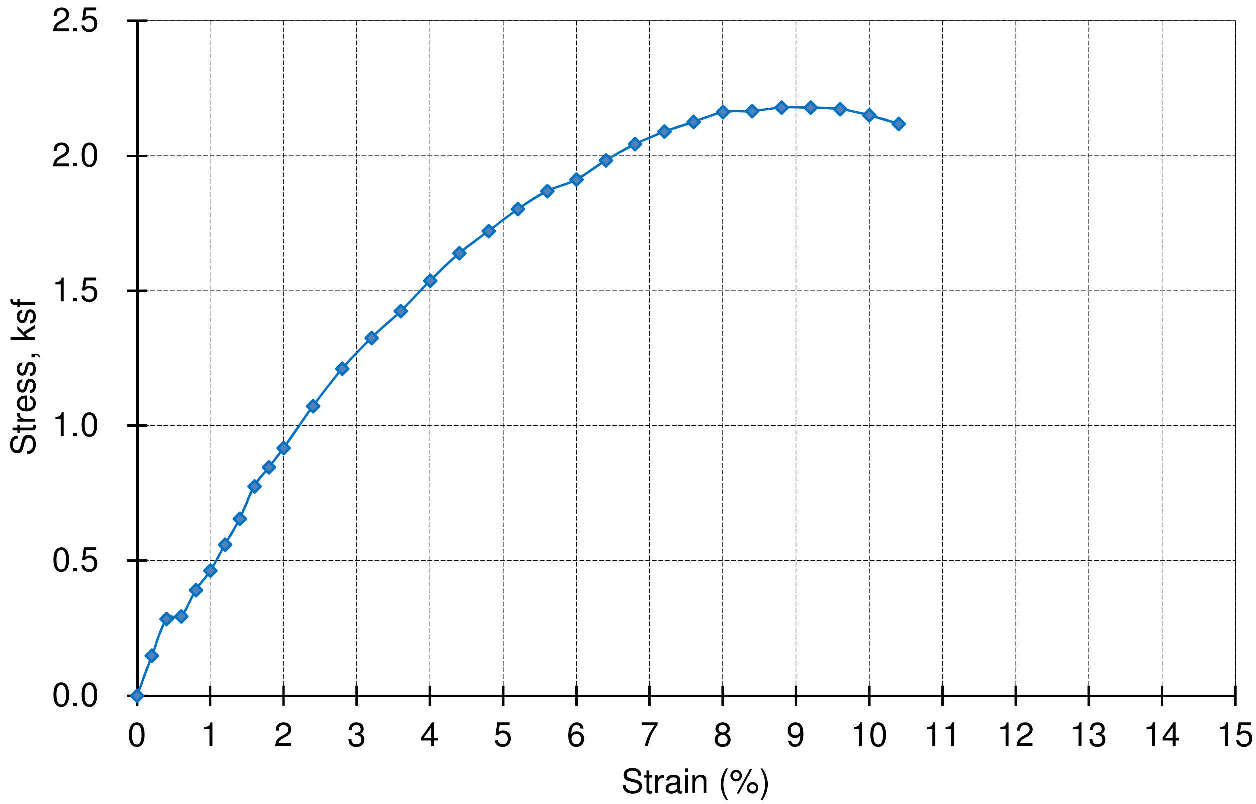
NORTHBOUND 101 ON-RAMP PEDESTRIAN OVERCROSSING SAN JOSE. CALIFORNIA	
JOB NO.: 2016-146-NOC	**PLATE NO.: IV-4E**

UNCONFINED COMPRESSION TEST



Boring No.:	R-18-NO-002	**Unconfined Compressive Strength (ksf):**	2.18
Sample No. :	4	**Shear Strength (ksf)**	1.09
Depth (feet):	16	**Strain @ Failure (%):**	8.8
Sample Type:	MC - 2.416 inch dia.	**Initial Dry Density (pcf):**	105
Test Method	ASTM D2166	**Water Content (%):**	19.0
Material Type:	CL		
Material Description:	SANDY LEAN CLAY		

Initial Height (inch): 5.00
Initial Diameter (inch) 2.42
Initial Area (ft^2): 0.032
Strain Rate (inch/min) 0.1

Remarks:

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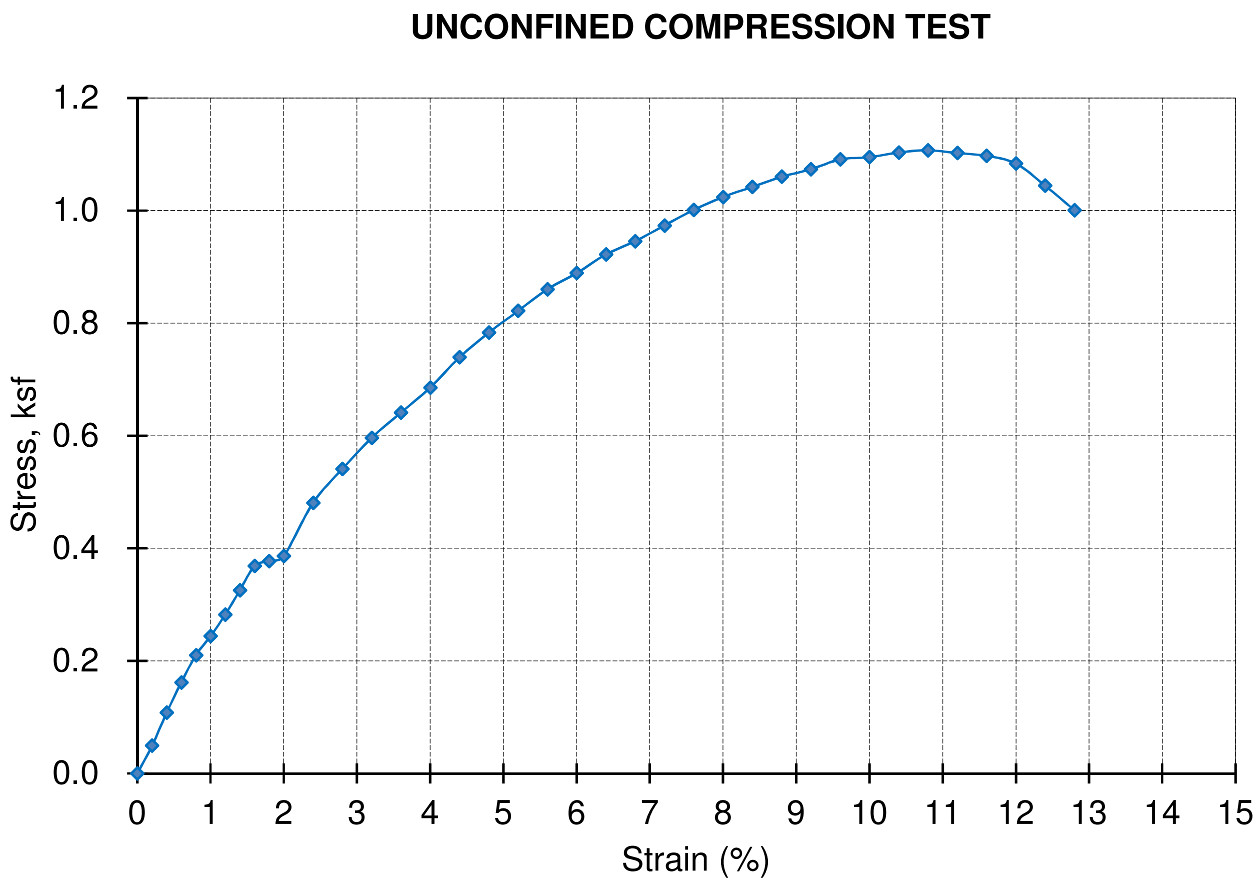
Practicing in the Geosciences

NORTHBOUND 101 ON-RAMP PEDESTRIAN OVERCROSSING
SAN JOSE. CALIFORNIA

JOB NO.: 2016-146-NOC | **PLATE NO.: IV-4F**



Boring No.:	R-18-NO-002	**Unconfined Compressive Strength (ksf):**	1.11
Sample No. :	7	**Shear Strength (ksf)**	0.55
Depth (feet):	31	**Strain @ Failure (%):**	10.8
Sample Type:	MC - 2.416 inch dia.	**Initial Dry Density (pcf):**	101
Test Method	ASTM D2166	**Water Content (%):**	19.9
Material Type:	ML		
Material Description:	SANDY SILT		

Initial Height (inch):	5.00
Initial Diameter (inch)	2.42
Initial Area (ft^2):	0.032
Strain Rate (inch/min)	0.1

Remarks:

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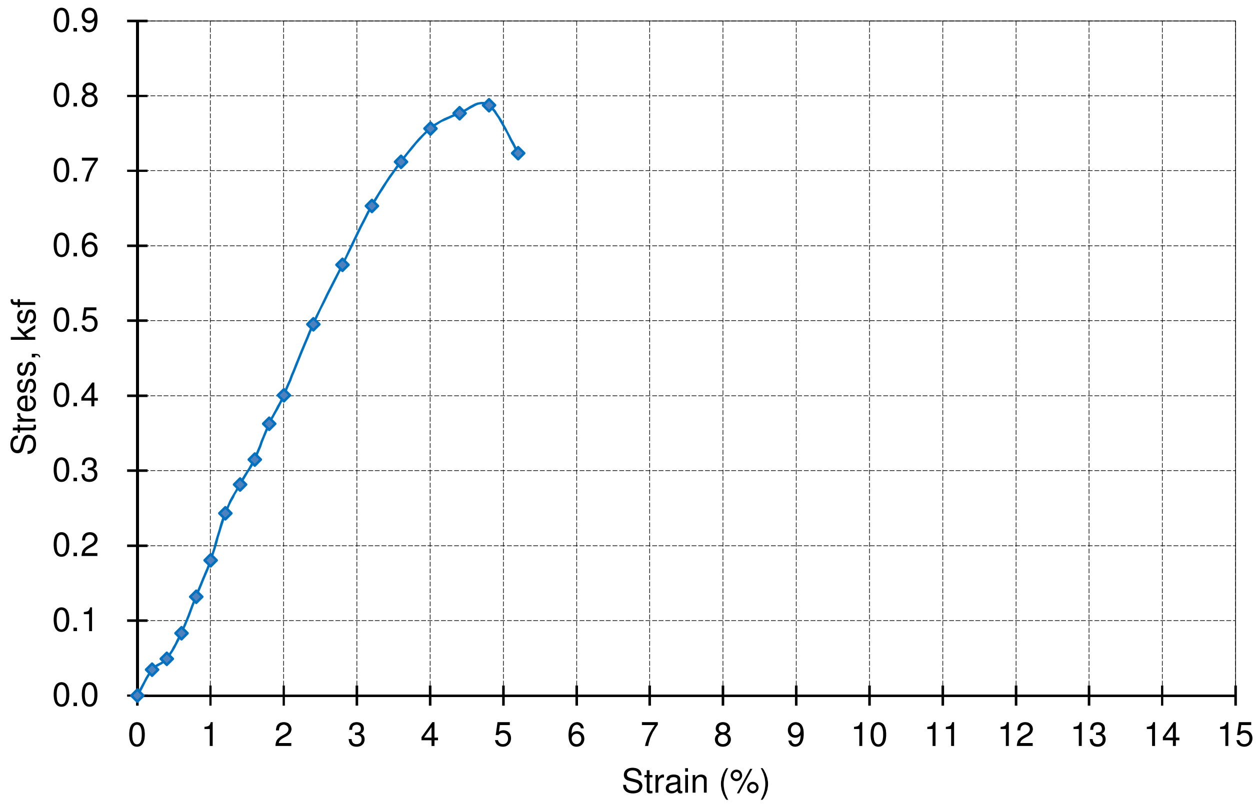
NORTHBOUND 101 ON-RAMP PEDESTRIAN OVERCROSSING
SAN JOSE. CALIFORNIA

JOB NO.: 2016-146-NOC	**PLATE NO.: IV-4G**

UNCONFINED COMPRESSION TEST



Boring No.:	R-18-NO-002
Sample No. :	11
Depth (feet):	51
Sample Type:	MC - 2.416 inch dia.
Test Method	ASTM D2166
Material Type:	CL
Material Description:	LEAN CLAY

Unconfined Compressive Strength (ksf):	0.79
Shear Strength (ksf)	0.39
Strain @ Failure (%):	4.8
Initial Dry Density (pcf):	112
Water Content (%):	10.2

Initial Height (inch):	5.00
Initial Diameter (inch)	2.42
Initial Area (ft^2):	0.032
Strain Rate (inch/min)	0.1

Remarks:

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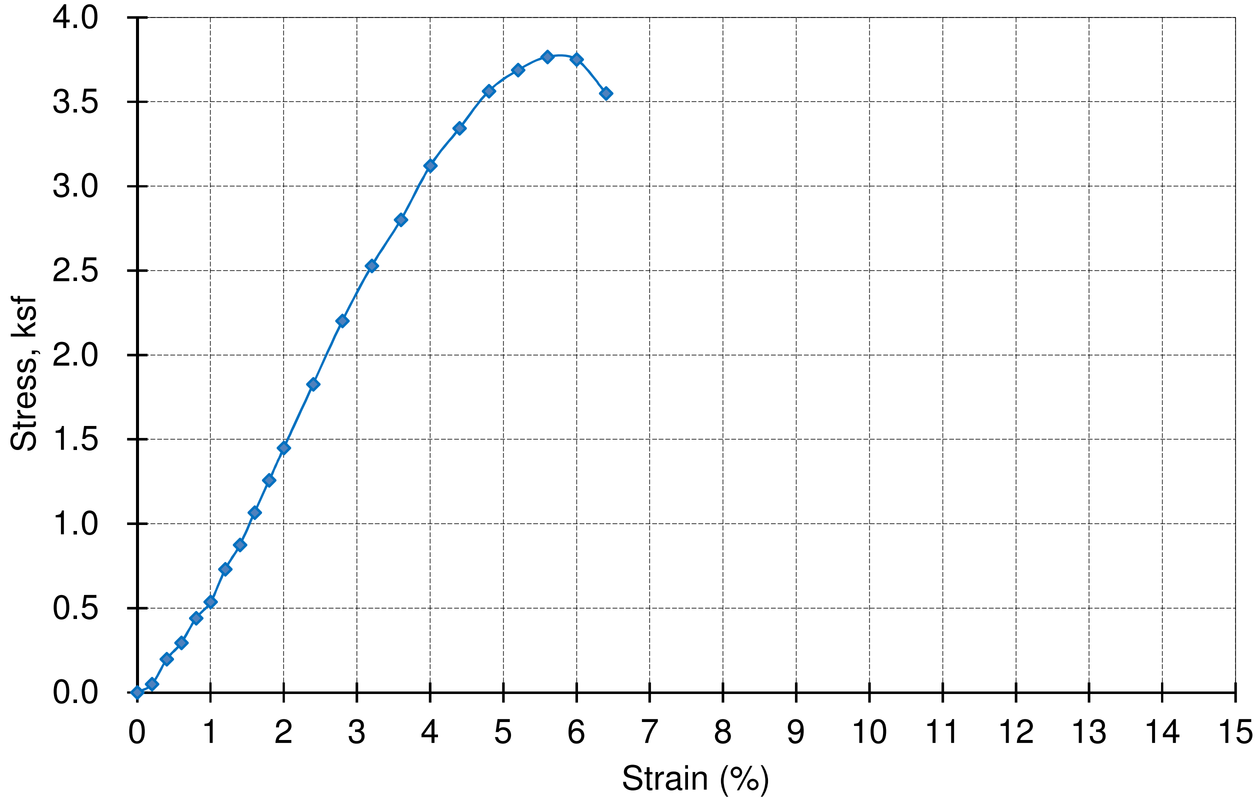
NORTHBOUND 101 ON-RAMP PEDESTRIAN OVERCROSSING
SAN JOSE. CALIFORNIA

JOB NO.: 2016-146-NOC	**PLATE NO.: IV-4H**

UNCONFINED COMPRESSION TEST



Boring No.:	R-18-NO-003
Sample No. :	6
Depth (feet):	26
Sample Type:	MC - 2.416 inch dia.
Test Method	ASTM D2166
Material Type:	ML
Material Description:	SANDY SILT

Unconfined Compressive Strength (ksf):	3.77
Shear Strength (ksf)	1.88
Strain @ Failure (%):	5.6
Initial Dry Density (pcf):	115
Water Content (%):	15.7

Initial Height (inch):	5.00
Initial Diameter (inch)	2.42
Initial Area (ft^2):	0.032
Strain Rate (inch/min)	0.1

Remarks:

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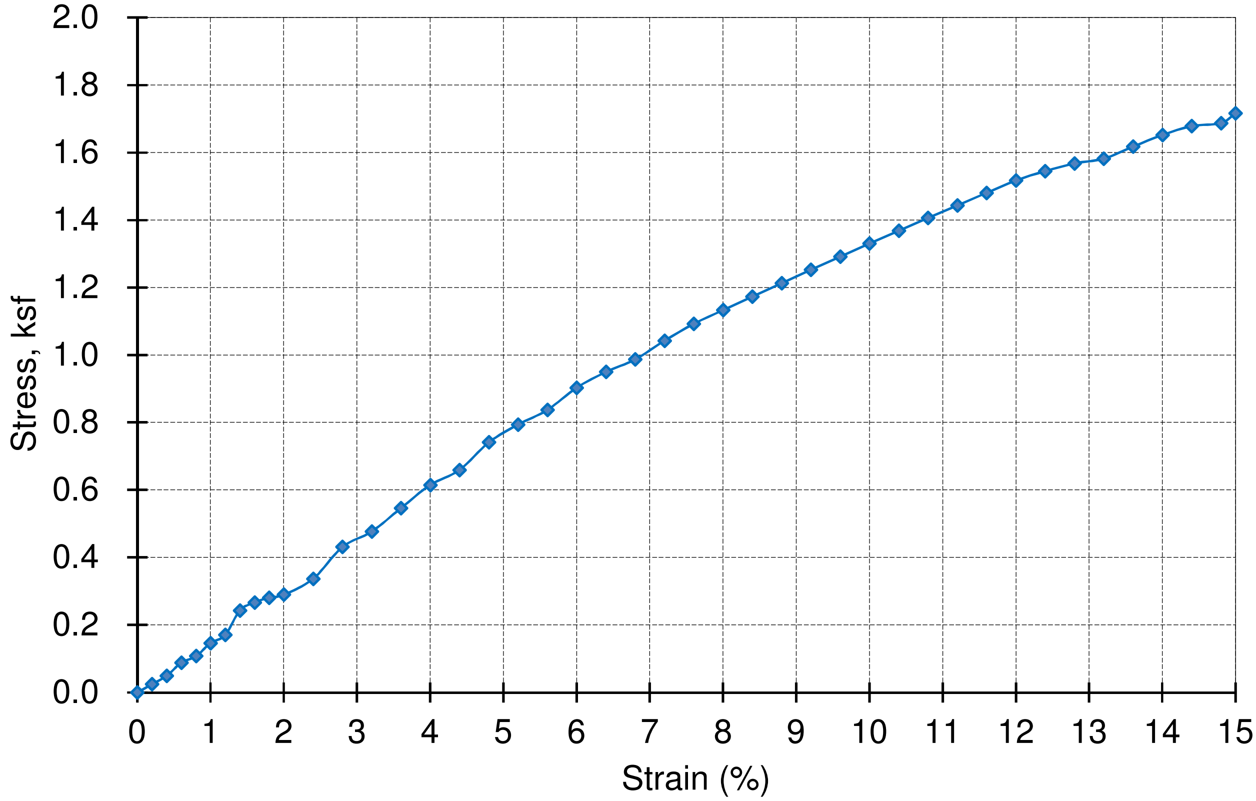
NORTHBOUND 101 ON-RAMP PEDESTRIAN OVERCROSSING
SAN JOSE. CALIFORNIA

JOB NO.: 2016-146-NOC	**PLATE NO.: IV-4I**

UNCONFINED COMPRESSION TEST



Boring No.:	R-18-NO-003
Sample No. :	14
Depth (feet):	71
Sample Type:	MC - 2.416 inch dia.
Test Method	ASTM D2166
Material Type:	ML
Material Description:	SILT

Unconfined Compressive Strength (ksf):	1.72
Shear Strength (ksf)	0.86
Strain @ Failure (%):	15.0
Initial Dry Density (pcf):	93
Water Content (%):	28.2

Initial Height (inch):	5.00
Initial Diameter (inch)	2.42
Initial Area (ft^2):	0.032
Strain Rate (inch/min)	0.1

Remarks:

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NORTHBOUND 101 ON-RAMP PEDESTRIAN OVERCROSSING
SAN JOSE. CALIFORNIA

JOB NO.: 2016-146-NOC	PLATE NO.: IV-4J

CORROSION TEST

Sunland Analytical
11419 Sunrise Gold Circle, #10
Rancho Cordova, CA 95742
(916) 852-8557

Date Reported 10/17/2018
Date Submitted 10/10/2018

To: Nasir Ahmad
Parikh Consultants, Inc.
2360 Qume Dr. Suite A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 2016-146-NOC Site ID : R18NO001 7@31FT.
Thank you for your business.

* For future reference to this analysis please use SUN # 78265-163683.

EVALUATION FOR SOIL CORROSION

Soil pH	7.98		
Minimum Resistivity	2.09	ohm-cm (x1000)	
Chloride	8.8 ppm	00.00088	%
Sulfate	25.4 ppm	00.00254	%

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

PLATE NO.: IV-5A

Sunland Analytical
11419 Sunrise Gold Circle, #10
Rancho Cordova, CA 95742
(916) 852-8557

Date Reported 10/17/2018
Date Submitted 10/10/2018

To: Nasir Ahmad
Parikh Consultants, Inc.
2360 Qume Dr. Suite A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 2016-146-NOC Site ID : R18N0002 4@16FT.
Thank you for your business.

* For future reference to this analysis please use SUN # 78267-163686.

EVALUATION FOR SOIL CORROSION

Soil pH	7.23			
Minimum Resistivity	1.23	ohm-cm (x1000)		
Chloride	5.1	ppm	00.00051	%
Sulfate	125.4	ppm	00.01254	%

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

PLATE NO.: IV-5B

Sunland Analytical
11419 Sunrise Gold Circle, #10
Rancho Cordova, CA 95742
(916) 852-8557

Date Reported 10/03/2018
Date Submitted 09/28/2018

To: Nasir Ahmad
Parikh Consultants, Inc.
2360 Qume Dr. Suite A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 2016-146-NOC Site ID : R18N0003 7@31FT.
Thank you for your business.

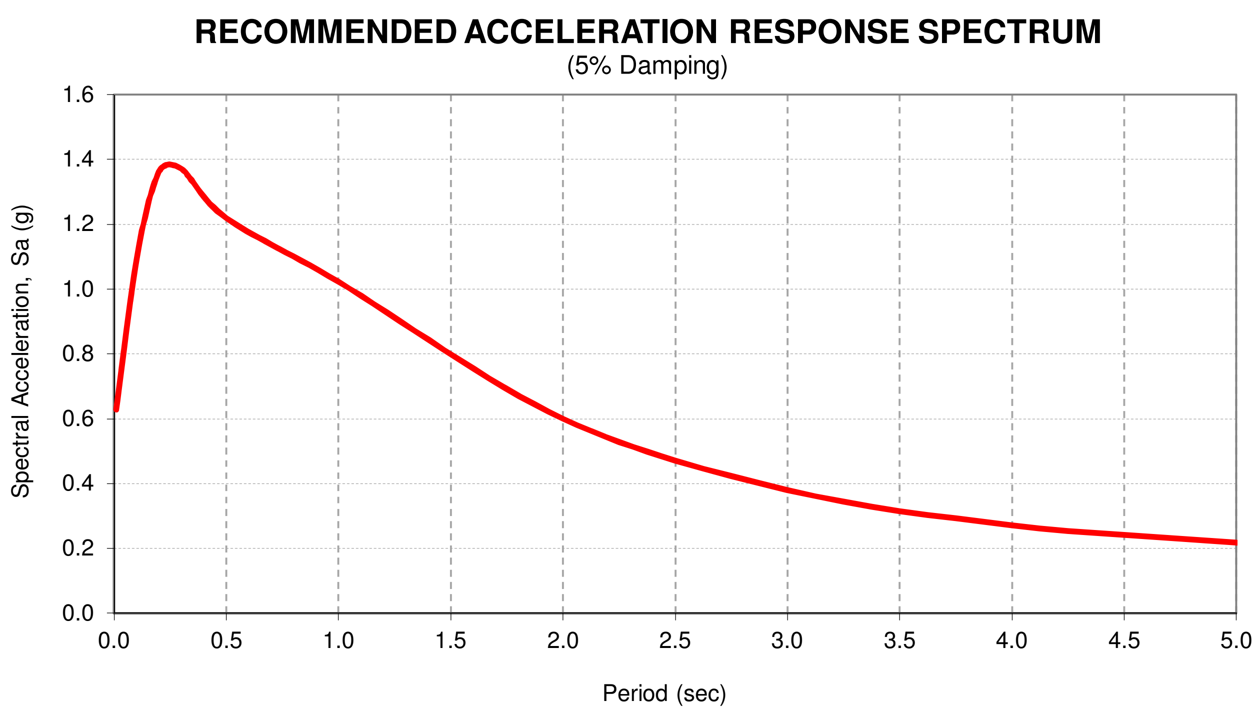
* For future reference to this analysis please use SUN # 78178-163493.

EVALUATION FOR SOIL CORROSION

Soil pH	7.58		
Minimum Resistivity	4.82	ohm-cm (x1000)	
Chloride	10.6 ppm	00.00106	%
Sulfate	42.3 ppm	00.00423	%

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

APPENDIX V



Site Information

Latitude:	37.2579
Longitude	-121.7960
V_{S30} (m/s) =	220
$Z_{1.0}$ (m) =	N/A
$Z_{2.5}$ (km) =	N/A
Near Fault Factor, Derived from USGS Unified Hazard Tool. Dist (km) =	8.03

Governing Curve:

Caltrans Online Probabilistic ARS

Recommended Response Spectrum				
Period (sec)	Caltrans Online Probabilistic Spectral Acceleration (g)	Adjusted for Near Fault Effect	Adjusted For Basin Effect	Final Adjusted Spectral Acceleration (g)
0.0	0.628	1	1	0.628
0.1	1.093	1	1	1.093
0.2	1.362	1	1	1.362
0.3	1.371	1	1	1.371
0.5	1.219	1	1	1.219
1.0	0.852	1.2	1	1.022
2.0	0.5	1.2	1	0.600
3.0	0.317	1.2	1	0.380
4.0	0.226	1.2	1	0.271
5.0	0.181	1.2	1	0.217

Source:

1. Caltrans ARS Online tool (V.2.3.09, http://dap3.dot.ca.gov/ARS_Online/)

2. Caltrans Methodology for Developing Design Response Spectrum for Use in Seismic Design Recommendations, November 2012

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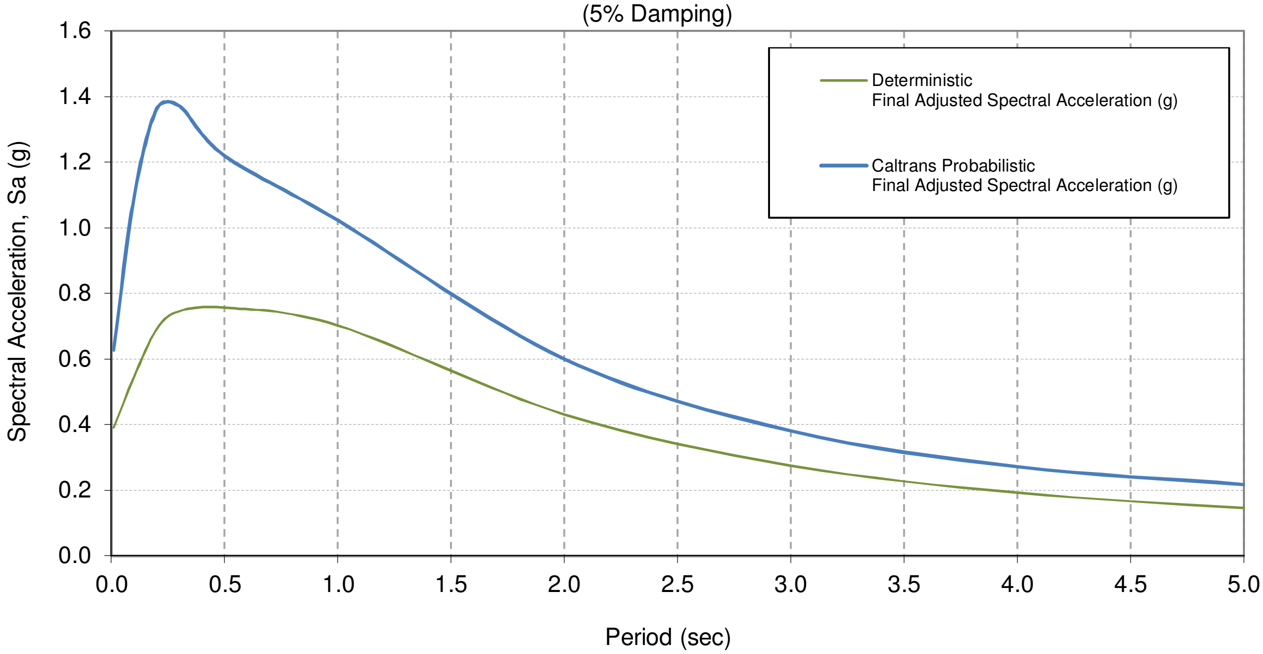
NORTHBOUND 101 ON-RAMP PEDESTRIAN OVERCROSSING
SAN JOSE, CALIFORNIA

Project No.: 2016-146-NOC | **APPENDIX V-1**

ACCELERATION RESPONSE SPECTRUM COMPARISON

(Deterministic & Probablistic Curves)
(5% Damping)



Site Information

Latitude:	37.2579
Longitude	-121.7960
V_{S30} (m/s) =	220
$Z_{1.0}$ (m) =	N/A
$Z_{2.5}$ (km) =	N/A
Near Fault Factor, Derived from USGS Unified Hazard Tool. Dist (km) =	8.03

Period (sec)	Deterministic Final Adjusted Spectral Acceleration (g)	Caltrans Probabilistic Final Adjusted Spectral Acceleration (g)
0.0	0.391	0.628
0.1	0.546	1.093
0.2	0.691	1.362
0.3	0.746	1.371
0.5	0.756	1.219
1.0	0.702	1.022
2.0	0.431	0.600
3.0	0.275	0.380
4.0	0.192	0.271
5.0	0.145	0.217

Source:

1. Caltrans ARS Online tool (V.2.3.09, http://dap3.dot.ca.gov/ARS_Online/)

2. USGS Unified Hazard Tool (https://earthquake.usgs.gov/hazards/interactive/)

3. Caltrans Methodology for Developing Design Response Spectrum for Use in Seismic Design Recommendations, November 2012

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NORTHBOUND 101 ON-RAMP PEDESTRIAN OVERCROSSING
SAN JOSE, CALIFORNIA

Project No.: 2016-146-NOC	**APPENDIX V-2**

APPENDIX VI

LIQUEFACTION ANALYSES

LIQUEFACTION POTENTIAL ANALYSIS (SPT procedures per Youd et al, 2001)

PROJECT NAME	***Northbound 101 On-Ramp Pedestrian Overcrossing***	*SOIL GROUPS*	*FAULT INFO*	
PROJECT NO.	***2016-146-NOC***	1. GRAVELS, SANDS AND NONPLASTIC SILTS	*Silver Creek Fault*	
BORING NO.	***R-18-NO-001***	2. CLAYS AND PLASTIC SILTS	*a_{max} (g)=*	0.63
			FAULT M_w =	6.9

GW DEPTH (ft)=	30	*BOREHOLE DIA (in)=*	3.3	*CUT(-)/FILL(+) (ft) =*	0		*MSF =*	1.24
		HAMMER ENERGY =	78%	*DESIGN GW DEPTH (ft)=*	30	*(below OG)*		

SOIL STRATA							*LIQUEFACTION RESISTANCE ($CRR_{7.5}$)*												*CYCLIC STRESS RATIO (CSR)*				*F.S.=($CRR_{7.5}$/CSR)*MSF*Ks*Ka*			*POST-LIQ. SETTLEMENT*	
Layer Thickness from	to	Sample No	Depth (ft)	Soil Type	Blow Count	Sampler Type	$SPT\text{-}N_{eq.}$	C_E	C_R	C_S	C_B	N_{60}	σ_v' (psf)	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60,\,CS}$	$CRR_{7.5}$	σ_v (psf)	σ_v' (psf)	r_d	CSR	Ks	Ka	F.S.	Vol. Strain (%)	ΔD (in)
0	4.0	1	3	1	34	MC	22.1	1.3	0.75	1.0	1.00	21.5	345.0	1.7	36.6	15%	40.9		345.0	345.0	1.0	0.4	1.0	1.0			
4.0	8.0	2	6	1	42	MC	27.3	1.3	0.80	1.0	1.00	28.4	700.0	1.7	48.0	15%	52.8		700.0	700.0	1.0	0.4	1.0	1.0			
8.0	13.0	3	11	1	26	MC	16.9	1.3	0.85	1.0	1.00	18.7	1300.0	1.2	23.2	15%	26.8		1300.0	1300.0	1.0	0.4	1.0	1.0			
13.0	18.0	4	16	1	20	MC	13.0	1.3	0.95	1.0	1.00	16.1	1900.0	1.0	16.5	25%	19.8		1900.0	1900.0	1.0	0.4	1.0	1.0			
18.0	21.5	5	21	1	15	MC	9.8	1.3	0.95	1.0	1.00	12.0	2500.0	0.9	10.8	15%	13.8		2500.0	2500.0	1.0	0.4	0.9	1.0			
21.5	28.0	6	26	2	16	MC	10.4	1.3	1.00	1.0	1.00	13.5	3100.0	0.8	10.9												
28.0	33.0	7	31	2	10	MC	6.5	1.3	1.00	1.0	1.00	8.5	3637.6	0.7	6.3												
33.0	38.0	8	36	2	17	MC	11.1	1.3	1.00	1.0	1.00	14.4	3925.6	0.7	10.3												
38.0	43.0	9	41	2	16	MC	10.4	1.3	1.00	1.0	1.00	13.5	4213.6	0.7	9.3												
43.0	48.5	10	46	2	7	MC	4.6	1.3	1.00	1.0	1.00	5.9	4501.6	0.7	3.9												
48.5	53.5	11	51	2	8	MC	5.2	1.3	1.00	1.0	1.00	6.8	4789.6	0.6	4.4												
53.5	58.0	12	56	2	14	MC	9.1	1.3	1.00	1.0	1.00	11.8	5077.6	0.6	7.4												
58.0	65.0	13	61	2	16	MC	10.4	1.3	1.00	1.0	1.00	13.5	5365.6	0.6	8.3												
65.0	75.0	14	71	2	16	MC	10.4	1.3	1.00	1.0	1.00	13.5	5941.6	0.6	7.8												
75.0	81.5	15	81	2	42	MC	27.3	1.3	1.00	1.0	1.00	35.5	6517.6	0.6	19.7	86%											
81.5	95.0	16	91	1	48	SPT	48.0	1.3	1.00	1.2	1.00	74.9	7093.6	0.5	39.8	15%	44.2		10900.00	7093.6	0.5	0.3	0.6	1.0	NON-LIQ.		
95.0	108.0	17	101	1	30	SPT	30.0	1.3	1.00	1.2	1.00	46.8	7669.6	0.5	23.9	15%	27.5	0.4	12100.00	7669.6	0.5	0.3	0.6	1.0	NON-LIQ.		
108.0	111.5	18	111	2	45	MC	29.3	1.3	1.00	1.0	1.00	38.0	8245.6	0.5	18.7												

Fines Content based on visual inspection

Fines Content based on lab results

Notes:

1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner) are per Youd et al. (2001).
2. For correction of overburden, $C_N = (1/\sigma_v')^{0.5}$ with a maximum value of 1.7.
3. The influence of Fines Contents are expressed by the following correction: $(N_1)_{60cs} = a + b\,(N_1)_{60}$

   where a and b = coefficients determined from the following relationships

   for FC $\le$ 5% a = 0, b = 1.0

   for 5% < FC < 35% $a = \exp(1.76-(190/FC^2))$, $b = (0.99+(FC^{1.5}/1000))$

   for FC $\ge$ 35% a = 5.0, b = 1.2
4. For $(N_1)_{60,cs}$ greater than 30, clean granular soils are too dense to liquefy and are classed as non-liquefiable.

Reference:

Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER Workshops on Evaluation of Liquefaction Resistance of Soils, Youd, et al., ASCE Journal of Geotechnical and Geoenvironmental Engineering, October 2001, Vol. 127 No. 10

LIQUEFACTION POTENTIAL ANALYSIS (SPT procedures per Youd et al, 2001)

PROJECT NAME ***Northbound 101 On-Ramp Pedestrian Overcrossing***
PROJECT NO. ***2016-146-NOC***
BORING NO. ***R-18-NO-002***

SOIL GROUPS
1. GRAVELS, SANDS AND NONPLASTIC SILTS
2. CLAYS AND PLASTIC SILTS

FAULT INFO
Silver Creek Fault
a_{max} (g)= 0.63
FAULT M_w = 6.9

GW DEPTH (ft)= 25
BOREHOLE DIA (in)= 4.3
HAMMER ENERGY = 78%
CUT(-)/FILL(+) (ft) = 0
DESIGN GW DEPTH (ft)= 25 *(below OG)*
MSF = 1.24

SOIL STRATA							LIQUEFACTION RESISTANCE ($CRR_{7.5}$)												CYCLIC STRESS RATIO (CSR)				F.S.=($CRR_{7.5}$/CSR)*MSF*Ks*Ka			POST-LIQ. SETTLEMENT	
Layer Thickness from	to	Sample No	Depth (ft)	Soil Type	Blow Count	Sampler Type	SPT-$N_{eq.}$	C_E	C_R	C_S	C_B	N_{60}	σ_v' (psf)	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60,CS}$	$CRR_{7.5}$	σ_v (psf)	σ_v' (psf)	r_d	CSR	Ks	Ka	F.S.	Vol. Strain (%)	ΔD (in)
0	3.3	1A	3	2	26	MC	16.9	1.3	0.75	1.0	1.00	16.5	345.0	1.7	28.0												
3.3	4.5	1B	3.25	1	26	MC	16.9	1.3	0.75	1.0	1.00	16.5	373.8	1.7	28.0	15%	28.0		373.8	373.8	1.0	0.4	1.0	1.0			
4.5	8.0	2	6	1	29	MC	18.9	1.3	0.80	1.0	1.00	19.6	703.8	1.7	33.0	15%	37.1		703.8	703.8	1.0	0.4	1.0	1.0			
8.0	13.0	3	11	1	36	MC	23.4	1.3	0.85	1.0	1.00	25.9	1303.8	1.2	32.0	15%	36.1		1303.8	1303.8	1.0	0.4	1.0	1.0			
13.0	19.0	4	16	2	18	MC	11.7	1.3	0.95	1.0	1.00	14.4	1903.8	1.0	14.8												
19.0	23.5	5	21	1	22	MC	14.3	1.3	0.95	1.0	1.00	17.7	2503.8	0.9	15.8	15%	19.0		2503.8	2503.8	1.0	0.4	0.9	1.0			
23.5	28.5	6	26	2	12	SPT	12.0	1.3	1.00	1.2	1.00	18.7	3041.4	0.8	15.2	61%											
28.5	33.5	7	31	2	14	MC	9.1	1.3	1.00	1.0	1.00	11.8	3329.4	0.8	9.2												
33.5	38.5	8	36	2	19	MC	12.4	1.3	1.00	1.0	1.00	16.1	3617.4	0.7	11.9												
38.5	43.0	9	41	2	10	SPT	10.0	1.3	1.00	1.2	1.00	15.6	3905.4	0.7	11.2												
43.0	48.0	10	46	2	15	MC	9.8	1.3	1.00	1.0	1.00	12.7	4193.4	0.7	8.8	61%											
48.0	53.0	11	51	2	12	MC	7.8	1.3	1.00	1.0	1.00	10.1	4481.4	0.7	6.8												
53.0	58.5	12	56	2	13	MC	8.5	1.3	1.00	1.0	1.00	11.0	4769.4	0.6	7.1												
58.5	65.0	13	61	1	38	MC	24.7	1.3	1.00	1.0	1.00	32.1	5057.4	0.6	20.2	11%	21.9	0.2	7303.75	5057.4	0.7	0.4	0.7	1.0	(0.56)	1.31%	1.02
65.0	76.0	14	71	2	22	SPT	22.0	1.3	1.00	1.2	1.00	34.3	5633.4	0.6	20.4												
76.0	87.5	15	81	1	39	SPT	39.0	1.3	1.00	1.2	1.00	60.8	6209.4	0.6	34.5	15%	38.7		9703.75	6209.4	0.5	0.3	0.6	1.0	NON-LIQ.		
87.5	100.0	16	91	1	90	SPT	90.0	1.3	1.00	1.2	1.00	140.4	6785.4	0.5	76.2	15%	82.4		10903.75	6785.4	0.5	0.3	0.6	1.0	NON-LIQ.		
100.0	102.5	17	101	1	61	SPT	61.0	1.3	1.00	1.2	1.00	95.2	7361.4	0.5	49.6	15%	54.5		12103.75	7361.4	0.5	0.3	0.6	1.0	NON-LIQ.		
102.5	104.5	18	104	1	100	SPT	100.0	1.3	1.00	1.2	1.00	156.0	7534.2	0.5	80.4	10%	83.0		12463.75	7534.2	0.5	0.3	0.6	1.0	NON-LIQ.		

Fines Content based on visual inspection
Fines Content based on lab results

Notes:
1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner) are per Youd et al. (2001).
2. For correction of overburden, $C_N = (1/\sigma_v')^{0.5}$ with a maximum value of 1.7.
3. The influence of Fines Contents are expressed by the following correction: $(N_1)_{60cs} = a + b\,(N_1)_{60}$
where a and b = coefficients determined from the following relationships
for FC ≤ 5% a = 0, b = 1.0
for 5% < FC < 35% a = exp(1.76-(190/FC^2)), b = (0.99+(FC$^{1.5}$/1000))
for FC ≥ 35% a = 5.0, b = 1.2
4. For $(N_1)_{60,cs}$ greater than 30, clean granular soils are too dense to liquefy and are classed as non-liquefiable.

Reference:
Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER Workshops on Evaluation of Liquefaction Resistance of Soils, Youd, et al., ASCE Journal of Geotechnical and Geoenvironmental Engineering, October 2001, Vol. 127 No. 10

LIQUEFACTION POTENTIAL ANALYSIS (SPT procedures per Youd et al, 2001)

PROJECT NAME	***Northbound 101 On-Ramp Pedestrian Overcrossing***	*SOIL GROUPS*		*FAULT INFO*	
PROJECT NO.	***2016-146-NOC***	1. GRAVELS, SANDS AND NONPLASTIC SILTS		*Silver Creek Fault*	
BORING NO.	***R-18-NO-003***	2. CLAYS AND PLASTIC SILTS		*a_{max} (g)=*	0.63
				FAULT M_w =	6.9
GW DEPTH (ft)=	32	*BOREHOLE DIA (in)=*	3.3	*CUT(-)/FILL(+) (ft) =* 0	*MSF =* 1.24
		HAMMER ENERGY =	78%	*DESIGN GW DEPTH (ft)=* 32 *(below OG)*	

SOIL STRATA							*LIQUEFACTION RESISTANCE ($CRR_{7.5}$)*												*CYCLIC STRESS RATIO (CSR)*				*F.S.=($CRR_{7.5}$/CSR)*MSF*Ks*Ka*			*POST-LIQ. SETTLEMENT*	
Layer Thickness from	to	Sample No	Depth (ft)	Soil Type	Blow Count	Sampler Type	SPT-$N_{eq.}$	C_E	C_R	C_S	C_B	N_{60}	σ_v' (psf)	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60,\,CS}$	$CRR_{7.5}$	σ_v (psf)	σ_v' (psf)	r_d	CSR	Ks	Ka	F.S.	Vol. Strain (%)	ΔD (in)
0	4.0	1	3	1	60	MC	39.0	1.3	0.75	1.0	1.00	38.0	345.0	1.7	64.6	15%	70.2		345.0	345.0	1.0	0.4	1.0	1.0			
4.0	8.0	2	6	1	53	MC	34.5	1.3	0.80	1.0	1.00	35.8	700.0	1.7	60.6	15%	66.0		700.0	700.0	1.0	0.4	1.0	1.0			
8.0	11.5	3	11	1	24	SPT	24.0	1.3	0.85	1.2	1.00	31.8	1300.0	1.2	39.5	15%	43.9		1300.0	1300.0	1.0	0.4	1.0	1.0			
11.5	18.5	4	16	2	25	MC	16.3	1.3	0.95	1.0	1.00	20.1	1900.0	1.0	20.6	59%											
18.5	23.0	5	21	1	11	MC	7.2	1.3	0.95	1.0	1.00	8.8	2500.0	0.9	7.9	50%	14.5		2500.0	2500.0	1.0	0.4	0.9	1.0			
23.0	29.0	6	26	2	17	MC	11.1	1.3	1.00	1.0	1.00	14.4	3100.0	0.8	11.5												
29.0	34.0	7	31	2	13	MC	8.5	1.3	1.00	1.0	1.00	11.0	3700.0	0.7	8.1												
34.0	38.0	8	36	1	4	SPT	4.0	1.3	1.00	1.2	1.00	6.2	4050.4	0.7	4.4	50%	10.3	0.1	4300.0	4050.4	0.9	0.4	0.9	1.0	(0.32)	2.31%	1.11
38.0	43.0	9	41	1	9	SPT	9.0	1.3	1.00	1.2	1.00	14.0	4338.4	0.7	9.5	50%	16.4	0.2	4900.00	4338.4	0.8	0.4	0.8	1.0	(0.46)	1.62%	0.97
43.0	48.5	10	46	1	12	MC	7.8	1.3	1.00	1.0	1.00	10.1	4626.4	0.7	6.7	50%	13.0	0.1	5500.00	4626.4	0.8	0.4	0.8	1.0	(0.37)	1.93%	1.28
48.5	53.0	11	51	1	25	MC	16.3	1.3	1.00	1.0	1.00	21.1	4914.4	0.6	13.5	37%	21.2	0.2	6100.00	4914.4	0.7	0.4	0.8	1.0	(0.58)	1.34%	0.72
53.0	56.5	12	56	1	19	SPT	19.0	1.3	1.00	1.2	1.00	29.6	5202.4	0.6	18.4	15%	21.8	0.2	6700.00	5202.4	0.7	0.4	0.7	1.0	(0.60)	1.31%	0.55
56.5	65.0	13	61	1	8	SPT	8.0	1.3	1.00	1.2	1.00	12.5	5490.4	0.6	7.5	50%	14.0	0.2	7300.00	5490.4	0.7	0.4	0.8	1.0	(0.42)	1.83%	1.86
65.0	75.0	14	71	2	19	MC	12.4	1.3	1.00	1.0	1.00	16.1	6066.4	0.6	9.2												
75.0	85.0	15	81	1	31	SPT	31.0	1.3	1.00	1.2	1.00	48.4	6642.4	0.5	26.5	10%	28.0	0.4	9700.00	6642.4	0.5	0.3	0.7	1.0	NON-LIQ.		
85.0	95.5	16	91	1	94	SPT	94.0	1.3	1.00	1.2	1.00	146.6	7218.4	0.5	77.2	10%	79.7		10900.00	7218.4	0.5	0.3	0.6	1.0	NON-LIQ.		
95.5	106.0	17	101	1	69	SPT	69.0	1.3	1.00	1.2	1.00	107.6	7794.4	0.5	54.5	15%	59.6		12100.00	7794.4	0.5	0.3	0.6	1.0	NON-LIQ.		
106.0	111.5	18	111	2	21	SPT	21.0	1.3	1.00	1.2	1.00	32.8	8370.4	0.5	16.0												

Fines Content based on visual inspection

Fines Content based on lab results

Notes:

1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner) are per Youd et al. (2001).
2. For correction of overburden, $C_N = (1/\sigma_v')^{0.5}$ with a maximum value of 1.7.
3. The influence of Fines Contents are expressed by the following correction: $(N_1)_{60cs} = a + b\,(N_1)_{60}$
   where a and b = coefficients determined from the following relationships
   - for FC $\leq$ 5%   a = 0,   b = 1.0
   - for 5% < FC < 35%   a = exp(1.76-(190/FC^2)),   b = (0.99+(FC$^{1.5}$/1000))
   - for FC $\geq$ 35%   a = 5.0,   b = 1.2
4. For $(N_1)_{60,cs}$ greater than 30, clean granular soils are too dense to liquefy and are classed as non-liquefiable.

Reference:

Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER Workshops on Evaluation of Liquefaction Resistance of Soils, Youd, et al., ASCE Journal of Geotechnical and Geoenvironmental Engineering, October 2001, Vol. 127 No. 10

:: Liquefaction Potential Index calculation data ::

Depth (ft)	FS	F_L	w_z	d_z	LPI	Depth (ft)	FS	F_L	w_z	d_z	LPI
0.16	2.00	0.00	9.97	0.16	0.00	0.33	2.00	0.00	9.95	0.16	0.00
0.49	2.00	0.00	9.92	0.16	0.00	0.66	2.00	0.00	9.90	0.16	0.00
0.82	2.00	0.00	9.87	0.16	0.00	0.98	2.00	0.00	9.85	0.16	0.00
1.15	2.00	0.00	9.82	0.16	0.00	1.31	2.00	0.00	9.80	0.16	0.00
1.48	2.00	0.00	9.77	0.16	0.00	1.64	2.00	0.00	9.75	0.16	0.00
1.80	2.00	0.00	9.72	0.16	0.00	1.97	2.00	0.00	9.70	0.16	0.00
2.13	2.00	0.00	9.67	0.16	0.00	2.30	2.00	0.00	9.65	0.16	0.00
2.46	2.00	0.00	9.62	0.16	0.00	2.62	2.00	0.00	9.60	0.16	0.00
2.79	2.00	0.00	9.57	0.16	0.00	2.95	2.00	0.00	9.55	0.16	0.00
3.12	2.00	0.00	9.52	0.16	0.00	3.28	2.00	0.00	9.50	0.16	0.00
3.44	2.00	0.00	9.47	0.16	0.00	3.61	2.00	0.00	9.45	0.16	0.00
3.77	2.00	0.00	9.42	0.16	0.00	3.94	2.00	0.00	9.40	0.16	0.00
4.10	2.00	0.00	9.37	0.16	0.00	4.27	2.00	0.00	9.35	0.16	0.00
4.43	2.00	0.00	9.32	0.16	0.00	4.59	2.00	0.00	9.30	0.16	0.00
4.76	2.00	0.00	9.27	0.16	0.00	4.92	2.00	0.00	9.25	0.16	0.00
5.09	2.00	0.00	9.22	0.16	0.00	5.25	2.00	0.00	9.20	0.16	0.00
5.41	2.00	0.00	9.17	0.16	0.00	5.58	2.00	0.00	9.15	0.16	0.00
5.74	2.00	0.00	9.12	0.16	0.00	5.91	2.00	0.00	9.10	0.16	0.00
6.07	2.00	0.00	9.07	0.16	0.00	6.23	2.00	0.00	9.05	0.16	0.00
6.40	2.00	0.00	9.02	0.16	0.00	6.56	2.00	0.00	9.00	0.16	0.00
6.73	2.00	0.00	8.97	0.16	0.00	6.89	2.00	0.00	8.95	0.16	0.00
7.05	2.00	0.00	8.92	0.16	0.00	7.22	2.00	0.00	8.90	0.16	0.00
7.38	2.00	0.00	8.87	0.16	0.00	7.55	2.00	0.00	8.85	0.16	0.00
7.71	2.00	0.00	8.82	0.16	0.00	7.87	2.00	0.00	8.80	0.16	0.00
8.04	2.00	0.00	8.77	0.16	0.00	8.20	2.00	0.00	8.75	0.16	0.00
8.37	2.00	0.00	8.72	0.16	0.00	8.53	2.00	0.00	8.70	0.16	0.00
8.69	2.00	0.00	8.67	0.16	0.00	8.86	2.00	0.00	8.65	0.16	0.00
9.02	2.00	0.00	8.62	0.16	0.00	9.19	2.00	0.00	8.60	0.16	0.00
9.35	2.00	0.00	8.57	0.16	0.00	9.51	2.00	0.00	8.55	0.16	0.00
9.68	2.00	0.00	8.52	0.16	0.00	9.84	2.00	0.00	8.50	0.16	0.00
10.01	2.00	0.00	8.47	0.16	0.00	10.17	2.00	0.00	8.45	0.16	0.00
10.33	2.00	0.00	8.42	0.16	0.00	10.50	2.00	0.00	8.40	0.16	0.00
10.66	2.00	0.00	8.37	0.16	0.00	10.83	2.00	0.00	8.35	0.16	0.00
10.99	2.00	0.00	8.32	0.16	0.00	11.15	2.00	0.00	8.30	0.16	0.00
11.32	2.00	0.00	8.27	0.16	0.00	11.48	2.00	0.00	8.25	0.16	0.00
11.65	2.00	0.00	8.22	0.16	0.00	11.81	2.00	0.00	8.20	0.16	0.00
11.98	2.00	0.00	8.17	0.16	0.00	12.14	2.00	0.00	8.15	0.16	0.00
12.30	2.00	0.00	8.12	0.16	0.00	12.47	2.00	0.00	8.10	0.16	0.00
12.63	2.00	0.00	8.07	0.16	0.00	12.80	2.00	0.00	8.05	0.16	0.00
12.96	2.00	0.00	8.02	0.16	0.00	13.12	2.00	0.00	8.00	0.16	0.00
13.29	2.00	0.00	7.97	0.16	0.00	13.45	2.00	0.00	7.95	0.16	0.00
13.62	2.00	0.00	7.92	0.16	0.00	13.78	2.00	0.00	7.90	0.16	0.00
13.94	2.00	0.00	7.87	0.16	0.00	14.11	2.00	0.00	7.85	0.16	0.00
14.27	2.00	0.00	7.82	0.16	0.00	14.44	2.00	0.00	7.80	0.16	0.00
14.60	2.00	0.00	7.77	0.16	0.00	14.76	2.00	0.00	7.75	0.16	0.00
14.93	2.00	0.00	7.72	0.16	0.00	15.09	2.00	0.00	7.70	0.16	0.00
15.26	2.00	0.00	7.67	0.16	0.00	15.42	2.00	0.00	7.65	0.16	0.00
15.58	2.00	0.00	7.62	0.16	0.00	15.75	2.00	0.00	7.60	0.16	0.00

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

Depth (ft)	FS	F_L	w_z	d_z	LPI	Depth (ft)	FS	F_L	w_z	d_z	LPI
15.91	2.00	0.00	7.57	0.16	0.00	16.08	2.00	0.00	7.55	0.16	0.00
16.24	2.00	0.00	7.52	0.16	0.00	16.40	2.00	0.00	7.50	0.16	0.00
16.57	2.00	0.00	7.47	0.16	0.00	16.73	2.00	0.00	7.45	0.16	0.00
16.90	2.00	0.00	7.42	0.16	0.00	17.06	2.00	0.00	7.40	0.16	0.00
17.22	2.00	0.00	7.37	0.16	0.00	17.39	2.00	0.00	7.35	0.16	0.00
17.55	2.00	0.00	7.32	0.16	0.00	17.72	2.00	0.00	7.30	0.16	0.00
17.88	2.00	0.00	7.27	0.16	0.00	18.04	2.00	0.00	7.25	0.16	0.00
18.21	2.00	0.00	7.22	0.16	0.00	18.37	2.00	0.00	7.20	0.16	0.00
18.54	2.00	0.00	7.17	0.16	0.00	18.70	2.00	0.00	7.15	0.16	0.00
18.86	2.00	0.00	7.12	0.16	0.00	19.03	2.00	0.00	7.10	0.16	0.00
19.19	2.00	0.00	7.07	0.16	0.00	19.36	2.00	0.00	7.05	0.16	0.00
19.52	2.00	0.00	7.02	0.16	0.00	19.69	2.00	0.00	7.00	0.16	0.00
19.85	2.00	0.00	6.97	0.16	0.00	20.01	2.00	0.00	6.95	0.16	0.00
20.18	2.00	0.00	6.92	0.16	0.00	20.34	2.00	0.00	6.90	0.16	0.00
20.51	2.00	0.00	6.87	0.16	0.00	20.67	2.00	0.00	6.85	0.16	0.00
20.83	2.00	0.00	6.82	0.16	0.00	21.00	2.00	0.00	6.80	0.16	0.00
21.16	2.00	0.00	6.77	0.16	0.00	21.33	2.00	0.00	6.75	0.16	0.00
21.49	2.00	0.00	6.72	0.16	0.00	21.65	2.00	0.00	6.70	0.16	0.00
21.82	2.00	0.00	6.67	0.16	0.00	21.98	2.00	0.00	6.65	0.16	0.00
22.15	2.00	0.00	6.62	0.16	0.00	22.31	2.00	0.00	6.60	0.16	0.00
22.47	2.00	0.00	6.57	0.16	0.00	22.64	2.00	0.00	6.55	0.16	0.00
22.80	2.00	0.00	6.52	0.16	0.00	22.97	2.00	0.00	6.50	0.16	0.00
23.13	2.00	0.00	6.47	0.16	0.00	23.29	2.00	0.00	6.45	0.16	0.00
23.46	2.00	0.00	6.42	0.16	0.00	23.62	2.00	0.00	6.40	0.16	0.00
23.79	2.00	0.00	6.37	0.16	0.00	23.95	2.00	0.00	6.35	0.16	0.00
24.11	2.00	0.00	6.32	0.16	0.00	24.28	2.00	0.00	6.30	0.16	0.00
24.44	2.00	0.00	6.27	0.16	0.00	24.61	2.00	0.00	6.25	0.16	0.00
24.77	2.00	0.00	6.22	0.16	0.00	24.93	2.00	0.00	6.20	0.16	0.00
25.10	2.00	0.00	6.17	0.16	0.00	25.26	2.00	0.00	6.15	0.16	0.00
25.43	2.00	0.00	6.12	0.16	0.00	25.59	2.00	0.00	6.10	0.16	0.00
25.75	2.00	0.00	6.07	0.16	0.00	25.92	2.00	0.00	6.05	0.16	0.00
26.08	2.00	0.00	6.02	0.16	0.00	26.25	2.00	0.00	6.00	0.16	0.00
26.41	2.00	0.00	5.97	0.16	0.00	26.57	2.00	0.00	5.95	0.16	0.00
26.74	2.00	0.00	5.92	0.16	0.00	26.90	2.00	0.00	5.90	0.16	0.00
27.07	2.00	0.00	5.87	0.16	0.00	27.23	2.00	0.00	5.85	0.16	0.00
27.40	2.00	0.00	5.82	0.16	0.00	27.56	2.00	0.00	5.80	0.16	0.00
27.72	2.00	0.00	5.77	0.16	0.00	27.89	2.00	0.00	5.75	0.16	0.00
28.05	2.00	0.00	5.72	0.16	0.00	28.22	2.00	0.00	5.70	0.16	0.00
28.38	2.00	0.00	5.67	0.16	0.00	28.54	2.00	0.00	5.65	0.16	0.00
28.71	2.00	0.00	5.62	0.16	0.00	28.87	2.00	0.00	5.60	0.16	0.00
29.04	2.00	0.00	5.57	0.16	0.00	29.20	2.00	0.00	5.55	0.16	0.00
29.36	2.00	0.00	5.52	0.16	0.00	29.53	2.00	0.00	5.50	0.16	0.00
29.69	2.00	0.00	5.47	0.16	0.00	29.86	2.00	0.00	5.45	0.16	0.00
30.02	2.00	0.00	5.42	0.16	0.00	30.18	2.00	0.00	5.40	0.16	0.00
30.35	2.00	0.00	5.37	0.16	0.00	30.51	2.00	0.00	5.35	0.16	0.00
30.68	2.00	0.00	5.32	0.16	0.00	30.84	2.00	0.00	5.30	0.16	0.00
31.00	2.00	0.00	5.27	0.16	0.00	31.17	2.00	0.00	5.25	0.16	0.00
31.33	2.00	0.00	5.22	0.16	0.00	31.50	2.00	0.00	5.20	0.16	0.00

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

Depth (ft)	FS	F_L	w_z	d_z	LPI	Depth (ft)	FS	F_L	w_z	d_z	LPI
31.66	2.00	0.00	5.17	0.16	0.00	31.82	2.00	0.00	5.15	0.16	0.00
31.99	2.00	0.00	5.12	0.16	0.00	32.15	2.00	0.00	5.10	0.16	0.00
32.32	2.00	0.00	5.07	0.16	0.00	32.48	2.00	0.00	5.05	0.16	0.00
32.64	2.00	0.00	5.02	0.16	0.00	32.81	2.00	0.00	5.00	0.16	0.00
32.97	2.00	0.00	4.97	0.16	0.00	33.14	2.00	0.00	4.95	0.16	0.00
33.30	2.00	0.00	4.92	0.16	0.00	33.46	2.00	0.00	4.90	0.16	0.00
33.63	2.00	0.00	4.87	0.16	0.00	33.79	2.00	0.00	4.85	0.16	0.00
33.96	2.00	0.00	4.82	0.16	0.00	34.12	2.00	0.00	4.80	0.16	0.00
34.28	2.00	0.00	4.77	0.16	0.00	34.45	2.00	0.00	4.75	0.16	0.00
34.61	2.00	0.00	4.72	0.16	0.00	34.78	2.00	0.00	4.70	0.16	0.00
34.94	2.00	0.00	4.67	0.16	0.00	35.10	2.00	0.00	4.65	0.16	0.00
35.27	2.00	0.00	4.62	0.16	0.00	35.43	2.00	0.00	4.60	0.16	0.00
35.60	2.00	0.00	4.57	0.16	0.00	35.76	2.00	0.00	4.55	0.16	0.00
35.93	2.00	0.00	4.52	0.16	0.00	36.09	2.00	0.00	4.50	0.16	0.00
36.25	2.00	0.00	4.47	0.16	0.00	36.42	2.00	0.00	4.45	0.16	0.00
36.58	2.00	0.00	4.42	0.16	0.00	36.75	2.00	0.00	4.40	0.16	0.00
36.91	2.00	0.00	4.37	0.16	0.00	37.07	2.00	0.00	4.35	0.16	0.00
37.24	2.00	0.00	4.32	0.16	0.00	37.40	2.00	0.00	4.30	0.16	0.00
37.57	2.00	0.00	4.27	0.16	0.00	37.73	2.00	0.00	4.25	0.16	0.00
37.89	2.00	0.00	4.22	0.16	0.00	38.06	2.00	0.00	4.20	0.16	0.00
38.22	2.00	0.00	4.17	0.16	0.00	38.39	2.00	0.00	4.15	0.16	0.00
38.55	2.00	0.00	4.12	0.16	0.00	38.71	2.00	0.00	4.10	0.16	0.00
38.88	2.00	0.00	4.07	0.16	0.00	39.04	2.00	0.00	4.05	0.16	0.00
39.21	2.00	0.00	4.02	0.16	0.00	39.37	2.00	0.00	4.00	0.16	0.00
39.53	2.00	0.00	3.97	0.16	0.00	39.70	2.00	0.00	3.95	0.16	0.00
39.86	2.00	0.00	3.92	0.16	0.00	40.03	2.00	0.00	3.90	0.16	0.00
40.19	2.00	0.00	3.87	0.16	0.00	40.35	2.00	0.00	3.85	0.16	0.00
40.52	2.00	0.00	3.82	0.16	0.00	40.68	2.00	0.00	3.80	0.16	0.00
40.85	2.00	0.00	3.77	0.16	0.00	41.01	2.00	0.00	3.75	0.16	0.00
41.17	2.00	0.00	3.72	0.16	0.00	41.34	2.00	0.00	3.70	0.16	0.00
41.50	2.00	0.00	3.67	0.16	0.00	41.67	2.00	0.00	3.65	0.16	0.00
41.83	2.00	0.00	3.62	0.16	0.00	41.99	2.00	0.00	3.60	0.16	0.00
42.16	2.00	0.00	3.57	0.16	0.00	42.32	2.00	0.00	3.55	0.16	0.00
42.49	2.00	0.00	3.52	0.16	0.00	42.65	2.00	0.00	3.50	0.16	0.00
42.81	2.00	0.00	3.47	0.16	0.00	42.98	2.00	0.00	3.45	0.16	0.00
43.14	2.00	0.00	3.42	0.16	0.00	43.31	2.00	0.00	3.40	0.16	0.00
43.47	2.00	0.00	3.37	0.16	0.00	43.64	2.00	0.00	3.35	0.16	0.00
43.80	2.00	0.00	3.32	0.16	0.00	43.96	2.00	0.00	3.30	0.16	0.00
44.13	2.00	0.00	3.27	0.16	0.00	44.29	2.00	0.00	3.25	0.16	0.00
44.46	2.00	0.00	3.22	0.16	0.00	44.62	2.00	0.00	3.20	0.16	0.00
44.78	2.00	0.00	3.17	0.16	0.00	44.95	2.00	0.00	3.15	0.16	0.00
45.11	2.00	0.00	3.12	0.16	0.00	45.28	2.00	0.00	3.10	0.16	0.00
45.44	2.00	0.00	3.07	0.16	0.00	45.60	2.00	0.00	3.05	0.16	0.00
45.77	2.00	0.00	3.02	0.16	0.00	45.93	2.00	0.00	3.00	0.16	0.00
46.10	2.00	0.00	2.97	0.16	0.00	46.26	2.00	0.00	2.95	0.16	0.00
46.42	2.00	0.00	2.92	0.16	0.00	46.59	2.00	0.00	2.90	0.16	0.00
46.75	2.00	0.00	2.87	0.16	0.00	46.92	2.00	0.00	2.85	0.16	0.00
47.08	2.00	0.00	2.82	0.16	0.00	47.24	2.00	0.00	2.80	0.16	0.00

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

Depth (ft)	FS	F_L	w_z	d_z	LPI	Depth (ft)	FS	F_L	w_z	d_z	LPI
47.41	2.00	0.00	2.77	0.16	0.00	47.57	2.00	0.00	2.75	0.16	0.00
47.74	2.00	0.00	2.72	0.16	0.00	47.90	2.00	0.00	2.70	0.16	0.00
48.06	2.00	0.00	2.67	0.16	0.00	48.23	2.00	0.00	2.65	0.16	0.00
48.39	2.00	0.00	2.62	0.16	0.00	48.56	2.00	0.00	2.60	0.16	0.00
48.72	2.00	0.00	2.57	0.16	0.00	48.88	2.00	0.00	2.55	0.16	0.00
49.05	2.00	0.00	2.52	0.16	0.00	49.21	2.00	0.00	2.50	0.16	0.00
49.38	2.00	0.00	2.47	0.16	0.00	49.54	2.00	0.00	2.45	0.16	0.00
49.70	2.00	0.00	2.42	0.16	0.00	49.87	2.00	0.00	2.40	0.16	0.00
50.03	2.00	0.00	2.37	0.16	0.00	50.20	2.00	0.00	2.35	0.16	0.00
50.36	2.00	0.00	2.32	0.16	0.00	50.52	2.00	0.00	2.30	0.16	0.00
50.69	2.00	0.00	2.27	0.16	0.00	50.85	2.00	0.00	2.25	0.16	0.00
51.02	2.00	0.00	2.22	0.16	0.00	51.18	2.00	0.00	2.20	0.16	0.00
51.35	2.00	0.00	2.17	0.16	0.00	51.51	2.00	0.00	2.15	0.16	0.00
51.67	2.00	0.00	2.12	0.16	0.00	51.84	2.00	0.00	2.10	0.16	0.00
52.00	2.00	0.00	2.07	0.16	0.00	52.17	2.00	0.00	2.05	0.16	0.00
52.33	2.00	0.00	2.02	0.16	0.00	52.49	2.00	0.00	2.00	0.16	0.00
52.66	2.00	0.00	1.97	0.16	0.00	52.82	2.00	0.00	1.95	0.16	0.00
52.99	2.00	0.00	1.92	0.16	0.00	53.15	2.00	0.00	1.90	0.16	0.00
53.31	2.00	0.00	1.87	0.16	0.00	53.48	2.00	0.00	1.85	0.16	0.00
53.64	2.00	0.00	1.82	0.16	0.00	53.81	2.00	0.00	1.80	0.16	0.00
53.97	2.00	0.00	1.77	0.16	0.00	54.13	2.00	0.00	1.75	0.16	0.00
54.30	2.00	0.00	1.72	0.16	0.00	54.46	2.00	0.00	1.70	0.16	0.00
54.63	2.00	0.00	1.67	0.16	0.00	54.79	2.00	0.00	1.65	0.16	0.00
54.95	2.00	0.00	1.62	0.16	0.00	55.12	2.00	0.00	1.60	0.16	0.00
55.28	2.00	0.00	1.57	0.16	0.00	55.45	2.00	0.00	1.55	0.16	0.00
55.61	2.00	0.00	1.52	0.16	0.00	55.77	2.00	0.00	1.50	0.16	0.00
55.94	2.00	0.00	1.47	0.16	0.00	56.10	2.00	0.00	1.45	0.16	0.00
56.27	2.00	0.00	1.42	0.16	0.00	56.43	2.00	0.00	1.40	0.16	0.00
56.59	2.00	0.00	1.37	0.16	0.00	56.76	2.00	0.00	1.35	0.16	0.00
56.92	2.00	0.00	1.32	0.16	0.00	57.09	2.00	0.00	1.30	0.16	0.00
57.25	2.00	0.00	1.27	0.16	0.00	57.41	2.00	0.00	1.25	0.16	0.00
57.58	2.00	0.00	1.22	0.16	0.00	57.74	2.00	0.00	1.20	0.16	0.00
57.91	2.00	0.00	1.17	0.16	0.00	58.07	2.00	0.00	1.15	0.16	0.00
58.23	2.00	0.00	1.12	0.16	0.00	58.40	2.00	0.00	1.10	0.16	0.00
58.56	2.00	0.00	1.07	0.16	0.00	58.73	2.00	0.00	1.05	0.16	0.00
58.89	2.00	0.00	1.02	0.16	0.00	59.06	2.00	0.00	1.00	0.16	0.00
59.22	2.00	0.00	0.97	0.16	0.00	59.38	2.00	0.00	0.95	0.16	0.00
59.55	2.00	0.00	0.92	0.16	0.00	59.71	2.00	0.00	0.90	0.16	0.00
59.88	2.00	0.00	0.87	0.16	0.00	60.04	2.00	0.00	0.85	0.16	0.00
60.20	2.00	0.00	0.82	0.16	0.00	60.37	2.00	0.00	0.80	0.16	0.00
60.53	2.00	0.00	0.77	0.16	0.00						

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

Depth (ft)	FS	F_L	w_z	d_z	LPI	Depth (ft)	FS	F_L	w_z	d_z	LPI

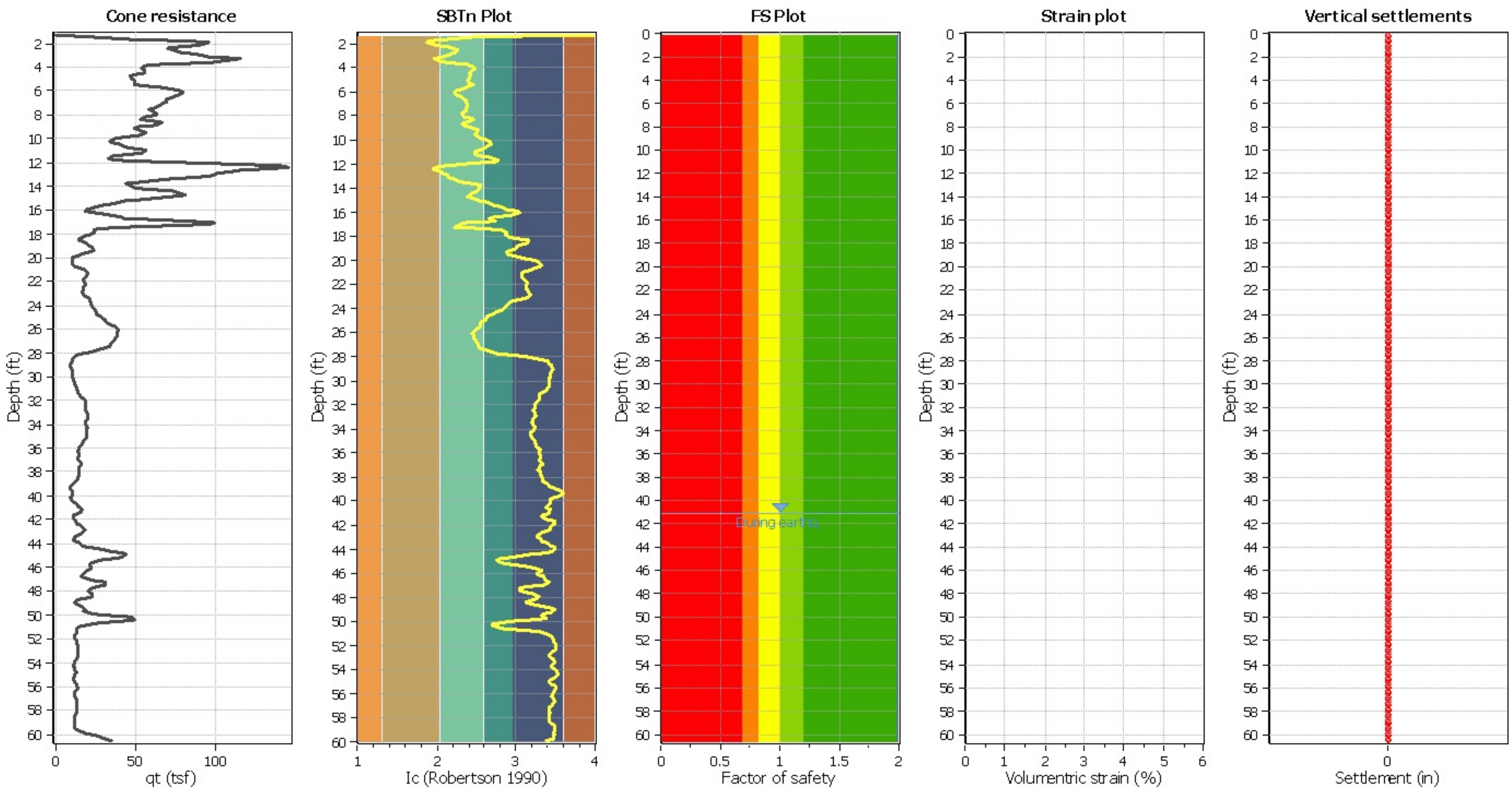
Overall liquefaction potential: 0.00

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

Abbreviations

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

Estimation of post-earthquake settlements



Abbreviations

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

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

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
41.17	65.94	2.00	0.00	1.00	0.00	41.34	61.55	2.00	0.00	1.00	0.00
41.50	55.31	2.00	0.00	1.00	0.00	41.67	49.80	2.00	0.00	1.00	0.00
41.83	47.99	2.00	0.00	1.00	0.00	41.99	49.27	2.00	0.00	1.00	0.00
42.16	51.75	2.00	0.00	1.00	0.00	42.32	55.93	2.00	0.00	1.00	0.00
42.49	61.26	2.00	0.00	1.00	0.00	42.65	64.78	2.00	0.00	1.00	0.00
42.81	64.92	2.00	0.00	1.00	0.00	42.98	62.11	2.00	0.00	1.00	0.00
43.14	56.76	2.00	0.00	1.00	0.00	43.31	50.71	2.00	0.00	1.00	0.00
43.47	45.26	2.00	0.00	1.00	0.00	43.64	45.30	2.00	0.00	1.00	0.00
43.80	51.74	2.00	0.00	1.00	0.00	43.96	63.76	2.00	0.00	1.00	0.00
44.13	74.42	2.00	0.00	1.00	0.00	44.29	81.36	2.00	0.00	1.00	0.00
44.46	84.10	2.00	0.00	1.00	0.00	44.62	78.28	2.00	0.00	1.00	0.00
44.78	76.32	2.00	0.00	1.00	0.00	44.95	76.35	2.00	0.00	1.00	0.00
45.11	79.13	2.00	0.00	1.00	0.00	45.28	78.40	2.00	0.00	1.00	0.00
45.44	77.31	2.00	0.00	1.00	0.00	45.60	77.18	2.00	0.00	1.00	0.00
45.77	77.67	2.00	0.00	1.00	0.00	45.93	77.76	2.00	0.00	1.00	0.00
46.10	75.64	2.00	0.00	1.00	0.00	46.26	71.18	2.00	0.00	1.00	0.00
46.42	67.71	2.00	0.00	1.00	0.00	46.59	64.12	2.00	0.00	1.00	0.00
46.75	62.63	2.00	0.00	1.00	0.00	46.92	64.91	2.00	0.00	1.00	0.00
47.08	72.12	2.00	0.00	1.00	0.00	47.24	77.59	2.00	0.00	1.00	0.00
47.41	78.87	2.00	0.00	1.00	0.00	47.57	75.67	2.00	0.00	1.00	0.00
47.74	71.35	2.00	0.00	1.00	0.00	47.90	69.78	2.00	0.00	1.00	0.00
48.06	71.01	2.00	0.00	1.00	0.00	48.23	69.48	2.00	0.00	1.00	0.00
48.39	62.80	2.00	0.00	1.00	0.00	48.56	54.18	2.00	0.00	1.00	0.00
48.72	46.71	2.00	0.00	1.00	0.00	48.88	45.70	2.00	0.00	1.00	0.00
49.05	50.57	2.00	0.00	1.00	0.00	49.21	56.62	2.00	0.00	1.00	0.00
49.38	63.10	2.00	0.00	1.00	0.00	49.54	65.67	2.00	0.00	1.00	0.00
49.70	66.25	2.00	0.00	1.00	0.00	49.87	67.72	2.00	0.00	1.00	0.00
50.03	68.68	2.00	0.00	1.00	0.00	50.20	72.52	2.00	0.00	1.00	0.00
50.36	74.98	2.00	0.00	1.00	0.00	50.52	73.40	2.00	0.00	1.00	0.00
50.69	65.38	2.00	0.00	1.00	0.00	50.85	55.92	2.00	0.00	1.00	0.00
51.02	49.45	2.00	0.00	1.00	0.00	51.18	47.42	2.00	0.00	1.00	0.00
51.35	46.81	2.00	0.00	1.00	0.00	51.51	46.21	2.00	0.00	1.00	0.00
51.67	45.92	2.00	0.00	1.00	0.00	51.84	46.07	2.00	0.00	1.00	0.00
52.00	46.95	2.00	0.00	1.00	0.00	52.17	48.68	2.00	0.00	1.00	0.00
52.33	50.43	2.00	0.00	1.00	0.00	52.49	51.39	2.00	0.00	1.00	0.00
52.66	50.72	2.00	0.00	1.00	0.00	52.82	48.91	2.00	0.00	1.00	0.00
52.99	48.36	2.00	0.00	1.00	0.00	53.15	50.05	2.00	0.00	1.00	0.00
53.31	51.96	2.00	0.00	1.00	0.00	53.48	51.71	2.00	0.00	1.00	0.00
53.64	47.90	2.00	0.00	1.00	0.00	53.81	43.72	2.00	0.00	1.00	0.00
53.97	41.07	2.00	0.00	1.00	0.00	54.13	41.19	2.00	0.00	1.00	0.00
54.30	42.02	2.00	0.00	1.00	0.00	54.46	43.06	2.00	0.00	1.00	0.00
54.63	43.19	2.00	0.00	1.00	0.00	54.79	42.54	2.00	0.00	1.00	0.00
54.95	41.14	2.00	0.00	1.00	0.00	55.12	39.71	2.00	0.00	1.00	0.00
55.28	39.41	2.00	0.00	1.00	0.00	55.45	40.01	2.00	0.00	1.00	0.00
55.61	42.48	2.00	0.00	1.00	0.00	55.77	45.44	2.00	0.00	1.00	0.00
55.94	47.41	2.00	0.00	1.00	0.00	56.10	47.62	2.00	0.00	1.00	0.00
56.27	45.09	2.00	0.00	1.00	0.00	56.43	42.22	2.00	0.00	1.00	0.00
56.59	40.23	2.00	0.00	1.00	0.00	56.76	40.55	2.00	0.00	1.00	0.00

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

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
56.92	41.48	2.00	0.00	1.00	0.00	57.09	41.97	2.00	0.00	1.00	0.00
57.25	41.76	2.00	0.00	1.00	0.00	57.41	41.43	2.00	0.00	1.00	0.00
57.58	41.23	2.00	0.00	1.00	0.00	57.74	41.08	2.00	0.00	1.00	0.00
57.91	40.96	2.00	0.00	1.00	0.00	58.07	40.74	2.00	0.00	1.00	0.00
58.23	40.21	2.00	0.00	1.00	0.00	58.40	39.52	2.00	0.00	1.00	0.00
58.56	39.08	2.00	0.00	1.00	0.00	58.73	38.93	2.00	0.00	1.00	0.00
58.89	38.87	2.00	0.00	1.00	0.00	59.06	38.52	2.00	0.00	1.00	0.00
59.22	38.37	2.00	0.00	1.00	0.00	59.38	38.47	2.00	0.00	1.00	0.00
59.55	41.06	2.00	0.00	1.00	0.00	59.71	48.35	2.00	0.00	1.00	0.00
59.88	58.93	2.00	0.00	1.00	0.00	60.04	-1.00	2.00	0.00	1.00	0.00
60.20	-1.00	2.00	0.00	1.00	0.00	60.37	-1.00	2.00	0.00	1.00	0.00
60.53	-1.00	2.00	0.00	1.00	0.00						

Total estimated settlement: 0.00

Abbreviations

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

:: Liquefaction Potential Index calculation data ::

Depth (ft)	FS	F_L	w_z	d_z	LPI	Depth (ft)	FS	F_L	w_z	d_z	LPI
0.16	2.00	0.00	9.97	0.16	0.00	0.33	2.00	0.00	9.95	0.16	0.00
0.49	2.00	0.00	9.92	0.16	0.00	0.66	2.00	0.00	9.90	0.16	0.00
0.82	2.00	0.00	9.87	0.16	0.00	0.98	2.00	0.00	9.85	0.16	0.00
1.15	2.00	0.00	9.82	0.16	0.00	1.31	2.00	0.00	9.80	0.16	0.00
1.48	2.00	0.00	9.77	0.16	0.00	1.64	2.00	0.00	9.75	0.16	0.00
1.80	2.00	0.00	9.72	0.16	0.00	1.97	2.00	0.00	9.70	0.16	0.00
2.13	2.00	0.00	9.67	0.16	0.00	2.30	2.00	0.00	9.65	0.16	0.00
2.46	2.00	0.00	9.62	0.16	0.00	2.62	2.00	0.00	9.60	0.16	0.00
2.79	2.00	0.00	9.57	0.16	0.00	2.95	2.00	0.00	9.55	0.16	0.00
3.12	2.00	0.00	9.52	0.16	0.00	3.28	2.00	0.00	9.50	0.16	0.00
3.44	2.00	0.00	9.47	0.16	0.00	3.61	2.00	0.00	9.45	0.16	0.00
3.77	2.00	0.00	9.42	0.16	0.00	3.94	2.00	0.00	9.40	0.16	0.00
4.10	2.00	0.00	9.37	0.16	0.00	4.27	2.00	0.00	9.35	0.16	0.00
4.43	2.00	0.00	9.32	0.16	0.00	4.59	2.00	0.00	9.30	0.16	0.00
4.76	2.00	0.00	9.27	0.16	0.00	4.92	2.00	0.00	9.25	0.16	0.00
5.09	2.00	0.00	9.22	0.16	0.00	5.25	2.00	0.00	9.20	0.16	0.00
5.41	2.00	0.00	9.17	0.16	0.00	5.58	2.00	0.00	9.15	0.16	0.00
5.74	2.00	0.00	9.12	0.16	0.00	5.91	2.00	0.00	9.10	0.16	0.00
6.07	2.00	0.00	9.07	0.16	0.00	6.23	2.00	0.00	9.05	0.16	0.00
6.40	2.00	0.00	9.02	0.16	0.00	6.56	2.00	0.00	9.00	0.16	0.00
6.73	2.00	0.00	8.97	0.16	0.00	6.89	2.00	0.00	8.95	0.16	0.00
7.05	2.00	0.00	8.92	0.16	0.00	7.22	2.00	0.00	8.90	0.16	0.00
7.38	2.00	0.00	8.87	0.16	0.00	7.55	2.00	0.00	8.85	0.16	0.00
7.71	2.00	0.00	8.82	0.16	0.00	7.87	2.00	0.00	8.80	0.16	0.00
8.04	2.00	0.00	8.77	0.16	0.00	8.20	2.00	0.00	8.75	0.16	0.00
8.37	2.00	0.00	8.72	0.16	0.00	8.53	2.00	0.00	8.70	0.16	0.00
8.69	2.00	0.00	8.67	0.16	0.00	8.86	2.00	0.00	8.65	0.16	0.00
9.02	2.00	0.00	8.62	0.16	0.00	9.19	2.00	0.00	8.60	0.16	0.00
9.35	2.00	0.00	8.57	0.16	0.00	9.51	2.00	0.00	8.55	0.16	0.00
9.68	2.00	0.00	8.52	0.16	0.00	9.84	2.00	0.00	8.50	0.16	0.00
10.01	2.00	0.00	8.47	0.16	0.00	10.17	2.00	0.00	8.45	0.16	0.00
10.33	2.00	0.00	8.42	0.16	0.00	10.50	2.00	0.00	8.40	0.16	0.00
10.66	2.00	0.00	8.37	0.16	0.00	10.83	2.00	0.00	8.35	0.16	0.00
10.99	2.00	0.00	8.32	0.16	0.00	11.15	2.00	0.00	8.30	0.16	0.00
11.32	2.00	0.00	8.27	0.16	0.00	11.48	2.00	0.00	8.25	0.16	0.00
11.65	2.00	0.00	8.22	0.16	0.00	11.81	2.00	0.00	8.20	0.16	0.00
11.98	2.00	0.00	8.17	0.16	0.00	12.14	2.00	0.00	8.15	0.16	0.00
12.30	2.00	0.00	8.12	0.16	0.00	12.47	2.00	0.00	8.10	0.16	0.00
12.63	2.00	0.00	8.07	0.16	0.00	12.80	2.00	0.00	8.05	0.16	0.00
12.96	2.00	0.00	8.02	0.16	0.00	13.12	2.00	0.00	8.00	0.16	0.00
13.29	2.00	0.00	7.97	0.16	0.00	13.45	2.00	0.00	7.95	0.16	0.00
13.62	2.00	0.00	7.92	0.16	0.00	13.78	2.00	0.00	7.90	0.16	0.00
13.94	2.00	0.00	7.87	0.16	0.00	14.11	2.00	0.00	7.85	0.16	0.00
14.27	2.00	0.00	7.82	0.16	0.00	14.44	2.00	0.00	7.80	0.16	0.00
14.60	2.00	0.00	7.77	0.16	0.00	14.76	2.00	0.00	7.75	0.16	0.00
14.93	2.00	0.00	7.72	0.16	0.00	15.09	2.00	0.00	7.70	0.16	0.00
15.26	2.00	0.00	7.67	0.16	0.00	15.42	2.00	0.00	7.65	0.16	0.00
15.58	2.00	0.00	7.62	0.16	0.00	15.75	2.00	0.00	7.60	0.16	0.00

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

Depth (ft)	FS	F_L	w_z	d_z	LPI	Depth (ft)	FS	F_L	w_z	d_z	LPI
15.91	2.00	0.00	7.57	0.16	0.00	16.08	2.00	0.00	7.55	0.16	0.00
16.24	2.00	0.00	7.52	0.16	0.00	16.40	2.00	0.00	7.50	0.16	0.00
16.57	2.00	0.00	7.47	0.16	0.00	16.73	2.00	0.00	7.45	0.16	0.00
16.90	2.00	0.00	7.42	0.16	0.00	17.06	2.00	0.00	7.40	0.16	0.00
17.22	2.00	0.00	7.37	0.16	0.00	17.39	2.00	0.00	7.35	0.16	0.00
17.55	2.00	0.00	7.32	0.16	0.00	17.72	2.00	0.00	7.30	0.16	0.00
17.88	2.00	0.00	7.27	0.16	0.00	18.04	2.00	0.00	7.25	0.16	0.00
18.21	2.00	0.00	7.22	0.16	0.00	18.37	2.00	0.00	7.20	0.16	0.00
18.54	2.00	0.00	7.17	0.16	0.00	18.70	2.00	0.00	7.15	0.16	0.00
18.86	2.00	0.00	7.12	0.16	0.00	19.03	2.00	0.00	7.10	0.16	0.00
19.19	2.00	0.00	7.07	0.16	0.00	19.36	2.00	0.00	7.05	0.16	0.00
19.52	2.00	0.00	7.02	0.16	0.00	19.69	2.00	0.00	7.00	0.16	0.00
19.85	2.00	0.00	6.97	0.16	0.00	20.01	2.00	0.00	6.95	0.16	0.00
20.18	2.00	0.00	6.92	0.16	0.00	20.34	2.00	0.00	6.90	0.16	0.00
20.51	2.00	0.00	6.87	0.16	0.00	20.67	2.00	0.00	6.85	0.16	0.00
20.83	2.00	0.00	6.82	0.16	0.00	21.00	2.00	0.00	6.80	0.16	0.00
21.16	2.00	0.00	6.77	0.16	0.00	21.33	2.00	0.00	6.75	0.16	0.00
21.49	2.00	0.00	6.72	0.16	0.00	21.65	2.00	0.00	6.70	0.16	0.00
21.82	2.00	0.00	6.67	0.16	0.00	21.98	2.00	0.00	6.65	0.16	0.00
22.15	2.00	0.00	6.62	0.16	0.00	22.31	2.00	0.00	6.60	0.16	0.00
22.47	2.00	0.00	6.57	0.16	0.00	22.64	2.00	0.00	6.55	0.16	0.00
22.80	2.00	0.00	6.52	0.16	0.00	22.97	2.00	0.00	6.50	0.16	0.00
23.13	2.00	0.00	6.47	0.16	0.00	23.29	2.00	0.00	6.45	0.16	0.00
23.46	2.00	0.00	6.42	0.16	0.00	23.62	2.00	0.00	6.40	0.16	0.00
23.79	2.00	0.00	6.37	0.16	0.00	23.95	2.00	0.00	6.35	0.16	0.00
24.11	2.00	0.00	6.32	0.16	0.00	24.28	2.00	0.00	6.30	0.16	0.00
24.44	2.00	0.00	6.27	0.16	0.00	24.61	2.00	0.00	6.25	0.16	0.00
24.77	2.00	0.00	6.22	0.16	0.00	24.93	2.00	0.00	6.20	0.16	0.00
25.10	2.00	0.00	6.17	0.16	0.00	25.26	2.00	0.00	6.15	0.16	0.00
25.43	2.00	0.00	6.12	0.16	0.00	25.59	2.00	0.00	6.10	0.16	0.00
25.75	2.00	0.00	6.07	0.16	0.00	25.92	2.00	0.00	6.05	0.16	0.00
26.08	2.00	0.00	6.02	0.16	0.00	26.25	2.00	0.00	6.00	0.16	0.00
26.41	2.00	0.00	5.97	0.16	0.00	26.57	2.00	0.00	5.95	0.16	0.00
26.74	2.00	0.00	5.92	0.16	0.00	26.90	2.00	0.00	5.90	0.16	0.00
27.07	2.00	0.00	5.87	0.16	0.00	27.23	2.00	0.00	5.85	0.16	0.00
27.40	2.00	0.00	5.82	0.16	0.00	27.56	2.00	0.00	5.80	0.16	0.00
27.72	2.00	0.00	5.77	0.16	0.00	27.89	2.00	0.00	5.75	0.16	0.00
28.05	2.00	0.00	5.72	0.16	0.00	28.22	2.00	0.00	5.70	0.16	0.00
28.38	2.00	0.00	5.67	0.16	0.00	28.54	2.00	0.00	5.65	0.16	0.00
28.71	2.00	0.00	5.62	0.16	0.00	28.87	2.00	0.00	5.60	0.16	0.00
29.04	2.00	0.00	5.57	0.16	0.00	29.20	2.00	0.00	5.55	0.16	0.00
29.36	2.00	0.00	5.52	0.16	0.00	29.53	2.00	0.00	5.50	0.16	0.00
29.69	2.00	0.00	5.47	0.16	0.00	29.86	2.00	0.00	5.45	0.16	0.00
30.02	2.00	0.00	5.42	0.16	0.00	30.18	2.00	0.00	5.40	0.16	0.00
30.35	2.00	0.00	5.37	0.16	0.00	30.51	2.00	0.00	5.35	0.16	0.00
30.68	2.00	0.00	5.32	0.16	0.00	30.84	2.00	0.00	5.30	0.16	0.00
31.00	2.00	0.00	5.27	0.16	0.00	31.17	2.00	0.00	5.25	0.16	0.00
31.33	2.00	0.00	5.22	0.16	0.00	31.50	2.00	0.00	5.20	0.16	0.00

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

Depth (ft)	FS	F_L	w_z	d_z	LPI	Depth (ft)	FS	F_L	w_z	d_z	LPI
31.66	2.00	0.00	5.17	0.16	0.00	31.82	2.00	0.00	5.15	0.16	0.00
31.99	2.00	0.00	5.12	0.16	0.00	32.15	2.00	0.00	5.10	0.16	0.00
32.32	2.00	0.00	5.07	0.16	0.00	32.48	2.00	0.00	5.05	0.16	0.00
32.64	2.00	0.00	5.02	0.16	0.00	32.81	2.00	0.00	5.00	0.16	0.00
32.97	2.00	0.00	4.97	0.16	0.00	33.14	2.00	0.00	4.95	0.16	0.00
33.30	2.00	0.00	4.92	0.16	0.00	33.46	2.00	0.00	4.90	0.16	0.00
33.63	2.00	0.00	4.87	0.16	0.00	33.79	2.00	0.00	4.85	0.16	0.00
33.96	2.00	0.00	4.82	0.16	0.00	34.12	2.00	0.00	4.80	0.16	0.00
34.28	2.00	0.00	4.77	0.16	0.00	34.45	2.00	0.00	4.75	0.16	0.00
34.61	2.00	0.00	4.72	0.16	0.00	34.78	2.00	0.00	4.70	0.16	0.00
34.94	2.00	0.00	4.67	0.16	0.00	35.10	2.00	0.00	4.65	0.16	0.00
35.27	2.00	0.00	4.62	0.16	0.00	35.43	2.00	0.00	4.60	0.16	0.00
35.60	2.00	0.00	4.57	0.16	0.00	35.76	2.00	0.00	4.55	0.16	0.00
35.93	2.00	0.00	4.52	0.16	0.00	36.09	2.00	0.00	4.50	0.16	0.00
36.25	2.00	0.00	4.47	0.16	0.00	36.42	2.00	0.00	4.45	0.16	0.00
36.58	2.00	0.00	4.42	0.16	0.00	36.75	2.00	0.00	4.40	0.16	0.00
36.91	2.00	0.00	4.37	0.16	0.00	37.07	2.00	0.00	4.35	0.16	0.00
37.24	2.00	0.00	4.32	0.16	0.00	37.40	2.00	0.00	4.30	0.16	0.00
37.57	2.00	0.00	4.27	0.16	0.00	37.73	2.00	0.00	4.25	0.16	0.00
37.89	2.00	0.00	4.22	0.16	0.00	38.06	2.00	0.00	4.20	0.16	0.00
38.22	2.00	0.00	4.17	0.16	0.00	38.39	2.00	0.00	4.15	0.16	0.00
38.55	2.00	0.00	4.12	0.16	0.00	38.71	2.00	0.00	4.10	0.16	0.00
38.88	2.00	0.00	4.07	0.16	0.00	39.04	2.00	0.00	4.05	0.16	0.00
39.21	2.00	0.00	4.02	0.16	0.00	39.37	2.00	0.00	4.00	0.16	0.00
39.53	2.00	0.00	3.97	0.16	0.00	39.70	2.00	0.00	3.95	0.16	0.00
39.86	2.00	0.00	3.92	0.16	0.00	40.03	2.00	0.00	3.90	0.16	0.00
40.19	2.00	0.00	3.87	0.16	0.00	40.35	2.00	0.00	3.85	0.16	0.00
40.52	2.00	0.00	3.82	0.16	0.00	40.68	2.00	0.00	3.80	0.16	0.00
40.85	2.00	0.00	3.77	0.16	0.00	41.01	2.00	0.00	3.75	0.16	0.00
41.17	2.00	0.00	3.72	0.16	0.00	41.34	2.00	0.00	3.70	0.16	0.00
41.50	2.00	0.00	3.67	0.16	0.00	41.67	2.00	0.00	3.65	0.16	0.00
41.83	2.00	0.00	3.62	0.16	0.00	41.99	2.00	0.00	3.60	0.16	0.00
42.16	2.00	0.00	3.57	0.16	0.00	42.32	2.00	0.00	3.55	0.16	0.00
42.49	2.00	0.00	3.52	0.16	0.00	42.65	2.00	0.00	3.50	0.16	0.00
42.81	2.00	0.00	3.47	0.16	0.00	42.98	2.00	0.00	3.45	0.16	0.00
43.14	2.00	0.00	3.42	0.16	0.00	43.31	2.00	0.00	3.40	0.16	0.00
43.47	2.00	0.00	3.37	0.16	0.00	43.64	2.00	0.00	3.35	0.16	0.00
43.80	0.31	0.69	3.32	0.16	0.12	43.96	0.31	0.69	3.30	0.16	0.11
44.13	2.00	0.00	3.27	0.16	0.00	44.29	2.00	0.00	3.25	0.16	0.00
44.46	2.00	0.00	3.22	0.16	0.00	44.62	2.00	0.00	3.20	0.16	0.00
44.78	2.00	0.00	3.17	0.16	0.00	44.95	2.00	0.00	3.15	0.16	0.00
45.11	2.00	0.00	3.12	0.16	0.00	45.28	2.00	0.00	3.10	0.16	0.00
45.44	2.00	0.00	3.07	0.16	0.00	45.60	2.00	0.00	3.05	0.16	0.00
45.77	2.00	0.00	3.02	0.16	0.00	45.93	2.00	0.00	3.00	0.16	0.00
46.10	2.00	0.00	2.97	0.16	0.00	46.26	2.00	0.00	2.95	0.16	0.00
46.42	2.00	0.00	2.92	0.16	0.00	46.59	2.00	0.00	2.90	0.16	0.00
46.75	2.00	0.00	2.87	0.16	0.00	46.92	2.00	0.00	2.85	0.16	0.00
47.08	2.00	0.00	2.82	0.16	0.00	47.24	2.00	0.00	2.80	0.16	0.00

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

Depth (ft)	FS	F_L	w_z	d_z	LPI	Depth (ft)	FS	F_L	w_z	d_z	LPI
47.41	2.00	0.00	2.77	0.16	0.00	47.57	2.00	0.00	2.75	0.16	0.00
47.74	2.00	0.00	2.72	0.16	0.00	47.90	2.00	0.00	2.70	0.16	0.00
48.06	2.00	0.00	2.67	0.16	0.00	48.23	2.00	0.00	2.65	0.16	0.00
48.39	2.00	0.00	2.62	0.16	0.00	48.56	2.00	0.00	2.60	0.16	0.00
48.72	2.00	0.00	2.57	0.16	0.00	48.88	2.00	0.00	2.55	0.16	0.00
49.05	2.00	0.00	2.52	0.16	0.00	49.21	2.00	0.00	2.50	0.16	0.00
49.38	2.00	0.00	2.47	0.16	0.00	49.54	2.00	0.00	2.45	0.16	0.00
49.70	2.00	0.00	2.42	0.16	0.00	49.87	2.00	0.00	2.40	0.16	0.00
50.03	2.00	0.00	2.37	0.16	0.00	50.20	2.00	0.00	2.35	0.16	0.00
50.36	2.00	0.00	2.32	0.16	0.00	50.52	2.00	0.00	2.30	0.16	0.00
50.69	2.00	0.00	2.27	0.16	0.00	50.85	2.00	0.00	2.25	0.16	0.00
51.02	2.00	0.00	2.22	0.16	0.00	51.18	2.00	0.00	2.20	0.16	0.00
51.35	2.00	0.00	2.17	0.16	0.00	51.51	2.00	0.00	2.15	0.16	0.00
51.67	2.00	0.00	2.12	0.16	0.00	51.84	2.00	0.00	2.10	0.16	0.00
52.00	0.40	0.60	2.07	0.16	0.06	52.17	0.36	0.64	2.05	0.16	0.07
52.33	0.34	0.66	2.02	0.16	0.07	52.49	0.38	0.62	2.00	0.16	0.06
52.66	0.45	0.55	1.97	0.16	0.05	52.82	0.42	0.58	1.95	0.16	0.06
52.99	0.38	0.62	1.92	0.16	0.06	53.15	0.36	0.64	1.90	0.16	0.06
53.31	0.35	0.65	1.87	0.16	0.06	53.48	0.36	0.64	1.85	0.16	0.06
53.64	0.38	0.62	1.82	0.16	0.06	53.81	0.43	0.57	1.80	0.16	0.05
53.97	0.50	0.50	1.77	0.16	0.04	54.13	0.55	0.45	1.75	0.16	0.04
54.30	0.52	0.48	1.72	0.16	0.04	54.46	0.50	0.50	1.70	0.16	0.04
54.63	0.49	0.51	1.67	0.16	0.04	54.79	0.47	0.53	1.65	0.16	0.04
54.95	0.38	0.62	1.62	0.16	0.05	55.12	0.37	0.63	1.60	0.16	0.05
55.28	0.34	0.66	1.57	0.16	0.05	55.45	0.35	0.65	1.55	0.16	0.05
55.61	0.35	0.65	1.52	0.16	0.05	55.77	0.42	0.58	1.50	0.16	0.04
55.94	0.44	0.56	1.47	0.16	0.04	56.10	0.46	0.54	1.45	0.16	0.04
56.27	0.44	0.56	1.42	0.16	0.04	56.43	0.43	0.57	1.40	0.16	0.04
56.59	0.35	0.65	1.37	0.16	0.04	56.76	0.34	0.66	1.35	0.16	0.04
56.92	0.36	0.64	1.32	0.16	0.04	57.09	0.34	0.66	1.30	0.16	0.04
57.25	0.34	0.66	1.27	0.16	0.04	57.41	0.35	0.65	1.25	0.16	0.04
57.58	0.37	0.63	1.22	0.16	0.04	57.74	0.39	0.61	1.20	0.16	0.04
57.91	0.39	0.61	1.17	0.16	0.04	58.07	0.41	0.59	1.15	0.16	0.03
58.23	0.47	0.53	1.12	0.16	0.03	58.40	0.55	0.45	1.10	0.16	0.02
58.56	0.54	0.46	1.07	0.16	0.02	58.73	0.53	0.47	1.05	0.16	0.02
58.89	0.49	0.51	1.02	0.16	0.03	59.06	0.52	0.48	1.00	0.16	0.02
59.22	2.00	0.00	0.97	0.16	0.00	59.38	2.00	0.00	0.95	0.16	0.00
59.55	2.00	0.00	0.92	0.16	0.00	59.71	2.00	0.00	0.90	0.16	0.00
59.88	0.49	0.51	0.87	0.16	0.02	60.04	0.48	0.52	0.85	0.16	0.02
60.20	0.63	0.37	0.82	0.16	0.02	60.37	0.97	0.03	0.80	0.16	0.00
60.53	1.42	0.00	0.77	0.16	0.00	60.70	1.71	0.00	0.75	0.16	0.00
60.86	1.69	0.00	0.72	0.16	0.00	61.02	1.25	0.00	0.70	0.16	0.00
61.19	0.89	0.11	0.67	0.16	0.00	61.35	0.72	0.28	0.65	0.16	0.01
61.52	0.66	0.34	0.62	0.16	0.01	61.68	2.00	0.00	0.60	0.16	0.00
61.84	2.00	0.00	0.57	0.16	0.00	62.01	2.00	0.00	0.55	0.16	0.00
62.17	2.00	0.00	0.52	0.16	0.00	62.34	2.00	0.00	0.50	0.16	0.00
62.50	2.00	0.00	0.47	0.16	0.00	62.66	2.00	0.00	0.45	0.16	0.00
62.83	2.00	0.00	0.42	0.16	0.00	62.99	2.00	0.00	0.40	0.16	0.00

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

Depth (ft)	FS	F_L	w_z	d_z	LPI
63.16	2.00	0.00	0.37	0.16	0.00
63.32	2.00	0.00	0.35	0.16	0.00
63.48	2.00	0.00	0.32	0.16	0.00
63.65	2.00	0.00	0.30	0.16	0.00
63.81	2.00	0.00	0.27	0.16	0.00
63.98	2.00	0.00	0.25	0.16	0.00
64.14	2.00	0.00	0.22	0.16	0.00
64.30	2.00	0.00	0.20	0.16	0.00
64.47	2.00	0.00	0.17	0.16	0.00
64.63	2.00	0.00	0.15	0.16	0.00
64.80	2.00	0.00	0.12	0.16	0.00
64.96	2.00	0.00	0.10	0.16	0.00
65.12	2.00	0.00	0.07	0.16	0.00
65.29	2.00	0.00	0.05	0.16	0.00
65.45	2.00	0.00	0.02	0.16	0.00
65.62	2.00	0.00	0.00	0.00	0.00
65.78	2.00	0.00	0.00	0.00	0.00
65.94	2.00	0.00	0.00	0.00	0.00
66.11	2.00	0.00	0.00	0.00	0.00
66.27	2.00	0.00	0.00	0.00	0.00
66.44	2.00	0.00	0.00	0.00	0.00
66.60	2.00	0.00	0.00	0.00	0.00
66.77	2.00	0.00	0.00	0.00	0.00
66.93	2.00	0.00	0.00	0.00	0.00
67.09	2.00	0.00	0.00	0.00	0.00
67.26	2.00	0.00	0.00	0.00	0.00
67.42	2.00	0.00	0.00	0.00	0.00
67.59	2.00	0.00	0.00	0.00	0.00
67.75	2.00	0.00	0.00	0.00	0.00
67.91	2.00	0.00	0.00	0.00	0.00
68.08	2.00	0.00	0.00	0.00	0.00
68.24	2.00	0.00	0.00	0.00	0.00
68.41	2.00	0.00	0.00	0.00	0.00
68.57	2.00	0.00	0.00	0.00	0.00
68.73	2.00	0.00	0.00	0.00	0.00
68.90	2.00	0.00	0.00	0.00	0.00
69.06	2.00	0.00	0.00	0.00	0.00
69.23	2.00	0.00	0.00	0.00	0.00
69.39	2.00	0.00	0.00	0.00	0.00
69.55	2.00	0.00	0.00	0.00	0.00
69.72	2.00	0.00	0.00	0.00	0.00
69.88	2.00	0.00	0.00	0.00	0.00
70.05	2.00	0.00	0.00	0.00	0.00
70.21	2.00	0.00	0.00	0.00	0.00
70.37	2.00	0.00	0.00	0.00	0.00
70.54	2.00	0.00	0.00	0.00	0.00
70.70	2.00	0.00	0.00	0.00	0.00
70.87	2.00	0.00	0.00	0.00	0.00
71.03	2.00	0.00	0.00	0.00	0.00
71.19	2.00	0.00	0.00	0.00	0.00
71.36	2.00	0.00	0.00	0.00	0.00
71.52	2.00	0.00	0.00	0.00	0.00
71.69	2.00	0.00	0.00	0.00	0.00
71.85	2.00	0.00	0.00	0.00	0.00
72.01	2.00	0.00	0.00	0.00	0.00

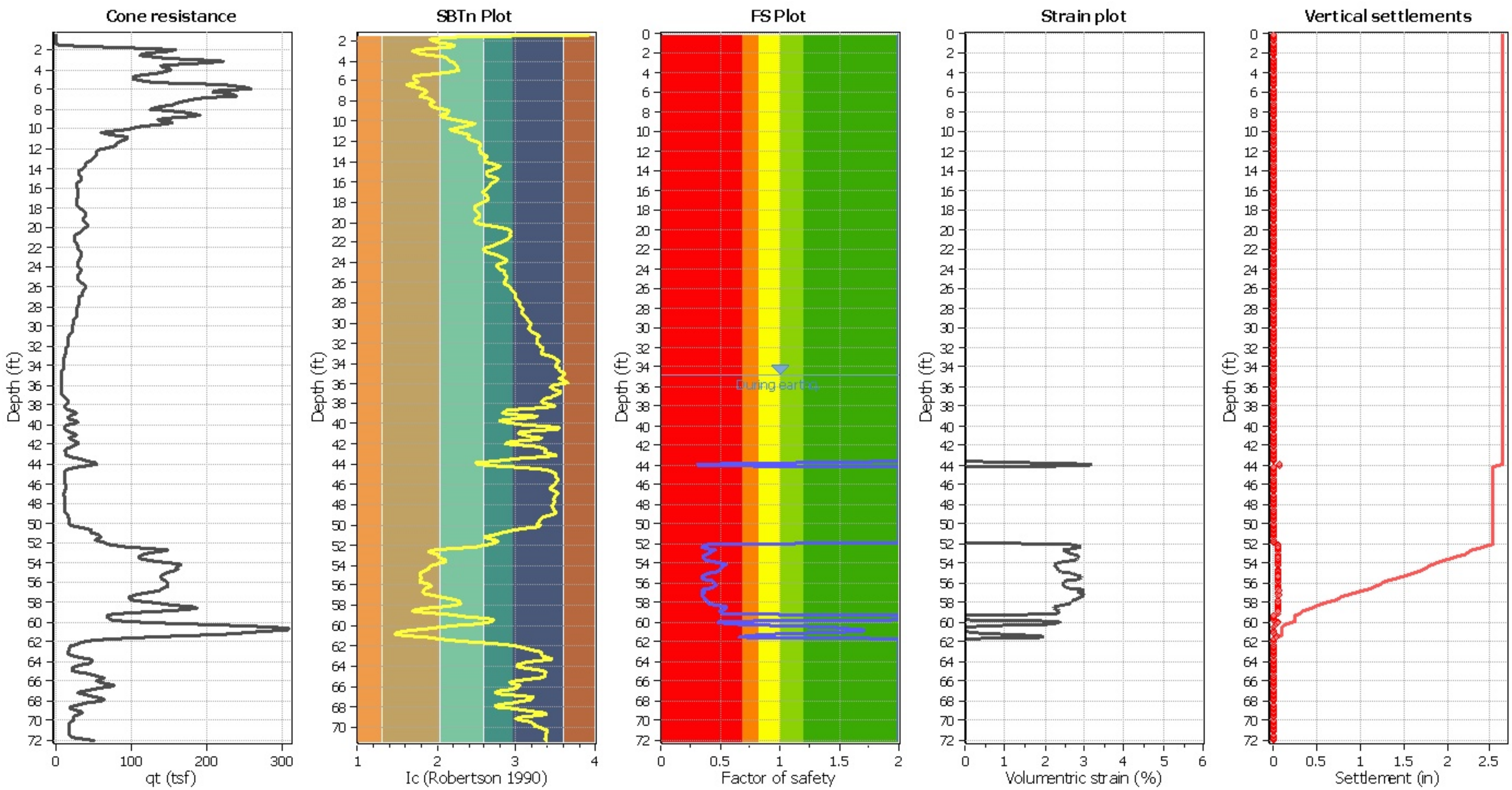
Overall liquefaction potential: 2.29

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

Abbreviations

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

Estimation of post-earthquake settlements



Abbreviations

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

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

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
34.94	41.53	2.00	0.00	1.00	0.00	35.10	41.47	2.00	0.00	1.00	0.00
35.27	43.00	2.00	0.00	1.00	0.00	35.43	43.87	2.00	0.00	1.00	0.00
35.60	46.09	2.00	0.00	1.00	0.00	35.76	47.09	2.00	0.00	1.00	0.00
35.93	44.91	2.00	0.00	1.00	0.00	36.09	41.95	2.00	0.00	1.00	0.00
36.25	37.29	2.00	0.00	1.00	0.00	36.42	36.84	2.00	0.00	1.00	0.00
36.58	36.08	2.00	0.00	1.00	0.00	36.75	38.56	2.00	0.00	1.00	0.00
36.91	43.95	2.00	0.00	1.00	0.00	37.07	54.42	2.00	0.00	1.00	0.00
37.24	62.88	2.00	0.00	1.00	0.00	37.40	67.68	2.00	0.00	1.00	0.00
37.57	67.47	2.00	0.00	1.00	0.00	37.73	64.24	2.00	0.00	1.00	0.00
37.89	59.29	2.00	0.00	1.00	0.00	38.06	55.15	2.00	0.00	1.00	0.00
38.22	54.19	2.00	0.00	1.00	0.00	38.39	57.71	2.00	0.00	1.00	0.00
38.55	61.13	2.00	0.00	1.00	0.00	38.71	59.70	2.00	0.00	1.00	0.00
38.88	58.65	2.00	0.00	1.00	0.00	39.04	61.00	2.00	0.00	1.00	0.00
39.21	62.25	2.00	0.00	1.00	0.00	39.37	62.77	2.00	0.00	1.00	0.00
39.53	60.46	2.00	0.00	1.00	0.00	39.70	56.44	2.00	0.00	1.00	0.00
39.86	52.80	2.00	0.00	1.00	0.00	40.03	47.94	2.00	0.00	1.00	0.00
40.19	49.66	2.00	0.00	1.00	0.00	40.35	55.42	2.00	0.00	1.00	0.00
40.52	62.13	2.00	0.00	1.00	0.00	40.68	71.08	2.00	0.00	1.00	0.00
40.85	73.38	2.00	0.00	1.00	0.00	41.01	74.98	2.00	0.00	1.00	0.00
41.17	74.83	2.00	0.00	1.00	0.00	41.34	74.08	2.00	0.00	1.00	0.00
41.50	73.35	2.00	0.00	1.00	0.00	41.67	71.77	2.00	0.00	1.00	0.00
41.83	66.84	2.00	0.00	1.00	0.00	41.99	63.79	2.00	0.00	1.00	0.00
42.16	60.42	2.00	0.00	1.00	0.00	42.32	56.13	2.00	0.00	1.00	0.00
42.49	52.05	2.00	0.00	1.00	0.00	42.65	49.74	2.00	0.00	1.00	0.00
42.81	50.98	2.00	0.00	1.00	0.00	42.98	56.84	2.00	0.00	1.00	0.00
43.14	67.98	2.00	0.00	1.00	0.00	43.31	81.38	2.00	0.00	1.00	0.00
43.47	83.75	2.00	0.00	1.00	0.00	43.64	76.59	2.00	0.00	1.00	0.00
43.80	68.43	0.31	3.19	1.00	0.06	43.96	69.80	0.31	3.14	1.00	0.06
44.13	72.62	2.00	0.00	1.00	0.00	44.29	71.77	2.00	0.00	1.00	0.00
44.46	66.28	2.00	0.00	1.00	0.00	44.62	58.98	2.00	0.00	1.00	0.00
44.78	54.10	2.00	0.00	1.00	0.00	44.95	52.65	2.00	0.00	1.00	0.00
45.11	52.54	2.00	0.00	1.00	0.00	45.28	52.17	2.00	0.00	1.00	0.00
45.44	52.23	2.00	0.00	1.00	0.00	45.60	52.01	2.00	0.00	1.00	0.00
45.77	52.89	2.00	0.00	1.00	0.00	45.93	53.61	2.00	0.00	1.00	0.00
46.10	54.97	2.00	0.00	1.00	0.00	46.26	54.30	2.00	0.00	1.00	0.00
46.42	52.72	2.00	0.00	1.00	0.00	46.59	50.65	2.00	0.00	1.00	0.00
46.75	47.50	2.00	0.00	1.00	0.00	46.92	45.66	2.00	0.00	1.00	0.00
47.08	44.07	2.00	0.00	1.00	0.00	47.24	44.70	2.00	0.00	1.00	0.00
47.41	44.98	2.00	0.00	1.00	0.00	47.57	45.99	2.00	0.00	1.00	0.00
47.74	48.52	2.00	0.00	1.00	0.00	47.90	51.14	2.00	0.00	1.00	0.00
48.06	51.76	2.00	0.00	1.00	0.00	48.23	49.58	2.00	0.00	1.00	0.00
48.39	46.69	2.00	0.00	1.00	0.00	48.56	44.99	2.00	0.00	1.00	0.00
48.72	45.96	2.00	0.00	1.00	0.00	48.88	47.96	2.00	0.00	1.00	0.00
49.05	51.65	2.00	0.00	1.00	0.00	49.21	55.84	2.00	0.00	1.00	0.00
49.38	59.75	2.00	0.00	1.00	0.00	49.54	61.88	2.00	0.00	1.00	0.00
49.70	62.00	2.00	0.00	1.00	0.00	49.87	61.82	2.00	0.00	1.00	0.00
50.03	64.29	2.00	0.00	1.00	0.00	50.20	72.58	2.00	0.00	1.00	0.00
50.36	81.95	2.00	0.00	1.00	0.00	50.52	87.35	2.00	0.00	1.00	0.00

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

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
50.69	87.18	2.00	0.00	1.00	0.00
51.02	82.83	2.00	0.00	1.00	0.00
51.35	88.85	2.00	0.00	1.00	0.00
51.67	92.71	2.00	0.00	1.00	0.00
52.00	87.29	0.40	2.61	1.00	0.05
52.33	75.49	0.34	2.94	1.00	0.06
52.66	95.03	0.45	2.44	1.00	0.05
52.99	83.55	0.38	2.71	1.00	0.05
53.31	78.04	0.35	2.86	1.00	0.06
53.64	82.44	0.38	2.74	1.00	0.05
53.97	101.41	0.50	2.31	1.00	0.05
54.30	102.95	0.52	2.28	1.00	0.04
54.63	99.72	0.49	2.34	1.00	0.05
54.95	83.82	0.38	2.70	1.00	0.05
55.28	75.90	0.34	2.93	1.00	0.06
55.61	77.70	0.35	2.87	1.00	0.06
55.94	92.67	0.44	2.49	1.00	0.05
56.27	92.80	0.44	2.48	1.00	0.05
56.59	77.24	0.35	2.89	1.00	0.06
56.92	79.27	0.36	2.83	1.00	0.06
57.25	74.28	0.34	2.98	1.00	0.06
57.58	80.65	0.37	2.79	1.00	0.05
57.91	84.31	0.39	2.69	1.00	0.05
58.23	95.96	0.47	2.42	1.00	0.05
58.56	105.06	0.54	2.24	1.00	0.04
58.89	98.39	0.49	2.37	1.00	0.05
59.22	105.23	2.00	0.00	1.00	0.00
59.55	99.89	2.00	0.00	1.00	0.00
59.88	98.34	0.49	2.37	1.00	0.05
60.20	113.49	0.63	2.11	1.00	0.04
60.53	163.69	1.42	0.00	1.00	0.00
60.86	174.97	1.69	0.00	1.00	0.00
61.19	134.12	0.89	1.02	1.00	0.02
61.52	116.02	0.66	1.99	1.00	0.04
61.84	91.05	2.00	0.00	1.00	0.00
62.17	72.62	2.00	0.00	1.00	0.00
62.50	57.22	2.00	0.00	1.00	0.00
62.83	48.30	2.00	0.00	1.00	0.00
63.16	50.32	2.00	0.00	1.00	0.00
63.48	75.67	2.00	0.00	1.00	0.00
63.81	97.52	2.00	0.00	1.00	0.00
64.14	104.05	2.00	0.00	1.00	0.00
64.47	78.32	2.00	0.00	1.00	0.00
64.80	65.66	2.00	0.00	1.00	0.00
65.12	87.35	2.00	0.00	1.00	0.00
65.45	117.29	2.00	0.00	1.00	0.00
65.78	117.74	2.00	0.00	1.00	0.00
66.11	125.96	2.00	0.00	1.00	0.00
50.85	83.64	2.00	0.00	1.00	0.00
51.18	84.24	2.00	0.00	1.00	0.00
51.51	91.27	2.00	0.00	1.00	0.00
51.84	92.46	2.00	0.00	1.00	0.00
52.17	79.25	0.36	2.83	1.00	0.06
52.49	82.98	0.38	2.72	1.00	0.05
52.82	90.86	0.42	2.53	1.00	0.05
53.15	78.80	0.36	2.84	1.00	0.06
53.48	80.17	0.36	2.80	1.00	0.06
53.81	92.08	0.43	2.50	1.00	0.05
54.13	106.64	0.55	2.22	1.00	0.04
54.46	100.47	0.50	2.33	1.00	0.05
54.79	96.52	0.47	2.41	1.00	0.05
55.12	80.45	0.37	2.79	1.00	0.05
55.45	76.14	0.35	2.92	1.00	0.06
55.77	89.87	0.42	2.55	1.00	0.05
56.10	95.01	0.46	2.44	1.00	0.05
56.43	90.42	0.43	2.54	1.00	0.05
56.76	73.38	0.34	3.01	1.00	0.06
57.09	75.38	0.34	2.95	1.00	0.06
57.41	76.52	0.35	2.91	1.00	0.06
57.74	84.58	0.39	2.68	1.00	0.05
58.07	86.65	0.41	2.63	1.00	0.05
58.40	106.01	0.55	2.23	1.00	0.04
58.73	103.72	0.53	2.27	1.00	0.04
59.06	101.90	0.52	2.30	1.00	0.05
59.38	102.52	2.00	0.00	1.00	0.00
59.71	99.47	2.00	0.00	1.00	0.00
60.04	96.98	0.48	2.40	1.00	0.05
60.37	139.72	0.97	0.65	1.00	0.01
60.70	175.98	1.71	0.00	1.00	0.00
61.02	155.10	1.25	0.30	1.00	0.01
61.35	121.22	0.72	1.87	1.00	0.04
61.68	106.85	2.00	0.00	1.00	0.00
62.01	78.59	2.00	0.00	1.00	0.00
62.34	66.20	2.00	0.00	1.00	0.00
62.66	51.07	2.00	0.00	1.00	0.00
62.99	47.21	2.00	0.00	1.00	0.00
63.32	61.00	2.00	0.00	1.00	0.00
63.65	87.42	2.00	0.00	1.00	0.00
63.98	103.83	2.00	0.00	1.00	0.00
64.30	93.05	2.00	0.00	1.00	0.00
64.63	68.35	2.00	0.00	1.00	0.00
64.96	71.98	2.00	0.00	1.00	0.00
65.29	107.46	2.00	0.00	1.00	0.00
65.62	119.66	2.00	0.00	1.00	0.00
65.94	121.64	2.00	0.00	1.00	0.00
66.27	126.84	2.00	0.00	1.00	0.00

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

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
66.44	119.87	2.00	0.00	1.00	0.00	66.60	103.41	2.00	0.00	1.00	0.00
66.77	85.83	2.00	0.00	1.00	0.00	66.93	76.04	2.00	0.00	1.00	0.00
67.09	79.74	2.00	0.00	1.00	0.00	67.26	90.38	2.00	0.00	1.00	0.00
67.42	97.36	2.00	0.00	1.00	0.00	67.59	100.25	2.00	0.00	1.00	0.00
67.75	96.96	2.00	0.00	1.00	0.00	67.91	91.97	2.00	0.00	1.00	0.00
68.08	84.24	2.00	0.00	1.00	0.00	68.24	74.64	2.00	0.00	1.00	0.00
68.41	64.10	2.00	0.00	1.00	0.00	68.57	58.48	2.00	0.00	1.00	0.00
68.73	60.04	2.00	0.00	1.00	0.00	68.90	64.55	2.00	0.00	1.00	0.00
69.06	66.73	2.00	0.00	1.00	0.00	69.23	65.15	2.00	0.00	1.00	0.00
69.39	64.64	2.00	0.00	1.00	0.00	69.55	62.77	2.00	0.00	1.00	0.00
69.72	60.51	2.00	0.00	1.00	0.00	69.88	57.73	2.00	0.00	1.00	0.00
70.05	53.60	2.00	0.00	1.00	0.00	70.21	51.35	2.00	0.00	1.00	0.00
70.37	49.83	2.00	0.00	1.00	0.00	70.54	47.73	2.00	0.00	1.00	0.00
70.70	46.84	2.00	0.00	1.00	0.00	70.87	46.63	2.00	0.00	1.00	0.00
71.03	47.91	2.00	0.00	1.00	0.00	71.19	48.56	2.00	0.00	1.00	0.00
71.36	51.88	2.00	0.00	1.00	0.00	71.52	-1.00	2.00	0.00	1.00	0.00
71.69	-1.00	2.00	0.00	1.00	0.00	71.85	-1.00	2.00	0.00	1.00	0.00
72.01	-1.00	2.00	0.00	1.00	0.00						

Total estimated settlement: 2.64

Abbreviations

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

CALCULATIONS OF SHEAR WAVE VELOCITY

SOIL STRENGTH PARAMETERS & V_{s30}

Calc By: JZ
Date: 10/10/18

PROJECT NAME: ***Northbound 101 On-Ramp Pedestrian Overcrossing***
PROJECT NO.: ***2016-146-NOC***
STRUCTURE:
BORING NO.: ***R-18-NO-001***

BOREHOLE DIA (in)= 3.3 *HAMMER ENERGY =* 78%
GW DEPTH (ft)= 30 *DRILLING RODS (Y/N)=* Y

SOIL GROUPS
1. SANDS & GRAVELS
2. CLAYS AND PLASTIC SILTS
3. NON TO LOW PLASTIC SILTS
4. YOUNG SEDIMENTARY ROCKS
5. LIQUEFIABLE SANDS (RESIDUAL STRENGTH)
6. LIQUEFIABLE SILTS (RESIDUAL STRENGTH)

Nd; N_{30}: 15
V_{sd} (m/s); V_{s30} (m/s): *204*
Correlation: 1) Caltrans

Sample No	Layer Thickness from	to	Sample Depth (ft)	Soil Type	Field Blow Count	Sampler Type	Unit Weight (pcf)	σ_v (psf)	σ_v' (psf)	SPT-$N_{eq.}$	N_{60} CE Corr.	N_{60} CR,CB,CS Corr.	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60,CS}$	Correlated Strength Parameters ϕ (°)	c (psf)	S_r (psf)	Lab Test Results c (psf)	Vs (m/s)
1	0.0	4.0	3	1	34	MC	125	375	375	22	28.7	21.5	1.70	36.6		36.6	42				156
2	4.0	8.0	6	1	42	MC	125	750	750	27	35.5	28.4	1.63	46.4		46.4	43				187
3	8.0	13.0	11	1	26	MC	125	1375	1375	17	22.0	18.7	1.21	22.5		22.5	38				206
4	13.0	18.0	16	1	20	MC	125	2000	2000	13	16.9	16.1	1.00	16.1	25%	22.2	36				220
5	18.0	21.5	21	1	15	MC	125	2625	2625	10	12.7	12.0	0.87	10.5		10.5	34				228
6	21.5	28.0	26	2	16	MC	125	3250	3250	10	13.5	13.5	0.78	10.6				1690		1850	196
7	28.0	33.0	31	2	10	MC	125	3875	3813	7	8.5	8.5	0.72	6.1				1056		1230	161
8	33.0	38.0	36	2	17	MC	125	4500	4126	11	14.4	14.4	0.70	10.0				1796			239
9	38.0	43.0	41	2	16	MC	125	5125	4439	10	13.5	13.5	0.67	9.1				1690			238
10	43.0	48.5	46	2	7	MC	125	5750	4752	5	5.9	5.9	0.65	3.8				739			199
11	48.5	53.5	51	2	8	MC	125	6375	5065	5	6.8	6.8	0.63	4.2				845		450	100
12	53.5	58.0	56	2	14	MC	125	7000	5378	9	11.8	11.8	0.61	7.2				1479		820	133
13	58.0	65.0	61	2	16	MC	125	7625	5691	10	13.5	13.5	0.59	8.0				1690			248
14	65.0	75.0	71	2	16	MC	125	8875	6317	10	13.5	13.5	0.56	7.6				1690		1360	169
15	75.0	81.5	81	2	42	MC	125	10125	6943	27	35.5	35.5	0.54	19.0	86%			4436			320
16	81.5	95.0	91	1	48	SPT	125	11375	7569	48	62.4	81.1	0.51	41.7		41.7	37				341
17	95.0	108.0	101	1	30	SPT	125	12625	8195	30	39.0	48.3	0.49	23.9	12%	26.2	34				332
18	108.0	111.5	111	2	45	MC	125	13875	8821	29	38.0	38.0	0.48	18.1				4753			338

Note:
1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner), C_N (Overburden) are per Youd 2001
2. For fine-grained materials, the correlation between blow-counts and shear is based on NAVFAC DM 7.1.
3. The phi angle was estimated based on Meyerhof (1956).
4. Residual Strength (Sr) is based on Caltrans "Guidelines on Foundation Loading and Deformation Due to Liquefaction Induced Lateral Spreading", Caltrans 2011
5. The Vs were correlated based on N_{60} for Soil Types 1,3, 4; based on N_{60} or c_{lab} for Soil Type 2 and based on Sr for Soil Types 5 & 6 per Caltrans Guidelines (2012).
6. Spreadsheet Revision Date: 10/29/13

SOIL STRENGTH PARAMETERS & V_{s30}

Calc By: JZ
Date: 10/5/18

PROJECT NAME: ***Northbound 101 On-Ramp Pedestrian Overcrossing***
PROJECT NO.: ***2016-146-NOC***
STRUCTURE:
BORING NO.: ***R-18-NO-002***

BOREHOLE DIA (in)= 4.3 *HAMMER ENERGY =* 78%
GW DEPTH (ft)= 25 *DRILLING RODS (Y/N)=* Y

SOIL GROUPS
1. SANDS & GRAVELS
2. CLAYS AND PLASTIC SILTS
3. NON TO LOW PLASTIC SILTS
4. YOUNG SEDIMENTARY ROCKS
5. LIQUEFIABLE SANDS (RESIDUAL STRENGTH)
6. LIQUEFIABLE SILTS (RESIDUAL STRENGTH)

Nd
N_{30} 21

V_{sd} (m/s)
V_{s30} (m/s) *218*

Correlation: 1) Caltrans

Sample No	Layer Thickness from	Layer Thickness to	Sample Depth (ft)	Soil Type	Field Blow Count	Sampler Type	Unit Weight (pcf)	σ_v (psf)	σ_v' (psf)	SPT-$N_{eq.}$	N_{60} CE Corr.	N_{60} CR,CB,CS Corr.	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60,CS}$	Correlated Strength Parameters ϕ (°)	Correlated Strength Parameters c (psf)	Correlated Strength Parameters S_r (psf)	Lab Test Results c (psf)	Vs (m/s)
1A	0.0	3.3	3	2	26	MC	125	375	375	17	22.0	16.5	1.70	28.0				2746			178
1B	3.3	4.5	3.25	1	26	MC	125	406.25	406	17	22.0	16.5	1.70	28.0		28.0	40				155
2	4.5	8.0	6	1	29	MC	125	750	750	19	24.5	19.6	1.63	32.0		32.0	40				181
3	8.0	13.0	11	1	36	MC	125	1375	1375	23	30.4	25.9	1.21	31.2		31.2	39				213
4	13.0	19.0	16	2	18	MC	125	2000	2000	12	15.2	14.4	1.00	14.4				1901		1090	152
5	19.0	23.5	21	1	22	MC	125	2625	2625	14	18.6	17.7	0.87	15.4		15.4	35				237
6	23.5	28.5	26	2	12	SPT	125	3250	3188	12	15.6	17.8	0.79	14.1	61%			1950			233
7	28.5	33.5	31	2	14	MC	125	3875	3501	9	11.8	11.8	0.76	8.9				1479		550	110
8	33.5	38.5	36	2	19	MC	125	4500	3814	12	16.1	16.1	0.72	11.6				2007			242
9	38.5	43.0	41	2	10	SPT	125	5125	4127	10	13.0	14.3	0.70	10.0				1625			233
10	43.0	48.0	46	2	15	MC	125	5750	4440	10	12.7	12.7	0.67	8.5	61%			1584			235
11	48.0	53.0	51	2	12	MC	125	6375	4753	8	10.1	10.1	0.65	6.6				1268		390	100
12	53.0	58.5	56	2	13	MC	125	7000	5066	8	11.0	11.0	0.63	6.9				1373			232
13	58.5	65.0	61	1	38	MC	125	7625	5379	25	32.1	32.1	0.61	19.6	11%	21.3	35				295
14	65.0	76.0	71	2	22	SPT	125	8875	6005	22	28.6	34.3	0.58	19.8				3575			298
15	76.0	87.5	81	1	39	SPT	125	10125	6631	39	50.7	65.9	0.55	36.2		36.2	36				324
16	87.5	100.0	91	1	90	SPT	125	11375	7257	90	117.0	152.1	0.52	79.9		79.9	40				359
17	100.0	102.5	101	1	61	SPT	125	12625	7883	61	79.3	103.1	0.50	51.9		51.9	37				353
18	102.5	104.5	104	1	100	SPT	125	13000	8070	100	130.0	169.0	0.50	84.1		84.1	40				372

Note:
1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner), C_N (Overburden) are per Youd 2001
2. For fine-grained materials, the correlation between blow-counts and shear is based on NAVFAC DM 7.1.
3. The phi angle was estimated based on Meyerhof (1956).
4. Residual Strength (Sr) is based on Caltrans "Guidelines on Foundation Loading and Deformation Due to Liquefaction Induced Lateral Spreading", Caltrans 2011
5. The Vs were correlated based on N_{60} for Soil Types 1,3, 4; based on N_{60} or c_{lab} for Soil Type 2 and based on Sr for Soil Types 5 & 6 per Caltrans Guidelines (2012).
6. Spreadsheet Revision Date: 10/29/13

SOIL STRENGTH PARAMETERS & V_{s30}

Calc By: JZ
Date: 10/5/18

PROJECT NAME: ***Northbound 101 On-Ramp Pedestrian Overcrossing***
PROJECT NO.: ***2016-146-NOC***
STRUCTURE:
BORING NO.: ***R-18-NO-003***

BOREHOLE DIA (in)= 3.3 | *HAMMER ENERGY =* 78%
GW DEPTH (ft)= 32 | *DRILLING RODS (Y/N)=* Y

SOIL GROUPS
1. SANDS & GRAVELS
2. CLAYS AND PLASTIC SILTS
3. NON TO LOW PLASTIC SILTS
4. YOUNG SEDIMENTARY ROCKS
5. LIQUEFIABLE SANDS (RESIDUAL STRENGTH)
6. LIQUEFIABLE SILTS (RESIDUAL STRENGTH)

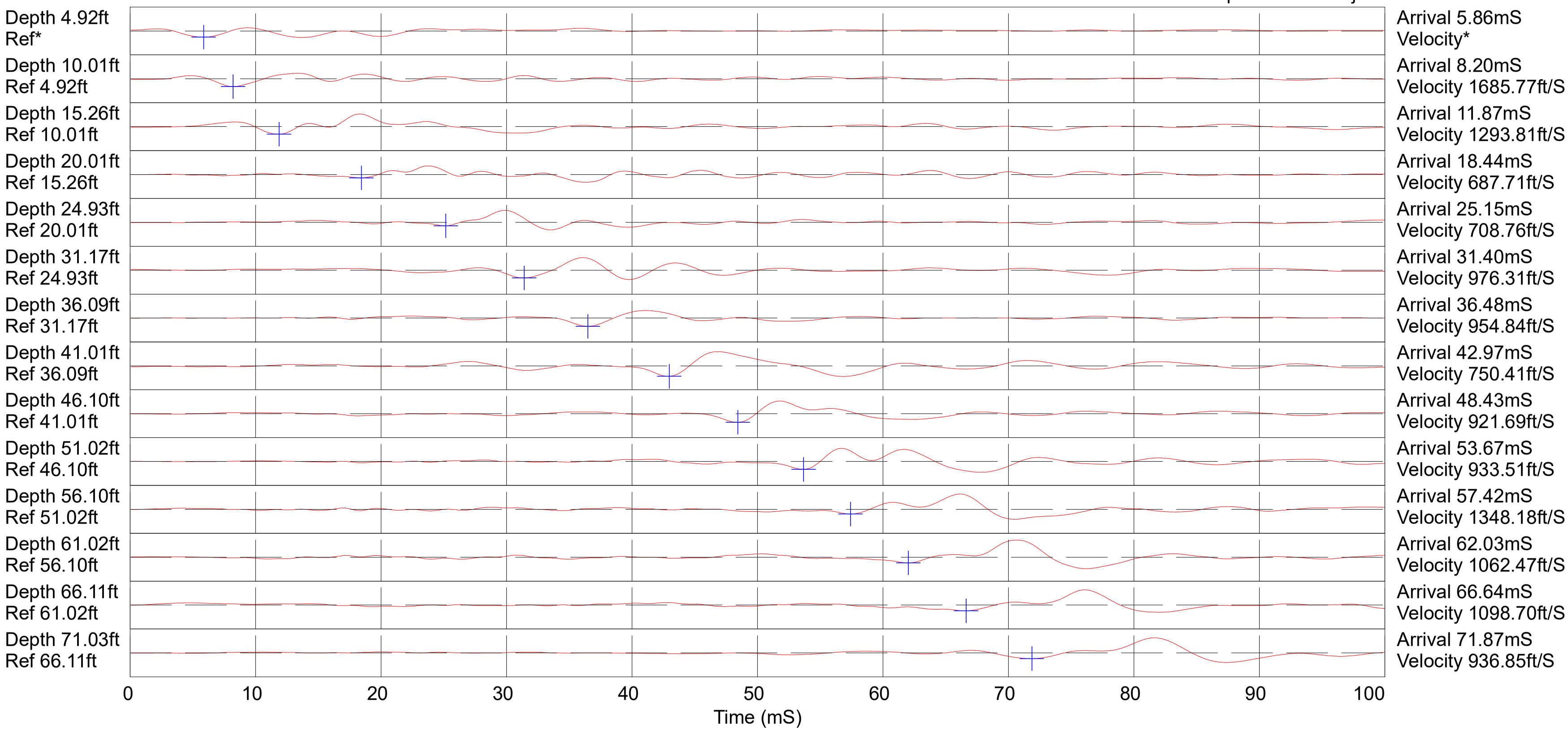
Nd
N_{30} 17

V_{sd} (m/s)
V_{s30} (m/s) *227*
Correlation 1) Caltrans

Sample No	Layer Thickness from	Layer Thickness to	Sample Depth (ft)	Soil Type	Field Blow Count	Sampler Type	Unit Weight (pcf)	σ_v (psf)	σ_v' (psf)	SPT-$N_{eq.}$	N_{60} CE Corr.	N_{60} CR,CB,CS Corr.	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60,CS}$	Correlated Strength Parameters ϕ (°)	Correlated Strength Parameters c (psf)	Correlated Strength Parameters S_r (psf)	Lab Test Results c (psf)	Vs (m/s)
1	0.0	4.0	3	1	60	MC	125	375	375	39	50.7	38.0	1.70	64.6		64.6	46				165
2	4.0	8.0	6	1	53	MC	125	750	750	34	44.8	35.8	1.63	58.5		58.5	44				192
3	8.0	11.5	11	1	24	SPT	125	1375	1375	24	31.2	34.5	1.21	41.6		41.6	41				213
4	11.5	18.5	16	2	25	MC	125	2000	2000	16	21.1	20.1	1.00	20.1	59%			2641			232
5	18.5	23.0	21	3	11	MC	125	2625	2625	7	9.3	8.8	0.87	7.7				930			200
6	23.0	29.0	26	2	17	MC	125	3250	3250	11	14.4	14.4	0.78	11.3				1796		1880	197
7	29.0	34.0	31	2	13	MC	125	3875	3875	8	11.0	11.0	0.72	7.9				1373			222
8	34.0	38.0	36	3	4	SPT	125	4500	4250	4	5.2	5.7	0.69	3.9				520			201
9	38.0	43.0	41	3	9	SPT	125	5125	4563	9	11.7	12.9	0.66	8.5				1170			236
10	43.0	48.5	46	3	12	MC	125	5750	4876	8	10.1	10.1	0.64	6.5				1014			234
11	48.5	53.0	51	1	25	MC	125	6375	5189	16	21.1	21.1	0.62	13.1	37%	20.7	33				281
12	53.0	56.5	56	1	19	SPT	125	7000	5502	19	24.7	29.0	0.60	17.5		17.5	34				290
13	56.5	65.0	61	3	8	SPT	125	7625	5815	8	10.4	11.4	0.59	6.7				1040			245
14	65.0	75.0	71	2	19	MC	125	8875	6441	12	16.1	16.1	0.56	8.9				2007		860	136
15	75.0	85.0	81	1	31	SPT	125	10125	7067	31	40.3	51.3	0.53	27.3		27.3	35				322
16	85.0	95.5	91	1	94	SPT	125	11375	7693	94	122.2	158.9	0.51	81.0		81.0	40				365
17	95.5	106.0	101	1	69	SPT	125	12625	8319	69	89.7	116.6	0.49	57.2		57.2	38				361
18	106.0	111.5	111	2	21	SPT	125	13875	8945	21	27.3	31.3	0.47	14.8				3413			314

Note:
1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner), C_N (Overburden) are per Youd 2001
2. For fine-grained materials, the correlation between blow-counts and shear is based on NAVFAC DM 7.1.
3. The phi angle was estimated based on Meyerhof (1956).
4. Residual Strength (Sr) is based on Caltrans "Guidelines on Foundation Loading and Deformation Due to Liquefaction Induced Lateral Spreading", Caltrans 2011
5. The Vs were correlated based on N_{60} for Soil Types 1,3, 4; based on N_{60} or c_{lab} for Soil Type 2 and based on Sr for Soil Types 5 & 6 per Caltrans Guidelines (2012).
6. Spreadsheet Revision Date: 10/29/13

CPT-18-NO-005 | Parikh Consultants | US 101 Blossom Hill Rd IC Improvement Project



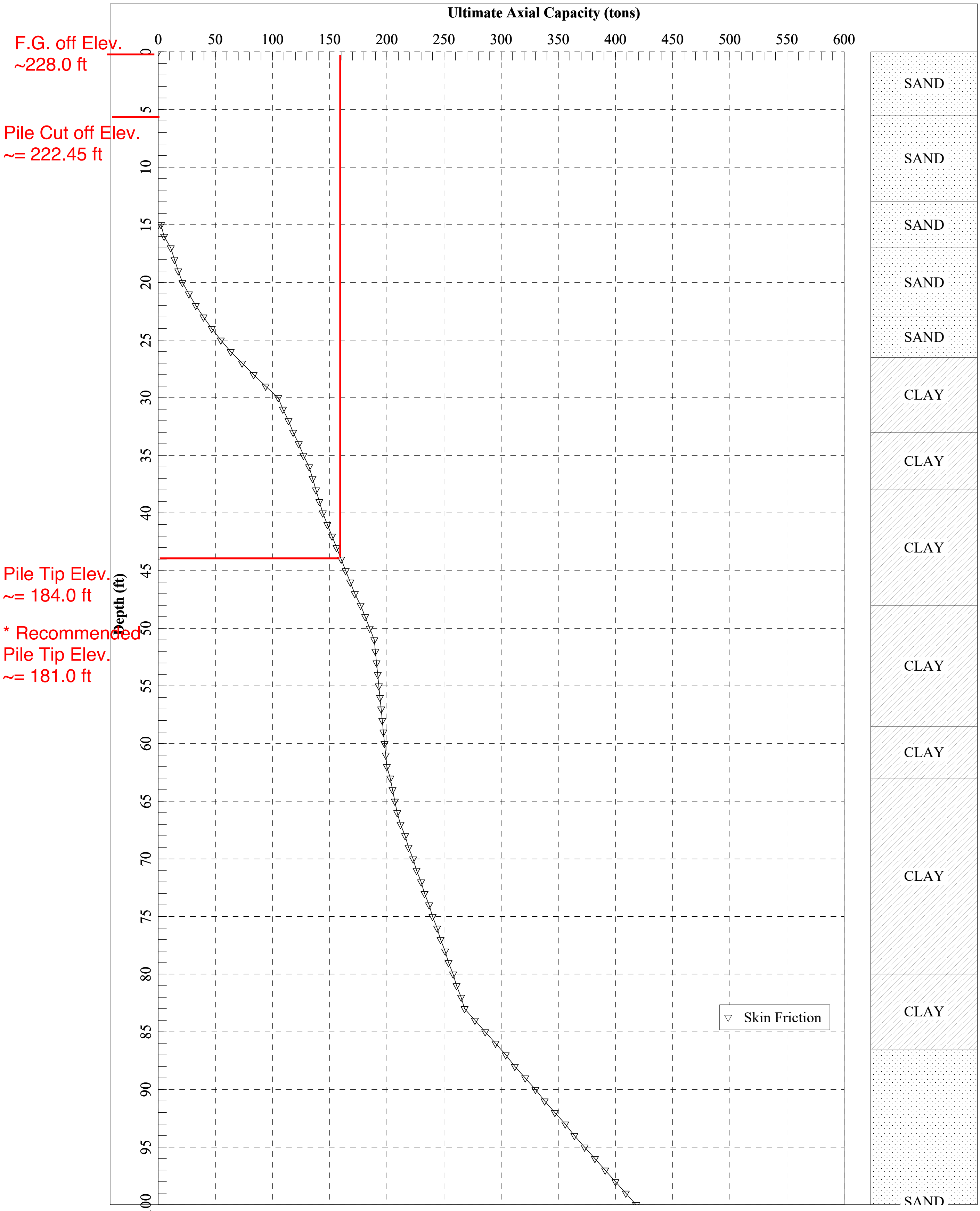
Hammer to Rod String Distance (ft): 5.83
* = Not Determined

COMMENT:

Average Vs30 = 283m/s

VERTICAL PILE CAPACITY ANALYSIS (SHAFT ANALYSIS RESULTS)

Vertical loading = 220 kips / 0.7 ~= 320 kips = 160 tons



Abutment 1_36" Diameter CIDH_Strength Limit State

-Ignore 5 feet or one pile diameter (whichever is greater) frictional capacity from the top of pile
-Ignore one diameters frictional capacity from bottom
-Add 3 feet of pile length at the bottom to be conservative
-The soil friction is reduced by 50% behind the soil nail wall (0-17 feet) to consider the effect of construction.

```
=========================================================================

                SHAFT for Windows, Version 2012.7.17

                 Serial Number :  291911540

               VERTICALLY LOADED DRILLED SHAFT ANALYSIS
                (c) Copyright ENSOFT, Inc., 1987-2012
                      All Rights Reserved

=========================================================================


Path to file locations      : T:\Ongoing Projects\2016\2016-146-NOC NB101
On-Ramp POC\Calculations\SHAFT Analysis\2019-02\
Name of input data file     : Abut 1_Strength Limit State_50%off.sfd
Name of output file         : Abut 1_Strength Limit State_50%off.sfo
Name of plot output file    : Abut 1_Strength Limit State_50%off.sfp
Name of runtime file        : Abut 1_Strength Limit State_50%off.sfr


-------------------------------------------------------------------------
                     Time and Date of Analysis
-------------------------------------------------------------------------

          Date:  February 21, 2019     Time:  15:40:38

New Pile


PROPOSED DEPTH =     100.0 FT
----------------


NUMBER OF LAYERS =   14
------------------


WATER TABLE DEPTH =      35.0 FT.
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FACTOR OF SAFETY APPLIED TO THE ULTIMATE SIDE FRICTION CAPACITY = 2.50
-------------------------------------------------------
FACTOR OF SAFETY APPLIED TO THE ULTIMATE BASE CAPACITY = 3.00
------------------------------------------------------
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```
SOIL INFORMATION
----------------

LAYER NO 1----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                   = 0.600E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.360E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.625E+02
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.000E+00


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                   = 0.592E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.360E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.625E+02
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.550E+01


LAYER NO 2----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                   = 0.592E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.360E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.550E+01


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                   = 0.507E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.360E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
```

```
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.130E+02


LAYER NO 3----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                  = 0.507E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                    = 0.360E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                       = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.130E+02


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                  = 0.472E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                    = 0.360E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                       = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.170E+02


LAYER NO 4----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                  = 0.663E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                    = 0.340E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                       = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.170E+02


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                  = 0.762E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                    = 0.340E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                       = 0.125E+03
```



```
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.230E+02


LAYER NO 5----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                  = 0.853E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                    = 0.320E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                       = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.230E+02


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                  = 0.805E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                    = 0.320E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                       = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.265E+02


LAYER NO 6----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                  = 0.550E+00
  END BEARING COEFFICIENT-Nc                       = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.175E+04
  INTERNAL FRICTION ANGLE, DEG.                    = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                       = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.265E+02


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                  = 0.550E+00
  END BEARING COEFFICIENT-Nc                       = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.175E+04
  INTERNAL FRICTION ANGLE, DEG.                    = 0.000E+00
```

```
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.330E+02


LAYER NO 7----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.120E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.330E+02


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.120E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.380E+02


LAYER NO 8----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.160E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.380E+02


  AT THE BOTTOM
```



```
  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.160E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.480E+02


LAYER NO 9----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.400E+03
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.480E+02


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.400E+03
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.585E+02


LAYER NO10----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.800E+03
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.585E+02
```

```
  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
  END BEARING COEFFICIENT-Nc                         = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.800E+03
  INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.630E+02


LAYER NO11----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
  END BEARING COEFFICIENT-Nc                         = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.135E+04
  INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.630E+02


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
  END BEARING COEFFICIENT-Nc                         = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.135E+04
  INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.800E+02


LAYER NO12----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                    = 0.535E+00
  END BEARING COEFFICIENT-Nc                         = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.350E+04
  INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
```



```
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.800E+02


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                    = 0.535E+00
  END BEARING COEFFICIENT-Nc                         = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.350E+04
  INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.865E+02


LAYER NO13----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                    = 0.250E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.360E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.865E+02


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                    = 0.250E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.360E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.113E+03


LAYER NO14----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                    = 0.511E+00
  END BEARING COEFFICIENT-Nc                         = 0.900E+01
```

```
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.400E+04
  INTERNAL FRICTION ANGLE, DEG.                    = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                       = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.113E+03


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                  = 0.511E+00
  END BEARING COEFFICIENT-Nc                       = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.400E+04
  INTERNAL FRICTION ANGLE, DEG.                    = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                       = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.116E+03



DRILLED SHAFT INFORMATION
-------------------------

 DIAMETER OF STEM         =    3.000  FT.
 DIAMETER OF BASE         =    3.000  FT.
 END OF STEM TO BASE      =    0.000  FT.
 ANGLE OF BELL            =    0.000  DEG.
 IGNORED TOP PORTION      =   10.500  FT.
 IGNORED BOTTOM PORTION   =    3.000  FT.
 AREA OF ONE PERCENT STEEL =   10.180  SQ.IN.
 ELASTIC MODULUS, Ec      = 0.300E+07 LB/SQ IN
 VOLUME OF UNDERREAM      =    0.000  CU.YDS.



PREDICTED RESULTS
-----------------

QS     = ULTIMATE SIDE RESISTANCE;
QB     = ULTIMATE BASE RESISTANCE;
WT     = WEIGHT OF DRILLED SHAFT (FOR UPLIFT CAPACITY ONLY);
QU     = TOTAL ULTIMATE RESISTANCE;
QBD    = TOTAL ALLOWABLE LOAD USING A FACTOR OF SAFETY
         APPLIED TO THE ULTIMATE BASE RESISTANCE;
QDN    = TOTAL ALLOWABLE LOAD USING FACTORS OF SAFETY
```


APPLIED TO THE ULTIMATE SIDE RESISTANCE AND
THE ULTIMATE BASE RESISTANCE.

LENGTH (FEET)	VOLUME (CU.YDS)	QS (TONS)	QB (TONS)	QU (TONS)	QBD (TONS)	QDN (TONS)	QU/VOLUME (TONS/CU.YDS)
14.0	3.67	5.49	53.55	59.04	14.41	11.12	25.54
15.0	3.93	2.47	50.47	52.94	19.29	17.81	13.48
16.0	4.19	5.19	51.04	56.23	22.20	19.09	13.42
17.0	4.45	10.98	53.55	64.53	28.83	22.24	14.50
18.0	4.71	14.15	49.67	63.82	30.71	22.22	13.54
19.0	4.97	17.55	44.60	62.15	32.42	21.89	12.49
20.0	5.24	21.16	38.32	59.48	33.94	21.24	11.36
21.0	5.50	26.77	34.43	61.20	38.25	22.18	11.13
22.0	5.76	32.92	37.41	70.32	45.39	25.64	12.21
23.0	6.02	39.63	43.36	82.99	54.09	30.31	13.78
24.0	6.28	46.94	49.63	96.57	63.48	35.32	15.37
25.0	6.55	54.84	53.70	108.54	72.74	39.84	16.58
26.0	6.81	63.37	55.67	119.04	81.93	43.91	17.49
27.0	7.07	73.25	55.67	128.92	91.81	47.86	18.24
28.0	7.33	83.46	51.96	135.42	100.78	50.70	18.47
29.0	7.59	93.98	47.72	141.70	109.88	53.50	18.66
30.0	7.86	104.80	42.95	147.74	119.11	56.23	18.81
31.0	8.12	109.33	39.77	149.10	122.59	56.99	18.37
32.0	8.38	113.87	38.18	152.05	126.60	58.27	18.15
33.0	8.64	118.41	40.87	159.28	132.03	60.99	18.43
34.0	8.90	122.94	43.96	166.90	137.60	63.83	18.75
35.0	9.16	127.48	47.43	174.91	143.29	66.80	19.09
36.0	9.43	132.02	49.74	181.76	148.60	69.39	19.28
37.0	9.69	135.13	50.90	186.03	152.09	71.02	19.20
38.0	9.95	138.24	50.90	189.14	155.20	72.26	19.01
39.0	10.21	141.35	50.90	192.25	158.31	73.51	18.83
40.0	10.47	144.46	50.90	195.36	161.42	74.75	18.65
41.0	10.74	147.57	50.90	198.47	164.53	75.99	18.49
42.0	11.00	151.72	50.90	202.62	168.68	77.65	18.42
43.0	11.26	155.86	42.80	198.67	170.13	76.61	17.65
44.0	11.52	160.01	33.55	193.56	171.19	75.19	16.80
45.0	11.78	164.16	23.14	187.29	171.87	73.38	15.90
46.0	12.04	168.31	16.20	184.50	173.70	72.72	15.32
47.0	12.31	172.45	12.73	185.18	176.69	73.22	15.05
48.0	12.57	176.60	12.73	189.33	180.84	74.88	15.06
49.0	12.83	180.75	12.73	193.47	184.99	76.54	15.08
50.0	13.09	184.90	12.73	197.62	189.14	78.20	15.10
51.0	13.35	189.04	12.73	201.77	193.28	79.86	15.11
52.0	13.62	190.08	12.73	202.80	194.32	80.27	14.90
53.0	13.88	191.12	12.73	203.84	195.36	80.69	14.69
54.0	14.14	192.15	15.42	207.58	197.29	82.00	14.68
55.0	14.40	193.19	18.51	211.70	199.36	83.45	14.70
56.0	14.66	194.23	21.98	216.21	201.55	85.02	14.75

57.0	14.92	195.26	24.29	219.56	203.36	86.20	14.71
58.0	15.19	196.30	29.16	225.46	206.02	88.24	14.85
59.0	15.45	197.34	33.40	230.74	208.47	90.07	14.94
60.0	15.71	198.37	38.18	236.55	211.10	92.07	15.06
61.0	15.97	199.41	41.36	240.77	213.20	93.55	15.07
62.0	16.23	200.45	42.95	243.40	214.76	94.49	14.99
63.0	16.50	202.52	42.95	245.47	216.84	95.32	14.88
64.0	16.76	204.60	42.95	247.54	218.91	96.15	14.77
65.0	17.02	206.67	42.95	249.62	220.98	96.98	14.67
66.0	17.28	208.74	42.95	251.69	223.06	97.81	14.56
67.0	17.54	212.24	42.95	255.19	226.56	99.21	14.55
68.0	17.80	215.74	42.95	258.69	230.06	100.61	14.53
69.0	18.07	219.24	42.95	262.19	233.56	102.01	14.51
70.0	18.33	222.74	42.95	265.69	237.06	103.41	14.50
71.0	18.59	226.24	42.95	269.19	240.56	104.81	14.48
72.0	18.85	229.74	42.95	272.69	244.06	106.21	14.46
73.0	19.11	233.24	42.95	276.19	247.55	107.61	14.45
74.0	19.38	236.74	42.95	279.69	251.05	109.01	14.43
75.0	19.64	240.24	57.46	297.69	259.39	115.25	15.16
76.0	19.90	243.74	74.04	317.77	268.42	122.17	15.97
77.0	20.16	247.24	92.69	339.93	278.13	129.79	16.86
78.0	20.42	250.74	105.13	355.86	285.78	135.34	17.42
79.0	20.68	254.24	111.34	365.58	291.35	138.81	17.67
80.0	20.95	257.73	111.34	369.08	294.85	140.21	17.62
81.0	21.21	261.23	111.34	372.58	298.35	141.61	17.57
82.0	21.47	264.73	111.72	376.46	301.97	143.13	17.53
83.0	21.73	268.23	112.15	380.39	305.62	144.68	17.50
84.0	21.99	277.05	112.64	389.69	314.60	148.37	17.72
85.0	22.26	285.87	112.96	398.84	323.53	152.00	17.92
86.0	22.52	294.69	113.13	407.82	332.40	155.59	18.11
87.0	22.78	303.51	113.13	416.64	341.22	159.11	18.29
88.0	23.04	312.33	113.13	425.46	350.04	162.64	18.46
89.0	23.30	321.15	113.13	434.28	358.86	166.17	18.64
90.0	23.57	329.97	113.13	443.09	367.68	169.70	18.80
91.0	23.83	338.48	113.13	451.61	376.19	173.10	18.95
92.0	24.09	347.07	113.13	460.19	384.77	176.54	19.10
93.0	24.35	355.73	113.13	468.85	393.43	180.00	19.25
94.0	24.61	364.46	113.13	477.58	402.17	183.49	19.40
95.0	24.87	373.26	113.13	486.39	410.97	187.01	19.55
96.0	25.14	382.15	113.13	495.27	419.85	190.57	19.70
97.0	25.40	391.10	113.13	504.23	428.81	194.15	19.85
98.0	25.66	400.13	113.13	513.25	437.84	197.76	20.00
99.0	25.92	409.23	113.13	522.36	446.94	201.40	20.15
100.0	26.18	418.40	113.13	531.53	456.11	205.07	20.30

RESULT FROM TREND (AVERAGED) LINE

TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.9417E-01	0.4648E-04	0.2482E-02	0.1000E-04
0.4708E+00	0.2324E-03	0.1241E-01	0.5000E-04
0.9417E+00	0.4648E-03	0.2482E-01	0.1000E-03
0.4738E+02	0.2331E-01	0.1241E+01	0.5000E-02
0.7121E+02	0.3501E-01	0.1862E+01	0.7500E-02
0.9504E+02	0.4672E-01	0.2482E+01	0.1000E-01
0.2053E+03	0.1091E+00	0.6206E+01	0.2500E-01
0.2999E+03	0.1807E+00	0.1241E+02	0.5000E-01
0.3543E+03	0.2372E+00	0.1862E+02	0.7500E-01
0.3873E+03	0.2826E+00	0.2482E+02	0.1000E+00
0.4516E+03	0.4775E+00	0.5194E+02	0.2500E+00
0.4662E+03	0.7435E+00	0.7567E+02	0.5000E+00
0.4632E+03	0.8698E+00	0.8360E+02	0.6250E+00
0.4741E+03	0.1154E+01	0.9785E+02	0.9000E+00
0.4855E+03	0.2063E+01	0.1097E+03	0.1800E+01

RESULT FROM UPPER-BOUND LINE

TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.1629E+00	0.6954E-04	0.3708E-02	0.1000E-04
0.8143E+00	0.3477E-03	0.1854E-01	0.5000E-04
0.1629E+01	0.6954E-03	0.3708E-01	0.1000E-03
0.8236E+02	0.3499E-01	0.1854E+01	0.5000E-02
0.1236E+03	0.5258E-01	0.2781E+01	0.7500E-02
0.1630E+03	0.6988E-01	0.3708E+01	0.1000E-01
0.2981E+03	0.1475E+00	0.9270E+01	0.2500E-01
0.3762E+03	0.2195E+00	0.1854E+02	0.5000E-01
0.4206E+03	0.2738E+00	0.2781E+02	0.7500E-01
0.4462E+03	0.3167E+00	0.3708E+02	0.1000E+00
0.4997E+03	0.5077E+00	0.7378E+02	0.2500E+00
0.5072E+03	0.7685E+00	0.9452E+02	0.5000E+00
0.5057E+03	0.8944E+00	0.9996E+02	0.6250E+00
0.5126E+03	0.1175E+01	0.1086E+03	0.9000E+00
0.5165E+03	0.2078E+01	0.1126E+03	0.1800E+01

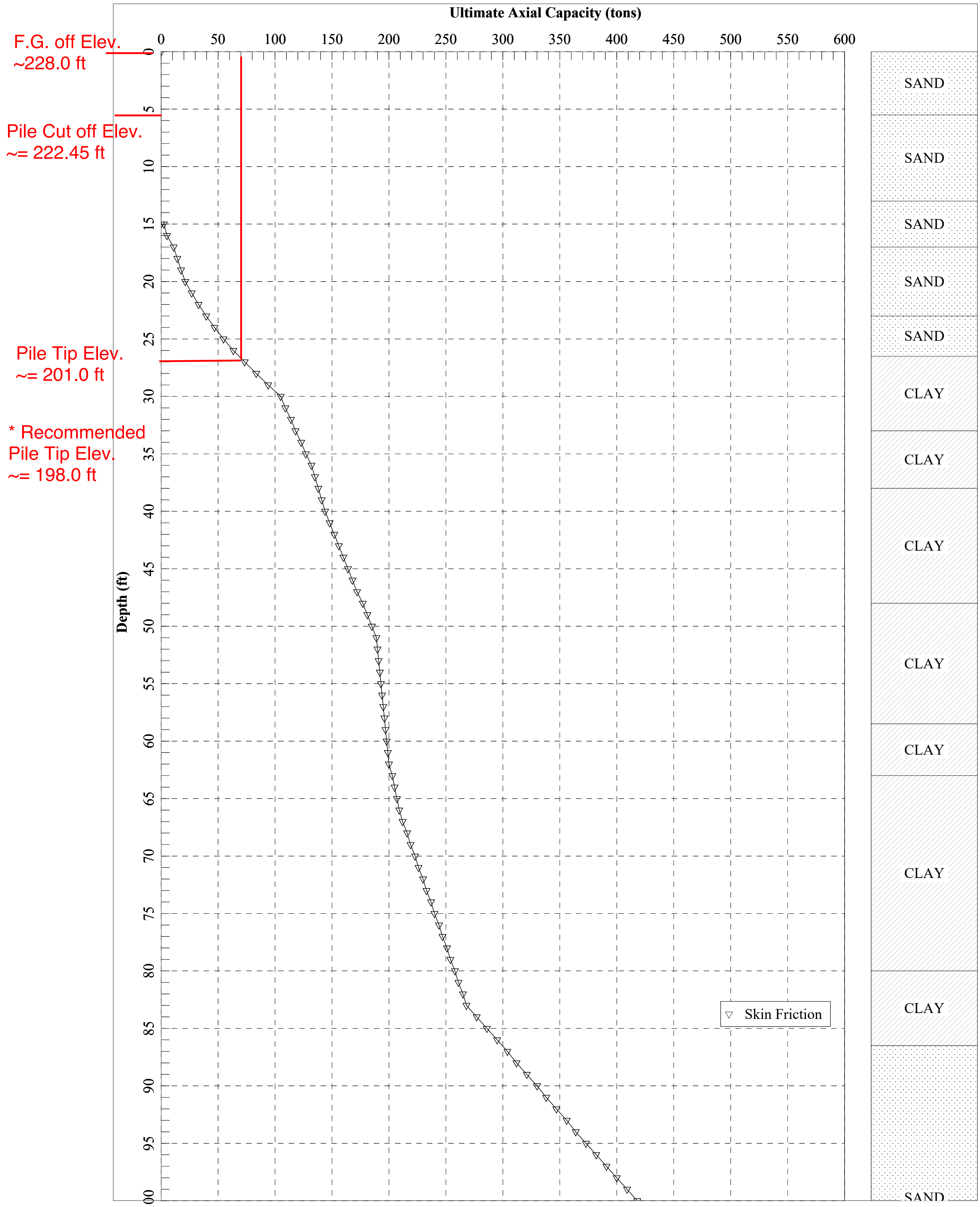
RESULT FROM LOWER-BOUND LINE

TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.4537E-01	0.2880E-04	0.1257E-02	0.1000E-04

Abut 1_Strength Limit State_50%off.sfo

0.2269E+00	0.1440E-03	0.6285E-02	0.5000E-04
0.4537E+00	0.2880E-03	0.1257E-01	0.1000E-03
0.2269E+02	0.1440E-01	0.6285E+00	0.5000E-02
0.3413E+02	0.2162E-01	0.9427E+00	0.7500E-02
0.4556E+02	0.2884E-01	0.1257E+01	0.1000E-01
0.1111E+03	0.7158E-01	0.3142E+01	0.2500E-01
0.1975E+03	0.1349E+00	0.6285E+01	0.5000E-01
0.2608E+03	0.1904E+00	0.9427E+01	0.7500E-01
0.3051E+03	0.2379E+00	0.1257E+02	0.1000E+00
0.4032E+03	0.4471E+00	0.3010E+02	0.2500E+00
0.4188E+03	0.7157E+00	0.5681E+02	0.5000E+00
0.4189E+03	0.8440E+00	0.6723E+02	0.6250E+00
0.4357E+03	0.1133E+01	0.8711E+02	0.9000E+00
0.4538E+03	0.2047E+01	0.1063E+03	0.1800E+01

Vertical loading = 140 kips = 70 tons



Abutment 1_36" Diameter CIDH_Extreme Event Limit State

-Ignore 5 feet or one pile diameter (whichever is greater) frictional capacity from the top of pile
-Ignore one diameters frictional capacity from bottom
-Add 3 feet of pile length at the bottom to be conservative
-The soil friction is reduced by 50% behind the soil nail wall (0-17 feet) to consider the effect of construction.

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======================================================================

                SHAFT for Windows, Version 2012.7.17

                 Serial Number :  291911540

              VERTICALLY LOADED DRILLED SHAFT ANALYSIS
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                      All Rights Reserved

======================================================================


     Path to file locations      : T:\Ongoing Projects\2016\2016-146-NOC NB101
On-Ramp POC\Calculations\SHAFT Analysis\2019-02\
     Name of input data file     : Abut 1_Extreme Event Limit State_50%off.sfd
     Name of output file         : Abut 1_Extreme Event Limit State_50%off.sfo
     Name of plot output file    : Abut 1_Extreme Event Limit State_50%off.sfp
     Name of runtime file        : Abut 1_Extreme Event Limit State_50%off.sfr


     ----------------------------------------------------------------------
                         Time and Date of Analysis
     ----------------------------------------------------------------------

               Date:  February 28, 2019     Time:  15:26:45

     New Pile


     PROPOSED DEPTH =     100.0 FT
     ----------------


     NUMBER OF LAYERS =   14
     ------------------


     WATER TABLE DEPTH =      35.0 FT.
     -------------------



     FACTOR OF SAFETY APPLIED TO THE ULTIMATE SIDE FRICTION CAPACITY = 2.50
     -------------------------------------------------------
     FACTOR OF SAFETY APPLIED TO THE ULTIMATE BASE CAPACITY = 3.00
     ------------------------------------------------------
```



```
SOIL INFORMATION
---------------

LAYER NO 1----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                  = 0.600E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                    = 0.360E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                       = 0.625E+02
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.000E+00


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                  = 0.592E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                    = 0.360E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                       = 0.625E+02
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.550E+01


LAYER NO 2----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                  = 0.592E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                    = 0.360E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                       = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.550E+01


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                  = 0.507E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                    = 0.360E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                       = 0.125E+03
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  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.130E+02


LAYER NO 3----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                   = 0.507E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.360E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.130E+02


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                   = 0.472E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.360E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.170E+02


LAYER NO 4----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                   = 0.663E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.340E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.170E+02


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                   = 0.762E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.340E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
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  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.230E+02


LAYER NO 5----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                   = 0.853E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.320E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.230E+02


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                   = 0.805E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.320E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.265E+02


LAYER NO 6----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.175E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.265E+02


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.175E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
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  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.330E+02


LAYER NO 7----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.120E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.330E+02


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.120E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.380E+02


LAYER NO 8----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.160E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.380E+02


  AT THE BOTTOM
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  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.160E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.480E+02


LAYER NO 9----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.400E+03
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.480E+02


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.400E+03
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.585E+02


LAYER NO10----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.800E+03
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.585E+02
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  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
  END BEARING COEFFICIENT-Nc                         = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.800E+03
  INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.630E+02


LAYER NO11----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
  END BEARING COEFFICIENT-Nc                         = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.135E+04
  INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.630E+02


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
  END BEARING COEFFICIENT-Nc                         = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.135E+04
  INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.800E+02


LAYER NO12----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                    = 0.535E+00
  END BEARING COEFFICIENT-Nc                         = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.350E+04
  INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
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```
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.800E+02


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                    = 0.535E+00
  END BEARING COEFFICIENT-Nc                         = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.350E+04
  INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.865E+02


LAYER NO13----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                    = 0.250E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.360E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.865E+02


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                    = 0.250E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.360E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.113E+03


LAYER NO14----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                    = 0.511E+00
  END BEARING COEFFICIENT-Nc                         = 0.900E+01
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 UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.400E+04
 INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
 BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
 SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
 MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
 DEPTH, FT                                         = 0.113E+03


 AT THE BOTTOM

 STRENGTH REDUCTION FACTOR-ALPHA                   = 0.511E+00
 END BEARING COEFFICIENT-Nc                        = 0.900E+01
 UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.400E+04
 INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
 BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
 SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
 MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
 DEPTH, FT                                         = 0.116E+03



DRILLED SHAFT INFORMATION
-------------------------

 DIAMETER OF STEM          =    3.000  FT.
 DIAMETER OF BASE          =    3.000  FT.
 END OF STEM TO BASE       =    0.000  FT.
 ANGLE OF BELL             =    0.000  DEG.
 IGNORED TOP PORTION       =   10.500  FT.
 IGNORED BOTTOM PORTION    =    3.000  FT.
 AREA OF ONE PERCENT STEEL =   10.180  SQ.IN.
 ELASTIC MODULUS, Ec       = 0.300E+07 LB/SQ IN
 VOLUME OF UNDERREAM       =    0.000  CU.YDS.



PREDICTED RESULTS
-----------------

QS     = ULTIMATE SIDE RESISTANCE;
QB     = ULTIMATE BASE RESISTANCE;
WT     = WEIGHT OF DRILLED SHAFT (FOR UPLIFT CAPACITY ONLY);
QU     = TOTAL ULTIMATE RESISTANCE;
QBD    = TOTAL ALLOWABLE LOAD USING A FACTOR OF SAFETY
         APPLIED TO THE ULTIMATE BASE RESISTANCE;
QDN    = TOTAL ALLOWABLE LOAD USING FACTORS OF SAFETY
```


APPLIED TO THE ULTIMATE SIDE RESISTANCE AND
THE ULTIMATE BASE RESISTANCE.

LENGTH (FEET)	VOLUME (CU.YDS)	QS (TONS)	QB (TONS)	QU (TONS)	QBD (TONS)	QDN (TONS)	QU/VOLUME (TONS/CU.YDS)
14.0	3.67	5.49	53.55	59.04	14.41	11.12	25.54
15.0	3.93	2.47	50.47	52.94	19.29	17.81	13.48
16.0	4.19	5.19	51.04	56.23	22.20	19.09	13.42
17.0	4.45	10.98	53.55	64.53	28.83	22.24	14.50
18.0	4.71	14.15	49.67	63.82	30.71	22.22	13.54
19.0	4.97	17.55	44.60	62.15	32.42	21.89	12.49
20.0	5.24	21.16	38.32	59.48	33.94	21.24	11.36
21.0	5.50	26.77	34.43	61.20	38.25	22.18	11.13
22.0	5.76	32.92	37.41	70.32	45.39	25.64	12.21
23.0	6.02	39.63	43.36	82.99	54.09	30.31	13.78
24.0	6.28	46.94	49.63	96.57	63.48	35.32	15.37
25.0	6.55	54.84	53.70	108.54	72.74	39.84	16.58
26.0	6.81	63.37	55.67	119.04	81.93	43.91	17.49
27.0	7.07	73.25	55.67	128.92	91.81	47.86	18.24
28.0	7.33	83.46	51.96	135.42	100.78	50.70	18.47
29.0	7.59	93.98	47.72	141.70	109.88	53.50	18.66
30.0	7.86	104.80	42.95	147.74	119.11	56.23	18.81
31.0	8.12	109.33	39.77	149.10	122.59	56.99	18.37
32.0	8.38	113.87	38.18	152.05	126.60	58.27	18.15
33.0	8.64	118.41	40.87	159.28	132.03	60.99	18.43
34.0	8.90	122.94	43.96	166.90	137.60	63.83	18.75
35.0	9.16	127.48	47.43	174.91	143.29	66.80	19.09
36.0	9.43	132.02	49.74	181.76	148.60	69.39	19.28
37.0	9.69	135.13	50.90	186.03	152.09	71.02	19.20
38.0	9.95	138.24	50.90	189.14	155.20	72.26	19.01
39.0	10.21	141.35	50.90	192.25	158.31	73.51	18.83
40.0	10.47	144.46	50.90	195.36	161.42	74.75	18.65
41.0	10.74	147.57	50.90	198.47	164.53	75.99	18.49
42.0	11.00	151.72	50.90	202.62	168.68	77.65	18.42
43.0	11.26	155.86	42.80	198.67	170.13	76.61	17.65
44.0	11.52	160.01	33.55	193.56	171.19	75.19	16.80
45.0	11.78	164.16	23.14	187.29	171.87	73.38	15.90
46.0	12.04	168.31	16.20	184.50	173.70	72.72	15.32
47.0	12.31	172.45	12.73	185.18	176.69	73.22	15.05
48.0	12.57	176.60	12.73	189.33	180.84	74.88	15.06
49.0	12.83	180.75	12.73	193.47	184.99	76.54	15.08
50.0	13.09	184.90	12.73	197.62	189.14	78.20	15.10
51.0	13.35	189.04	12.73	201.77	193.28	79.86	15.11
52.0	13.62	190.08	12.73	202.80	194.32	80.27	14.90
53.0	13.88	191.12	12.73	203.84	195.36	80.69	14.69
54.0	14.14	192.15	15.42	207.58	197.29	82.00	14.68
55.0	14.40	193.19	18.51	211.70	199.36	83.45	14.70
56.0	14.66	194.23	21.98	216.21	201.55	85.02	14.75

57.0	14.92	195.26	24.29	219.56	203.36	86.20	14.71
58.0	15.19	196.30	29.16	225.46	206.02	88.24	14.85
59.0	15.45	197.34	33.40	230.74	208.47	90.07	14.94
60.0	15.71	198.37	38.18	236.55	211.10	92.07	15.06
61.0	15.97	199.41	41.36	240.77	213.20	93.55	15.07
62.0	16.23	200.45	42.95	243.40	214.76	94.49	14.99
63.0	16.50	202.52	42.95	245.47	216.84	95.32	14.88
64.0	16.76	204.60	42.95	247.54	218.91	96.15	14.77
65.0	17.02	206.67	42.95	249.62	220.98	96.98	14.67
66.0	17.28	208.74	42.95	251.69	223.06	97.81	14.56
67.0	17.54	212.24	42.95	255.19	226.56	99.21	14.55
68.0	17.80	215.74	42.95	258.69	230.06	100.61	14.53
69.0	18.07	219.24	42.95	262.19	233.56	102.01	14.51
70.0	18.33	222.74	42.95	265.69	237.06	103.41	14.50
71.0	18.59	226.24	42.95	269.19	240.56	104.81	14.48
72.0	18.85	229.74	42.95	272.69	244.06	106.21	14.46
73.0	19.11	233.24	42.95	276.19	247.55	107.61	14.45
74.0	19.38	236.74	42.95	279.69	251.05	109.01	14.43
75.0	19.64	240.24	57.46	297.69	259.39	115.25	15.16
76.0	19.90	243.74	74.04	317.77	268.42	122.17	15.97
77.0	20.16	247.24	92.69	339.93	278.13	129.79	16.86
78.0	20.42	250.74	105.13	355.86	285.78	135.34	17.42
79.0	20.68	254.24	111.34	365.58	291.35	138.81	17.67
80.0	20.95	257.73	111.34	369.08	294.85	140.21	17.62
81.0	21.21	261.23	111.34	372.58	298.35	141.61	17.57
82.0	21.47	264.73	111.72	376.46	301.97	143.13	17.53
83.0	21.73	268.23	112.15	380.39	305.62	144.68	17.50
84.0	21.99	277.05	112.64	389.69	314.60	148.37	17.72
85.0	22.26	285.87	112.96	398.84	323.53	152.00	17.92
86.0	22.52	294.69	113.13	407.82	332.40	155.59	18.11
87.0	22.78	303.51	113.13	416.64	341.22	159.11	18.29
88.0	23.04	312.33	113.13	425.46	350.04	162.64	18.46
89.0	23.30	321.15	113.13	434.28	358.86	166.17	18.64
90.0	23.57	329.97	113.13	443.09	367.68	169.70	18.80
91.0	23.83	338.48	113.13	451.61	376.19	173.10	18.95
92.0	24.09	347.07	113.13	460.19	384.77	176.54	19.10
93.0	24.35	355.73	113.13	468.85	393.43	180.00	19.25
94.0	24.61	364.46	113.13	477.58	402.17	183.49	19.40
95.0	24.87	373.26	113.13	486.39	410.97	187.01	19.55
96.0	25.14	382.15	113.13	495.27	419.85	190.57	19.70
97.0	25.40	391.10	113.13	504.23	428.81	194.15	19.85
98.0	25.66	400.13	113.13	513.25	437.84	197.76	20.00
99.0	25.92	409.23	113.13	522.36	446.94	201.40	20.15
100.0	26.18	418.40	113.13	531.53	456.11	205.07	20.30

RESULT FROM TREND (AVERAGED) LINE

TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.9417E-01	0.4648E-04	0.2482E-02	0.1000E-04
0.4708E+00	0.2324E-03	0.1241E-01	0.5000E-04
0.9417E+00	0.4648E-03	0.2482E-01	0.1000E-03
0.4738E+02	0.2331E-01	0.1241E+01	0.5000E-02
0.7121E+02	0.3501E-01	0.1862E+01	0.7500E-02
0.9504E+02	0.4672E-01	0.2482E+01	0.1000E-01
0.2053E+03	0.1091E+00	0.6206E+01	0.2500E-01
0.2999E+03	0.1807E+00	0.1241E+02	0.5000E-01
0.3543E+03	0.2372E+00	0.1862E+02	0.7500E-01
0.3873E+03	0.2826E+00	0.2482E+02	0.1000E+00
0.4516E+03	0.4775E+00	0.5194E+02	0.2500E+00
0.4662E+03	0.7435E+00	0.7567E+02	0.5000E+00
0.4632E+03	0.8698E+00	0.8360E+02	0.6250E+00
0.4741E+03	0.1154E+01	0.9785E+02	0.9000E+00
0.4855E+03	0.2063E+01	0.1097E+03	0.1800E+01

RESULT FROM UPPER-BOUND LINE

TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.1629E+00	0.6954E-04	0.3708E-02	0.1000E-04
0.8143E+00	0.3477E-03	0.1854E-01	0.5000E-04
0.1629E+01	0.6954E-03	0.3708E-01	0.1000E-03
0.8236E+02	0.3499E-01	0.1854E+01	0.5000E-02
0.1236E+03	0.5258E-01	0.2781E+01	0.7500E-02
0.1630E+03	0.6988E-01	0.3708E+01	0.1000E-01
0.2981E+03	0.1475E+00	0.9270E+01	0.2500E-01
0.3762E+03	0.2195E+00	0.1854E+02	0.5000E-01
0.4206E+03	0.2738E+00	0.2781E+02	0.7500E-01
0.4462E+03	0.3167E+00	0.3708E+02	0.1000E+00
0.4997E+03	0.5077E+00	0.7378E+02	0.2500E+00
0.5072E+03	0.7685E+00	0.9452E+02	0.5000E+00
0.5057E+03	0.8944E+00	0.9996E+02	0.6250E+00
0.5126E+03	0.1175E+01	0.1086E+03	0.9000E+00
0.5165E+03	0.2078E+01	0.1126E+03	0.1800E+01

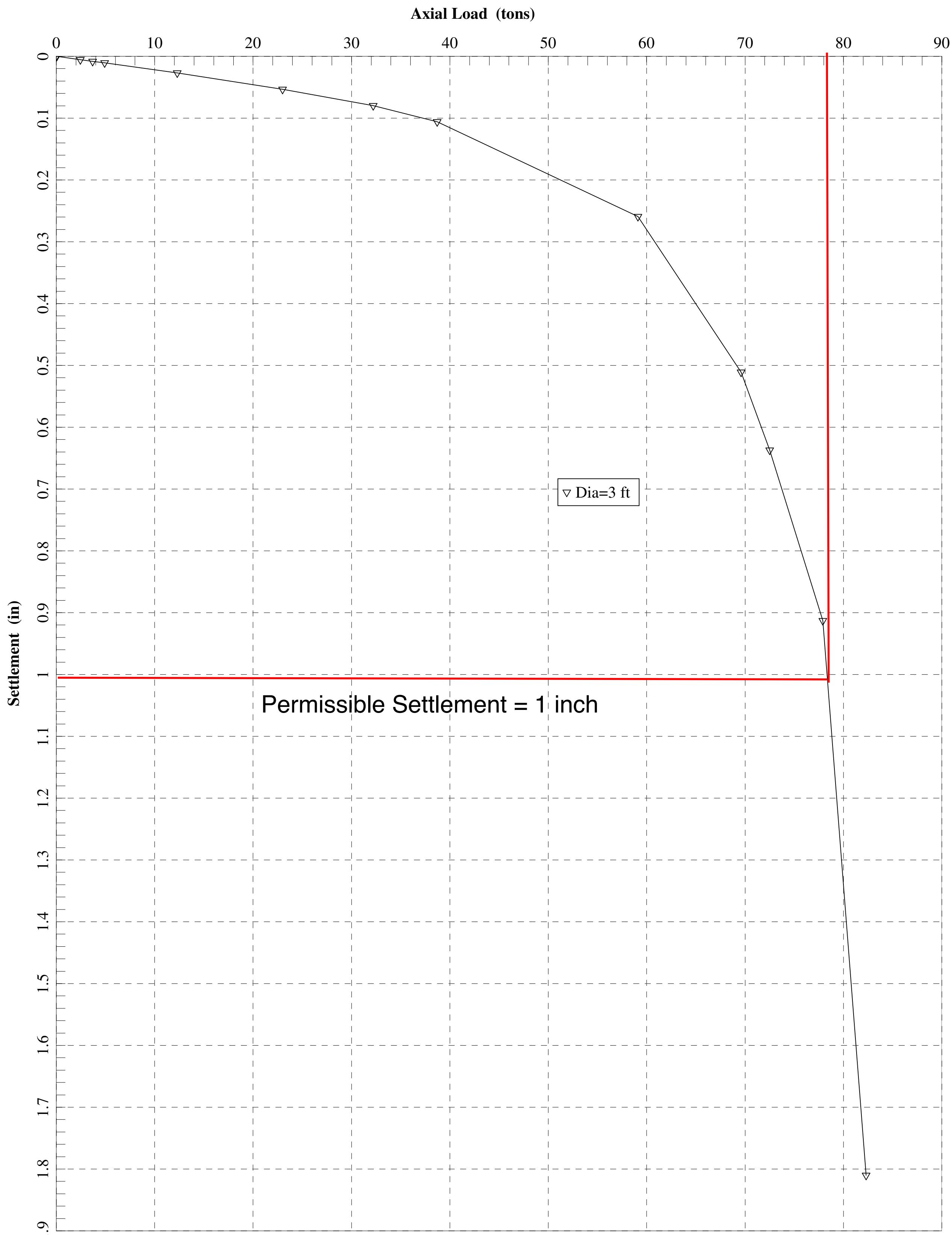
RESULT FROM LOWER-BOUND LINE

TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.4537E-01	0.2880E-04	0.1257E-02	0.1000E-04

Abut 1_Extreme Event Limit State_50%off.sfo

0.2269E+00	0.1440E-03	0.6285E-02	0.5000E-04
0.4537E+00	0.2880E-03	0.1257E-01	0.1000E-03
0.2269E+02	0.1440E-01	0.6285E+00	0.5000E-02
0.3413E+02	0.2162E-01	0.9427E+00	0.7500E-02
0.4556E+02	0.2884E-01	0.1257E+01	0.1000E-01
0.1111E+03	0.7158E-01	0.3142E+01	0.2500E-01
0.1975E+03	0.1349E+00	0.6285E+01	0.5000E-01
0.2608E+03	0.1904E+00	0.9427E+01	0.7500E-01
0.3051E+03	0.2379E+00	0.1257E+02	0.1000E+00
0.4032E+03	0.4471E+00	0.3010E+02	0.2500E+00
0.4188E+03	0.7157E+00	0.5681E+02	0.5000E+00
0.4189E+03	0.8440E+00	0.6723E+02	0.6250E+00
0.4357E+03	0.1133E+01	0.8711E+02	0.9000E+00
0.4538E+03	0.2047E+01	0.1063E+03	0.1800E+01

Settlement Graph Generated with Pile Tip at Elev. 205.0'
Permanent Load = 140 kips =70 tons



Abutment 1_36" Diameter CIDH_Service Limit State_Settlement vs Axial Load

```
=========================================================================

                 SHAFT for Windows, Version 2012.7.17

                  Serial Number :  291911540

               VERTICALLY LOADED DRILLED SHAFT ANALYSIS
                (c) Copyright ENSOFT, Inc., 1987-2012
                      All Rights Reserved

=========================================================================


Path to file locations      : T:\Ongoing Projects\2016\2016-146-NOC NB101
On-Ramp POC\Calculations\SHAFT Analysis\2019-02\
Name of input data file     : Abut 1_Service Limit State_50%off.sfd
Name of output file         : Abut 1_Service Limit State_50%off.sfo
Name of plot output file    : Abut 1_Service Limit State_50%off.sfp
Name of runtime file        : Abut 1_Service Limit State_50%off.sfr


-------------------------------------------------------------------------
                     Time and Date of Analysis
-------------------------------------------------------------------------

          Date:  February 21, 2019     Time:  15:50:39

New Pile


PROPOSED DEPTH =      23.0 FT
----------------


NUMBER OF LAYERS =   14
------------------


WATER TABLE DEPTH =      35.0 FT.
-------------------



FACTOR OF SAFETY APPLIED TO THE ULTIMATE SIDE FRICTION CAPACITY = 2.50
-------------------------------------------------------
FACTOR OF SAFETY APPLIED TO THE ULTIMATE BASE CAPACITY = 3.00
------------------------------------------------------
```


Abut 1_Service Limit State_50%off.sfo

```
SOIL INFORMATION
----------------

LAYER NO 1----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                     = 0.600E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                  = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                       = 0.360E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST       = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                          = 0.625E+02
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT            = 0.100E+11
  DEPTH, FT                                           = 0.000E+00


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                     = 0.592E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                  = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                       = 0.360E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST       = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                          = 0.625E+02
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT            = 0.100E+11
  DEPTH, FT                                           = 0.550E+01


LAYER NO 2----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                     = 0.592E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                  = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                       = 0.360E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST       = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                          = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT            = 0.100E+11
  DEPTH, FT                                           = 0.550E+01


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                     = 0.507E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                  = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                       = 0.360E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST       = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                          = 0.125E+03
```

```
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.130E+02


LAYER NO 3----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                   = 0.507E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.360E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.130E+02


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                   = 0.472E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.360E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.170E+02


LAYER NO 4----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                   = 0.663E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.340E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.170E+02


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                   = 0.762E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.340E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
```



```
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.230E+02


LAYER NO 5----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                   = 0.853E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.320E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.230E+02


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                   = 0.805E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.320E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.265E+02


LAYER NO 6----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.175E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.265E+02


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.175E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
```

```
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.330E+02


LAYER NO 7----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.120E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.330E+02


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.120E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.380E+02


LAYER NO 8----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.160E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.380E+02


  AT THE BOTTOM
```



```
  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.160E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.480E+02


LAYER NO 9----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.400E+03
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.480E+02


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.400E+03
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.585E+02


LAYER NO10----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.800E+03
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.585E+02
```

```
  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
  END BEARING COEFFICIENT-Nc                         = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.800E+03
  INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.630E+02


LAYER NO11----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
  END BEARING COEFFICIENT-Nc                         = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.135E+04
  INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.630E+02


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
  END BEARING COEFFICIENT-Nc                         = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.135E+04
  INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.800E+02


LAYER NO12----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                    = 0.535E+00
  END BEARING COEFFICIENT-Nc                         = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.350E+04
  INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
```



```
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.800E+02


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                    = 0.535E+00
  END BEARING COEFFICIENT-Nc                         = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.350E+04
  INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.865E+02


LAYER NO13----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                    = 0.250E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.360E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.865E+02


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                    = 0.250E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.360E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.113E+03


LAYER NO14----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                    = 0.511E+00
  END BEARING COEFFICIENT-Nc                         = 0.900E+01
```

```
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.400E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.113E+03


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.511E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.400E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.116E+03



DRILLED SHAFT INFORMATION
-------------------------

 DIAMETER OF STEM          =    3.000  FT.
 DIAMETER OF BASE          =    3.000  FT.
 END OF STEM TO BASE       =    0.000  FT.
 ANGLE OF BELL             =    0.000  DEG.
 IGNORED TOP PORTION       =   10.500  FT.
 IGNORED BOTTOM PORTION    =    3.000  FT.
 AREA OF ONE PERCENT STEEL =   10.180  SQ.IN.
 ELASTIC MODULUS, Ec       = 0.300E+07 LB/SQ IN
 VOLUME OF UNDERREAM       =    0.000  CU.YDS.



PREDICTED RESULTS
-----------------

QS     = ULTIMATE SIDE RESISTANCE;
QB     = ULTIMATE BASE RESISTANCE;
WT     = WEIGHT OF DRILLED SHAFT (FOR UPLIFT CAPACITY ONLY);
QU     = TOTAL ULTIMATE RESISTANCE;
QBD    = TOTAL ALLOWABLE LOAD USING A FACTOR OF SAFETY
         APPLIED TO THE ULTIMATE BASE RESISTANCE;
QDN    = TOTAL ALLOWABLE LOAD USING FACTORS OF SAFETY
```



```
         APPLIED TO THE ULTIMATE SIDE RESISTANCE AND
         THE ULTIMATE BASE RESISTANCE.
```

LENGTH (FEET)	VOLUME (CU.YDS)	QS (TONS)	QB (TONS)	QU (TONS)	QBD (TONS)	QDN (TONS)	QU/VOLUME (TONS/CU.YDS)
14.0	3.67	5.49	53.55	59.04	14.41	11.12	25.54
15.0	3.93	2.47	50.47	52.94	19.29	17.81	13.48
16.0	4.19	5.19	51.04	56.23	22.20	19.09	13.42
17.0	4.45	10.98	53.55	64.53	28.83	22.24	14.50
18.0	4.71	14.15	49.67	63.82	30.71	22.22	13.54
19.0	4.97	17.55	44.60	62.15	32.42	21.89	12.49
20.0	5.24	21.16	38.32	59.48	33.94	21.24	11.36
21.0	5.50	26.77	34.43	61.20	38.25	22.18	11.13
22.0	5.76	32.92	37.41	70.32	45.39	25.64	12.21
23.0	6.02	39.63	43.36	82.99	54.09	30.31	13.78

RESULT FROM TREND (AVERAGED) LINE

TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.4902E-02	0.1073E-04	0.9515E-03	0.1000E-04
0.2451E-01	0.5366E-04	0.4758E-02	0.5000E-04
0.4902E-01	0.1073E-03	0.9515E-02	0.1000E-03
0.2451E+01	0.5366E-02	0.4758E+00	0.5000E-02
0.3676E+01	0.8049E-02	0.7136E+00	0.7500E-02
0.4902E+01	0.1073E-01	0.9515E+00	0.1000E-01
0.1226E+02	0.2683E-01	0.2379E+01	0.2500E-01
0.2302E+02	0.5345E-01	0.4758E+01	0.5000E-01
0.3217E+02	0.7984E-01	0.7136E+01	0.7500E-01
0.3868E+02	0.1059E+00	0.9515E+01	0.1000E+00
0.5909E+02	0.2592E+00	0.1991E+02	0.2500E+00
0.6957E+02	0.5110E+00	0.2900E+02	0.5000E+00
0.7249E+02	0.6365E+00	0.3204E+02	0.6250E+00
0.7792E+02	0.9125E+00	0.3751E+02	0.9000E+00
0.8234E+02	0.1813E+01	0.4206E+02	0.1800E+01

RESULT FROM UPPER-BOUND LINE

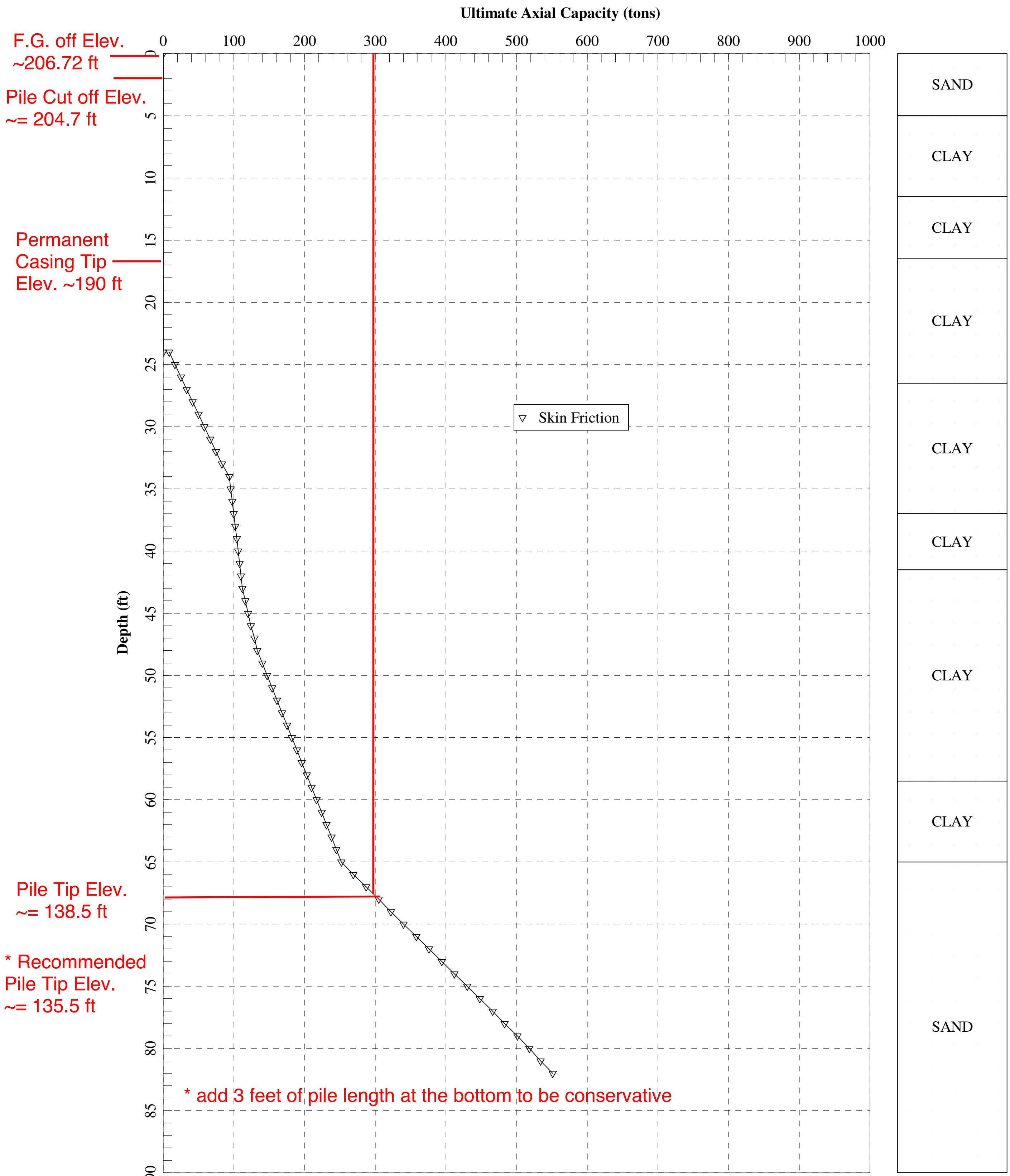
TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.6743E-02	0.1101E-04	0.1421E-02	0.1000E-04
0.3371E-01	0.5505E-04	0.7106E-02	0.5000E-04
0.6743E-01	0.1101E-03	0.1421E-01	0.1000E-03
0.3371E+01	0.5505E-02	0.7106E+00	0.5000E-02

0.5057E+01	0.8258E-02	0.1066E+01	0.7500E-02
0.6743E+01	0.1101E-01	0.1421E+01	0.1000E-01
0.1689E+02	0.2753E-01	0.3553E+01	0.2500E-01
0.3138E+02	0.5472E-01	0.7106E+01	0.5000E-01
0.4333E+02	0.8156E-01	0.1066E+02	0.7500E-01
0.5101E+02	0.1078E+00	0.1421E+02	0.1000E+00
0.7042E+02	0.2611E+00	0.2828E+02	0.2500E+00
0.7837E+02	0.5125E+00	0.3623E+02	0.5000E+00
0.8045E+02	0.6379E+00	0.3831E+02	0.6250E+00
0.8377E+02	0.9135E+00	0.4163E+02	0.9000E+00
0.8528E+02	0.1814E+01	0.4314E+02	0.1800E+01

RESULT FROM LOWER-BOUND LINE

TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.3068E-02	0.1045E-04	0.4818E-03	0.1000E-04
0.1534E-01	0.5227E-04	0.2409E-02	0.5000E-04
0.3068E-01	0.1045E-03	0.4818E-02	0.1000E-03
0.1534E+01	0.5227E-02	0.2409E+00	0.5000E-02
0.2301E+01	0.7840E-02	0.3613E+00	0.7500E-02
0.3068E+01	0.1045E-01	0.4818E+00	0.1000E-01
0.7671E+01	0.2613E-01	0.1204E+01	0.2500E-01
0.1468E+02	0.5218E-01	0.2409E+01	0.5000E-01
0.2103E+02	0.7812E-01	0.3613E+01	0.7500E-01
0.2635E+02	0.1039E+00	0.4818E+01	0.1000E+00
0.4773E+02	0.2572E+00	0.1154E+02	0.2500E+00
0.6076E+02	0.5095E+00	0.2178E+02	0.5000E+00
0.6452E+02	0.6352E+00	0.2577E+02	0.6250E+00
0.7207E+02	0.9115E+00	0.3339E+02	0.9000E+00
0.7919E+02	0.1813E+01	0.4076E+02	0.1800E+01

Vertical loading = 410 kips / 0.7 / 2 ~= 295 tons



Bent 2_72" Diameter Type-II CIDH_Strength Limit State

```
=========================================================================

              SHAFT for Windows, Version 2012.7.17

               Serial Number :  291911540

            VERTICALLY LOADED DRILLED SHAFT ANALYSIS
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=========================================================================


Path to file locations      : T:\Ongoing Projects\2016\2016-146-NOC NB101
On-Ramp POC\Calculations\SHAFT Analysis\2019-03\
Name of input data file     : Bent 2_Strength Limit State.sfd
Name of output file         : Bent 2_Strength Limit State.sfo
Name of plot output file    : Bent 2_Strength Limit State.sfp
Name of runtime file        : Bent 2_Strength Limit State.sfr


-------------------------------------------------------------------------
                    Time and Date of Analysis
-------------------------------------------------------------------------

          Date:  April 02, 2019     Time:  14:30:34

New Pile


PROPOSED DEPTH =      85.0 FT
----------------


NUMBER OF LAYERS =   10
------------------


WATER TABLE DEPTH =      13.5 FT.
-------------------



FACTOR OF SAFETY APPLIED TO THE ULTIMATE SIDE FRICTION CAPACITY = 2.50
-------------------------------------------------------
FACTOR OF SAFETY APPLIED TO THE ULTIMATE BASE CAPACITY = 3.00
------------------------------------------------------
```



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SOIL INFORMATION
---------------

LAYER NO 1----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                   = 0.120E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.320E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.000E+00


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                   = 0.120E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.320E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.500E+01


LAYER NO 2----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.700E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.175E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.500E+01


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.830E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.175E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
```

```
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.115E+02


LAYER NO 3----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.830E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.120E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.115E+02


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.120E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.165E+02


LAYER NO 4----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.160E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.165E+02


  AT THE BOTTOM
```



```
  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.160E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.265E+02


LAYER NO 5----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.400E+03
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.265E+02


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.400E+03
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.370E+02


LAYER NO 6----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.800E+03
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.370E+02
```

```
  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
  END BEARING COEFFICIENT-Nc                         = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.800E+03
  INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.415E+02


LAYER NO 7----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
  END BEARING COEFFICIENT-Nc                         = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.135E+04
  INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.415E+02


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
  END BEARING COEFFICIENT-Nc                         = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.135E+04
  INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.585E+02


LAYER NO 8----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                    = 0.535E+00
  END BEARING COEFFICIENT-Nc                         = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.350E+04
  INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
```



```
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.585E+02


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                    = 0.535E+00
  END BEARING COEFFICIENT-Nc                         = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.350E+04
  INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.650E+02


LAYER NO 9----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                    = 0.412E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.360E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.650E+02


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                    = 0.250E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.360E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.915E+02


LAYER NO10----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                    = 0.511E+00
  END BEARING COEFFICIENT-Nc                         = 0.900E+01
```

```
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.400E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.915E+02


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.511E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.400E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.950E+02




DRILLED SHAFT INFORMATION
-------------------------

 DIAMETER OF STEM          =    6.000  FT.
 DIAMETER OF BASE          =    6.000  FT.
 END OF STEM TO BASE       =    0.000  FT.
 ANGLE OF BELL             =    0.000  DEG.
 IGNORED TOP PORTION       =   16.500  FT.
 IGNORED BOTTOM PORTION    =    6.000  FT.
 AREA OF ONE PERCENT STEEL =   40.720  SQ.IN.
 ELASTIC MODULUS, Ec       = 0.300E+07 LB/SQ IN
 VOLUME OF UNDERREAM       =    0.000  CU.YDS.



PREDICTED RESULTS
-----------------

QS     = ULTIMATE SIDE RESISTANCE;
QB     = ULTIMATE BASE RESISTANCE;
WT     = WEIGHT OF DRILLED SHAFT (FOR UPLIFT CAPACITY ONLY);
QU     = TOTAL ULTIMATE RESISTANCE;
QBD    = TOTAL ALLOWABLE LOAD USING A FACTOR OF SAFETY
         APPLIED TO THE ULTIMATE BASE RESISTANCE;
QDN    = TOTAL ALLOWABLE LOAD USING FACTORS OF SAFETY
```


APPLIED TO THE ULTIMATE SIDE RESISTANCE AND
THE ULTIMATE BASE RESISTANCE.

LENGTH (FEET)	VOLUME (CU.YDS)	QS (TONS)	QB (TONS)	QU (TONS)	QBD (TONS)	QDN (TONS)	QU/VOLUME (TONS/CU.YDS)
23.0	24.09	12.44	55.70	68.14	21.72	14.26	35.98
24.0	25.14	8.29	60.86	69.15	28.58	23.60	2.75
25.0	26.18	16.59	54.22	70.81	34.66	24.71	2.70
26.0	27.23	24.88	55.70	80.58	43.45	28.52	2.96
27.0	28.28	33.18	60.86	94.04	53.47	33.56	3.33
28.0	29.33	41.47	66.39	107.87	63.61	38.72	3.68
29.0	30.37	49.77	72.29	122.06	73.87	44.01	4.02
30.0	31.42	58.06	78.56	136.63	84.25	49.41	4.35
31.0	32.47	66.36	91.80	158.15	96.96	57.14	4.87
32.0	33.51	74.65	104.43	179.08	109.46	64.67	5.34
33.0	34.56	82.95	116.46	199.41	121.77	72.00	5.77
34.0	35.61	93.32	127.90	221.21	135.95	79.96	6.21
35.0	36.66	95.39	138.73	234.12	141.63	84.40	6.39
36.0	37.70	97.46	148.97	246.43	147.12	88.64	6.54
37.0	38.75	99.54	156.57	256.11	151.73	92.01	6.61
38.0	39.80	101.61	162.66	264.27	155.83	94.86	6.64
39.0	40.85	103.69	167.22	270.91	159.43	97.22	6.63
40.0	41.89	105.76	170.27	276.03	162.52	99.06	6.59
41.0	42.94	107.83	171.79	279.62	165.10	100.40	6.51
42.0	43.99	109.91	171.79	281.70	167.17	101.23	6.40
43.0	45.04	111.98	171.79	283.77	169.24	102.06	6.30
44.0	46.08	116.13	171.79	287.92	173.39	103.71	6.25
45.0	47.13	120.28	171.79	292.06	177.54	105.37	6.20
46.0	48.18	124.42	171.79	296.21	181.69	107.03	6.15
47.0	49.22	128.57	171.79	300.36	185.83	108.69	6.10
48.0	50.27	132.72	197.56	330.28	198.57	118.94	6.57
49.0	51.32	139.72	225.32	365.03	214.82	130.99	7.11
50.0	52.37	146.72	255.06	401.77	231.73	143.70	7.67
51.0	53.41	153.71	286.78	440.49	249.31	157.08	8.25
52.0	54.46	160.71	320.48	481.19	267.54	171.11	8.84
53.0	55.51	167.71	356.16	523.88	286.43	185.81	9.44
54.0	56.56	174.71	373.55	548.26	299.23	194.40	9.69
55.0	57.60	181.71	384.04	565.74	309.72	200.70	9.82
56.0	58.65	188.71	387.62	576.33	317.92	204.69	9.83
57.0	59.70	195.71	384.31	580.02	323.81	206.39	9.72
58.0	60.75	202.71	374.11	576.81	327.41	205.78	9.50
59.0	61.79	209.71	357.00	566.71	328.71	202.88	9.17
60.0	62.84	216.70	342.75	559.45	330.95	200.93	8.90
61.0	63.89	223.70	331.34	555.05	334.15	199.93	8.69
62.0	64.93	230.70	322.79	553.49	338.30	199.88	8.52
63.0	65.98	237.70	317.09	554.79	343.40	200.78	8.41
64.0	67.03	244.70	314.24	558.94	349.45	202.63	8.34
65.0	68.08	251.70	314.24	565.94	356.44	205.43	8.31

66.0	69.12	269.34	314.24	583.58	374.08	212.48	8.44
67.0	70.17	286.98	314.24	601.21	391.72	219.54	8.57
68.0	71.22	304.61	314.24	618.85	409.36	226.59	8.69
69.0	72.27	322.25	314.24	636.49	427.00	233.65	8.81
70.0	73.31	339.89	314.24	654.13	444.64	240.70	8.92
71.0	74.36	357.53	314.24	671.77	462.28	247.76	9.03
72.0	75.41	375.96	314.24	690.20	480.71	255.13	9.15
73.0	76.46	394.25	314.24	708.49	498.99	262.45	9.27
74.0	77.50	412.38	314.24	726.62	517.13	269.70	9.38
75.0	78.55	430.36	314.24	744.60	535.10	276.89	9.48
76.0	79.60	448.16	314.24	762.40	552.91	284.01	9.58
77.0	80.64	465.80	314.24	780.04	570.55	291.07	9.67
78.0	81.69	483.26	314.24	797.50	588.00	298.05	9.76
79.0	82.74	500.53	314.24	814.77	605.28	304.96	9.85
80.0	83.79	517.61	314.24	831.85	622.35	311.79	9.93
81.0	84.83	534.49	332.59	867.07	645.35	324.66	10.22
82.0	85.88	551.16	352.35	903.51	668.61	337.91	10.52

RESULT FROM TREND (AVERAGED) LINE

TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.4126E-01	0.1446E-04	0.3866E-02	0.1000E-04
0.2063E+00	0.7229E-04	0.1933E-01	0.5000E-04
0.4126E+00	0.1446E-03	0.3866E-01	0.1000E-03
0.2063E+02	0.7229E-02	0.1933E+01	0.5000E-02
0.3095E+02	0.1084E-01	0.2900E+01	0.7500E-02
0.4126E+02	0.1446E-01	0.3866E+01	0.1000E-01
0.1033E+03	0.3615E-01	0.9665E+01	0.2500E-01
0.2067E+03	0.7233E-01	0.1933E+02	0.5000E-01
0.2906E+03	0.1071E+00	0.2900E+02	0.7500E-01
0.3490E+03	0.1391E+00	0.3866E+02	0.1000E+00
0.5812E+03	0.3187E+00	0.9665E+02	0.2500E+00
0.7097E+03	0.5876E+00	0.1618E+03	0.5000E+00
0.7488E+03	0.8142E+00	0.1973E+03	0.7200E+00
0.8276E+03	0.1909E+01	0.3048E+03	0.1800E+01
0.8637E+03	0.3715E+01	0.3418E+03	0.3600E+01

RESULT FROM UPPER-BOUND LINE

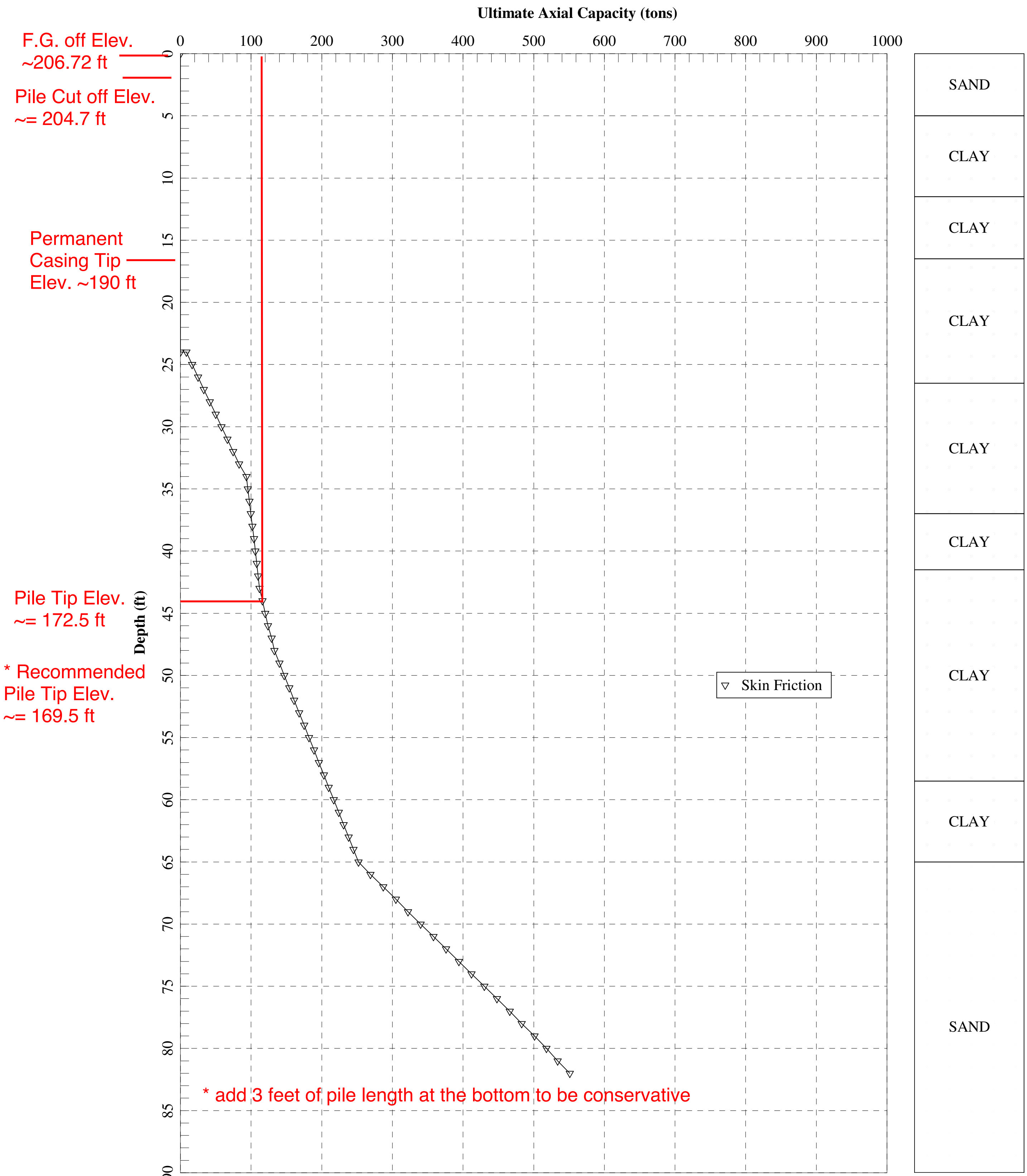
TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.6051E-01	0.1641E-04	0.5775E-02	0.1000E-04
0.3026E+00	0.8205E-04	0.2887E-01	0.5000E-04

0.6051E+00	0.1641E-03	0.5775E-01	0.1000E-03
0.3026E+02	0.8205E-02	0.2887E+01	0.5000E-02
0.4539E+02	0.1231E-01	0.4331E+01	0.7500E-02
0.6051E+02	0.1641E-01	0.5775E+01	0.1000E-01
0.1517E+03	0.4105E-01	0.1444E+02	0.2500E-01
0.3036E+03	0.8213E-01	0.2887E+02	0.5000E-01
0.4081E+03	0.1199E+00	0.4331E+02	0.7500E-01
0.4753E+03	0.1535E+00	0.5775E+02	0.1000E+00
0.7002E+03	0.3352E+00	0.1444E+03	0.2500E+00
0.8179E+03	0.6031E+00	0.2298E+03	0.5000E+00
0.8486E+03	0.8284E+00	0.2643E+03	0.7200E+00
0.8976E+03	0.1918E+01	0.3383E+03	0.1800E+01
0.9100E+03	0.3720E+01	0.3506E+03	0.3600E+01

RESULT FROM LOWER-BOUND LINE

TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.2368E-01	0.1262E-04	0.1957E-02	0.1000E-04
0.1184E+00	0.6311E-04	0.9787E-02	0.5000E-04
0.2368E+00	0.1262E-03	0.1957E-01	0.1000E-03
0.1184E+02	0.6311E-02	0.9787E+00	0.5000E-02
0.1776E+02	0.9466E-02	0.1468E+01	0.7500E-02
0.2368E+02	0.1262E-01	0.1957E+01	0.1000E-01
0.5921E+02	0.3155E-01	0.4894E+01	0.2500E-01
0.1185E+03	0.6312E-01	0.9787E+01	0.5000E-01
0.1748E+03	0.9443E-01	0.1468E+02	0.7500E-01
0.2230E+03	0.1249E+00	0.1957E+02	0.1000E+00
0.4387E+03	0.3002E+00	0.4894E+02	0.2500E+00
0.6011E+03	0.5721E+00	0.9376E+02	0.5000E+00
0.6491E+03	0.8000E+00	0.1304E+03	0.7200E+00
0.7576E+03	0.1900E+01	0.2713E+03	0.1800E+01
0.8158E+03	0.3710E+01	0.3312E+03	0.3600E+01

Vertical loading = 230 kips / 2 = 115 tons



Bent 2_72" Diameter Type-II CIDH_Extreme Event Limit State

```
=========================================================================

                SHAFT for Windows, Version 2012.7.17

                 Serial Number :  291911540

               VERTICALLY LOADED DRILLED SHAFT ANALYSIS
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                      All Rights Reserved

=========================================================================


     Path to file locations      : T:\Ongoing Projects\2016\2016-146-NOC NB101
On-Ramp POC\Calculations\SHAFT Analysis\2019-03\
     Name of input data file     : Bent 2_Extreme Limit State.sfd
     Name of output file         : Bent 2_Extreme Limit State.sfo
     Name of plot output file    : Bent 2_Extreme Limit State.sfp
     Name of runtime file        : Bent 2_Extreme Limit State.sfr


     -------------------------------------------------------------------------
                       Time and Date of Analysis
     -------------------------------------------------------------------------

               Date:  April 02, 2019     Time:  14:11:14

     New Pile


     PROPOSED DEPTH =      85.0 FT
     ----------------


     NUMBER OF LAYERS =   10
     ------------------


     WATER TABLE DEPTH =      13.5 FT.
     -------------------



     FACTOR OF SAFETY APPLIED TO THE ULTIMATE SIDE FRICTION CAPACITY = 2.50
     -------------------------------------------------------
     FACTOR OF SAFETY APPLIED TO THE ULTIMATE BASE CAPACITY = 3.00
     ------------------------------------------------------
```



```
SOIL INFORMATION
---------------

LAYER NO 1----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                    = 0.120E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.320E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.000E+00


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                    = 0.120E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.320E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.500E+01


LAYER NO 2----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
  END BEARING COEFFICIENT-Nc                         = 0.700E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.175E+04
  INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.500E+01


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
  END BEARING COEFFICIENT-Nc                         = 0.830E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.175E+04
  INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
```

```
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.115E+02


LAYER NO 3----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.830E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.120E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.115E+02


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.120E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.165E+02


LAYER NO 4----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.160E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.165E+02


  AT THE BOTTOM
```



```
  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.160E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.265E+02


LAYER NO 5----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.400E+03
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.265E+02


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.400E+03
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.370E+02


LAYER NO 6----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.800E+03
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.370E+02
```

```
  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.800E+03
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.415E+02


LAYER NO 7----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.135E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.415E+02


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.135E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.585E+02


LAYER NO 8----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.535E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.350E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
```



```
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.585E+02


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.535E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.350E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.650E+02


LAYER NO 9----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                   = 0.412E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.360E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.650E+02


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                   = 0.250E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.360E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.915E+02


LAYER NO10----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.511E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
```

```
 UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.400E+04
 INTERNAL FRICTION ANGLE, DEG.                    = 0.000E+00
 BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
 SOIL UNIT WEIGHT, LB/CU FT                       = 0.125E+03
 MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
 DEPTH, FT                                        = 0.915E+02


 AT THE BOTTOM

 STRENGTH REDUCTION FACTOR-ALPHA                  = 0.511E+00
 END BEARING COEFFICIENT-Nc                       = 0.900E+01
 UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.400E+04
 INTERNAL FRICTION ANGLE, DEG.                    = 0.000E+00
 BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
 SOIL UNIT WEIGHT, LB/CU FT                       = 0.125E+03
 MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
 DEPTH, FT                                        = 0.950E+02
```

DRILLED SHAFT INFORMATION

```
 DIAMETER OF STEM         =    6.000  FT.
 DIAMETER OF BASE         =    6.000  FT.
 END OF STEM TO BASE      =    0.000  FT.
 ANGLE OF BELL            =    0.000  DEG.
 IGNORED TOP PORTION      =   16.500  FT.
 IGNORED BOTTOM PORTION   =    6.000  FT.
 AREA OF ONE PERCENT STEEL =   40.720  SQ.IN.
 ELASTIC MODULUS, Ec      = 0.300E+07 LB/SQ IN
 VOLUME OF UNDERREAM      =    0.000  CU.YDS.
```

PREDICTED RESULTS

```
QS     = ULTIMATE SIDE RESISTANCE;
QB     = ULTIMATE BASE RESISTANCE;
WT     = WEIGHT OF DRILLED SHAFT (FOR UPLIFT CAPACITY ONLY);
QU     = TOTAL ULTIMATE RESISTANCE;
QBD    = TOTAL ALLOWABLE LOAD USING A FACTOR OF SAFETY
         APPLIED TO THE ULTIMATE BASE RESISTANCE;
QDN    = TOTAL ALLOWABLE LOAD USING FACTORS OF SAFETY
```


APPLIED TO THE ULTIMATE SIDE RESISTANCE AND
THE ULTIMATE BASE RESISTANCE.

LENGTH (FEET)	VOLUME (CU.YDS)	QS (TONS)	QB (TONS)	QU (TONS)	QBD (TONS)	QDN (TONS)	QU/VOLUME (TONS/CU.YDS)
23.0	24.09	12.44	55.70	68.14	21.72	14.26	35.98
24.0	25.14	8.29	60.86	69.15	28.58	23.60	2.75
25.0	26.18	16.59	54.22	70.81	34.66	24.71	2.70
26.0	27.23	24.88	55.70	80.58	43.45	28.52	2.96
27.0	28.28	33.18	60.86	94.04	53.47	33.56	3.33
28.0	29.33	41.47	66.39	107.87	63.61	38.72	3.68
29.0	30.37	49.77	72.29	122.06	73.87	44.01	4.02
30.0	31.42	58.06	78.56	136.63	84.25	49.41	4.35
31.0	32.47	66.36	91.80	158.15	96.96	57.14	4.87
32.0	33.51	74.65	104.43	179.08	109.46	64.67	5.34
33.0	34.56	82.95	116.46	199.41	121.77	72.00	5.77
34.0	35.61	93.32	127.90	221.21	135.95	79.96	6.21
35.0	36.66	95.39	138.73	234.12	141.63	84.40	6.39
36.0	37.70	97.46	148.97	246.43	147.12	88.64	6.54
37.0	38.75	99.54	156.57	256.11	151.73	92.01	6.61
38.0	39.80	101.61	162.66	264.27	155.83	94.86	6.64
39.0	40.85	103.69	167.22	270.91	159.43	97.22	6.63
40.0	41.89	105.76	170.27	276.03	162.52	99.06	6.59
41.0	42.94	107.83	171.79	279.62	165.10	100.40	6.51
42.0	43.99	109.91	171.79	281.70	167.17	101.23	6.40
43.0	45.04	111.98	171.79	283.77	169.24	102.06	6.30
44.0	46.08	116.13	171.79	287.92	173.39	103.71	6.25
45.0	47.13	120.28	171.79	292.06	177.54	105.37	6.20
46.0	48.18	124.42	171.79	296.21	181.69	107.03	6.15
47.0	49.22	128.57	171.79	300.36	185.83	108.69	6.10
48.0	50.27	132.72	197.56	330.28	198.57	118.94	6.57
49.0	51.32	139.72	225.32	365.03	214.82	130.99	7.11
50.0	52.37	146.72	255.06	401.77	231.73	143.70	7.67
51.0	53.41	153.71	286.78	440.49	249.31	157.08	8.25
52.0	54.46	160.71	320.48	481.19	267.54	171.11	8.84
53.0	55.51	167.71	356.16	523.88	286.43	185.81	9.44
54.0	56.56	174.71	373.55	548.26	299.23	194.40	9.69
55.0	57.60	181.71	384.04	565.74	309.72	200.70	9.82
56.0	58.65	188.71	387.62	576.33	317.92	204.69	9.83
57.0	59.70	195.71	384.31	580.02	323.81	206.39	9.72
58.0	60.75	202.71	374.11	576.81	327.41	205.78	9.50
59.0	61.79	209.71	357.00	566.71	328.71	202.88	9.17
60.0	62.84	216.70	342.75	559.45	330.95	200.93	8.90
61.0	63.89	223.70	331.34	555.05	334.15	199.93	8.69
62.0	64.93	230.70	322.79	553.49	338.30	199.88	8.52
63.0	65.98	237.70	317.09	554.79	343.40	200.78	8.41
64.0	67.03	244.70	314.24	558.94	349.45	202.63	8.34
65.0	68.08	251.70	314.24	565.94	356.44	205.43	8.31

66.0	69.12	269.34	314.24	583.58	374.08	212.48	8.44
67.0	70.17	286.98	314.24	601.21	391.72	219.54	8.57
68.0	71.22	304.61	314.24	618.85	409.36	226.59	8.69
69.0	72.27	322.25	314.24	636.49	427.00	233.65	8.81
70.0	73.31	339.89	314.24	654.13	444.64	240.70	8.92
71.0	74.36	357.53	314.24	671.77	462.28	247.76	9.03
72.0	75.41	375.96	314.24	690.20	480.71	255.13	9.15
73.0	76.46	394.25	314.24	708.49	498.99	262.45	9.27
74.0	77.50	412.38	314.24	726.62	517.13	269.70	9.38
75.0	78.55	430.36	314.24	744.60	535.10	276.89	9.48
76.0	79.60	448.16	314.24	762.40	552.91	284.01	9.58
77.0	80.64	465.80	314.24	780.04	570.55	291.07	9.67
78.0	81.69	483.26	314.24	797.50	588.00	298.05	9.76
79.0	82.74	500.53	314.24	814.77	605.28	304.96	9.85
80.0	83.79	517.61	314.24	831.85	622.35	311.79	9.93
81.0	84.83	534.49	332.59	867.07	645.35	324.66	10.22
82.0	85.88	551.16	352.35	903.51	668.61	337.91	10.52

RESULT FROM TREND (AVERAGED) LINE

TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.4126E-01	0.1446E-04	0.3866E-02	0.1000E-04
0.2063E+00	0.7229E-04	0.1933E-01	0.5000E-04
0.4126E+00	0.1446E-03	0.3866E-01	0.1000E-03
0.2063E+02	0.7229E-02	0.1933E+01	0.5000E-02
0.3095E+02	0.1084E-01	0.2900E+01	0.7500E-02
0.4126E+02	0.1446E-01	0.3866E+01	0.1000E-01
0.1033E+03	0.3615E-01	0.9665E+01	0.2500E-01
0.2067E+03	0.7233E-01	0.1933E+02	0.5000E-01
0.2906E+03	0.1071E+00	0.2900E+02	0.7500E-01
0.3490E+03	0.1391E+00	0.3866E+02	0.1000E+00
0.5812E+03	0.3187E+00	0.9665E+02	0.2500E+00
0.7097E+03	0.5876E+00	0.1618E+03	0.5000E+00
0.7488E+03	0.8142E+00	0.1973E+03	0.7200E+00
0.8276E+03	0.1909E+01	0.3048E+03	0.1800E+01
0.8637E+03	0.3715E+01	0.3418E+03	0.3600E+01

RESULT FROM UPPER-BOUND LINE

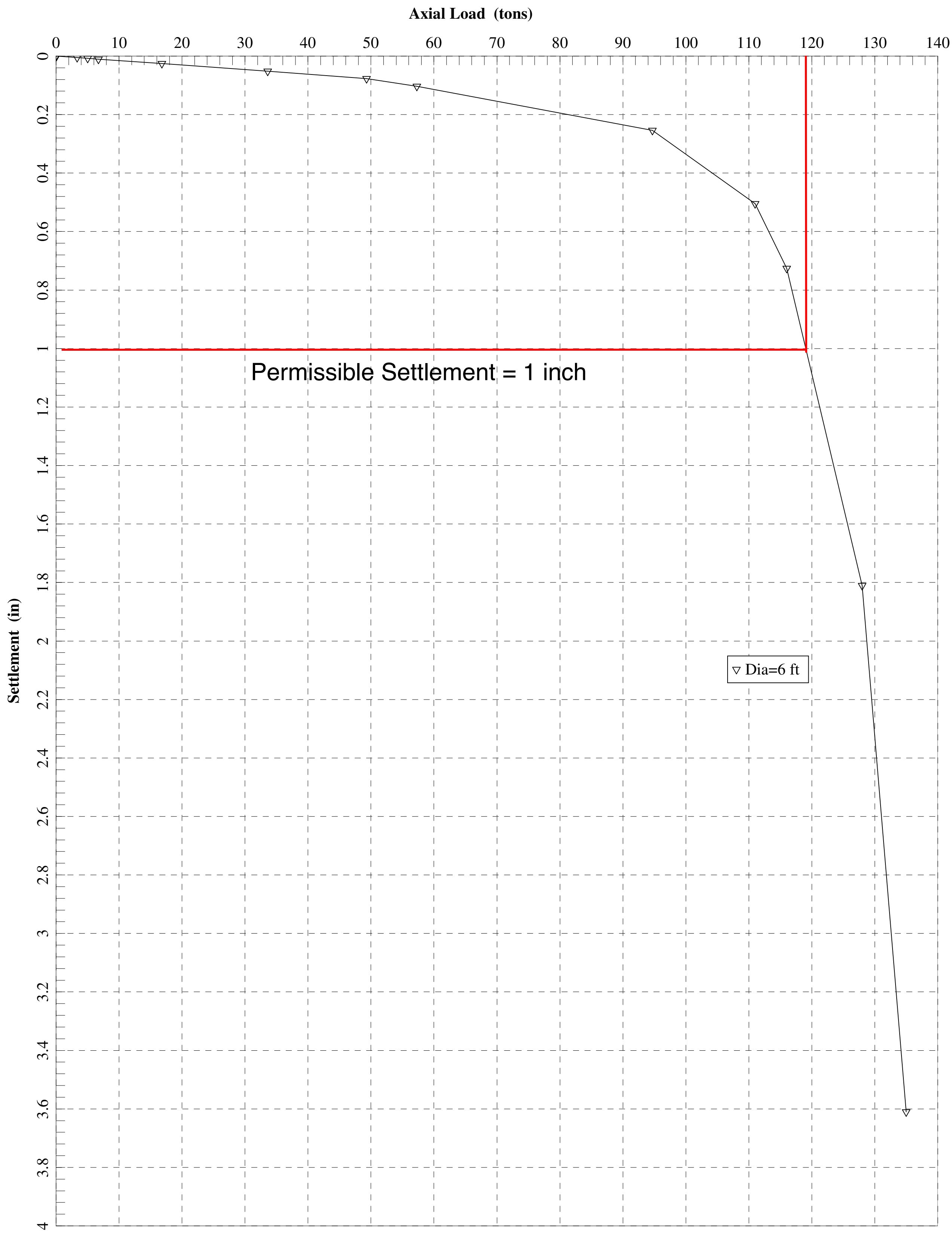
TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.6051E-01	0.1641E-04	0.5775E-02	0.1000E-04
0.3026E+00	0.8205E-04	0.2887E-01	0.5000E-04

0.6051E+00	0.1641E-03	0.5775E-01	0.1000E-03
0.3026E+02	0.8205E-02	0.2887E+01	0.5000E-02
0.4539E+02	0.1231E-01	0.4331E+01	0.7500E-02
0.6051E+02	0.1641E-01	0.5775E+01	0.1000E-01
0.1517E+03	0.4105E-01	0.1444E+02	0.2500E-01
0.3036E+03	0.8213E-01	0.2887E+02	0.5000E-01
0.4081E+03	0.1199E+00	0.4331E+02	0.7500E-01
0.4753E+03	0.1535E+00	0.5775E+02	0.1000E+00
0.7002E+03	0.3352E+00	0.1444E+03	0.2500E+00
0.8179E+03	0.6031E+00	0.2298E+03	0.5000E+00
0.8486E+03	0.8284E+00	0.2643E+03	0.7200E+00
0.8976E+03	0.1918E+01	0.3383E+03	0.1800E+01
0.9100E+03	0.3720E+01	0.3506E+03	0.3600E+01

RESULT FROM LOWER-BOUND LINE

TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.2368E-01	0.1262E-04	0.1957E-02	0.1000E-04
0.1184E+00	0.6311E-04	0.9787E-02	0.5000E-04
0.2368E+00	0.1262E-03	0.1957E-01	0.1000E-03
0.1184E+02	0.6311E-02	0.9787E+00	0.5000E-02
0.1776E+02	0.9466E-02	0.1468E+01	0.7500E-02
0.2368E+02	0.1262E-01	0.1957E+01	0.1000E-01
0.5921E+02	0.3155E-01	0.4894E+01	0.2500E-01
0.1185E+03	0.6312E-01	0.9787E+01	0.5000E-01
0.1748E+03	0.9443E-01	0.1468E+02	0.7500E-01
0.2230E+03	0.1249E+00	0.1957E+02	0.1000E+00
0.4387E+03	0.3002E+00	0.4894E+02	0.2500E+00
0.6011E+03	0.5721E+00	0.9376E+02	0.5000E+00
0.6491E+03	0.8000E+00	0.1304E+03	0.7200E+00
0.7576E+03	0.1900E+01	0.2713E+03	0.1800E+01
0.8158E+03	0.3710E+01	0.3312E+03	0.3600E+01

Settlement Graph Generated with Pile Tip at Elev. 178.0'
Permanent Load = 230 kips =115 tons



Bent 2_72" Diameter Type-II CIDH_Service Limit State_Settlement vs Axial Load

```
=========================================================================

                SHAFT for Windows, Version 2012.7.17

                 Serial Number :  291911540

               VERTICALLY LOADED DRILLED SHAFT ANALYSIS
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                      All Rights Reserved

=========================================================================


     Path to file locations      : T:\Ongoing Projects\2016\2016-146-NOC NB101
On-Ramp POC\Calculations\SHAFT Analysis\2019-03\
     Name of input data file     : Bent 2_Service Limit State.sfd
     Name of output file         : Bent 2_Service Limit State.sfo
     Name of plot output file    : Bent 2_Service Limit State.sfp
     Name of runtime file        : Bent 2_Service Limit State.sfr


     -------------------------------------------------------------------------
                       Time and Date of Analysis
     -------------------------------------------------------------------------

               Date:  April 02, 2019     Time:  14:36:08

     New Pile


     PROPOSED DEPTH =      10.0 FT
     ----------------


     NUMBER OF LAYERS =   10
     ------------------


     WATER TABLE DEPTH =      13.5 FT.
     -------------------



     FACTOR OF SAFETY APPLIED TO THE ULTIMATE SIDE FRICTION CAPACITY = 2.50
     -------------------------------------------------------
     FACTOR OF SAFETY APPLIED TO THE ULTIMATE BASE CAPACITY = 3.00
     ------------------------------------------------------
```



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SOIL INFORMATION
---------------

LAYER NO 1----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                    = 0.120E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.320E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.000E+00


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                    = 0.120E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.320E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.500E+01


LAYER NO 2----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
  END BEARING COEFFICIENT-Nc                         = 0.700E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.175E+04
  INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.500E+01


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
  END BEARING COEFFICIENT-Nc                         = 0.830E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.175E+04
  INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
```

```
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.115E+02


LAYER NO 3----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.830E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.120E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.115E+02


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.120E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.165E+02


LAYER NO 4----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.160E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.165E+02


  AT THE BOTTOM
```



```
  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.160E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.265E+02


LAYER NO 5----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.400E+03
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.265E+02


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.400E+03
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.370E+02


LAYER NO 6----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.800E+03
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.370E+02
```

```
  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.800E+03
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.415E+02


LAYER NO 7----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.135E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.415E+02


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.135E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.585E+02


LAYER NO 8----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.535E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.350E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
```



```
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.585E+02


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.535E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.350E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.650E+02


LAYER NO 9----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                   = 0.412E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.360E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.650E+02


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                   = 0.250E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.360E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.915E+02


LAYER NO10----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.511E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
```

```
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.400E+04
  INTERNAL FRICTION ANGLE, DEG.                    = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                       = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.915E+02

  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                  = 0.511E+00
  END BEARING COEFFICIENT-Nc                       = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.400E+04
  INTERNAL FRICTION ANGLE, DEG.                    = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                       = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.950E+02


DRILLED SHAFT INFORMATION
-------------------------

 DIAMETER OF STEM         =    6.000  FT.
 DIAMETER OF BASE         =    6.000  FT.
 END OF STEM TO BASE      =    0.000  FT.
 ANGLE OF BELL            =    0.000  DEG.
 IGNORED TOP PORTION      =   16.500  FT.
 IGNORED BOTTOM PORTION   =    6.000  FT.
 AREA OF ONE PERCENT STEEL =   40.720  SQ.IN.
 ELASTIC MODULUS, Ec      = 0.300E+07 LB/SQ IN
 VOLUME OF UNDERREAM      =    0.000  CU.YDS.


PREDICTED RESULTS
-----------------

QS     = ULTIMATE SIDE RESISTANCE;
QB     = ULTIMATE BASE RESISTANCE;
WT     = WEIGHT OF DRILLED SHAFT (FOR UPLIFT CAPACITY ONLY);
QU     = TOTAL ULTIMATE RESISTANCE;
QBD    = TOTAL ALLOWABLE LOAD USING A FACTOR OF SAFETY
         APPLIED TO THE ULTIMATE BASE RESISTANCE;
QDN    = TOTAL ALLOWABLE LOAD USING FACTORS OF SAFETY
```



```
         APPLIED TO THE ULTIMATE SIDE RESISTANCE AND
         THE ULTIMATE BASE RESISTANCE.
```

LENGTH (FEET)	VOLUME (CU.YDS)	QS (TONS)	QB (TONS)	QU (TONS)	QBD (TONS)	QDN (TONS)	QU/VOLUME (TONS/CU.YDS)
23.0	24.09	7.95	58.32	66.27	27.39	22.62	2.64
24.0	25.14	8.29	60.86	69.15	28.58	23.60	2.75

RESULT FROM TREND (AVERAGED) LINE

TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.6678E-03	0.1003E-04	0.6678E-03	0.1000E-04
0.3339E-02	0.5016E-04	0.3339E-02	0.5000E-04
0.6678E-02	0.1003E-03	0.6678E-02	0.1000E-03
0.3339E+00	0.5016E-02	0.3339E+00	0.5000E-02
0.5008E+00	0.7524E-02	0.5008E+00	0.7500E-02
0.6678E+00	0.1003E-01	0.6678E+00	0.1000E-01
0.1669E+01	0.2508E-01	0.1669E+01	0.2500E-01
0.3339E+01	0.5016E-01	0.3339E+01	0.5000E-01
0.5008E+01	0.7524E-01	0.5008E+01	0.7500E-01
0.6678E+01	0.1003E+00	0.6678E+01	0.1000E+00
0.1669E+02	0.2508E+00	0.1669E+02	0.2500E+00
0.2794E+02	0.5013E+00	0.2794E+02	0.5000E+00
0.3408E+02	0.7216E+00	0.3408E+02	0.7200E+00
0.5264E+02	0.1802E+01	0.5264E+02	0.1800E+01
0.5903E+02	0.3603E+01	0.5903E+02	0.3600E+01

RESULT FROM UPPER-BOUND LINE

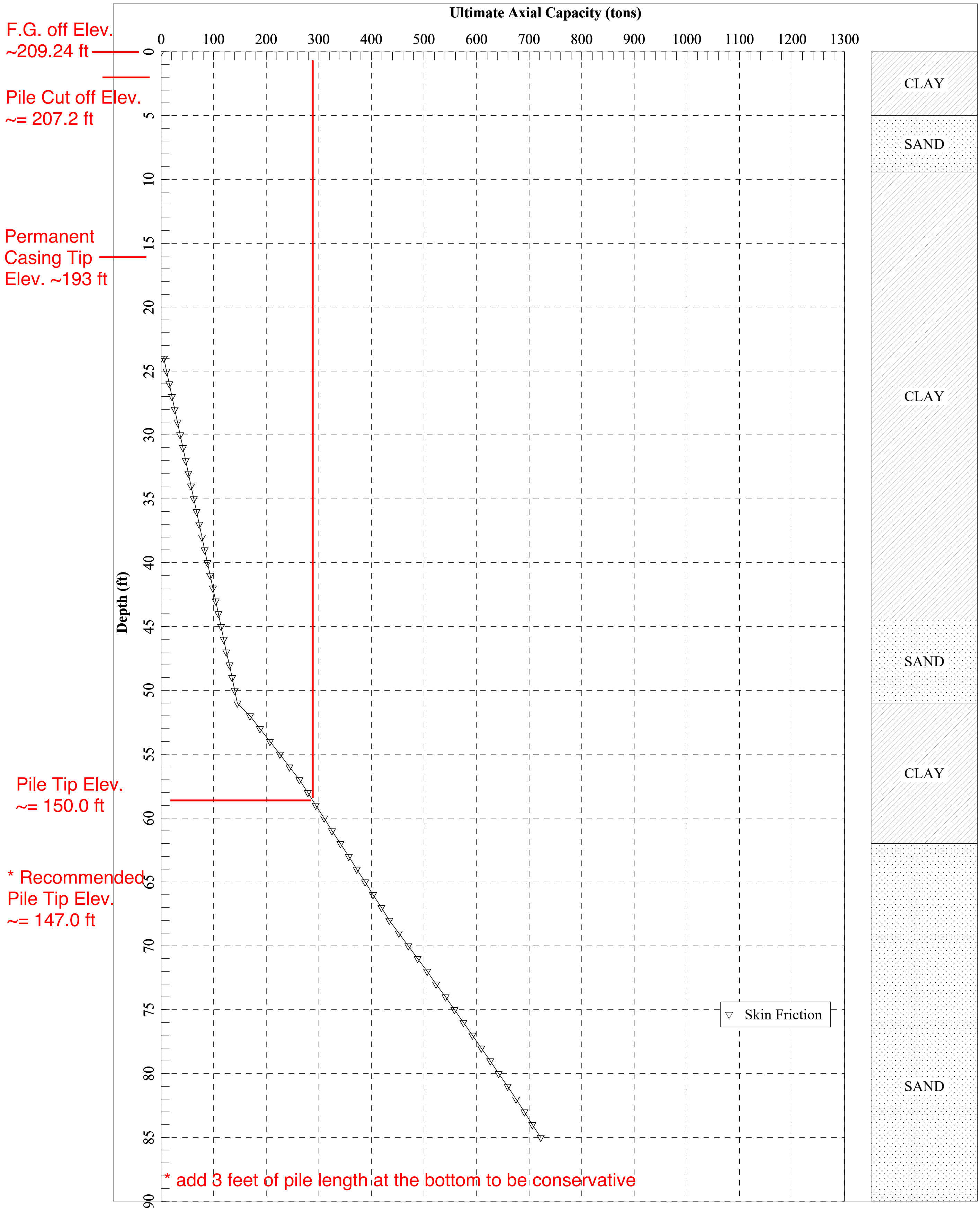
TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.9974E-03	0.1005E-04	0.9974E-03	0.1000E-04
0.4987E-02	0.5024E-04	0.4987E-02	0.5000E-04
0.9974E-02	0.1005E-03	0.9974E-02	0.1000E-03
0.4987E+00	0.5024E-02	0.4987E+00	0.5000E-02
0.7481E+00	0.7535E-02	0.7481E+00	0.7500E-02
0.9974E+00	0.1005E-01	0.9974E+00	0.1000E-01
0.2494E+01	0.2512E-01	0.2494E+01	0.2500E-01
0.4987E+01	0.5024E-01	0.4987E+01	0.5000E-01
0.7481E+01	0.7535E-01	0.7481E+01	0.7500E-01
0.9974E+01	0.1005E+00	0.9974E+01	0.1000E+00
0.2494E+02	0.2512E+00	0.2494E+02	0.2500E+00
0.3969E+02	0.5019E+00	0.3969E+02	0.5000E+00

0.4564E+02	0.7222E+00	0.4564E+02	0.7200E+00
0.5842E+02	0.1803E+01	0.5842E+02	0.1800E+01
0.6055E+02	0.3603E+01	0.6055E+02	0.3600E+01

RESULT FROM LOWER-BOUND LINE

TOP LOAD	TOP MOVEMENT	TIP LOAD	TIP MOVEMENT
ton	IN.	ton	IN.
0.3381E-03	0.1002E-04	0.3381E-03	0.1000E-04
0.1691E-02	0.5008E-04	0.1691E-02	0.5000E-04
0.3381E-02	0.1002E-03	0.3381E-02	0.1000E-03
0.1691E+00	0.5008E-02	0.1691E+00	0.5000E-02
0.2536E+00	0.7512E-02	0.2536E+00	0.7500E-02
0.3381E+00	0.1002E-01	0.3381E+00	0.1000E-01
0.8453E+00	0.2504E-01	0.8453E+00	0.2500E-01
0.1691E+01	0.5008E-01	0.1691E+01	0.5000E-01
0.2536E+01	0.7512E-01	0.2536E+01	0.7500E-01
0.3381E+01	0.1002E+00	0.3381E+01	0.1000E+00
0.8453E+01	0.2504E+00	0.8453E+01	0.2500E+00
0.1620E+02	0.5008E+00	0.1620E+02	0.5000E+00
0.2252E+02	0.7211E+00	0.2252E+02	0.7200E+00
0.4686E+02	0.1802E+01	0.4686E+02	0.1800E+01
0.5721E+02	0.3603E+01	0.5721E+02	0.3600E+01

Vertical loading = 405 kips / 0.7 / 2 ~= 290 tons



Bent 3_72" Diameter Type-II CIDH_Strength Limit State

```
=========================================================================

          SHAFT for Windows, Version 2012.7.17

            Serial Number :  291911540

        VERTICALLY LOADED DRILLED SHAFT ANALYSIS
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Path to file locations      : T:\Ongoing Projects\2016\2016-146-NOC NB101
On-Ramp POC\Calculations\SHAFT Analysis\2019-02\
Name of input data file     : Bent 3_Strength Limit State.sfd
Name of output file         : Bent 3_Strength Limit State.sfo
Name of plot output file    : Bent 3_Strength Limit State.sfp
Name of runtime file        : Bent 3_Strength Limit State.sfr


-------------------------------------------------------------------------
                     Time and Date of Analysis
-------------------------------------------------------------------------

          Date:  February 19, 2019     Time:  14:16:54

New Pile


PROPOSED DEPTH =      85.0 FT
----------------


NUMBER OF LAYERS =    6
------------------


WATER TABLE DEPTH =      11.0 FT.
-------------------



FACTOR OF SAFETY APPLIED TO THE ULTIMATE SIDE FRICTION CAPACITY = 2.50
-------------------------------------------------------
FACTOR OF SAFETY APPLIED TO THE ULTIMATE BASE CAPACITY = 3.00
------------------------------------------------------
```



```
SOIL INFORMATION
---------------

LAYER NO 1----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                  = 0.550E+00
  END BEARING COEFFICIENT-Nc                       = 0.600E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.100E+04
  INTERNAL FRICTION ANGLE, DEG.                    = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                       = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.000E+00


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                  = 0.550E+00
  END BEARING COEFFICIENT-Nc                       = 0.700E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.100E+04
  INTERNAL FRICTION ANGLE, DEG.                    = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                       = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.500E+01


LAYER NO 2----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                  = 0.120E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                    = 0.320E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                       = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.500E+01


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                  = 0.108E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                    = 0.320E+02
```

```
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.950E+01


LAYER NO 3----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.790E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.100E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.950E+01


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.100E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.445E+02


LAYER NO 4----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                   = 0.599E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.330E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.445E+02


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                   = 0.536E+00
```



```
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.330E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.510E+02


LAYER NO 5----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.300E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.510E+02


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.300E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.620E+02


LAYER NO 6----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                   = 0.437E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.380E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.620E+02


  AT THE BOTTOM
```

SKIN FRICTION COEFFICIENT- BETA = 0.250E+00
UNDRAINED SHEAR STRENGTH, LB/SQ FT = 0.000E+00
INTERNAL FRICTION ANGLE, DEG. = 0.380E+02
BLOWS PER FOOT FROM STANDARD PENETRATION TEST = 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT = 0.125E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT = 0.100E+11
DEPTH, FT = 0.100E+03

DRILLED SHAFT INFORMATION

DIAMETER OF STEM = 6.000 FT.
DIAMETER OF BASE = 6.000 FT.
END OF STEM TO BASE = 0.000 FT.
ANGLE OF BELL = 0.000 DEG.
IGNORED TOP PORTION = 16.500 FT.
IGNORED BOTTOM PORTION = 6.000 FT.
AREA OF ONE PERCENT STEEL = 40.720 SQ.IN.
ELASTIC MODULUS, Ec = 0.300E+07 LB/SQ IN
VOLUME OF UNDERREAM = 0.000 CU.YDS.

PREDICTED RESULTS

QS = ULTIMATE SIDE RESISTANCE;
QB = ULTIMATE BASE RESISTANCE;
WT = WEIGHT OF DRILLED SHAFT (FOR UPLIFT CAPACITY ONLY);
QU = TOTAL ULTIMATE RESISTANCE;
QBD = TOTAL ALLOWABLE LOAD USING A FACTOR OF SAFETY APPLIED TO THE ULTIMATE BASE RESISTANCE;
QDN = TOTAL ALLOWABLE LOAD USING FACTORS OF SAFETY APPLIED TO THE ULTIMATE SIDE RESISTANCE AND THE ULTIMATE BASE RESISTANCE.

LENGTH (FEET)	VOLUME (CU.YDS)	QS (TONS)	QB (TONS)	QU (TONS)	QBD (TONS)	QDN (TONS)	QU/VOLUME (TONS/CU.YDS)
23.0	24.09	7.78	122.12	129.90	28.13	23.46	51.59
24.0	25.14	5.18	121.25	126.43	45.60	42.49	5.03
25.0	26.18	10.37	121.69	132.05	50.93	44.71	5.04
26.0	27.23	15.55	122.12	137.68	56.26	46.93	5.06
27.0	28.28	20.74	122.56	143.30	61.59	49.15	5.07

28.0	29.33	25.92	123.00	148.92	66.92	51.37	5.08
29.0	30.37	31.11	123.44	154.54	72.25	53.59	5.09
30.0	31.42	36.29	123.88	160.17	77.58	55.81	5.10
31.0	32.47	41.47	124.31	165.79	82.91	58.03	5.11
32.0	33.51	46.66	124.75	171.41	88.24	60.25	5.11
33.0	34.56	51.84	125.19	177.03	93.57	62.47	5.12
34.0	35.61	57.03	124.97	182.00	98.68	64.47	5.11
35.0	36.66	62.21	124.90	187.11	103.85	66.52	5.10
36.0	37.70	67.40	125.00	192.40	109.06	68.63	5.10
37.0	38.75	72.58	125.29	197.87	114.34	70.80	5.11
38.0	39.80	77.76	125.78	203.55	119.69	73.03	5.11
39.0	40.85	82.95	126.49	209.44	125.11	75.34	5.13
40.0	41.89	88.13	150.77	238.90	138.39	85.51	5.70
41.0	42.94	93.32	176.97	270.29	152.31	96.32	6.29
42.0	43.99	98.50	205.03	303.53	166.85	107.74	6.90
43.0	45.04	103.69	234.88	338.57	181.98	119.77	7.52
44.0	46.08	108.87	266.45	375.32	197.69	132.37	8.14
45.0	47.13	114.05	299.68	413.73	213.95	145.51	8.78
46.0	48.18	119.24	327.23	446.47	228.31	156.77	9.27
47.0	49.22	124.42	349.15	473.57	240.81	166.15	9.62
48.0	50.27	129.61	365.51	495.12	251.44	173.68	9.85
49.0	51.32	134.79	376.36	511.15	260.24	179.37	9.96
50.0	52.37	139.98	381.75	521.73	267.23	183.24	9.96
51.0	53.41	145.16	393.15	538.31	276.21	189.11	10.08
52.0	54.46	169.13	405.42	574.55	304.27	202.79	10.55
53.0	55.51	187.93	418.57	606.50	327.45	214.69	10.93
54.0	56.56	206.75	432.59	639.34	350.94	226.90	11.30
55.0	57.60	225.57	447.50	673.06	374.73	239.39	11.68
56.0	58.65	244.38	463.27	707.66	398.81	252.18	12.07
57.0	59.70	263.19	476.42	739.61	421.99	264.08	12.39
58.0	60.75	278.74	486.94	765.68	441.05	273.81	12.60
59.0	61.79	294.29	494.83	789.12	459.24	282.66	12.77
60.0	62.84	309.85	500.09	809.94	476.54	290.64	12.89
61.0	63.89	325.40	502.72	828.12	492.97	297.73	12.96
62.0	64.93	340.95	502.72	843.67	508.52	303.95	12.99
63.0	65.98	356.50	502.72	859.22	524.08	310.18	13.02
64.0	67.03	372.06	502.72	874.78	539.63	316.40	13.05
65.0	68.08	387.61	502.72	890.33	555.18	322.62	13.08
66.0	69.12	403.16	502.72	905.88	570.74	328.84	13.11
67.0	70.17	418.72	502.72	921.44	586.29	335.06	13.13
68.0	71.22	434.27	502.72	936.99	601.84	341.28	13.16
69.0	72.27	452.34	502.72	955.06	619.91	348.51	13.22
70.0	73.31	470.30	502.72	973.02	637.87	355.69	13.27
71.0	74.36	488.14	502.72	990.86	655.71	362.83	13.33
72.0	75.41	505.86	502.72	1008.58	673.43	369.92	13.37
73.0	76.46	523.45	502.72	1026.17	691.02	376.95	13.42
74.0	77.50	540.90	502.72	1043.62	708.47	383.93	13.47
75.0	78.55	558.21	502.72	1060.93	725.78	390.86	13.51

76.0	79.60	575.36	502.72	1078.08	742.94	397.72	13.54
77.0	80.64	592.36	502.72	1095.08	759.93	404.52	13.58
78.0	81.69	609.19	502.72	1111.91	776.76	411.25	13.61
79.0	82.74	625.85	502.72	1128.57	793.42	417.91	13.64
80.0	83.79	642.33	502.72	1145.05	809.90	424.51	13.67
81.0	84.83	658.63	502.72	1161.35	826.20	431.02	13.69
82.0	85.88	674.73	502.72	1177.45	842.30	437.47	13.71
83.0	86.93	690.64	502.72	1193.36	858.21	443.83	13.73
84.0	87.98	706.34	502.72	1209.06	873.91	450.11	13.74
85.0	89.02	721.82	502.72	1224.54	889.40	456.30	13.76

RESULT FROM TREND (AVERAGED) LINE

TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.4915E-01	0.1554E-04	0.2444E-02	0.1000E-04
0.2458E+00	0.7771E-04	0.1222E-01	0.5000E-04
0.4915E+00	0.1554E-03	0.2444E-01	0.1000E-03
0.2458E+02	0.7771E-02	0.1222E+01	0.5000E-02
0.3687E+02	0.1166E-01	0.1833E+01	0.7500E-02
0.4915E+02	0.1554E-01	0.2444E+01	0.1000E-01
0.1231E+03	0.3887E-01	0.6109E+01	0.2500E-01
0.2464E+03	0.7776E-01	0.1222E+02	0.5000E-01
0.3462E+03	0.1147E+00	0.1833E+02	0.7500E-01
0.4146E+03	0.1481E+00	0.2444E+02	0.1000E+00
0.6736E+03	0.3312E+00	0.6109E+02	0.2500E+00
0.8177E+03	0.6024E+00	0.1212E+03	0.5000E+00
0.8755E+03	0.8322E+00	0.1734E+03	0.7200E+00
0.9901E+03	0.1934E+01	0.3217E+03	0.1800E+01
0.1177E+04	0.3765E+01	0.5103E+03	0.3600E+01

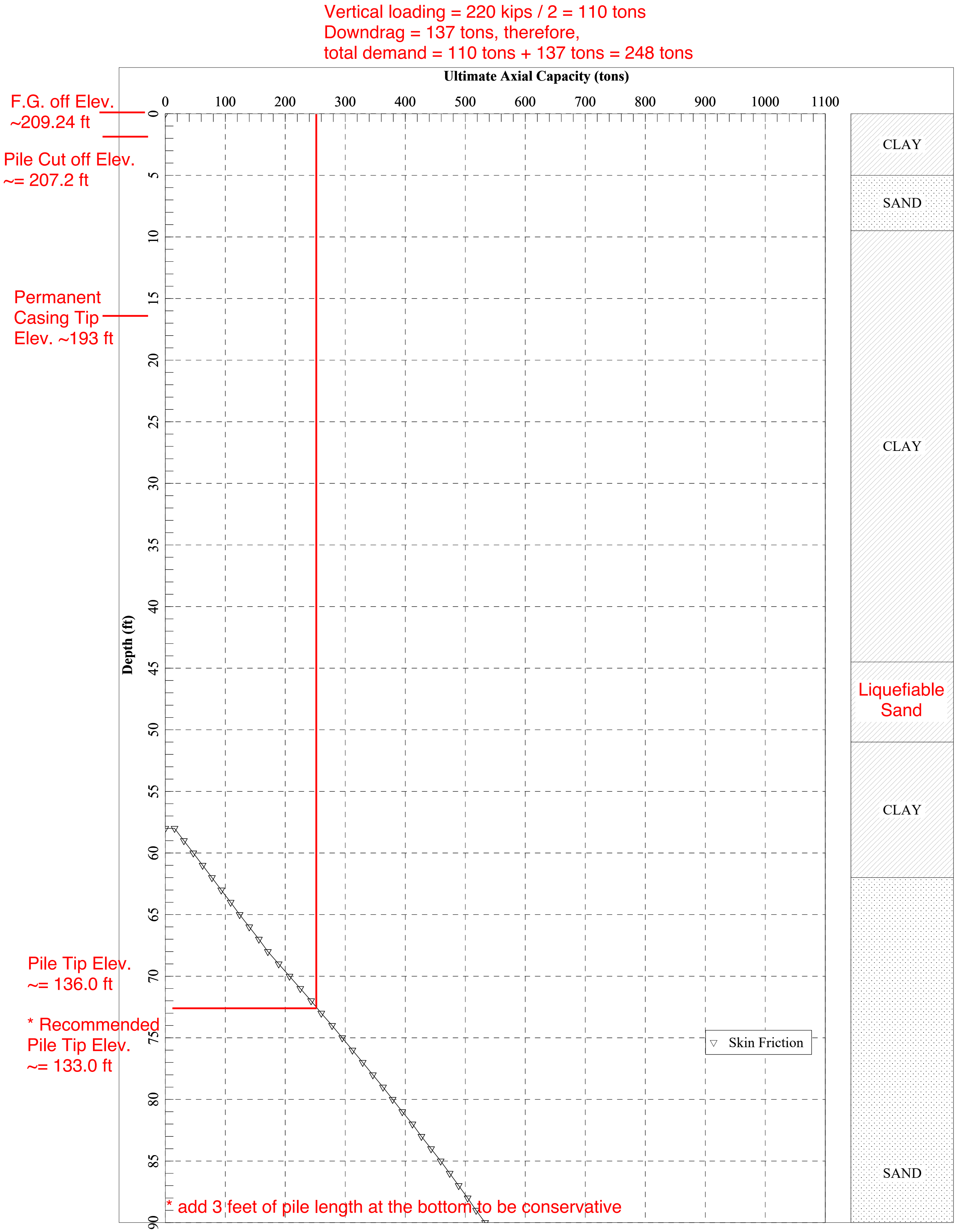
RESULT FROM UPPER-BOUND LINE

TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.7149E-01	0.1792E-04	0.3491E-02	0.1000E-04
0.3575E+00	0.8958E-04	0.1746E-01	0.5000E-04
0.7149E+00	0.1792E-03	0.3491E-01	0.1000E-03
0.3575E+02	0.8958E-02	0.1746E+01	0.5000E-02
0.5362E+02	0.1344E-01	0.2618E+01	0.7500E-02
0.7149E+02	0.1792E-01	0.3491E+01	0.1000E-01
0.1793E+03	0.4483E-01	0.8728E+01	0.2500E-01
0.3580E+03	0.8967E-01	0.1746E+02	0.5000E-01
0.4826E+03	0.1301E+00	0.2618E+02	0.7500E-01

0.5598E+03	0.1650E+00	0.3491E+02	0.1000E+00
0.7924E+03	0.3473E+00	0.8728E+02	0.2500E+00
0.9180E+03	0.6167E+00	0.1706E+03	0.5000E+00
0.9842E+03	0.8481E+00	0.2413E+03	0.7200E+00
0.1096E+04	0.1949E+01	0.3821E+03	0.1800E+01
0.1257E+04	0.3776E+01	0.5429E+03	0.3600E+01

RESULT FROM LOWER-BOUND LINE

TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.2876E-01	0.1332E-04	0.1396E-02	0.1000E-04
0.1438E+00	0.6661E-04	0.6982E-02	0.5000E-04
0.2876E+00	0.1332E-03	0.1396E-01	0.1000E-03
0.1438E+02	0.6661E-02	0.6982E+00	0.5000E-02
0.2157E+02	0.9991E-02	0.1047E+01	0.7500E-02
0.2876E+02	0.1332E-01	0.1396E+01	0.1000E-01
0.7189E+02	0.3330E-01	0.3491E+01	0.2500E-01
0.1440E+03	0.6662E-01	0.6982E+01	0.5000E-01
0.2121E+03	0.9958E-01	0.1047E+02	0.7500E-01
0.2703E+03	0.1314E+00	0.1396E+02	0.1000E+00
0.5269E+03	0.3124E+00	0.3491E+02	0.2500E+00
0.7168E+03	0.5880E+00	0.7178E+02	0.5000E+00
0.7668E+03	0.8163E+00	0.1056E+03	0.7200E+00
0.8846E+03	0.1919E+01	0.2614E+03	0.1800E+01
0.1098E+04	0.3755E+01	0.4776E+03	0.3600E+01



Bent 3_72" Diameter Type-II CIDH_Extreme Event Limit State

Downdrag Forces on Circular Piles

Project No	2016-146-NOC
Project	NB 101 ON-RAMP POC
Location	Bent 3 -1 rows
Boring	R-18-NO-002
Single Pile Dia. (ft)	6
GW Depth (ft)	11
Bulk Unit Weight (pcf)	125
Pile Length (ft)	100
# of Equiv. Pile Circumference	1

FG Elev.	209.24
Pile Cut-off.	207.2

Analysis By:	EO
Date:	2/19/2019

Layer Number	Layer Thickness (ft)	Soil Type	Beta	Consider downdrag (y/n)	Total Depth (ft)	Layer Mid-Point Depth (ft)	Effective Stress (psf)	Contributing Thickness (ft)	Unit Negative Friction (ft)	Downdrag Force per Section (ton)	Total Downdrag Force (ton)	Remarks
1a	2.00	CL	0.20	n	2.00	1.00	125	2.0	25	0.0		Above Cut-off
1b	3.00	CL	0.20	n	5.00	3.50	438	3.0	88	0.0		
2	4.50	SM	0.30	n	9.50	7.25	906	4.5	272	0.0		Permanent Casing
3a	7.00	CL	0.20	n	16.50	13.00	1500	7.0	300	0.0		
3b	28.00	CL	0.20	y	44.50	30.50	2596	28.0	519	137.0	137.0	Downdrag Contributing
4	6.50	SM	0.30	n	51.00	19.75	1923	6.5	577	0.0		Liquefied
5	11.00	CL	0.20	n	62.00	56.50	4223	11.0	845	0.0		Below Liquefied
6	28.50	SM	0.30	n	90.50	76.25	5460	28.5	1638	0.0		

Notes Area

Downdrag for the CIDH pile is ~137 tons

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=========================================================================

                 SHAFT for Windows, Version 2012.7.17

                  Serial Number :  291911540

               VERTICALLY LOADED DRILLED SHAFT ANALYSIS
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Path to file locations      : T:\Ongoing Projects\2016\2016-146-NOC NB101
On-Ramp POC\Calculations\SHAFT Analysis\2019-02\
Name of input data file     : Bent 3_Extreme Limit State.sfd
Name of output file         : Bent 3_Extreme Limit State.sfo
Name of plot output file    : Bent 3_Extreme Limit State.sfp
Name of runtime file        : Bent 3_Extreme Limit State.sfr


-------------------------------------------------------------------------
                    Time and Date of Analysis
-------------------------------------------------------------------------

          Date:  February 19, 2019     Time:  14:28:23

New Pile


PROPOSED DEPTH =      90.0 FT
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NUMBER OF LAYERS =    6
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WATER TABLE DEPTH =      11.0 FT.
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FACTOR OF SAFETY APPLIED TO THE ULTIMATE SIDE FRICTION CAPACITY = 2.50
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FACTOR OF SAFETY APPLIED TO THE ULTIMATE BASE CAPACITY = 3.00
------------------------------------------------------
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SOIL INFORMATION
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LAYER NO 1----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
  END BEARING COEFFICIENT-Nc                         = 0.600E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.100E+04
  INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.000E+00


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
  END BEARING COEFFICIENT-Nc                         = 0.700E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.100E+04
  INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.500E+01


LAYER NO 2----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                    = 0.120E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.320E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.500E+01


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                    = 0.108E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.320E+02
```

```
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.950E+01


LAYER NO 3----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.790E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.100E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.950E+01


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.100E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.445E+02


LAYER NO 4----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.100E-02
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.445E+02


  AT THE BOTTOM
```



```
  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.100E-02
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.510E+02


LAYER NO 5----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.300E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.510E+02


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.300E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.620E+02


LAYER NO 6----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                   = 0.437E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.380E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.620E+02
```

AT THE BOTTOM

SKIN FRICTION COEFFICIENT- BETA	=	0.250E+00
UNDRAINED SHEAR STRENGTH, LB/SQ FT	=	0.000E+00
INTERNAL FRICTION ANGLE, DEG.	=	0.380E+02
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	=	0.000E+00
SOIL UNIT WEIGHT, LB/CU FT	=	0.125E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	=	0.100E+11
DEPTH, FT	=	0.110E+03

DRILLED SHAFT INFORMATION

DIAMETER OF STEM	=	6.000	FT.
DIAMETER OF BASE	=	6.000	FT.
END OF STEM TO BASE	=	0.000	FT.
ANGLE OF BELL	=	0.000	DEG.
IGNORED TOP PORTION	=	51.000	FT.
IGNORED BOTTOM PORTION	=	6.000	FT.
AREA OF ONE PERCENT STEEL	=	40.720	SQ.IN.
ELASTIC MODULUS, Ec	=	0.300E+07	LB/SQ IN
VOLUME OF UNDERREAM	=	0.000	CU.YDS.

PREDICTED RESULTS

QS = ULTIMATE SIDE RESISTANCE;
QB = ULTIMATE BASE RESISTANCE;
WT = WEIGHT OF DRILLED SHAFT (FOR UPLIFT CAPACITY ONLY);
QU = TOTAL ULTIMATE RESISTANCE;
QBD = TOTAL ALLOWABLE LOAD USING A FACTOR OF SAFETY APPLIED TO THE ULTIMATE BASE RESISTANCE;
QDN = TOTAL ALLOWABLE LOAD USING FACTORS OF SAFETY APPLIED TO THE ULTIMATE SIDE RESISTANCE AND THE ULTIMATE BASE RESISTANCE.

LENGTH (FEET)	VOLUME (CU.YDS)	QS (TONS)	QB (TONS)	QU (TONS)	QBD (TONS)	QDN (TONS)	QU/VOLUME (TONS/CU.YDS)
58.0	60.75	15.55	486.94	502.49	177.87	168.54	8.27
59.0	61.79	31.11	494.83	525.94	196.05	177.39	8.51
60.0	62.84	46.66	500.09	546.75	213.36	185.36	8.70

61.0	63.89	62.21	502.72	564.93	229.78	192.46	8.84
62.0	64.93	77.76	502.72	580.48	245.34	198.68	8.94
63.0	65.98	93.32	502.72	596.04	260.89	204.90	9.03
64.0	67.03	108.87	502.72	611.59	276.44	211.12	9.12
65.0	68.08	124.42	502.72	627.14	292.00	217.34	9.21
66.0	69.12	139.98	502.72	642.70	307.55	223.56	9.30
67.0	70.17	155.53	502.72	658.25	323.10	229.78	9.38
68.0	71.22	171.08	502.72	673.80	338.66	236.01	9.46
69.0	72.27	189.15	502.72	691.87	356.72	243.23	9.57
70.0	73.31	207.11	502.72	709.83	374.68	250.42	9.68
71.0	74.36	224.95	502.72	727.67	392.53	257.55	9.79
72.0	75.41	242.67	502.72	745.39	410.25	264.64	9.88
73.0	76.46	260.26	502.72	762.98	427.84	271.68	9.98
74.0	77.50	277.71	502.72	780.43	445.29	278.66	10.07
75.0	78.55	295.02	502.72	797.74	462.59	285.58	10.16
76.0	79.60	312.18	502.72	814.90	479.75	292.44	10.24
77.0	80.64	329.17	502.72	831.89	496.75	299.24	10.32
78.0	81.69	346.00	502.72	848.72	513.58	305.97	10.39
79.0	82.74	362.66	502.72	865.38	530.24	312.64	10.46
80.0	83.79	379.14	502.72	881.86	546.72	319.23	10.53
81.0	84.83	395.44	502.72	898.16	563.01	325.75	10.59
82.0	85.88	411.54	502.72	914.26	579.12	332.19	10.65
83.0	86.93	427.45	502.72	930.17	595.02	338.55	10.70
84.0	87.98	443.15	502.72	945.87	610.72	344.83	10.75
85.0	89.02	458.64	502.72	961.36	626.21	351.03	10.80
86.0	90.07	473.91	502.72	976.63	641.48	357.14	10.84
87.0	91.12	488.95	502.72	991.67	656.53	363.15	10.88
88.0	92.17	503.77	502.72	1006.49	671.34	369.08	10.92
89.0	93.21	518.35	502.72	1021.07	685.92	374.91	10.95
90.0	94.26	532.68	502.72	1035.40	700.25	380.65	10.98

RESULT FROM TREND (AVERAGED) LINE

TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.3615E-01	0.1500E-04	0.2444E-02	0.1000E-04
0.1808E+00	0.7502E-04	0.1222E-01	0.5000E-04
0.3615E+00	0.1500E-03	0.2444E-01	0.1000E-03
0.1808E+02	0.7502E-02	0.1222E+01	0.5000E-02
0.2712E+02	0.1125E-01	0.1833E+01	0.7500E-02
0.3615E+02	0.1500E-01	0.2444E+01	0.1000E-01
0.9072E+02	0.3755E-01	0.6109E+01	0.2500E-01
0.1815E+03	0.7511E-01	0.1222E+02	0.5000E-01
0.2625E+03	0.1115E+00	0.1833E+02	0.7500E-01
0.3199E+03	0.1448E+00	0.2444E+02	0.1000E+00
0.5456E+03	0.3278E+00	0.6109E+02	0.2500E+00

0.6894E+03	0.6007E+00	0.1212E+03	0.5000E+00
0.7513E+03	0.8315E+00	0.1734E+03	0.7200E+00
0.8832E+03	0.1936E+01	0.3217E+03	0.1800E+01
0.1070E+04	0.3769E+01	0.5103E+03	0.3600E+01

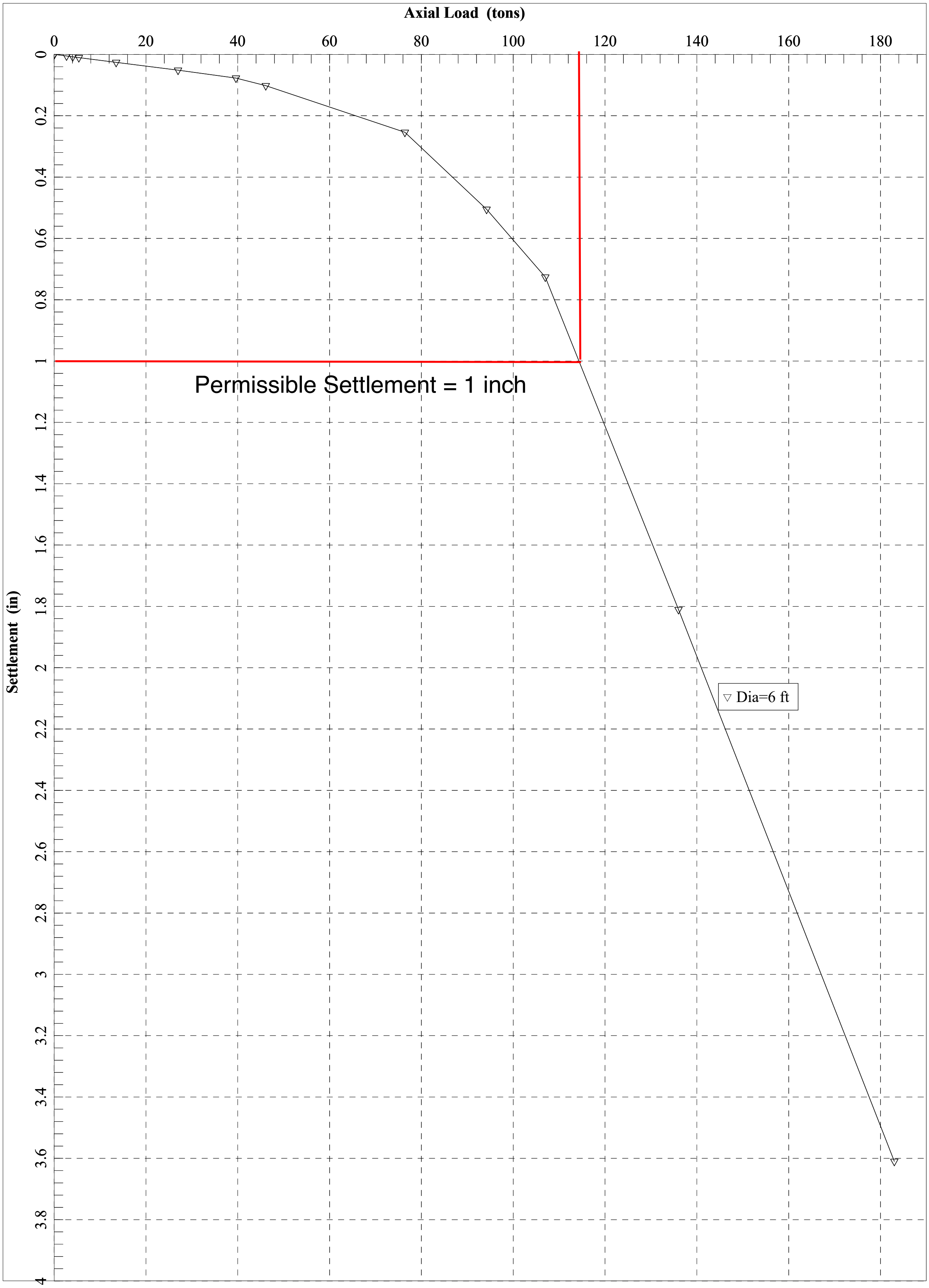
RESULT FROM UPPER-BOUND LINE

TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.5092E-01	0.1700E-04	0.3491E-02	0.1000E-04
0.2546E+00	0.8502E-04	0.1746E-01	0.5000E-04
0.5092E+00	0.1700E-03	0.3491E-01	0.1000E-03
0.2546E+02	0.8502E-02	0.1746E+01	0.5000E-02
0.3819E+02	0.1275E-01	0.2618E+01	0.7500E-02
0.5106E+02	0.1702E-01	0.3491E+01	0.1000E-01
0.1280E+03	0.4259E-01	0.8728E+01	0.2500E-01
0.2561E+03	0.8521E-01	0.1746E+02	0.5000E-01
0.3627E+03	0.1253E+00	0.2618E+02	0.7500E-01
0.4315E+03	0.1604E+00	0.3491E+02	0.1000E+00
0.6572E+03	0.3448E+00	0.8728E+02	0.2500E+00
0.7807E+03	0.6153E+00	0.1706E+03	0.5000E+00
0.8494E+03	0.8476E+00	0.2413E+03	0.7200E+00
0.9757E+03	0.1951E+01	0.3821E+03	0.1800E+01
0.1137E+04	0.3779E+01	0.5429E+03	0.3600E+01

RESULT FROM LOWER-BOUND LINE

TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.2210E-01	0.1308E-04	0.1396E-02	0.1000E-04
0.1105E+00	0.6542E-04	0.6982E-02	0.5000E-04
0.2210E+00	0.1308E-03	0.1396E-01	0.1000E-03
0.1105E+02	0.6542E-02	0.6982E+00	0.5000E-02
0.1657E+02	0.9813E-02	0.1047E+01	0.7500E-02
0.2210E+02	0.1308E-01	0.1396E+01	0.1000E-01
0.5532E+02	0.3272E-01	0.3491E+01	0.2500E-01
0.1107E+03	0.6545E-01	0.6982E+01	0.5000E-01
0.1641E+03	0.9792E-01	0.1047E+02	0.7500E-01
0.2094E+03	0.1293E+00	0.1396E+02	0.1000E+00
0.4191E+03	0.3091E+00	0.3491E+02	0.2500E+00
0.5976E+03	0.5860E+00	0.7178E+02	0.5000E+00
0.6532E+03	0.8154E+00	0.1056E+03	0.7200E+00
0.7907E+03	0.1921E+01	0.2614E+03	0.1800E+01
0.1004E+04	0.3759E+01	0.4776E+03	0.3600E+01

Settlement Graph Generated with Pile Tip at Elev. 177.0'
Permanent Load = 220 kips =110 tons



Bent 3_72" Diameter Type-II CIDH_Service Limit State_Settlement vs Axial Load

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=========================================================================

                  SHAFT for Windows, Version 2012.7.17

                   Serial Number :  291911540

                VERTICALLY LOADED DRILLED SHAFT ANALYSIS
                   (c) Copyright ENSOFT, Inc., 1987-2012
                         All Rights Reserved

=========================================================================


     Path to file locations      : T:\Ongoing Projects\2016\2016-146-NOC NB101
On-Ramp POC\Calculations\SHAFT Analysis\2019-02\
     Name of input data file     : Bent 3_Service Limit State.sfd
     Name of output file         : Bent 3_Service Limit State.sfo
     Name of plot output file    : Bent 3_Service Limit State.sfp
     Name of runtime file        : Bent 3_Service Limit State.sfr


-------------------------------------------------------------------------
                     Time and Date of Analysis
-------------------------------------------------------------------------

          Date:  February 19, 2019     Time:  14:41:09

     New Pile


     PROPOSED DEPTH =      32.0 FT
     ----------------


     NUMBER OF LAYERS =    6
     ------------------


     WATER TABLE DEPTH =      11.0 FT.
     -------------------



     FACTOR OF SAFETY APPLIED TO THE ULTIMATE SIDE FRICTION CAPACITY = 2.50
     -------------------------------------------------------
     FACTOR OF SAFETY APPLIED TO THE ULTIMATE BASE CAPACITY = 3.00
     ------------------------------------------------------
```



```
SOIL INFORMATION
---------------

LAYER NO 1----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                  = 0.550E+00
  END BEARING COEFFICIENT-Nc                       = 0.600E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.100E+04
  INTERNAL FRICTION ANGLE, DEG.                    = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                       = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.000E+00


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                  = 0.550E+00
  END BEARING COEFFICIENT-Nc                       = 0.700E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.100E+04
  INTERNAL FRICTION ANGLE, DEG.                    = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                       = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.500E+01


LAYER NO 2----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                  = 0.120E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                    = 0.320E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                       = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.500E+01


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                  = 0.108E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                    = 0.320E+02
```

```
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.950E+01


LAYER NO 3----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.790E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.100E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.950E+01


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.100E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.445E+02


LAYER NO 4----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                   = 0.599E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.330E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.445E+02


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                   = 0.536E+00
```



```
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.330E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.510E+02


LAYER NO 5----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.300E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.510E+02


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.300E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.620E+02


LAYER NO 6----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                   = 0.437E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.380E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.620E+02


  AT THE BOTTOM
```

```
SKIN FRICTION COEFFICIENT- BETA                  = 0.250E+00
UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.000E+00
INTERNAL FRICTION ANGLE, DEG.                    = 0.380E+02
BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT                       = 0.125E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
DEPTH, FT                                        = 0.100E+03
```

DRILLED SHAFT INFORMATION

```
DIAMETER OF STEM          =    6.000  FT.
DIAMETER OF BASE          =    6.000  FT.
END OF STEM TO BASE       =    0.000  FT.
ANGLE OF BELL             =    0.000  DEG.
IGNORED TOP PORTION       =   16.500  FT.
IGNORED BOTTOM PORTION    =    6.000  FT.
AREA OF ONE PERCENT STEEL =   40.720  SQ.IN.
ELASTIC MODULUS, Ec       = 0.300E+07 LB/SQ IN
VOLUME OF UNDERREAM       =    0.000  CU.YDS.
```

PREDICTED RESULTS

```
QS     = ULTIMATE SIDE RESISTANCE;
QB     = ULTIMATE BASE RESISTANCE;
WT     = WEIGHT OF DRILLED SHAFT (FOR UPLIFT CAPACITY ONLY);
QU     = TOTAL ULTIMATE RESISTANCE;
QBD    = TOTAL ALLOWABLE LOAD USING A FACTOR OF SAFETY
         APPLIED TO THE ULTIMATE BASE RESISTANCE;
QDN    = TOTAL ALLOWABLE LOAD USING FACTORS OF SAFETY
         APPLIED TO THE ULTIMATE SIDE RESISTANCE AND
         THE ULTIMATE BASE RESISTANCE.
```

LENGTH (FEET)	VOLUME (CU.YDS)	QS (TONS)	QB (TONS)	QU (TONS)	QBD (TONS)	QDN (TONS)	QU/VOLUME (TONS/CU.YDS)
23.0	24.09	7.78	122.12	129.90	28.13	23.46	51.59
24.0	25.14	5.18	121.25	126.43	45.60	42.49	5.03
25.0	26.18	10.37	121.69	132.05	50.93	44.71	5.04
26.0	27.23	15.55	122.12	137.68	56.26	46.93	5.06
27.0	28.28	20.74	122.56	143.30	61.59	49.15	5.07

28.0	29.33	25.92	123.00	148.92	66.92	51.37	5.08
29.0	30.37	31.11	123.44	154.54	72.25	53.59	5.09
30.0	31.42	36.29	123.88	160.17	77.58	55.81	5.10
31.0	32.47	41.47	124.31	165.79	82.91	58.03	5.11
32.0	33.51	46.66	124.75	171.41	88.24	60.25	5.11

RESULT FROM TREND (AVERAGED) LINE

TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.5401E-02	0.1028E-04	0.6064E-03	0.1000E-04
0.2700E-01	0.5138E-04	0.3032E-02	0.5000E-04
0.5401E-01	0.1028E-03	0.6064E-02	0.1000E-03
0.2700E+01	0.5138E-02	0.3032E+00	0.5000E-02
0.4050E+01	0.7707E-02	0.4548E+00	0.7500E-02
0.5401E+01	0.1028E-01	0.6064E+00	0.1000E-01
0.1350E+02	0.2569E-01	0.1516E+01	0.2500E-01
0.2700E+02	0.5138E-01	0.3032E+01	0.5000E-01
0.3962E+02	0.7702E-01	0.4548E+01	0.7500E-01
0.4607E+02	0.1024E+00	0.6064E+01	0.1000E+00
0.7635E+02	0.2540E+00	0.1516E+02	0.2500E+00
0.9423E+02	0.5051E+00	0.3008E+02	0.5000E+00
0.1065E+03	0.7259E+00	0.4304E+02	0.7200E+00
0.1362E+03	0.1808E+01	0.7984E+02	0.1800E+01
0.1830E+03	0.3611E+01	0.1266E+03	0.3600E+01

RESULT FROM UPPER-BOUND LINE

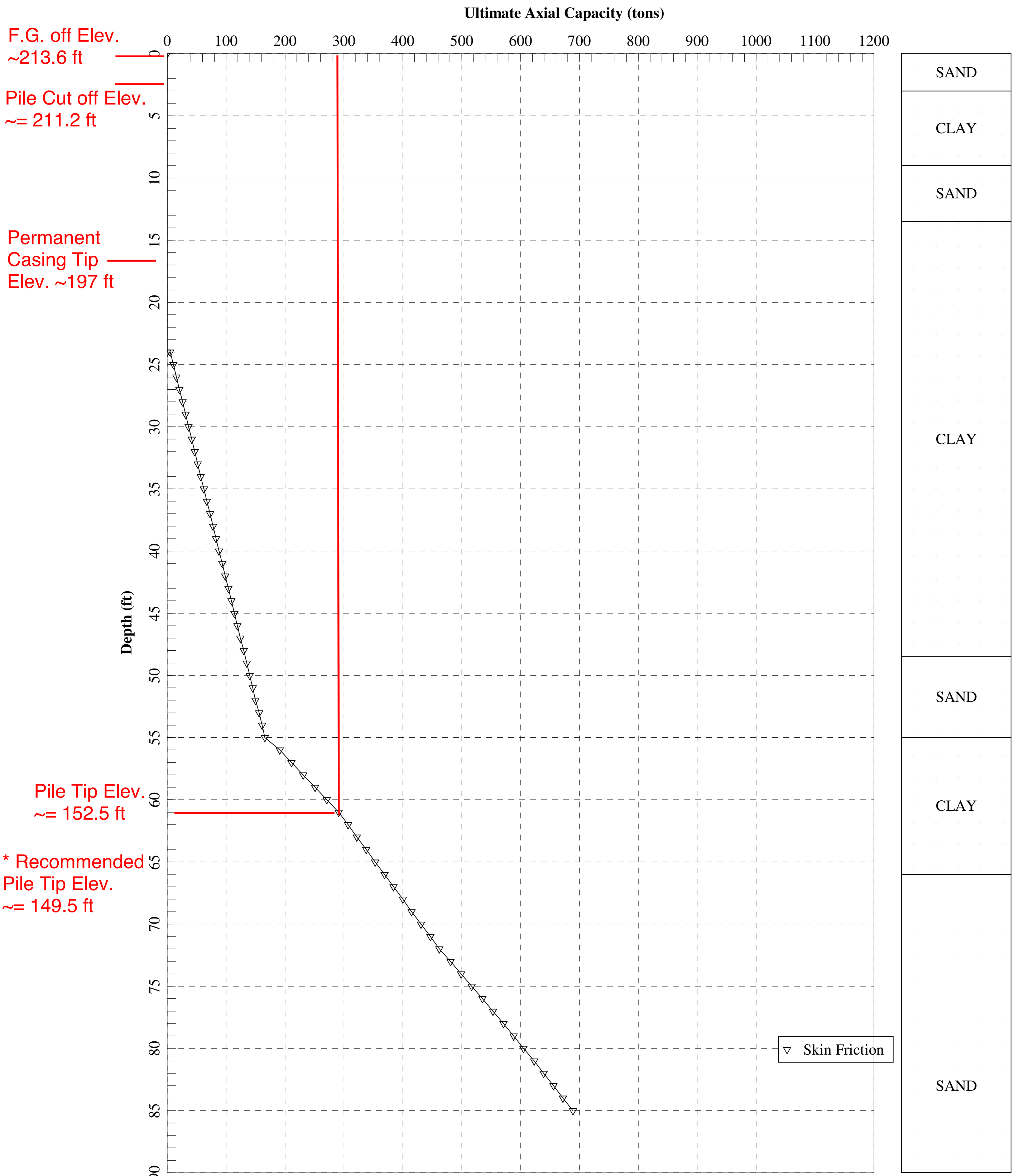
TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.7829E-02	0.1040E-04	0.8663E-03	0.1000E-04
0.3914E-01	0.5200E-04	0.4332E-02	0.5000E-04
0.7829E-01	0.1040E-03	0.8663E-02	0.1000E-03
0.3914E+01	0.5200E-02	0.4332E+00	0.5000E-02
0.5872E+01	0.7800E-02	0.6498E+00	0.7500E-02
0.7829E+01	0.1040E-01	0.8663E+00	0.1000E-01
0.1957E+02	0.2600E-01	0.2166E+01	0.2500E-01
0.3916E+02	0.5200E-01	0.4332E+01	0.5000E-01
0.5703E+02	0.7791E-01	0.6498E+01	0.7500E-01
0.6343E+02	0.1033E+00	0.8663E+01	0.1000E+00
0.8782E+02	0.2546E+00	0.2166E+02	0.2500E+00
0.1112E+03	0.5061E+00	0.4235E+02	0.5000E+00
0.1281E+03	0.7271E+00	0.5988E+02	0.7200E+00
0.1570E+03	0.1809E+01	0.9481E+02	0.1800E+01

0.1969E+03	0.3612E+01	0.1347E+03	0.3600E+01

RESULT FROM LOWER-BOUND LINE

TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.3070E-02	0.1016E-04	0.3465E-03	0.1000E-04
0.1535E-01	0.5078E-04	0.1733E-02	0.5000E-04
0.3070E-01	0.1016E-03	0.3465E-02	0.1000E-03
0.1535E+01	0.5078E-02	0.1733E+00	0.5000E-02
0.2303E+01	0.7618E-02	0.2599E+00	0.7500E-02
0.3070E+01	0.1016E-01	0.3465E+00	0.1000E-01
0.7675E+01	0.2539E-01	0.8663E+00	0.2500E-01
0.1535E+02	0.5078E-01	0.1733E+01	0.5000E-01
0.2285E+02	0.7617E-01	0.2599E+01	0.7500E-01
0.2912E+02	0.1015E+00	0.3465E+01	0.1000E+00
0.5820E+02	0.2530E+00	0.8663E+01	0.2500E+00
0.7722E+02	0.5041E+00	0.1781E+02	0.5000E+00
0.8496E+02	0.7246E+00	0.2620E+02	0.7200E+00
0.1155E+03	0.1807E+01	0.6487E+02	0.1800E+01
0.1692E+03	0.3610E+01	0.1185E+03	0.3600E+01

Vertical loading = 385 kips / 0.7 / 2 ~= 285 tons



* add 3 feet of pile length at the bottom to be conservative

Bent 4_72" Diameter Type-II CIDH_Strength Limit State

```
========================================================================

                 SHAFT for Windows, Version 2012.7.17

                  Serial Number :  291911540

               VERTICALLY LOADED DRILLED SHAFT ANALYSIS
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                      All Rights Reserved

========================================================================


     Path to file locations      : T:\Ongoing Projects\2016\2016-146-NOC NB101
On-Ramp POC\Calculations\SHAFT Analysis\2019-03\
     Name of input data file     : Bent 4_Strength Limit State.sfd
     Name of output file         : Bent 4_Strength Limit State.sfo
     Name of plot output file    : Bent 4_Strength Limit State.sfp
     Name of runtime file        : Bent 4_Strength Limit State.sfr


------------------------------------------------------------------------
                     Time and Date of Analysis
------------------------------------------------------------------------

          Date:  March 29, 2019     Time:  17:00:24

     New Pile


     PROPOSED DEPTH =      85.0 FT
     ----------------


     NUMBER OF LAYERS =    7
     ------------------


     WATER TABLE DEPTH =      15.0 FT.
     -------------------



     FACTOR OF SAFETY APPLIED TO THE ULTIMATE SIDE FRICTION CAPACITY = 2.50
     -------------------------------------------------------
     FACTOR OF SAFETY APPLIED TO THE ULTIMATE BASE CAPACITY = 3.00
     ------------------------------------------------------
```



```
SOIL INFORMATION
---------------

LAYER NO 1----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                  = 0.120E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                    = 0.350E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                       = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.000E+00


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                  = 0.120E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                    = 0.350E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                       = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.300E+01


LAYER NO 2----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                  = 0.550E+00
  END BEARING COEFFICIENT-Nc                       = 0.660E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.100E+04
  INTERNAL FRICTION ANGLE, DEG.                    = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                       = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.300E+01


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                  = 0.550E+00
  END BEARING COEFFICIENT-Nc                       = 0.780E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.100E+04
  INTERNAL FRICTION ANGLE, DEG.                    = 0.000E+00
```

```
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.900E+01


LAYER NO 3----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                   = 0.110E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.320E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.900E+01


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                   = 0.100E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.320E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.135E+02


LAYER NO 4----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.870E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.100E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.135E+02


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
```



```
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.100E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.485E+02


LAYER NO 5----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                   = 0.560E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.330E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.485E+02


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                   = 0.499E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.330E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.550E+02


LAYER NO 6----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.300E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.550E+02


  AT THE BOTTOM
```

```
  STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
  END BEARING COEFFICIENT-Nc                         = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.300E+04
  INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.660E+02


LAYER NO 7----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                    = 0.403E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.380E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.660E+02


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                    = 0.250E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.380E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.100E+03



DRILLED SHAFT INFORMATION
-------------------------

 DIAMETER OF STEM          =    6.000  FT.
 DIAMETER OF BASE          =    6.000  FT.
 END OF STEM TO BASE       =    0.000  FT.
 ANGLE OF BELL             =    0.000  DEG.
 IGNORED TOP PORTION       =   16.500  FT.
 IGNORED BOTTOM PORTION    =    6.000  FT.
 AREA OF ONE PERCENT STEEL =   40.720  SQ.IN.
 ELASTIC MODULUS, Ec       = 0.300E+07 LB/SQ IN
 VOLUME OF UNDERREAM       =    0.000  CU.YDS.
```



```
PREDICTED RESULTS
-----------------

QS     = ULTIMATE SIDE RESISTANCE;
QB     = ULTIMATE BASE RESISTANCE;
WT     = WEIGHT OF DRILLED SHAFT (FOR UPLIFT CAPACITY ONLY);
QU     = TOTAL ULTIMATE RESISTANCE;
QBD    = TOTAL ALLOWABLE LOAD USING A FACTOR OF SAFETY
         APPLIED TO THE ULTIMATE BASE RESISTANCE;
QDN    = TOTAL ALLOWABLE LOAD USING FACTORS OF SAFETY
         APPLIED TO THE ULTIMATE SIDE RESISTANCE AND
         THE ULTIMATE BASE RESISTANCE.
```

LENGTH (FEET)	VOLUME (CU.YDS)	QS (TONS)	QB (TONS)	QU (TONS)	QBD (TONS)	QDN (TONS)	QU/VOLUME (TONS/CU.YDS)
23.0	24.09	7.78	125.37	133.15	28.67	24.01	52.68
24.0	25.14	5.18	125.14	130.32	46.90	43.79	5.18
25.0	26.18	10.37	125.26	135.62	52.12	45.90	5.18
26.0	27.23	15.55	125.37	140.93	57.34	48.01	5.18
27.0	28.28	20.74	125.49	146.23	62.57	50.13	5.17
28.0	29.33	25.92	125.61	151.54	67.79	52.24	5.17
29.0	30.37	31.11	125.73	156.84	73.02	54.35	5.16
30.0	31.42	36.29	125.85	162.14	78.24	56.47	5.16
31.0	32.47	41.47	125.97	167.45	83.47	58.58	5.16
32.0	33.51	46.66	126.09	172.75	88.69	60.69	5.15
33.0	34.56	51.84	126.21	178.05	93.91	62.81	5.15
34.0	35.61	57.03	126.33	183.36	99.14	64.92	5.15
35.0	36.66	62.21	126.45	188.66	104.36	67.03	5.15
36.0	37.70	67.40	126.57	193.97	109.59	69.15	5.14
37.0	38.75	72.58	126.69	199.27	114.81	71.26	5.14
38.0	39.80	77.76	127.15	204.91	120.15	73.49	5.15
39.0	40.85	82.95	127.87	210.82	125.57	75.80	5.16
40.0	41.89	88.13	128.87	217.01	131.09	78.21	5.18
41.0	42.94	93.32	130.17	223.49	136.71	80.72	5.20
42.0	43.99	98.50	131.79	230.29	142.43	83.33	5.24
43.0	45.04	103.69	133.74	237.43	148.27	86.05	5.27
44.0	46.08	108.87	158.09	266.96	161.57	96.24	5.79
45.0	47.13	114.05	184.08	298.14	175.42	106.98	6.33
46.0	48.18	119.24	211.65	330.89	189.79	118.25	6.87
47.0	49.22	124.42	240.73	365.15	204.67	130.01	7.42
48.0	50.27	129.61	271.23	400.84	220.02	142.25	7.97
49.0	51.32	134.79	303.09	437.89	235.82	154.95	8.53
50.0	52.37	139.98	329.50	469.48	249.81	165.83	8.97
51.0	53.41	145.16	350.52	495.68	262.00	174.90	9.28

52.0	54.46	150.34	366.19	516.54	272.41	182.20	9.48
53.0	55.51	155.53	376.59	532.11	281.06	187.74	9.59
54.0	56.56	160.71	381.75	542.47	287.96	191.54	9.59
55.0	57.60	165.90	393.15	559.05	296.95	197.41	9.71
56.0	58.65	191.18	405.42	596.60	326.32	211.61	10.17
57.0	59.70	211.25	418.57	629.82	350.77	224.02	10.55
58.0	60.75	231.27	432.59	663.87	375.47	236.71	10.93
59.0	61.79	251.25	447.50	698.74	400.41	249.66	11.31
60.0	62.84	271.17	463.27	734.44	425.59	262.89	11.69
61.0	63.89	291.02	476.42	767.44	449.83	275.22	12.01
62.0	64.93	306.57	486.94	793.51	468.89	284.94	12.22
63.0	65.98	322.13	494.83	816.96	487.07	293.79	12.38
64.0	67.03	337.68	500.09	837.77	504.38	301.77	12.50
65.0	68.08	353.23	502.72	855.95	520.81	308.87	12.57
66.0	69.12	368.78	502.72	871.50	536.36	315.09	12.61
67.0	70.17	384.34	502.72	887.06	551.91	321.31	12.64
68.0	71.22	399.89	502.72	902.61	567.46	327.53	12.67
69.0	72.27	415.44	502.72	918.16	583.02	333.75	12.71
70.0	73.31	431.00	502.72	933.72	598.57	339.97	12.74
71.0	74.36	446.55	502.72	949.27	614.12	346.19	12.77
72.0	75.41	462.10	502.72	964.82	629.68	352.41	12.79
73.0	76.46	480.62	502.72	983.34	648.19	359.82	12.86
74.0	77.50	498.98	502.72	1001.70	666.55	367.17	12.92
75.0	78.55	517.18	502.72	1019.90	684.75	374.44	12.98
76.0	79.60	535.21	502.72	1037.93	702.78	381.66	13.04
77.0	80.64	553.06	502.72	1055.78	720.63	388.80	13.09
78.0	81.69	570.72	502.72	1073.44	738.29	395.86	13.14
79.0	82.74	588.20	502.72	1090.92	755.77	402.85	13.18
80.0	83.79	605.47	502.72	1108.19	773.05	409.76	13.23
81.0	84.83	622.55	502.72	1125.27	790.12	416.59	13.26
82.0	85.88	639.41	502.72	1142.13	806.99	423.34	13.30
83.0	86.93	656.06	502.72	1158.78	823.63	430.00	13.33
84.0	87.98	672.48	502.72	1175.20	840.06	436.57	13.36
85.0	89.02	688.68	502.72	1191.40	856.25	443.04	13.38

RESULT FROM TREND (AVERAGED) LINE

TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.4838E-01	0.1551E-04	0.2444E-02	0.1000E-04
0.2419E+00	0.7756E-04	0.1222E-01	0.5000E-04
0.4838E+00	0.1551E-03	0.2444E-01	0.1000E-03
0.2419E+02	0.7756E-02	0.1222E+01	0.5000E-02
0.3629E+02	0.1163E-01	0.1833E+01	0.7500E-02
0.4838E+02	0.1551E-01	0.2444E+01	0.1000E-01
0.1211E+03	0.3879E-01	0.6109E+01	0.2500E-01

0.2425E+03	0.7762E-01	0.1222E+02	0.5000E-01
0.3403E+03	0.1145E+00	0.1833E+02	0.7500E-01
0.4055E+03	0.1475E+00	0.2444E+02	0.1000E+00
0.6550E+03	0.3297E+00	0.6109E+02	0.2500E+00
0.7904E+03	0.6000E+00	0.1212E+03	0.5000E+00
0.8464E+03	0.8296E+00	0.1734E+03	0.7200E+00
0.9580E+03	0.1931E+01	0.3217E+03	0.1800E+01
0.1145E+04	0.3762E+01	0.5103E+03	0.3600E+01

RESULT FROM UPPER-BOUND LINE

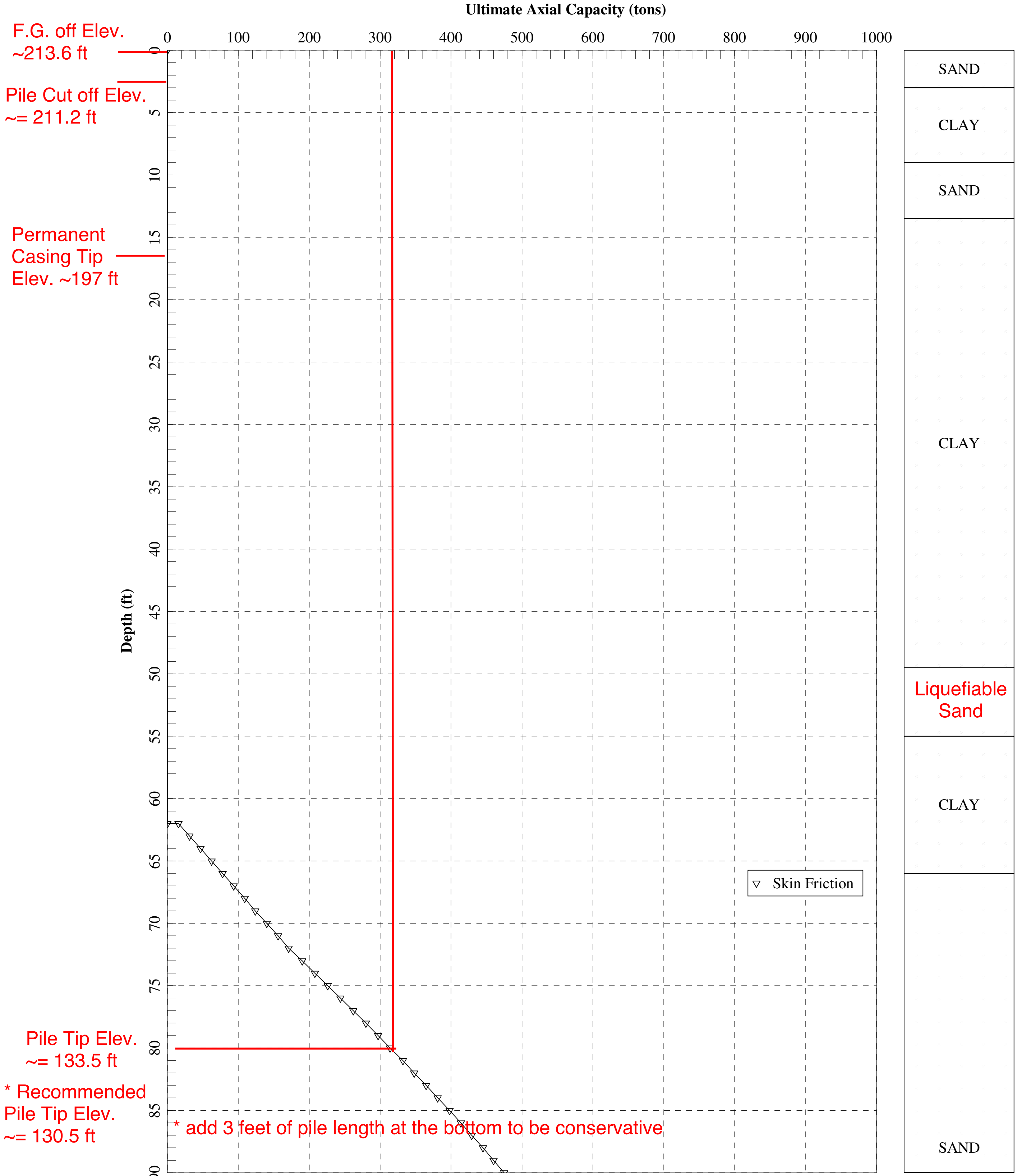
TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.7068E-01	0.1791E-04	0.3491E-02	0.1000E-04
0.3534E+00	0.8954E-04	0.1746E-01	0.5000E-04
0.7068E+00	0.1791E-03	0.3491E-01	0.1000E-03
0.3534E+02	0.8954E-02	0.1746E+01	0.5000E-02
0.5301E+02	0.1343E-01	0.2618E+01	0.7500E-02
0.7068E+02	0.1791E-01	0.3491E+01	0.1000E-01
0.1773E+03	0.4482E-01	0.8728E+01	0.2500E-01
0.3538E+03	0.8962E-01	0.1746E+02	0.5000E-01
0.4759E+03	0.1300E+00	0.2618E+02	0.7500E-01
0.5481E+03	0.1643E+00	0.3491E+02	0.1000E+00
0.7664E+03	0.3450E+00	0.8728E+02	0.2500E+00
0.8887E+03	0.6141E+00	0.1706E+03	0.5000E+00
0.9547E+03	0.8455E+00	0.2413E+03	0.7200E+00
0.1064E+04	0.1946E+01	0.3821E+03	0.1800E+01
0.1224E+04	0.3773E+01	0.5429E+03	0.3600E+01

RESULT FROM LOWER-BOUND LINE

TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.2808E-01	0.1328E-04	0.1396E-02	0.1000E-04
0.1404E+00	0.6638E-04	0.6982E-02	0.5000E-04
0.2808E+00	0.1328E-03	0.1396E-01	0.1000E-03
0.1404E+02	0.6638E-02	0.6982E+00	0.5000E-02
0.2106E+02	0.9957E-02	0.1047E+01	0.7500E-02
0.2808E+02	0.1328E-01	0.1396E+01	0.1000E-01
0.7019E+02	0.3319E-01	0.3491E+01	0.2500E-01
0.1405E+03	0.6639E-01	0.6982E+01	0.5000E-01
0.2071E+03	0.9925E-01	0.1047E+02	0.7500E-01
0.2638E+03	0.1309E+00	0.1396E+02	0.1000E+00
0.5131E+03	0.3114E+00	0.3491E+02	0.2500E+00

0.6915E+03	0.5858E+00	0.7178E+02	0.5000E+00
0.7382E+03	0.8137E+00	0.1056E+03	0.7200E+00
0.8524E+03	0.1916E+01	0.2614E+03	0.1800E+01
0.1066E+04	0.3752E+01	0.4776E+03	0.3600E+01

Vertical loading = 240 kips / 2 = 120 tons
Downdrag = 188 tons, therefore,
total demand = 120 tons + 188 tons = 308 tons



Bent 4_72" Diameter Type-II CIDH_Extreme Event Limit State

Downdrag Forces on Circular Piles

Project No	2016-146-NOC
Project	NB 101 ON-RAMP POC
Location	Bent 4 -1 rows
Boring	R-18-NO-002
Single Pile Dia. (ft)	6
GW Depth (ft)	17
Bulk Unit Weight (pcf)	125
Pile Length (ft)	100
# of Equiv. Pile Circumference	1

FG Elev.	213.6
Pile Cut-off.	211.2

Analysis By:	JZ
Date:	3/29/2019

Layer Number	Layer Thickness (ft)	Soil Type	Beta	Consider downdrag (y/n)	Total Depth (ft)	Layer Mid-Point Depth (ft)	Effective Stress (psf)	Contributing Thickness (ft)	Unit Negative Friction (ft)	Downdrag Force per Section (ton)	Total Downdrag Force (ton)	Remarks
1a	2.40	SM	0.30	n	2.40	1.20	150	2.4	45	0.0		Above Cut-off
1b	1.00	SM	0.30	n	3.40	2.90	363	1.0	109	0.0		
2	6.00	CL	0.20	n	9.40	6.40	800	6.0	160	0.0		Permanent Casing
3	4.50	SM	0.30	n	13.90	11.65	1456	4.5	437	0.0		
4a	3.00	CL	0.20	n	16.90	15.40	1925	3.0	385	0.0		
4b	32.00	CL	0.20	y	48.90	32.90	3120	32.0	624	188.2	188.2	Downdrag Contributing
5	6.50	SM	0.30	n	55.40	20.15	2322	6.5	697	0.0		Liquefied
6	11.00	CL	0.20	n	66.40	60.90	4873	11.0	975	0.0		Below Liquefied
7	28.50	SM	0.30	n	94.90	80.65	6109	28.5	1833	0.0		

Notes Area

Downdrag for the CIDH pile is ~188 tons

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=========================================================================

                 SHAFT for Windows, Version 2012.7.17

                  Serial Number :  291911540

                VERTICALLY LOADED DRILLED SHAFT ANALYSIS
                 (c) Copyright ENSOFT, Inc., 1987-2012
                       All Rights Reserved

=========================================================================


Path to file locations      : T:\Ongoing Projects\2016\2016-146-NOC NB101
On-Ramp POC\Calculations\SHAFT Analysis\2019-03\
Name of input data file     : Bent 4_Extreme Limit State.sfd
Name of output file         : Bent 4_Extreme Limit State.sfo
Name of plot output file    : Bent 4_Extreme Limit State.sfp
Name of runtime file        : Bent 4_Extreme Limit State.sfr


-------------------------------------------------------------------------
                     Time and Date of Analysis
-------------------------------------------------------------------------

          Date:  March 29, 2019     Time:  16:33:14

New Pile


PROPOSED DEPTH =      90.0 FT
----------------


NUMBER OF LAYERS =    7
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WATER TABLE DEPTH =      15.0 FT.
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FACTOR OF SAFETY APPLIED TO THE ULTIMATE SIDE FRICTION CAPACITY = 2.50
-------------------------------------------------------
FACTOR OF SAFETY APPLIED TO THE ULTIMATE BASE CAPACITY = 3.00
------------------------------------------------------
```



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SOIL INFORMATION
---------------

LAYER NO 1----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                   = 0.120E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.350E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.000E+00


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                   = 0.120E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.350E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.300E+01


LAYER NO 2----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.660E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.100E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.300E+01


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.780E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.100E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
```

```
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.900E+01


LAYER NO 3----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                   = 0.110E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.320E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.900E+01


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                   = 0.100E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.320E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.135E+02


LAYER NO 4----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.870E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.100E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.135E+02


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
```



```
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.100E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.495E+02


LAYER NO 5----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.100E-02
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.495E+02


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.100E-02
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.550E+02


LAYER NO 6----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.300E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.550E+02
```

```
  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                  = 0.550E+00
  END BEARING COEFFICIENT-Nc                       = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.300E+04
  INTERNAL FRICTION ANGLE, DEG.                    = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                       = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.660E+02


LAYER NO 7----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                  = 0.403E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                    = 0.380E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                       = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.660E+02


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                  = 0.250E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                    = 0.380E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                       = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.110E+03



DRILLED SHAFT INFORMATION
-------------------------

 DIAMETER OF STEM         =    6.000  FT.
 DIAMETER OF BASE         =    6.000  FT.
 END OF STEM TO BASE      =    0.000  FT.
 ANGLE OF BELL            =    0.000  DEG.
 IGNORED TOP PORTION      =   55.000  FT.
 IGNORED BOTTOM PORTION   =    6.000  FT.
 AREA OF ONE PERCENT STEEL =   40.720  SQ.IN.
```



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 ELASTIC MODULUS, Ec       = 0.300E+07 LB/SQ IN
 VOLUME OF UNDERREAM       =    0.000  CU.YDS.


PREDICTED RESULTS
-----------------

QS     = ULTIMATE SIDE RESISTANCE;
QB     = ULTIMATE BASE RESISTANCE;
WT     = WEIGHT OF DRILLED SHAFT (FOR UPLIFT CAPACITY ONLY);
QU     = TOTAL ULTIMATE RESISTANCE;
QBD    = TOTAL ALLOWABLE LOAD USING A FACTOR OF SAFETY
         APPLIED TO THE ULTIMATE BASE RESISTANCE;
QDN    = TOTAL ALLOWABLE LOAD USING FACTORS OF SAFETY
         APPLIED TO THE ULTIMATE SIDE RESISTANCE AND
         THE ULTIMATE BASE RESISTANCE.
```

LENGTH (FEET)	VOLUME (CU.YDS)	QS (TONS)	QB (TONS)	QU (TONS)	QBD (TONS)	QDN (TONS)	QU/VOLUME (TONS/CU.YDS)
62.0	64.93	15.55	486.94	502.49	177.87	168.54	7.74
63.0	65.98	31.11	494.83	525.94	196.05	177.39	7.97
64.0	67.03	46.66	500.09	546.75	213.36	185.36	8.16
65.0	68.08	62.21	502.72	564.93	229.78	192.46	8.30
66.0	69.12	77.76	502.72	580.48	245.34	198.68	8.40
67.0	70.17	93.32	502.72	596.04	260.89	204.90	8.49
68.0	71.22	108.87	502.72	611.59	276.44	211.12	8.59
69.0	72.27	124.42	502.72	627.14	292.00	217.34	8.68
70.0	73.31	139.98	502.72	642.70	307.55	223.56	8.77
71.0	74.36	155.53	502.72	658.25	323.10	229.78	8.85
72.0	75.41	171.08	502.72	673.80	338.66	236.01	8.94
73.0	76.46	189.60	502.72	692.32	357.17	243.41	9.06
74.0	77.50	207.96	502.72	710.68	375.53	250.76	9.17
75.0	78.55	226.16	502.72	728.88	393.73	258.04	9.28
76.0	79.60	244.19	502.72	746.91	411.76	265.25	9.38
77.0	80.64	262.03	502.72	764.75	429.61	272.39	9.48
78.0	81.69	279.70	502.72	782.42	447.27	279.45	9.58
79.0	82.74	297.18	502.72	799.90	464.75	286.44	9.67
80.0	83.79	314.45	502.72	817.17	482.03	293.35	9.75
81.0	84.83	331.53	502.72	834.25	499.10	300.18	9.83
82.0	85.88	348.39	502.72	851.11	515.97	306.93	9.91
83.0	86.93	365.04	502.72	867.76	532.61	313.59	9.98
84.0	87.98	381.46	502.72	884.18	549.04	320.16	10.05
85.0	89.02	397.66	502.72	900.38	565.23	326.64	10.11
86.0	90.07	413.62	502.72	916.34	581.19	333.02	10.17
87.0	91.12	429.33	502.72	932.05	596.91	339.31	10.23
88.0	92.17	444.80	502.72	947.52	612.37	345.49	10.28

89.0	93.21	460.01	502.72	962.73	627.59	351.58	10.33
90.0	94.26	474.96	502.72	977.68	642.54	357.56	10.37

RESULT FROM TREND (AVERAGED) LINE

TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.3281E-01	0.1469E-04	0.2444E-02	0.1000E-04
0.1641E+00	0.7347E-04	0.1222E-01	0.5000E-04
0.3281E+00	0.1469E-03	0.2444E-01	0.1000E-03
0.1641E+02	0.7347E-02	0.1222E+01	0.5000E-02
0.2461E+02	0.1102E-01	0.1833E+01	0.7500E-02
0.3281E+02	0.1469E-01	0.2444E+01	0.1000E-01
0.8234E+02	0.3677E-01	0.6109E+01	0.2500E-01
0.1648E+03	0.7356E-01	0.1222E+02	0.5000E-01
0.2392E+03	0.1093E+00	0.1833E+02	0.7500E-01
0.2914E+03	0.1421E+00	0.2444E+02	0.1000E+00
0.5000E+03	0.3234E+00	0.6109E+02	0.2500E+00
0.6355E+03	0.5954E+00	0.1212E+03	0.5000E+00
0.6965E+03	0.8260E+00	0.1734E+03	0.7200E+00
0.8295E+03	0.1930E+01	0.3217E+03	0.1800E+01
0.1017E+04	0.3764E+01	0.5103E+03	0.3600E+01

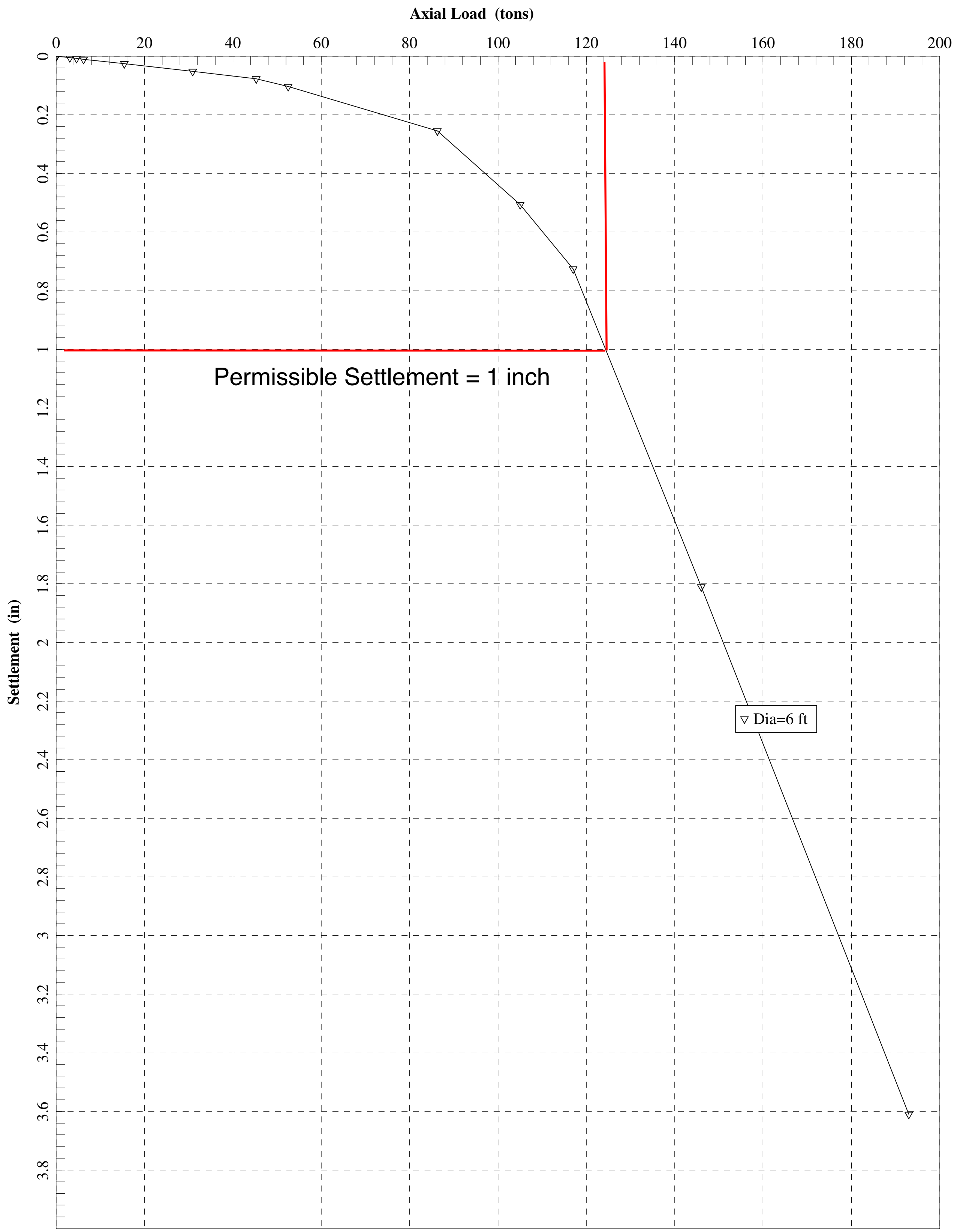
RESULT FROM UPPER-BOUND LINE

TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.4611E-01	0.1656E-04	0.3491E-02	0.1000E-04
0.2305E+00	0.8282E-04	0.1746E-01	0.5000E-04
0.4611E+00	0.1656E-03	0.3491E-01	0.1000E-03
0.2305E+02	0.8282E-02	0.1746E+01	0.5000E-02
0.3458E+02	0.1242E-01	0.2618E+01	0.7500E-02
0.4622E+02	0.1658E-01	0.3491E+01	0.1000E-01
0.1159E+03	0.4149E-01	0.8728E+01	0.2500E-01
0.2320E+03	0.8300E-01	0.1746E+02	0.5000E-01
0.3307E+03	0.1223E+00	0.2618E+02	0.7500E-01
0.3933E+03	0.1568E+00	0.3491E+02	0.1000E+00
0.6031E+03	0.3394E+00	0.8728E+02	0.2500E+00
0.7230E+03	0.6096E+00	0.1706E+03	0.5000E+00
0.7919E+03	0.8419E+00	0.2413E+03	0.7200E+00
0.9191E+03	0.1945E+01	0.3821E+03	0.1800E+01
0.1080E+04	0.3774E+01	0.5429E+03	0.3600E+01

RESULT FROM LOWER-BOUND LINE

TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.2008E-01	0.1289E-04	0.1396E-02	0.1000E-04
0.1004E+00	0.6446E-04	0.6982E-02	0.5000E-04
0.2008E+00	0.1289E-03	0.1396E-01	0.1000E-03
0.1004E+02	0.6446E-02	0.6982E+00	0.5000E-02
0.1506E+02	0.9670E-02	0.1047E+01	0.7500E-02
0.2008E+02	0.1289E-01	0.1396E+01	0.1000E-01
0.5027E+02	0.3224E-01	0.3491E+01	0.2500E-01
0.1006E+03	0.6449E-01	0.6982E+01	0.5000E-01
0.1493E+03	0.9651E-01	0.1047E+02	0.7500E-01
0.1905E+03	0.1275E+00	0.1396E+02	0.1000E+00
0.3828E+03	0.3057E+00	0.3491E+02	0.2500E+00
0.5476E+03	0.5811E+00	0.7178E+02	0.5000E+00
0.6011E+03	0.8101E+00	0.1056E+03	0.7200E+00
0.7398E+03	0.1916E+01	0.2614E+03	0.1800E+01
0.9537E+03	0.3754E+01	0.4776E+03	0.3600E+01

Settlement Graph Generated with Pile Tip at Elev. 180.0'
Permanent Load = 240 kips =120 tons



Bent 4_72" Diameter Type-II CIDH_Service Limit State_Settlement vs Axial Load

```
==========================================================================

               SHAFT for Windows, Version 2012.7.17

                Serial Number :  291911540

             VERTICALLY LOADED DRILLED SHAFT ANALYSIS
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==========================================================================


Path to file locations      : T:\Ongoing Projects\2016\2016-146-NOC NB101
On-Ramp POC\Calculations\SHAFT Analysis\2019-03\
Name of input data file     : Bent 4_Service Limit State.sfd
Name of output file         : Bent 4_Service Limit State.sfo
Name of plot output file    : Bent 4_Service Limit State.sfp
Name of runtime file        : Bent 4_Service Limit State.sfr


--------------------------------------------------------------------------
                  Time and Date of Analysis
--------------------------------------------------------------------------

          Date:  March 29, 2019     Time:  16:51:37

New Pile


PROPOSED DEPTH =      33.0 FT
----------------


NUMBER OF LAYERS =    7
------------------


WATER TABLE DEPTH =      15.0 FT.
-------------------



FACTOR OF SAFETY APPLIED TO THE ULTIMATE SIDE FRICTION CAPACITY = 2.50
-------------------------------------------------------
FACTOR OF SAFETY APPLIED TO THE ULTIMATE BASE CAPACITY = 3.00
------------------------------------------------------
```


Bent 4_Service Limit State.sfo

```
SOIL INFORMATION
---------------

LAYER NO 1----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                   = 0.120E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.350E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.000E+00


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                   = 0.120E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.350E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.300E+01


LAYER NO 2----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.660E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.100E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.300E+01


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.780E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.100E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
```

```
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.900E+01


LAYER NO 3----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                   = 0.110E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.320E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.900E+01


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                   = 0.100E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.320E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.135E+02


LAYER NO 4----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.870E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.100E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.135E+02


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
```



```
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.100E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.485E+02


LAYER NO 5----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                   = 0.560E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.330E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.485E+02


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                   = 0.499E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.330E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.550E+02


LAYER NO 6----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.300E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.550E+02


  AT THE BOTTOM
```

```
  STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
  END BEARING COEFFICIENT-Nc                         = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.300E+04
  INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.660E+02


LAYER NO 7----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                    = 0.403E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.380E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.660E+02


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                    = 0.250E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.380E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.100E+03



DRILLED SHAFT INFORMATION
-------------------------

 DIAMETER OF STEM          =    6.000  FT.
 DIAMETER OF BASE          =    6.000  FT.
 END OF STEM TO BASE       =    0.000  FT.
 ANGLE OF BELL             =    0.000  DEG.
 IGNORED TOP PORTION       =   16.500  FT.
 IGNORED BOTTOM PORTION    =    6.000  FT.
 AREA OF ONE PERCENT STEEL =   40.720  SQ.IN.
 ELASTIC MODULUS, Ec       = 0.300E+07 LB/SQ IN
 VOLUME OF UNDERREAM       =    0.000  CU.YDS.
```



```
PREDICTED RESULTS
-----------------

QS     = ULTIMATE SIDE RESISTANCE;
QB     = ULTIMATE BASE RESISTANCE;
WT     = WEIGHT OF DRILLED SHAFT (FOR UPLIFT CAPACITY ONLY);
QU     = TOTAL ULTIMATE RESISTANCE;
QBD    = TOTAL ALLOWABLE LOAD USING A FACTOR OF SAFETY
         APPLIED TO THE ULTIMATE BASE RESISTANCE;
QDN    = TOTAL ALLOWABLE LOAD USING FACTORS OF SAFETY
         APPLIED TO THE ULTIMATE SIDE RESISTANCE AND
         THE ULTIMATE BASE RESISTANCE.
```

LENGTH (FEET)	VOLUME (CU.YDS)	QS (TONS)	QB (TONS)	QU (TONS)	QBD (TONS)	QDN (TONS)	QU/VOLUME (TONS/CU.YDS)
23.0	24.09	7.78	125.37	133.15	28.67	24.01	52.68
24.0	25.14	5.18	125.14	130.32	46.90	43.79	5.18
25.0	26.18	10.37	125.26	135.62	52.12	45.90	5.18
26.0	27.23	15.55	125.37	140.93	57.34	48.01	5.18
27.0	28.28	20.74	125.49	146.23	62.57	50.13	5.17
28.0	29.33	25.92	125.61	151.54	67.79	52.24	5.17
29.0	30.37	31.11	125.73	156.84	73.02	54.35	5.16
30.0	31.42	36.29	125.85	162.14	78.24	56.47	5.16
31.0	32.47	41.47	125.97	167.45	83.47	58.58	5.16
32.0	33.51	46.66	126.09	172.75	88.69	60.69	5.15
33.0	34.56	51.84	126.21	178.05	93.91	62.81	5.15

RESULT FROM TREND (AVERAGED) LINE

TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.6177E-02	0.1031E-04	0.6135E-03	0.1000E-04
0.3088E-01	0.5157E-04	0.3068E-02	0.5000E-04
0.6177E-01	0.1031E-03	0.6135E-02	0.1000E-03
0.3088E+01	0.5157E-02	0.3068E+00	0.5000E-02
0.4632E+01	0.7736E-02	0.4601E+00	0.7500E-02
0.6177E+01	0.1031E-01	0.6135E+00	0.1000E-01
0.1544E+02	0.2579E-01	0.1534E+01	0.2500E-01
0.3088E+02	0.5157E-01	0.3068E+01	0.5000E-01
0.4528E+02	0.7731E-01	0.4601E+01	0.7500E-01
0.5254E+02	0.1027E+00	0.6135E+01	0.1000E+00
0.8629E+02	0.2545E+00	0.1534E+02	0.2500E+00

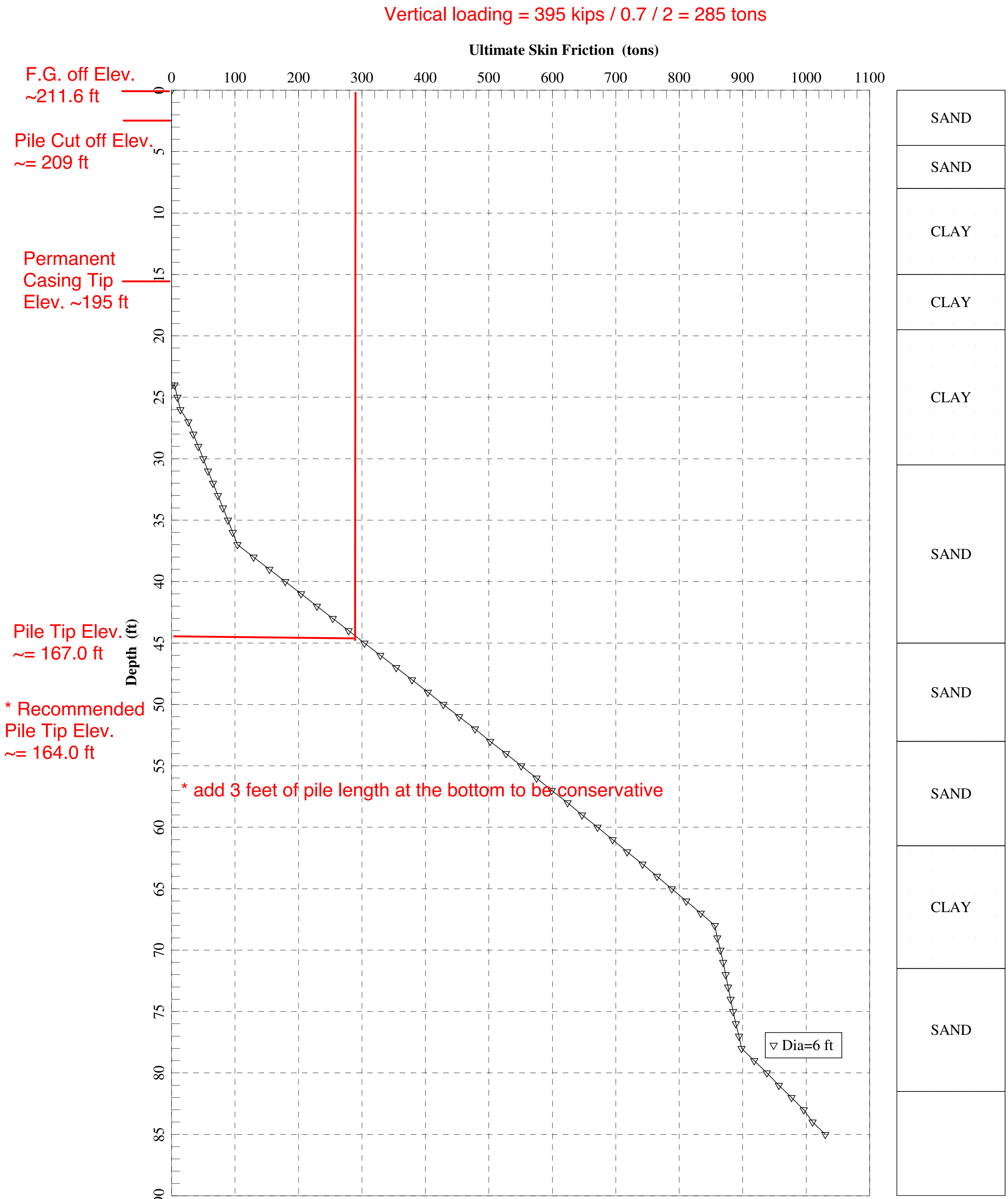
0.1048E+03	0.5057E+00	0.3043E+02	0.5000E+00
0.1171E+03	0.7265E+00	0.4354E+02	0.7200E+00
0.1462E+03	0.1808E+01	0.8078E+02	0.1800E+01
0.1935E+03	0.3612E+01	0.1281E+03	0.3600E+01

RESULT FROM UPPER-BOUND LINE

TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.8959E-02	0.1046E-04	0.8765E-03	0.1000E-04
0.4479E-01	0.5228E-04	0.4382E-02	0.5000E-04
0.8959E-01	0.1046E-03	0.8765E-02	0.1000E-03
0.4479E+01	0.5228E-02	0.4382E+00	0.5000E-02
0.6719E+01	0.7842E-02	0.6573E+00	0.7500E-02
0.8959E+01	0.1046E-01	0.8765E+00	0.1000E-01
0.2240E+02	0.2614E-01	0.2191E+01	0.2500E-01
0.4483E+02	0.5228E-01	0.4382E+01	0.5000E-01
0.6519E+02	0.7832E-01	0.6573E+01	0.7500E-01
0.7229E+02	0.1037E+00	0.8765E+01	0.1000E+00
0.9863E+02	0.2552E+00	0.2191E+02	0.2500E+00
0.1227E+03	0.5067E+00	0.4284E+02	0.5000E+00
0.1397E+03	0.7278E+00	0.6058E+02	0.7200E+00
0.1680E+03	0.1810E+01	0.9592E+02	0.1800E+01
0.2084E+03	0.3612E+01	0.1363E+03	0.3600E+01

RESULT FROM LOWER-BOUND LINE

TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.3510E-02	0.1018E-04	0.3506E-03	0.1000E-04
0.1755E-01	0.5089E-04	0.1753E-02	0.5000E-04
0.3510E-01	0.1018E-03	0.3506E-02	0.1000E-03
0.1755E+01	0.5089E-02	0.1753E+00	0.5000E-02
0.2632E+01	0.7634E-02	0.2629E+00	0.7500E-02
0.3510E+01	0.1018E-01	0.3506E+00	0.1000E-01
0.8775E+01	0.2545E-01	0.8765E+00	0.2500E-01
0.1755E+02	0.5089E-01	0.1753E+01	0.5000E-01
0.2612E+02	0.7633E-01	0.2629E+01	0.7500E-01
0.3326E+02	0.1017E+00	0.3506E+01	0.1000E+00
0.6620E+02	0.2534E+00	0.8765E+01	0.2500E+00
0.8690E+02	0.5046E+00	0.1802E+02	0.5000E+00
0.9463E+02	0.7251E+00	0.2650E+02	0.7200E+00
0.1244E+03	0.1807E+01	0.6563E+02	0.1800E+01
0.1786E+03	0.3611E+01	0.1199E+03	0.3600E+01



Bent 5_72" Diameter Type-II CIDH_Strength Limit State

```
==========================================================================

                 SHAFT for Windows, Version 2012.7.17

                  Serial Number :  291911540

               VERTICALLY LOADED DRILLED SHAFT ANALYSIS
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                      All Rights Reserved

==========================================================================


     Path to file locations      : T:\Ongoing Projects\2016\2016-146-NOC NB101
On-Ramp POC\Calculations\SHAFT Analysis\2019-03\
     Name of input data file     : Bent 5_Strength Limit State.sfd
     Name of output file         : Bent 5_Strength Limit State.sfo
     Name of plot output file    : Bent 5_Strength Limit State.sfp
     Name of runtime file        : Bent 5_Strength Limit State.sfr


--------------------------------------------------------------------------
                   Time and Date of Analysis
--------------------------------------------------------------------------

          Date:  April 02, 2019     Time:  15:02:42

     New Pile


     PROPOSED DEPTH =      85.0 FT
     ----------------


     NUMBER OF LAYERS =   12
     ------------------


     WATER TABLE DEPTH =      28.5 FT.
     -------------------



     FACTOR OF SAFETY APPLIED TO THE ULTIMATE SIDE FRICTION CAPACITY = 2.50
     -------------------------------------------------------
     FACTOR OF SAFETY APPLIED TO THE ULTIMATE BASE CAPACITY = 3.00
     ------------------------------------------------------
```



```
SOIL INFORMATION
---------------

LAYER NO 1----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                   = 0.120E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.380E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.000E+00


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                   = 0.120E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.380E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.450E+01


LAYER NO 2----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                   = 0.120E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.360E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.450E+01


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                   = 0.112E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.360E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
```

```
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.800E+01


LAYER NO 3----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                  = 0.550E+00
  END BEARING COEFFICIENT-Nc                       = 0.760E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.200E+04
  INTERNAL FRICTION ANGLE, DEG.                    = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                       = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.800E+01


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                  = 0.550E+00
  END BEARING COEFFICIENT-Nc                       = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.200E+04
  INTERNAL FRICTION ANGLE, DEG.                    = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                       = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.150E+02


LAYER NO 4----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                  = 0.550E+00
  END BEARING COEFFICIENT-Nc                       = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.900E+03
  INTERNAL FRICTION ANGLE, DEG.                    = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                       = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.150E+02


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                  = 0.550E+00
  END BEARING COEFFICIENT-Nc                       = 0.900E+01
```



```
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.900E+03
  INTERNAL FRICTION ANGLE, DEG.                    = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                       = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.195E+02


LAYER NO 5----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                  = 0.550E+00
  END BEARING COEFFICIENT-Nc                       = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.150E+04
  INTERNAL FRICTION ANGLE, DEG.                    = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                       = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.195E+02


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                  = 0.550E+00
  END BEARING COEFFICIENT-Nc                       = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.150E+04
  INTERNAL FRICTION ANGLE, DEG.                    = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                       = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.305E+02


LAYER NO 6----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                  = 0.754E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                    = 0.300E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                       = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.305E+02


  AT THE BOTTOM
```

```
  SKIN FRICTION COEFFICIENT- BETA                    = 0.594E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.300E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.450E+02


LAYER NO 7----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                    = 0.594E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.320E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.450E+02


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                    = 0.517E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.320E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.530E+02


LAYER NO 8----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                    = 0.517E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.300E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.530E+02


  AT THE BOTTOM
```



```
  SKIN FRICTION COEFFICIENT- BETA                    = 0.441E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.300E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.615E+02


LAYER NO 9----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
  END BEARING COEFFICIENT-Nc                         = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.800E+03
  INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.615E+02


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
  END BEARING COEFFICIENT-Nc                         = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.800E+03
  INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.715E+02


LAYER NO10----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                    = 0.358E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.360E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.715E+02
```

```
  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                    = 0.281E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.360E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.815E+02


LAYER NO11----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                    = 0.281E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.380E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.815E+02


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                    = 0.250E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.380E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.102E+03


LAYER NO12----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
  END BEARING COEFFICIENT-Nc                         = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.250E+04
  INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.102E+03
```



```
  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
  END BEARING COEFFICIENT-Nc                         = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.250E+04
  INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.110E+03



DRILLED SHAFT INFORMATION
-------------------------

 DIAMETER OF STEM         =    6.000  FT.
 DIAMETER OF BASE         =    6.000  FT.
 END OF STEM TO BASE      =    0.000  FT.
 ANGLE OF BELL            =    0.000  DEG.
 IGNORED TOP PORTION      =   16.500  FT.
 IGNORED BOTTOM PORTION   =    6.000  FT.
 AREA OF ONE PERCENT STEEL =   40.720  SQ.IN.
 ELASTIC MODULUS, Ec      = 0.300E+07 LB/SQ IN
 VOLUME OF UNDERREAM      =    0.000  CU.YDS.



PREDICTED RESULTS
-----------------

QS     = ULTIMATE SIDE RESISTANCE;
QB     = ULTIMATE BASE RESISTANCE;
WT     = WEIGHT OF DRILLED SHAFT (FOR UPLIFT CAPACITY ONLY);
QU     = TOTAL ULTIMATE RESISTANCE;
QBD    = TOTAL ALLOWABLE LOAD USING A FACTOR OF SAFETY
         APPLIED TO THE ULTIMATE BASE RESISTANCE;
QDN    = TOTAL ALLOWABLE LOAD USING FACTORS OF SAFETY
         APPLIED TO THE ULTIMATE SIDE RESISTANCE AND
         THE ULTIMATE BASE RESISTANCE.

LENGTH  VOLUME     QS      QB      QU      QBD     QDN     QU/VOLUME
(FEET)  (CU.YDS) (TONS)  (TONS)  (TONS)  (TONS)  (TONS)  (TONS/CU.YDS)
23.0    24.09     7.00   41.49   48.49   13.91    9.72     23.63
```

24.0	25.14	4.67	87.14	91.81	33.71	30.91	3.65
25.0	26.18	9.33	62.24	71.57	30.08	24.48	2.73
26.0	27.23	14.00	41.49	55.49	27.83	19.43	2.04
27.0	28.28	26.44	24.90	51.34	34.74	18.87	1.82
28.0	29.33	34.22	12.45	46.66	38.37	17.84	1.59
29.0	30.37	41.99	4.15	46.14	43.38	18.18	1.52
30.0	31.42	49.77	0.00	49.77	49.77	19.91	1.58
31.0	32.47	57.55	0.00	57.55	57.55	23.02	1.77
32.0	33.51	65.32	0.00	65.32	65.32	26.13	1.95
33.0	34.56	73.10	0.00	73.10	73.10	29.24	2.12
34.0	35.61	80.88	7.57	88.44	83.40	34.87	2.48
35.0	36.66	88.65	15.88	104.53	93.94	40.75	2.85
36.0	37.70	96.43	24.95	121.37	104.74	46.89	3.22
37.0	38.75	104.20	34.79	138.99	115.80	53.28	3.59
38.0	39.80	129.15	45.42	174.57	144.29	66.80	4.39
39.0	40.85	154.12	56.84	210.96	173.07	80.59	5.16
40.0	41.89	179.11	66.74	245.86	201.36	93.89	5.87
41.0	42.94	204.11	75.09	279.21	229.14	106.68	6.50
42.0	43.99	229.12	72.97	302.09	253.44	115.97	6.87
43.0	45.04	254.12	68.36	322.48	276.90	124.43	7.16
44.0	46.08	279.11	61.23	340.33	299.51	132.05	7.39
45.0	47.13	304.07	51.51	355.59	321.24	138.80	7.54
46.0	48.18	329.02	40.91	369.93	342.65	145.24	7.68
47.0	49.22	353.92	29.41	383.34	363.73	151.37	7.79
48.0	50.27	378.79	19.73	398.52	385.37	158.09	7.93
49.0	51.32	403.61	11.92	415.52	407.58	165.41	8.10
50.0	52.37	428.37	6.00	434.36	430.36	173.34	8.29
51.0	53.41	453.06	11.60	464.66	456.93	185.09	8.70
52.0	54.46	477.69	19.92	497.60	484.33	197.71	9.14
53.0	55.51	502.23	30.98	533.22	512.56	211.22	9.61
54.0	56.56	526.70	42.79	569.48	540.96	224.94	10.07
55.0	57.60	551.07	55.33	606.39	569.51	238.87	10.53
56.0	58.65	575.34	68.60	643.94	598.20	253.00	10.98
57.0	59.70	599.50	79.67	679.17	626.06	266.36	11.38
58.0	60.75	623.55	88.52	712.07	653.06	278.93	11.72
59.0	61.79	647.48	95.16	742.64	679.20	290.71	12.02
60.0	62.84	671.28	99.59	770.87	704.48	301.71	12.27
61.0	63.89	694.95	121.81	816.76	735.56	318.58	12.78
62.0	64.93	718.48	143.36	861.84	766.27	335.18	13.27
63.0	65.98	741.86	166.46	908.31	797.34	352.23	13.77
64.0	67.03	765.08	191.09	956.17	828.78	369.73	14.26
65.0	68.08	788.15	217.26	1005.40	860.57	387.68	14.77
66.0	69.12	811.04	244.97	1056.01	892.70	406.07	15.28
67.0	70.17	833.77	268.06	1101.82	923.12	422.86	15.70
68.0	71.22	856.31	286.53	1142.84	951.82	438.03	16.05
69.0	72.27	860.45	300.38	1160.84	960.58	444.31	16.06
70.0	73.31	864.60	309.62	1174.22	967.81	449.05	16.02
71.0	74.36	868.75	331.99	1200.74	979.41	458.16	16.15

72.0	75.41	872.90	351.12	1224.01	989.94	466.20	16.23
73.0	76.46	877.04	371.60	1248.65	1000.91	474.69	16.33
74.0	77.50	881.19	393.46	1274.65	1012.34	483.63	16.45
75.0	78.55	885.34	416.67	1302.01	1024.23	493.03	16.58
76.0	79.60	889.49	441.26	1330.75	1036.57	502.88	16.72
77.0	80.64	893.63	461.75	1355.38	1047.55	511.37	16.81
78.0	81.69	897.78	478.14	1375.92	1057.16	518.49	16.84
79.0	82.74	917.91	490.43	1408.33	1081.38	530.64	17.02
80.0	83.79	937.77	498.62	1436.40	1103.98	541.32	17.14
81.0	84.83	957.38	502.72	1460.10	1124.95	550.52	17.21
82.0	85.88	976.71	502.72	1479.43	1144.29	558.26	17.23
83.0	86.93	995.77	502.72	1498.49	1163.34	565.88	17.24
84.0	87.98	1014.55	502.72	1517.27	1182.12	573.39	17.25
85.0	89.02	1033.04	502.72	1535.76	1200.61	580.79	17.25

RESULT FROM TREND (AVERAGED) LINE

TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.6802E-01	0.1732E-04	0.5516E-02	0.1000E-04
0.3401E+00	0.8658E-04	0.2758E-01	0.5000E-04
0.6802E+00	0.1732E-03	0.5516E-01	0.1000E-03
0.3401E+02	0.8658E-02	0.2758E+01	0.5000E-02
0.5102E+02	0.1299E-01	0.4137E+01	0.7500E-02
0.6802E+02	0.1732E-01	0.5516E+01	0.1000E-01
0.1706E+03	0.4333E-01	0.1379E+02	0.2500E-01
0.3412E+03	0.8669E-01	0.2758E+02	0.5000E-01
0.4834E+03	0.1277E+00	0.4137E+02	0.7500E-01
0.5936E+03	0.1650E+00	0.5516E+02	0.1000E+00
0.9939E+03	0.3631E+00	0.1379E+03	0.2500E+00
0.1232E+04	0.6444E+00	0.2308E+03	0.5000E+00
0.1298E+04	0.8746E+00	0.2815E+03	0.7200E+00
0.1428E+04	0.1978E+01	0.4349E+03	0.1800E+01
0.1478E+04	0.3786E+01	0.4876E+03	0.3600E+01

RESULT FROM UPPER-BOUND LINE

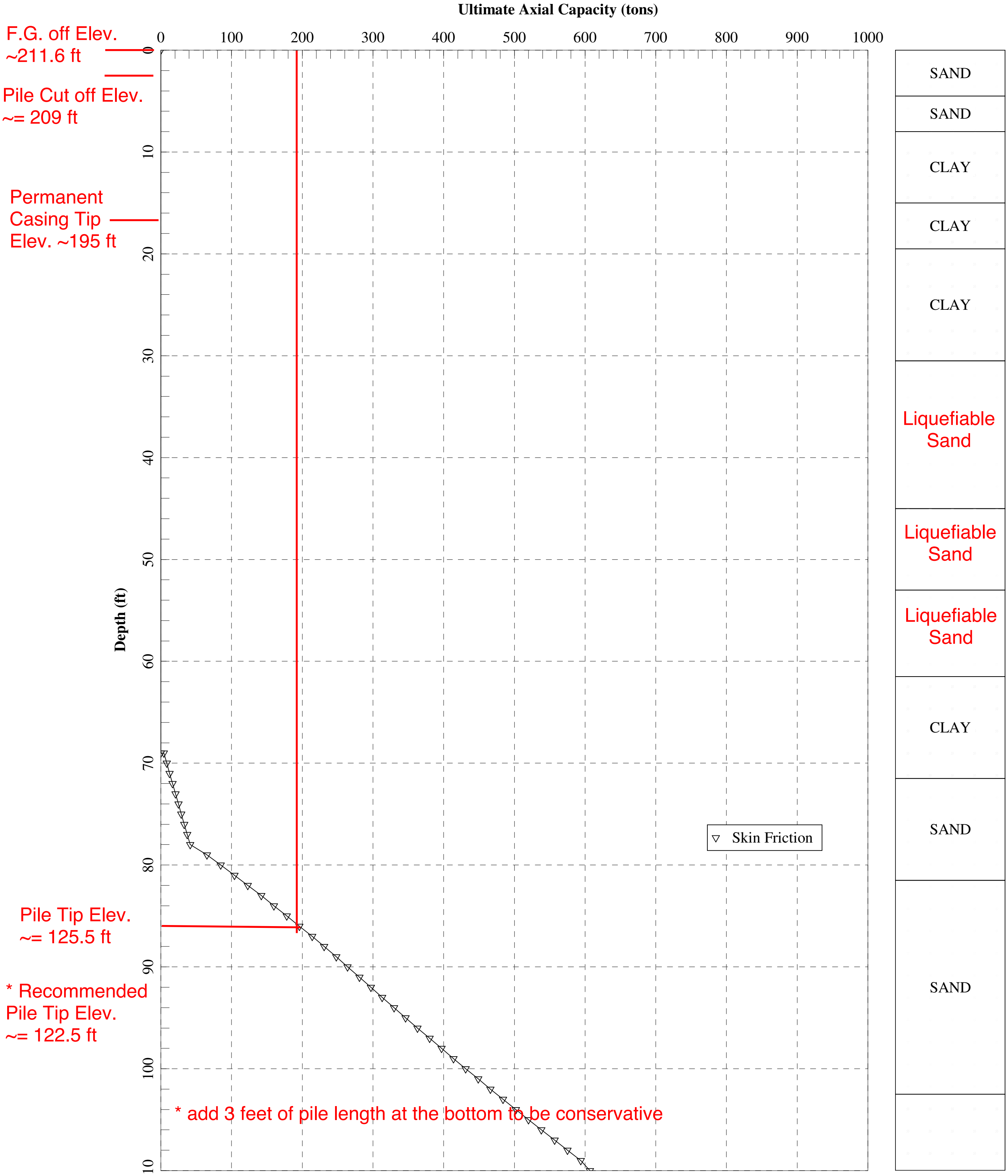
TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.9858E-01	0.2051E-04	0.8239E-02	0.1000E-04
0.4929E+00	0.1025E-03	0.4120E-01	0.5000E-04
0.9858E+00	0.2051E-03	0.8239E-01	0.1000E-03
0.4929E+02	0.1025E-01	0.4120E+01	0.5000E-02
0.7393E+02	0.1538E-01	0.6179E+01	0.7500E-02

0.9877E+02	0.2052E-01	0.8239E+01	0.1000E-01
0.2477E+03	0.5136E-01	0.2060E+02	0.2500E-01
0.4916E+03	0.1026E+00	0.4120E+02	0.5000E-01
0.6772E+03	0.1490E+00	0.6179E+02	0.7500E-01
0.8144E+03	0.1896E+00	0.8239E+02	0.1000E+00
0.1214E+04	0.3907E+00	0.2060E+03	0.2500E+00
0.1397E+04	0.6679E+00	0.3279E+03	0.5000E+00
0.1444E+04	0.8958E+00	0.3770E+03	0.7200E+00
0.1529E+04	0.1991E+01	0.4826E+03	0.1800E+01
0.1547E+04	0.3794E+01	0.5002E+03	0.3600E+01

RESULT FROM LOWER-BOUND LINE

TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.4029E-01	0.1435E-04	0.2793E-02	0.1000E-04
0.2014E+00	0.7177E-04	0.1396E-01	0.5000E-04
0.4029E+00	0.1435E-03	0.2793E-01	0.1000E-03
0.2014E+02	0.7177E-02	0.1396E+01	0.5000E-02
0.3022E+02	0.1077E-01	0.2095E+01	0.7500E-02
0.4029E+02	0.1435E-01	0.2793E+01	0.1000E-01
0.1008E+03	0.3589E-01	0.6982E+01	0.2500E-01
0.2019E+03	0.7180E-01	0.1396E+02	0.5000E-01
0.2967E+03	0.1072E+00	0.2095E+02	0.7500E-01
0.3791E+03	0.1412E+00	0.2793E+02	0.1000E+00
0.7504E+03	0.3331E+00	0.6982E+02	0.2500E+00
0.1064E+04	0.6205E+00	0.1338E+03	0.5000E+00
0.1152E+04	0.8533E+00	0.1860E+03	0.7200E+00
0.1326E+04	0.1964E+01	0.3871E+03	0.1800E+01
0.1407E+04	0.3778E+01	0.4726E+03	0.3600E+01

Vertical loading = 240 kips / 2 = 120 tons
Downdrag = 70 tons, therefore,
total demand = 120 tons + 70 tons = 190 tons



Bent 5_72" Diameter Type-II CIDH_Extreme Event Limit State

Downdrag Forces on Circular Piles

Project No	2016-146-NOC
Project	NB 101 ON-RAMP POC
Location	Bent 5 -1 rows
Boring	R-18-NO-003
Single Pile Dia. (ft)	6
GW Depth (ft)	32
Bulk Unit Weight (pcf)	125
Pile Length (ft)	110
# of Equiv. Pile Circumference	1

FG Elev.	211.6
Pile Cut-off.	209

Analysis By:	JZ
Date:	3/29/2019

Layer Number	Layer Thickness (ft)	Soil Type	Beta	Consider downdrag (y/n)	Total Depth (ft)	Layer Mid-Point Depth (ft)	Effective Stress (psf)	Contributing Thickness (ft)	Unit Negative Friction (ft)	Downdrag Force per Section (ton)	Total Downdrag Force (ton)	Remarks
1a	2.50	SM	0.30	n	2.50	1.25	156	2.5	47	0.0		Above Cut-off
1b	2.00	SM	0.30	n	4.50	3.50	438	2.0	131	0.0		
2	3.50	SM	0.30	n	8.00	6.25	781	3.5	234	0.0		Permanent Casing
3	7.00	CL	0.20	n	15.00	11.50	1438	7.0	288	0.0		
4a	1.50	ML	0.20	n	16.50	15.75	1969	1.5	394	0.0		
4b	3.00	ML	0.20	y	19.50	18.00	2250	3.0	450	12.7	12.7	Downdrag Contributing
5	11.00	ML	0.20	y	30.50	22.00	2750	11.0	550	57.0	69.7	
6	14.50	SM	0.30	n	45.00	37.75	4360	14.5	1308	0.0		Liquefied
7	8.00	SC	0.30	n	53.00	49.00	5064	8.0	1519	0.0		
8	8.50	SM	0.30	n	61.50	57.25	5581	8.5	1674	0.0		
9	10.00	ML	0.25	n	71.50	66.50	6160	10.0	1540	0.0		Below Liquefied
10	10.00	GP-GM	0.35	n	81.50	76.50	6786	10.0	2375	0.0		
11	21.00	SM	0.30	n	102.50	92.00	7756	21.0	2327	0.0		
12	5.50	CL	0.20	n	108.00	105.25	8585	5.5	1717	0.0		

Notes Area

Downdrag for the CIDH pile is ~70 tons

```
=========================================================================

                  SHAFT for Windows, Version 2012.7.17

                   Serial Number :  291911540

                VERTICALLY LOADED DRILLED SHAFT ANALYSIS
                 (c) Copyright ENSOFT, Inc., 1987-2012
                       All Rights Reserved

=========================================================================


Path to file locations      : T:\Ongoing Projects\2016\2016-146-NOC NB101
On-Ramp POC\Calculations\SHAFT Analysis\2019-03\
Name of input data file     : Bent 5_Extreme Limit State.sfd
Name of output file         : Bent 5_Extreme Limit State.sfo
Name of plot output file    : Bent 5_Extreme Limit State.sfp
Name of runtime file        : Bent 5_Extreme Limit State.sfr


-------------------------------------------------------------------------
                   Time and Date of Analysis
-------------------------------------------------------------------------

          Date:  March 29, 2019     Time:  17:27:26

New Pile


PROPOSED DEPTH =     110.0 FT
----------------


NUMBER OF LAYERS =   12
------------------


WATER TABLE DEPTH =      28.5 FT.
-------------------



FACTOR OF SAFETY APPLIED TO THE ULTIMATE SIDE FRICTION CAPACITY = 2.50
-------------------------------------------------------
FACTOR OF SAFETY APPLIED TO THE ULTIMATE BASE CAPACITY = 3.00
------------------------------------------------------
```



```
SOIL INFORMATION
---------------

LAYER NO 1----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                    = 0.120E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.380E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.000E+00


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                    = 0.120E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.380E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.450E+01


LAYER NO 2----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                    = 0.120E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.360E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.450E+01


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                    = 0.112E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.360E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
```

```
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.800E+01


LAYER NO 3----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.760E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.200E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.800E+01


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.200E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.150E+02


LAYER NO 4----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.900E+03
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.150E+02


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
```



```
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.900E+03
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.195E+02


LAYER NO 5----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.150E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.195E+02


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.150E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.305E+02


LAYER NO 6----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                   = 0.754E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.300E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.305E+02


  AT THE BOTTOM
```

```
  SKIN FRICTION COEFFICIENT- BETA                  = 0.594E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                    = 0.300E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                       = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.450E+02


LAYER NO 7----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                  = 0.594E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                    = 0.320E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                       = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.450E+02


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                  = 0.517E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                    = 0.320E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                       = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.530E+02


LAYER NO 8----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                  = 0.517E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                    = 0.300E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                       = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.530E+02


  AT THE BOTTOM
```



```
  SKIN FRICTION COEFFICIENT- BETA                  = 0.441E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                    = 0.300E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                       = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.615E+02


LAYER NO 9----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                  = 0.550E+00
  END BEARING COEFFICIENT-Nc                       = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.800E+03
  INTERNAL FRICTION ANGLE, DEG.                    = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                       = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.615E+02


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                  = 0.550E+00
  END BEARING COEFFICIENT-Nc                       = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.800E+03
  INTERNAL FRICTION ANGLE, DEG.                    = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                       = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.715E+02


LAYER NO10----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                  = 0.358E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                    = 0.360E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                       = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.715E+02
```

```
  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                    = 0.281E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.360E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.815E+02


LAYER NO11----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                    = 0.281E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.380E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.815E+02


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                    = 0.250E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.380E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.102E+03


LAYER NO12----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
  END BEARING COEFFICIENT-Nc                         = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.250E+04
  INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.102E+03
```



```
  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
  END BEARING COEFFICIENT-Nc                         = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.250E+04
  INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.125E+03



DRILLED SHAFT INFORMATION
-------------------------

 DIAMETER OF STEM          =    6.000  FT.
 DIAMETER OF BASE          =    6.000  FT.
 END OF STEM TO BASE       =    0.000  FT.
 ANGLE OF BELL             =    0.000  DEG.
 IGNORED TOP PORTION       =   61.500  FT.
 IGNORED BOTTOM PORTION    =    6.000  FT.
 AREA OF ONE PERCENT STEEL =   40.720  SQ.IN.
 ELASTIC MODULUS, Ec       = 0.300E+07 LB/SQ IN
 VOLUME OF UNDERREAM       =    0.000  CU.YDS.



PREDICTED RESULTS
-----------------

QS     = ULTIMATE SIDE RESISTANCE;
QB     = ULTIMATE BASE RESISTANCE;
WT     = WEIGHT OF DRILLED SHAFT (FOR UPLIFT CAPACITY ONLY);
QU     = TOTAL ULTIMATE RESISTANCE;
QBD    = TOTAL ALLOWABLE LOAD USING A FACTOR OF SAFETY
         APPLIED TO THE ULTIMATE BASE RESISTANCE;
QDN    = TOTAL ALLOWABLE LOAD USING FACTORS OF SAFETY
         APPLIED TO THE ULTIMATE SIDE RESISTANCE AND
         THE ULTIMATE BASE RESISTANCE.

LENGTH  VOLUME     QS      QB      QU      QBD     QDN      QU/VOLUME
(FEET)  (CU.YDS) (TONS)   (TONS)  (TONS)   (TONS)  (TONS)  (TONS/CU.YDS)
68.0    71.22     6.22   331.99   338.22   61.55   57.82    119.37
```

69.0	72.27	4.15	300.38	304.53	104.28	101.79	4.21
70.0	73.31	8.29	309.62	317.92	111.50	106.52	4.34
71.0	74.36	12.44	331.99	344.44	123.11	115.64	4.63
72.0	75.41	16.59	351.12	367.71	133.63	123.67	4.88
73.0	76.46	20.74	371.60	392.34	144.60	132.16	5.13
74.0	77.50	24.88	393.46	418.34	156.04	141.11	5.40
75.0	78.55	29.03	416.67	445.71	167.92	150.50	5.67
76.0	79.60	33.18	441.26	474.44	180.27	160.36	5.96
77.0	80.64	37.33	461.75	499.07	191.24	168.85	6.19
78.0	81.69	41.47	478.14	519.61	200.85	175.97	6.36
79.0	82.74	65.34	490.43	555.77	228.81	189.61	6.72
80.0	83.79	84.81	498.62	583.43	251.01	200.13	6.96
81.0	84.83	104.02	502.72	606.74	271.59	209.18	7.15
82.0	85.88	122.97	502.72	625.69	290.55	216.76	7.29
83.0	86.93	141.66	502.72	644.38	309.23	224.24	7.41
84.0	87.98	160.07	502.72	662.79	327.65	231.60	7.53
85.0	89.02	178.21	502.72	680.93	345.78	238.86	7.65
86.0	90.07	196.06	502.72	698.78	363.63	246.00	7.76
87.0	91.12	213.62	502.72	716.34	381.19	253.02	7.86
88.0	92.17	230.88	502.72	733.60	398.45	259.93	7.96
89.0	93.21	247.84	502.72	750.56	415.41	266.71	8.05
90.0	94.26	264.49	502.72	767.21	432.06	273.37	8.14
91.0	95.31	280.83	502.72	783.55	448.40	279.90	8.22
92.0	96.35	296.97	485.33	782.30	458.74	280.56	8.12
93.0	97.40	313.25	466.60	779.86	468.79	280.84	8.01
94.0	98.45	329.69	446.54	776.23	478.54	280.72	7.88
95.0	99.50	346.27	425.14	771.41	487.98	280.22	7.75
96.0	100.54	363.00	402.40	765.40	497.14	279.33	7.61
97.0	101.59	379.88	378.32	758.20	505.99	278.06	7.46
98.0	102.64	396.91	358.26	755.16	516.32	278.18	7.36
99.0	103.69	414.08	342.20	756.28	528.15	279.70	7.29
100.0	104.73	431.40	330.17	761.57	541.45	282.62	7.27
101.0	105.78	448.87	322.14	771.01	556.25	286.93	7.29
102.0	106.83	466.48	318.13	784.61	572.53	292.64	7.34
103.0	107.88	484.25	318.13	802.37	590.29	299.74	7.44
104.0	108.92	502.16	318.13	820.28	608.20	306.91	7.53
105.0	109.97	520.21	318.13	838.34	626.26	314.13	7.62
106.0	111.02	538.42	318.13	856.55	644.46	321.41	7.72
107.0	112.06	556.77	318.13	874.90	662.82	328.75	7.81
108.0	113.11	575.27	318.13	893.40	681.32	336.15	7.90
109.0	114.16	593.92	318.13	912.05	699.96	343.61	7.99
110.0	115.21	606.88	318.13	925.01	712.93	348.80	8.03

RESULT FROM TREND (AVERAGED) LINE

TOP LOAD   TOP MOVEMENT   TIP LOAD   TIP MOVEMENT

ton	IN.	ton	IN.
0.3853E-01	0.1703E-04	0.3491E-02	0.1000E-04
0.1926E+00	0.8517E-04	0.1745E-01	0.5000E-04
0.3853E+00	0.1703E-03	0.3491E-01	0.1000E-03
0.1926E+02	0.8517E-02	0.1745E+01	0.5000E-02
0.2889E+02	0.1278E-01	0.2618E+01	0.7500E-02
0.3853E+02	0.1703E-01	0.3491E+01	0.1000E-01
0.9668E+02	0.4264E-01	0.8726E+01	0.2500E-01
0.1934E+03	0.8530E-01	0.1745E+02	0.5000E-01
0.2808E+03	0.1264E+00	0.2618E+02	0.7500E-01
0.3433E+03	0.1629E+00	0.3491E+02	0.1000E+00
0.5912E+03	0.3594E+00	0.8726E+02	0.2500E+00
0.7366E+03	0.6375E+00	0.1461E+03	0.5000E+00
0.7788E+03	0.8662E+00	0.1782E+03	0.7200E+00
0.8596E+03	0.1964E+01	0.2752E+03	0.1800E+01
0.8916E+03	0.3771E+01	0.3086E+03	0.3600E+01

RESULT FROM UPPER-BOUND LINE

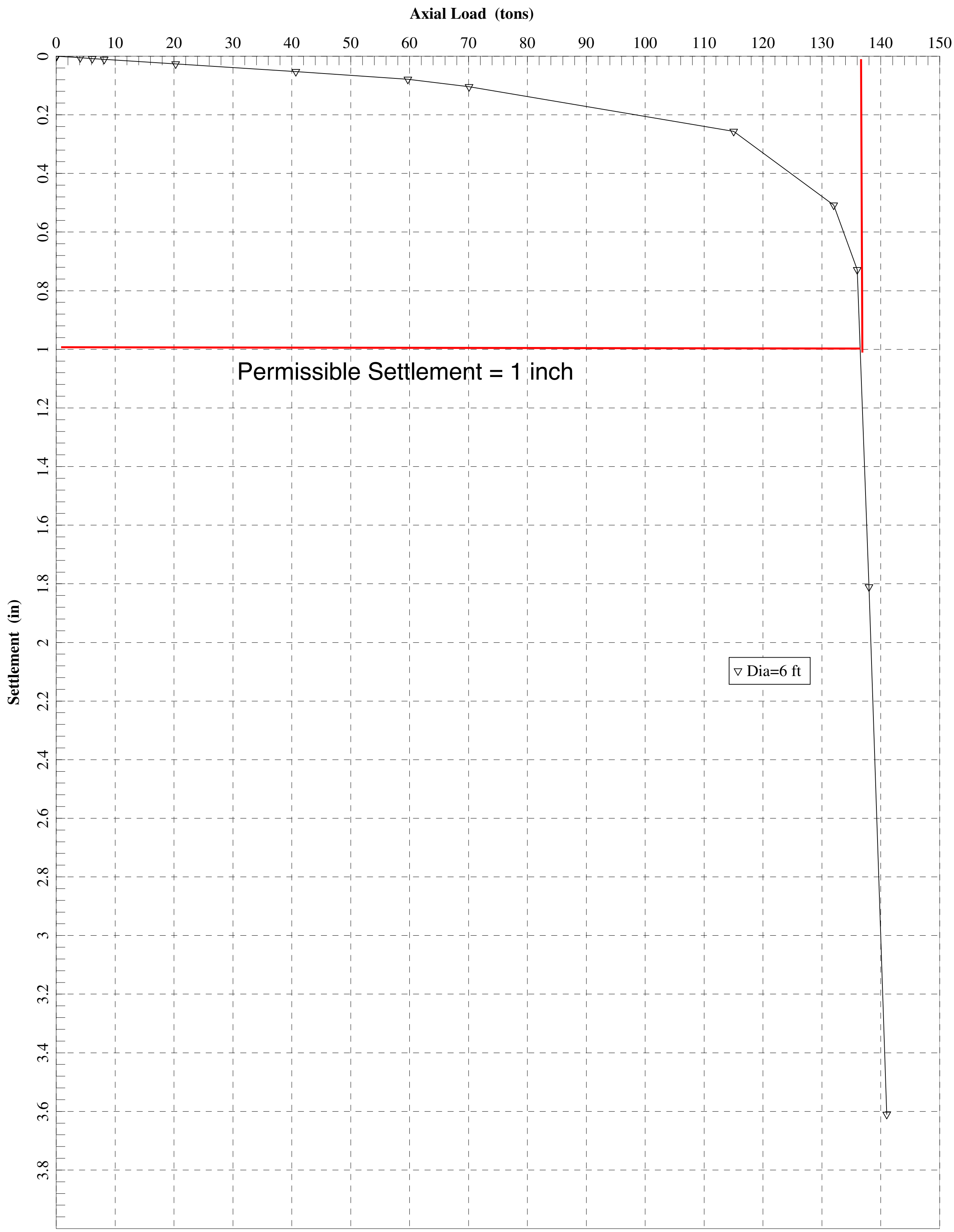
TOP LOAD	TOP MOVEMENT	TIP LOAD	TIP MOVEMENT
ton	IN.	ton	IN.
0.5463E-01	0.1997E-04	0.5214E-02	0.1000E-04
0.2732E+00	0.9984E-04	0.2607E-01	0.5000E-04
0.5463E+00	0.1997E-03	0.5214E-01	0.1000E-03
0.2732E+02	0.9984E-02	0.2607E+01	0.5000E-02
0.4099E+02	0.1498E-01	0.3910E+01	0.7500E-02
0.5479E+02	0.1999E-01	0.5214E+01	0.1000E-01
0.1374E+03	0.5005E-01	0.1303E+02	0.2500E-01
0.2748E+03	0.1001E+00	0.2607E+02	0.5000E-01
0.3920E+03	0.1469E+00	0.3910E+02	0.7500E-01
0.4687E+03	0.1860E+00	0.5214E+02	0.1000E+00
0.7230E+03	0.3845E+00	0.1303E+03	0.2500E+00
0.8408E+03	0.6585E+00	0.2075E+03	0.5000E+00
0.8701E+03	0.8849E+00	0.2386E+03	0.7200E+00
0.9227E+03	0.1977E+01	0.3054E+03	0.1800E+01
0.9338E+03	0.3779E+01	0.3165E+03	0.3600E+01

RESULT FROM LOWER-BOUND LINE

TOP LOAD	TOP MOVEMENT	TIP LOAD	TIP MOVEMENT
ton	IN.	ton	IN.
0.2325E-01	0.1423E-04	0.1767E-02	0.1000E-04
0.1162E+00	0.7117E-04	0.8837E-02	0.5000E-04
0.2325E+00	0.1423E-03	0.1767E-01	0.1000E-03

0.1162E+02	0.7117E-02	0.8837E+00	0.5000E-02
0.1744E+02	0.1068E-01	0.1326E+01	0.7500E-02
0.2325E+02	0.1423E-01	0.1767E+01	0.1000E-01
0.5821E+02	0.3560E-01	0.4418E+01	0.2500E-01
0.1165E+03	0.7122E-01	0.8837E+01	0.5000E-01
0.1726E+03	0.1065E+00	0.1326E+02	0.7500E-01
0.2204E+03	0.1402E+00	0.1767E+02	0.1000E+00
0.4433E+03	0.3313E+00	0.4418E+02	0.2500E+00
0.6316E+03	0.6164E+00	0.8466E+02	0.5000E+00
0.6874E+03	0.8476E+00	0.1177E+03	0.7200E+00
0.7964E+03	0.1952E+01	0.2450E+03	0.1800E+01
0.8477E+03	0.3763E+01	0.2990E+03	0.3600E+01

Settlement Graph Generated with Pile Tip at Elev. 174.0'
Permanent Load = 240 kips =120 tons



Bent 5_72" Diameter Type-II CIDH_Service Limit State_Settlement vs Axial Load

```
=========================================================================

              SHAFT for Windows, Version 2012.7.17

               Serial Number :  291911540

            VERTICALLY LOADED DRILLED SHAFT ANALYSIS
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=========================================================================


Path to file locations      : T:\Ongoing Projects\2016\2016-146-NOC NB101
On-Ramp POC\Calculations\SHAFT Analysis\2019-03\
Name of input data file     : Bent 5_Service Limit State.sfd
Name of output file         : Bent 5_Service Limit State.sfo
Name of plot output file    : Bent 5_Service Limit State.sfp
Name of runtime file        : Bent 5_Service Limit State.sfr


-------------------------------------------------------------------------
                     Time and Date of Analysis
-------------------------------------------------------------------------

          Date:  April 02, 2019     Time:  15:08:34

New Pile


PROPOSED DEPTH =      37.0 FT
----------------


NUMBER OF LAYERS =   12
------------------


WATER TABLE DEPTH =      28.5 FT.
-------------------



FACTOR OF SAFETY APPLIED TO THE ULTIMATE SIDE FRICTION CAPACITY = 2.50
-------------------------------------------------------
FACTOR OF SAFETY APPLIED TO THE ULTIMATE BASE CAPACITY = 3.00
------------------------------------------------------
```



```
SOIL INFORMATION
---------------

LAYER NO 1----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                     = 0.120E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                  = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                       = 0.380E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST       = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                          = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT            = 0.100E+11
  DEPTH, FT                                           = 0.000E+00


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                     = 0.120E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                  = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                       = 0.380E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST       = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                          = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT            = 0.100E+11
  DEPTH, FT                                           = 0.450E+01


LAYER NO 2----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                     = 0.120E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                  = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                       = 0.360E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST       = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                          = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT            = 0.100E+11
  DEPTH, FT                                           = 0.450E+01


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                     = 0.112E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                  = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                       = 0.360E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST       = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                          = 0.125E+03
```

```
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.800E+01


LAYER NO 3----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                  = 0.550E+00
  END BEARING COEFFICIENT-Nc                       = 0.760E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.200E+04
  INTERNAL FRICTION ANGLE, DEG.                    = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                       = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.800E+01


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                  = 0.550E+00
  END BEARING COEFFICIENT-Nc                       = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.200E+04
  INTERNAL FRICTION ANGLE, DEG.                    = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                       = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.150E+02


LAYER NO 4----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                  = 0.550E+00
  END BEARING COEFFICIENT-Nc                       = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.900E+03
  INTERNAL FRICTION ANGLE, DEG.                    = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                       = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.150E+02


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                  = 0.550E+00
  END BEARING COEFFICIENT-Nc                       = 0.900E+01
```



```
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.900E+03
  INTERNAL FRICTION ANGLE, DEG.                    = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                       = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.195E+02


LAYER NO 5----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                  = 0.550E+00
  END BEARING COEFFICIENT-Nc                       = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.150E+04
  INTERNAL FRICTION ANGLE, DEG.                    = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                       = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.195E+02


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                  = 0.550E+00
  END BEARING COEFFICIENT-Nc                       = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.150E+04
  INTERNAL FRICTION ANGLE, DEG.                    = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                       = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.305E+02


LAYER NO 6----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                  = 0.754E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                    = 0.300E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                       = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.305E+02


  AT THE BOTTOM
```

```
  SKIN FRICTION COEFFICIENT- BETA                    = 0.594E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.300E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.450E+02


LAYER NO 7----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                    = 0.594E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.320E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.450E+02


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                    = 0.517E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.320E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.530E+02


LAYER NO 8----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                    = 0.517E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.300E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.530E+02


  AT THE BOTTOM
```



```
  SKIN FRICTION COEFFICIENT- BETA                    = 0.441E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.300E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.615E+02


LAYER NO 9----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
  END BEARING COEFFICIENT-Nc                         = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.800E+03
  INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.615E+02


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
  END BEARING COEFFICIENT-Nc                         = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.800E+03
  INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.715E+02


LAYER NO10----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                    = 0.358E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.360E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.715E+02
```

```
  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                    = 0.281E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.360E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.815E+02


LAYER NO11----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                    = 0.281E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.380E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.815E+02


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                    = 0.250E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.380E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.102E+03


LAYER NO12----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
  END BEARING COEFFICIENT-Nc                         = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.250E+04
  INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.102E+03
```



```
  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
  END BEARING COEFFICIENT-Nc                         = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.250E+04
  INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.110E+03



DRILLED SHAFT INFORMATION
-------------------------

 DIAMETER OF STEM         =    6.000  FT.
 DIAMETER OF BASE         =    6.000  FT.
 END OF STEM TO BASE      =    0.000  FT.
 ANGLE OF BELL            =    0.000  DEG.
 IGNORED TOP PORTION      =   16.500  FT.
 IGNORED BOTTOM PORTION   =    6.000  FT.
 AREA OF ONE PERCENT STEEL =   40.720  SQ.IN.
 ELASTIC MODULUS, Ec      = 0.300E+07 LB/SQ IN
 VOLUME OF UNDERREAM      =    0.000  CU.YDS.



PREDICTED RESULTS
-----------------

QS     = ULTIMATE SIDE RESISTANCE;
QB     = ULTIMATE BASE RESISTANCE;
WT     = WEIGHT OF DRILLED SHAFT (FOR UPLIFT CAPACITY ONLY);
QU     = TOTAL ULTIMATE RESISTANCE;
QBD    = TOTAL ALLOWABLE LOAD USING A FACTOR OF SAFETY
         APPLIED TO THE ULTIMATE BASE RESISTANCE;
QDN    = TOTAL ALLOWABLE LOAD USING FACTORS OF SAFETY
         APPLIED TO THE ULTIMATE SIDE RESISTANCE AND
         THE ULTIMATE BASE RESISTANCE.

LENGTH  VOLUME     QS      QB      QU      QBD     QDN      QU/VOLUME
(FEET)  (CU.YDS) (TONS)   (TONS)  (TONS)   (TONS)  (TONS)  (TONS/CU.YDS)
23.0    24.09     7.00    41.49    48.49    13.91    9.72     23.63
```

24.0	25.14	4.67	87.14	91.81	33.71	30.91	3.65
25.0	26.18	9.33	62.24	71.57	30.08	24.48	2.73
26.0	27.23	14.00	41.49	55.49	27.83	19.43	2.04
27.0	28.28	26.44	24.90	51.34	34.74	18.87	1.82
28.0	29.33	34.22	12.45	46.66	38.37	17.84	1.59
29.0	30.37	41.99	4.15	46.14	43.38	18.18	1.52
30.0	31.42	49.77	0.00	49.77	49.77	19.91	1.58
31.0	32.47	57.55	0.00	57.55	57.55	23.02	1.77
32.0	33.51	65.32	0.00	65.32	65.32	26.13	1.95
33.0	34.56	73.10	0.00	73.10	73.10	29.24	2.12
34.0	35.61	80.88	7.57	88.44	83.40	34.87	2.48
35.0	36.66	88.65	15.88	104.53	93.94	40.75	2.85
36.0	37.70	96.43	24.95	121.37	104.74	46.89	3.22
37.0	38.75	104.20	34.79	138.99	115.80	53.28	3.59

RESULT FROM TREND (AVERAGED) LINE

TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.8131E-02	0.1045E-04	0.3817E-03	0.1000E-04
0.4066E-01	0.5223E-04	0.1909E-02	0.5000E-04
0.8131E-01	0.1045E-03	0.3817E-02	0.1000E-03
0.4066E+01	0.5223E-02	0.1909E+00	0.5000E-02
0.6098E+01	0.7834E-02	0.2863E+00	0.7500E-02
0.8131E+01	0.1045E-01	0.3817E+00	0.1000E-01
0.2033E+02	0.2611E-01	0.9543E+00	0.2500E-01
0.4066E+02	0.5223E-01	0.1909E+01	0.5000E-01
0.5967E+02	0.7827E-01	0.2863E+01	0.7500E-01
0.7012E+02	0.1039E+00	0.3817E+01	0.1000E+00
0.1147E+03	0.2565E+00	0.9543E+01	0.2500E+00
0.1320E+03	0.5076E+00	0.1597E+02	0.5000E+00
0.1358E+03	0.7279E+00	0.1948E+02	0.7200E+00
0.1379E+03	0.1808E+01	0.3009E+02	0.1800E+01
0.1414E+03	0.3608E+01	0.3375E+02	0.3600E+01

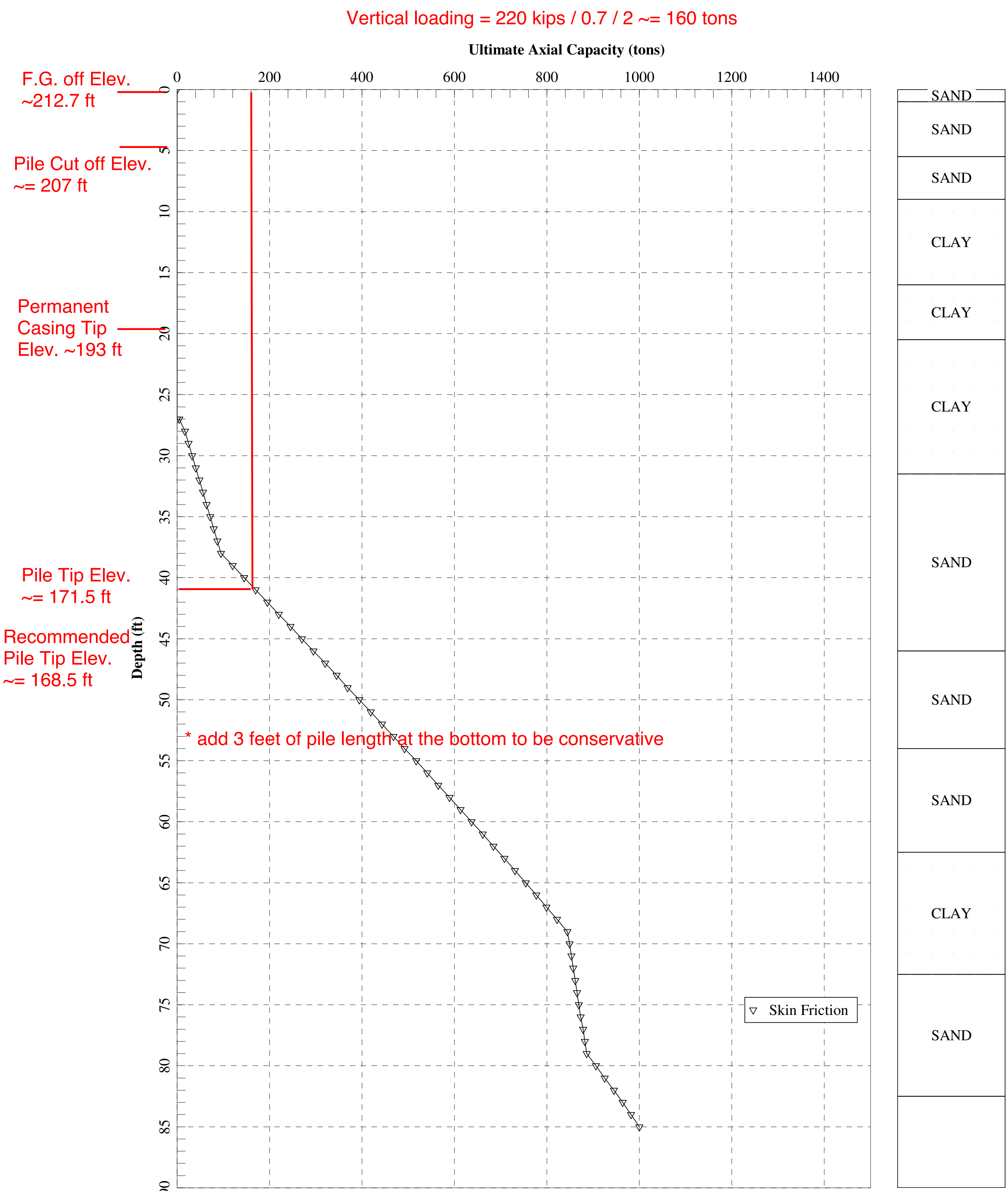
RESULT FROM UPPER-BOUND LINE

TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.1163E-01	0.1063E-04	0.5702E-03	0.1000E-04
0.5815E-01	0.5317E-04	0.2851E-02	0.5000E-04
0.1163E+00	0.1063E-03	0.5702E-02	0.1000E-03
0.5815E+01	0.5317E-02	0.2851E+00	0.5000E-02
0.8722E+01	0.7975E-02	0.4276E+00	0.7500E-02

0.1163E+02	0.1063E-01	0.5702E+00	0.1000E-01
0.2907E+02	0.2658E-01	0.1425E+01	0.2500E-01
0.5819E+02	0.5317E-01	0.2851E+01	0.5000E-01
0.8468E+02	0.7963E-01	0.4276E+01	0.7500E-01
0.9568E+02	0.1053E+00	0.5702E+01	0.1000E+00
0.1323E+03	0.2576E+00	0.1425E+02	0.2500E+00
0.1473E+03	0.5086E+00	0.2269E+02	0.5000E+00
0.1499E+03	0.7288E+00	0.2609E+02	0.7200E+00
0.1499E+03	0.1809E+01	0.3340E+02	0.1800E+01
0.1511E+03	0.3609E+01	0.3462E+02	0.3600E+01

RESULT FROM LOWER-BOUND LINE

TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.4760E-02	0.1026E-04	0.1933E-03	0.1000E-04
0.2380E-01	0.5131E-04	0.9664E-03	0.5000E-04
0.4760E-01	0.1026E-03	0.1933E-02	0.1000E-03
0.2380E+01	0.5131E-02	0.9664E-01	0.5000E-02
0.3570E+01	0.7697E-02	0.1450E+00	0.7500E-02
0.4760E+01	0.1026E-01	0.1933E+00	0.1000E-01
0.1190E+02	0.2566E-01	0.4832E+00	0.2500E-01
0.2380E+02	0.5131E-01	0.9664E+00	0.5000E-01
0.3541E+02	0.7695E-01	0.1450E+01	0.7500E-01
0.4503E+02	0.1025E+00	0.1933E+01	0.1000E+00
0.8908E+02	0.2550E+00	0.4832E+01	0.2500E+00
0.1166E+03	0.5066E+00	0.9258E+01	0.5000E+00
0.1217E+03	0.7270E+00	0.1287E+02	0.7200E+00
0.1259E+03	0.1808E+01	0.2679E+02	0.1800E+01
0.1316E+03	0.3608E+01	0.3270E+02	0.3600E+01



Abutment 6_72" Diameter Type-II CIDH_Strength Limit State

```
======================================================================

                SHAFT for Windows, Version 2012.7.17

                 Serial Number :  291911540

              VERTICALLY LOADED DRILLED SHAFT ANALYSIS
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======================================================================


Path to file locations      : T:\Ongoing Projects\2016\2016-146-NOC NB101
On-Ramp POC\Calculations\SHAFT Analysis\2019-03\
Name of input data file     : Abut 6_Strength Limit State.sfd
Name of output file         : Abut 6_Strength Limit State.sfo
Name of plot output file    : Abut 6_Strength Limit State.sfp
Name of runtime file        : Abut 6_Strength Limit State.sfr


----------------------------------------------------------------------
                    Time and Date of Analysis
----------------------------------------------------------------------

          Date:  March 29, 2019     Time:  18:22:01

New Pile


PROPOSED DEPTH =      85.0 FT
----------------


NUMBER OF LAYERS =   13
------------------


WATER TABLE DEPTH =      29.5 FT.
-------------------



FACTOR OF SAFETY APPLIED TO THE ULTIMATE SIDE FRICTION CAPACITY = 2.50
-------------------------------------------------------
FACTOR OF SAFETY APPLIED TO THE ULTIMATE BASE CAPACITY = 3.00
------------------------------------------------------
```



```
SOIL INFORMATION
---------------

LAYER NO 1----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                   = 0.120E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.380E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.625E+02
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.000E+00


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                   = 0.120E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.380E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.625E+02
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.100E+01


LAYER NO 2----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                   = 0.120E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.380E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.100E+01


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                   = 0.118E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.380E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
```

```
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.550E+01


LAYER NO 3----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                  = 0.118E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                    = 0.360E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                       = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.550E+01


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                  = 0.110E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                    = 0.360E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                       = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.900E+01


LAYER NO 4----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                  = 0.550E+00
  END BEARING COEFFICIENT-Nc                       = 0.780E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.200E+04
  INTERNAL FRICTION ANGLE, DEG.                    = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                       = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.900E+01


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                  = 0.550E+00
  END BEARING COEFFICIENT-Nc                       = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.200E+04
  INTERNAL FRICTION ANGLE, DEG.                    = 0.000E+00
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  BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                       = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.160E+02


LAYER NO 5----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                  = 0.550E+00
  END BEARING COEFFICIENT-Nc                       = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.900E+03
  INTERNAL FRICTION ANGLE, DEG.                    = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                       = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.160E+02


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                  = 0.550E+00
  END BEARING COEFFICIENT-Nc                       = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.900E+03
  INTERNAL FRICTION ANGLE, DEG.                    = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                       = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.205E+02


LAYER NO 6----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                  = 0.550E+00
  END BEARING COEFFICIENT-Nc                       = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.150E+04
  INTERNAL FRICTION ANGLE, DEG.                    = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                       = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.205E+02


  AT THE BOTTOM
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  STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
  END BEARING COEFFICIENT-Nc                         = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.150E+04
  INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.315E+02


LAYER NO 7----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                    = 0.742E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.300E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.315E+02


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                    = 0.584E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.300E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.460E+02


LAYER NO 8----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                    = 0.584E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.320E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.460E+02


  AT THE BOTTOM
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  SKIN FRICTION COEFFICIENT- BETA                    = 0.508E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.320E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.540E+02


LAYER NO 9----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                    = 0.508E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.300E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.540E+02


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                    = 0.433E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.300E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.625E+02


LAYER NO10----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
  END BEARING COEFFICIENT-Nc                         = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.800E+03
  INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.625E+02
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  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.800E+03
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.725E+02


LAYER NO11----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                   = 0.351E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.360E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.725E+02


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                   = 0.274E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.360E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.825E+02

LAYER NO12----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                   = 0.274E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.380E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.825E+02
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  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                   = 0.250E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.380E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.104E+03


LAYER NO13----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.250E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.104E+03


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.250E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.110E+03



DRILLED SHAFT INFORMATION
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 DIAMETER OF STEM         =    6.000  FT.
 DIAMETER OF BASE         =    6.000  FT.
 END OF STEM TO BASE      =    0.000  FT.
 ANGLE OF BELL            =    0.000  DEG.
 IGNORED TOP PORTION      =   19.500  FT.
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IGNORED BOTTOM PORTION = 6.000 FT.
AREA OF ONE PERCENT STEEL = 40.720 SQ.IN.
ELASTIC MODULUS, Ec = 0.300E+07 LB/SQ IN
VOLUME OF UNDERREAM = 0.000 CU.YDS.

PREDICTED RESULTS

QS = ULTIMATE SIDE RESISTANCE;
QB = ULTIMATE BASE RESISTANCE;
WT = WEIGHT OF DRILLED SHAFT (FOR UPLIFT CAPACITY ONLY);
QU = TOTAL ULTIMATE RESISTANCE;
QBD = TOTAL ALLOWABLE LOAD USING A FACTOR OF SAFETY APPLIED TO THE ULTIMATE BASE RESISTANCE;
QDN = TOTAL ALLOWABLE LOAD USING FACTORS OF SAFETY APPLIED TO THE ULTIMATE SIDE RESISTANCE AND THE ULTIMATE BASE RESISTANCE.

LENGTH (FEET)	VOLUME (CU.YDS)	QS (TONS)	QB (TONS)	QU (TONS)	QBD (TONS)	QDN (TONS)	QU/VOLUME (TONS/CU.YDS)
26.0	27.23	12.44	12.45	24.89	14.52	7.05	21.57
27.0	28.28	4.67	41.49	46.16	18.50	15.70	1.63
28.0	29.33	17.11	24.90	42.01	25.41	15.14	1.43
29.0	30.37	24.88	12.45	37.33	29.03	14.10	1.23
30.0	31.42	32.66	4.15	36.81	34.04	14.45	1.17
31.0	32.47	40.44	0.00	40.44	40.44	16.18	1.25
32.0	33.51	48.21	0.00	48.21	48.21	19.29	1.44
33.0	34.56	55.99	0.00	55.99	55.99	22.40	1.62
34.0	35.61	63.77	0.00	63.77	63.77	25.51	1.79
35.0	36.66	71.54	7.73	79.27	74.12	31.19	2.16
36.0	37.70	79.32	16.22	95.54	84.73	37.13	2.53
37.0	38.75	87.10	25.48	112.57	95.59	43.33	2.91
38.0	39.80	94.87	35.52	130.40	106.71	49.79	3.28
39.0	40.85	119.84	46.36	166.21	135.30	63.39	4.07
40.0	41.89	144.83	58.02	202.85	164.17	77.27	4.84
41.0	42.94	169.83	68.11	237.94	192.54	90.64	5.54
42.0	43.99	194.84	76.61	271.45	220.37	103.47	6.17
43.0	45.04	219.84	74.44	294.27	244.65	112.75	6.53
44.0	46.08	244.82	69.73	314.55	268.07	121.17	6.83
45.0	47.13	269.79	62.44	332.24	290.61	128.73	7.05
46.0	48.18	294.73	52.53	347.26	312.24	135.40	7.21
47.0	49.22	319.64	41.71	361.35	333.54	141.76	7.34
48.0	50.27	344.51	29.98	374.49	354.50	147.80	7.45
49.0	51.32	369.32	20.11	389.44	376.03	154.43	7.59
50.0	52.37	394.08	12.14	406.23	398.13	161.68	7.76

51.0	53.41	418.78	6.11	424.89	420.81	169.55	7.95
52.0	54.46	443.40	11.64	455.04	447.28	181.24	8.36
53.0	55.51	467.95	19.92	487.87	474.59	193.82	8.79
54.0	56.56	492.41	30.98	523.39	502.74	207.29	9.25
55.0	57.60	516.78	42.79	559.56	531.04	220.97	9.71
56.0	58.65	541.05	55.33	596.37	559.49	234.86	10.17
57.0	59.70	565.21	68.60	633.82	588.08	248.95	10.62
58.0	60.75	589.26	79.67	668.93	615.82	262.26	11.01
59.0	61.79	613.19	88.52	701.71	642.70	274.78	11.36
60.0	62.84	636.99	95.16	732.15	668.71	286.52	11.65
61.0	63.89	660.66	99.59	760.25	693.86	297.46	11.90
62.0	64.93	684.19	121.81	806.00	724.79	314.28	12.41
63.0	65.98	707.57	143.36	850.93	755.36	330.82	12.90
64.0	67.03	730.79	166.46	897.25	786.28	347.80	13.39
65.0	68.08	753.86	191.09	944.94	817.55	365.24	13.88
66.0	69.12	776.75	217.26	994.01	849.17	383.12	14.38
67.0	70.17	799.47	244.97	1044.44	881.13	401.44	14.88
68.0	71.22	822.01	268.06	1090.07	911.37	418.16	15.31
69.0	72.27	844.37	286.53	1130.90	939.88	433.26	15.65
70.0	73.31	848.51	300.38	1148.90	948.64	439.53	15.67
71.0	74.36	852.66	309.62	1162.28	955.87	444.27	15.63
72.0	75.41	856.81	331.99	1188.80	967.47	453.39	15.76
73.0	76.46	860.96	351.12	1212.07	978.00	461.42	15.85
74.0	77.50	865.10	371.60	1236.71	988.97	469.91	15.96
75.0	78.55	869.25	393.46	1262.71	1000.40	478.85	16.08
76.0	79.60	873.40	416.67	1290.07	1012.29	488.25	16.21
77.0	80.64	877.55	441.26	1318.81	1024.63	498.10	16.35
78.0	81.69	881.69	461.75	1343.44	1035.61	506.59	16.45
79.0	82.74	885.84	478.14	1363.98	1045.22	513.72	16.49
80.0	83.79	905.71	490.43	1396.14	1069.18	525.76	16.66
81.0	84.83	925.31	498.62	1423.93	1091.52	536.33	16.78
82.0	85.88	944.65	502.72	1447.37	1112.22	545.43	16.85
83.0	86.93	963.71	502.72	1466.43	1131.28	553.06	16.87
84.0	87.98	982.48	502.72	1485.20	1150.06	560.57	16.88
85.0	89.02	1000.97	502.72	1503.69	1168.54	567.96	16.89

RESULT FROM TREND (AVERAGED) LINE

TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.6546E-01	0.1720E-04	0.5516E-02	0.1000E-04
0.3273E+00	0.8598E-04	0.2758E-01	0.5000E-04
0.6546E+00	0.1720E-03	0.5516E-01	0.1000E-03
0.3273E+02	0.8598E-02	0.2758E+01	0.5000E-02
0.4910E+02	0.1290E-01	0.4137E+01	0.7500E-02
0.6546E+02	0.1720E-01	0.5516E+01	0.1000E-01

0.1642E+03	0.4304E-01	0.1379E+02	0.2500E-01
0.3286E+03	0.8609E-01	0.2758E+02	0.5000E-01
0.4672E+03	0.1270E+00	0.4137E+02	0.7500E-01
0.5739E+03	0.1641E+00	0.5516E+02	0.1000E+00
0.9658E+03	0.3616E+00	0.1379E+03	0.2500E+00
0.1200E+04	0.6425E+00	0.2308E+03	0.5000E+00
0.1266E+04	0.8727E+00	0.2815E+03	0.7200E+00
0.1396E+04	0.1976E+01	0.4349E+03	0.1800E+01
0.1447E+04	0.3784E+01	0.4876E+03	0.3600E+01

RESULT FROM UPPER-BOUND LINE

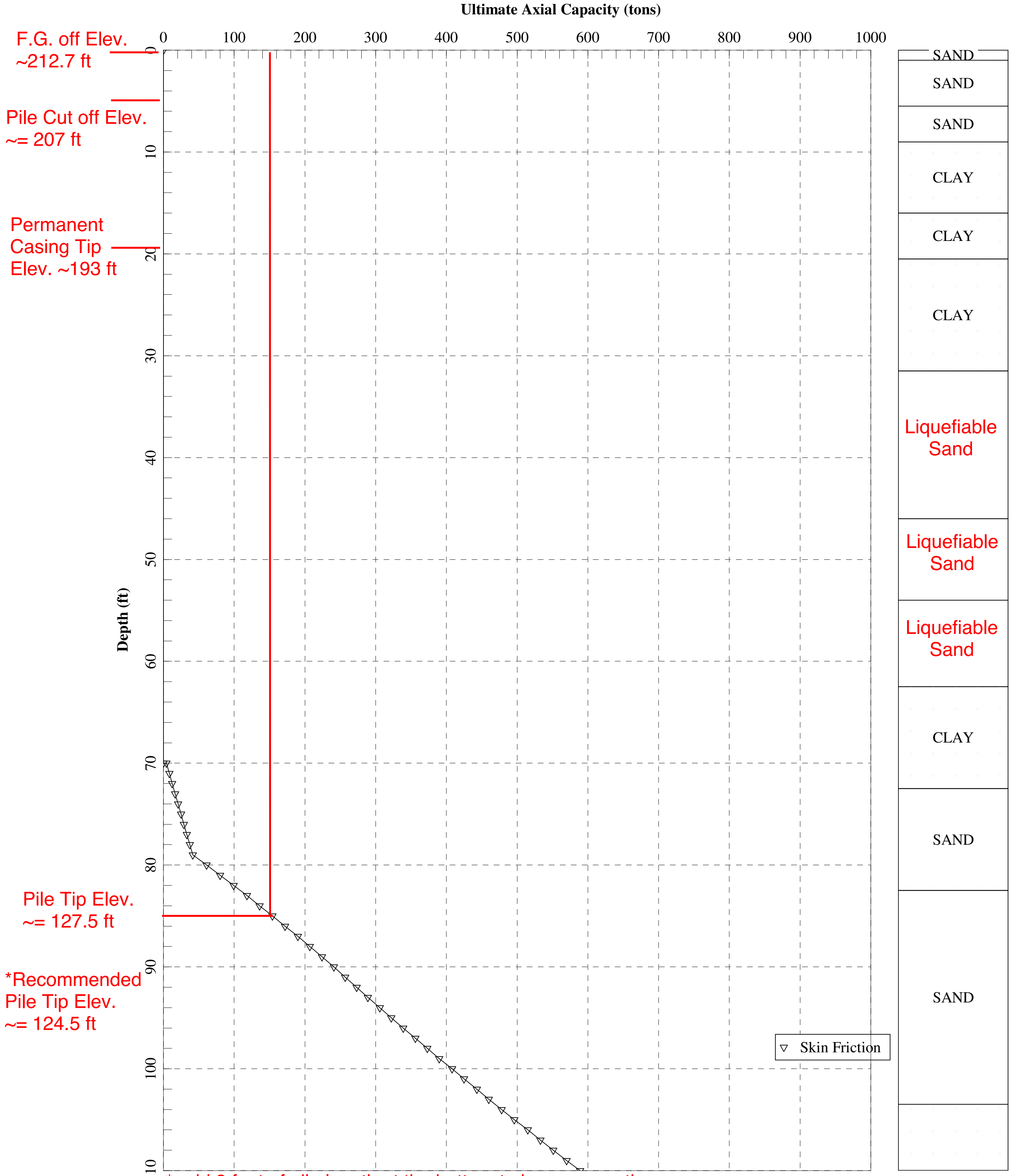
TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.9458E-01	0.2033E-04	0.8239E-02	0.1000E-04
0.4729E+00	0.1016E-03	0.4120E-01	0.5000E-04
0.9458E+00	0.2033E-03	0.8239E-01	0.1000E-03
0.4729E+02	0.1016E-01	0.4120E+01	0.5000E-02
0.7093E+02	0.1524E-01	0.6179E+01	0.7500E-02
0.9477E+02	0.2034E-01	0.8239E+01	0.1000E-01
0.2376E+03	0.5091E-01	0.2060E+02	0.2500E-01
0.4731E+03	0.1017E+00	0.4120E+02	0.5000E-01
0.6547E+03	0.1479E+00	0.6179E+02	0.7500E-01
0.7879E+03	0.1882E+00	0.8239E+02	0.1000E+00
0.1181E+04	0.3888E+00	0.2060E+03	0.2500E+00
0.1363E+04	0.6659E+00	0.3279E+03	0.5000E+00
0.1410E+04	0.8939E+00	0.3770E+03	0.7200E+00
0.1496E+04	0.1989E+01	0.4826E+03	0.1800E+01
0.1514E+04	0.3792E+01	0.5002E+03	0.3600E+01

RESULT FROM LOWER-BOUND LINE

TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.3889E-01	0.1428E-04	0.2793E-02	0.1000E-04
0.1944E+00	0.7142E-04	0.1396E-01	0.5000E-04
0.3889E+00	0.1428E-03	0.2793E-01	0.1000E-03
0.1944E+02	0.7142E-02	0.1396E+01	0.5000E-02
0.2916E+02	0.1071E-01	0.2095E+01	0.7500E-02
0.3889E+02	0.1428E-01	0.2793E+01	0.1000E-01
0.9731E+02	0.3571E-01	0.6982E+01	0.2500E-01
0.1948E+03	0.7145E-01	0.1396E+02	0.5000E-01
0.2867E+03	0.1067E+00	0.2095E+02	0.7500E-01
0.3663E+03	0.1405E+00	0.2793E+02	0.1000E+00

0.7274E+03	0.3319E+00	0.6982E+02	0.2500E+00
0.1034E+04	0.6188E+00	0.1338E+03	0.5000E+00
0.1121E+04	0.8514E+00	0.1860E+03	0.7200E+00
0.1297E+04	0.1962E+01	0.3871E+03	0.1800E+01
0.1377E+04	0.3776E+01	0.4726E+03	0.3600E+01

Vertical loading = 140 kips / 2 = 70 tons
Downdrag = 72 tons, therefore,
total demand = 70 tons + 72 tons = 142 tons



* add 3 feet of pile length at the bottom to be conservative

Abutment 6_72" Diameter Type-II CIDH_Extreme Event Limit State

Downdrag Forces on Circular Piles

Project No	2016-146-NOC	FG Elev.	212.7	Analysis By:	JZ
Project	NB 101 ON-RAMP POC	Pile Cut-off.	207	Date:	3/29/2019
Location	Abutment 6 -1 rows				
Boring	R-18-NO-003				
Single Pile Dia. (ft)	6				
GW Depth (ft)	31.5				
Bulk Unit Weight (pcf)	125				
Pile Length (ft)	110				
# of Equiv. Pile Circumference	1				

Layer Number	Layer Thickness (ft)	Soil Type	Beta	Consider downdrag (y/n)	Total Depth (ft)	Layer Mid-Point Depth (ft)	Effective Stress (psf)	Contributing Thickness (ft)	Unit Negative Friction (ft)	Downdrag Force per Section (ton)	Total Downdrag Force (ton)	Remarks
1a	5.70	SM	0.30	n	5.70	2.85	356	5.7	107	0.0		Above Cut-off
1b	0.50	SM	0.30	n	6.20	5.95	744	0.5	223	0.0		
2	3.50	SM	0.30	n	9.70	7.95	994	3.5	298	0.0		Permanent Casing
3	7.00	CL	0.20	n	16.70	13.20	1650	7.0	330	0.0		
4a	3.50	ML	0.20	n	20.20	18.45	2306	3.5	461	0.0		
4b	1.00	ML	0.20	y	21.20	20.70	2588	1.0	518	4.9	4.9	Downdrag Contributing
5	11.00	ML	0.20	y	32.20	25.70	3213	11.0	643	66.6	71.5	
6	14.50	SM	0.30	n	46.70	39.45	4435	14.5	1331	0.0		Liquefied
7	8.00	SC	0.30	n	54.70	50.70	5139	8.0	1542	0.0		
8	8.50	SM	0.30	n	63.20	58.95	5656	8.5	1697	0.0		
9	10.00	ML	0.25	n	73.20	68.20	6235	10.0	1559	0.0		Below Liquefied
10	10.00	GP-GM	0.35	n	83.20	78.20	6861	10.0	2401	0.0		
11	21.00	SM	0.30	n	104.20	93.70	7831	21.0	2349	0.0		
12	5.50	CL	0.20	n	109.70	106.95	8661	5.5	1732	0.0		

Notes Area

Downdrag for the CIDH pile is ~72 tons

```
=========================================================================

                 SHAFT for Windows, Version 2012.7.17

                  Serial Number :  291911540

                VERTICALLY LOADED DRILLED SHAFT ANALYSIS
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=========================================================================


Path to file locations      : T:\Ongoing Projects\2016\2016-146-NOC NB101
On-Ramp POC\Calculations\SHAFT Analysis\2019-03\
Name of input data file     : Abut 6_Extreme Limit State.sfd
Name of output file         : Abut 6_Extreme Limit State.sfo
Name of plot output file    : Abut 6_Extreme Limit State.sfp
Name of runtime file        : Abut 6_Extreme Limit State.sfr


-------------------------------------------------------------------------
                   Time and Date of Analysis
-------------------------------------------------------------------------

          Date:  March 29, 2019     Time:  18:01:43

New Pile


PROPOSED DEPTH =     110.0 FT
----------------


NUMBER OF LAYERS =   13
------------------


WATER TABLE DEPTH =      29.5 FT.
-------------------



FACTOR OF SAFETY APPLIED TO THE ULTIMATE SIDE FRICTION CAPACITY = 2.50
-------------------------------------------------------
FACTOR OF SAFETY APPLIED TO THE ULTIMATE BASE CAPACITY = 3.00
------------------------------------------------------
```



```
SOIL INFORMATION
---------------

LAYER NO 1----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                    = 0.120E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.380E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.625E+02
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.000E+00


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                    = 0.120E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.380E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.625E+02
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.100E+01


LAYER NO 2----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                    = 0.120E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.380E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.100E+01


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                    = 0.118E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.380E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
```

```
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.550E+01


LAYER NO 3----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                  = 0.118E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                    = 0.360E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                       = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.550E+01


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                  = 0.110E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                    = 0.360E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                       = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.900E+01


LAYER NO 4----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                  = 0.550E+00
  END BEARING COEFFICIENT-Nc                       = 0.780E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.200E+04
  INTERNAL FRICTION ANGLE, DEG.                    = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                       = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.900E+01


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                  = 0.550E+00
  END BEARING COEFFICIENT-Nc                       = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.200E+04
  INTERNAL FRICTION ANGLE, DEG.                    = 0.000E+00
```



```
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                       = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.160E+02


LAYER NO 5----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                  = 0.550E+00
  END BEARING COEFFICIENT-Nc                       = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.900E+03
  INTERNAL FRICTION ANGLE, DEG.                    = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                       = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.160E+02


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                  = 0.550E+00
  END BEARING COEFFICIENT-Nc                       = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.900E+03
  INTERNAL FRICTION ANGLE, DEG.                    = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                       = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.205E+02


LAYER NO 6----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                  = 0.550E+00
  END BEARING COEFFICIENT-Nc                       = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.150E+04
  INTERNAL FRICTION ANGLE, DEG.                    = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                       = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.205E+02


  AT THE BOTTOM
```

```
  STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
  END BEARING COEFFICIENT-Nc                         = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.150E+04
  INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.315E+02


LAYER NO 7----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                    = 0.742E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.300E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.315E+02


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                    = 0.584E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.300E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.460E+02


LAYER NO 8----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                    = 0.584E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.320E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.460E+02


  AT THE BOTTOM
```



```
  SKIN FRICTION COEFFICIENT- BETA                    = 0.508E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.320E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.540E+02


LAYER NO 9----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                    = 0.508E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.300E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.540E+02


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                    = 0.433E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.300E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.625E+02


LAYER NO10----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
  END BEARING COEFFICIENT-Nc                         = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.800E+03
  INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.625E+02
```

```
  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
  END BEARING COEFFICIENT-Nc                         = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.800E+03
  INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.725E+02


LAYER NO11----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                    = 0.351E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.360E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.725E+02


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                    = 0.274E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.360E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.825E+02

LAYER NO12----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                    = 0.274E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.380E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.825E+02
```



```
  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                    = 0.250E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.380E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.104E+03


LAYER NO13----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
  END BEARING COEFFICIENT-Nc                         = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.250E+04
  INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.104E+03


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
  END BEARING COEFFICIENT-Nc                         = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.250E+04
  INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.125E+03



DRILLED SHAFT INFORMATION
-------------------------

 DIAMETER OF STEM          =    6.000  FT.
 DIAMETER OF BASE          =    6.000  FT.
 END OF STEM TO BASE       =    0.000  FT.
 ANGLE OF BELL             =    0.000  DEG.
 IGNORED TOP PORTION       =   63.000  FT.
```

IGNORED BOTTOM PORTION = 6.000 FT.
AREA OF ONE PERCENT STEEL = 40.720 SQ.IN.
ELASTIC MODULUS, Ec = 0.300E+07 LB/SQ IN
VOLUME OF UNDERREAM = 0.000 CU.YDS.

PREDICTED RESULTS

QS = ULTIMATE SIDE RESISTANCE;
QB = ULTIMATE BASE RESISTANCE;
WT = WEIGHT OF DRILLED SHAFT (FOR UPLIFT CAPACITY ONLY);
QU = TOTAL ULTIMATE RESISTANCE;
QBD = TOTAL ALLOWABLE LOAD USING A FACTOR OF SAFETY APPLIED TO THE ULTIMATE BASE RESISTANCE;
QDN = TOTAL ALLOWABLE LOAD USING FACTORS OF SAFETY APPLIED TO THE ULTIMATE SIDE RESISTANCE AND THE ULTIMATE BASE RESISTANCE.

LENGTH (FEET)	VOLUME (CU.YDS)	QS (TONS)	QB (TONS)	QU (TONS)	QBD (TONS)	QDN (TONS)	QU/VOLUME (TONS/CU.YDS)
70.0	73.31	4.15	300.38	304.53	104.28	101.79	4.15
71.0	74.36	8.29	309.62	317.92	111.50	106.52	4.28
72.0	75.41	12.44	331.99	344.44	123.11	115.64	4.57
73.0	76.46	16.59	351.12	367.71	133.63	123.67	4.81
74.0	77.50	20.74	371.60	392.34	144.60	132.16	5.06
75.0	78.55	24.88	393.46	418.34	156.04	141.11	5.33
76.0	79.60	29.03	416.67	445.71	167.92	150.50	5.60
77.0	80.64	33.18	441.26	474.44	180.27	160.36	5.88
78.0	81.69	37.33	461.75	499.07	191.24	168.85	6.11
79.0	82.74	41.47	478.14	519.61	200.85	175.97	6.28
80.0	83.79	60.94	490.43	551.37	224.42	187.85	6.58
81.0	84.83	80.16	498.62	578.78	246.36	198.27	6.82
82.0	85.88	99.11	502.72	601.83	266.68	207.22	7.01
83.0	86.93	117.79	502.72	620.51	285.37	214.69	7.14
84.0	87.98	136.21	502.72	638.93	303.78	222.06	7.26
85.0	89.02	154.34	502.72	657.06	321.92	229.31	7.38
86.0	90.07	172.19	502.72	674.91	339.77	236.45	7.49
87.0	91.12	189.75	502.72	692.47	357.32	243.47	7.60
88.0	92.17	207.01	502.72	709.73	374.59	250.38	7.70
89.0	93.21	223.97	502.72	726.69	391.55	257.16	7.80
90.0	94.26	240.62	502.72	743.34	408.20	263.82	7.89
91.0	95.31	256.96	502.72	759.68	424.53	270.36	7.97
92.0	96.35	273.10	502.72	775.82	440.67	276.81	8.05
93.0	97.40	289.39	485.33	774.72	451.16	277.53	7.95
94.0	98.45	305.82	466.60	772.43	461.36	277.86	7.85

95.0	99.50	322.40	446.54	768.94	471.25	277.81	7.73
96.0	100.54	339.13	425.14	764.27	480.85	277.37	7.60
97.0	101.59	356.01	402.40	758.41	490.14	276.54	7.47
98.0	102.64	373.04	378.32	751.36	499.14	275.32	7.32
99.0	103.69	390.21	358.26	748.47	509.63	275.50	7.22
100.0	104.73	407.53	342.20	749.74	521.60	277.08	7.16
101.0	105.78	425.00	330.17	755.16	535.05	280.05	7.14
102.0	106.83	442.61	322.14	764.75	549.99	284.43	7.16
103.0	107.88	460.38	318.13	778.50	566.42	290.19	7.22
104.0	108.92	478.29	318.13	796.41	584.33	297.36	7.31
105.0	109.97	496.34	318.13	814.47	602.39	304.58	7.41
106.0	111.02	514.55	318.13	832.68	620.59	311.86	7.50
107.0	112.06	532.90	318.13	851.03	638.95	319.20	7.59
108.0	113.11	551.40	318.13	869.53	657.45	326.60	7.69
109.0	114.16	570.05	318.13	888.18	676.09	334.06	7.78
110.0	115.21	588.85	318.13	906.97	694.89	341.58	7.87

RESULT FROM TREND (AVERAGED) LINE

TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.3714E-01	0.1681E-04	0.3491E-02	0.1000E-04
0.1857E+00	0.8405E-04	0.1745E-01	0.5000E-04
0.3714E+00	0.1681E-03	0.3491E-01	0.1000E-03
0.1857E+02	0.8405E-02	0.1745E+01	0.5000E-02
0.2785E+02	0.1261E-01	0.2618E+01	0.7500E-02
0.3714E+02	0.1681E-01	0.3491E+01	0.1000E-01
0.9319E+02	0.4208E-01	0.8726E+01	0.2500E-01
0.1865E+03	0.8419E-01	0.1745E+02	0.5000E-01
0.2711E+03	0.1249E+00	0.2618E+02	0.7500E-01
0.3323E+03	0.1612E+00	0.3491E+02	0.1000E+00
0.5760E+03	0.3571E+00	0.8726E+02	0.2500E+00
0.7216E+03	0.6354E+00	0.1461E+03	0.5000E+00
0.7643E+03	0.8642E+00	0.1782E+03	0.7200E+00
0.8472E+03	0.1963E+01	0.2752E+03	0.1800E+01
0.8792E+03	0.3769E+01	0.3086E+03	0.3600E+01

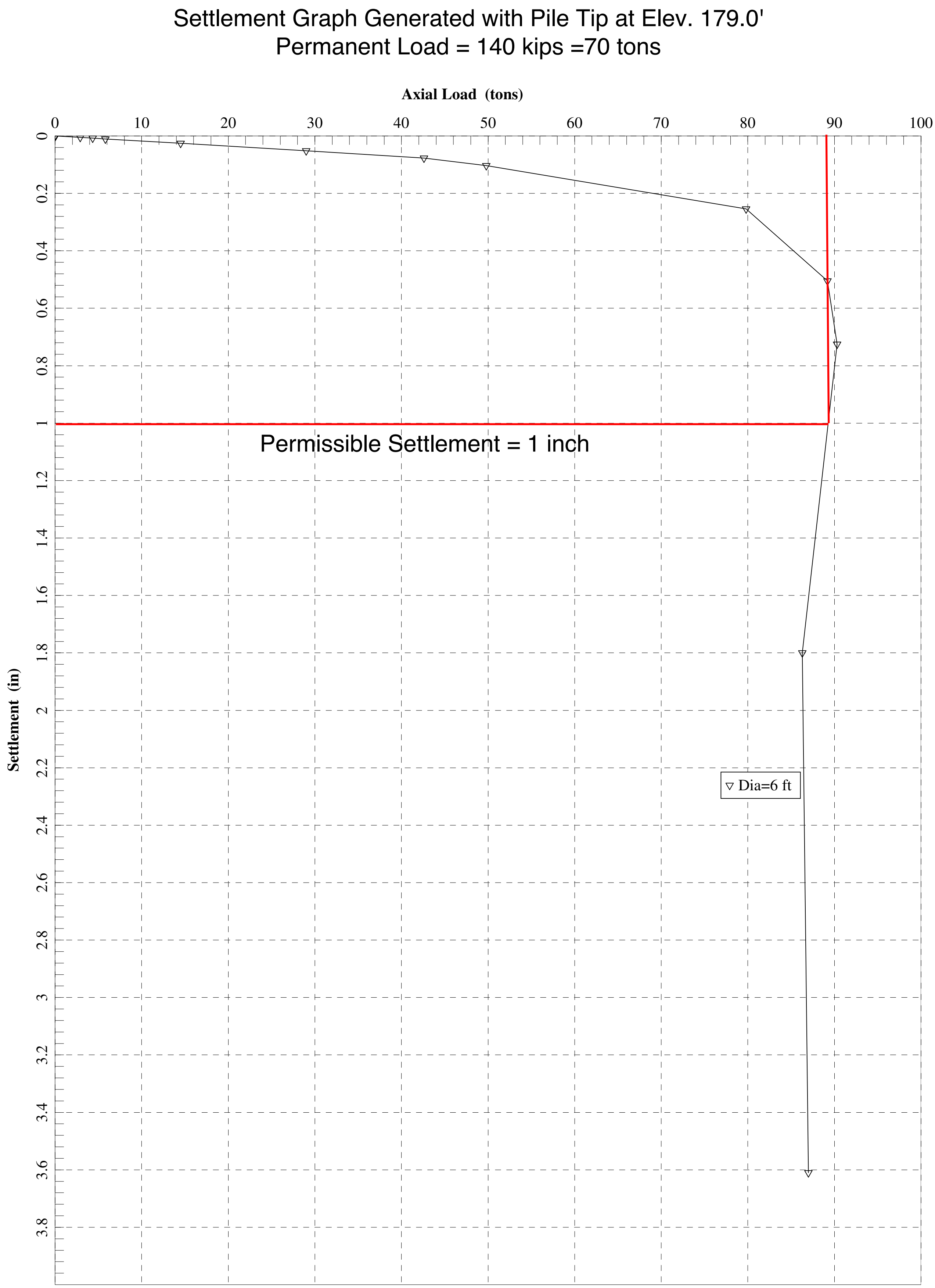
RESULT FROM UPPER-BOUND LINE

TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.5250E-01	0.1962E-04	0.5214E-02	0.1000E-04
0.2625E+00	0.9811E-04	0.2607E-01	0.5000E-04
0.5250E+00	0.1962E-03	0.5214E-01	0.1000E-03

0.2625E+02	0.9811E-02	0.2607E+01	0.5000E-02
0.3938E+02	0.1472E-01	0.3910E+01	0.7500E-02
0.5263E+02	0.1964E-01	0.5214E+01	0.1000E-01
0.1320E+03	0.4918E-01	0.1303E+02	0.2500E-01
0.2641E+03	0.9838E-01	0.2607E+02	0.5000E-01
0.3776E+03	0.1446E+00	0.3910E+02	0.7500E-01
0.4534E+03	0.1836E+00	0.5214E+02	0.1000E+00
0.7071E+03	0.3822E+00	0.1303E+03	0.2500E+00
0.8248E+03	0.6562E+00	0.2075E+03	0.5000E+00
0.8543E+03	0.8827E+00	0.2386E+03	0.7200E+00
0.9088E+03	0.1975E+01	0.3054E+03	0.1800E+01
0.9199E+03	0.3777E+01	0.3165E+03	0.3600E+01

RESULT FROM LOWER-BOUND LINE

TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.2252E-01	0.1412E-04	0.1767E-02	0.1000E-04
0.1126E+00	0.7060E-04	0.8837E-02	0.5000E-04
0.2252E+00	0.1412E-03	0.1767E-01	0.1000E-03
0.1126E+02	0.7060E-02	0.8837E+00	0.5000E-02
0.1689E+02	0.1059E-01	0.1326E+01	0.7500E-02
0.2252E+02	0.1412E-01	0.1767E+01	0.1000E-01
0.5637E+02	0.3531E-01	0.4418E+01	0.2500E-01
0.1128E+03	0.7065E-01	0.8837E+01	0.5000E-01
0.1672E+03	0.1056E+00	0.1326E+02	0.7500E-01
0.2136E+03	0.1391E+00	0.1767E+02	0.1000E+00
0.4307E+03	0.3293E+00	0.4418E+02	0.2500E+00
0.6176E+03	0.6144E+00	0.8466E+02	0.5000E+00
0.6741E+03	0.8457E+00	0.1177E+03	0.7200E+00
0.7856E+03	0.1950E+01	0.2450E+03	0.1800E+01
0.8369E+03	0.3761E+01	0.2990E+03	0.3600E+01



Abutment 6_72" Diameter Type-II CIDH_Service Limit State

```
=========================================================================

                SHAFT for Windows, Version 2012.7.17

                 Serial Number :  291911540

              VERTICALLY LOADED DRILLED SHAFT ANALYSIS
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                     All Rights Reserved

=========================================================================


     Path to file locations      : T:\Ongoing Projects\2016\2016-146-NOC NB101
On-Ramp POC\Calculations\SHAFT Analysis\2019-03\
     Name of input data file     : Abut 6_Service Limit State.sfd
     Name of output file         : Abut 6_Service Limit State.sfo
     Name of plot output file    : Abut 6_Service Limit State.sfp
     Name of runtime file        : Abut 6_Service Limit State.sfr


-------------------------------------------------------------------------
                     Time and Date of Analysis
-------------------------------------------------------------------------

          Date:  March 29, 2019     Time:  18:17:57

     New Pile


     PROPOSED DEPTH =      37.0 FT
     ----------------


     NUMBER OF LAYERS =   13
     ------------------


     WATER TABLE DEPTH =      29.5 FT.
     -------------------



     FACTOR OF SAFETY APPLIED TO THE ULTIMATE SIDE FRICTION CAPACITY = 2.50
     -------------------------------------------------------
     FACTOR OF SAFETY APPLIED TO THE ULTIMATE BASE CAPACITY = 3.00
     ------------------------------------------------------
```



```
SOIL INFORMATION
---------------

LAYER NO 1----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                    = 0.120E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.380E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.625E+02
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.000E+00


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                    = 0.120E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.380E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.625E+02
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.100E+01


LAYER NO 2----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                    = 0.120E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.380E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.100E+01


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                    = 0.118E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.380E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
```

```
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.550E+01


LAYER NO 3----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                  = 0.118E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                    = 0.360E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                       = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.550E+01


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                  = 0.110E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                    = 0.360E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                       = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.900E+01


LAYER NO 4----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                  = 0.550E+00
  END BEARING COEFFICIENT-Nc                       = 0.780E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.200E+04
  INTERNAL FRICTION ANGLE, DEG.                    = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                       = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.900E+01


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                  = 0.550E+00
  END BEARING COEFFICIENT-Nc                       = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.200E+04
  INTERNAL FRICTION ANGLE, DEG.                    = 0.000E+00
```



```
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                       = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.160E+02


LAYER NO 5----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                  = 0.550E+00
  END BEARING COEFFICIENT-Nc                       = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.900E+03
  INTERNAL FRICTION ANGLE, DEG.                    = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                       = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.160E+02


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                  = 0.550E+00
  END BEARING COEFFICIENT-Nc                       = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.900E+03
  INTERNAL FRICTION ANGLE, DEG.                    = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                       = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.205E+02


LAYER NO 6----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                  = 0.550E+00
  END BEARING COEFFICIENT-Nc                       = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.150E+04
  INTERNAL FRICTION ANGLE, DEG.                    = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                       = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
  DEPTH, FT                                        = 0.205E+02


  AT THE BOTTOM
```

```
  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.150E+04
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.315E+02


LAYER NO 7----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                   = 0.742E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.300E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.315E+02


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                   = 0.584E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.300E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.460E+02


LAYER NO 8----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                   = 0.584E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.320E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.460E+02


  AT THE BOTTOM
```



```
  SKIN FRICTION COEFFICIENT- BETA                   = 0.508E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.320E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.540E+02


LAYER NO 9----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                   = 0.508E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.300E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.540E+02


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                   = 0.433E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.300E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.625E+02


LAYER NO10----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                   = 0.550E+00
  END BEARING COEFFICIENT-Nc                        = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.800E+03
  INTERNAL FRICTION ANGLE, DEG.                     = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.625E+02
```

```
  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
  END BEARING COEFFICIENT-Nc                         = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.800E+03
  INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.725E+02


LAYER NO11----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                    = 0.351E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.360E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.725E+02


  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                    = 0.274E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.360E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.825E+02

LAYER NO12----SAND

  AT THE TOP

  SKIN FRICTION COEFFICIENT- BETA                    = 0.274E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.380E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.825E+02
```



```
  AT THE BOTTOM

  SKIN FRICTION COEFFICIENT- BETA                    = 0.250E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.380E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.104E+03


LAYER NO13----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
  END BEARING COEFFICIENT-Nc                         = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.250E+04
  INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.104E+03


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                    = 0.550E+00
  END BEARING COEFFICIENT-Nc                         = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.250E+04
  INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.125E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.100E+11
  DEPTH, FT                                          = 0.110E+03



DRILLED SHAFT INFORMATION
-------------------------

 DIAMETER OF STEM          =    6.000  FT.
 DIAMETER OF BASE          =    6.000  FT.
 END OF STEM TO BASE       =    0.000  FT.
 ANGLE OF BELL             =    0.000  DEG.
 IGNORED TOP PORTION       =   19.500  FT.
```

IGNORED BOTTOM PORTION = 6.000 FT.
AREA OF ONE PERCENT STEEL = 40.720 SQ.IN.
ELASTIC MODULUS, Ec = 0.300E+07 LB/SQ IN
VOLUME OF UNDERREAM = 0.000 CU.YDS.

PREDICTED RESULTS

QS = ULTIMATE SIDE RESISTANCE;
QB = ULTIMATE BASE RESISTANCE;
WT = WEIGHT OF DRILLED SHAFT (FOR UPLIFT CAPACITY ONLY);
QU = TOTAL ULTIMATE RESISTANCE;
QBD = TOTAL ALLOWABLE LOAD USING A FACTOR OF SAFETY APPLIED TO THE ULTIMATE BASE RESISTANCE;
QDN = TOTAL ALLOWABLE LOAD USING FACTORS OF SAFETY APPLIED TO THE ULTIMATE SIDE RESISTANCE AND THE ULTIMATE BASE RESISTANCE.

LENGTH (FEET)	VOLUME (CU.YDS)	QS (TONS)	QB (TONS)	QU (TONS)	QBD (TONS)	QDN (TONS)	QU/VOLUME (TONS/CU.YDS)
26.0	27.23	12.44	12.45	24.89	14.52	7.05	21.57
27.0	28.28	4.67	41.49	46.16	18.50	15.70	1.63
28.0	29.33	17.11	24.90	42.01	25.41	15.14	1.43
29.0	30.37	24.88	12.45	37.33	29.03	14.10	1.23
30.0	31.42	32.66	4.15	36.81	34.04	14.45	1.17
31.0	32.47	40.44	0.00	40.44	40.44	16.18	1.25
32.0	33.51	48.21	0.00	48.21	48.21	19.29	1.44
33.0	34.56	55.99	0.00	55.99	55.99	22.40	1.62
34.0	35.61	63.77	0.00	63.77	63.77	25.51	1.79
35.0	36.66	71.54	7.73	79.27	74.12	31.19	2.16
36.0	37.70	79.32	16.22	95.54	84.73	37.13	2.53
37.0	38.75	87.10	25.48	112.57	95.59	43.33	2.91

RESULT FROM TREND (AVERAGED) LINE

TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.6933E-02	0.1040E-04	0.2796E-03	0.1000E-04
0.3467E-01	0.5202E-04	0.1398E-02	0.5000E-04
0.6933E-01	0.1040E-03	0.2796E-02	0.1000E-03
0.3467E+01	0.5202E-02	0.1398E+00	0.5000E-02
0.5200E+01	0.7803E-02	0.2097E+00	0.7500E-02
0.6933E+01	0.1040E-01	0.2796E+00	0.1000E-01

0.1733E+02	0.2601E-01	0.6989E+00	0.2500E-01
0.3468E+02	0.5202E-01	0.1398E+01	0.5000E-01
0.5088E+02	0.7796E-01	0.2097E+01	0.7500E-01
0.5940E+02	0.1035E+00	0.2796E+01	0.1000E+00
0.9600E+02	0.2557E+00	0.6989E+01	0.2500E+00
0.1087E+03	0.5065E+00	0.1170E+02	0.5000E+00
0.1112E+03	0.7267E+00	0.1427E+02	0.7200E+00
0.1110E+03	0.1807E+01	0.2204E+02	0.1800E+01
0.1136E+03	0.3607E+01	0.2471E+02	0.3600E+01

RESULT FROM UPPER-BOUND LINE

TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.9952E-02	0.1058E-04	0.4176E-03	0.1000E-04
0.4976E-01	0.5289E-04	0.2088E-02	0.5000E-04
0.9952E-01	0.1058E-03	0.4176E-02	0.1000E-03
0.4976E+01	0.5289E-02	0.2088E+00	0.5000E-02
0.7464E+01	0.7933E-02	0.3132E+00	0.7500E-02
0.9952E+01	0.1058E-01	0.4176E+00	0.1000E-01
0.2488E+02	0.2644E-01	0.1044E+01	0.2500E-01
0.4980E+02	0.5289E-01	0.2088E+01	0.5000E-01
0.7251E+02	0.7922E-01	0.3132E+01	0.7500E-01
0.8117E+02	0.1048E+00	0.4176E+01	0.1000E+00
0.1094E+03	0.2565E+00	0.1044E+02	0.2500E+00
0.1208E+03	0.5073E+00	0.1662E+02	0.5000E+00
0.1225E+03	0.7275E+00	0.1911E+02	0.7200E+00
0.1210E+03	0.1807E+01	0.2446E+02	0.1800E+01
0.1219E+03	0.3608E+01	0.2535E+02	0.3600E+01

RESULT FROM LOWER-BOUND LINE

TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.4028E-02	0.1024E-04	0.1415E-03	0.1000E-04
0.2014E-01	0.5118E-04	0.7077E-03	0.5000E-04
0.4028E-01	0.1024E-03	0.1415E-02	0.1000E-03
0.2014E+01	0.5118E-02	0.7077E-01	0.5000E-02
0.3021E+01	0.7677E-02	0.1062E+00	0.7500E-02
0.4028E+01	0.1024E-01	0.1415E+00	0.1000E-01
0.1007E+02	0.2559E-01	0.3539E+00	0.2500E-01
0.2014E+02	0.5118E-01	0.7077E+00	0.5000E-01
0.2997E+02	0.7675E-01	0.1062E+01	0.7500E-01
0.3808E+02	0.1022E+00	0.1415E+01	0.1000E+00

0.7502E+02	0.2544E+00	0.3539E+01	0.2500E+00
0.9651E+02	0.5057E+00	0.6780E+01	0.5000E+00
0.9991E+02	0.7260E+00	0.9427E+01	0.7200E+00
0.1010E+03	0.1806E+01	0.1962E+02	0.1800E+01
0.1052E+03	0.3607E+01	0.2395E+02	0.3600E+01

GEOTECHNICAL LPILE PARAMETERS

NB101 ON-RAMP PEDESTRIAN OVERCROSSING
LPILE PARAMETERS

Boring ID: R-18-NO-001
Station: "BP" Line 34+90
Date: 10/10/2018
By: JZ

Approx. Ground Surface Elevation: 223.0
Structure ID: Abutment 1 & Bent 2

Depth (ft)	Elevation (ft)	LPILE Soil Type	c (psf)	Phi (degrees)	Effective Unit Weight γ' (pcf)
0 to 8	223 to 215	Sand (Reese)	-	36	125
8 to 18	215 to 205	Sand (Reese)	-	34	125
18 to 21.5	205 to 201.5	Sand (Reese)	-	32	125
21.5 to 28	201.5 to 195	Stiff Clay w/o Free Water (Reese)	1750	-	125
28 to 30	195 to 193	Stiff Clay w/o Free Water (Reese)	1200	-	125
30 to 33	193 to 190	Stiff Clay w/o Free Water (Reese)	1200	-	65
33 to 43	190 to 180	Stiff Clay w/o Free Water (Reese)	1600	-	65
43 to 53.5	180 to 169.5	Soft Clay (Matlock)	400	-	65
53.5 to 58	169.5 to 165	Soft Clay (Matlock)	800	-	65
58 to 75	165 to 148	Stiff Clay w/o Free Water (Reese)	1350	-	65
75 to 81.5	148 to 141.5	Stiff Clay w/o Free Water (Reese)	3500	-	65
81.5 to 108	141.5 to 115	Sand (Reese)	-	36	65
108 to 111.5	115 to 111.5	Stiff Clay w/o Free Water (Reese)	4000	-	65

Default values can be used for e_{50} and K except for the liquefied soils (Case II) where e_{50} of 0.05 should be used.
Groundwater was measured at the depth of 30.0 feet below existing ground during drilling at Elevation +193.0 feet.
Soil unit weights of 125 pcf and 65 pcf can be used above and below groundwater level, respectively.

NB101 ON-RAMP PEDESTRIAN OVERCROSSING
LPILE PARAMETERS

Boring ID: R-18-NO-002 **Date:** 10/10/2018
Station: "BP" Line 35+85 **By:** JZ

Approx. Ground Surface Elevation: 223.0

Structure ID: Bent 3 & Bent 4

Depth (ft)	Elevation (ft)	LPILE Soil Type	c (psf)	Phi (degrees)	Effective Unit Weight γ' (pcf)
0 to 3.3	223 to 219.7	Stiff Clay w/o Free Water (Reese)	2000	-	125
3.3 to 13	219.7 to 210	Sand (Reese)	-	35	125
13 to 19	210 to 204	Stiff Clay w/o Free Water (Reese)	1000	-	125
19 to 25	204 to 198	Sand (Reese)	-	32	125
25 to 26.3	198 to 196.7	Stiff Clay w/o Free Water (Reese)	1000	-	125
26.3 to 58.5	196.7 to 164.5	Stiff Clay w/o Free Water (Reese)	1000	-	65
58.5 to 65	164.5 to 158	Case I) Sand (Reese)	-	33	65
		Case II) Stiff Clay w/o Free Water (Reese)	Sr=1200	-	65
65 to 76	158 to 147	Stiff Clay w/o Free Water (Reese)	3000	-	65
76 to 104.5	147 to 118.5	Sand (Reese)	-	38	65

Default values can be used for e_{50} and K except for the liquefied soils (Case II) where e_{50} of 0.05 should be used.
Groundwater was measured at the depth of 25 feet below existing ground during drilling at Elevation +198.0 feet.
Soil unit weights of 125 pcf and 65 pcf can be used above and below groundwater level, respectively.

NB101 ON-RAMP PEDESTRIAN OVERCROSSING
LPILE PARAMETERS

Boring ID: R-18-NO-003 **Date:** 10/10/2018
Station: "BP" Line 37+90 **By:** JZ

Approx. Ground Surface Elevation: 215.0
Structure ID: Bent 5 & Abutment 6

Depth (ft)	Elevation (ft)	LPILE Soil Type	c (psf)	Phi (degrees)	Effective Unit Weight γ’ (pcf)
0 to 8	215 to 207	Sand (Reese)	-	38	125
8 to 11.5	207 to 203.5	Sand (Reese)	-	36	125
11.5 to 18.5	203.5 to 196.5	Stiff Clay w/o Free Water (Reese)	2000	-	125
18.5 to 23	196.5 to 192	Soft Clay (Matlock)	900	-	125
23 to 32	192 to 183	Stiff Clay w/o Free Water (Reese)	1500	-	125
32 to 34	183 to 181	Stiff Clay w/o Free Water (Reese)	1500	-	65
34 to 48.5	181 to 166.5	Case I) Sand (Reese)	-	30	65
		Case II) Soft Clay (Matlock)	Sr=300	-	65
48.5 to 56.5	166.5 to 158.5	Case I) Sand (Reese)	-	32	65
		Case II) Soft Clay (Matlock)	Sr=600	-	65
56.5 to 65	158.5 to 150	Case I) Sand (Reese)	-	30	65
		Case II) Soft Clay (Matlock)	Sr=300	-	65
65 to 75	150 to 140	Soft Clay (Matlock)	800	-	65
75 to 85	140 to 130	Sand (Reese)	-	36	65
85 to 106	130 to 109	Sand (Reese)	-	38	65
106 to 111.5	109 to 103.5	Stiff Clay w/o Free Water (Reese)	2500	-	65

Default values can be used for e_{50} and K except for the liquefied soils (Case II) where e_{50} of 0.05 should be used.
Groundwater was measured at the depth of 32.0 feet below existing ground during drilling at Elevation +183.0 feet.
Soil unit weights of 125 pcf and 65 pcf can be used above and below groundwater level, respectively.

NB101 ON-RAMP PEDESTRIAN OVERCROSSING
LPILE PARAMETERS

Boring ID: CPT-18-NO-004 **Date:** 10/31/2018
Station: "BP" Line 35+85 **By:** JZ

Approx. Ground Surface Elevation: 223.0

Structure ID: Bent 3 & Bent 4

Depth (ft)	Elevation (ft)	LPILE Soil Type	c (psf)	Phi (degrees)	Effective Unit Weight γ' (pcf)
0 to 10	223 to 213	Sand (Reese)	-	36	125
10 to 13	213 to 210	Stiff Clay w/o Free Water (Reese)	2500	-	125
13 to 16	210 to 207	Sand (Reese)	-	36	125
16 to 20	207 to 203	Stiff Clay w/o Free Water (Reese)	2000	-	125
20 to 25	203 to 198	Stiff Clay w/o Free Water (Reese)	1500	-	125
25 to 45	198 to 178	Stiff Clay w/o Free Water (Reese)	1250	-	65
45 to 50	178 to 173	Stiff Clay w/o Free Water (Reese)	1800	-	65
50 to 60	173 to 163	Stiff Clay w/o Free Water (Reese)	1250	-	65

Default values can be used for e_{50} and K except for the liquefied soils (Case II) where e_{50} of 0.05 should be used.
Groundwater was measured at the depth of 25.0 feet below existing ground during drilling at Elevation +198.0 feet.
Soil unit weights of 125 pcf and 65 pcf can be used above and below groundwater level, respectively.

NB101 ON-RAMP PEDESTRIAN OVERCROSSING
LPILE PARAMETERS

Boring ID: CPT-18-NO-005 **Date:** 10/31/2018
Station: "BP" Line 37+90 **By:** JZ

Approx. Ground Surface Elevation: 215.0
Structure ID: Bent 5 & Abutment 6

Depth (ft)	Elevation (ft)	LPILE Soil Type	c (psf)	Phi (degrees)	Effective Unit Weight γ' (pcf)
0 to 10	215 to 205	Sand (Reese)	-	36	125
10 to 26.3	205 to 188.7	Stiff Clay w/o Free Water (Reese)	2500	-	125
26.3 to 30	188.7 to 185	Stiff Clay w/o Free Water (Reese)	2500	-	65
30 to 37	185 to 178	Stiff Clay w/o Free Water (Reese)	1000	-	65
37 to 45	178 to 170	Stiff Clay w/o Free Water (Reese)	1500	-	65
45 to 52	170 to 163	Stiff Clay w/o Free Water (Reese)	1000	-	65
52 to 60	163 to 155	Case I) Sand (Reese)	-	33	65
		Case II) Soft Clay (Matlock)	Sr=1000	-	65

Default values can be used for e_{50} and K except for the liquefied soils (Case II) where e_{50} of 0.05 should be used.
Groundwater was measured at the depth of 26.3 feet below existing ground during drilling at Elevation +188.7 feet.
Soil unit weights of 125 pcf and 65 pcf can be used above and below groundwater level, respectively.

APPENDIX VII

The appendix for
'Exceptions to Policy'
is not applicable to this report.

APPENDIX VIII

Office of Special Funded Projects
Comment & Response Form

(Revised 08/2011)

General Project Information (OSFP Liaison to complete)		**Review Phase** (OSFP Liaison to complete)	**Reviewer Information** (Reviewer Liaison to complete)	
Dist:	**04**	☐ PSR/PDS (Review No.)	Reviewer Name:	**R. Nashed/ J.Anderson**
Proj ID (Phase):	**0416000224**	☐ APS/PSR (Review No.)	Functional Unit:	**Geotechnical Design- West**
EA:	**1K2801**	☐ APS/PR (Review No.)	Cost Center:	**59-3660**
Project Name:	**Blossom Hill Rd Interchange Improvement**	☐ Type Selection	Phone Number:	**510-622-1773**
OSFP Liaison:	**Shu-Shang Liu**	☐ 65% PS&E Unchecked Details	e-mail:	**Rifaat.nashed@ dot.ca.gov**
Phone:	**916-227-8919**	☐ PS&E (Review No. 1)	Date of Review:	**12/ 26/2018**
E-mail:	**Shu-shang.liu@dot.ca.gov**	☐ Construction	Structure Name*:	**NB101 On-Ramp Pedestrian Overcrossing**
		☑ Other: FR	Br No*:	**37-676**
			(*Use if necessary to when comment sheets are by individual structure)	

Consultant Information (to be filled in by Consultant)

Consultant Lead (First and Last Name)	Consultant Firm	Phone Number	E-mail	Response Date

#	Doc. (See Note 1)	Page, Section, or SSP	Review Comments	Consultant Responses	Caltrans Responses
	FR	N/A	Review of Geology and subsurface and Related sections items Foundation Report (DRAFT) by Parikh consultants prepared for HMH Engineers dated December, 2018		
1	FR	Section 8.0 Subsurface Conditions Page 8	Table 3 BH# R-18-NO-001 " …and hard lean clay to the boring depth 111.5	Comment incorporated. Description of Boring R-18-NO-001 has been revised.	

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓= Comment Resolved (for Reviewer's use)

			feet". Should be corrected to be stiff lean clay to very stiff fat clay from elevation 119 feet to the bottom of the bore hole. – RN		
2	FR	Section 13.1 Seismic Sources Page 11	Table 6- ARS DATA Please add the "Spectral Acceleration" (SA) column including the deterministic data for each listed fault. -RN	The "Spectral Acceleration" (SA) column including the deterministic data for each listed fault will be added to Table 6 – ARS DATA.	
3	FR	Appendix II LOTB	BH# R-18-NO-001& R-18-NO-002 Many Pocket Penetrometer readings are missing in clayey layers. - RN	Available pocket penetrometer readings have been added to the clayey layers in Borings R-18-NO-001, R-18-NO-002 and R-18-NO-003.	
4	FR	Table 1/Table 4/ Table 7/ LOTB	CPT Depth shown in table and the depth shown in the attached data are inconsistent. Which is correct? -JA	The CPT depth has been changed for Tables 1, 7 and in the LOTB and they are consistent. The CPT depth for CPT-18-NO-004 is 59.9 feet and CPT depth for CPT-18-NO-005 is 71.4 feet. The depth shown in Table 4 is the measured groundwater depth.	
5	FR	Section 9.0	Are there any nearby wells with groundwater measurements for comparison? -JA	There is not any nearby wells with groundwater measurements available for comparison.	
6	FR	Section 13.2 - Output	Bullet point 1 in the output is unclear. Please revise - JA	Bullet Point 1 under "Output" has been revised to "The recommended ARS curve is based on the maximum of the comparison of the deterministic data and Caltrans Probabilistic data. The	

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✓= Comment Resolved
(for Reviewer's use)

				recommended ARS curve at this site is based on the Probabilistic curve”.	
7	FR	Section 13.3.2	Section references Section 12.2, which does not exist. Please correct -JA	Comment noted. The referenced section should be Section 13.2 instead. This has been corrected in the foundation report.	
8	FR	Table 11	Settlement analyses appear to be missing. Please append these -JA	The method for the calculation of the design tip elevation controlled by the settlement has been included in Appendix.	
9	FR	Table 13A/13B/13C	Tables don’t match the attached tables in the appendix. Please correct. -JA	Table 13A/13B/13C has been revised to match the attached tables in the appendix.	
10	FR	Section 14.6	Sliver fill is not allowed. Refer to Caltrans Standard Spec 19-6.03A -JA	Comment noted. “Fill up to approximately 2 feet maximum high is anticipated to be placed on the original ground at Abutment 1” is used instead of “Sliver fill” in Section 14.6	
11	FR	Appendix II - Log of the Borings	UC values are in ksf, but they are labeled at tsf. Please correct. -JA	The UC values are in the unit of ksf based on the laboratory test result. The UC values are in the unit of tsf in the Log of Test Borings.	
12	FR	Appendix IV – Laboratory Tests	Appendix is labeled as B instead of IV. Additionally, the introductory page references Appendix A instead of Appendix II. Please correct. -JA	The appendices referred in the introductory page of Appendix IV has been corrected.	

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
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✓= Comment Resolved
(for Reviewer’s use)

13	FR	Appendix VI – Liquefaction Analyses	For liquefaction calculations, Fines content values are required. If there is a lack of lab data, these should be estimated by visual inspection of the samples. -JA	Estimated fine content has been added to the sand layer(s) (without any sieve analyses) based on the visual inspection of the soil samples.	
14	FR	Appendix VI – Liquefaction Analyses R-18-NO-003	Do you believe 34 through 65 feet will liquefy? Based on the borings, I would estimate that only 34 through 48.5 feet would liquefy. However, the CPT seems to suggest 48.5 through 65 feet will liquefy, but not the layer above. -JA	The soil from the depth of 34 feet through 65 feet has the potential to liquefy based on the liquefaction analyses.	
15	FR	Appendix VI - Vertical Pile Capacity Analysis	Is there a reason the top of pile is not set to a depth of zero? Additionally, the bottom 1 diameter in depth is typically ignored for capacity in cohesive material. For the 72 -inch diameter pile, you appear to only be ignoring the bottom 36 inches. What is your reasoning? -JA	The analysis has Finished Grade (FG) set to zero in the y-axis so that the full overburden is counted in the analyses. The pile cut-off is about 2-3 feet below the FG. The top 5 feet below the pile cut-off and the capacity from bottom one diameter of the pile are ignored for CIDH foundations. Our analysis used no frictional capacity from first 8 (5+3=8) feet and bottom 6 feet (one diameter). The text output from the software will be provided in the next submittal to clarify. An additional 3 feet of pile length is assumed for conservatism. This is not due to frictional loses. Frictional loses already considered in our analysis as stated above.	

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✓= Comment Resolved
(for Reviewer's use)

16	FR	Appendix VI – Geotechnical LPIle Parameters – R-18-NO-001	Based on the UC taken at elevation 148 to 141.5 ft, the cohesion used in the LPILE analysis looks very high. What is your justification? -JA	UC test was performed on Sample No. 14 at the depth of 71 feet (Between Elev. 165 feet and Elev. 148 feet) with the tested shear strength of 1.36 ksf and c = 1,350 psf was recommended in the LPILE analyses. No UC test was taken for the soil sample between the depth of 75 feet and 81.5 feet (Between Elevation 148.0 feet to Elev. 141.5 feet).	
17	FR	All Sections	Please review report for grammar and consistent formatting/structure across all reports. -JA	Comment incorporated.	

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✓= Comment Resolved
(for Reviewer's use)

FOUNDATION REPORT

SB 101 OFF-RAMP PEDESTRIAN UNDERCROSSING
(BRIDGE NO. – 37-675J)
SAN JOSE, CALIFORNIA
04-SCl-101, R28.4/R28.9 EA 04-1K280

Prepared For:

HMH Engineers
1570 Oakland Road
San Jose, CA 95131

PARIKH CONSULTANTS, INC.
2360 Qume Drive, Suite A, San Jose, CA 95131
(408) 452-9000

October 15, 2019 Job No.: 2016-146-OUC

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APPENDIX VII

Exceptions to Policy – Not Applicable

APPENDIX VIII

Office of Special Funded Projects Comment & Response Form - Parikh Consultants, Inc. Response to Caltrans Review Comments.

FOUNDATION REPORT
SB 101 OFF-RAMP PEDESTRIAN UNDERCROSSING
(BRIDGE NO. 37-675J)
SAN JOSE, CALIFORNIA
04-SCl-101, R28.4/R28.9 EA 04-1K280

1.0 INTRODUCTION

This foundation report presents the results of our geotechnical engineering investigation for the proposed "US 101/Blossom Hill Road Interchange Improvement Project – SB 101 Off-Ramp Pedestrian Undercrossing" in San Jose, California, hereinafter referred to as "PROJECT". The work was performed in general accordance with the scope of work outlined in our proposal to HMH Engineers (Designer).

The geotechnical recommendations presented in this report are intended for design input and are not intended to be used as specifications. In addition, the data provided in this report including these geotechnical recommendations should not be used for bidding purposes or for construction cost estimates. If the report is provided as a reference document, any interpretation of the data and recommendations should be the sole responsibility of the user and PARIKH Consultants, Inc. (PARIKH) shall not be liable for any consequences.

2.0 SCOPE OF WORK

The purpose of this investigation was to evaluate the general subsurface conditions at the project site, to evaluate their engineering properties, and to provide geotechnical recommendations for the foundation design of the proposed project.

The scope of work performed for this investigation included a review of the readily available soils and geologic literature pertaining to the project site including review of boring data, laboratory testing of the representative soil samples, performing engineering analyses based on the field and laboratory data, and preparation of this foundation report. The recommendations in this report are based on the field exploration performed by Parikh, general plan and foundation plan and loading information provided by the designer and Biggs Cardosa Associates (Structural Designer). This foundation report supersedes the preliminary foundation report for "Southbound Off-Ramp Pedestrian Undercrossing" dated June 11, 2018.

3.0 PROJECT DESCRIPTION

The project proposes to modify the US 101/ Blossom Hill Road Interchange to improve traffic operations and connectivity for pedestrians and bicyclists along Blossom Hill Road. The existing Blossom Hill Road Interchange consists of two separate overcrossing structures over US 101 with partial cloverleaf ramps. The project is located within the City of San Jose, in Santa Clara County. It will be implemented as a locally-funded project with the City of San Jose performing advertisement, award and administration (AAA) of the construction contract through a Caltrans encroachment permit.

Blossom Hill Road is a key connector between job locations, mixed-use housing, commercial development and recreational opportunities in an area where San Jose is focused on developing greater internalization of automobile trips, increased use of transit and expanded active transportation. The level-of-service for existing and forecasted traffic is deficient for existing developments and nearby proposed projects. The configuration of the existing interchange and ramp intersections along Blossom Hill Road are not consistent with the latest standards for accommodating balanced use by vehicles, bicyclists and pedestrians.

The proposed project improvements will occur along Blossom Hill Road from east of the Monterey Road / Blossom Hill Road grade separation to the US 101 Northbound Off-Ramp / Coyote Road intersection. All improvements will be constructed within existing Caltrans and City of San Jose rights-of-way.

In addition, the existing 5-foot sidewalk on the north side of Blossom Hill Road will be replaced with a 10-foot to 12-foot wide Class I Bike/Pedestrian path. The Class I Bike/Pedestrian path will cross under the SB 101 Off-Ramp and the SB 101 On-Ramp with two short span undercrossing structures

The following bridge structures and retaining walls would be modified or constructed in association with the "US 101/Blossom Hill Road Interchange Improvement Project" and path:

1. Blossom Hill Road Overcrossing (OC) (Widen) (Bridge No. 37-0348)
2. NB 101 On-Ramp Pedestrian Overcrossing (POC) (Bridge No. 37-676)
3. SB 101 Off-Ramp Pedestrian Undercrossing (PUC) (Bridge No. 37-675J)
4. SB 101 On-Ramp PUC (Bridge No. 37-675K)
5. Retaining Wall No. 1 (Soil Nail Wall)(Bridge No. 37E0125)
6. Retaining Wall No. 2 (MSE Wall)(Bridge No. 37E0126)

This foundation report is for the "SB 101 Off-Ramp PUC". A map showing the project location and its vicinity is presented in Appendix I. The following foundation reports will be separately submitted:

1. Foundation Report for Blossom Hill Road OC (Widen) (Bridge No. 37-0348).
2. Foundation Report for NB 101 On-Ramp POC (Bridge No. 37-676).
3. Foundation Report for SB 101 On-Ramp PUC (Bridge No. 37-675K).
4. Foundation Report for Retaining Wall No. 1 (Soil Nail Wall)(Bridge No. 37E0125).
5. Foundation Report for Retaining Wall No. 2 (MSE Wall)(Bridge No. 37E0126).

Proposed Bridge Structure

Based on the General Plan and Foundation Plan provided by the structural designer, the new bridge structure generally consists of the following:

a) A single-span bridge structure with Abutment 1 in the south and Abutment 2 in the north.
b) The new bridge will be from “AR4” Line Station 514+31.99 to “AR4” Line Station 514+67.03 with the span length of 35’-0” along the “AR4” Line.
c) The bridge is expected to provide four travel lanes in the southbound direction and 8 feet wide shoulder in the west and 4 feet wide shoulder in the east.
d) The proposed new bridge will be CIP reinforced concrete slab structure. The foundation will consist of 18” x 0.625” Steel Pipe Piles.

All elevations referenced within this report are based on the North American Vertical Datum of 1988 (NAVD 88), unless otherwise noted. To convert elevation at this site from National Geodetic Vertical Datum of 1929 (NGVD 29) to NAVD 88, we added 1.8 feet to the NGVD 29 elevation.

Our recommendations in this report are based on the above information. Any major deviation should be reported to this office for consideration.

4.0 EXCEPTION TO POLICIES AND PROCEDURES

No exception to policies and produces are needed for the preparation of this report. Normal procedures were assumed for construction of the bridge structure throughout our analyses and represent one of the bases of recommendations presented herein. The investigation of the proposed foundations has followed Caltrans policy.

5.0 SITE CONDITIONS

The general project area is the existing interchange of Blossom Hill Road at Route 101 in San Jose, Santa Clara County, California. The existing SB101 Off-Ramp has three lanes with two right turn lanes and one left turn lane into the Blossom Hill Road. The elevation increased from approximate Elev. 195 feet at the beginning of off-ramp to approximate Elev. 221.5 feet at the off-ramp and Blossom Hill Road intersection. The existing embankment slope gradient of the off-ramp ranges from 2(H):1(V) to 1.5(H): 1(V).

6.0 FIELD INVESTIGATION AND FIELD TESTING PROGRAM

Field Exploration

Borings R-18-SO-001 and R-18-SO-002 were drilled in the vicinity of the proposed abutment of the proposed PUC in August and September 2018. The field exploration was performed by the drilling contractor, Geo-Ex Subsurface Exploration. The location, approximate ground elevation and depth of these borings are summarized in the table below.

TABLE 1 – SUBSURFACE INVESTIGATION SUMMARY

Boring No.	Completion Date	Drill Rig Type	Hammer Type	Hammer Efficiency (%)	Approx. Ground Elev. (ft)	Boring Depth (ft)
R-18-SO-001	9/12/2018	CME 75	Automatic	78	221.0	101.5
R-18-SO-002	8/22/2018	CME 75	Automatic	78	220.0	121.5

TABLE 2 - SUMMARY OF BORINGS

Boring No.	"AR4" Line Station (ft)	Offset (ft)	Boring Depth (ft)	Approx. Ground Elev. (ft)
R-18-SO-001	514+75	39.0 Lt.	101.5	221.0
R-18-SO-002	514+45	47.0 Rt.	121.5	220.0

(1) Boring location stations and offset and elevations are stated to the nearest foot to be consistent with the LOTB, however they were not surveyed.

The approximate locations of the soil borings are shown on the "Boring Location Map", Plate 1. The descriptions of the soil materials encountered in the field exploration and relevant boring information are presented on the LOTB included in Appendix II.

Field Testing

a) The current investigation borings (by Parikh) were advanced using a truck-mounted CME-75 drill rig with 8-inch hollow-stem auger and 3 ¾-inch rotary wash drilling method. The soil samples were obtained from the borings during drilling at various depths by driving a 2.5-inch Inside Diameter (I. D.) Modified California Sampler or a 1.375-inch I.D. Standard Penetration Sampler (ASTM Test Method No. 1586). The sampler was driven into the subsurface soils under the impact of a 140 pounds hammer having a free fall of 30 inches. The blow counts required to drive the sampler for the last 12 inches are presented on the LOTB, Appendix II. (When correlating standard penetration data in similar soils, the blow counts for the Modified California sampler can be converted to equivalent Standard Penetration Test sampler by multiplying a factor of safety of 0.65);

b) Pocket penetration tests were also performed on clay samples to evaluate their consistency.

Details of Field Exploration

All the test borings were drilled with a truck-mounted drill rig using 8-inch hollow-stem auger and rotary-wash drilling method. The borings were drilled under the technical supervision of our engineers, who classified and continuously logged the soils encountered during drilling and supervised the collection of soil samples at various depths for visual examination and laboratory testing. The soil samples were visually classified in the field according to the Unified Soil Classification System and then transported to our laboratory for further evaluation and testing. Upon completion of drilling, the boreholes were backfilled with cement grout.

The logs presented in Appendix II were prepared from the field logs which were edited after visual re-examination of the soil samples in the laboratory and results of classification tests on selected soil samples as indicated on the logs.

It should be noted that the descriptions of the soils encountered and relevant boring information presented on the LOTB depict subsurface conditions only at the locations indicated on the plan and on the particular date noted on the LOTB. Because of the variability from place to place within soil/rock in general, subsurface conditions at other locations may differ from conditions occurring at the boring locations explored. The abrupt stratum changes shown on the logs may be gradational and relatively minor changes in soil types within a stratum may not be noted on the logs due to field limitations. Also, the passage of time may result in a change in the soil conditions at these locations due to environmental changes.

7.0 LABORATORY TESTING PROGRAM

The following laboratory tests were performed on selected soil samples collected during field exploration to evaluate the physical and engineering properties of the subsurface soils at the project site to support the foundation recommendations:

a) Laboratory determination of Moisture Contents (ASTM D-2216);
b) Atterberg Limits (ASTM D-4318);
c) Particle Size Analysis (ASTM D-422);
d) Unconfined Compression Test (ASTM D-2166);
e) Corrosivity Test (California Test Method T-643, T-422, and T-417).

The laboratory test methods and test results are presented on plates included in Appendix IV. Laboratory test results for moisture content, total unit weight, unconfined compression, Plasticity Index and grain size classification of the soil samples are summarized in the table in Appendix IV.

8.0 SITE GEOLOGY AND SUBSURFACE CONDITIONS

Geology

General geologic features pertaining to the project site were evaluated by reference to the "Dibblee, T.W.; and Minch, J.A., 2005, Geologic Maps of the San Jose East Quadrangle, Santa Clara County, California; Dibblee Geological Foundation DF-155, scale 1:24,000" and "Dibblee, T.W.; and Minch, J.A., 2005, Geologic Maps of the Santa Teresa Hills Quadrangle, Santa Clara County, California; Dibblee Geological Foundation DF-158, scale 1:24,000".

Based on the geologic map, the project site subsurface soils consist of mainly Holocene surficial sediments with alluvial gravel, sand and clay soil of valley areas (Qa). The general geology of the project area is shown on the "Geologic Map", Plate No. 2.

The descriptions of the subsurface soils encountered in the geotechnical explorations are consistent with the published geologic maps.

Subsurface Conditions

Based on Borings R-18-SO-001 and R-18-SO-002, the descriptions of the subsurface soil materials encountered in each of the exploratory boring are summarized in the table below. Detailed soil descriptions and location of the borings are presented on the LOTBs.

TABLE 3 - SUMMARY OF SUBSURFACE SOIL CONDITIONS

Boring	Support	Soil Description
R-18-SO-001	Abut 2	Approximately 8.5 feet of medium dense to dense silty gravel with sand, underlain by approximately 14 feet of very stiff fat clay (pocket penetrometer measurement = 2.75 tsf for Sample No. 3), underlain by approximately 11 feet of very stiff silt, underlain by approximately 23 feet of medium dense poorly graded sand and silty sand with gravel, underlain by approximately 19 feet of stiff to very stiff silt, underlain by approximately 9 feet of very stiff fat clay, underlain by very dense poorly graded sand/silty sand with gravel to the boring depth of 101.5 feet.
R-18-SO-002	Abut 1	Approximately 10 feet of dense silty gravel and medium dense poorly graded sand, underlain by approximately 12 feet of stiff to hard lean clay, underlain by approximately 4.5 feet of very dense silty gravel with sand, underlain by approximately 12 feet of very stiff lean clay and hard silt with sand, underlain by approximately 26 feet of interbedded layers of medium dense silty gravel with sand/silty sand/poorly graded sand/clayey sand, underlain by approximately 21 feet of medium stiff to stiff lean clay, underlain by dense to very dense poorly graded sand to the boring depth of 121.5 feet.

Due to limitations inherent in geotechnical investigations, it is neither uncommon to encounter unforeseen variations in the subsurface soil conditions during construction nor is it practical to determine all such variations during an acceptable program of drilling and sampling for a project of this scope. Such variations, when encountered, generally require additional engineering services to attain properly constructed project. We, therefore, recommend that a contingency fund be provided to accommodate any additional charges resulting from technical services that may be required during construction.

9.0 GROUNDWATER

Groundwater measured during the field exploration is summarized in the table below.

TABLE 4 - SUMMARY OF MEASURED GROUNDWATER LEVEL

Boring No.	Date	Depth (feet)	Elevation (feet)
R-18-SO-001	9/21/2018	32.5	188.5
R-18-SO-002	8/22/2018	22.0	198.0

Groundwater level is anticipated to vary with the passage of time due to seasonal groundwater fluctuations, variations in yearly rainfall, water elevations in the nearby creeks, surface and subsurface flows, ground surface run-off, and other environmental factors that may not be present at the time of the investigation.

Measured groundwater depth was used for engineering analyses.

10.0 AS-BUILT FOUNDATION DATA

There is no as-built foundation data available for the proposed bridge structure since it is a new bridge structure.

11.0 SCOUR EVALUATION

There is no significant drainage or flowing bodies of water passing through or adjacent to the site. Therefore, scour should not be a design concern and was not considered for foundation design.

12.0 CORROSION

The corrosion investigation for this project was performed on the selected samples from borings drilled in 2018 in general accordance with the provisions of California Test Methods 417, 422 and 643. A summary of the corrosion test results is presented in the table below, and the test results are presented in Appendix IV.

TABLE 5 - SUMMARY OF CORROSION TEST RESULT

Boring	Approx. Sample Depth (feet)	Minimum Resistivity (ohms-cm)	PH	Water-soluble Chloride (ppm)	Water-soluble Sulfate (ppm)
R-18-SO-001	31.0	1,740	7.92	4.2	26.9
R-18-SO-002	21.0	1,260	7.97	16.4	40.0

According to the Section 10.7.5. of the AASHTO LRFD Bridge Design Specifications (BDS) – Sixth Edition (2012) with Caltrans Amendment, the following soil, water or site conditions shall be considered as indicators of potential pile corrosion or deterioration:

- Minimum resistivity equal to or less than 1,000 ohm-cm,
- Chloride concentration equal to or greater than 500 ppm,
- Sulfate concentration equal to or greater than 2,000 ppm,
- pH equals to or less than 5.5
- Landfills and cinder fills,

- Mines or industrial drainage,
- Suspected chemical wastes, and
- Stray currents.

Per Caltrans Corrosion Guidelines (Version 3.0, March 2018), Caltrans considers a project site to be corrosive for structural elements if one or more of the following conditions exist for the representative soil and/or water samples taken at the project site:

- Chloride concentration equal to or greater than 500 ppm, or
- Sulfate concentration equal to or greater than 1,500 ppm, or
- pH equals to or less than 5.5.

Therefore the on-site soil materials should be non-corrosive according to the criteria above.

13.0 SITE SEISMICITY AND ANALYSIS

13.1 Seismic Sources

The project is located in a seismically active part of northern California. Many faults exist in the regional area. These faults are capable of producing earthquakes and may cause strong ground shaking at the site.

Maximum magnitudes (M_{max}) of some of the closest faults in the area are based on Caltrans ARS Online Website. These maximum moment magnitudes represent the largest earthquake a fault is capable of generating and is related to the seismic moment. The earthquake data of the active faults in the project vicinity are summarized in the table below.

TABLE 6- ARS DATA

Fault (Fault ID)	Maximum Moment Magnitude of Fault, M_{Max}	Fault Type	Site-to-Fault Distance, R_{rup}* (miles)	Peak Ground Acceleration (PGA) Based on Deterministic Data (g)
Silver Creek (148)	6.9	Strike Slip	2.22	0.400
Hayward (Southern extension) (149)	6.7	Strike Slip	4.15	0.321
Calaveras (Central) 2011 CFM (151)	6.9	Strike Slip	6.81	0.261
Cascade fault (153)	6.7	Reverse	3.16	0.370
Monte Vista-Shannon (154)	6.4	Reverse	4.67	0.298
San Andreas (Santa Cruz Mts) 2011 CFM (158)	8.0	Strike Slip	11.78	0.250

*Closest distance (mi) to the fault rupture plane as obtained from Caltrans ARS Online Website.

13.2 Seismic Design Criteria

The development of the Acceleration Response Spectrum (ARS) followed the standard Caltrans procedure by using Caltrans ARS Online webtool (Ver. 2.3.09). The ARS curve is based on several input parameters, including site location (longitude/latitude), average shear wave velocity for the top 100 feet (Vs_{30m}), and other site parameters, such as fault characteristics and site-to-fault distances.

Average shear wave velocities (Vs_{30m}) for the top 100 feet at the project site was calculated by using established correlations and the procedure provided in the "Caltrans Design Manual (Version 2.0, 2012)". The design method incorporates both deterministic and probabilistic seismic hazards to produce the design response spectrum.

Based on all the available boring data, we have calculated the Vs_{30m}. The Vs_{30m} are summarized in the following table.

TABLE 7- SUMMARY OF CALCULATED Vs_{30m}

Boring No.	Boring Depth	Rock Depth (ft)	Vs_{30m} (m/s)
R-18-SO-001	101.5	Not encountered	243
R-18-SO-002	121.5	Not encountered	232

The ARS was developed based on the shear wave velocity of 240 m/s. Average shear wave velocity calculation is included in Appendix VI.

The site location and the relevant parameters are summarized as follows, and the recommended design curve is presented on Appendix V.

Input

- Site Location: 37.2579ºN/121.7993ºW
- Average V_{S30m}: 240 m/s
- Depth to rock with a shear wave velocity of 1.0 km/sec ($Z_{1.0}$) = N/A
- Depth to rock with a shear wave velocity of 2.5 km/sec ($Z_{2.5}$) = N/A

Output

- The recommended ARS curve is based on the maximum of the comparison of the deterministic data and Caltrans Probabilistic data. The recommended ARS curve at this site is based on the Probabilistic curve.

- An adjustment factor for the near-fault effect was applied to the calculated spectral acceleration values. The increase of 20% to the spectral acceleration values corresponds to period longer than 1 second and linearly tapes to zero at a period of 0.5 seconds.
- Anticipated Peak Ground Acceleration (PGA): 0.634 g
- Near Fault Effect: Yes
- Basin Effect: No. The project site is not located within the limit of the $Z_{2.5}$ contour map for Northern California.
- Governing Fault is the Silver Creek Fault (Fault I.D.=148, Mmax=6.9)

13.3 Seismic Hazards/Liquefaction Potential

Potential seismic hazards may arise from three sources: surface fault rupture, ground shaking and liquefaction. Since no active faults pass through the site, the potential for fault rupture does not exist at the site. As shown on the ARS Online Map, Plate No. 3, the closest active fault is Silver Creek fault, which is located approximately 2.2 miles northeast from the project site.

13.3.1 Seismic Hazards

Potential seismic hazards may arise from three sources: surface fault rupture, ground shaking and liquefaction.

13.3.2 Seismic Ground Shaking

Based on available geological and seismic data, the project site is expected to experience strong ground shaking. PGA of 0.634 g was estimated for the site which is discussed in Section 13.2.

13.3.3 Surface Fault Rupture

Since no known active fault passes through the project site and the project site is not within a state Alquist-Priolo Zone, the potential for fault rupture does not exist.

13.3.4 Liquefaction Potential

Liquefaction is a phenomenon in which saturated cohesionless soils are subject to a temporary but essentially total loss of shear strength under the reversing, cyclic shear stresses associated with earthquake shaking. Submerged cohesionless sands and silts of low relative density are the type of soils, which usually are susceptible to liquefaction. Clays are generally not susceptible to liquefaction.

The liquefaction potential was evaluated in accordance with the methods proposed by Youd, et al. (2001). The evaluation was done using the boring data from all the available borings using a Magnitude 6.9 earthquake and a peak ground acceleration of 0.634 g (Caltrans Online Probabilistic ARS). This method compares the estimates of the earthquake-induced shear stress to the susceptibility of soil liquefaction. According to Bray (2006), liquefaction appears to occur in soils where these fines are either non-plastic or are low plasticity silts and/or silty clays (PI<12%, and LL<37%), and with high water content relative to their liquid limit (w>0.85 LL). Estimated fine content has been added to the sand layers (without any sieve analyses) based on the visual inspection and soil classification of the soil sample.

Based on the results of the liquefaction analyses, liquefaction potential may exist at the project site at the isolated locations for the loose to medium dense cohesionless soil encountered in the borings with the following estimated post-liquefaction settlements.

TABLE 8 - SUMMARY OF ESTIMATED POST-LIQUEFACTION SETTLEMENT

Support No.	Boring No.	Estimated liquefiable Soil Depth (ft)	Approx. Thickness (ft)	Estimated liquefiable Soil Top Elev.(ft)	Estimated liquefiable Soil Bottom Elev.(ft)	$(N_1)_{60,CS}$	Estimated Post-liquefaction Settlement (inches)
Abut 1	R-18-SO-002	61.0	3.5	159.0	155.5	18.2	0.6
Abut 2	R-18-SO-001	33.5	9.5	187.5	178.0	19.75	1.6
		53.0	3.5	168.0	164.5	17.4	0.6

Based on the results of the liquefaction analyses as shown above, it appears that

a) The calculated post-liquefaction settlement of 0.6 inches for Boring R-18-SO-002 is marginal in mobilized downdrag. Downdrag due to potential post-liquefaction settlement is not considered for Abutment 1.

b) The post-liquefaction settlement due to the potential liquefiable soil encountered in Boring R-18-SO-001 for Abutment 2 might cause downdrag and reduce the load carrying capacity of the piles. Downdrag load has been considered in the calculations of the vertical pile capacities of Abutment 2.

Liquefaction analyses are included in Appendix VI.

Lateral Spreading

Liquefaction-induced spreading has been defined as the *"lateral displacement of large surficial blocks of soil as a result of liquefaction in a subsurface layer"*. Lateral spreading refers to the more moderate movements of gently sloping ground due to soil liquefaction. As described by Bartlett and Youd (1992a; 1992b), liquefaction-induced lateral spreading occurs on mild slopes of 0.3% to 5% underlain by loose sand and shallow water. The geologic conditions conducive to lateral spreading (gentle surface slope, shallow water table, and liquefiable cohesionless soils) are frequently found along streams and other waterfronts in recent alluvial or deltaic deposits, as well as in loosely-packed, saturated, sandy fills.

In our opinion, the potential for lateral spreading does not exist because it appears that there is no continuous layer of liquefiable soil and stream/water course at the project site.

14.0 FOUNDATION RECOMMENDATIONS

14.1 General

Based on the findings of our investigation, no major adverse condition was noted for the planned structure provided the recommendations presented in this report are incorporated into the final design and construction. Bridge plans should be reviewed by our office prior to finalizing the plans to see that the intent of our recommendations is included in the plans.

This report was prepared specifically for the proposed project according to the foundation plans dated provided to us on November 12, 2018. Normal construction procedures were assumed throughout our analysis and represent one of the bases of recommendations presented herein. Our design recommendations have been based upon the materials and subsurface soil conditions encountered in the soil borings at the project site. Therefore, we should be notified in the event that these conditions are changed, so as to modify or amend our recommendations.

The following foundation recommendations were designed in accordance with the 2012 AASHTO LRFD Bridge Design Specifications (6th Edition) with Caltrans Amendments.

14.2 Earthwork and Grading

All grading operations should be performed in accordance with the project specifications and Caltrans Standard Specifications for Earthwork (Section 19). A representative from PARIKH or regulating agency should observe all excavated areas during grading and perform moisture and density tests on prepared subgrade and compacted fill materials.

14.3 Deep Foundations

Recommended Foundation Type

1. Based on the available boring information and considering the drivability through the significant strata of medium dense to dense sand, 18” x 0.625” steel pipe piles appear to be the recommended foundation system for the proposed bridge structure.

2. Cast-In-Drilled-Hole (CIDH) Concrete pile is feasible but not preferred considering medium dense to dense sand below groundwater which may cause soil caving-in. Also driven pile tends to be more cost effective than the CIDH Concrete pile.

3. Shallow foundation is not recommended considering the magnitude of the demand load, medium stiff to stiff subsurface soils at shallow depth and potentially liquefiable soil encountered in Boring R-18-SO-001 for Abutment 2.

18” x 0.625” steel pipe piles may be designed for the foundation loads at the abutments to the indicated pile tip elevations as shown in Table 12. Pertinent foundation design information provided by the structural designer, including Foundation Design Data and Foundation Loads, are presented in the following tables.

TABLE 9 - FOUNDATION DESIGN DATA

Support No	Design Method	Pile Type	Finish Grade Elev. (ft)	Pile Cut-off Elev. or Bottom of Footing Elev. (ft)	Pile Cap Size (ft)		Permissible Settlement (in)	No. of Piles per Support
					B	L		
Abut 1	LRFD	18” x 0.625” Steel Pipe	221.43	206.0	3	87	1.00	18
Abut 2	LRFD	18” x 0.625” Steel Pipe	221.61	206.0	3	68	1.00	14

TABLE 10 - FOUNDATION DESIGN LOADS0

Support No.	Service-I Limit State (kips)			Strength Limit State (Controlling Group, kips)				Extreme Limit State (Controlling Group, kips)			
	Total Load		Permanent Loads	Compression		Tension		Compression		Tension	
	Per Support	Max Per Pile	Per Support	Per Support	Max. Per Pile	Per Support	Max. Per Pile	Per Support	Max. Per Pile	Per Support	Max. Per Pile
Abut 1	1800	110	1500	2400	140	N/A	N/A	N/A	N/A	N/A	N/A
Abut 2	1500	110	1200	2000	150	N/A	N/A	1200(1)	90(1)	N/A	N/A

(1) Extreme event compression loading provided are permanent loads that will need to be resisted under liquefaction downdrag.

Load and Resistance Factor Design (LRFD) was used for abutment foundations, per AASHTO LRFD Bridge Design Specifications–6th Edition, with Caltrans Amendments.

The pile cut-off or bottom of footing elevations are shown in Table 9. The evaluation of Load Demands on the piles, based upon LRFD is presented in Table 10 above. The estimated specified tip elevations for the anticipated design loading of the piles are shown in Table 11 below.

TABLE 11 - FOUNDATION RECOMMENDATIONS

Location	Cut-off Elev. Or Bottom of Footing Elev. (ft)	Service-I Limit State Load per Support (kips)		Total Permissible Footing Settlement (inches)	Nominal Resistance(iii), (iv) (kips)				Design Tip Elev.(i) (ft)	Specified Tip Elev. (ft)	Nominal Driving Resistance (kips)
		Total	Permanent		Strength Limit (φ_{qs}&φ_{qp} = 0.7)		Extreme Event (φ_{qs}&φ_{qp} = 1.0)				
					Comp.	Tension	Comp.	Tension			
Abut 1	206.0	1800	1500	1	200	0	N/A	N/A	168.5 (a-I) 184.5 (a-II) 181.0 (c), 170.0 (d)	168.5	300
Abut 2	206.0	1500	1200	1	220	0	200(v)	N/A	168.5 (a-I) 129.0 (a-II) 188.0 (c), 170.0 (d)	129.0	620

(i) Design tip elevations are controlled by (a-I) Compression (Strength Limit), (a-II) Compression (Extreme Event), (c) Settlement, (d) Lateral Load.
(ii) The nominal driving resistance required is equal to the nominal resistance needed to support the factored load plus driving resistance from the penetrated soil layers, if any, which do not contribute to the design resistance.
(iii) Column heading modified from *Required Factored Nominal Resistance* to **Nominal Resistance**
(iv) *Resistance* factor for φ_{qs} is for skin friction and φ_{qp} is for end bearing.
(v) The additional downdrag induced load of 110.0 kips was assumed in the analysis for Abutment 2 for Extreme Event Limit State.
(vi) Lateral Pile Capacity Analysis was performed by the structural designer.

TABLE 12 - PILE DATA TABLE

Location	Pile Type	Cut-off Elev. Or Bottom of Footing Elev. (ft)	Nominal Resistance (kips)		Design Tip Elev. (ft)	Specified Tip Elev. (ft)
			Compression	Tension		
Abu 1	18” x 0.625” Steel Pipe Pile	206.0	200	N/A	168.5 (a), 181.0 (c), 170.0 (d)	168.5
Abut 2	18” x 0.625” Steel Pipe Pile	206.0	220	N/A	129.0 (a), 188.0 (c), 170.0 (d)	129.0

i Design tip elevations for Abutments are controlled by: (a) Compression, (c) Settlement, (d) Lateral
ii Lateral Pile Capacity Analysis was performed by the structural designer.

The pile capacities for the 18" x 0.625" steel pipe piles were calculated based on guidelines by American Petroleum Institute (API) publication "Recommended Practice for Planning, Designing and Constructing Fixed Offshore Platforms – Working Stress Design" (API RP 2A-WSD, 2002). The pile capacities were derived both from frictional resistance along the pile shaft and end bearing resistance under compression. For soil layers above liquefiable zone, downdrag load is considered as additional ultimate structural demands (Factor of Safety = 1.0) for extreme event. For end bearing resistance, we assumed that a soil plug will be formed during driving.

The estimated design tip elevations and specified tip elevations are based on the general plan, foundation plan, "Foundation Design Data" and "Foundation Design Loads" provided by the structural designer. In the event that these footing bottom elevations are changed, the design pile tip elevations may have to be revised accordingly. The axial pile capacity calculations are presented in Appendix VI.

14.4 Lateral Design for Piles

The piles should not be spaced closer than 3 times the pile diameter measured center-to-center. For piles spaced at center-to-center distance greater than or equal to 3 times the pile diameter, there is no group effect for pile vertical capacity.

Based on the pile layouts provided by the structural designer provided by the structural designer, the following "P-Y" Curve Modification Factors should be used for lateral pile capacity analysis:

- Abutment 1 - Transverse: 0.44, Longitudinal: 0.91
- Abutment 2 - Transverse: 0.44, Longitudinal: 0.91

The piles under the lateral demand using L-PILE software was performed by the structural designer. The L-PILE results will be provided by the structural designer. The recommended L-PILE parameters are included in Appendix VI and in the tables below.

TABLE 13A–GEOTECHNICAL PARAMETERS FOR LPILE ANALYSIS ABUTMENT 1
(Boring R-18-SO-002)

Approx. Depth (ft)	Elevation (ft.)	Soil Type	c (psf)	Phi (degrees)	Effective Unit Weight γ' (pcf)
0 to 10	220 to 210	Sand (Reese)	-	ϕ = 36°	125
10 to 18	210 to 202	Stiff Clay w/o Free Water (Reese)	c=1800 psf	-	125
18 to 22	202 to 198	Stiff Clay w/o Free Water (Reese)	c=3000 psf	-	125
22 to 26.5	198 to 193.5	Sand (Reese)	-	ϕ = 38°	65
26.5 to 38.5	193.5 to 181.5	Stiff Clay w/o Free Water (Reese)	c=2000 psf	-	65
38.5 to 61	181.5 to 159	Sand (Reese)	-	ϕ = 36°	65
61 to 64.5	159 to 155.5	Case I) Sand (Reese)	-	ϕ = 32°	65
		Case II) Soft Clay (Matlock)	c=500 psf	-	65
64.5 to 76	155.5 to 144	Soft Clay (Matlock)	c=900 psf	-	65
76 to 85	144 to 135	Stiff Clay w/o Free Water (Reese)	c=2500 psf	-	65
85 to 121.5	135 to 98.5	Sand (Reese)	-	ϕ = 38°	65

(1) Default values of soil modulus (k) and soil strain (ε_{50}) can be used for all layers
(2) Groundwater was measured at the depth of 22 feet below existing ground during drilling at Elevation +198.0 feet.

TABLE 13B–GEOTECHNICAL PARAMETERS FOR LPILE ANALYSIS ABUTMENT 2
(Boring R-18-SO-001)

Approx. Depth (ft)	Elevation (ft.)	Soil Type	c (psf)	Phi (degrees)	Effective Unit Weight γ' (pcf)
0 to 8.5	221 to 212.5	Sand (Reese)	-	$\phi = 36°$	125
8.5 to 16	212.5 to 205	Stiff Clay w/o Free Water (Reese)	c=1800 psf	-	125
16 to 32.5	205 to 188.5	Stiff Clay w/o Free Water (Reese)	c=1800 psf	-	125
32.5 to 33.5	188.5 to 187.5	Stiff Clay w/o Free Water (Reese)	c=2000 psf	-	65
33.5 to 39	187.5 to 182	Case I) Sand (Reese)	-	$\phi = 34°$	65
		Case II) Stiff Clay w/o Free Water (Reese)	c=1400 psf	-	65
39 to 43	182 to 178	Case I) Sand (Reese)	-	$\phi = 32°$	65
		Case II) Soft Clay (Matlock)	c=650 psf	-	65
43 to 53	178 to 168	Sand (Reese)	-	$\phi = 36°$	65
53 to 56.5	168 to 164.5	Case I) Sand (Reese)	-	$\phi = 33°$	65
		Case II) Stiff Clay w/o Free Water (Reese)	c=1000 psf	-	65
56.5 to 71	164.5 to 150	Stiff Clay w/o Free Water (Reese)	c=1000 psf	-	65
71 to 85	150 to 130	Stiff Clay w/o Free Water (Reese)	c=1250 psf	-	65
85 to 101.5	130 to 119.5	Sand (Reese)	-	$\phi = 38°$	65

(1) Default values of soil modulus (k) and soil strain (ε_{50}) can be used for all layers
(2) Groundwater was measured at the depth of 32.5 feet below existing ground during drilling at Elevation +188.5 feet.

14.5 Lateral Earth Pressures

Abutment retaining walls should be designed to resist the following Applied Lateral Earth Pressures (Equivalent Fluid Pressures-EFP) and live load. These values assume no hydrostatic pore pressure buildup behind the wall and are based on well-drained backfill behind the walls supported in native soil. If hydrostatic pressures are allowed to build up behind the walls, additional lateral loads should be considered in the design.

<u>Applied Lateral Earth Pressure</u>

(a) Active Condition — Recommended active pressure is 36 pcf EFP for the engineered backfill.

(b) At-Rest Condition — Recommended at-rest pressure is 55 pcf EFP for the engineered backfill.

(c) Passive Resistance — 5.0 ksf (ultimate) for seismic design of the abutment backwall (5.5 feet or greater); for activated height less than 5.5 feet, modify proportionally i.e. 5.0x (H/5.5) ksf per. A minimum lateral wall movement of 2% of wall height to mobilize the full ultimate passive resistance is required.

Cantilever walls, which are free to rotate by at least 0.005 radian, may be assumed flexible and designed for the active condition. Walls that are not capable of this movement should be assumed rigid and designed for the at-rest condition. The effect of any surcharge (dead, live, or traffic load) should be added to the preceding lateral earth pressures. A coefficient of 0.4 and 0.5 may be used to determine the additional lateral earth pressures resulting from the surcharge for cantilever walls and rigid walls, respectively.

14.6 Settlement

The proposed bridge structure will be formed by excavation and backfill and no additional fill or overburden will be placed on the original ground. Therefore, the settlement is anticipated to be minimal and should not be a geotechnical concern.

15.0 CONSTRUCTION CONSIDERATIONS

15.1 General

To a degree, the performance of any structure is dependent upon construction procedures and quality. Hence, observation of foundation construction should be carried out by the responsible Agency. If the encountered subsurface conditions differ from the basis of our recommendations, Parikh should be informed in order to assess the need for design changes. Therefore, the recommendations presented in this report are contingent upon good quality control and these geotechnical observations during construction.

A safe working distance from underground and overhead utilities should be provided during construction work. If this is not possible, the utility lines may need to be cleared from the site before the start of construction work.

15.2 18” x 0.625” Steel Pipe Pile

a) There are houses in the vicinity of the proposed bridge structure. Noise levels by construction such as pile driving, the construction noise impacts and requirements related to construction noise have been addressed in Section 8 of the PA&ED "US 101/Blossom Hill Road Interchange Improvement Project – Noise Study Report".

b) Medium stiff to stiff cohesive soils with interbedded layers of medium dense to dense sands are generally encountered at the project site. Hard driving is expected.

c) Should difficult driving be encountered where the vertical compression requirement is met prior to reaching the specified tip elevation, pile driving may be allowed to terminate if other tip requirements for lateral, tension and settlement are met. Undersize pre-drill (partial length) may be considered to help reach the tip elevation if necessary.

d) In general, a pile may be considered to have reached "practical refusal" if pile advance less than 1 inch under 10 blows or a foot under 100 blows.

e) It is anticipated that the pile capacity will develop after driving as a result of soil "freeze" and dissipation of excess pore water pressures. The final pile capacity can be verified and the gain of pile capacity after initial driving may be evaluated based on "re-driving" after 24-hour (min.) set up. 2015 Caltrans Standard Specifications (Section 49-2.01A (4)9b)) may be used as the pile driving acceptance criteria.

f) As an option, Pile Driving Analyzer (PDA) may be used to evaluate the pile capacity of the driven piles when unanticipated conditions arise. Typical applications of the PDA include capacity evaluation (for both during driving and re-driving) and integrity testing for piles that have experienced hard driving.

g) It is prudent to make the contractor aware of these conditions so that appropriate steps can be taken to comply with the standards and maintain the integrity of the piles.

h) Due to the hard driving condition that may be encountered during pile driving, pile driving should be allowed to terminate short of the specified tip elevation provided the following conditions are satisfied:

- Other requirements including tension and lateral demands are met;
- Pile attaining its capacity and refusal within 5 feet above the specified tip elevation.

16.0 NOTES TO DESIGNER

Should the specified pile tip elevation required to meet lateral load demands exceed the specified pile tip elevation given within this report, the Geotechnical Engineer must be contacted for further recommendations.

17.0 PLAN REVIEW

This report is prepared for the proposed "SB 101 Off-Ramp PUC) (Bridge No. 37-675J)". We recommend that final foundation plans for the proposed project to be reviewed by PARIKH prior to construction so that the intent of our recommendations is included in the project plans and specifications and to further see that no misunderstandings or misinterpretations have occurred. However, design-build elements should be reviewed only from overall compliance standpoint.

18.0 CONSTRUCTION OBSERVATION

To a degree, the performance of any structure is dependent upon construction procedures and quality control measures. Hence, geotechnical observation and testing of grading operations, foundation excavations, and observation of pile installations should be carried out by the Geotechnical Engineer. If the subsurface conditions different from those forming the basis of our recommendations are encountered, this office should be informed in order to assess the need for design changes. Therefore, the recommendations presented in this report are contingent upon good quality control and these geotechnical observations during construction.

19.0 INVESTIGATION LIMITATIONS

Our services consist of professional opinions and recommendations made in accordance with generally accepted geotechnical engineering principles and practices and are based on our site reconnaissance and the assumption that the subsurface conditions do not deviate from observed conditions. All work done is in accordance with generally accepted geotechnical engineering principles and practices. No warranty, expressed or implied, of merchantability or fitness, is made or intended in connection with our work or by the furnishing of oral or written reports or findings.

The scope of our services did not include any environmental assessment or investigation for the presence or absence of hazardous or toxic materials in structures, soil, surface water, groundwater or air, below or around this site. Unanticipated soil conditions are commonly encountered and cannot be fully determined by taking soil samples and excavating test borings; different soil conditions may require that additional expenditures be made during construction to attain a properly constructed project. Some contingency fund is thus recommended to accommodate these possible extra costs.

This report has been prepared for the proposed project as described earlier, to assist the engineer in the design of this project. In the event any changes in the design or location of the facilities are planned, or if any variations or undesirable conditions are encountered during construction, our conclusions and recommendations shall not be considered valid unless the changes or variations are reviewed and our recommendations modified or approved by us in writing.

This report is issued with the understanding that it is the designer's responsibility to ensure that the information and recommendations contained herein are incorporated into the project and that necessary steps are also taken to see that the recommendations are carried out in the field.

The findings in this report are valid as of the present date. However, changes in the subsurface conditions can occur with the passage of time, whether they are due to natural processes or to the works of man, on this or adjacent properties. In addition, changes in applicable or appropriate standards occur, whether they result from legislation or from the broadening of knowledge. Accordingly, the findings in this report might be invalidated, wholly or partially, by changes outside of our control.

Respectfully submitted,
PARIKH CONSULTANTS, INC.

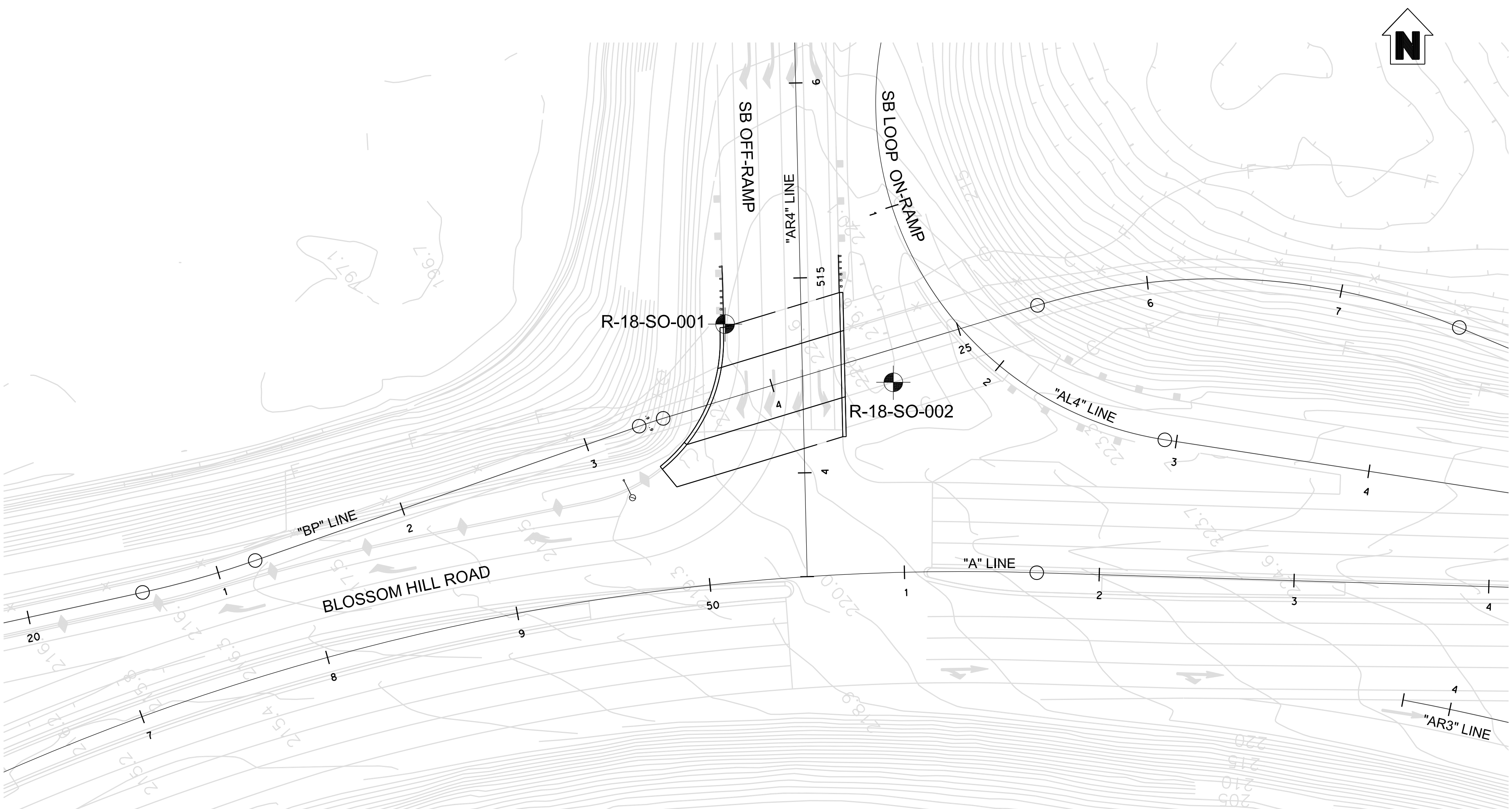
REGISTERED PROFESSIONAL ENGINEER
Y. DAVID WANG
No. P.E. 52911
Exp. 12/31/20
CIVIL
STATE OF CALIFORNIA

Y. David Wang

Alston Lam, P.E., G.E. 2605
Project Engineer

Y. David Wang, Ph.D., P.E., 52911
Senior Engineer

T:\Ongoing Projects\2016\2016-146-OUC SB101 Off-Ramp PUC\FR (Final) (Words)\SB101 Off-Ramp PUC FR (10-2019).docx



BORING LOCATION MAP

LEGEND

R-18-SO-001

Approx. Boring Location (Drilled by PARIKH in 2018)

SCALE: 1 inch = 100 feet

Note: All units are in feet unless otherwise specified
Reference Map was provided by HMH Engineers.

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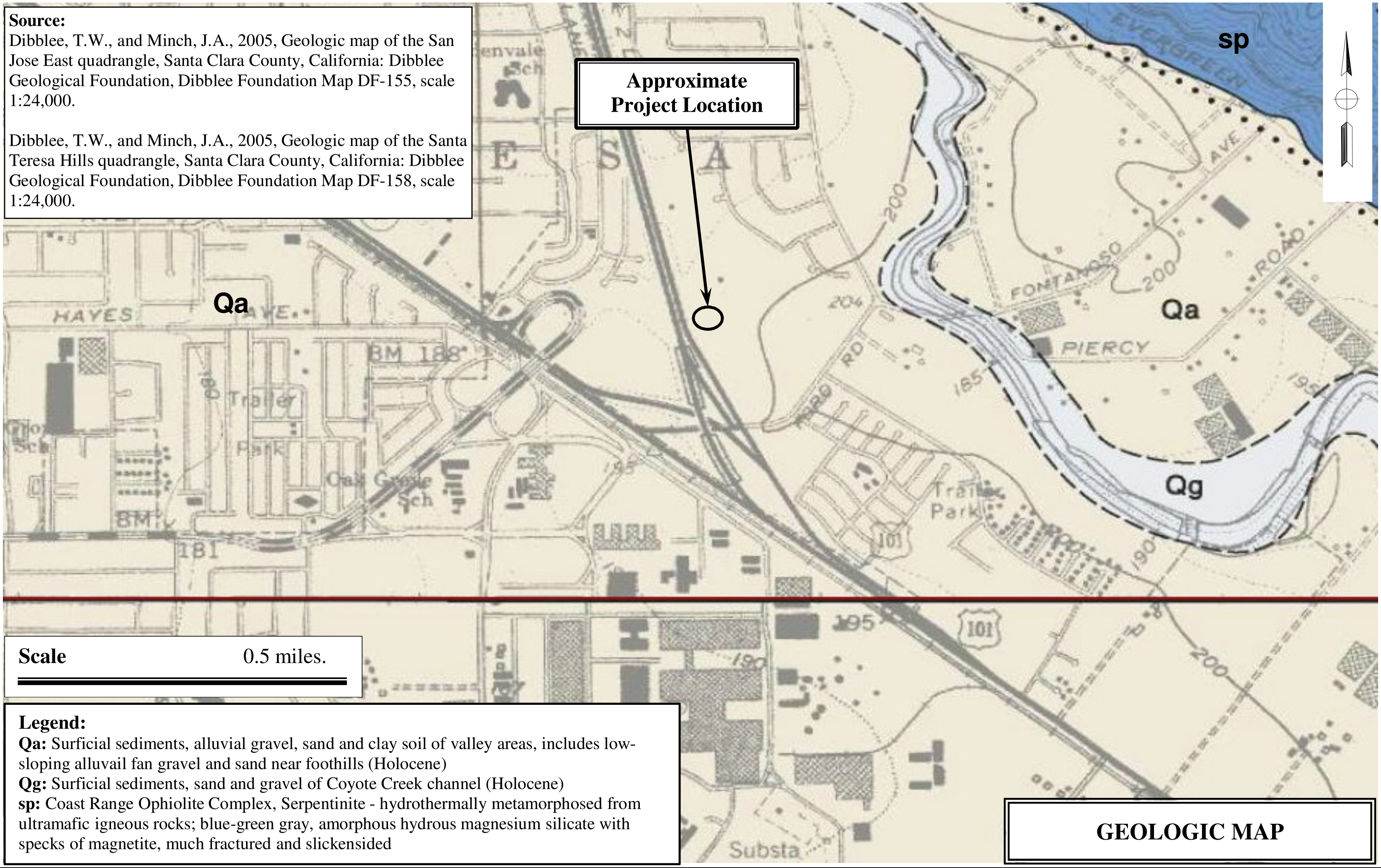
SB101 OFF-RAMP PEDESTRIAN UC
SAN JOSE, CALIFORNIA

JOB NO.:2016-146-OUC	PLATE NO: 1

Source:
Dibblee, T.W., and Minch, J.A., 2005, Geologic map of the San Jose East quadrangle, Santa Clara County, California: Dibblee Geological Foundation, Dibblee Foundation Map DF-155, scale 1:24,000.

Dibblee, T.W., and Minch, J.A., 2005, Geologic map of the Santa Teresa Hills quadrangle, Santa Clara County, California: Dibblee Geological Foundation, Dibblee Foundation Map DF-158, scale 1:24,000.



Scale 0.5 miles.

Legend:
Qa: Surficial sediments, alluvial gravel, sand and clay soil of valley areas, includes low-sloping alluvail fan gravel and sand near foothills (Holocene)
Qg: Surficial sediments, sand and gravel of Coyote Creek channel (Holocene)
sp: Coast Range Ophiolite Complex, Serpentinite - hydrothermally metamorphosed from ultramafic igneous rocks; blue-green gray, amorphous hydrous magnesium silicate with specks of magnetite, much fractured and slickensided

GEOLOGIC MAP

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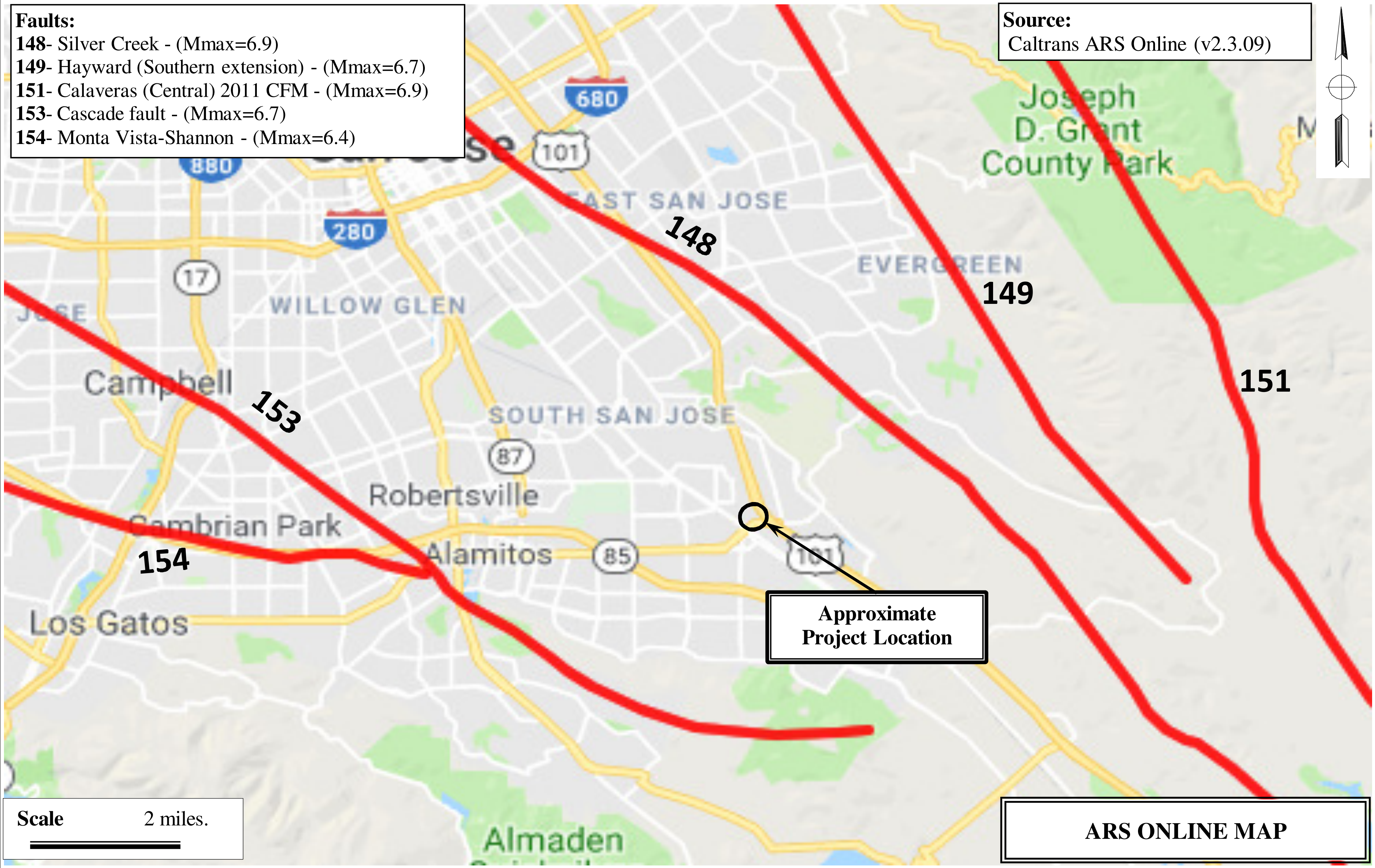
Practicing in the Geosciences

SOUTHBOUND 101 OFF-RAMP PEDESTRIAN UNDERCROSSING
SAN JOSE, CALIFORNIA

JOB NO.: 2016-146-OUC	**PLATE NO.: 2**



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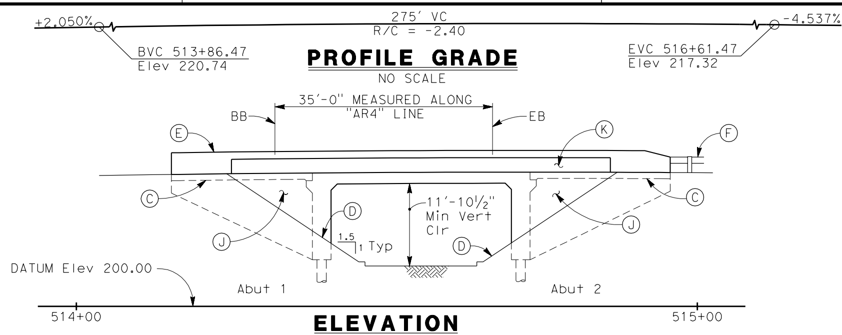
SOUTHBOUND 101 OFF-RAMP PEDESTRIAN UNDERCROSSING SAN JOSE, CALIFORNIA	
JOB NO.: 2016-146-OUC	PLATE NO.: 3

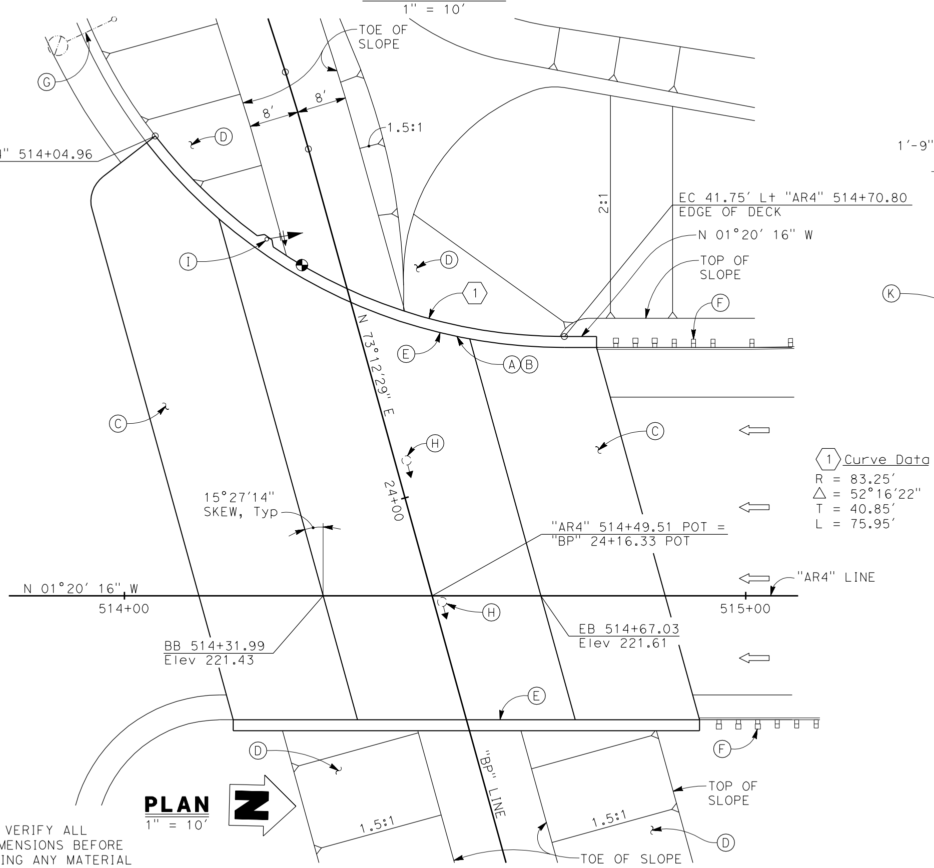


PROFILE GRADE

NO SCALE

ELEVATION

1" = 10'



1 Curve Data
R = 83.25'
Δ = 52°16'22"
T = 40.85'
L = 75.95'

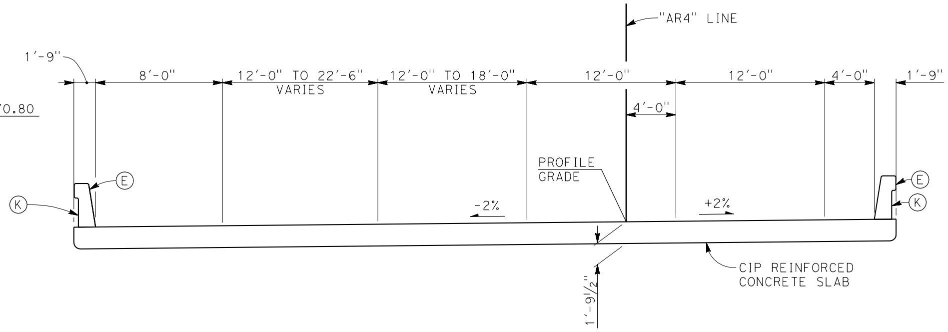
PLAN

1" = 10'

NOTE:
THE CONTRACTOR MUST VERIFY ALL CONTROLLING FIELD DIMENSIONS BEFORE ORDERING OR FABRICATING ANY MATERIAL

LEGEND:

- Indicates Point of Minimum Vertical Clearance
- Indicates Traffic Direction



TYPICAL SECTION

1" = 5'

NOTES:

- (A) Paint "BRIDGE NO. 37-675J"
- (B) Paint "SB OFF-RAMP PEDESTRIAN UC"
- (C) Structure Approach Type N
- (D) Slope Paving with Architectural Treatment, see "Roadway Plans"
- (E) Concrete Barrier Type 842 (Mod)
- (F) Midwest Guardrail System, see "Roadway Plans"
- (G) Replace Signal Standard, see "Roadway Plans"
- (H) Soffit Lighting, see "Roadway Plans"
- (I) Type 1B Signal Pole on barrier, see "Roadway Plans"
- (J) Architectural Treatment on Wingwall, see "Roadway Plans"
- (K) Architectural Treatment on Concrete Barriers, see "Roadway Plans"

1. For Index to Plans, Quantities, and General Notes, see "GENERAL NOTES" sheet.
2. For Pile Data Table, see "FOUNDATION PLAN" sheet.
3. For Bench Mark and Datum, see "FOUNDATION PLAN" sheet.

PLAN CHECK SET/NOT FOR CONSTRUCTION (9/19/19)

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	SCI	101	R28.4/R28.9		

REGISTERED STRUCTURAL ENGINEER DATE

REGISTERED PROFESSIONAL ENGINEER MAHVASH M. HARMS No. 2639 Exp. 12/31/20 STRUCTURAL STATE OF CALIFORNIA

PLANS APPROVAL DATE

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SAN JOSE, CA 95113

BIGGS CARDOSA ASSOCIATES INC.
865 THE ALAMEDA
SAN JOSE, CALIFORNIA 95126

		BY	CHECKED		BY	CHECKED
DESIGN OVERSIGHT	DESIGN	R. YAMANE	A. RICHARDSON	LOAD & RESISTANCE FACTOR DESIGN	LIVE LOADING: HL93 W/"LOW-BOY"; PERMIT DESIGN VEHICLE	
	DETAILS	R. YAMANE	A. RICHARDSON	LAYOUT	G. KENNING	A. RICHARDSON
SIGN OFF DATE	QUANTITIES	D. ROZPORKA	R. RIVAS	SPECIFICATIONS	G. KENNING	PLANS AND SPECS COMPARED A. NOTARO

PREPARED FOR THE **STATE OF CALIFORNIA** DEPARTMENT OF TRANSPORTATION

G. KENNING
PROJECT ENGINEER

BRIDGE NO. 37-675J
POST MILES R28.75

SB 101 OFF-RAMP PEDESTRIAN UC
GENERAL PLAN

DESIGN GENERAL PLAN SHEET (ENGLISH) (REV. 7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0000
PROJECT NUMBER & PHASE: 04160002241
CONTRACT NO.: 04-1K2804
FILE => $REQUEST

DISREGARD PRINTS BEARING EARLIER REVISION DATES
REVISION DATES: 7/11/18 12/05/18 4/17/19

SHEET 1 OF 14

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

2016309 (2016309BS1)

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	SCI	101	R28.4/R28.9		

REGISTERED STRUCTURAL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER MAHVASH M. HARMS No. 2639 Exp. 12/31/20 STRUCTURAL STATE OF CALIFORNIA

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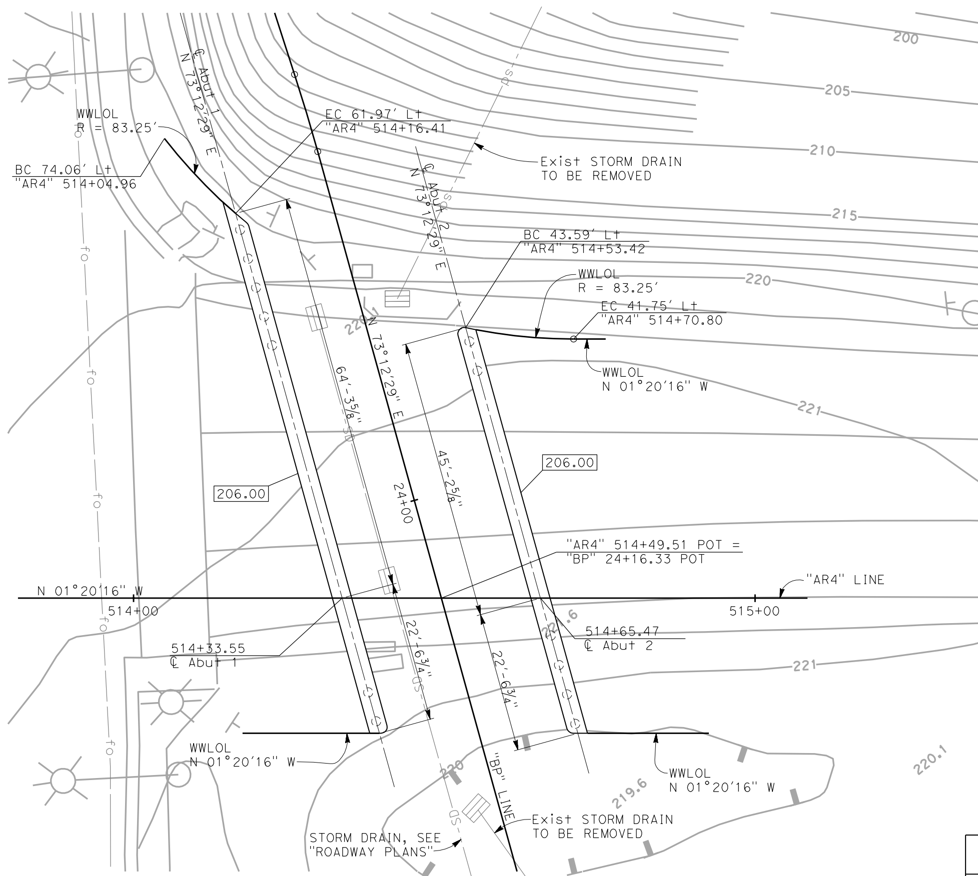
865 THE ALAMEDA
SAN JOSE, CALIFORNIA 95126

LEGEND:
29.6 Indicates Spot Elevation
Indicates Bottom of Abutment Diaphragm Elevation
Indicates Pile, not all piles shown



FOUNDATION PLAN

1" = 10'

NOTE:
Verify utility locations with "Roadway Plans"

BENCH MARK AND DATUM

MONUMENT	COORDINATES NORTHING	COORDINATES EASTING	ELEVATION	DESCRIPTION/LOCATION
107	1,918,675.697	6,184,775.266	220.36	SET MAG NAIL & SHINER ± 70' EAST OF SILVER CREEK VALLEY Rd OVERPASS.
118	1,919,879.851	6,183,487.929	197.17	SET MAG NAIL & SHINER AT 101 SOUTHBOUND SHOULDER.

PILE DATA TABLE

LOCATION	PILE TYPE	NOMINAL RESISTANCE		DESIGN TIP Elev (ft)	SPECIFIED TIP Elev (ft)	NOMINAL DRIVING RESISTANCE (kips)
		COMPRESSION	TENSION			
ABUTMENT 1	PP 18x0.625	200 kips	N/A	168.5(a); 181.0(c); 170.0(d)	168.5	300
ABUTMENT 2	PP 18x0.625	220 kips	N/A	129.0(a); 188.0(c); 170.0 (d)	129.0	620

NOTES:
1. Design tip elevations for Abutments are controlled by: (a) Compression, (c) Settlement, (d) Lateral load.
2. The specified tip elevation must not be raised above the design tip for lateral load, and tolerable settlement.

GEOTECHNICAL PROFESSIONAL APPROVAL DATE

NOTE:
THE CONTRACTOR MUST VERIFY ALL
CONTROLLING FIELD DIMENSIONS BEFORE
ORDERING OR FABRICATING ANY MATERIAL

PLAN CHECK SET/NOT FOR CONSTRUCTION (8/29/19)

DESIGN OVERSIGHT	SCALE: AS SHOWN	VERT.DATUM NAVD88	HORZ.DATUM CCS83 ZONE 3	DESIGN	BY R. YAMANE	CHECKED A. RICHARDSON	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION
	PHOTOGRAMMETRY AS OF: JULY 2016	ALIGNMENT TIES		DETAILS	BY R. YAMANE	CHECKED A. RICHARDSON	
SIGN OFF DATE	SURVEYED BY HMH	DRAFTED	BY RADMAN AERIAL	QUANTITIES	BY D. ROZPORKA	CHECKED R. RIVAS	
	FIELD CHECKED BY RADMAN AERIAL	CHECKED	BY RADMAN AERIAL				

G. KENNING
PROJECT ENGINEER

BRIDGE NO. 37-675J
POST MILES R28.75

SB 101 OFF-RAMP PEDESTRIAN UC
FOUNDATION PLAN

FOUNDATION PLAN SHEET (ENGLISH) (REV. 7-16-10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0000
PROJECT NUMBER & PHASE: 04160002241 CONTRACT NO.: 04-1K2804

DISREGARD PRINTS BEARING EARLIER REVISION DATES
REVISION DATES 7/11/18 12/05/18 4/17/19

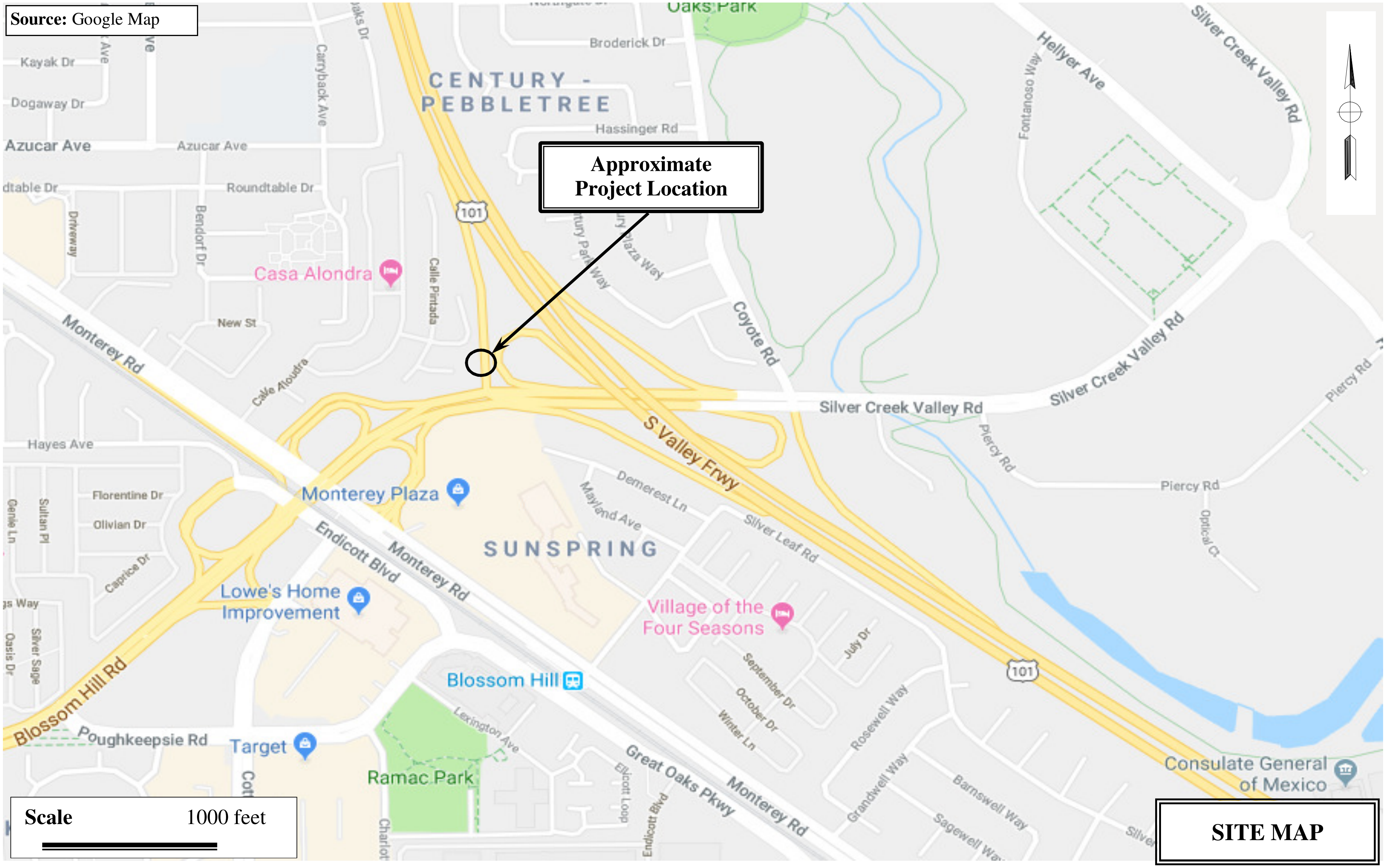
SHEET 4 OF 14

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

2016309 (2016309BS4)

APPENDIX I



SITE MAP

SOUTHBOUND 101 OFF-RAMP PEDESTRIAN UNDERCROSSING SAN JOSE, CALIFORNIA	
JOB NO.: 2016-146-OUC	APPENDIX I

PARIKH
Practicing in the Geosciences

APPENDIX II

APPENDIX II

FIELD EXPLORATION

All the test borings were drilled with a truck-mounted drill rig using 8-inch diameter hollow-stem auger and switched to rotary-wash drilling method with 3.3-inch diameter drilling bit. The soil samples were obtained from the borings during drilling at various depths by driving a 2.5 inches Inside Diameter (I. D.) Modified California Sampler or a 1.375 inches I.D. Standard Penetration Sampler (ASTM Test Method No. 1586). The sampler was driven into the subsurface soils under the impact of a 140 pounds hammer having a free fall of 30 inches. The blow counts required to drive the sampler for the last 12 inches are presented on the Logs of Test Borings, Appendix II. (When correlating standard penetration data in similar soils, the blow counts for the Modified California sampler can be converted to equivalent Standard Penetration Test sampler by multiplying a factor of 0.65). Pocket penetration tests were also performed on clay samples to evaluate their consistency. Upon completion of drilling, the boreholes were backfilled with cement grout.

The borings were drilled under the technical supervision of our engineers, who classified and continuously logged the soils encountered during drilling and supervised the collection of soil samples at various depths for visual examination and laboratory testing. The soil samples were visually classified in the field according to the Caltrans “Soil and Rock Logging, Classification and Presentation Manual” (2010 Edition) and then transported to our laboratory for further evaluation and testing.

The descriptions of the soils encountered and relevant boring information are presented on the Log of Test Borings attached in Appendix II. The laboratory test methods and results are presented in Appendix IV. The logs presented in Appendix II were prepared from the field logs which were edited after visual re-examination of the soil samples in the laboratory and results of classification tests on selected soil samples as indicated on the logs.

The descriptions and related information presented on these logs of test borings depict subsurface conditions only at the locations indicated on the plan and on the particular date noted on the logs. Because of the variability from place to place within soil/rock in general, subsurface conditions at other locations may differ from conditions occurring at the location explored. The abrupt stratum changes shown on the logs may be gradational and relatively minor changes in soil types within a stratum may not be noted on the logs due to field limitations. Also, the passage of time may result in a change in the soil conditions at these locations due to environmental changes.

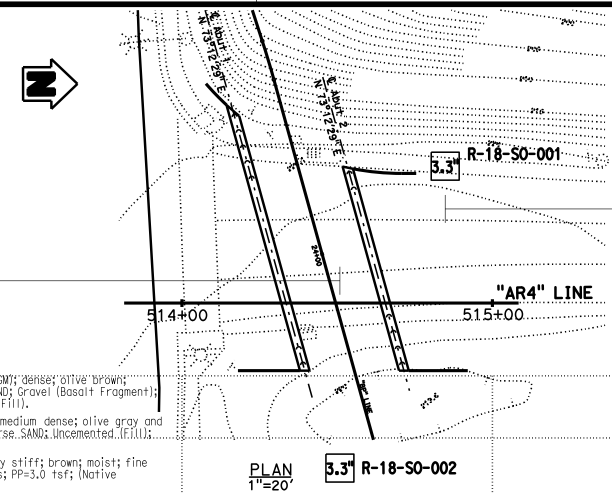
NOTES:

Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2" Modified California Sampler: I.D. = 2.5"; O.D. = 3" Hammer Assembly: A 140 lb hammer with a 30" drop (Automatic Hammer)

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock, Logging, Classification, and Presentation Manual (2010)

See Caltrans 2015 Standard Plans A10F, A10G and A10H for Soil and Rock Legend.

All dimensions are in feet unless otherwise shown



BENCH MARK:

NGS QQ453 (HS 2787)
Elev. 190.83
4.7 miles northwest along the southern Pacific Company Railroad from the station at Coyote.

Vertical Datum: NAVDBB
Horizontal Datum: CCS83, Zone 3, Epoch 2010.00 in U.S Survey Feet.

BOREHOLE LOCATION TABLE

Hole ID	Alignment Name	Station and Offset
R-18-SO-001	"AR4" Line	514+75 39' Lt.
R-18-SO-002	"AR4" Line	514+45 47' Rt.

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	SCI	101	R28.4/R28.9		

GEOTECHNICAL PROFESSIONAL 10-15-19 DATE

REGISTERED PROFESSIONAL ENGINEER GARY PARIKH No. 666 Exp. 12/31/19 GEOTECHNICAL STATE OF CALIFORNIA

PLANS APPROVAL DATE

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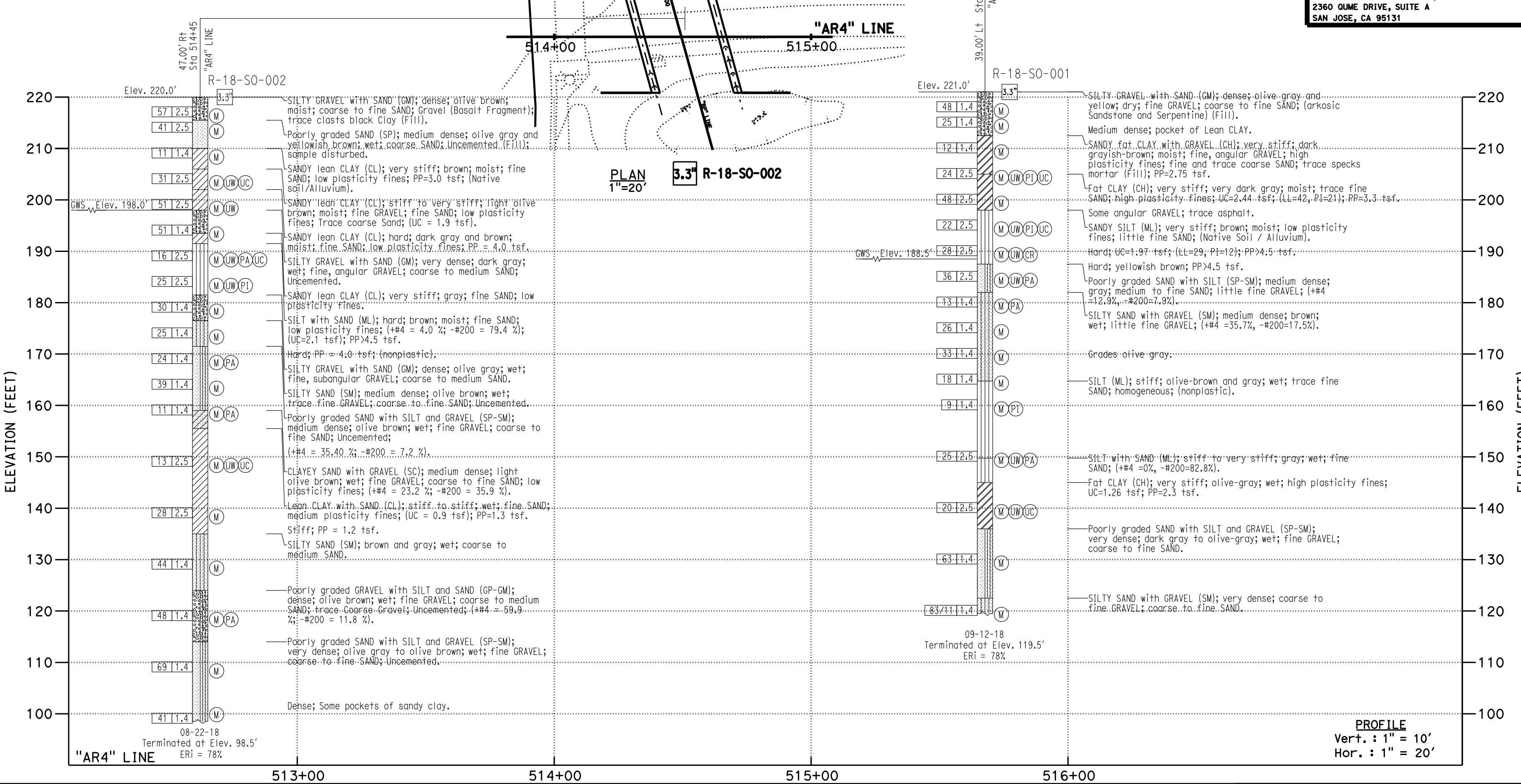
PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131



DESIGN OVERSIGHT	DRAWN BY	KIM OUYANG	L.S. BHANGOO FIELD INVESTIGATION BY:
SIGN OFF DATE	CHECKED BY	ALSTON LAM	DATE: AUGUST 2018 TO SEPTEMBER 2018

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

ALSTON LAM
PROJECT ENGINEER

BRIDGE NO. 37-675J
POST MILES R28.75

SB101 OFF-RAMP PEDESTRIAN UC

LOG OF TEST BORINGS 1 OF 1

GS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 03/14/12)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0000
PROJECT NUMBER & PHASE: 04160002241 CONTRACT NO.: 04-1K2804

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES 7-11-18 4-9-19 10-15-19

SHEET 14 OF 14

FILE => SB101 off-ramp puc-ltb01.dgn

USERNAME => ogouthier DATE PLOTTED => 19-SEP-2019 TIME PLOTTED => 13:58

APPENDIX III

The appendix for
'Field Exploration and Testing'
is not applicable to this report.

APPENDIX IV

APPENDIX IV
LABORATORY TESTS

Classification Tests

The field classification of the samples was visually verified in the laboratory according to the Unified Soil Classification System. The results are presented on "Log of Test Borings", Appendix II.

Moisture-Density

The natural moisture contents were determined for selected undisturbed samples of the soils in accordance with American Standard Test Method (ASTM) D-2216 and dry unit weights were calculated based on natural moisture contents and total unit weights. This information was used to classify and correlate the soils. The results are presented on Plate IV-1, "Laboratory Test Summary ", Appendix IV.

Atterberg Limits

The Atterberg Limits were determined for selected samples of the fine-grained materials. These results were used to classify the soils, as well as to obtain an indication of the expansion potential with variations in moisture content. The Atterberg Limits were determined in accordance with ASTM D-4318. The results of the test are presented on Plate IV-2, "Plasticity Chart", Appendix IV.

Grain Size Classification

Grain size classification tests (ASTM D-422) were performed on selected samples of granular soil to aid in the classification. The results are presented on Plates IV-3A and IV-3B, "Grain Size Distribution Curves", Appendix IV.

Unconfined Compression Tests

Strength tests were performed on selected undisturbed samples using unconfined compression machine. Unconfined compression tests were performed in accordance with ASTM D 2166. The results are presented on Plates IV-4A through IV-4F, "Unconfined Compression Test", Appendix IV.

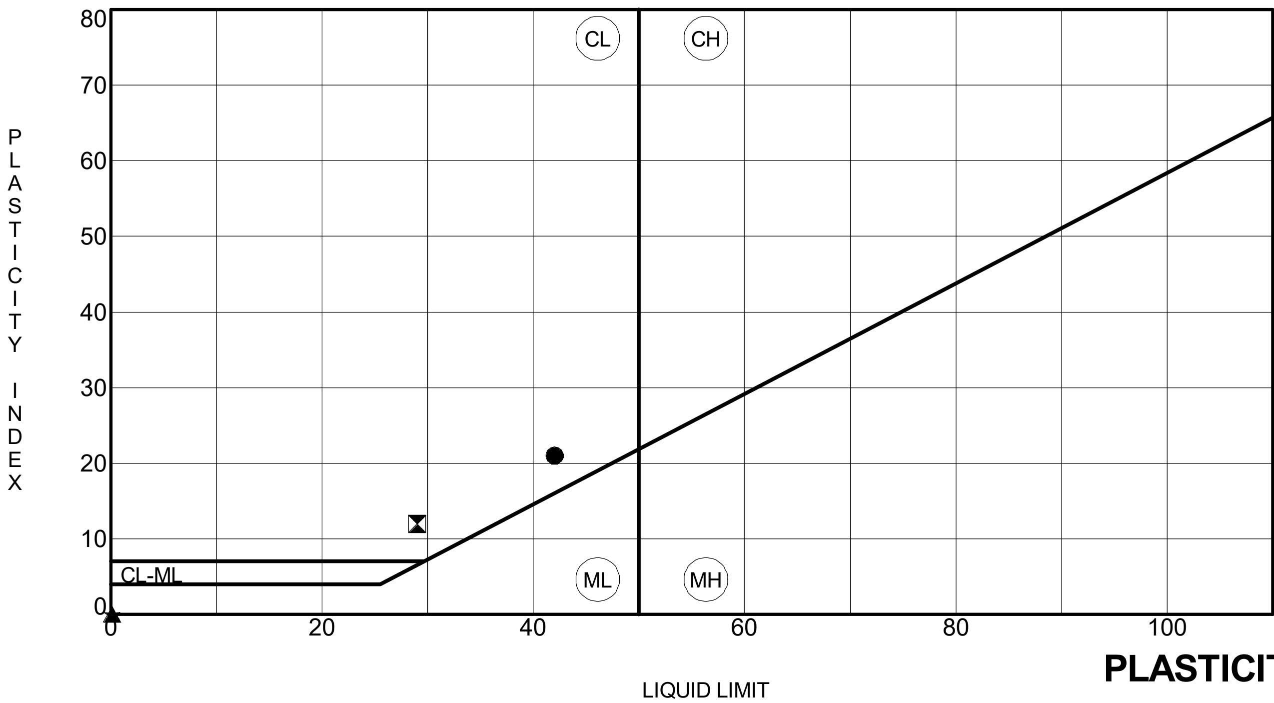
Corrosion Tests

Corrosion tests were performed on selected samples to determine the corrosion potential of the soils. The pH and minimum resistivity tests were performed according to California Test Method CT-643. Sulfate (California Test Method CT-417) and chloride (California Test Method CT-422) tests were performed by Sunland Analytical. The test results are presented on Plates IV-5A and IV-5B, Appendix IV.

LABORATORY TEST SUMMARY

Borehole	Sample Number	Depth	Classi-fication	Water Content	Dry Density	Liquid Limit	Plastic Limit	Plasticity Index	% > Sieve 4	% < Sieve 200	Unconfined Shear Strength (tsf)
R-18-SO-001	1	3.0	GM	13.9	-						
R-18-SO-001	2	6.0	GM	14.0	-						
R-18-SO-001	3	11.0	CH	23.1	-						
R-18-SO-001	4	16.0	CH	22.4	100.8	42	21	21			1.22
R-18-SO-001	5	21.0	CH	7.7	-						
R-18-SO-001	6	26.0	ML	12.9	103.5	29	17	12			0.99
R-18-SO-001	7	31.0	ML	13.1	96.6						
R-18-SO-001	8	36.0	SP-SM	9.2	114.4				12.9	7.9	
R-18-SO-001	9	41.0	SM	7.5	-				35.7	17.5	
R-18-SO-001	10	46.0	SM	15.2	-						
R-18-SO-001	11	51.0	SM	11.2	-						
R-18-SO-001	12	56.0	SM	10.4	-						
R-18-SO-001	13	61.0	ML	29.5	-	NP	NP	NP			
R-18-SO-001	14	71.0	ML	29.8	77.0					82.8	
R-18-SO-001	15	81.0	ML	26.0	92.6						0.63
R-18-SO-001	16	91.0	SP-SM	2.7	-						
R-18-SO-001	17	101.0	SM	6.1	-						
R-18-SO-002	1	3.0	GM	14.2	-						
R-18-SO-002	2	6.0	SP	10.9	-						
R-18-SO-002	3	11.0	CL	21.9	-						
R-18-SO-002	4	16.0	CL	20.0	107.1						0.98
R-18-SO-002	5	21.0	CL	19.2	107.0						
R-18-SO-002	6	26.0	CL	12.1	-						
R-18-SO-002	7	31.0	ML	15.1	112.9				4.0	79.4	1.08
R-18-SO-002	8	36.0	ML	13.9	108.8	NP	NP	NP			
R-18-SO-002	9	41.0	GM	7.3	-						
R-18-SO-002	10	46.0	SM	9.9	-						
R-18-SO-002	11	51.0	SM	8.4	-				35.4	7.2	
R-18-SO-002	12	56.0	SM	8.0	-						
R-18-SO-002	13	61.0	SC	16.0	-				23.2	35.9	
R-18-SO-002	14	71.0	CL	28.1	95.5						0.48
R-18-SO-002	15	81.0	CL	28.6	-						
R-18-SO-002	16	91.0	SM	14.7	-						
R-18-SO-002	17	101.0	SM	6.3	-				59.9	11.8	
R-18-SO-002	18	111.0	SP-SM	8.1	-						
R-18-SO-002	19	121.0	SP-SM	14.8	-						

ATTERBERG LIMITS



PLASTICITY

	BOREHOLE	SAMPLE #	DEPTH	LL	PL	PI	Fines	Classification
●	**R-18-SO-001**	**4**	**16.0**	**42**	**21**	**21**		**Fat CLAY**
⧗	**R-18-SO-001**	**6**	**26.0**	**29**	**17**	**12**		**SANDY SILT**
▲	**R-18-SO-001**	**13**	**61.0**	**NP**	**NP**	**NP**		**SILT**
★	**R-18-SO-002**	**8**	**36.0**	**NP**	**NP**	**NP**		**SANDY SILT**

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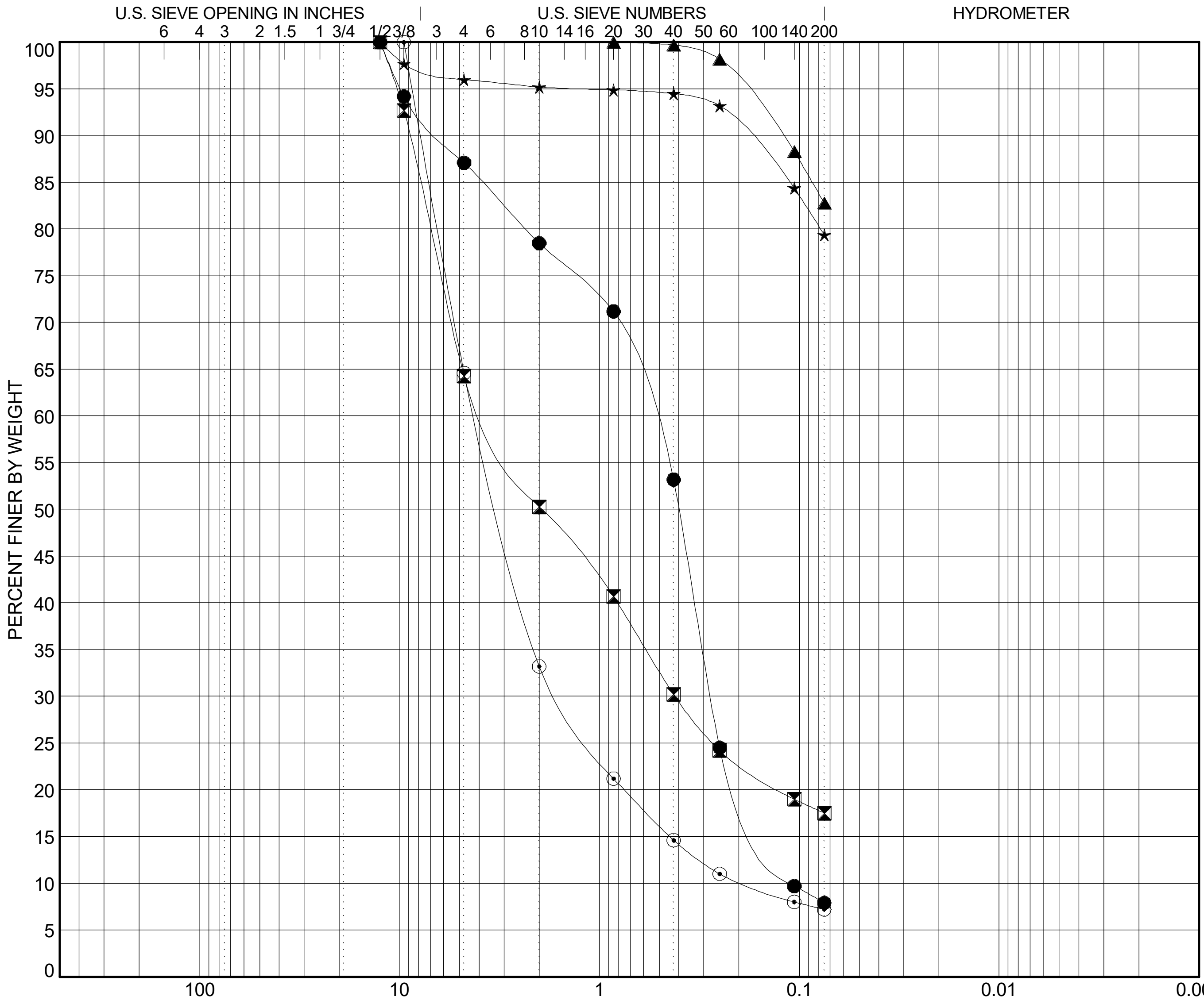
SOUTHBOUND 101 OFF-RAMP PEDESTRIAN UNDERCROSSING
SAN JOSE, CALIFORNIA

JOB NO: 2016-146-OUC | **PLATE NO: IV-2**

GRAIN SIZE DISTRIBUTION CURVE



GRAIN SIZE DISTRIBUTION

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING	SAMPLE #	DEPTH	Classification	LL	PL	PI	Cc	Cu
●	**R-18-SO-001**	**8**	**36.0**	**Poorly graded SAND with SILT**				**1.29**	**5.12**
⧗	**R-18-SO-001**	**9**	**41.0**	**SILTY SAND with GRAVEL**					
▲	**R-18-SO-001**	**14**	**71.0**	**SILT**					
★	**R-18-SO-002**	**7**	**31.0**	**SANDY SILT**					
⊙	**R-18-SO-002**	**11**	**51.0**	**SILTY SAND**				**3.22**	**22.28**

	BORING	SAMPLE #	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**R-18-SO-001**	**8**	**36.0**	**12.5**	**0.552**	**0.277**	**0.108**	**12.9**	**79.2**	**7.9**	
⧗	**R-18-SO-001**	**9**	**41.0**	**12.5**	**3.642**	**0.418**		**35.7**	**46.8**	**17.5**	
▲	**R-18-SO-001**	**14**	**71.0**	**0.85**				**0.0**	**17.2**	**82.8**	
★	**R-18-SO-002**	**7**	**31.0**	**12.5**				**4.0**	**16.6**	**79.4**	
⊙	**R-18-SO-002**	**11**	**51.0**	**9.5**	**4.185**	**1.592**	**0.188**	**35.4**	**57.4**	**7.2**	

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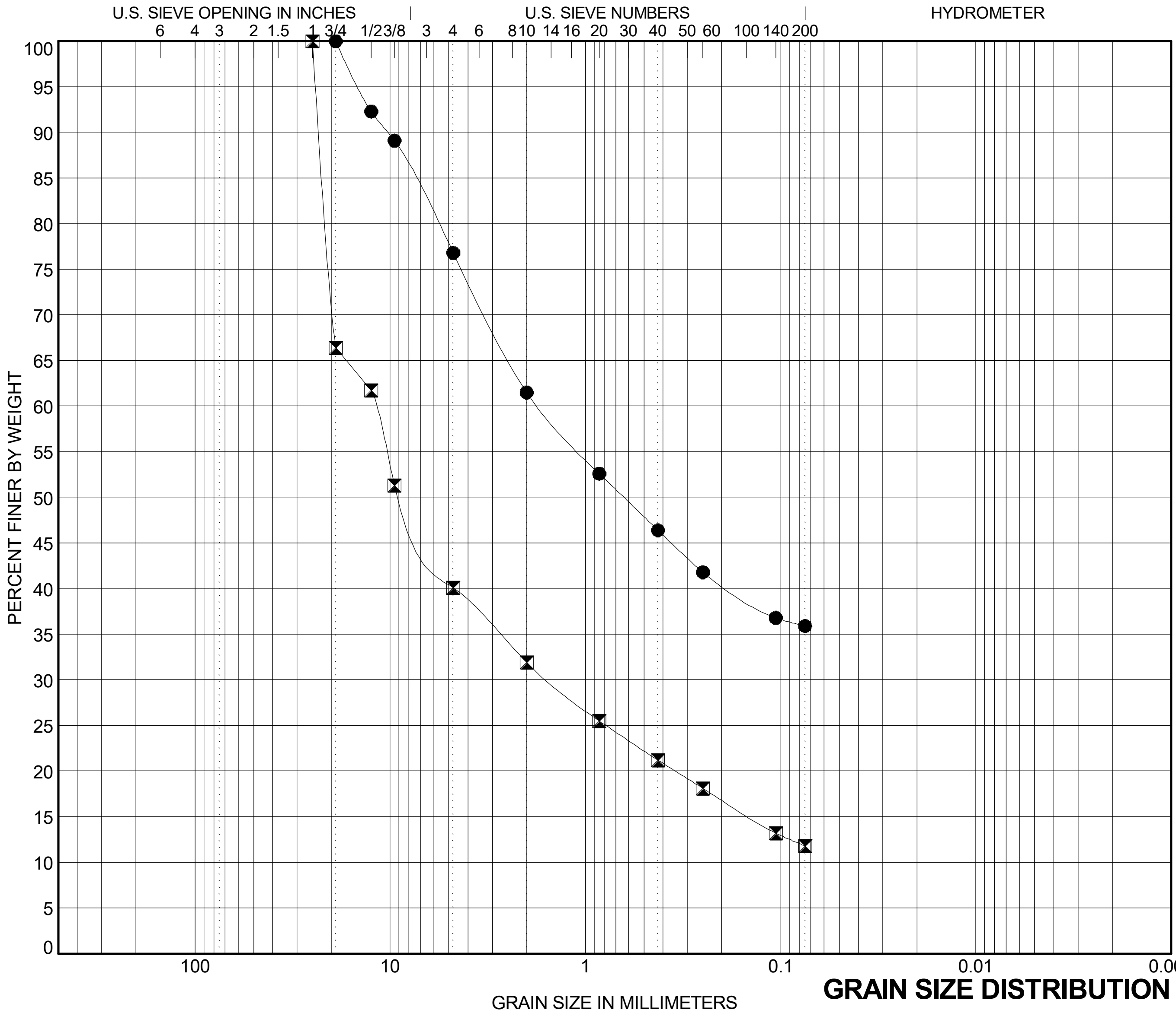
SOUTHBOUND 101 OFF-RAMP PEDESTRIAN UNDERCROSSING
SAN JOSE, CALIFORNIA

JOB NO: 2016-146-OUC | **PLATE NO: IV-3A**



GRAIN SIZE DISTRIBUTION

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

BORING	SAMPLE #	DEPTH	Classification	LL	PL	PI	Cc	Cu
● R-18-SO-002	13	61.0	CLAYEY SAND					
⧗ R-18-SO-002	17	101.0	SILTY SAND				4.19	248.62

BORING	SAMPLE #	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● R-18-SO-002	13	61.0	19	1.731			23.2	40.9	35.9	
⧗ R-18-SO-002	17	101.0	25	11.952	1.551		59.9	28.3	11.8	

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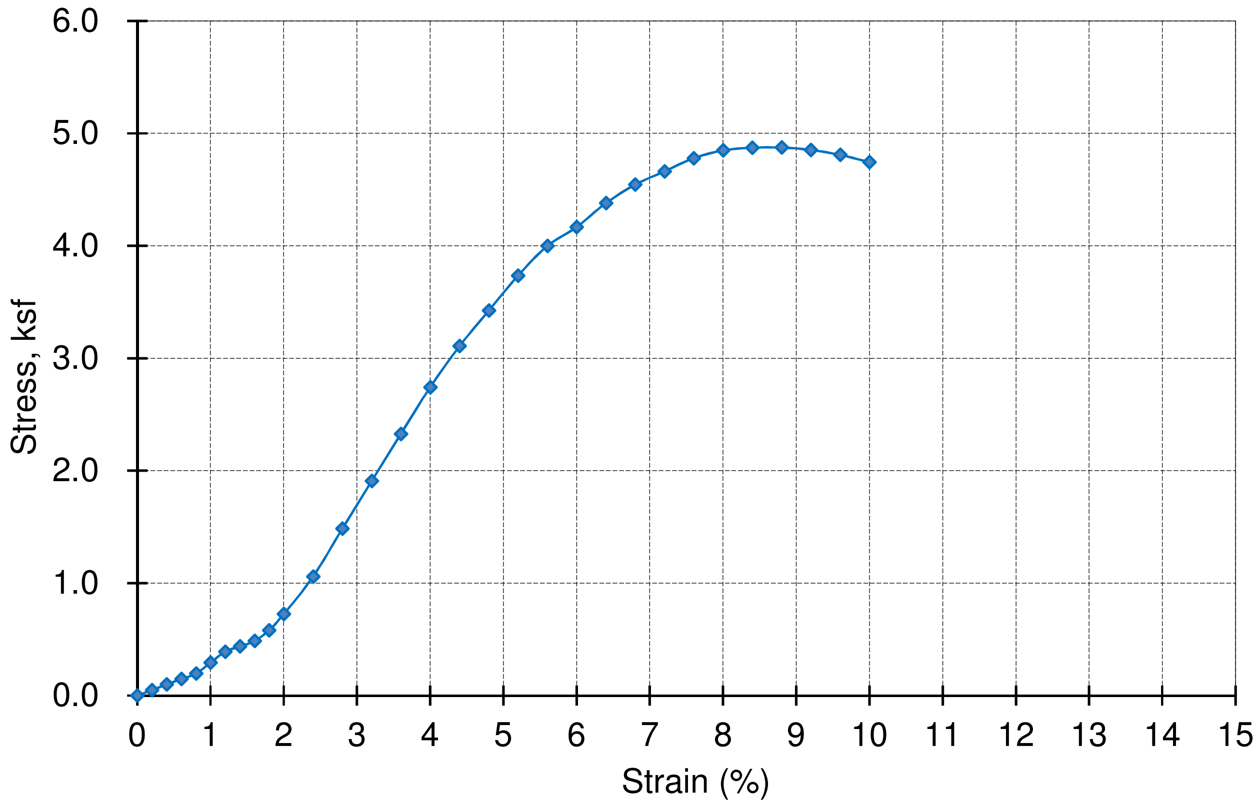
SOUTHBOUND 101 OFF-RAMP PEDESTRIAN UNDERCROSSING
SAN JOSE, CALIFORNIA

JOB NO: 2016-146-OUC | PLATE NO: IV-3B

UNCONFINED COMPRESSION TEST

UNCONFINED COMPRESSION TEST



Boring No.:	R-18-SO-001	**Unconfined Compressive Strength (ksf):**	4.87
Sample No. :	4	**Shear Strength (ksf)**	2.44
Depth (feet):	16	**Strain @ Failure (%):**	8.8
Sample Type:	MC - 2.416 inch dia.	**Initial Dry Density (pcf):**	101
Test Method	ASTM D2166	**Water Content (%):**	22.4
Material Type:	CH		
Material Description:	Fat Clay		

Initial Height (inch):	5.00
Initial Diameter (inch)	2.42
Initial Area (ft^2):	0.032
Strain Rate (inch/min)	0.1

Remarks:

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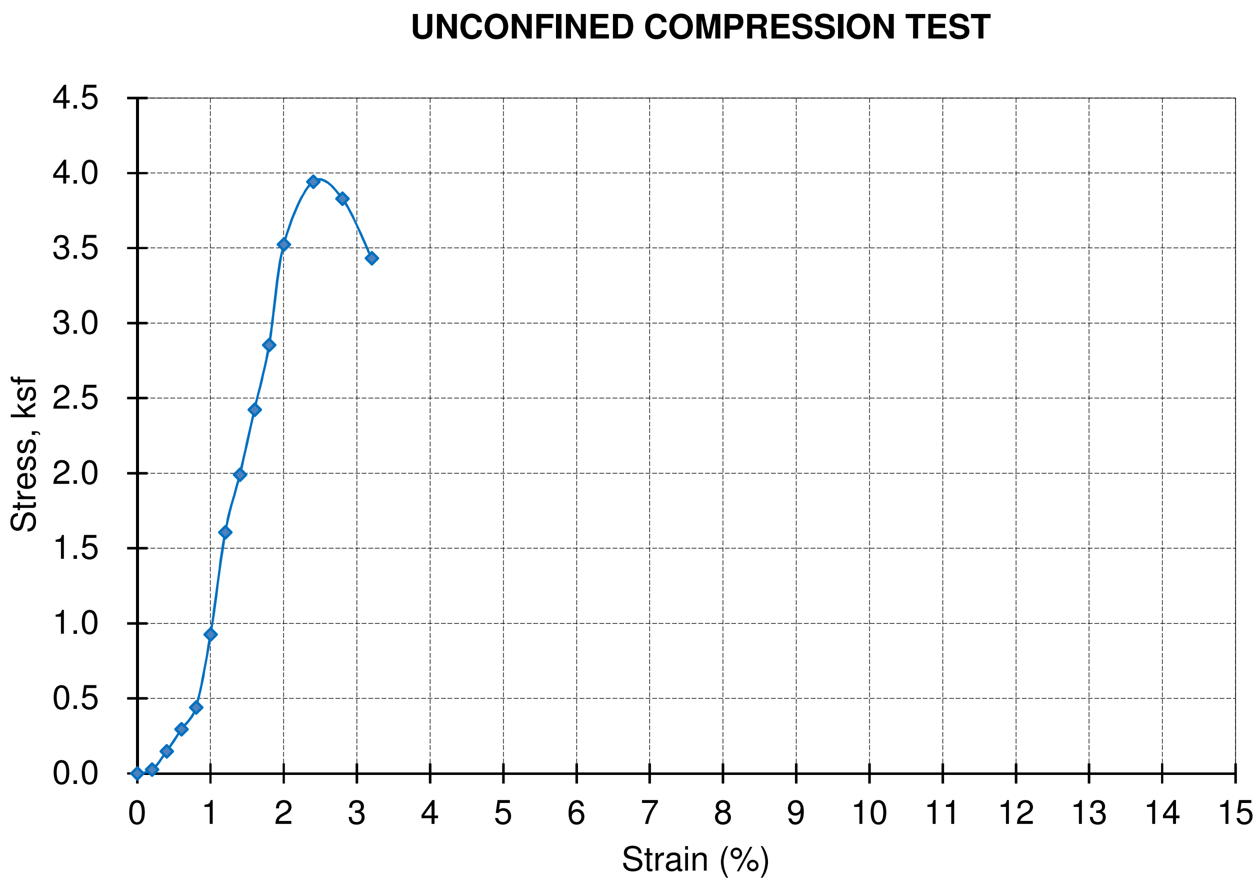
SOUTHBOUND 101 OFF-RAMP PEDESTRIAN UNDERCROSSING
SAN JOSE, CALIFORNIA

JOB NO.: 2016-146-OUC | PLATE NO.: IV-4A



Boring No.:	R-18-SO-001	**Unconfined Compressive Strength (ksf):**	3.94
Sample No. :	6	**Shear Strength (ksf)**	1.97
Depth (feet):	26	**Strain @ Failure (%):**	2.4
Sample Type:	MC - 2.416 inch dia.	**Initial Dry Density (pcf):**	104
Test Method	ASTM D2166	**Water Content (%):**	12.9
Material Type:	ML		
Material Description:	Sandy Silt		

Initial Height (inch):	5.00
Initial Diameter (inch)	2.42
Initial Area (ft^2):	0.032
Strain Rate (inch/min)	0.1

Remarks:

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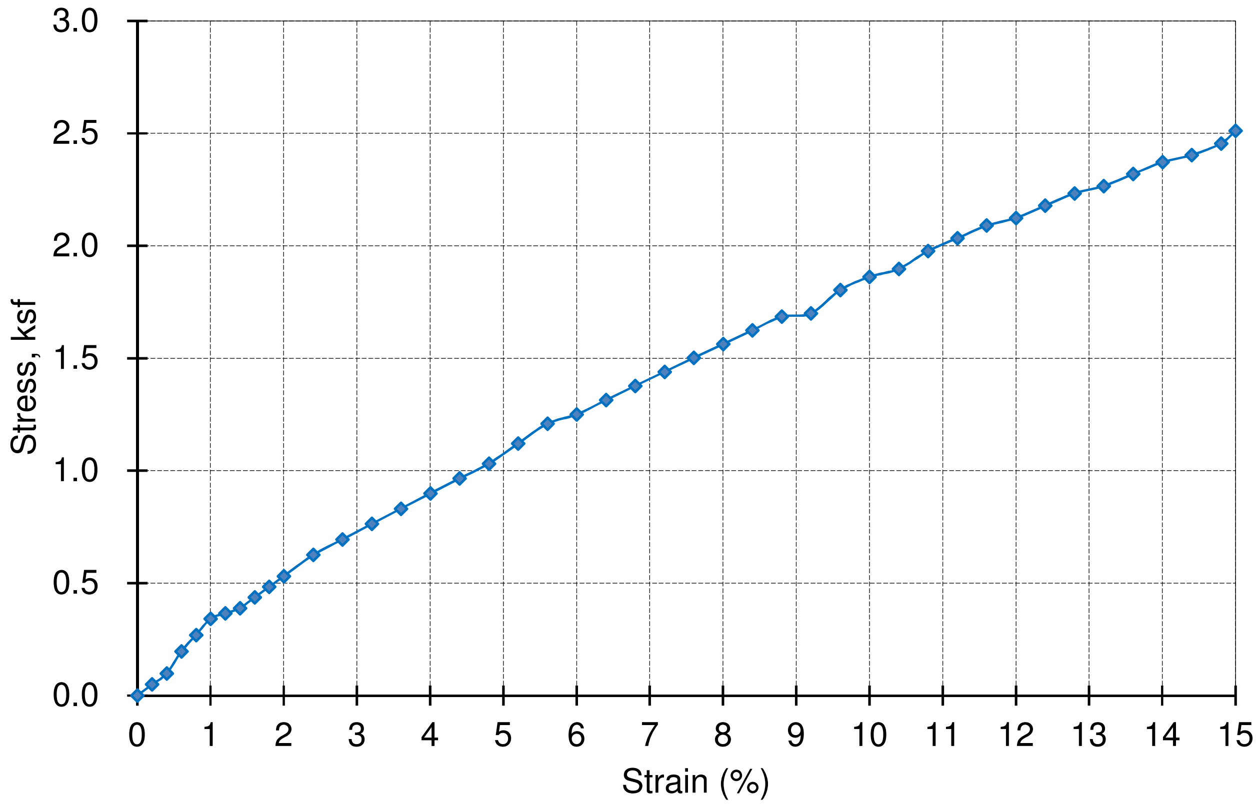
SOUTHBOUND 101 OFF-RAMP PEDESTRIAN UNDERCROSSING SAN JOSE, CALIFORNIA	
JOB NO.: 2016-146-OUC	PLATE NO.: IV-4B

UNCONFINED COMPRESSION TEST



Boring No.:	R-18-SO-001	**Unconfined Compressive Strength (ksf):**	2.51
Sample No. :	15	**Shear Strength (ksf)**	1.26
Depth (feet):	81	**Strain @ Failure (%):**	15.0
Sample Type:	MC - 2.416 inch dia.	**Initial Dry Density (pcf):**	93
Test Method	ASTM D2166	**Water Content (%):**	26.0
Material Type:	CH		
Material Description:	Fat Clay		

Initial Height (inch):	5.00
Initial Diameter (inch)	2.42
Initial Area (ft^2):	0.032
Strain Rate (inch/min)	0.1

Remarks:

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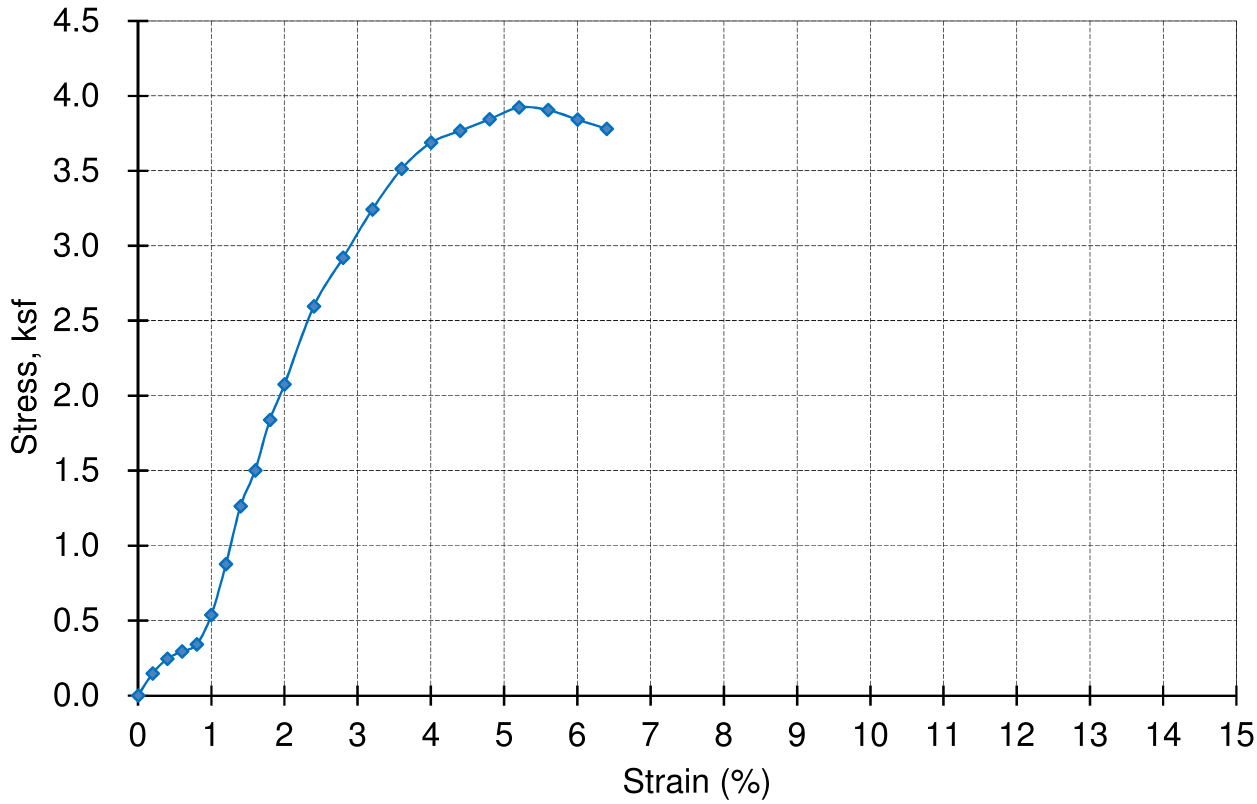
SOUTHBOUND 101 OFF-RAMP PEDESTRIAN UNDERCROSSING
SAN JOSE, CALIFORNIA

JOB NO.: 2016-146-OUC	**PLATE NO.: IV-4C**

UNCONFINED COMPRESSION TEST



Boring No.:	R-18-SO-002	**Unconfined Compressive Strength (ksf):**	3.92
Sample No. :	4	**Shear Strength (ksf)**	1.96
Depth (feet):	16'	**Strain @ Failure (%):**	5.2
Sample Type:	MC - 2.416 inch dia.	**Initial Dry Density (pcf):**	107
Test Method	ASTM D2166	**Water Content (%):**	20.0
Material Type:	CL		
Material Description:	Sandy Lean Clay		

Initial Height (inch): 5.00
Initial Diameter (inch) 2.42
Initial Area (ft^2): 0.032
Strain Rate (inch/min) 0.1

Remarks:

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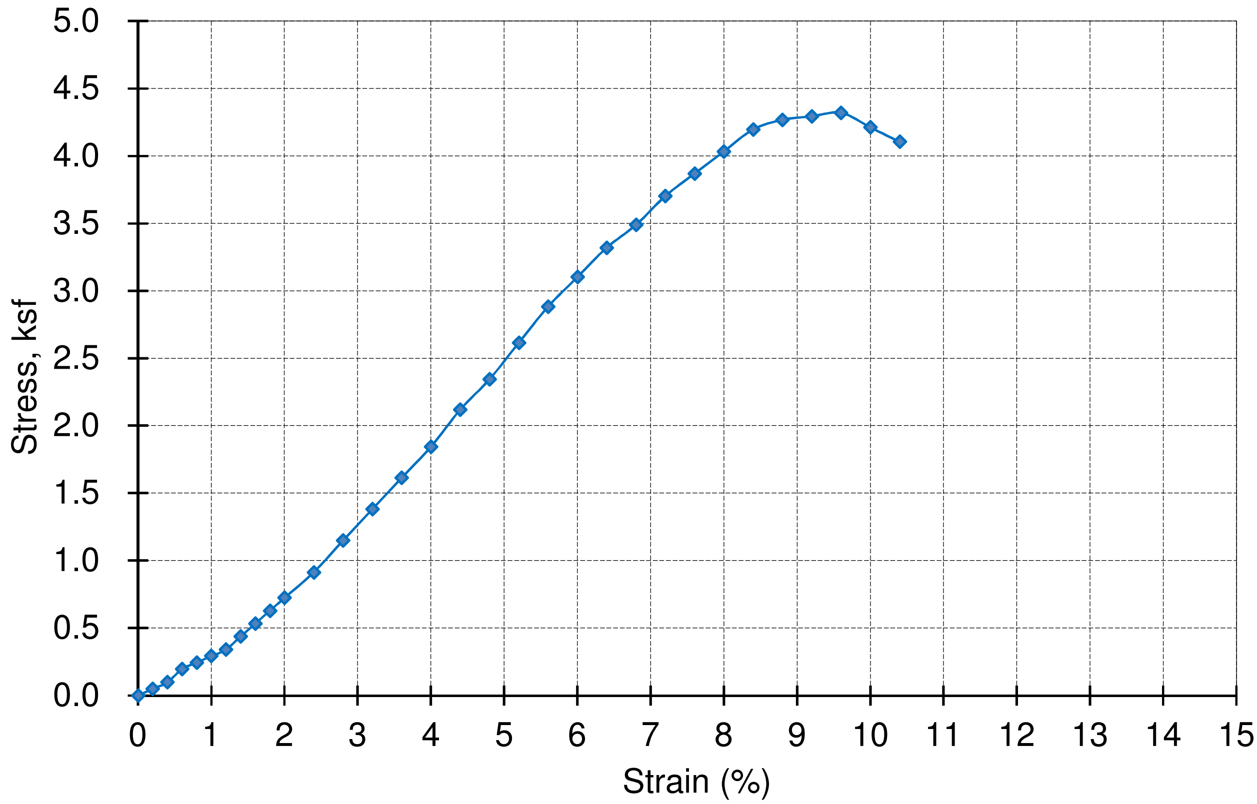
SOUTHBOUND 101 OFF-RAMP PEDESTRIAN UNDERCROSSING
SAN JOSE, CALIFORNIA

JOB NO.: 2016-146-OUC	**PLATE NO.: IV-4D**

UNCONFINED COMPRESSION TEST



Boring No.:	R-18-SO-002
Sample No. :	7
Depth (feet):	31'
Sample Type:	MC - 2.416 inch dia.
Test Method	ASTM D2166
Material Type:	ML
Material Description:	Silt with Sand

Unconfined Compressive Strength (ksf):	4.32
Shear Strength (ksf)	2.16
Strain @ Failure (%):	9.6
Initial Dry Density (pcf):	113
Water Content (%):	15.1

Initial Height (inch):	5.00
Initial Diameter (inch)	2.42
Initial Area (ft^2):	0.032
Strain Rate (inch/min)	0.1

Remarks:

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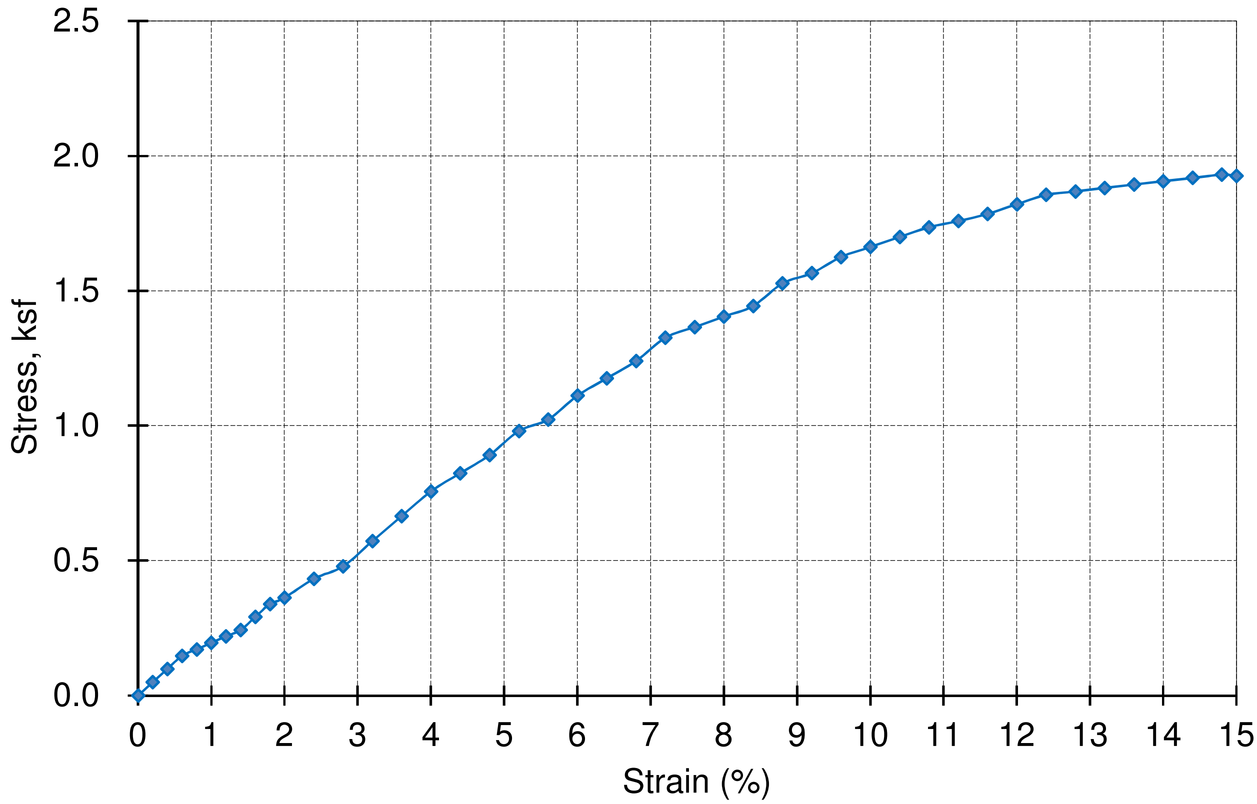
SOUTHBOUND 101 OFF-RAMP PEDESTRIAN UNDERCROSSING
SAN JOSE, CALIFORNIA

JOB NO.: 2016-146-OUC | PLATE NO.: IV-4E

UNCONFINED COMPRESSION TEST



Boring No.:	R-18-SO-002	**Unconfined Compressive Strength (ksf):**	1.93
Sample No. :	14	**Shear Strength (ksf)**	0.97
Depth (feet):	71'	**Strain @ Failure (%):**	14.8
Sample Type:	MC - 2.416 inch dia.	**Initial Dry Density (pcf):**	96
Test Method	ASTM D2166	**Water Content (%):**	28.1
Material Type:	CL		
Material Description:	Lean Clay with Sand		

Initial Height (inch): 5.00
Initial Diameter (inch) 2.42
Initial Area (ft^2): 0.032
Strain Rate (inch/min) 0.1

Remarks:

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SOUTHBOUND 101 OFF-RAMP PEDESTRIAN UNDERCROSSING SAN JOSE, CALIFORNIA	
JOB NO.: 2016-146-OUC	PLATE NO.: IV-4F

CORROSION TEST

Sunland Analytical

11419 Sunrise Gold Circle, #10
Rancho Cordova, CA 95742
(916) 852-8557

Date Reported 10/10/2018
Date Submitted 10/05/2018

To: Nasir Ahmad
Parikh Consultants, Inc.
2360 Qume Dr. Suite A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 2016-146-RW1 Site ID : R-18-SO-001
Thank you for your business.

* For future reference to this analysis please use SUN # 78232-163611.

EVALUATION FOR SOIL CORROSION

Soil pH	7.92		
Minimum Resistivity	1.74	ohm-cm (x1000)	
Chloride	4.2 ppm	00.00042	%
Sulfate	26.9 ppm	00.00269	%

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

PLATE NO.: IV-5A

Sunland Analytical
11419 Sunrise Gold Circle, #10
Rancho Cordova, CA 95742
(916) 852-8557

Date Reported 09/19/2018
Date Submitted 09/13/2018

To: Nasir Ahmad
Parikh Consultants, Inc.
2360 Qume Dr. Suite A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 2016-146-LUC Site ID : R18-50-002 5@21.
Thank you for your business.

* For future reference to this analysis please use SUN # 78032-163159.

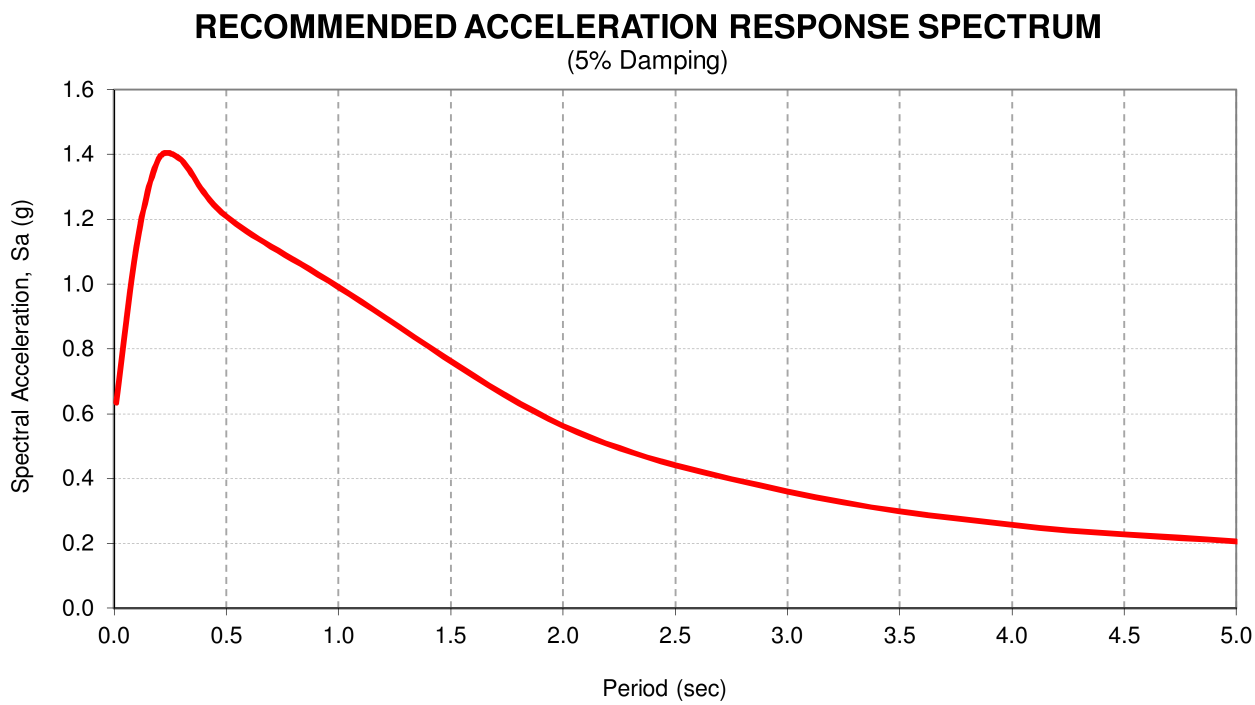
EVALUATION FOR SOIL CORROSION

Soil pH	7.97	
Minimum Resistivity	1.26 ohm-cm (x1000)	
Chloride	16.4 ppm	00.00164 %
Sulfate	40.0 ppm	00.00400 %

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

PLATE NO.: IV-5B

APPENDIX V



Site Information

Latitude:	37.2579
Longitude	-121.7993
V_{S30} (m/s) =	240
$Z_{1.0}$ (m) =	N/A
$Z_{2.5}$ (km) =	N/A
Near Fault Factor, Derived from USGS Unified Hazard Tool. Dist (km) =	10.66

Governing Curve:
Caltrans Online Probabilistic ARS

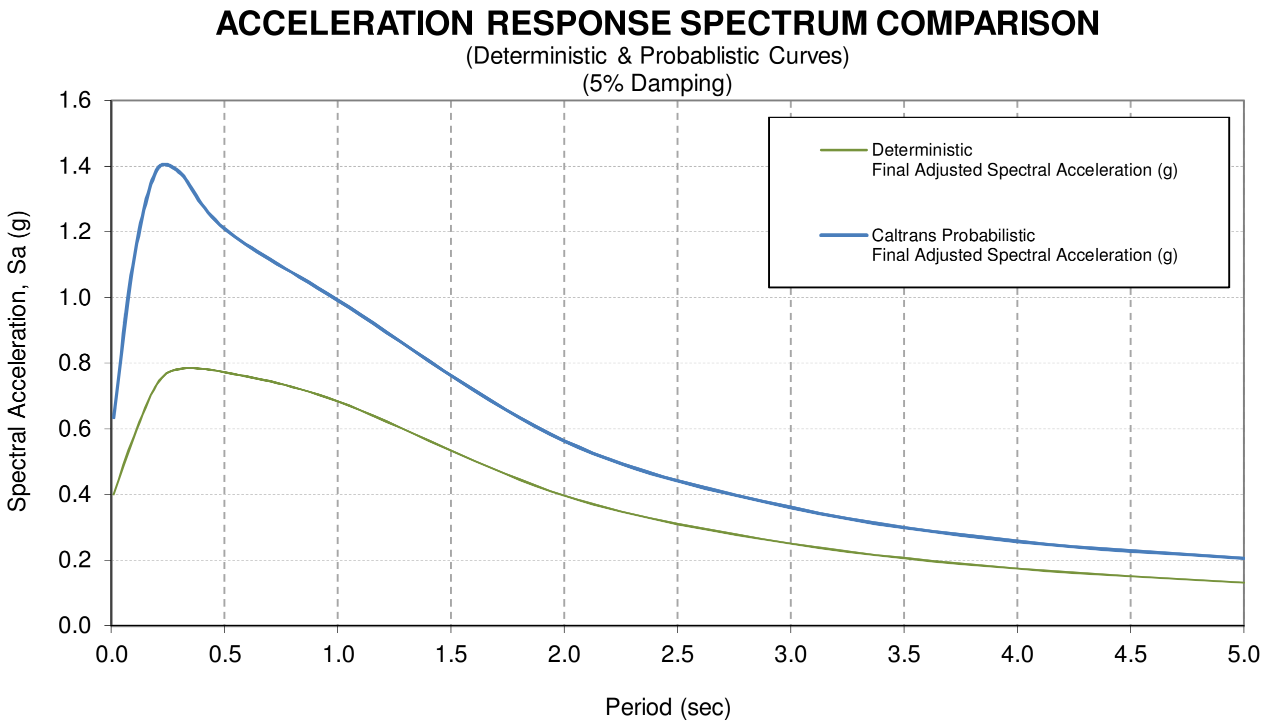
Recommended Response Spectrum

Period (sec)	Caltrans Online Probabilistic Spectral Acceleration (g)	Adjusted for Near Fault Effect	Adjusted For Basin Effect	Final Adjusted Spectral Acceleration (g)
0.0	0.634	1	1	0.634
0.1	1.119	1	1	1.119
0.2	1.388	1	1	1.388
0.3	1.382	1	1	1.382
0.5	1.209	1	1	1.209
1.0	0.826	1.2	1	0.991
2.0	0.469	1.2	1	0.563
3.0	0.3	1.2	1	0.360
4.0	0.214	1.2	1	0.257
5.0	0.171	1.2	1	0.205

Source:

1. Caltrans ARS Online tool (V.2.3.09, http://dap3.dot.ca.gov/ARS_Online/)

2. Caltrans Methodology for Developing Design Response Spectrum for Use in Seismic Design Recommendations, November 2012



Site Information

Latitude:	37.2579
Longitude	-121.7993
V_{S30} (m/s) =	240
$Z_{1.0}$ (m) =	N/A
$Z_{2.5}$ (km) =	N/A
Near Fault Factor, Derived from USGS Unified Hazard Tool. Dist (km) =	10.66

Period (sec)	Deterministic Final Adjusted Spectral Acceleration (g)	Caltrans Probabilistic Final Adjusted Spectral Acceleration (g)
0.0	0.400	0.634
0.1	0.577	1.119
0.2	0.734	1.388
0.3	0.782	1.382
0.5	0.772	1.209
1.0	0.683	0.991
2.0	0.396	0.563
3.0	0.250	0.360
4.0	0.174	0.257
5.0	0.131	0.205

Source:

1. Caltrans ARS Online tool (V.2.3.09, http://dap3.dot.ca.gov/ARS_Online/)
2. USGS Unified Hazard Tool (https://earthquake.usgs.gov/hazards/interactive/)
3. Caltrans Methodology for Developing Design Response Spectrum for Use in Seismic Design Recommendations, November 2012

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SOUTHBOUND 101 OFF-RAMP PEDESTRIAN UNDERCROSSING
SAN JOSE, CALIFORNIA

Project No.: 2016-146-OUC	**APPENDIX V-2**

APPENDIX VI

LIQUEFACTION ANALYSES

LIQUEFACTION POTENTIAL ANALYSIS (SPT procedures per Youd et al, 2001)

PROJECT NAME ***Southbound 101 Off-Ramp Pedestrian Undercrossing***
PROJECT NO. ***2016-146-OUC***
BORING NO. ***R-18-SO-001***

SOIL GROUPS
1. GRAVELS, SANDS AND NONPLASTIC SILTS
2. CLAYS AND PLASTIC SILTS

FAULT INFO
Silver Creek Fault
a_{max} (g)= 0.63
FAULT M_w = 6.9

GW DEPTH (ft)= 32.5

BOREHOLE DIA (in)= 3.3
HAMMER ENERGY = 78%

CUT(-)/FILL(+) (ft) = 0
DESIGN GW DEPTH (ft)= 32.5 *(below OG)*

MSF = 1.24

SOIL STRATA							*LIQUEFACTION RESISTANCE ($CRR_{7.5}$)*												*CYCLIC STRESS RATIO (CSR)*				*F.S.=($CRR_{7.5}$/CSR)*MSF*Ks*Ka*			*POST-LIQ. SETTLEMENT*	
Layer Thickness from	to	Sample No	Depth (ft)	Soil Type	Blow Count	Sampler Type	SPT-$N_{eq.}$	C_E	C_R	C_S	C_B	N_{60}	σ_v' (psf)	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60,CS}$	$CRR_{7.5}$	σ_v (psf)	σ_v' (psf)	r_d	CSR	Ks	Ka	F.S.	Vol. Strain (%)	ΔD (in)
0	4.0	1	3	1	48	SPT	48.0	1.3	0.75	1.2	1.00	56.2	345.0	1.7	95.5	15%	102.6		345.0	345.0	1.0	0.4	1.0	1.0			
4.0	8.5	2	6	1	25	SPT	25.0	1.3	0.80	1.2	1.00	31.2	700.0	1.7	52.7	15%	57.8		700.0	700.0	1.0	0.4	1.0	1.0			
8.5	16.0	3	11	2	12	SPT	12.0	1.3	0.85	1.2	1.00	15.9	1300.0	1.2	19.7												
16.0	18.0	4	16	2	24	MC	15.6	1.3	0.95	1.0	1.00	19.3	1900.0	1.0	19.8												
18.0	23.0	5	21	2	48	MC	31.2	1.3	0.95	1.0	1.00	38.5	2500.0	0.9	34.5												
23.0	28.0	6	26	2	22	MC	14.3	1.3	1.00	1.0	1.00	18.6	3100.0	0.8	14.9												
28.0	33.5	7	31	2	28	MC	18.2	1.3	1.00	1.0	1.00	23.7	3700.0	0.7	17.4												
33.5	39.0	8	36	1	36	MC	23.4	1.3	1.00	1.0	1.00	30.4	4081.6	0.7	21.3	8%	21.8	0.2	4300.0	4081.6	0.9	0.4	0.8	1.0	(0.60)	1.31%	0.87
39.0	43.0	9	41	1	13	SPT	13.0	1.3	1.00	1.2	1.00	20.3	4369.6	0.7	13.7	18%	17.7	0.2	4900.00	4369.6	0.8	0.4	0.8	1.0	(0.48)	1.53%	0.74
43.0	48.0	10	46	1	26	SPT	26.0	1.3	1.00	1.2	1.00	40.6	4657.6	0.7	26.6	15%	30.4		5500.00	4657.6	0.8	0.4	0.7	1.0	NON-LIQ.		
48.0	53.0	11	51	1	33	SPT	33.0	1.3	1.00	1.2	1.00	51.5	4945.6	0.6	32.7	15%	36.8		6100.00	4945.6	0.7	0.4	0.7	1.0	NON-LIQ.		
53.0	56.5	12	56	1	18	SPT	18.0	1.3	1.00	1.2	1.00	28.1	5233.6	0.6	17.4	15%	20.7	0.2	6700.00	5233.6	0.7	0.4	0.7	1.0	(0.57)	1.36%	0.57
56.5	71.0	13	61	2	9	SPT	9.0	1.3	1.00	1.2	1.00	14.0	5521.6	0.6	8.4												
71.0	76.0	14	71	2	25	MC	16.3	1.3	1.00	1.0	1.00	21.1	6097.6	0.6	12.1	83%											
76.0	85.0	15	81	2	20	MC	13.0	1.3	1.00	1.0	1.00	16.9	6673.6	0.5	9.3												
85.0	98.5	16	91	1	63	SPT	63.0	1.3	1.00	1.2	1.00	98.3	7249.6	0.5	51.6	10%	53.6		10900.00	7249.6	0.5	0.3	0.6	1.0	NON-LIQ.		
98.5	101.5	17	101	1	95	SPT	95.0	1.3	1.00	1.2	1.00	148.2	7825.6	0.5	74.9	15%	81.0		12100.00	7825.6	0.5	0.3	0.6	1.0	NON-LIQ.		

Fines Content based on visual inspection
Fines Content based on lab results

Notes:
1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner) are per Youd et al. (2001).
2. For correction of overburden, $C_N = (1/\sigma_v')^{0.5}$ with a maximum value of 1.7.
3. The influence of Fines Contents are expressed by the following correction: $(N_1)_{60cs} = a + b\,(N_1)_{60}$

where a and b = coefficients determined from the following relationships

for FC $\leq$ 5% a = 0, b = 1.0

for 5% < FC < 35% a = exp(1.76-(190/FC^2)), b = (0.99+($FC^{1.5}$/1000))

for FC $\geq$ 35% a = 5.0, b = 1.2

4. For $(N_1)_{60,cs}$ greater than 30, clean granular soils are too dense to liquefy and are classed as non-liquefiable.

Reference:

Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER Workshops on Evaluation of Liquefaction Resistance of Soils, Youd, et al., ASCE Journal of Geotechnical and Geoenvironmental Engineering, October 2001, Vol. 127 No. 10

LIQUEFACTION POTENTIAL ANALYSIS (SPT procedures per Youd et al, 2001)

PROJECT NAME	***Southbound 101 Off-Ramp Pedestrian Undercrossing***	*SOIL GROUPS*	*FAULT INFO*
PROJECT NO.	***2016-146-OUC***	1. GRAVELS, SANDS AND NONPLASTIC SILTS	*Silver Creek Fault*
BORING NO.	***R-18-SO-002***	2. CLAYS AND PLASTIC SILTS	*a_{max} (g)=* 0.63
			FAULT M_w = 6.9

GW DEPTH (ft)=	22	*BOREHOLE DIA (in)=* 3.3	*CUT(-)/FILL(+) (ft) =* 0		*MSF =*	1.24
		HAMMER ENERGY = 78%	*DESIGN GW DEPTH (ft)=* 22	*(below OG)*		

SOIL STRATA							*LIQUEFACTION RESISTANCE ($CRR_{7.5}$)*												*CYCLIC STRESS RATIO (CSR)*				*F.S.=($CRR_{7.5}$/CSR)*MSF*Ks*Ka*			*POST-LIQ. SETTLEMENT*	
Layer Thickness from	to	Sample No	Depth (ft)	Soil Type	Blow Count	Sampler Type	$SPT\text{-}N_{eq.}$	C_E	C_R	C_S	C_B	N_{60}	σ_v' (psf)	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60,cs}$	$CRR_{7.5}$	σ_v (psf)	σ_v' (psf)	r_d	CSR	Ks	Ka	F.S.	Vol. Strain (%)	ΔD (in)
0	4.5	1	3	1	57	MC	37.1	1.3	0.75	1.0	1.00	36.1	345.0	1.7	61.4	15%	66.9		345.0	345.0	1.0	0.4	1.0	1.0			
4.5	10.0	2	6	1	41	MC	26.7	1.3	0.80	1.0	1.00	27.7	697.5	1.7	46.9	5%	47.0		697.5	697.5	1.0	0.4	1.0	1.0			
10.0	14.0	3	11	2	11	SPT	11.0	1.3	0.85	1.2	1.00	14.6	1297.5	1.2	18.1												
14.0	18.0	4	16	2	31	MC	20.2	1.3	0.95	1.0	1.00	24.9	1897.5	1.0	25.5												
18.0	22.0	5	21	2	51	MC	33.2	1.3	0.95	1.0	1.00	40.9	2497.5	0.9	36.6												
22.0	26.5	6	26	1	51	SPT	51.0	1.3	1.00	1.2	1.00	79.6	2847.9	0.8	66.7	15%	72.4		3097.5	2847.9	0.9	0.4	0.9	1.0	NON-LIQ.		
26.5	33.0	7	31	2	16	MC	10.4	1.3	1.00	1.0	1.00	13.5	3135.9	0.8	10.8	79%											
33.0	38.5	8	36	2	25	MC	16.3	1.3	1.00	1.0	1.00	21.1	3423.9	0.8	16.1												
38.5	43.5	9	41	1	30	SPT	30.0	1.3	1.00	1.2	1.00	46.8	3711.9	0.7	34.4	15%	38.5		4897.50	3711.9	0.8	0.5	0.8	1.0	NON-LIQ.		
43.5	48.5	10	46	1	25	SPT	25.0	1.3	1.00	1.2	1.00	39.0	3999.9	0.7	27.6	15%	31.4		5497.50	3999.9	0.8	0.4	0.8	1.0	NON-LIQ.		
48.5	53.0	11	51	1	24	SPT	24.0	1.3	1.00	1.2	1.00	37.4	4287.9	0.7	25.6	7%	26.0	0.3	6097.50	4287.9	0.7	0.4	0.8	1.0	NON-LIQ.		
53.0	61.0	12	56	1	39	SPT	39.0	1.3	1.00	1.2	1.00	60.8	4575.9	0.7	40.2	10%	42.0		6697.50	4575.9	0.7	0.4	0.7	1.0	NON-LIQ.		
61.0	64.5	13	61	1	11	SPT	11.0	1.3	1.00	1.2	1.00	17.2	4863.9	0.6	11.0	36%	18.2	0.2	7297.50	4863.9	0.7	0.4	0.8	1.0	(0.48)	1.50%	0.63
64.5	76.0	14	71	2	13	MC	8.5	1.3	1.00	1.0	1.00	11.0	5439.9	0.6	6.7												
76.0	85.0	15	81	2	28	MC	18.2	1.3	1.00	1.0	1.00	23.7	6015.9	0.6	13.6												
85.0	96.0	16	91	1	44	SPT	44.0	1.3	1.00	1.2	1.00	68.6	6591.9	0.6	37.8	15%	42.1		10897.50	6591.9	0.5	0.3	0.6	1.0	NON-LIQ.		
96.0	106.0	17	101	1	48	SPT	48.0	1.3	1.00	1.2	1.00	74.9	7167.9	0.5	39.6	12%	42.2		12097.50	7167.9	0.5	0.3	0.6	1.0	NON-LIQ.		
106.0	116.0	18	111	1	69	SPT	69.0	1.3	1.00	1.2	1.00	107.6	7743.9	0.5	54.7	10%	56.8		13297.50	7743.9	0.5	0.3	0.6	1.0	NON-LIQ.		
116.0	121.5	19	121	1	41	SPT	41.0	1.3	1.00	1.2	1.00	64.0	8319.9	0.5	31.4	10%	32.9		14497.50	8319.9	0.5	0.3	0.6	1.0	NON-LIQ.		

Fines Content based on visual inspection
Fines Content based on lab results

Notes:
1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner) are per Youd et al. (2001).
2. For correction of overburden, $C_N = (1/\sigma_v')^{0.5}$ with a maximum value of 1.7.
3. The influence of Fines Contents are expressed by the following correction: $(N_1)_{60cs} = a + b\,(N_1)_{60}$
   where a and b = coefficients determined from the following relationships
   for FC ≤ 5% a = 0, b = 1.0
   for 5% < FC < 35% a = exp(1.76-(190/FC^2)), b = (0.99+(FC$^{1.5}$/1000))
   for FC ≥ 35% a = 5.0, b = 1.2
4. For $(N_1)_{60,cs}$ greater than 30, clean granular soils are too dense to liquefy and are classed as non-liquefiable.

Reference:
Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER Workshops on Evaluation of Liquefaction Resistance of Soils, Youd, et al., ASCE Journal of Geotechnical and Geoenvironmental Engineering, October 2001, Vol. 127 No. 10

CALCULATIONS OF SHEAR WAVE VELOCITY

SOIL STRENGTH PARAMETERS & V_{s30}

PROJECT NAME:	***SOUTHBOUND 101 OFF-RAMP PEDESTRIAN UNDERCRO***	Calc By:	JZ
PROJECT NO.:	***2016-146-OUC***	Date:	10/10/18
STRUCTURE:			
BORING NO.:	***R-18-SO-001***		

SOIL GROUPS
1. SANDS & GRAVELS
2. CLAYS AND PLASTIC SILTS
3. NON TO LOW PLASTIC SILTS
4. YOUNG SEDIMENTARY ROCKS
5. LIQUEFIABLE SANDS (RESIDUAL STRENGTH)
6. LIQUEFIABLE SILTS (RESIDUAL STRENGTH)

BOREHOLE DIA (in)=	3.3	*HAMMER ENERGY =*	78%	Nd		V_{sd} (m/s)	
GW DEPTH (ft)=	32.5	*DRILLING RODS (Y/N)=*	Y	N_{30}	23	V_{s30} (m/s)	*243*
						Correlation	1) Caltrans

Sample No	Layer Thickness from	Layer Thickness to	Sample Depth (ft)	Soil Type	Field Blow Count	Sampler Type	Unit Weight (pcf)	σ_v (psf)	σ_v' (psf)	SPT-$N_{eq.}$	N_{60} CE Corr.	N_{60} CR,CB,CS Corr.	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60,CS}$	Correlated Strength Parameters ϕ (°)	Correlated Strength Parameters c (psf)	Correlated Strength Parameters S_r (psf)	Lab Test Results c (psf)	Vs (m/s)
1	0.0	4.0	3	1	48	SPT	125	375	375	48	62.4	60.8	1.70	103.4		103.4	50				168
2	4.0	8.5	6	1	25	SPT	125	750	750	25	32.5	33.8	1.63	55.2		55.2	44				186
3	8.5	16.0	11	2	12	SPT	125	1375	1375	12	15.6	15.8	1.21	19.0				1950			203
4	16.0	18.0	16	2	24	MC	125	2000	2000	16	20.3	19.3	1.00	19.3				2535		2440	223
5	18.0	23.0	21	2	48	MC	125	2625	2625	31	40.6	38.5	0.87	33.6				5070			282
6	23.0	28.0	26	2	22	MC	125	3250	3250	14	18.6	18.6	0.78	14.6				2324		1970	202
7	28.0	33.5	31	2	28	MC	125	3875	3875	18	23.7	23.7	0.72	17.0				2958			265
8	33.5	39.0	36	1	36	MC	125	4500	4282	23	30.4	30.4	0.68	20.8	8%	21.3	35				278
9	39.0	43.0	41	1	13	SPT	125	5125	4595	13	16.9	19.0	0.66	12.5	18%	16.5	33				268
10	43.0	48.0	46	1	26	SPT	125	5750	4908	26	33.8	43.1	0.64	27.5		27.5	36				290
11	48.0	53.0	51	1	33	SPT	125	6375	5221	33	42.9	55.8	0.62	34.5		34.5	37				302
12	53.0	56.5	56	1	18	SPT	125	7000	5534	18	23.4	27.2	0.60	16.4		16.4	34				288
13	56.5	71.0	61	3	9	SPT	125	7625	5847	9	11.7	12.9	0.58	7.5				1170			250
14	71.0	76.0	71	2	25	MC	125	8875	6473	16	21.1	21.1	0.56	11.7	83%			2641			281
15	76.0	85.0	81	2	20	MC	125	10125	7099	13	16.9	16.9	0.53	9.0				2113		1260	163
16	85.0	98.5	91	1	63	SPT	125	11375	7725	63	81.9	106.5	0.51	54.2		54.2	38				352
17	98.5	101.5	101	1	95	SPT	125	12625	8351	95	123.5	160.6	0.49	78.6		78.6	39				373

Note:
1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner), C_N (Overburden) are per Youd 2001
2. For fine-grained materials, the correlation between blow-counts and shear is based on NAVFAC DM 7.1.
3. The phi angle was estimated based on Meyerhof (1956).
4. Residual Strength (Sr) is based on Caltrans "Guidelines on Foundation Loading and Deformation Due to Liquefaction Induced Lateral Spreading", Caltrans 2011
5. The Vs were correlated based on N_{60} for Soil Types 1,3, 4; based on N_{60} or c_{lab} for Soil Type 2 and based on Sr for Soil Types 5 & 6 per Caltrans Guidelines (2012).
6. Spreadsheet Revision Date: 10/29/13

SOIL STRENGTH PARAMETERS & V_{s30}

PROJECT NAME:	SOUTHBOUND 101 OFF-RAMP PEDESTRIAN UNDERCRO		
PROJECT NO.:	2016-146-OUC		
STRUCTURE:			
BORING NO.:	R-18-SO-002		
BOREHOLE DIA (in)=	3.3	HAMMER ENERGY =	78%
GW DEPTH (ft)=	22	DRILLING RODS (Y/N)=	Y

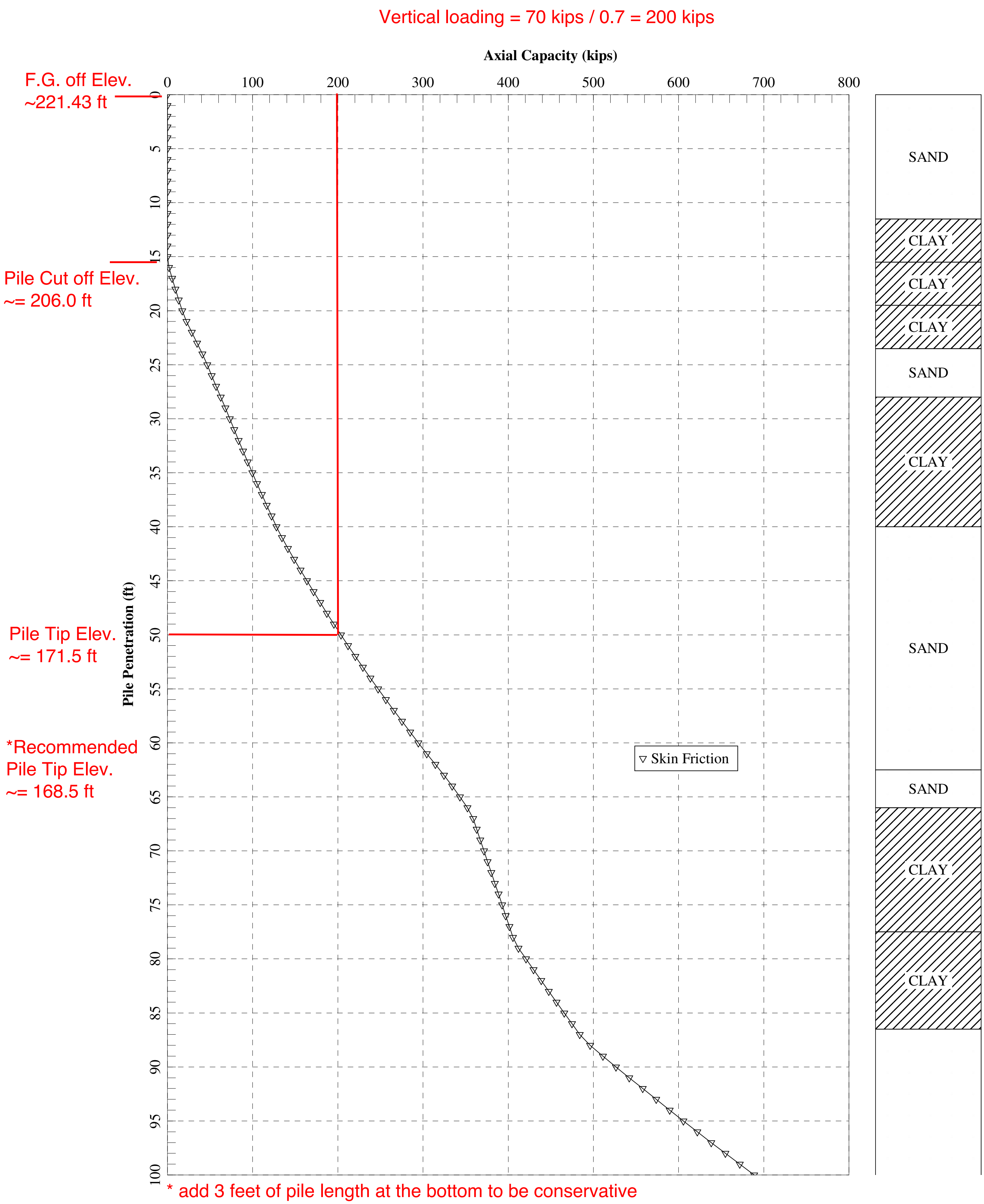
SOIL GROUPS
1. SANDS & GRAVELS
2. CLAYS AND PLASTIC SILTS
3. NON TO LOW PLASTIC SILTS
4. YOUNG SEDIMENTARY ROCKS
5. LIQUEFIABLE SANDS (RESIDUAL STRENGTH)
6. LIQUEFIABLE SILTS (RESIDUAL STRENGTH)

Calc By:	JZ		
Date:	10/10/18		
Nd		V_{sd} (m/s)	
N_{30}	24	V_{s30} (m/s)	*232*
		Correlation	1) Caltrans

Sample No	Layer Thickness from	Layer Thickness to	Sample Depth (ft)	Soil Type	Field Blow Count	Sampler Type	Unit Weight (pcf)	σ_v (psf)	σ_v' (psf)	SPT-$N_{eq.}$	N_{60} CE Corr.	N_{60} CR,CB,CS Corr.	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60,\,CS}$	Correlated Strength Parameters ϕ (°)	Correlated Strength Parameters c (psf)	Correlated Strength Parameters S_r (psf)	Lab Test Results c (psf)	Vs (m/s)
1	0.0	4.5	3	1	57	MC	125	375	375	37	48.2	36.1	1.70	61.4		61.4	45				164
2	4.5	10.0	6	1	41	MC	125	750	750	27	34.6	27.7	1.63	45.3		45.3	43				187
3	10.0	14.0	11	2	11	SPT	125	1375	1375	11	14.3	14.2	1.21	17.2				1788			199
4	14.0	18.0	16	2	31	MC	125	2000	2000	20	26.2	24.9	1.00	24.9				3274		1900	198
5	18.0	22.0	21	2	51	MC	125	2625	2625	33	43.1	40.9	0.87	35.7				5387			286
6	22.0	26.5	26	1	51	SPT	125	3250	3000	51	66.3	86.2	0.82	70.4		70.4	42				276
7	26.5	33.0	31	2	16	MC	125	3875	3313	10	13.5	13.5	0.78	10.5	79%			1690		2100	208
8	33.0	38.5	36	3	25	MC	125	4500	3626	16	21.1	21.1	0.74	15.7				2113			249
9	38.5	43.5	41	1	30	SPT	125	5125	3939	30	39.0	50.7	0.71	36.1		36.1	38				280
10	43.5	48.5	46	1	25	SPT	125	5750	4252	25	32.5	41.8	0.69	28.7		28.7	37				280
11	48.5	53.0	51	1	24	SPT	125	6375	4565	24	31.2	39.3	0.66	26.0	7%	26.4	36				283
12	53.0	61.0	56	1	39	SPT	125	7000	4878	39	50.7	65.9	0.64	42.2		42.2	38				302
13	61.0	64.5	61	1	11	SPT	125	7625	5191	11	14.3	15.7	0.62	9.8	36%	16.7	32				271
14	64.5	76.0	71	2	13	MC	125	8875	5817	8	11.0	11.0	0.59	6.4				1373		900	139
15	76.0	85.0	81	2	28	MC	125	10125	6443	18	23.7	23.7	0.56	13.2				2958			288
16	85.0	96.0	91	1	44	SPT	125	11375	7069	44	57.2	74.4	0.53	39.6		39.6	37				333
17	96.0	106.0	101	1	48	SPT	125	12625	7695	48	62.4	81.1	0.51	41.4	12%	44.1	37				343
18	106.0	116.0	111	1	69	SPT	125	13875	8321	69	89.7	116.6	0.49	57.2		57.2	38				361
19	116.0	121.5	121	1	41	SPT	125	15125	8947	41	53.3	69.3	0.47	32.8		32.8	35				350

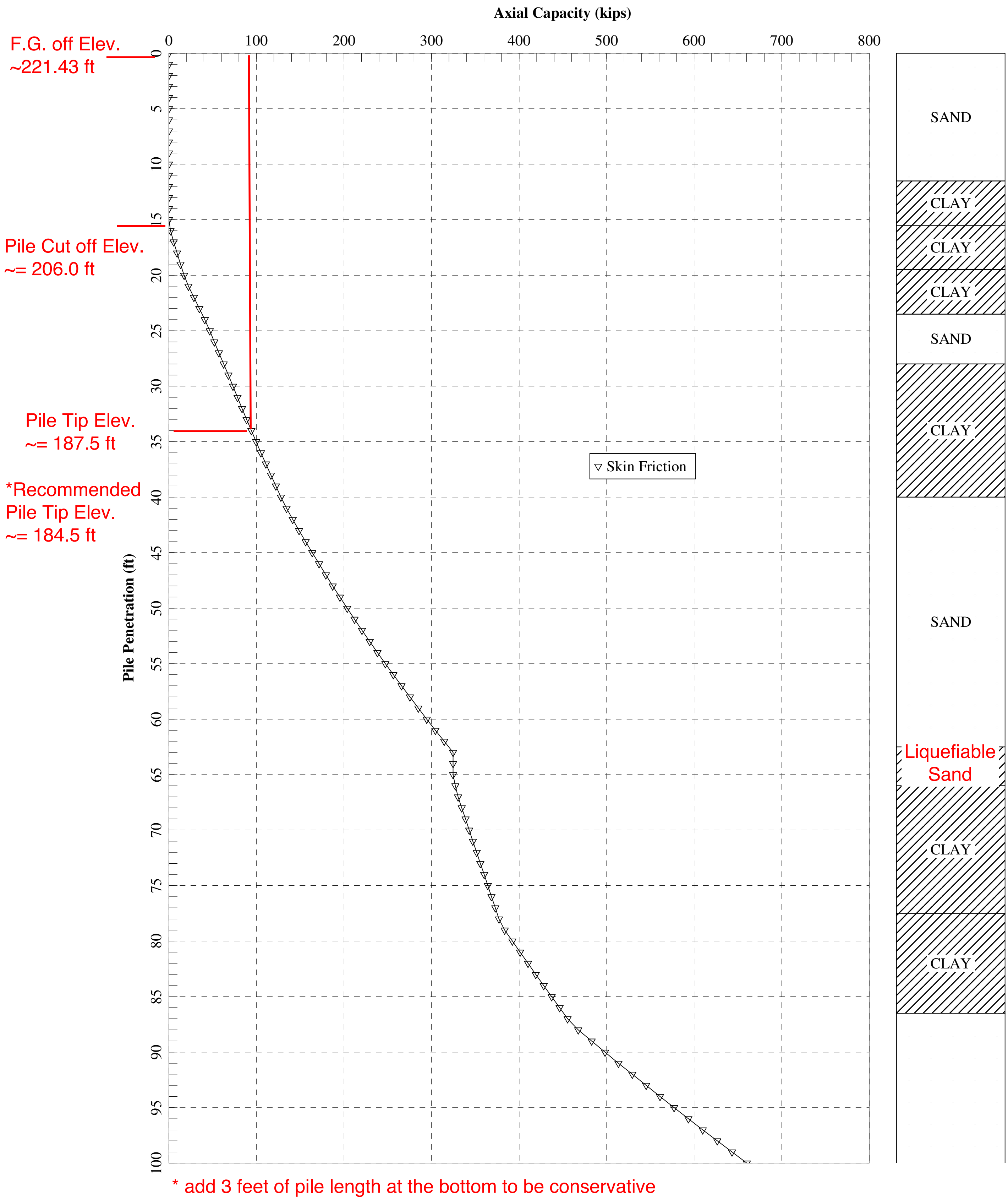
Note:
1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner), C_N (Overburden) are per Youd 2001
2. For fine-grained materials, the correlation between blow-counts and shear is based on NAVFAC DM 7.1.
3. The phi angle was estimated based on Meyerhof (1956).
4. Residual Strength (Sr) is based on Caltrans "Guidelines on Foundation Loading and Deformation Due to Liquefaction Induced Lateral Spreading", Caltrans 2011
5. The Vs were correlated based on N_{60} for Soil Types 1,3, 4; based on N_{60} or c_{lab} for Soil Type 2 and based on Sr for Soil Types 5 & 6 per Caltrans Guidelines (2012).
6. Spreadsheet Revision Date: 10/29/13

VERTICAL PILE CAPACITY ANALYSIS (A-PILE ANALYSIS RESULTS)



Abutment 1_18" x 0.625" Steel Pipe Pile_Strength Limit State

Vertical loading = 90 kips.
(No downdrag since liquefaction settlement <=0.6 inch)



Abutment 1_18" x 0.625" Steel Pipe Pile_Extreme Limit State

PILE GROUP SETTLEMENT ANALYSIS

PROJECT NAME	***SOUTHBOUND 101 OFF-RAMP PUC***
PROJECT NO.	***2016-146-OUC***
STRUCTURE	***Abutment 1***
REFERENCE BORIN	***R-18-SO-002***
Hammer Energy =	78%
GW Level (ft)=	23.5

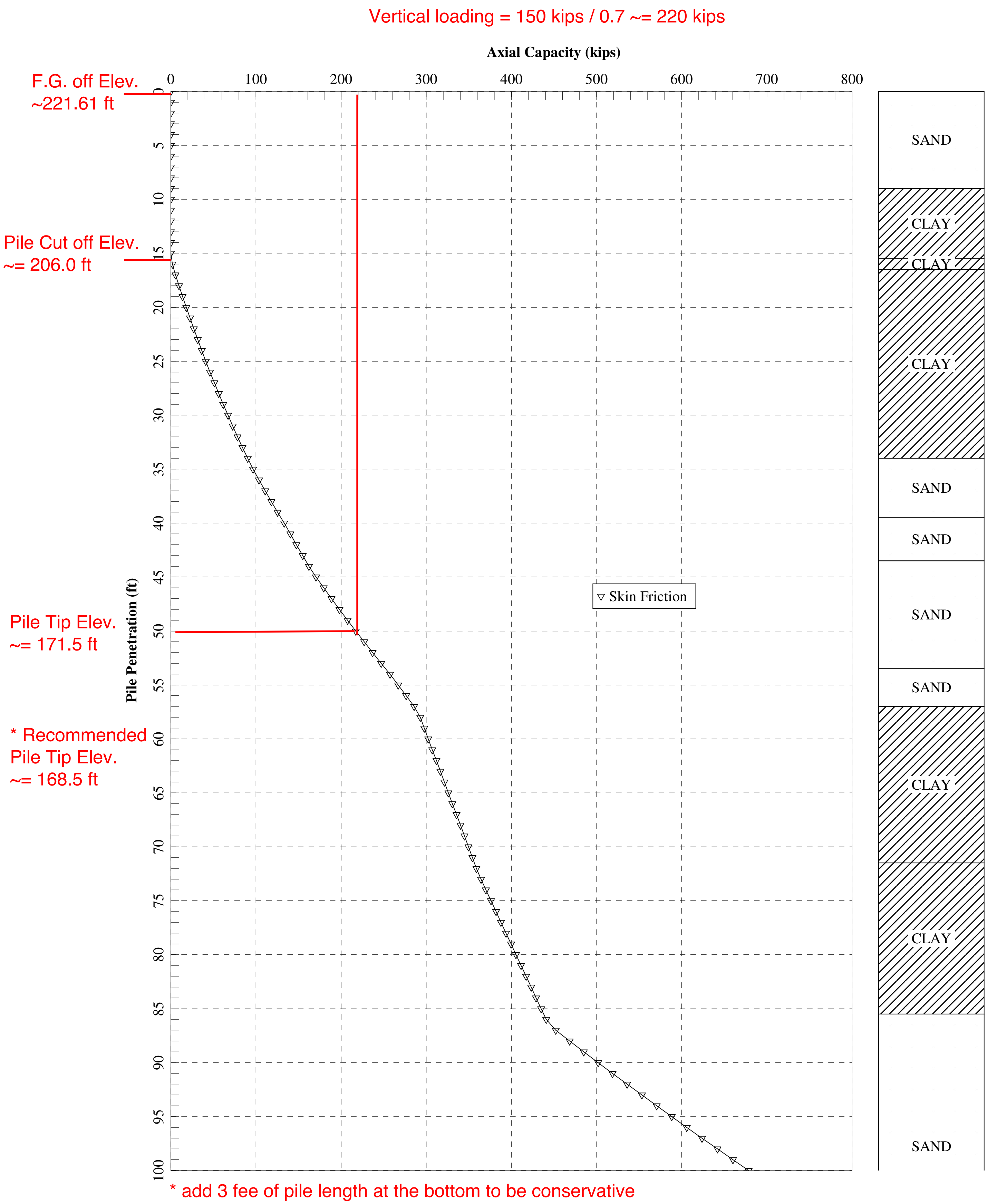
Finish Grade Elev. (ft) =	221.43
Pile Cut-off Elev. (ft) =	206
Footing Depth (ft) =	15.43
Pile Length (ft)=	25
Width of Pile Group, B (ft)=	3
Length of Pile Group, L (ft)=	87
Permanent Load Pressure (kip)=	1500

Cr/Cc= 25.0%

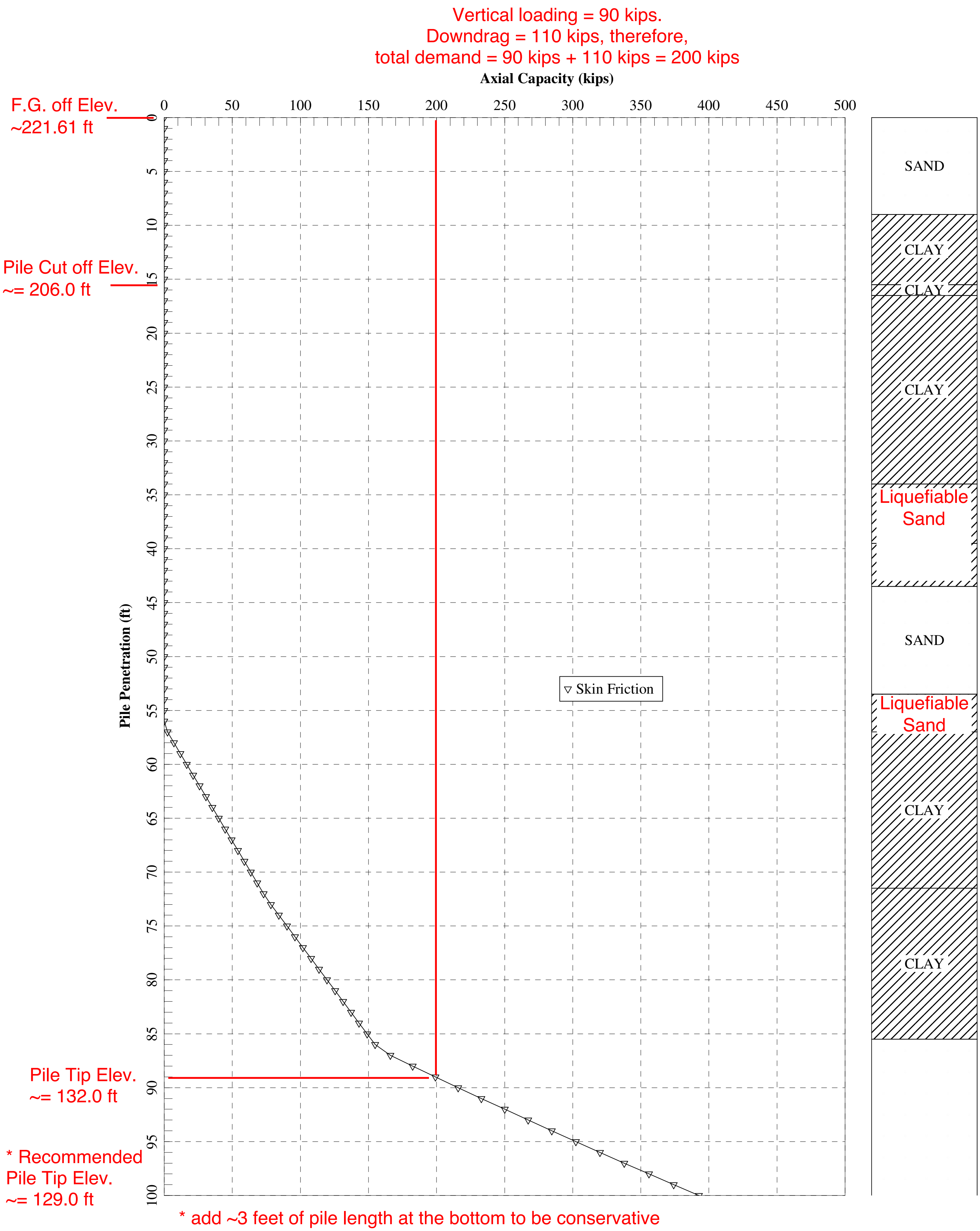
GROUPS
1. SANDS, GRAVELS AND NON-PLASTIC SILT
2. SATURATED CLAYS AND PLASTIC SILTS
3. OC CLAYS, NON-SATURATED CLAYS, AND NON-SATURATED PLASTIC SILTS

Depth from FG		Soil	BLOW	SAMPLER	AVG	γ_T	γ'	ω	σ_v'	σ_v'	$\Delta\sigma_v'$	Su	Lab Su	Pp	OCR	E	$Cr/1+e_0$	$Cc/1+e_0$	C'	Settlements (in)				
From	To	Type	COUNT	TYPE	$SPT\text{-}N_{60}$	(pcf)	(pcf)		(psf)	(psf)	(psf)	(psf)	(psf)	(psf)		(psf)			(Hough Method)	Elastic	OC	NC	SAND	Sum
0	6	1	57	MC	48	125.0	125.0	14.2%	750	375														
6	11.5	1	41	MC	35	125.0	125.0	10.9%	688	1094														
11.5	15.5	2	11	SPT	14	125.0	125.0	21.9%	500	1688														
15.5	19.5	3	31	MC	26	125.0	125.0	20.0%	500	2188			1900	7600	3.5	1146031								
19.5	23.5	2	51	MC	43	125.0	125.0	19.2%	500	2688														
23.5	28	1	51	SPT	66	125.0	62.6	12.1%	282	3078														
28	34.5	3	16	MC	14	125.0	62.6	15.1%	407	3423			2100	8400	2.5	591500								
34.5	40	3	25	MC	21	125.0	62.6	13.9%	344	3798	905.4	2641		10563	2.8	924219				0.065				0.065
40	45	1	30	SPT	39	125.0	62.6	7.3%	313	4127	652.6								72				0.053	0.053
45	50	1	25	SPT	33	125.0	62.6	9.9%	313	4440	506.6								62				0.045	0.045
50	54.5	1	24	SPT	31	125.0	62.6	8.4%	282	4737	412.5								60				0.033	0.033
54.5	62.5	1	39	SPT	51	125.0	62.6	8.0%	501	5129	326.5								80				0.032	0.032
62.5	66	1	11	SPT	14	125.0	62.6	16.0%	219	5488	270.6								40				0.022	0.022
66	77.5	2	13	MC	11	125.0	62.6	28.1%	720	5958	217.9	1373	900	3600	0.6		0.0366	0.1466				0.316		0.316
77.5	86.5	2	28	MC	24	125.0	62.6	28.6%	563	6600	168.7	2958		11830	1.8		0.0280	0.1119			0.033			0.033
86.5	97.5	1	44	SPT	57	125.0	62.6	14.7%	689	7226	135.6								77				0.014	0.014
97.5	107.5	1	48	SPT	62	125.0	62.6	6.3%	626	7883	110.7								80				0.009	0.009
107.5	117.5	1	69	SPT	90	126.0	63.6	8.1%	636	8514	93.0								103				0.005	0.005
117.5	123	1	41	SPT	53	127.0	64.6	14.8%	355	9010	82.2								68				0.004	0.004
																			Estimated Settlement (in)=	*0.1*	*0.0*	*0.3*	*0.2*	*0.6*

Note:
1. Cc is estiamted using empirical equation from "Soil Mechanics" by T. William lambe and Robert V. Whitman, unless there is existing consolidation lab results for Cc and Cr, which is in red font and applied in settlement calculation if soil type falls in Group 2, saturated clays and plastic silts.
2. Cr/Cc ratio of 25% was estimated based on the previous project experience.
3. OCR is calculated based on Su correlations.
4. Clays with OCR>=2.5 is considered as settling elasticly.
5. Soil profile starts from finish grade.



Abutment 2_18" x 0.625" Steel Pipe Pile_Strength Limit State



Abutment 2_18" x 0.625" Steel Pipe Pile_Extreme Limit State

Downdrag Forces on Circular Piles

Project No	2016-146-OUC
Project	SB 101 OFF-RAMP PUC
Location	Abutment 2 -1 rows
Boring	R-18-SO-001
Single Pile Dia. (ft)	1.5
GW Depth (ft)	33
Bulk Unit Weight (pcf)	125
Pile Length (ft)	100
# of Equiv. Pile Circumference	13.5

FG Elev.	221.61
Pile Cut-off.	206

Analysis By:	JZ
Date:	11/30/2018

Layer Number	Layer Thickness (ft)	Soil Type	Beta	Consider downdrag (y/n)	Total Depth (ft)	Layer Mid-Point Depth (ft)	Effective Stress (psf)	Contributing Thickness (ft)	Unit Negative Friction (ft)	Downdrag Force per Section (ton)	Total Downdrag Force (ton)	Remarks
1	7.75			n	7.75	3.88	484	7.8	0	0.0		Above Cut-off
2	1.00	CH	0.20	y	8.75	8.25	1031	1.0	206	6.6	6.6	Non-Liquefied Contribute to Downdrag
3	17.50	CH/ML	0.20	y	26.25	17.50	2188	17.5	438	243.5	250.1	
4	5.50	SP-SM	0.35	n	31.75	29.00	3625	5.5	1269	0.0		Liquefied
5	4.00	SM	0.30	n	35.75	33.75	4172	4.0	1252	0.0		
6	10.00	SP-SM	0.35	y	45.75	40.75	4610	10.0	1614	513.2	763.3	Non-Liquefied Contribute to Downdrag
7	3.50	SP-SM	0.35	n	49.25	47.50	5033	3.5	1761	0.0		Liquefied
8	14.50	ML	0.25	n	63.75	56.50	5596	14.5	1399	0.0		
9	14.00	CH	0.20	n	77.75	70.75	6488	14.0	1298	0.0		Below Liquefied
10	16.50	SP-SM	0.35	n	94.25	86.00	7443	16.5	2605	0.0		

Notes Area

-Layer 1 is above cut-off elevation at Abutment 2. Half thickness (15.5/2=7.75ft) assumed for effective stress estimation due to sloping ground.

-Assume the calculated downdrag load ~764 tons is acting on 13.5 equivalent pile circumference.

-If 14 piles with 764.0 tons of downdrag, then ~55 tons of downdrag load is acting on each pile.

PILE GROUP SETTLEMENT ANALYSIS

PROJECT NAME	***SOUTHBOUND 101 OFF-RAMP PUC***
PROJECT NO.	***2016-146-OUC***
STRUCTURE	***Abutment 2***
REFERENCE BORIN	***R-18-SO-001***
Hammer Energy =	78%
GW Level (ft)=	33

Finish Grade Elev. (ft) =	221.61
Pile Cut-off Elev. (ft) =	206
Footing Depth (ft) =	15.61
Pile Length (ft)=	18
Width of Pile Group, B (ft)=	3
Length of Pile Group, L (ft)=	68
Permanent Load Pressure (kip)=	1200

Cr/Cc= 25.0%

GROUPS
1. SANDS, GRAVELS AND NON-PLASTIC SILT
2. SATURATED CLAYS AND PLASTIC SILTS
3. OC CLAYS, NON-SATURATED CLAYS, AND NON-SATURATED PLASTIC SILTS

Depth from FG		Soil	BLOW	SAMPLER	AVG	γ_T	γ'	ω	σ_v'	σ_v'	$\Delta\sigma_v'$	Su	Lab Su	Pp	OCR	E	$Cr/1+e_0$	$Cc/1+e_0$	C'	Settlements (in)				
From	To	Type	COUNT	TYPE	$SPT\text{-}N_{60}$	(pcf)	(pcf)		(psf)	(psf)	(psf)	(psf)	(psf)	(psf)		(psf)			(Hough Method)	Elastic	OC	NC	SAND	Sum
0	4.5	1	48	SPT	62	125.0	125.0	13.9%	563	281														
4.5	9	1	25	SPT	33	125.0	125.0	14.0%	563	844														
9	16.5	2	12	SPT	16	125.0	125.0	23.1%	938	1594														
16.5	18.5	3	24	MC	20	125.0	125.0	22.4%	250	2188			2440	9760	4.5	887250								
18.5	23.5	2	48	MC	41	125.0	125.0	7.7%	625	2625														
23.5	28.5	3	22	MC	19	125.0	125.0	12.9%	625	3250			1970	7880	2.4	813313								
28.5	34	3	28	MC	24	125.0	62.6	13.1%	344	3735	1222.8	2958		11830	3.2	1035125				0.078				0.078
34	39.5	1	36	MC	30	125.0	62.6	9.2%	344	4079	795.7								61				0.083	0.083
39.5	43.5	1	13	SPT	17	125.0	62.6	7.5%	250	4376	596.5								45				0.059	0.059
43.5	48.5	1	26	SPT	34	125.0	62.6	15.2%	313	4658	474.2								63				0.040	0.040
48.5	53.5	1	33	SPT	43	125.0	62.6	11.2%	313	4971	380.4								72				0.027	0.027
53.5	57	1	18	SPT	23	125.0	62.6	10.4%	219	5237	322.2								50				0.022	0.022
57	71.5	2	9	SPT	12	125.0	62.6	29.5%	908	5800	237.6	1463		5850	1.0		0.0374	0.1495			0.024	0.358		0.382
71.5	76.5	2	25	MC	21	125.0	62.6	29.8%	313	6411	180.0	2641		10563	1.6		0.0350	0.1401			0.025			0.025
76.5	85.5	2	20	MC	17	125.0	62.6	26.0%	563	6849	151.0	2113	1260	5040	0.7		0.0250	0.1000				0.102		0.102
85.5	99	1	63	SPT	82	126.0	63.6	2.7%	859	7560	117.5								101				0.011	0.011
99	102	1	95	SPT	124	127.0	64.6	6.1%	194	8086	99.8								143				0.001	0.001
																			Estimated Settlement (in)=	*0.1*	*0.0*	*0.5*	*0.2*	*0.8*

Note:
1. Cc is estiamted using empirical equation from "Soil Mechanics" by T. William lambe and Robert V. Whitman, unless there is existing consolidation lab results for Cc and Cr, which is in red font and applied in settlement calculation if soil type falls in Group 2, saturated clays and plastic silts.
2. Cr/Cc ratio of 25% was estimated based on the previous project experience.
3. OCR is calculated based on Su correlations.
4. Clays with OCR>=2.5 is considered as settling elasticly.
5. Soil profile starts from finish grade.

GEOTECHNICAL LPILE PARAMETERS

SB101 OFF-RAMP PEDESTRIAN UNDERCROSSING
LPILE PARAMETERS

Boring ID: R-18-SO-002
Station: "AL4" Line 251+90

Date: 10/11/2018
By: JZ

Approx. Ground Surface Elevation: 220.0

Structure ID: Abutment 1

Depth (ft)	Elevation (ft)	LPILE Soil Type	c (psf)	Phi (degrees)	Effective Unit Weight γ’ (pcf)
0 to 10	220 to 210	Sand (Reese)	-	36	125
10 to 18	210 to 202	Stiff Clay w/o Free Water (Reese)	1800	-	125
18 to 22	202 to 198	Stiff Clay w/o Free Water (Reese)	3000	-	125
22 to 26.5	198 to 193.5	Sand (Reese)	-	38	65
26.5 to 38.5	193.5 to 181.5	Stiff Clay w/o Free Water (Reese)	2000	-	65
38.5 to 61	181.5 to 159	Sand (Reese)	-	36	65
61 to 64.5	159 to 155.5	Case I) Sand (Reese)	-	32	65
		Case II) Soft Clay (Matlock)	Sr=500	-	65
64.5 to 76	155.5 to 144	Soft Clay (Matlock)	900	-	65
76 to 85	144 to 135	Stiff Clay w/o Free Water (Reese)	2500	-	65
85 to 121.5	135 to 98.5	Sand (Reese)	-	38	65

Default values can be used for e_{50} and K except for the liquefied soils (Case II) where e_{50} of 0.05 should be used.
Groundwater was measured at the depth of 22.0 feet below existing ground during drilling at Elevation +198.0 feet.
Soil unit weights of 125 pcf and 65 pcf can be used above and below groundwater level, respectively.

SB101 OFF-RAMP PEDESTRIAN UNDERCROSSING
LPILE PARAMETERS

Boring ID: R-18-SO-001 **Date:** 10/11/2018
Station: "AR4" Line 514+75 **By:** JZ

Approx. Ground Surface Elevation: 221.0
Structure ID: Abutment 2

Depth (ft)	Elevation (ft)	LPILE Soil Type	c (psf)	Phi (degrees)	Effective Unit Weight γ' (pcf)
0 to 8.5	221 to 212.5	Sand (Reese)	-	36	125
8.5 to 16	212.5 to 205	Stiff Clay w/o Free Water (Reese)	1800	-	125
16 to 32.5	205 to 188.5	Stiff Clay w/o Free Water (Reese)	2000	-	125
32.5 to 33.5	188.5 to 187.5	Stiff Clay w/o Free Water (Reese)	2000	-	65
33.5 to 39	187.5 to 182	Case I) Sand (Reese)	-	34	65
		Case II) Stiff Clay w/o Free Water (Reese)	Sr=1400	-	65
39 to 43	182 to 178	Case I) Sand (Reese)	-	32	65
		Case II) Soft Clay (Matlock)	Sr=650	-	65
43 to 53	178 to 168	Sand (Reese)	-	36	65
53 to 56.5	168 to 164.5	Case I) Sand (Reese)	-	33	65
		Case II) Stiff Clay w/o Free Water (Reese)	Sr=1000	-	65
56.5 to 71	164.5 to 150	Stiff Clay w/o Free Water (Reese)	1000	-	65
71 to 85	150 to 136	Stiff Clay w/o Free Water (Reese)	1250	-	65
85 to 101.5	136 to 119.5	Sand (Reese)	-	38	65

Default values can be used for e_{50} and K except for the liquefied soils (Case II) where e_{50} of 0.05 should be used.
Groundwater was measured at the depth of 32.5 feet below existing ground during drilling at Elevation +188.5 feet.
Soil unit weights of 125 pcf and 65 pcf can be used above and below groundwater level, respectively.

APPENDIX VII

The appendix for

'Exceptions to Policy'

is not applicable to this report.

APPENDIX VIII

Office of Special Funded Projects
Comment & Response Form

(Revised 08/2011)

General Project Information (OSFP Liaison to complete)		**Review Phase** (OSFP Liaison to complete)	**Reviewer Information** (Reviewer Liaison to complete)	
Dist:	**04**	☐ PSR/PDS (Review No.)	Reviewer Name:	**R. Nashed/ J. Anderson**
Proj ID (Phase):	**0416000224**	☐ APS/PSR (Review No.)	Functional Unit:	**Geotechnical Design- West**
EA:	**1K2801**	☐ APS/PR (Review No.)	Cost Center:	**59-3660**
Project Name:	**Blossom Hill Rd Interchange Improvement**	☐ Type Selection	Phone Number:	**510-622-1773**
OSFP Liaison:	**Shu-Shang Liu**	☐ 65% PS&E Unchecked Details	e-mail:	**Rifaat.nashed@ dot.ca.gov**
Phone:	**916-227-8919**	☐ PS&E (Review No. 1)	Date of Review:	**12/ 27/2018**
E-mail:	**Shu-shang.liu@dot.ca.gov**	☐ Construction	Structure Name*:	**SB101 Off-Ramp Pedestrian Undercrossing**
		☑ Other: FR	Br No*:	**37-675J**
			(*Use if necessary to when comment sheets are by individual structure)	

Consultant Information (to be filled in by Consultant)

Consultant Lead (First and Last Name)	Consultant Firm	Phone Number	E-mail	Response Date

#	Doc. (See Note 1)	Page, Section, or SSP	Review Comments	Consultant Responses	Caltrans Responses
	FR	N/A	Review of Geology and subsurface and Related sections items Foundation Report (DRAFT) by Parikh consultants prepared for HMH Engineers dated December 4, 2018		
1	FR	Section 8.0 Subsurface condition Page 7	Table 3 For boring # R-18-SO-001 The fat clay layer between elevation 205 and 215 the	The pocket penetrometer measurement of Sample No. 3 (at the depth of 11 feet) of the fat clay layer between Elev. 205 feet and Elev. 215 feet has been	

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓= Comment Resolved
(for Reviewer's use)

			pocket penetrometer measurement is missing. – RN	added to the boring log of Boring R-18-SO-001 in the LOTB.	
2	FR	Section 10.0 Page 8	Table 6- ARS DATA Please add the "Spectral Acceleration" (SA) column including the deterministic data for each listed fault. -RN	The "Spectral Acceleration" (SA) column including the deterministic data for each listed fault will be added to Table 6 – ARS DATA.	
3	FR	Section 13.2 - Output	Bullet point 1 under "output" is unclear. Please revise	Bullet Point 1 under "Output" has been revised to "The recommended ARS curve is based on the maximum of the comparison of the deterministic data and Caltrans Probabilistic data. The recommended ARS curve at this site is based on the Probabilistic curve".	
4	FR	Section 13.3.2	References Section 12.2, but 12.2 does not exist. Was this supposed to be 13.2? -JA	Comment noted. The referenced section should be Section 13.2 instead. This has been corrected in the foundation report.	
5	FR	Appendix II LOTB	UC values are shown as tsf, but values are in ksf. Please correct. -JA	The UC values are in the unit of ksf based on the laboratory test result. The UC values are in the unit of tsf in the Log of Test Borings.	
6	FR	Appendix IV	Introductory page is labeled Appendix B and refers to Appendix A and B, which don't exist. Please relabel. -JA	The appendices referred in the introductory page of Appendix IV has been corrected.	
7	FR	Appendix VI	All layers should have a fines content inputted for liquefaction calculations. Please estimate based on	Estimated fine content has been added to the sand layer(s) (without any sieve analyses) based on the visual inspection of the soil samples.	

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓= Comment Resolved
(for Reviewer's use)

			visual inspection of the soil samples. -JA		
8	FR	All Sections	Please review report for grammar and consistent formatting/structure across all reports. -JA	Comment incorporated.	

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓= Comment Resolved
(for Reviewer's use)

FOUNDATION REPORT

SB 101 ON-RAMP PEDESTRIAN UNDERCROSSING
(BRIDGE NO. – 37-675K)
SAN JOSE, CALIFORNIA
04-SCl-101, R28.4/R28.9 EA 04-1K280

Prepared For:

HMH Engineers
1570 Oakland Road
San Jose, CA 95131

PARIKH CONSULTANTS, INC.
2360 Qume Drive, Suite A, San Jose, CA 95131
(408) 452-9000

October 15, 2019 Job No.: 2016-146-LUC

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APPENDIX VII

Exceptions to Policy – Not Applicable

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Office of Special Funded Projects Comment & Response Form - Parikh Consultants, Inc. Response to Caltrans Review Comments.

FOUNDATION REPORT
SB 101 ON-RAMP PEDESTRIAN UNDERCROSSING
(BRIDGE NO. 37-675K)
SAN JOSE, CALIFORNIA
04-SCl-101, R28.4/R28.9 EA 04-1K280

1.0 INTRODUCTION

This foundation report presents the results of our geotechnical engineering investigation for the proposed "US 101/Blossom Hill Road Interchange Improvement Project – SB 101 On-Ramp Pedestrian Undercrossing" in San Jose, California, hereinafter referred to as "PROJECT". The work was performed in general accordance with the scope of work outlined in our proposal to HMH Engineers (Designer).

The geotechnical recommendations presented in this report are intended for design input and are not intended to be used as specifications. In addition, the data provided in this report including these geotechnical recommendations should not be used for bidding purposes or for construction cost estimates. If the report is provided as a reference document, any interpretation of the data and recommendations should be the sole responsibility of the user and PARIKH Consultants, Inc. (PARIKH) shall not be liable for any consequences.

2.0 SCOPE OF WORK

The purpose of this investigation was to evaluate the general subsurface conditions at the project site, to evaluate their engineering properties, and to provide geotechnical recommendations for the foundation design of the proposed project.

The scope of work performed for this investigation included a review of the readily available soils and geologic literature pertaining to the project site including review of boring data, laboratory testing of the representative soil samples, performing engineering analyses based on the field and laboratory data, and preparation of this foundation report. The recommendations in this report are based on the field exploration performed by Parikh, general plan and foundation plan and loading information provided by the designer and Biggs Cardosa Associates (Structural Designer). This foundation report supersedes the preliminary foundation report for "Southbound Loop On-Ramp Pedestrian Undercrossing" dated June 11, 2018.

3.0 PROJECT DESCRIPTION

The project proposes to modify the US 101/ Blossom Hill Road Interchange to improve traffic operations and connectivity for pedestrians and bicyclists along Blossom Hill Road. The existing Blossom Hill Road Interchange consists of two separate overcrossing structures over US 101 with partial cloverleaf ramps. The project is located within the City of San Jose, in Santa Clara County. It will be implemented as a locally-funded project with the City of San Jose performing advertisement, award and administration (AAA) of the construction contract through a Caltrans encroachment permit.

Blossom Hill Road is a key connector between job locations, mixed-use housing, commercial development and recreational opportunities in an area where San Jose is focused on developing greater internalization of automobile trips, increased use of transit and expanded active transportation. The level-of-service for existing and forecasted traffic is deficient for existing developments and nearby proposed projects. The configuration of the existing interchange and ramp intersections along Blossom Hill Road are not consistent with the latest standards for accommodating balanced use by vehicles, bicyclists and pedestrians.

The proposed project improvements will occur along Blossom Hill Road from east of the Monterey Road / Blossom Hill Road grade separation to the US 101 Northbound Off-Ramp / Coyote Road intersection. All improvements will be constructed within existing Caltrans and City of San Jose rights-of-way.

In addition, the existing 5-foot sidewalk on the north side of Blossom Hill Road will be replaced with a 10-foot to 12-foot wide Class I Bike/Pedestrian path. The Class I Bike/Pedestrian path will cross under the SB 101 off-ramp and the SB 101 on-ramp with two short span undercrossing structures

The following bridge structures and retaining walls would be modified or constructed in association with the "US 101/Blossom Hill Road Interchange Improvement Project" and path:

1. Blossom Hill Road Overcrossing (OC) (Widen) (Bridge No. 37-0348)
2. NB 101 On-Ramp Pedestrian Overcrossing (POC) (Bridge No. 37-676)
3. SB 101 Off-Ramp Pedestrian Undercrossing (PUC) (Bridge No. 37-675J)
4. SB 101 On-Ramp PUC (Bridge No. 37-675K)
5. Retaining Wall No. 1 (Soil Nail Wall)(Bridge No. 37E0125)
6. Retaining Wall No. 2 (MSE Wall)(Bridge No. 37E0126)

This foundation report is for the "SB 101 On-Ramp PUC". A map showing the project location and its vicinity is presented in Appendix I. The following foundation reports will be separately submitted:

1. Foundation Report for Blossom Hill Road OC (Widen) (Bridge No. 37-0348).
2. Foundation Report for NB 101 On-Ramp POC (Bridge No. 37-676).
3. Foundation Report for SB 101 Off-Ramp PUC (Bridge No. 37-675J).
4. Foundation Report for Retaining Wall No. 1 (Soil Nail Wall)(Bridge No. 37E0125).
5. Foundation Report for Retaining Wall No. 2 (MSE Wall)(Bridge No. 37E0126).

Proposed Bridge Structure

Based on the General Plan and Foundation Plan provided by the structural designer, the new bridge structure generally consists of the following:

a) A single-span bridge structure with Abutment 1 in the north and Abutment 2 in the south.

b) The new bridge will be from "AL4" Line Station 521+54.16 to "AL4" Line Station 521+91.68 with the span length of 37'-6 ¼" along the "AL4" Line.

c) The bridge is expected to provide a travel lane for the SB 101 on-ramp and 8 feet wide shoulder in the east and 4 feet wide shoulder in the west.

d) The proposed new bridge will be CIP reinforced concrete slab structure. The foundation will consist of 18" x 0.625" Steel Pipe Piles.

All elevations referenced within this report are based on the North American Vertical Datum of 1988 (NAVD 88), unless otherwise noted. To convert elevation at this site from National Geodetic Vertical Datum of 1929 (NGVD 29) to NAVD 88, we added 1.8 feet to the NGVD 29 elevation.

Our recommendations in this report are based on the above information. Any major deviation should be reported to this office for consideration.

4.0 EXCEPTION TO POLICIES AND PROCEDURES

No exception to policies and produces are needed for the preparation of this report. Normal procedures were assumed for construction of the bridge structure throughout our analyses and represent one of the bases of recommendations presented herein. The investigation of the proposed foundations has followed Caltrans policy.

5.0 SITE CONDITIONS

The general project area is the existing interchange of Blossom Hill Road at Route 101 in San Jose, Santa Clara County, California. The existing SB 101 On-Ramp has one lane with a shoulder. The topography at the beginning of on-ramp is generally level on the side between the SB 101 On-Ramp and SB 101 Off-Ramp and has a slope gradient ranges from 2(H):1(V) to 1.5(H): 1(V) inside the loop.

6.0 FIELD INVESTIGATION AND FIELD TESTING PROGRAM

Field Exploration

Borings R-18-SO-002 and R-18-SO-003 were drilled in the vicinity of the proposed abutment of the proposed PUC in August 2018. The field exploration was performed by the drilling contractor, Geo-Ex Subsurface Exploration. The location, approximate ground elevation and depth of these borings are summarized in the table below.

TABLE 1 – SUBSURFACE INVESTIGATION SUMMARY

Boring No.	Completion Date	Drill Rig Type	Hammer Type	Hammer Efficiency (%)	Approx. Ground Elev. (ft)	Boring Depth (ft)
R-18-SO-002	8/22/2018	CME 75	Automatic	78	220.0	121.5
R-18-SO-003	8/24/2018	CME 75	Automatic	78	219.0	111.5

TABLE 2 - SUMMARY OF BORINGS

Boring No.	"AL4" Line Station (ft)	Offset (ft)	Boring Depth (ft)	Approx. Ground Elev. (ft)
R-18-SO-002	251+90	50.0 Rt.	121.5	220.0
R-18-SO-003	251+50	30.0 Lt.	111.5	219.0

(1) Boring location stations and offset and elevations are stated to the nearest foot to be consistent with the LOTB, however they were not surveyed.

The approximate locations of the soil borings are shown on the "Boring Location Map", Plate 1. The descriptions of the soil materials encountered in the field exploration and relevant boring information are presented on the LOTB included in Appendix II.

Field Testing

a) The current investigation borings (by Parikh) were advanced using a truck-mounted

CME-75 drill rig with 8-inch hollow-stem auger and 3 ¾-inch rotary wash drilling method. The soil samples were obtained from the borings during drilling at various depths by driving a 2.5-inch Inside Diameter (I. D.) Modified California Sampler or a 1.375-inch I.D. Standard Penetration Sampler (ASTM Test Method No. 1586). The sampler was driven into the subsurface soils under the impact of a 140 pounds hammer having a free fall of 30 inches. The blow counts required to drive the sampler for the last 12 inches are presented on the LOTB, Appendix II. (When correlating standard penetration data in similar soils, the blow counts for the Modified California sampler can be converted to equivalent Standard Penetration Test sampler by multiplying a factor of safety of 0.65);

b) Pocket penetration tests were also performed on clay samples to evaluate their consistency.

Details of Field Exploration

All the test borings were drilled with a truck-mounted drill rig using 8-inch hollow-stem auger and rotary-wash drilling method. The borings were drilled under the technical supervision of our engineers, who classified and continuously logged the soils encountered during drilling and supervised the collection of soil samples at various depths for visual examination and laboratory testing. The soil samples were visually classified in the field according to the Unified Soil Classification System and then transported to our laboratory for further evaluation and testing. Upon completion of drilling, the boreholes were backfilled with cement grout.

The logs presented in Appendix II were prepared from the field logs which were edited after visual re-examination of the soil samples in the laboratory and results of classification tests on selected soil samples as indicated on the logs.

It should be noted that the descriptions of the soils encountered and relevant boring information presented on the LOTB depict subsurface conditions only at the locations indicated on the plan and on the particular date noted on the LOTB. Because of the variability from place to place within soil/rock in general, subsurface conditions at other locations may differ from conditions occurring at the boring locations explored. The abrupt stratum changes shown on the logs may be gradational and relatively minor changes in soil types within a stratum may not be noted on the logs due to field limitations. Also, the passage of time may result in a change in the soil conditions at these locations due to environmental changes.

7.0 LABORATORY TESTING PROGRAM

The following laboratory tests were performed on selected soil samples collected during field exploration to evaluate the physical and engineering properties of the subsurface soils at the project site to support the foundation recommendations:

a) Laboratory determination of Moisture Contents (ASTM D-2216);
b) Atterberg Limits (ASTM D-4318);
c) Particle Size Analysis (ASTM D-422);
d) Unconfined Compression Test (ASTM D-2166);
e) Corrosivity Test (California Test Method T-643, T-422, and T-417).

The laboratory test methods and test results are presented on plates included in Appendix IV. Laboratory test results for moisture content, total unit weight, unconfined compression, Plasticity Index and grain size classification of the soil samples are summarized in the table in Appendix IV.

8.0 SITE GEOLOGY AND SUBSURFACE CONDITIONS

Geology

General geologic features pertaining to the project site were evaluated by reference to the "Dibblee, T.W.; and Minch, J.A., 2005, Geologic Maps of the San Jose East Quadrangle, Santa Clara County, California; Dibblee Geological Foundation DF-155, scale 1:24,000" and "Dibblee, T.W.; and Minch, J.A., 2005, Geologic Maps of the Santa Teresa Hills Quadrangle, Santa Clara County, California; Dibblee Geological Foundation DF-158, scale 1:24,000".

Based on the geologic map, the project site subsurface soils consist of mainly Holocene surficial sediments with alluvial gravel, sand and clay soil of valley areas (Qa). The general geology of the project area is shown on the "Geologic Map", Plate No. 2.

The descriptions of the subsurface soils encountered in the geotechnical explorations are consistent with the published geologic maps.

Subsurface Conditions

Based on Borings R-18-SO-002 and R-18-SO-003, the descriptions of the subsurface soil materials encountered in each of the exploratory boring are summarized in the table below. Detailed soil descriptions and location of the borings are presented on the LOTBs.

TABLE 3 - SUMMARY OF SUBSURFACE SOIL CONDITIONS

Boring	Support	Soil Description
R-18-SO-002	Abut 2	Approximately 10 feet of dense silty gravel and medium dense poorly graded sand, underlain by approximately 12 feet of stiff to hard lean clay, underlain by approximately 4.5 feet of very dense silty gravel with sand, underlain by approximately 12 feet of very stiff lean clay and hard silt with sand, underlain by approximately 26 feet of interbedded layers of medium dense silty gravel with sand/silty sand/poorly graded sand/clayey sand, underlain by approximately 21 feet of medium stiff to stiff lean clay, underlain by dense to very dense poorly graded sand to the boring depth of 121.5 feet.
R-18-SO-003	Abut 1	Approximately 16.5 feet of dense silty sand with gravel, underlain by approximately 6.5 feet of very stiff lean to fat clay, underlain by approximately 30 feet of medium dense to dense silty sand/poorly graded sand, underlain by approximately 12 feet of medium stiff lean clay, underlain by approximately 10 feet of medium dense silty sand, underlain by approximately 10 feet of stiff lean clay, underlain by very dense poorly graded gravel with silt and sand to the boring depth of 111.5 feet.

Due to limitations inherent in geotechnical investigations, it is neither uncommon to encounter unforeseen variations in the subsurface soil conditions during construction nor is it practical to determine all such variations during an acceptable program of drilling and sampling for a project of this scope. Such variations, when encountered, generally require additional engineering services to attain properly constructed project. We, therefore, recommend that a contingency fund be provided to accommodate any additional charges resulting from technical services that may be required during construction.

9.0 GROUNDWATER

Groundwater measured during the field exploration is summarized in the table below.

TABLE 4 - SUMMARY OF MEASURED GROUNDWATER LEVEL

Boring No.	Date	Depth (feet)	Elevation (feet)
R-18-SO-002	8/22/2018	22.0	198.0
R-18-SO-003	8/24/2018	25.0	194.0

Groundwater level is anticipated to vary with the passage of time due to seasonal groundwater fluctuations, variations in yearly rainfall, water elevations in the nearby creeks, surface and subsurface flows, ground surface run-off, and other environmental factors that may not be present at the time of the investigation.

Measured groundwater depth has been used for engineering design purposes.

10.0 AS-BUILT FOUNDATION DATA

There is no as-built foundation data available for the proposed bridge structure since it is a new bridge structure.

11.0 SCOUR EVALUATION

There is no significant drainage or flowing bodies of water passing through or adjacent to the site. Therefore, scour should not be a design concern and was not considered for foundation design.

12.0 CORROSION

The corrosion investigation for this project was performed on the selected samples from borings drilled in 2018 in general accordance with the provisions of California Test Methods 417, 422 and 643. A summary of the corrosion test results is presented in the table below, and the test results are presented in Appendix IV.

TABLE 5 - SUMMARY OF CORROSION TEST RESULT

Boring	Approx. Sample Depth (feet)	Minimum Resistivity (ohms-cm)	PH	Water-soluble Chloride (ppm)	Water-soluble Sulfate (ppm)
R-18-SO-002	21.0	1,260	7.97	16.4	40.0
R-18-SO-003	21.0	1,340	7.71	8.7	34.5

According to the Section 10.7.5. of the AASHTO LRFD Bridge Design Specifications (BDS) – Sixth Edition (2012) with Caltrans Amendment, the following soil, water or site conditions shall be considered as indicators of potential pile corrosion or deterioration:

- Minimum resistivity equal to or less than 1,000 ohm-cm,
- Chloride concentration equal to or greater than 500 ppm,
- Sulfate concentration equal to or greater than 2,000 ppm,
- pH equals to or less than 5.5
- Landfills and cinder fills,
- Mines or industrial drainage,
- Suspected chemical wastes, and

- Stray currents.

Per Caltrans Corrosion Guidelines (Version 3.0, March 2018), Caltrans considers a project site to be corrosive for structural elements if one or more of the following conditions exist for the representative soil and/or water samples taken at the project site:

- Chloride concentration equal to or greater than 500 ppm, or
- Sulfate concentration equal to or greater than 1,500 ppm, or
- pH equals to or less than 5.5.

Therefore the on-site soil materials should be non-corrosive according to the criteria above.

13.0 SITE SEISMICITY AND ANALYSIS

13.1 Seismic Sources

The project is located in a seismically active part of northern California. Many faults exist in the regional area. These faults are capable of producing earthquakes and may cause strong ground shaking at the site.

Maximum magnitudes (M_{max}) of some of the closest faults in the area are based on Caltrans ARS Online Website. These maximum moment magnitudes represent the largest earthquake a fault is capable of generating and is related to the seismic moment. The earthquake data of the active faults in the project vicinity are summarized in the table below.

TABLE 6- ARS DATA

Fault (Fault ID)	Maximum Moment Magnitude of Fault, M_{Max}	Fault Type	Site-to-Fault Distance, R_{rup}* (miles)	Peak Ground Acceleration (PGA) Based on Deterministic Data (g)
Silver Creek (148)	6.9	Strike Slip	2.20	0.400
Hayward (Southern extension) (149)	6.7	Strike Slip	4.14	0.322
Calaveras (Central) 2011 CFM (151)	6.9	Strike Slip	6.79	0.262
Cascade fault (153)	6.7	Reverse	3.15	0.370
Monte Vista-Shannon (154)	6.4	Reverse	4.68	0.297
San Andreas (Santa Cruz Mts) 2011 CFM (158)	8.0	Strike Slip	11.80	0.250

*Closest distance (mi) to the fault rupture plane as obtained from Caltrans ARS Online Website.

13.2 Seismic Design Criteria

The development of the Acceleration Response Spectrum (ARS) followed the standard

Caltrans procedure by using Caltrans ARS Online webtool (Ver. 2.3.09). The ARS curve is based on several input parameters, including site location (longitude/latitude), average shear wave velocity for the top 100 feet (Vs_{30m}), and other site parameters, such as fault characteristics and site-to-fault distances.

Average shear wave velocities (Vs_{30m}) for the top 100 feet at the project site was calculated by using established correlations and the procedure provided in the "Caltrans Design Manual (Version 2.0, 2012)". The design method incorporates both deterministic and probabilistic seismic hazards to produce the design response spectrum.

Based on all the available boring data, we have calculated the Vs_{30m}. The Vs_{30m} are summarized in the following table.

TABLE 7- SUMMARY OF CALCULATED Vs_{30m}

Boring No.	Boring Depth	Rock Depth (ft)	Vs_{30m} (m/s)
R-18-SO-002	121.5	Not encountered	232
R-18-SO-003	111.5	Not encountered	258

The ARS was developed based on the shear wave velocity of 240 m/s. Average shear wave velocity calculation is included in Appendix VI.

The site location and the relevant parameters are summarized as follows, and the recommended design curve is presented on Appendix V.

Input

- Site Location: 37.2579ºN/121.7990ºW
- Average V_{S30m}: 240 m/s
- Depth to rock with a shear wave velocity of 1.0 km/sec ($Z_{1.0}$) = N/A
- Depth to rock with a shear wave velocity of 2.5 km/sec ($Z_{2.5}$) = N/A

Output

- The recommended ARS curve is based on the maximum of the comparison of the deterministic data and Caltrans Probabilistic data. The recommended ARS curve at this site is based on the Probabilistic curve.
- An adjustment factor for the near-fault effect was applied to the calculated spectral acceleration values. The increase of 20% to the spectral acceleration values

corresponds to period longer than 1 second and linearly tapes to zero at a period of 0.5 seconds.

- Anticipated Peak Ground Acceleration (PGA): 0.634 g
- Near Fault Effect: Yes
- Basin Effect: No. The project site is not located within the limit of the $Z_{2.5}$ contour map for Northern California.
- Governing Fault is the Silver Creek Fault (Fault I.D.=148, Mmax=6.9)

13.3 Seismic Hazards/Liquefaction Potential

Potential seismic hazards may arise from three sources: surface fault rupture, ground shaking and liquefaction. Since no active faults pass through the site, the potential for fault rupture does not exist at the site. As shown on the ARS Online Map, Plate No. 3, the closest active fault is Silver Creek fault, which is located approximately 2.2 miles northeast from the project site.

13.3.1 Seismic Hazards

Potential seismic hazards may arise from three sources: surface fault rupture, ground shaking and liquefaction.

13.3.2 Seismic Ground Shaking

Based on available geological and seismic data, the project site is expected to experience strong ground shaking. PGA of 0.634 g was estimated for the site which is discussed in Section 13.2.

13.3.3 Surface Fault Rupture

Since no known active fault passes through the project site and the project site is not within a state Alquist-Priolo Zone, the potential for fault rupture does not exist.

13.3.4 Liquefaction Potential

Liquefaction is a phenomenon in which saturated cohesionless soils are subject to a temporary but essentially total loss of shear strength under the reversing, cyclic shear stresses associated with earthquake shaking. Submerged cohesionless sands and silts of low relative density are the type of soils, which usually are susceptible to liquefaction. Clays are generally not susceptible to liquefaction.

The liquefaction potential was evaluated in accordance with the methods proposed by Youd, et al. (2001). The evaluation was done using the boring data from all the available borings using a Magnitude 6.9 earthquake and a peak ground acceleration of 0.634 g (Caltrans Online Probabilistic ARS). This method compares the estimates of the earthquake-induced shear stress to the susceptibility of soil liquefaction. According to Bray (2006), liquefaction appears to occur in soils where these fines are either non-plastic or are low plasticity silts and/or silty clays (PI<12%, and LL<37%), and with high water content relative to their liquid limit (w>0.85 LL). Estimated fine content has been added to the sand layers (without any sieve analyses) based on the visual inspection and soil classification of the soil sample.

Based on the results of the liquefaction analyses, liquefaction potential may exist at the project site at the isolated locations for the loose to medium dense cohesionless soil encountered in the borings with the following estimated post-liquefaction settlements.

TABLE 8 - SUMMARY OF ESTIMATED POST-LIQUEFACTION SETTLEMENT

Support No.	Boring No.	Estimated liquefiable Soil Depth (ft)	Approx. Thickness (ft)	Estimated liquefiable Soil Top Elev.(ft)	Estimated liquefiable Soil Bottom Elev.(ft)	$(N_1)_{60,CS}$	Estimated Post-liquefaction Settlement (inches)
Abut 2	R-18-SO-002	61.0	3.5	159.0	155.5	18.2	0.6
Abut 1	R-18-SO-003	28.0	10.5	191.0	180.5	19.1	1.8
		44.0	4.0	175.0	171.0	19.6	0.7
		65.0	10.0	154.0	144.0	21.7	1.6

Based on the results of the liquefaction analyses as shown above, the following are considered for the potentially liquefiable soils encountered in the above borings:

a) The calculated post-liquefaction settlement of 0.6 inches for Boring R-18-SO-002 is marginal in mobilized downdrag. Downdrag due to potential post-liquefaction settlement is not considered for Abutment 2.

b) Some of the potentially liquefiable soil encountered in the soil borings are very deep at the depth of 60 feet or greater. These potentially liquefiable layers are not anticipated to have any effect on the pile capacity analyses in the foundation recommendations. Downdrag is not considered for potential post-liquefaction settlement encountered at the depth of 65 feet in Boring R-18-SO-003.

The post-liquefaction settlement due to the potential liquefiable soil encountered in Boring R-18-SO-003 for Abutment 1 might cause downdrag and reduce the load carrying capacity of the piles. Downdrag load has been considered in the calculations of the vertical pile capacities of Abutment 1.

Liquefaction analyses are included in Appendix VI.

Lateral Spreading

Liquefaction-induced spreading has been defined as the *"lateral displacement of large surficial blocks of soil as a result of liquefaction in a subsurface layer"*. Lateral spreading refers to the more moderate movements of gently sloping ground due to soil liquefaction. As described by Bartlett and Youd (1992a; 1992b), liquefaction-induced lateral spreading occurs on mild slopes of 0.3% to 5% underlain by loose sand and shallow water. The geologic conditions conducive to lateral spreading (gentle surface slope, shallow water table, and liquefiable cohesionless soils) are frequently found along streams and other waterfronts in recent alluvial or deltaic deposits, as well as in loosely-packed, saturated, sandy fills.

In our opinion, the potential for lateral spreading does not exist because it appears that there is no continuous layer of liquefiable soil and stream/water course at the project site.

14.0 FOUNDATION RECOMMENDATIONS

14.1 General

Based on the findings of our investigation, no major adverse condition was noted for the planned structure provided the recommendations presented in this report are incorporated into the final design and construction. Bridge plans should be reviewed by our office prior to finalizing the plans to see that the intent of our recommendations is included in the plans.

This report was prepared specifically for the proposed project according to the plans provided to us. Normal construction procedures were assumed throughout our analysis and represent one of the bases of recommendations presented herein. Our design recommendations have been based upon the materials and subsurface soil conditions encountered in the soil borings at the project site. Therefore, we should be notified in the event that these conditions are changed, so as to modify or amend our recommendations.

The following foundation recommendations were designed in accordance with the 2012 AASHTO LRFD Bridge Design Specifications (6th Edition) with Caltrans Amendments.

14.2 Earthwork and Grading

All grading operations should be performed in accordance with the project specifications and Caltrans Standard Specifications for Earthwork (Section 19). A representative from PARIKH or regulating agency should observe all excavated areas during grading and perform moisture and density tests on prepared subgrade and compacted fill materials.

14.3 Deep Foundations

Recommended Foundation Type

1. Based on the available boring information and considering the drivability through the significant strata of medium dense to dense sand, 18” x 0.625” steel pipe piles appear to be the recommended foundation system for the proposed bridge structure.

2. Cast-In-Drilled-Hole (CIDH) Concrete pile is feasible but not preferred considering medium dense to dense sand below groundwater which may cause soil caving-in. Also driven pile tends to be more cost effective than the CIDH Concrete pile.

3. Shallow foundation is not recommended considering the magnitude of the demand load, medium stiff to stiff subsurface soils at shallow depth and potentially liquefiable soil encountered in Boring R-18-SO-003 for Abutment 1.

18” x 0.625” steel pipe piles may be designed for the foundation loads at the abutments to the indicated pile tip elevations as shown in Table 11. Pertinent foundation design information provided by the structural designer, including Foundation Design Data and Foundation

Loads, are presented in the following tables.

TABLE 9 - FOUNDATION DESIGN DATA

Support No	Design Method	Pile Type	Finish Grade Elev. (ft)	Pile Cut-off Elev. or Bottom of Footing Elev. (ft)	Pile Cap Size (ft)		Permissible Settlement (in)	No. of Piles per Support
					B	L		
Abut 1	LRFD	18" x 0.625" Steel Pipe Pile	221.75	206.0	3	31	1.00	6
Abut 2	LRFD	18" x 0.625" Steel Pipe Pile	222.48	206.0	3	34	1.00	6

TABLE 10 - FOUNDATION DESIGN LOADS

Support No.	Service-I Limit State (kips)			Strength Limit State (Controlling Group, kips)				Extreme Limit State (Controlling Group, kips)			
	Total Load		Permanent Loads	Compression		Tension		Compression		Tension	
	Per Support	Max Per Pile	Per Support	Per Support	Max. Per Pile.	Per Support	Max. Per Pile	Per Support	Max. Per Pile	Per Support	Max. Per Pile
Abut 1	650	110	490	1050	180	N/A	N/A	490(1)	90(1)	N/A	N/A
Abut 2	650	110	490	1050	180	N/A	N/A	N/A	N/A	N/A	N/A

(1) Extreme event compression loading provided are permanent loads that will need to be resisted under liquefaction downdrag.

Load and Resistance Factor Design (LRFD) was used for abutment foundations, per AASHTO LRFD Bridge Design Specifications–6th Edition, with Caltrans Amendments.

The pile cut-off elevations are shown in Table 9. The evaluation of Load Demands on the piles, based upon LRFD is presented in Table 10 above. The estimated specified tip elevations for the anticipated design loading of the piles are shown in Table 11 below.

TABLE 11 - FOUNDATION RECOMMENDATIONS

Location	Cut-off Elev. Or Bottom of Footing Elev. (ft)	Service-I Limit State Load per Support (kips)		Total Permissible Footing Settlement (inches)	Nominal Resistance(iii), (iv) (kips)				Design Tip Elev.(i) (ft)	Specified Tip Elev. (ft)	Nominal Driving Resistance (kips)
					Strength Limit (φ_{qs}&φ_{qp} = 0.7)		Extreme Event (φ_{qs}&φ_{qp} = 1.0)				
		Total	Permanent		Comp.	Tension	Comp.	Tension			
Abut 1	206.0	650	490	1	260	N/A	150(v)	N/A	164.0 (a-I), 148.0 (a-II) 186.0 (c), 170 (d)	148.0	460
Abut 2	206.0	650	490	1	260	N/A	N/A	N/A	162.5 (a-I), 185.5 (a-II) 186.0 (c), 170 (d)	162.5	370

(i) Design tip elevations are controlled by (a-I) Compression (Strength Limit), (a-II) Compression (Extreme Event), (c) Settlement, (d) Lateral Load.
(ii) The nominal driving resistance required is equal to the nominal resistance needed to support the factored load plus driving resistance from the penetrated soil layers, if any, which do not contribute to the design resistance.
(iii) Column heading modified from *Required Factored Nominal Resistance* to **Nominal Resistance**
(iv) *Resistance* factor for φ_{qs} is for skin friction and φ_{qp} is for end bearing.
(v) The additional downdrag induced load of 58 kips was assumed in the analysis for Abutment 1 for Extreme Event Limit State.
(vi) Lateral Pile Capacity Analysis was performed by the structural designer.

TABLE 12 - PILE DATA TABLE

Location	Pile Type	Cut-off Elev. Or Bottom of Footing Elev. (ft)	Nominal Resistance (kips)		Design Tip Elev. (ft)	Specified Tip Elev. (ft)
			Compression	Tension		
Abut 1	18” x 0.625” Steel Pipe Pile	206.0	260	N/A	148.0 (a), 186.0 (c), 170 (d)	148.0
Abut 2	18” x 0.625” Steel Pipe Pile	206.0	260	N/A	162.5 (a), 186.0 (c), 170 (d)	162.5

i. Design tip elevations for Abutments are controlled by: (a) Compression, (c) Settlement, (d) Lateral
ii. Lateral Pile Capacity Analysis was performed by the structural designer.

The pile capacities for the 18” x 0.625” steel pipe piles were calculated based on guidelines by American Petroleum Institute (API) publication “Recommended Practice for Planning, Designing and Constructing Fixed Offshore Platforms – Working Stress Design” (API RP 2A-WSD, 2002). The pile capacities were derived both from frictional resistance along the pile shaft and end bearing resistance under compression. For soil layers above liquefiable zone, downdrag load is considered as additional ultimate structural demands (Factor of Safety = 1.0) for extreme event. For end bearing resistance, we assumed that a soil plug will be formed during driving.

The estimated design tip elevations and specified tip elevations are based on the general plan, foundation plan, “Foundation Design Data” and “Foundation Design Loads” provided by the structural designer. In the event that these footing bottom elevations are changed, the design pile tip elevations may have to be revised accordingly. The axial pile capacity calculations are presented in Appendix VI.

14.4 Lateral Design for Piles

The piles should not be spaced closer than 3 times the pile diameter measured center-to-center. For piles spaced at center-to-center distance greater than or equal to 3 times the pile diameter, there is no group effect for pile vertical capacity.

Based on the pile layouts provided by the structural designer, the following “P-Y” Curve Modification Factors should be used for lateral pile capacity analysis:

- Abutment 1 - Transverse: 0.52, Longitudinal: 0.92
- Abutment 2 - Transverse: 0.58, Longitudinal: 0.97

The piles under the lateral demand using L-PILE software was performed by the structural designer. The L-PILE results will be provided by the structural designer. The recommended L-PILE parameters are included in Appendix VI and in the tables below.

TABLE 13A–GEOTECHNICAL PARAMETERS FOR LPILE ANALYSIS ABUTMENT 1
(Boring R-18-SO-003)

Approx. Depth (ft)	Elevation (ft.)	LPILE Soil Type	c (psf)	Phi (degrees	Effective Unit Weight γ' (pcf)
0 to 16.5	219 to 202.5	Sand (Reese)	-	$\phi = 36°$	125
16.5 to 23	202.5 to 196	Stiff Clay w/o Free Water (Reese)	c=2400 psf	-	125
23 to 25	196 to 194	Sand (Reese)	-	$\phi = 38°$	125
25 to 28	194 to 191	Sand (Reese)	-	$\phi = 38°$	65
28 to 38.5	191 to 180.5	Case I) Sand (Reese)	-	$\phi = 34°$	65
		Case II) Soft Clay (Matlock)	c=700 psf	-	65
38.5 to 44	180.5 to 175	Sand (Reese)	-	$\phi = 38°$	65
44 to 48	175 to 171	Case I) Sand (Reese)	-	$\phi = 33°$	65
		Case II) Soft Clay (Matlock)	c=800 psf	-	65
48 to 53	171 to 166	Sand (Reese)	-	$\phi = 36°$	65
53 to 65	166 to 154	Stiff Clay w/o Free Water (Reese)	c=1600 psf	-	65
65 to 75	154 to 144	Sand (Reese)	-	$\phi = 32°$	65
75 to 85	144 to 134	Stiff Clay w/o Free Water (Reese)	c=1600 psf	-	65
85 to 111.5	134 to 107.5	Sand (Reese)	-	$\phi = 38°$	65

(1) Default values of soil modulus (k) and soil strain (ε_{50}) can be used for all layers
(2) Groundwater was measured at the depth of 25.0 feet below existing ground during drilling at Elevation +194.0 feet.

TABLE 13B–GEOTECHNICAL PARAMETERS FOR LPILE ANALYSIS ABUTMENT 2
(Boring R-18-SO-002)

Approx. Depth (ft)	Elevation (ft.)	LPILE Soil Type	c (psf0	Phi (degrees	Effective Unit Weight γ' (pcf)
0 to 10	220 to 210	Sand (Reese)	-	$\phi = 36°$	125
10 to 18	210 to 202	Stiff Clay w/o Free Water (Reese)	c=1800 psf	-	125
18 to 22	202 to 198	Stiff Clay w/o Free Water (Reese)	c=3000 psf	-	125
22 to 26.5	198 to 193.5	Sand (Reese)	-	$\phi = 38°$	65
26.5 to 38.5	193.5 to 181.5	Stiff Clay w/o Free Water (Reese)	c=2000 psf	-	65
38.5 to 61	181.5 to 159	Sand (Reese)	-	$\phi = 36°$	65
61 to 64.5	159 to 155.5	Case I) Sand (Reese)	-	$\phi = 32°$	65
		Case II) Soft Clay (Matlock)	c=500 psf	-	65
64.5 to 76	155.5 to 144	Soft Clay (Matlock)	c=900 psf	-	65
76 to 85	144 to 135	Stiff Clay w/o Free Water (Reese)	c=2500 psf	-	65
85 to 121.5	135 to 98.5	Sand (Reese)	-	$\phi = 38°$	65

(1) Default values of soil modulus (k) and soil strain (ε_{50}) can be used for all layers
(2) Groundwater was measured at the depth of 22 feet below existing ground during drilling at Elevation +198.0 feet.

Lateral Earth Pressures

Abutment retaining walls should be designed to resist the following Applied Lateral Earth Pressures (Equivalent Fluid Pressures-EFP) and live load. These values assume no hydrostatic pore pressure buildup behind the wall and are based on well-drained backfill behind the walls supported in native soil. If hydrostatic pressures are allowed to build up behind the walls, additional lateral loads should be considered in the design.

<u>Applied Lateral Earth Pressure</u>

(a) Active Condition	Recommended active pressure is 36 pcf EFP for the engineered backfill.
(b) At-Rest Condition	Recommended at-rest pressure is 55 pcf EFP for the engineered backfill.
Passive Resistance	5.0 ksf (ultimate) for seismic design of the abutment backwall (5.5 feet or greater); for activated height less than 5.5 feet, modify proportionally i.e. 5.0x (H/5.5) ksf per. A minimum lateral wall movement of 2% of wall height to mobilize the full ultimate passive resistance is required.

Cantilever walls, which are free to rotate by at least 0.005 radian, may be assumed flexible and designed for the active condition. Walls that are not capable of this movement should be assumed rigid and designed for the at-rest condition. The effect of any surcharge (dead, live, or traffic load) should be added to the preceding lateral earth pressures. A coefficient of 0.4 and 0.5 may be used to determine the additional lateral earth pressures resulting from the surcharge for cantilever walls and rigid walls, respectively.

14.5 Settlement

The proposed bridge structure will be formed by excavation and backfill and no additional fill or overburden will be placed on the original ground. Therefore, the settlement is anticipated to be minimal and should not be a geotechnical concern.

15.0 CONSTRUCTION CONSIDERATIONS

15.1 General

To a degree, the performance of any structure is dependent upon construction procedures and quality. Hence, observation of foundation construction should be carried out by the responsible Agency. If the encountered subsurface conditions differ from the basis of our recommendations, Parikh should be informed in order to assess the need for design changes. Therefore, the recommendations presented in this report are contingent upon good quality control and these geotechnical observations during construction.

A safe working distance from underground and overhead utilities should be provided during construction work. If this is not possible, the utility lines may need to be cleared from the site before the start of construction work.

15.2 18" x 0.625" Steel Pipe Pile

a) There are houses in the vicinity of the proposed bridge structure. Noise levels by construction such as pile driving, the construction noise impacts and requirements related to construction noise have been addressed in Section 8 of the PA&ED "US 101/Blossom Hill Road Interchange Improvement Project – Noise Study Report".

b) Medium stiff to hard cohesive soils with interbedded layers of medium dense to dense sands are generally encountered at the project site. Hard driving is expected.

c) Should difficult driving be encountered where the vertical compression requirement is met prior to reaching the specified tip elevation, pile driving may be allowed to terminate if other tip requirements for lateral, tension and settlement are met. Undersize pre-drill (partial length) may be considered to help reach the tip elevation if necessary.

d) In general, a pile may be considered to have reached "practical refusal" if pile advance less than 1 inch under 10 blows or a foot under 100 blows.

e) It is anticipated that the pile capacity will develop after driving as a result of soil "freeze" and dissipation of excess pore water pressures. The final pile capacity can be verified and the gain of pile capacity after initial driving may be evaluated based on "re-driving" after 24-hour (min.) set up. 2015 Caltrans Standard Specifications (Section 49-2.01A (4)9b)) may be used as the pile driving acceptance criteria.

f) As an option, Pile Driving Analyzer (PDA) may be used to evaluate the pile capacity of the driven piles when unanticipated conditions arise. Typical applications of the PDA include capacity evaluation (for both during driving and re-driving) and integrity testing for piles that have experienced hard driving.

g) It is prudent to make the contractor aware of these conditions so that appropriate steps can be taken to comply with the standards and maintain the integrity of the piles.

h) Due to the hard driving condition that may be encountered during pile driving, pile driving should be allowed to terminate short of the specified tip elevation provided the following conditions are satisfied:

- Other requirements including tension and lateral demands are met;
- Pile attaining its capacity and refusal within 5 feet above the specified tip elevation.

16.0 NOTES TO DESIGNER

Should the specified pile tip elevation required to meet lateral load demands exceed the specified pile tip elevation given within this report, the Geotechnical Engineer must be contacted for further recommendations.

17.0 PLAN REVIEW

This report is prepared for the proposed "SB 101 On-Ramp PUC) (Bridge No. 37-675K)". We recommend that final foundation plans for the proposed project to be reviewed by PARIKH prior to construction so that the intent of our recommendations is included in the project plans and specifications and to further see that no misunderstandings or misinterpretations have occurred. However, design-build elements should be reviewed only from overall compliance standpoint.

18.0 CONSTRUCTION OBSERVATION

To a degree, the performance of any structure is dependent upon construction procedures and quality control measures. Hence, geotechnical observation and testing of grading operations, foundation excavations, and observation of pile installations should be carried out by the Geotechnical Engineer. If the subsurface conditions different from those forming the basis of our recommendations are encountered, this office should be informed in order to assess the need for design changes. Therefore, the recommendations presented in this report are contingent upon good quality control and these geotechnical observations during construction.

19.0 INVESTIGATION LIMITATIONS

Our services consist of professional opinions and recommendations made in accordance with generally accepted geotechnical engineering principles and practices and are based on our site reconnaissance and the assumption that the subsurface conditions do not deviate from observed conditions. All work done is in accordance with generally accepted geotechnical engineering principles and practices. No warranty, expressed or implied, of merchantability or fitness, is made or intended in connection with our work or by the furnishing of oral or written reports or findings.

The scope of our services did not include any environmental assessment or investigation for the presence or absence of hazardous or toxic materials in structures, soil, surface water, groundwater or air, below or around this site. Unanticipated soil conditions are commonly encountered and cannot be fully determined by taking soil samples and excavating test borings; different soil conditions may require that additional expenditures be made during construction to attain a properly constructed project. Some contingency fund is thus recommended to accommodate these possible extra costs.

This report has been prepared for the proposed project as described earlier, to assist the engineer in the design of this project. In the event any changes in the design or location of the facilities are planned, or if any variations or undesirable conditions are encountered during construction, our conclusions and recommendations shall not be considered valid unless the changes or variations are reviewed and our recommendations modified or approved by us in writing.

This report is issued with the understanding that it is the designer's responsibility to ensure that the information and recommendations contained herein are incorporated into the project and that necessary steps are also taken to see that the recommendations are carried out in the field.

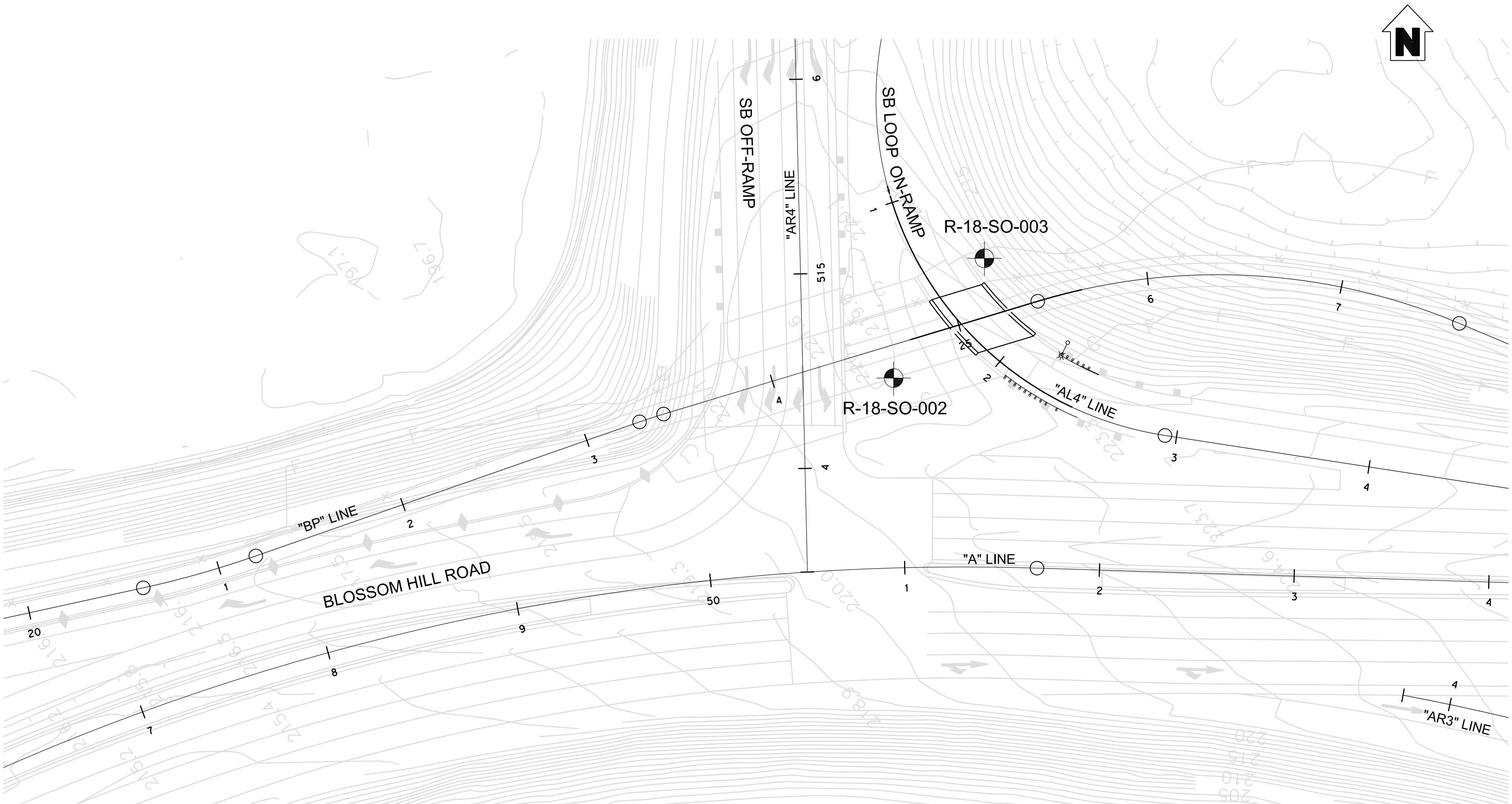
The findings in this report are valid as of the present date. However, changes in the subsurface conditions can occur with the passage of time, whether they are due to natural processes or to the works of man, on this or adjacent properties. In addition, changes in applicable or appropriate standards occur, whether they result from legislation or from the broadening of knowledge. Accordingly, the findings in this report might be invalidated, wholly or partially, by changes outside of our control.

Respectfully submitted,
PARIKH CONSULTANTS, INC.

Alston Lam, P.E., G.E. 2605
Project Engineer

Y. David Wang, Ph.D., P.E., 52911
Senior Engineer

T:\Ongoing Projects\2016\2016-146-LUC SB101 On-Ramp PUC\FR (Final) (Words)\SB101 On-Ramp PUC FR (10-2019).docx



BORING LOCATION MAP

LEGEND

R-18-SO-002

Approx. Boring Location (Drilled by PARIKH in 2018)

SCALE: 1 inch = 100 feet

Note: All units are in feet unless otherwise specified
Reference Map was provided by HMH Engineers.

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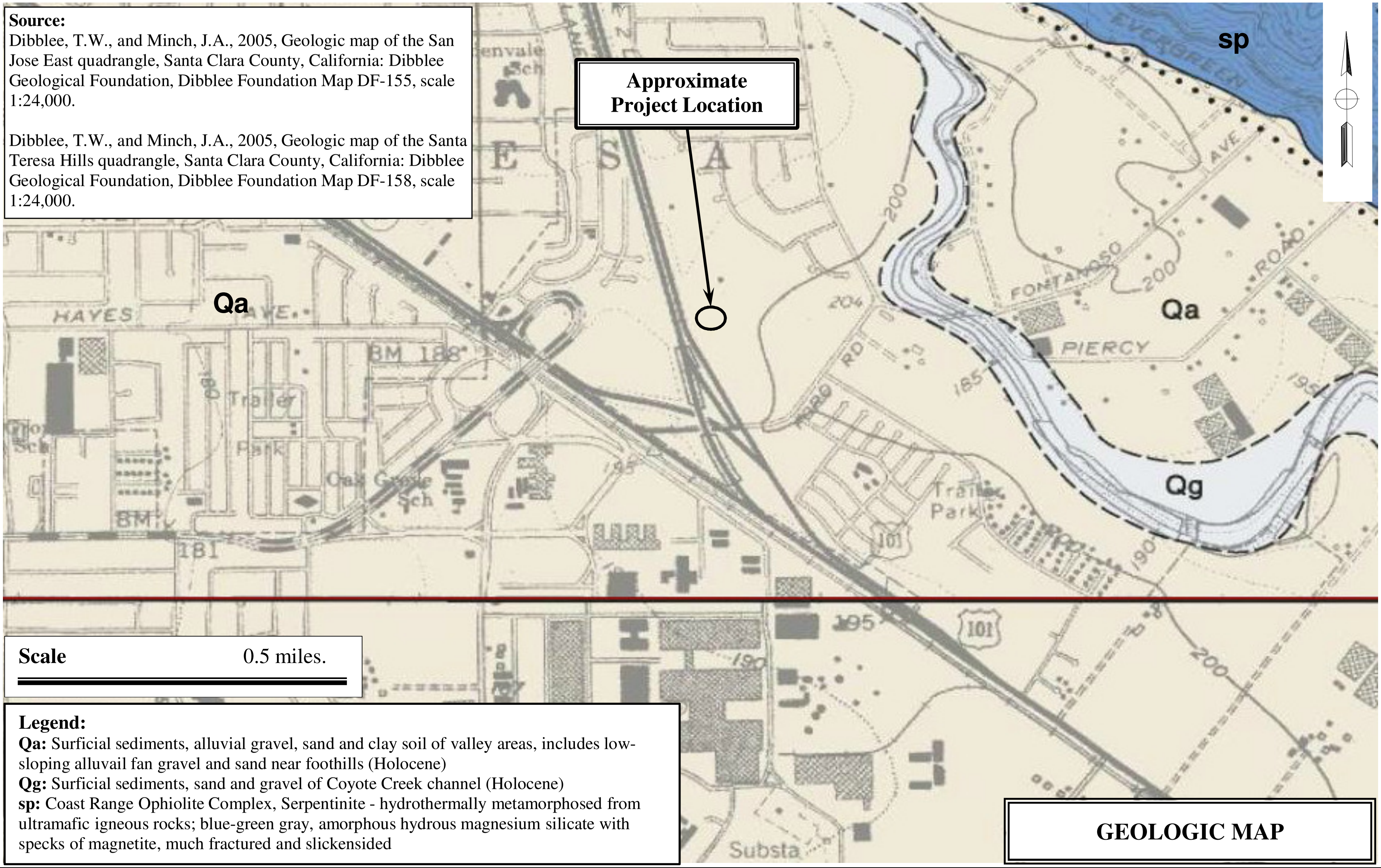
SB101 ON-RAMP PEDESTRIAN UC
SAN JOSE, CALIFORNIA

JOB NO.:2016-146-LUC

PLATE NO: 1

Source:
Dibblee, T.W., and Minch, J.A., 2005, Geologic map of the San Jose East quadrangle, Santa Clara County, California: Dibblee Geological Foundation, Dibblee Foundation Map DF-155, scale 1:24,000.

Dibblee, T.W., and Minch, J.A., 2005, Geologic map of the Santa Teresa Hills quadrangle, Santa Clara County, California: Dibblee Geological Foundation, Dibblee Foundation Map DF-158, scale 1:24,000.



Scale 0.5 miles.

Legend:
Qa: Surficial sediments, alluvial gravel, sand and clay soil of valley areas, includes low-sloping alluvail fan gravel and sand near foothills (Holocene)
Qg: Surficial sediments, sand and gravel of Coyote Creek channel (Holocene)
sp: Coast Range Ophiolite Complex, Serpentinite - hydrothermally metamorphosed from ultramafic igneous rocks; blue-green gray, amorphous hydrous magnesium silicate with specks of magnetite, much fractured and slickensided

GEOLOGIC MAP

PARIKH
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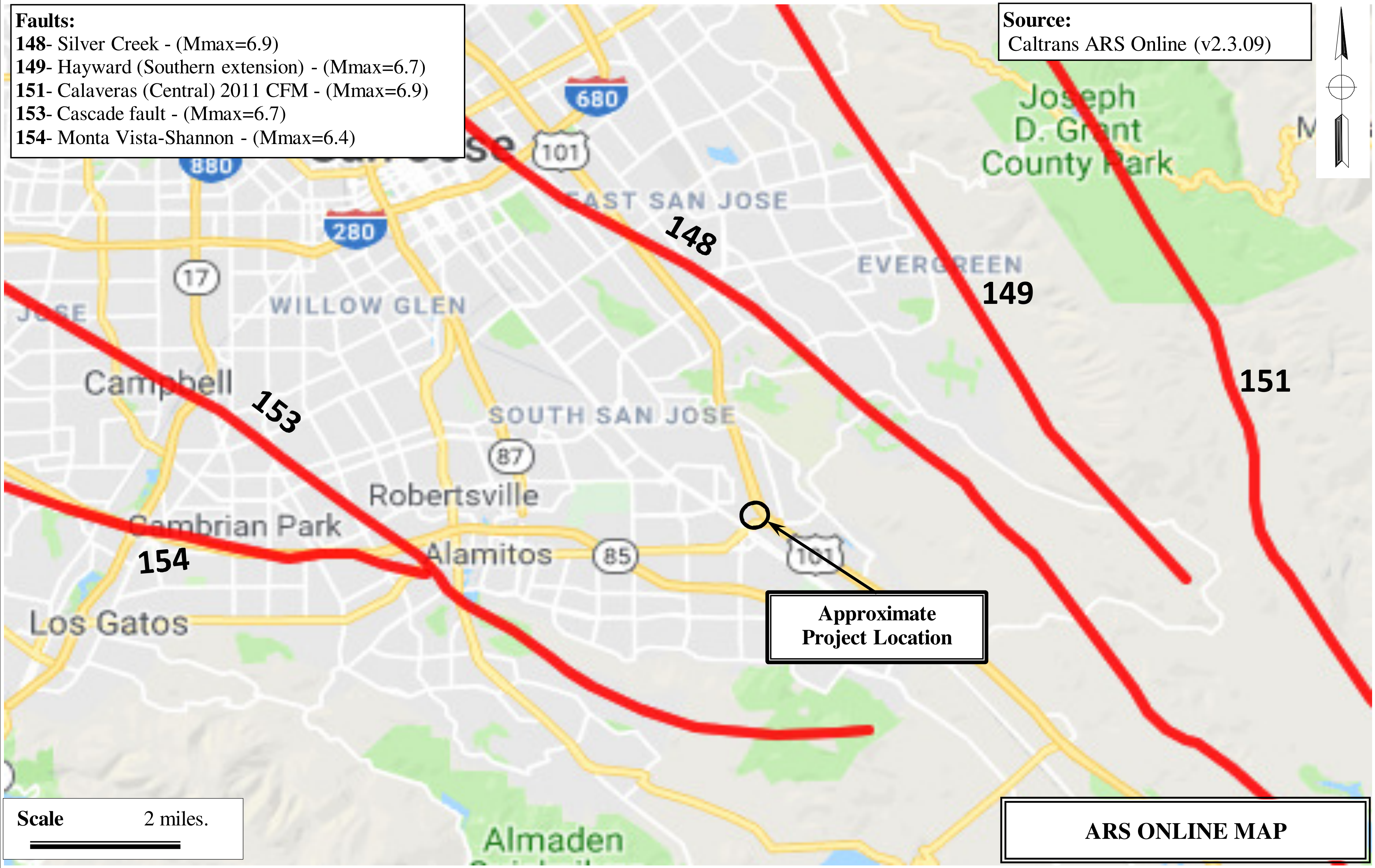
SOUTHBOUND 101 ON-RAMP PEDESTRIAN UNDERCROSSING
SAN JOSE, CALIFORNIA

JOB NO.: 2016-146-LUC	**PLATE NO.: 2**



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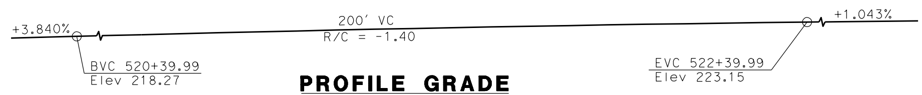
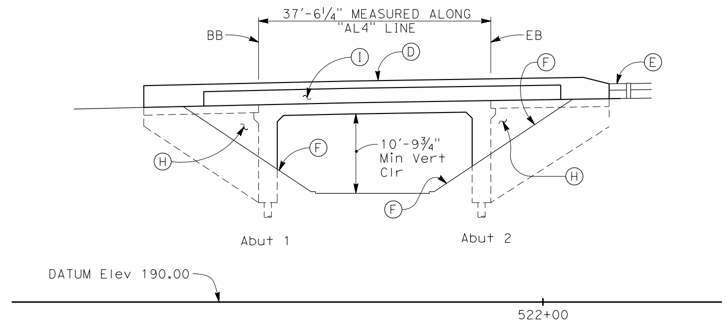
SOUTHBOUND 101 ON-RAMP PEDESTRIAN UNDERCROSSING
SAN JOSE, CALIFORNIA

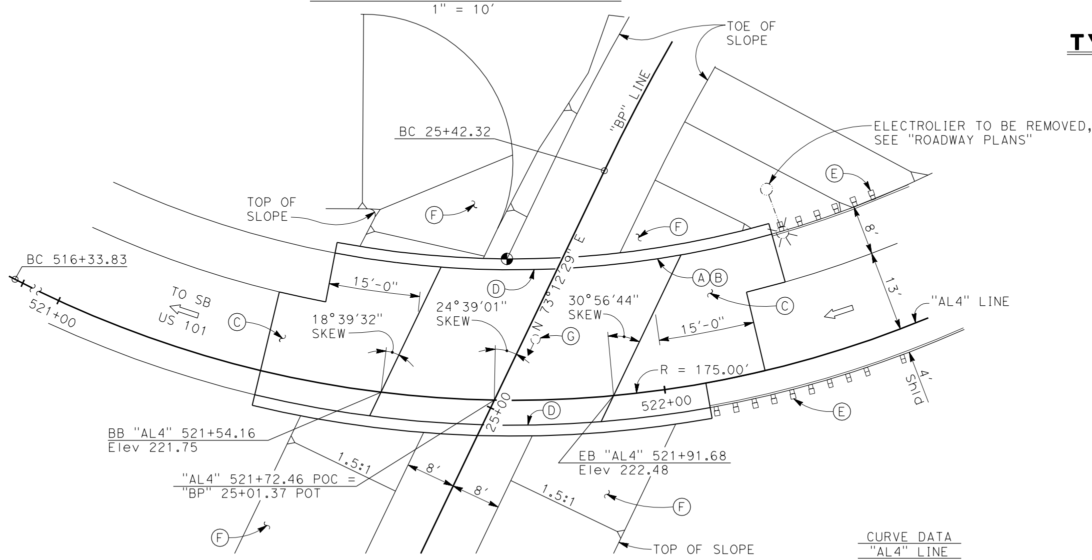
JOB NO.: 2016-146-LUC	PLATE NO.: 3



PROFILE GRADE
NO SCALE

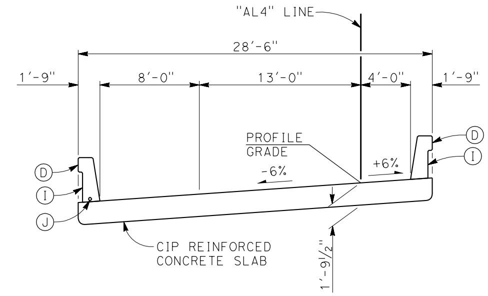


DEVELOPED ELEVATION
1" = 10′



CURVE DATA
"AL4" LINE
R = 175.00′
Δ = 216°08′53"
T = 536.24′
L = 660.19′

PLAN
1" = 10′



TYPICAL SECTION
1" = 5′

NOTES:
- (A) Paint "BRIDGE NO. 37-675K"
- (B) Paint "SB LOOP ON-RAMP PEDESTRIAN UC"
- (C) Structure Approach Type N
- (D) Concrete Barrier Type 842 (Mod)
- (E) Midwest Guardrail System, see "Roadway Plans"
- (F) Slope Paving with Architectural Treatment, see "Roadway Plans"
- (G) Soffit Lighting, see "Roadway Plans"
- (H) Architectural Treatment on Wingwall, see "Roadway Plans"
- (I) Architectural Treatment on Concrete Barriers, see "Roadway Plans"
- (J) 3" dia conduit, see "Roadway Plans"

1. For Index to Plans, Quantities, and General Notes, see "INDEX TO PLANS" sheet.
2. For Pile Data Table, see "FOUNDATION PLAN" sheet.
3. For Bench Mark and Datum, see "FOUNDATION PLAN" sheet.

LEGEND:
- Indicates Point of Minimum Vertical Clearance
- Indicates Traffic Direction

NOTE:
THE CONTRACTOR MUST VERIFY ALL CONTROLLING FIELD DIMENSIONS BEFORE ORDERING OR FABRICATING ANY MATERIAL

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	SCI	101	R28.4/R28.9		

REGISTERED STRUCTURAL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER MAHVASH M. HARMS No. 2639 Exp. 12/31/20 STRUCTURAL STATE OF CALIFORNIA

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SAN JOSE, CA 95113

BIGGS CARDOSA ASSOCIATES INC.
865 THE ALAMEDA
SAN JOSE, CALIFORNIA 95126

PLAN CHECK SET/NOT FOR CONSTRUCTION (9/11/19)

		BY	CHECKED
DESIGN OVERSIGHT	DESIGN	R. YAMANE	A. RICHARDSON
	DETAILS	R. YAMANE	A. RICHARDSON
SIGN OFF DATE	QUANTITIES	D. ROZPORKA	R. RIVAS

LOAD & RESISTANCE FACTOR DESIGN	LIVE LOADING: HL93 W/"LOW-BOY"; PERMIT DESIGN VEHICLE	
LAYOUT	BY G. KENNING	CHECKED A. RICHARDSON
SPECIFICATIONS	BY G. KENNING	PLANS AND SPECS COMPARED A. NOTARO

PREPARED FOR THE
STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

G. KENNING
PROJECT ENGINEER

BRIDGE NO. 37-675K
POST MILES R28.74

SB 101 ON-RAMP PEDESTRIAN UC
GENERAL PLAN

DESIGN GENERAL PLAN SHEET (ENGLISH) (REV. 7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0000
PROJECT NUMBER & PHASE: 04160002241
CONTRACT NO.: 04-1K2804

DISREGARD PRINTS BEARING EARLIER REVISION DATES → REVISION DATES 7/11/18 12/05/18 4/17/19

SHEET 1 OF 12

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

2016309 (2016309CS1)

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	SCI	101	R28.4/R28.9		

REGISTERED STRUCTURAL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER MAHVASH M. HARMS No. 2639 Exp. 12/31/20 STRUCTURAL STATE OF CALIFORNIA

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SAN JOSE, CA 95113

BIGGS CARDOSA ASSOCIATES INC.
865 THE ALAMEDA
SAN JOSE, CALIFORNIA 95126

BENCH MARK AND DATUM

MONUMENT	COORDINATES		ELEVATION	DESCRIPTION/LOCATION
	NORTHING	EASTING		
107	1,918,675.697	6,184,775.266	220.36	SET MAG NAIL & SHINER ± 70' EAST OF SILVER CREEK VALLEY Rd OVERPASS.
118	1,919,879.851	6,183,487.929	197.17	SET MAG NAIL & SHINER AT 101 SOUTHBOUND SHOULDER.

LEGEND:

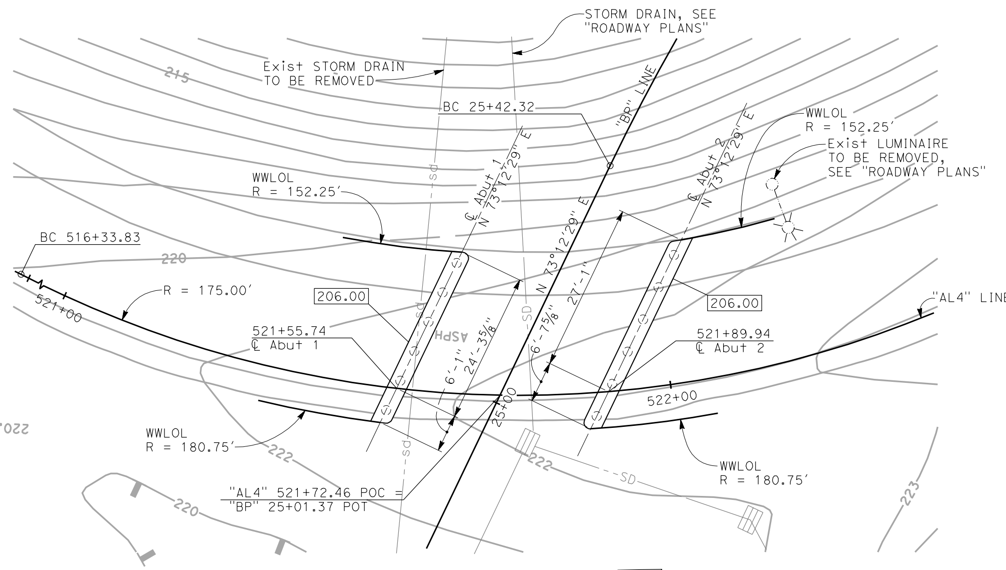
- Indicates Bottom of Abutment Diaphragm Elevation
- 29.6 Indicates Spot Elevation
- Indicates Pile, not all piles shown

PILE DATA TABLE

LOCATION	PILE TYPE	NOMINAL RESISTANCE		DESIGN TIP Elev (ft)	SPECIFIED TIP Elev (ft)	NOMINAL DRIVING RESISTANCE (kips)
		COMPRESSION	TENSION			
ABUTMENT 1	PP 18x0.625	260 kips	N/A	148.0(a); 186.0(c); 170.0(d)	148.0	460
ABUTMENT 2	PP 18x0.625	260 kips	N/A	162.5(a); 186.0(c); 170.0(d)	162.5	370

NOTES:
1. Design tip elevations for Abutments are controlled by: (a) Compression, (c) Settlement, (d) Lateral load.
2. The specified tip elevation must not be raised above the design tip for lateral load, and tolerable settlement.

NOTES:
1. Verify utility locations with "ROADWAY PLANS"
2. All WWLOL are concentric with "AL4" Line



FOUNDATION PLAN
1" = 10'

NOTE:
THE CONTRACTOR MUST VERIFY ALL CONTROLLING FIELD DIMENSIONS BEFORE ORDERING OR FABRICATING ANY MATERIAL

PLAN CHECK SET/NOT FOR CONSTRUCTION (8/29/19)

GEOTECHNICAL PROFESSIONAL APPROVAL DATE

DESIGN OVERSIGHT	SCALE: AS SHOWN	VERT.DATUM NAVD88	HORZ.DATUM CCS83 ZONE 3	DESIGN BY R. YAMANE	CHECKED A. RICHARDSON
SIGN OFF DATE	PHOTOGRAMMETRY AS OF: JULY 2016	ALIGNMENT TIES		DETAILS BY R. YAMANE	CHECKED A. RICHARDSON
	SURVEYED BY HMH	DRAFTED BY RADMAN AERIAL		QUANTITIES BY D. ROZPORKA	CHECKED R. RIVAS
	FIELD CHECKED BY RADMAN AERIAL	CHECKED BY RADMAN AERIAL			

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

G. KENNING
PROJECT ENGINEER

BRIDGE NO. 37-675K
POST MILES R28.74

SB 101 ON-RAMP PEDESTRIAN UC
FOUNDATION PLAN

FOUNDATION PLAN SHEET (ENGLISH) (REV. 7-16-10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0000
PROJECT NUMBER & PHASE: 04160002241 CONTRACT NO.: 04-1K2804

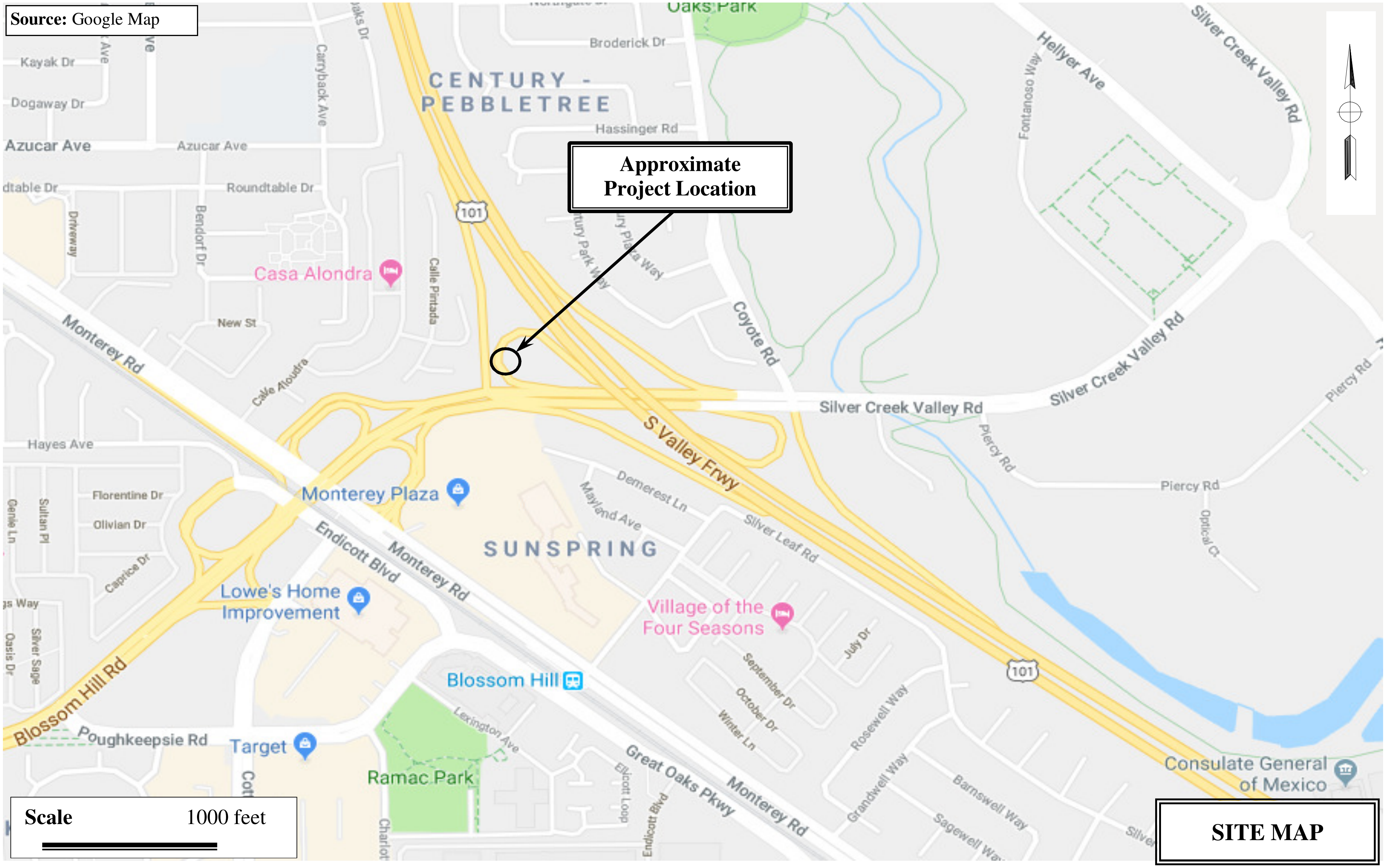
DISREGARD PRINTS BEARING EARLIER REVISION DATES → REVISION DATES 7/11/18 12/05/18 4/17/19

SHEET 4 OF 12

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME 2016309 (2016309CS4)

APPENDIX I



SOUTHBOUND 101 ON-RAMP PEDESTRIAN UNDERCROSSING
SAN JOSE, CALIFORNIA

JOB NO.: 2016-146-LUC	**APPENDIX I**

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APPENDIX II

APPENDIX II

FIELD EXPLORATION

All the test borings were drilled with a truck-mounted drill rig using 8-inch diameter hollow-stem auger and switched to rotary-wash drilling method with 3.3-inch diameter drilling bit. The soil samples were obtained from the borings during drilling at various depths by driving a 2.5 inches Inside Diameter (I. D.) Modified California Sampler or a 1.375 inches I.D. Standard Penetration Sampler (ASTM Test Method No. 1586). The sampler was driven into the subsurface soils under the impact of a 140 pounds hammer having a free fall of 30 inches. The blow counts required to drive the sampler for the last 12 inches are presented on the Logs of Test Borings, Appendix II. (When correlating standard penetration data in similar soils, the blow counts for the Modified California sampler can be converted to equivalent Standard Penetration Test sampler by multiplying a factor of 0.65). Pocket penetration tests were also performed on clay samples to evaluate their consistency. Upon completion of drilling, the boreholes were backfilled with cement grout.

The borings were drilled under the technical supervision of our engineers, who classified and continuously logged the soils encountered during drilling and supervised the collection of soil samples at various depths for visual examination and laboratory testing. The soil samples were visually classified in the field according to the Caltrans "Soil and Rock Logging, Classification and Presentation Manual" (2010 Edition) and then transported to our laboratory for further evaluation and testing.

The descriptions of the soils encountered and relevant boring information are presented on the Log of Test Borings attached in Appendix II. The laboratory test methods and results are presented in Appendix IV. The logs presented in Appendix II were prepared from the field logs which were edited after visual re-examination of the soil samples in the laboratory and results of classification tests on selected soil samples as indicated on the logs.

The descriptions and related information presented on these logs of test borings depict subsurface conditions only at the locations indicated on the plan and on the particular date noted on the logs. Because of the variability from place to place within soil/rock in general, subsurface conditions at other locations may differ from conditions occurring at the location explored. The abrupt stratum changes shown on the logs may be gradational and relatively minor changes in soil types within a stratum may not be noted on the logs due to field limitations. Also, the passage of time may result in a change in the soil conditions at these locations due to environmental changes.

NOTES:

Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2" Modified California Sampler: I.D. = 2.5"; O.D. = 3" Hammer Assembly: A 140 lb hammer with a 30" drop (Automatic Hammer)

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock, Logging, Classification, and Presentation Manual (2010)

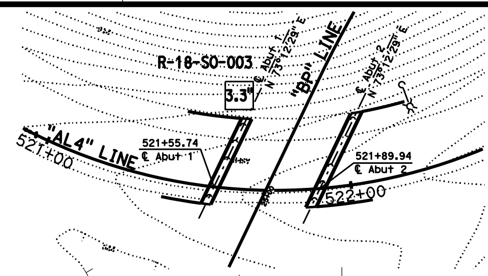
See Caltrans 2015 Standard Plans A10F, A10G and A10H for Soil and Rock Legend.

All dimensions are in feet unless otherwise shown

BENCH MARK:

NGS QQ453 (HS 2787)
Elev. 190.83
4.7 miles northwest along the southern Pacific Company Railroad from the station at Coyote.

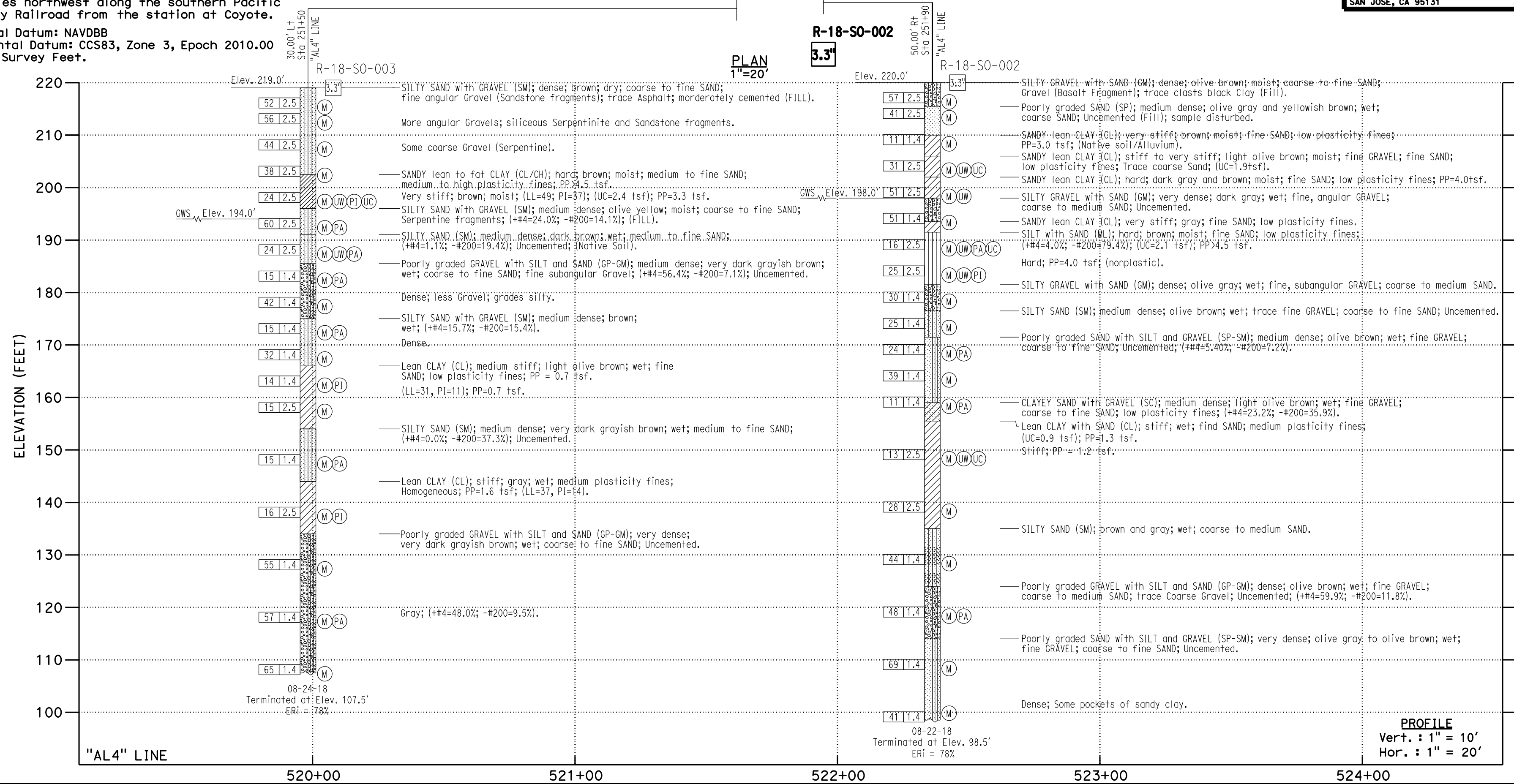
Vertical Datum: NAVDBB
Horizontal Datum: CCS83, Zone 3, Epoch 2010.00 in U.S Survey Feet.



PLAN
1"=20'

BOREHOLE LOCATION TABLE

Hole ID	Alignment Name	Station and Offset
R-18-SO-002	"AL4" Line	251+90 50' Rt.
R-18-SO-003	"AL4" Line	251+50 30' Lt.



PROFILE
Vert. : 1" = 10'
Hor. : 1" = 20'

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	SCI	101	R28.4/R28.9		

GEOTECHNICAL PROFESSIONAL DATE 10-15-19

REGISTERED PROFESSIONAL ENGINEER GARY PARIKH No. 666 Exp. 12/31/19 GEOTECHNICAL STATE OF CALIFORNIA

PLANS APPROVAL DATE

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CITY OF SAN JOSE DOT
200 E. SANTA CLARA St., 8th FLOOR
SAN JOSE, CA 95113

PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131

DESIGN OVERSIGHT
SIGN OFF DATE

DRAWN BY: KIM OUYANG
CHECKED BY: ALSTON LAM

L.S. BHANGOO
FIELD INVESTIGATION BY:
DATE: AUGUST 2018 TO SEPTEMBER 2018

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

ALSTON LAM
PROJECT ENGINEER

BRIDGE NO. 37-675K
POST MILES R28.74

SB101 ON-RAMP PEDESTRIAN UC
LOG OF TEST BORINGS 1 OF 1

GS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 03/14/12)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0000
PROJECT NUMBER & PHASE: 04160002241 CONTRACT NO.: 04-1K2804

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES 7-11-18 4-9-19 10-15-19

SHEET 12 OF 12

FILE => SB 101 on-ramp puc-ltb01.dgn

USERNAME => ogouthier DATE PLOTTED => 19-SEP-2019 TIME PLOTTED => 13:57

APPENDIX III

The appendix for
‘Field Exploration and Testing’
is not applicable to this report.

APPENDIX IV

APPENDIX IV
LABORATORY TESTS

Classification Tests

The field classification of the samples was visually verified in the laboratory according to the Unified Soil Classification System. The results are presented on "Log of Test Borings", Appendix II.

Moisture-Density

The natural moisture contents were determined for selected undisturbed samples of the soils in accordance with American Standard Test Method (ASTM) D-2216 and dry unit weights were calculated based on natural moisture contents and total unit weights. This information was used to classify and correlate the soils. The results are presented on Plate IV-1, "Laboratory Test Summary ", Appendix IV.

Atterberg Limits

The Atterberg Limits were determined for selected samples of the fine-grained materials. These results were used to classify the soils, as well as to obtain an indication of the expansion potential with variations in moisture content. The Atterberg Limits were determined in accordance with ASTM D-4318. The results of the test are presented on Plate IV-2, "Plasticity Chart", Appendix IV.

Grain Size Classification

Grain size classification tests (ASTM D-422) were performed on selected samples of granular soil to aid in the classification. The results are presented on Plates IV-3A and IV-3B, "Grain Size Distribution Curves", Appendix IV.

Unconfined Compression Tests

Strength tests were performed on selected undisturbed samples using unconfined compression machine. Unconfined compression tests were performed in accordance with ASTM D 2166. The results are presented on Plates IV-4A through IV-4D, "Unconfined Compression Test", Appendix IV.

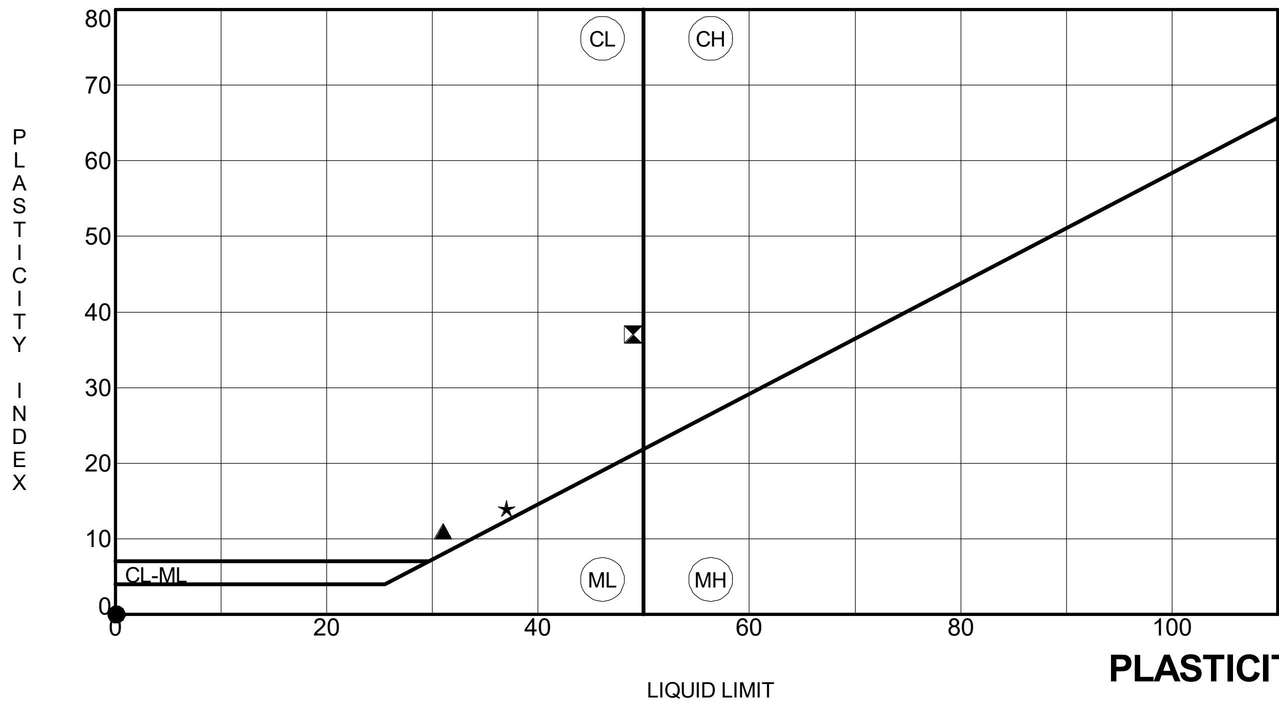
Corrosion Tests

Corrosion tests were performed on selected samples to determine the corrosion potential of the soils. The pH and minimum resistivity tests were performed according to California Test Method CT-643. Sulfate (California Test Method CT-417) and chloride (California Test Method CT-422) tests were performed by Sunland Analytical. The test results are presented on Plates IV-5A and IV-5B, Appendix IV.

LABORATORY TEST SUMMARY

Borehole	Sample Number	Depth	Classi-fication	Water Content	Dry Density	Liquid Limit	Plastic Limit	Plasticity Index	% > Sieve 4	% < Sieve 200	Unconfined Shear Strength (tsf)
R-18-SO-002	1	3.0	GM	14.2	-						
R-18-SO-002	2	6.0	SP	10.9	-						
R-18-SO-002	3	11.0	CL	21.9	-						
R-18-SO-002	4	16.0	CL	20.0	107.1						0.98
R-18-SO-002	5	21.0	CL	19.2	107.0						
R-18-SO-002	6	26.0	CL	12.1	-						
R-18-SO-002	7	31.0	ML	15.1	112.9				4.0	79.4	1.08
R-18-SO-002	8	36.0	ML	13.9	108.8	NP	NP	NP			
R-18-SO-002	9	41.0	GM	7.3	-						
R-18-SO-002	10	46.0	SM	9.9	-						
R-18-SO-002	11	51.0	SM	8.4	-				35.4	7.2	
R-18-SO-002	12	56.0	SM	8.0	-						
R-18-SO-002	13	61.0	SC	16.0	-				23.2	35.9	
R-18-SO-002	14	71.0	CL	28.1	95.5						0.48
R-18-SO-002	15	81.0	CL	28.6	-						
R-18-SO-002	16	91.0	SM	14.7	-						
R-18-SO-002	17	101.0	SM	6.3	-				59.9	11.8	
R-18-SO-002	18	111.0	SP-SM	8.1	-						
R-18-SO-002	19	121.0	SP-SM	14.8	-						
R-18-SO-003	1	3.0	SM	2.5	-						
R-18-SO-003	2	6.0	SM	26.8	-						
R-18-SO-003	3	11.0	SM	22.2	-						
R-18-SO-003	4	16.0	CL/CH	27.2	-						
R-18-SO-003	5	21.0	CL/CH	17.4	107.8	49	12	37			1.21
R-18-SO-003	6	26.0	SM	26.7	-				24.0	14.1	
R-18-SO-003	7	31.0	SP	19.2	105.7				1.1	19.4	
R-18-SO-003	8	36.0	SP-SM	6.4	-				56.4	7.1	
R-18-SO-003	9	41.0	SM	6.1	-						
R-18-SO-003	10	46.0	SM	16.7	-				15.7	15.4	
R-18-SO-003	11	51.0	SM	10.1	-						
R-18-SO-003	12	56.0	CL	23.9	-	31	20	11			
R-18-SO-003	13	61.0	CL	27.2	-						
R-18-SO-003	14	71.0	SM	23.6	-				0.0	37.3	
R-18-SO-003	15	81.0	CL	26.8	-	37	23	14			
R-18-SO-003	16	91.0	SP-SM	9.2	-						
R-18-SO-003	17	101.0	SP-SM	7.8	-				48.3	9.5	
R-18-SO-003	18	111.0	SP-SM	8.1	-						

ATTERBERG LIMITS



PLASTICITY

	BOREHOLE	SAMPLE #	DEPTH	LL	PL	PI	Fines	Classification
●	**R-18-SO-002**	**8**	**36.0**	**NP**	**NP**	**NP**		**SANDY SILT**
⧗	**R-18-SO-003**	**5**	**21.0**	**49**	**12**	**37**		**SANDY lean to fat CLAY**
▲	**R-18-SO-003**	**12**	**56.0**	**31**	**20**	**11**		**Lean CLAY**
★	**R-18-SO-003**	**15**	**81.0**	**37**	**23**	**14**		**Lean CLAY**

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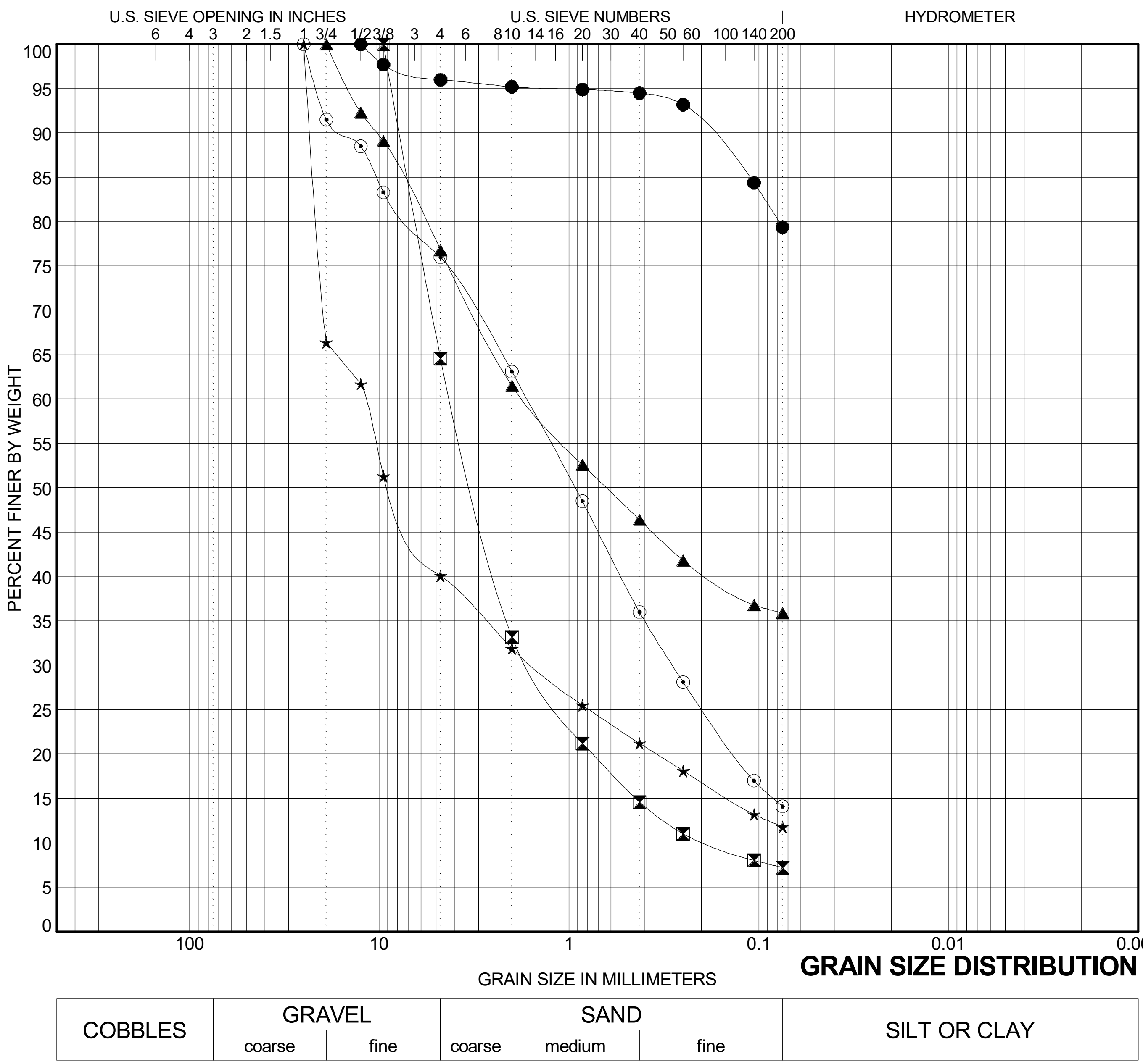
SOUTHBOUND 101 ON-RAMP PEDESTRIAN UNDERCROSSING
SAN JOSE, CALIFORNIA

JOB NO: 2016-146-LUC | **PLATE NO: IV-2**

Grain Size Distribution Curve



GRAIN SIZE DISTRIBUTION

	BORING	SAMPLE #	DEPTH	Classification	LL	PL	PI	Cc	Cu
●	**R-18-SO-002**	**7**	**31.0**	**SANDY SILT**					
⧗	**R-18-SO-002**	**11**	**51.0**	**SILTY SAND**				**3.22**	**22.28**
▲	**R-18-SO-002**	**13**	**61.0**	**CLAYEY SAND**					
★	**R-18-SO-002**	**17**	**101.0**	**SILTY SAND**				**4.19**	**248.62**
⊙	**R-18-SO-003**	**6**	**26.0**	**SILTY SAND with GRAVEL**					

	BORING	SAMPLE #	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**R-18-SO-002**	**7**	**31.0**	**12.5**				**4.0**	**16.6**	**79.4**	
⧗	**R-18-SO-002**	**11**	**51.0**	**9.5**	**4.185**	**1.592**	**0.188**	**35.4**	**57.4**	**7.2**	
▲	**R-18-SO-002**	**13**	**61.0**	**19**	**1.731**			**23.2**	**40.9**	**35.9**	
★	**R-18-SO-002**	**17**	**101.0**	**25**	**11.952**	**1.551**		**59.9**	**28.3**	**11.8**	
⊙	**R-18-SO-003**	**6**	**26.0**	**25**	**1.668**	**0.284**		**24.0**	**61.9**	**14.1**	

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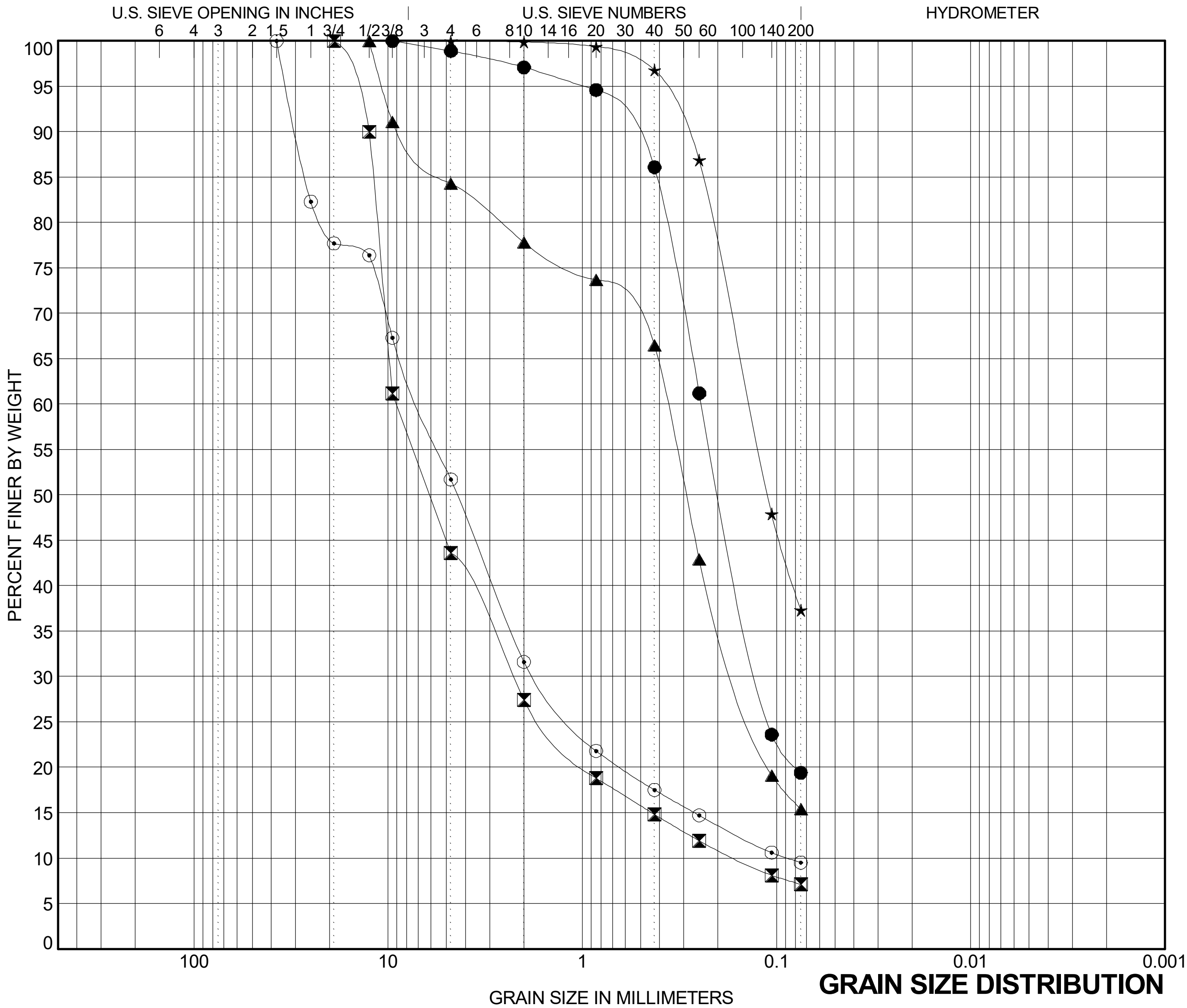
SOUTHBOUND 101 ON-RAMP PEDESTRIAN UNDERCROSSING

SAN JOSE, CALIFORNIA

JOB NO: 2016-146-LUC | **PLATE NO: IV-3A**



GRAIN SIZE DISTRIBUTION

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING	SAMPLE #	DEPTH	Classification	LL	PL	PI	Cc	Cu
●	**R-18-SO-003**	**7**	**31.0**	**Poorly graded SAND**					
⧗	**R-18-SO-003**	**8**	**36.0**	**Poorly graded SAND with SILT and GRAVEL**				**3.58**	**55.66**
▲	**R-18-SO-003**	**10**	**46.0**	**SILTY SAND with GRAVEL**					
★	**R-18-SO-003**	**14**	**71.0**	**SILTY SAND**					
⊙	**R-18-SO-003**	**17**	**101.0**	**Poorly graded SAND with SILT and GRAVEL**				**5.02**	**78.25**

	BORING	SAMPLE #	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**R-18-SO-003**	**7**	**31.0**	**9.5**	**0.243**	**0.123**		**1.1**	**79.5**	**19.4**	
⧗	**R-18-SO-003**	**8**	**36.0**	**19**	**9.061**	**2.298**	**0.163**	**56.4**	**36.5**	**7.1**	
▲	**R-18-SO-003**	**10**	**46.0**	**12.5**	**0.367**	**0.157**		**15.7**	**68.9**	**15.4**	
★	**R-18-SO-003**	**14**	**71.0**	**4.75**	**0.138**			**0.0**	**62.7**	**37.3**	
⊙	**R-18-SO-003**	**17**	**101.0**	**37.5**	**6.868**	**1.739**	**0.088**	**48.3**	**42.2**	**9.5**	

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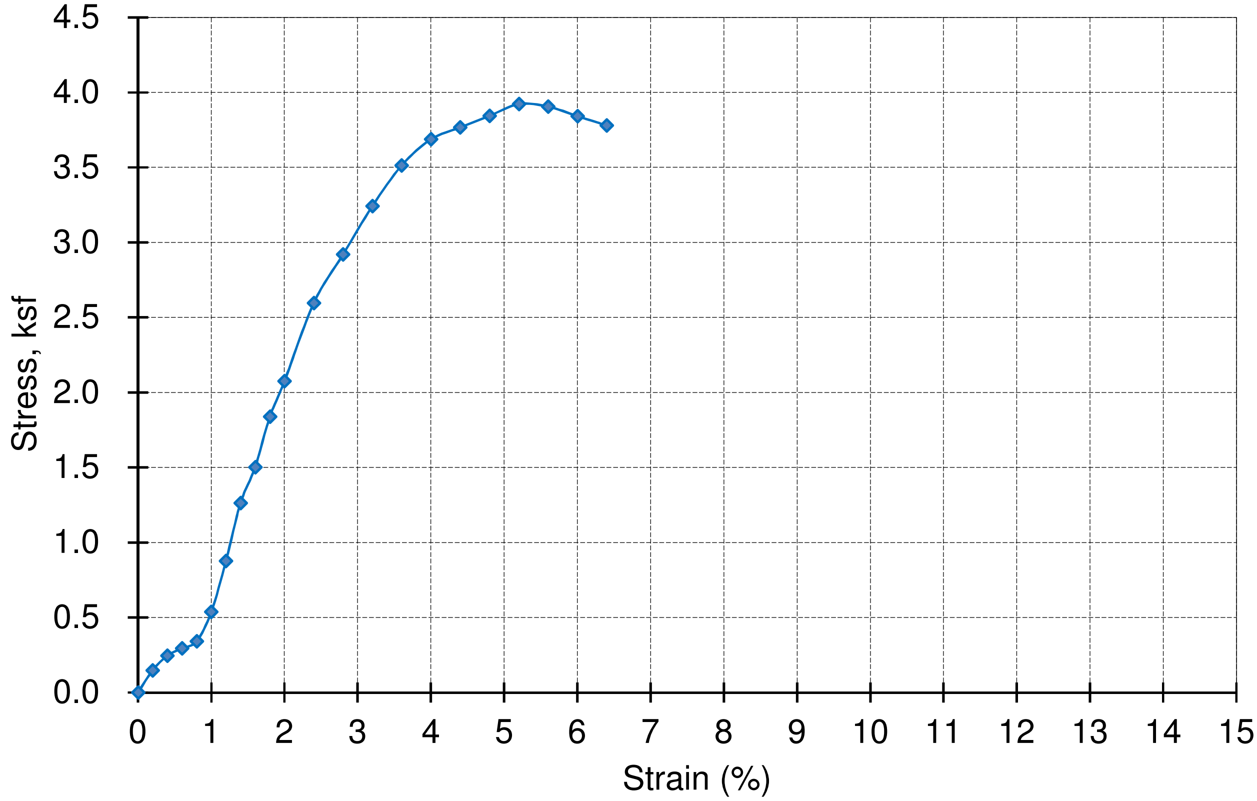
SOUTHBOUND 101 ON-RAMP PEDESTRIAN UNDERCROSSING
SAN JOSE, CALIFORNIA

JOB NO: 2016-146-LUC | **PLATE NO: IV-3B**

UNCONFINED COMPRESSION TEST

UNCONFINED COMPRESSION TEST



Boring No.:	R-18-SO-002	**Unconfined Compressive Strength (ksf):**	3.92
Sample No. :	4	**Shear Strength (ksf)**	1.96
Depth (feet):	16'	**Strain @ Failure (%):**	5.2
Sample Type:	MC - 2.416 inch dia.	**Initial Dry Density (pcf):**	107
Test Method	ASTM D2166	**Water Content (%):**	20.0
Material Type:	CL		
Material Description:	Sandy Lean Clay		

Initial Height (inch):	5.00
Initial Diameter (inch)	2.42
Initial Area (ft^2):	0.032
Strain Rate (inch/min)	0.1

Remarks:

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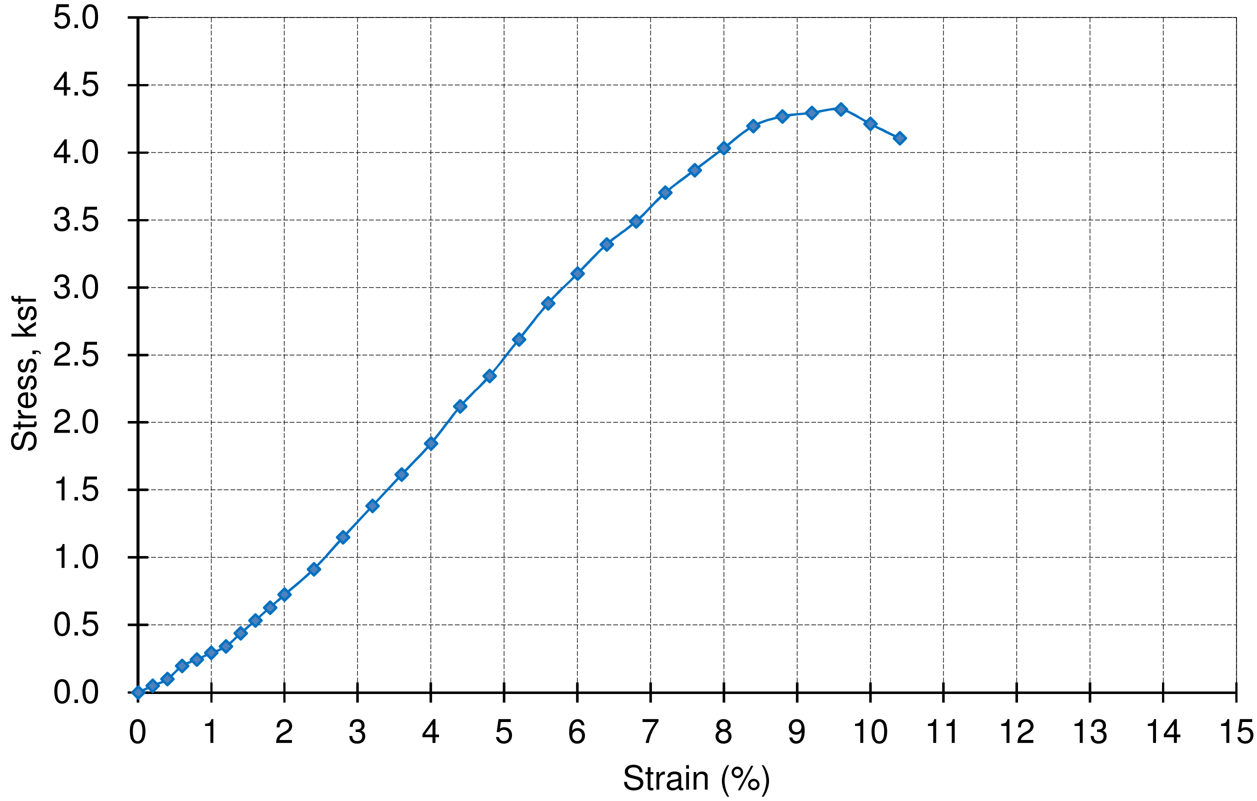
SOUTHBOUND 101 ON-RAMP PEDESTRIAN UNDERCROSSING
SAN JOSE, CALIFORNIA

JOB NO.: 2016-146-LUC	PLATE NO.: IV-4A

UNCONFINED COMPRESSION TEST



Boring No.:	R-18-SO-002	**Unconfined Compressive Strength (ksf):**	4.32
Sample No. :	7	**Shear Strength (ksf)**	2.16
Depth (feet):	31'	**Strain @ Failure (%):**	9.6
Sample Type:	MC - 2.416 inch dia.	**Initial Dry Density (pcf):**	113
Test Method	ASTM D2166	**Water Content (%):**	15.1
Material Type:	ML		
Material Description:	Silt with Sand		

Initial Height (inch): 5.00
Initial Diameter (inch) 2.42
Initial Area (ft^2): 0.032
Strain Rate (inch/min) 0.1

Remarks:

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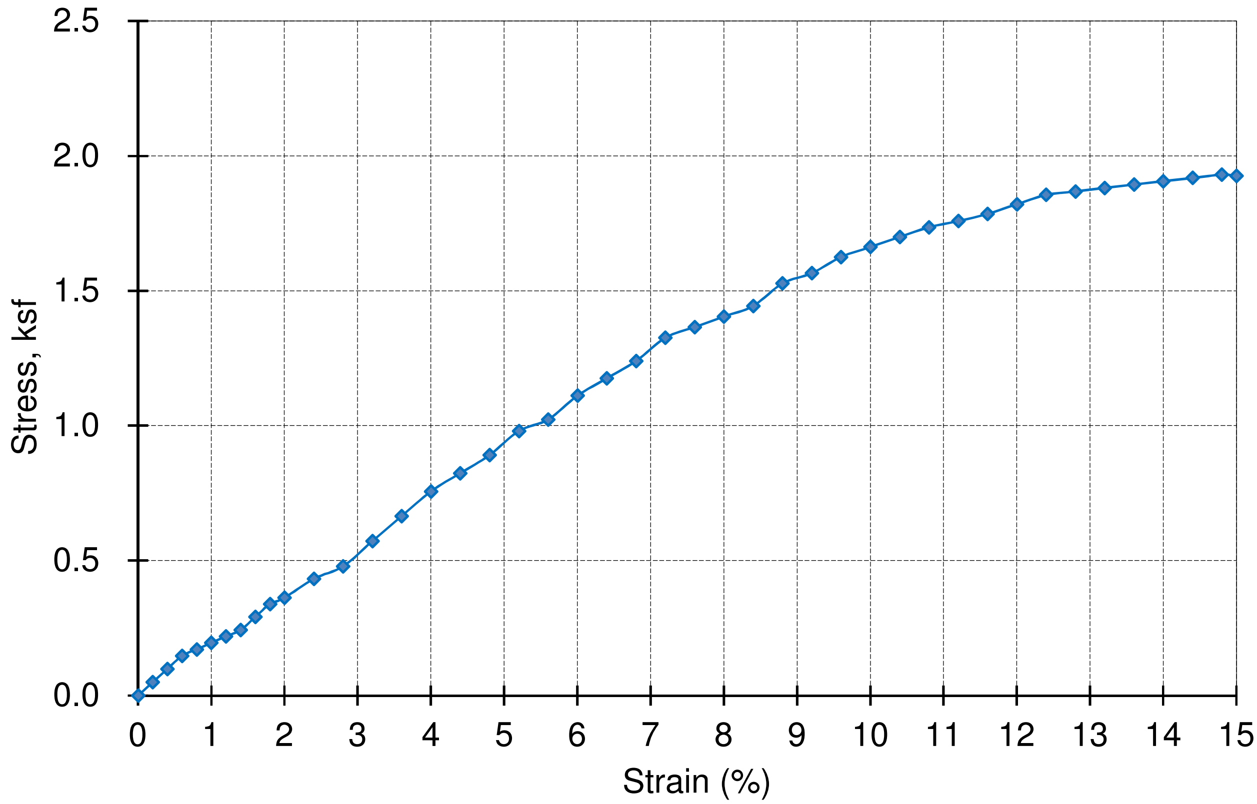
SOUTHBOUND 101 ON-RAMP PEDESTRIAN UNDERCROSSING SAN JOSE, CALIFORNIA	
JOB NO.: 2016-146-LUC	PLATE NO.: IV-4B

UNCONFINED COMPRESSION TEST



Boring No.:	R-18-SO-002	**Unconfined Compressive Strength (ksf):**	1.93
Sample No. :	14	**Shear Strength (ksf)**	0.97
Depth (feet):	71'	**Strain @ Failure (%):**	14.8
Sample Type:	MC - 2.416 inch dia.	**Initial Dry Density (pcf):**	96
Test Method	ASTM D2166	**Water Content (%):**	28.1
Material Type:	CL		
Material Description:	Lean Clay with Sand		

Initial Height (inch):	5.00
Initial Diameter (inch)	2.42
Initial Area (ft^2):	0.032
Strain Rate (inch/min)	0.1

Remarks:

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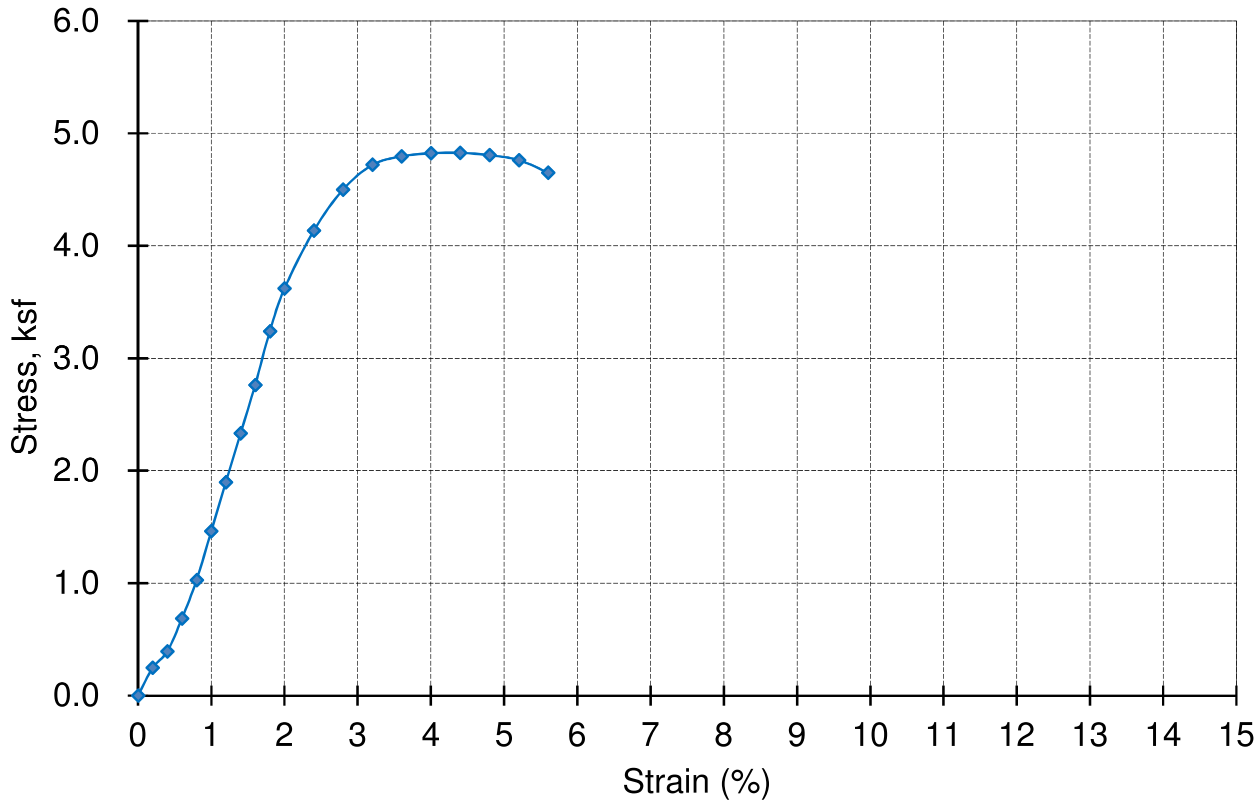
SOUTHBOUND 101 ON-RAMP PEDESTRIAN UNDERCROSSING
SAN JOSE, CALIFORNIA

JOB NO.: 2016-146-LUC | PLATE NO.: IV-4C

UNCONFINED COMPRESSION TEST



Boring No.:	R-18-SO-003	**Unconfined Compressive Strength (ksf):**	4.83
Sample No. :	5	**Shear Strength (ksf)**	2.41
Depth (feet):	21	**Strain @ Failure (%):**	4.4
Sample Type:	MC - 2.416 inch dia.	**Initial Dry Density (pcf):**	108
Test Method	ASTM D2166	**Water Content (%):**	17.4
Material Type:	CL/CH		
Material Description:	Sandy Lean to Fat Clay		

Initial Height (inch): 5.00
Initial Diameter (inch) 2.42
Initial Area (ft^2): 0.032
Strain Rate (inch/min) 0.1

Remarks:

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SOUTHBOUND 101 ON-RAMP PEDESTRIAN UNDERCROSSING
SAN JOSE, CALIFORNIA

JOB NO.: 2016-146-LUC	PLATE NO.: IV-4D

CORROSION TEST

Sunland Analytical
11419 Sunrise Gold Circle, #10
Rancho Cordova, CA 95742
(916) 852-8557

Date Reported 09/19/2018
Date Submitted 09/13/2018

To: Nasir Ahmad
Parikh Consultants, Inc.
2360 Qume Dr. Suite A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 2016-146-LUC Site ID : R18-50-002 5@21.
Thank you for your business.

* For future reference to this analysis please use SUN # 78032-163159.

EVALUATION FOR SOIL CORROSION

Soil pH	7.97		
Minimum Resistivity	1.26 ohm-cm (x1000)		
Chloride	16.4 ppm	00.00164	%
Sulfate	40.0 ppm	00.00400	%

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

Sunland Analytical
11419 Sunrise Gold Circle, #10
Rancho Cordova, CA 95742
(916) 852-8557

Date Reported 09/19/2018
Date Submitted 09/13/2018

To: Nasir Ahmad
Parikh Consultants, Inc.
2360 Qume Dr. Suite A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 2016-146-LUC Site ID : R1850003 5.
Thank you for your business.

* For future reference to this analysis please use SUN # 78032-163158.

EVALUATION FOR SOIL CORROSION

Soil pH	7.71	
Minimum Resistivity	1.34 ohm-cm (x1000)	
Chloride	8.7 ppm	00.00087 %
Sulfate	34.5 ppm	00.00345 %

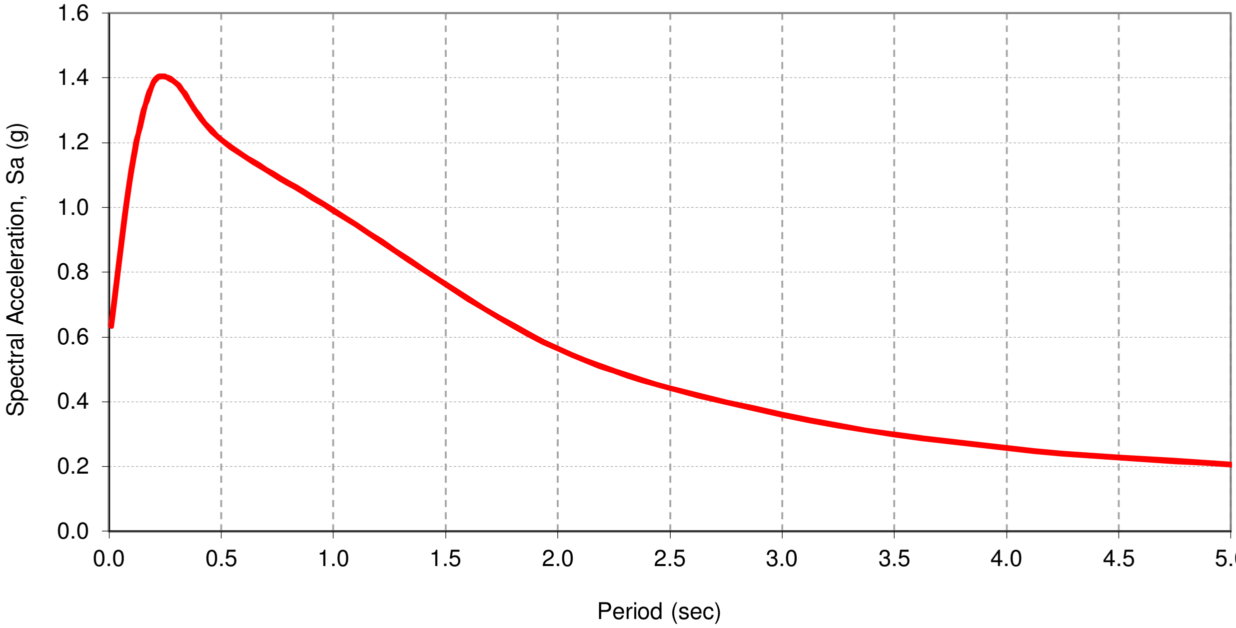
METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

PLATE NO.: IV-5B

APPENDIX V

RECOMMENDED ACCELERATION RESPONSE SPECTRUM

(5% Damping)



Site Information

Latitude:	37.2579
Longitude	-121.7990
V_{S30} (m/s) =	240
$Z_{1.0}$ (m) =	N/A
$Z_{2.5}$ (km) =	N/A
Near Fault Factor, Derived from USGS Unified Hazard Tool. Dist (km) =	10.64

Governing Curve:

Caltrans Online Probabilistic ARS

Recommended Response Spectrum				
Period (sec)	Caltrans Online Probabilistic Spectral Acceleration (g)	Adjusted for Near Fault Effect	Adjusted For Basin Effect	Final Adjusted Spectral Acceleration (g)
0.0	0.634	1	1	0.634
0.1	1.119	1	1	1.119
0.2	1.388	1	1	1.388
0.3	1.383	1	1	1.383
0.5	1.21	1	1	1.210
1.0	0.826	1.2	1	0.991
2.0	0.47	1.2	1	0.564
3.0	0.3	1.2	1	0.360
4.0	0.214	1.2	1	0.257
5.0	0.171	1.2	1	0.205

Source:

1. Caltrans ARS Online tool (V.2.3.09, http://dap3.dot.ca.gov/ARS_Online/)

2. Caltrans Methodology for Developing Design Response Spectrum for Use in Seismic Design Recommendations, November 2012

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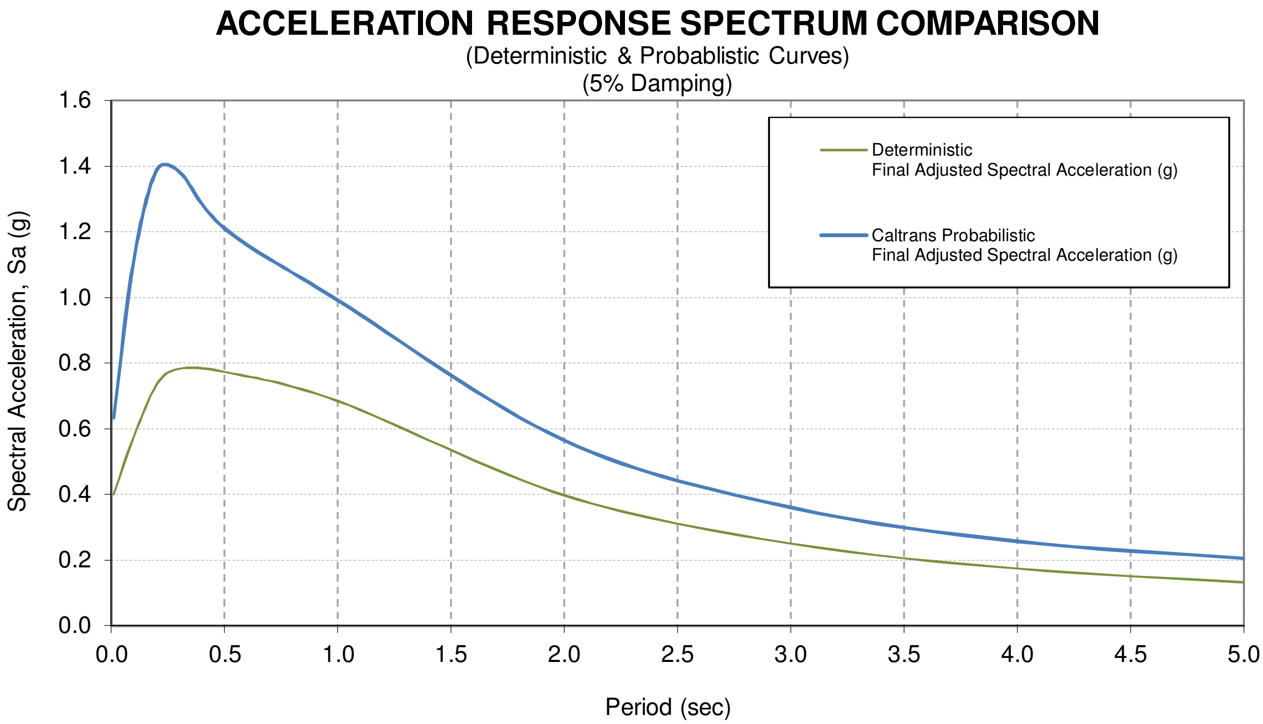
SOUTHBOUND 101 ON-RAMP PEDESTRIAN UNDERCROSSING
SAN JOSE, CALIFORNIA

Project No.: 2016-146-LUC	**APPENDIX V-1**



Period (sec)	Deterministic Final Adjusted Spectral Acceleration (g)	Caltrans Probabilistic Final Adjusted Spectral Acceleration (g)
0.0	0.400	0.634
0.1	0.578	1.119
0.2	0.734	1.388
0.3	0.783	1.383
0.5	0.773	1.210
1.0	0.684	0.991
2.0	0.397	0.564
3.0	0.250	0.360
4.0	0.174	0.257
5.0	0.132	0.205

Site Information

Latitude:	37.2579
Longitude	-121.7990
V_{S30} (m/s) =	240
$Z_{1.0}$ (m) =	N/A
$Z_{2.5}$ (km) =	N/A
Near Fault Factor, Derived from USGS Unified Hazard Tool. Dist (km) =	10.64

Source:

1. Caltrans ARS Online tool (V.2.3.09, http://dap3.dot.ca.gov/ARS_Online/)

2. USGS Unified Hazard Tool (https://earthquake.usgs.gov/hazards/interactive/)

3. Caltrans Methodology for Developing Design Response Spectrum for Use in Seismic Design Recommendations, November 2012

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SOUTHBOUND 101 ON-RAMP PEDESTRIAN UNDERCROSSING
SAN JOSE, CALIFORNIA

Project No.: 2016-146-LUC | **APPENDIX V-2**

APPENDIX VI

LIQUEFACTION ANALYSES

LIQUEFACTION POTENTIAL ANALYSIS (SPT procedures per Youd et al, 2001)

PROJECT NAME ***SOUTHBOUND 101 ON-RAMP PEDESTRIAN UNDERCROSSING***
PROJECT NO. ***2016-146-LUC***
BORING NO. ***R-18-SO-002***

SOIL GROUPS
1. GRAVELS, SANDS AND NONPLASTIC SILTS
2. CLAYS AND PLASTIC SILTS

FAULT INFO
Silver Creek Fault
a_{max} (g)= 0.63
FAULT M_w = 6.9

GW DEPTH (ft)= 22

BOREHOLE DIA (in)= 3.3
HAMMER ENERGY = 78%

CUT(-)/FILL(+) (ft) = 0
DESIGN GW DEPTH (ft)= 22 *(below OG)*

MSF = 1.24

SOIL STRATA							LIQUEFACTION RESISTANCE ($CRR_{7.5}$)													CYCLIC STRESS RATIO (CSR)				F.S.=($CRR_{7.5}$/CSR)*MSF*Ks*Ka			POST-LIQ. SETTLEMENT	
Layer Thickness from	to	Sample No	Depth (ft)	Soil Type	Blow Count	Sampler Type	SPT-$N_{eq.}$	C_E	C_R	C_S	C_B	N_{60}	σ_v' (psf)	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60,CS}$	$CRR_{7.5}$	σ_v (psf)	σ_v' (psf)	r_d	CSR	Ks	Ka	F.S.	Vol. Strain (%)	ΔD (in)
0	4.5	1	3	1	57	MC	37.1	1.3	0.75	1.0	1.00	36.1	345.0	1.7	61.4	15%	66.9		345.0	345.0	1.0	0.4	1.0	1.0			
4.5	10.0	2	6	1	41	MC	26.7	1.3	0.80	1.0	1.00	27.7	697.5	1.7	46.9	5%	47.0		697.5	697.5	1.0	0.4	1.0	1.0			
10.0	14.0	3	11	2	11	SPT	11.0	1.3	0.85	1.2	1.00	14.6	1297.5	1.2	18.1												
14.0	18.0	4	16	2	31	MC	20.2	1.3	0.95	1.0	1.00	24.9	1897.5	1.0	25.5												
18.0	22.0	5	21	2	51	MC	33.2	1.3	0.95	1.0	1.00	40.9	2497.5	0.9	36.6												
22.0	26.5	6	26	1	51	SPT	51.0	1.3	1.00	1.2	1.00	79.6	2847.9	0.8	66.7	15%	72.4		3097.5	2847.9	0.9	0.4	0.9	1.0	NON-LIQ.		
26.5	33.0	7	31	2	16	MC	10.4	1.3	1.00	1.0	1.00	13.5	3135.9	0.8	10.8	79%											
33.0	38.5	8	36	2	25	MC	16.3	1.3	1.00	1.0	1.00	21.1	3423.9	0.8	16.1												
38.5	43.5	9	41	1	30	SPT	30.0	1.3	1.00	1.2	1.00	46.8	3711.9	0.7	34.4	15%	38.5		4897.50	3711.9	0.8	0.5	0.8	1.0	NON-LIQ.		
43.5	48.5	10	46	1	25	SPT	25.0	1.3	1.00	1.2	1.00	39.0	3999.9	0.7	27.6	15%	31.4		5497.50	3999.9	0.8	0.4	0.8	1.0	NON-LIQ.		
48.5	53.0	11	51	1	24	SPT	24.0	1.3	1.00	1.2	1.00	37.4	4287.9	0.7	25.6	7%	26.0	0.3	6097.50	4287.9	0.7	0.4	0.8	1.0	NON-LIQ.		
53.0	61.0	12	56	1	39	SPT	39.0	1.3	1.00	1.2	1.00	60.8	4575.9	0.7	40.2	10%	42.0		6697.50	4575.9	0.7	0.4	0.7	1.0	NON-LIQ.		
61.0	64.5	13	61	1	11	SPT	11.0	1.3	1.00	1.2	1.00	17.2	4863.9	0.6	11.0	36%	18.2	0.2	7297.50	4863.9	0.7	0.4	0.8	1.0	(0.48)	1.50%	0.63
64.5	76.0	14	71	2	13	MC	8.5	1.3	1.00	1.0	1.00	11.0	5439.9	0.6	6.7												
76.0	85.0	15	81	2	28	MC	18.2	1.3	1.00	1.0	1.00	23.7	6015.9	0.6	13.6												
85.0	96.0	16	91	1	44	SPT	44.0	1.3	1.00	1.2	1.00	68.6	6591.9	0.6	37.8	15%	42.1		10897.50	6591.9	0.5	0.3	0.6	1.0	NON-LIQ.		
96.0	106.0	17	101	1	48	SPT	48.0	1.3	1.00	1.2	1.00	74.9	7167.9	0.5	39.6	12%	42.2		12097.50	7167.9	0.5	0.3	0.6	1.0	NON-LIQ.		
106.0	116.0	18	111	1	69	SPT	69.0	1.3	1.00	1.2	1.00	107.6	7743.9	0.5	54.7	10%	56.8		13297.50	7743.9	0.5	0.3	0.6	1.0	NON-LIQ.		
116.0	121.5	19	121	1	41	SPT	41.0	1.3	1.00	1.2	1.00	64.0	8319.9	0.5	31.4	10%	32.9		14497.50	8319.9	0.5	0.3	0.6	1.0	NON-LIQ.		

Fines Content based on visual inspection
Fines Content based on lab results

Notes:
1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner) are per Youd et al. (2001).
2. For correction of overburden, $C_N = (1/\sigma_v')^{0.5}$ with a maximum value of 1.7.
3. The influence of Fines Contents are expressed by the following correction: $(N_1)_{60cs} = a + b\,(N_1)_{60}$
where a and b = coefficients determined from the following relationships
for FC ≤ 5% a = 0, b = 1.0
for 5% < FC < 35% a = exp(1.76-(190/FC^2)), b = (0.99+($FC^{1.5}$/1000))
for FC ≥ 35% a = 5.0, b = 1.2
4. For $(N_1)_{60,cs}$ greater than 30, clean granular soils are too dense to liquefy and are classed as non-liquefiable.

Reference:
Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER Workshops on Evaluation of Liquefaction Resistance of Soils, Youd, et al., ASCE Journal of Geotechnical and Geoenvironmental Engineering, October 2001, Vol. 127 No. 10

LIQUEFACTION POTENTIAL ANALYSIS (SPT procedures per Youd et al, 2001)

PROJECT NAME	***SOUTHBOUND 101 ON-RAMP PEDESTRIAN UNDERCROSSING***	*SOIL GROUPS*	*FAULT INFO*
PROJECT NO.	***2016-146-LUC***	1. GRAVELS, SANDS AND NONPLASTIC SILTS	*Silver Creek Fault*
BORING NO.	***R-18-SO-003***	2. CLAYS AND PLASTIC SILTS	*a_{max} (g)=* 0.63
			FAULT M_w = 6.9

GW DEPTH (ft)= 25	*BOREHOLE DIA (in)=* 3.3	*CUT(-)/FILL(+) (ft) =* 0	*MSF =* 1.24
	HAMMER ENERGY = 78%	*DESIGN GW DEPTH (ft)=* 25 *(below OG)*	

SOIL STRATA							*LIQUEFACTION RESISTANCE ($CRR_{7.5}$)*												*CYCLIC STRESS RATIO (CSR)*				*F.S.=($CRR_{7.5}$/CSR)*MSF*Ks*Ka*			*POST-LIQ. SETTLEMENT*	
Layer Thickness from	to	Sample No	Depth (ft)	Soil Type	Blow Count	Sampler Type	SPT-$N_{eq.}$	C_E	C_R	C_S	C_B	N_{60}	σ_v' (psf)	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60,CS}$	$CRR_{7.5}$	σ_v (psf)	σ_v' (psf)	r_d	CSR	Ks	Ka	F.S.	Vol. Strain (%)	ΔD (in)
0	4.0	1	3	1	52	MC	33.8	1.3	0.75	1.0	1.00	33.0	345.0	1.7	56.0	15%	61.2		345.0	345.0	1.0	0.4	1.0	1.0			
4.0	8.0	2	6	1	56	MC	36.4	1.3	0.80	1.0	1.00	37.9	700.0	1.7	64.0	15%	69.6		700.0	700.0	1.0	0.4	1.0	1.0			
8.0	13.0	3	11	1	44	MC	28.6	1.3	0.85	1.0	1.00	31.6	1300.0	1.2	39.2	15%	43.6		1300.0	1300.0	1.0	0.4	1.0	1.0			
13.0	16.5	4	16	1	38	MC	24.7	1.3	0.95	1.0	1.00	30.5	1900.0	1.0	31.3	15%	35.3		1900.0	1900.0	1.0	0.4	1.0	1.0			
16.5	23.0	5	21	2	24	MC	15.6	1.3	0.95	1.0	1.00	19.3	2500.0	0.9	17.2												
23.0	28.0	6	26	1	60	MC	39.0	1.3	1.00	1.0	1.00	50.7	3037.6	0.8	41.1	14%	45.1		3100.0	3037.6	0.9	0.4	0.8	1.0	NON-LIQ.		
28.0	33.5	7	31	1	24	MC	15.6	1.3	1.00	1.0	1.00	20.3	3325.6	0.8	15.7	19%	20.4	0.2	3700.0	3325.6	0.9	0.4	0.8	1.0	(0.56)	1.38%	0.91
33.5	38.5	8	36	1	15	SPT	15.0	1.3	1.00	1.2	1.00	23.4	3613.6	0.7	17.4	7%	17.7	0.2	4300.0	3613.6	0.9	0.4	0.8	1.0	(0.45)	1.53%	0.92
38.5	44.0	9	41	1	42	SPT	42.0	1.3	1.00	1.2	1.00	65.5	3901.6	0.7	46.9	10%	48.8		4900.00	3901.6	0.8	0.4	0.8	1.0	NON-LIQ.		
44.0	48.0	10	46	1	15	SPT	15.0	1.3	1.00	1.2	1.00	23.4	4189.6	0.7	16.2	15%	19.6	0.2	5500.00	4189.6	0.8	0.4	0.8	1.0	(0.49)	1.42%	0.68
48.0	53.0	11	51	1	32	SPT	32.0	1.3	1.00	1.2	1.00	49.9	4477.6	0.7	33.4	15%	37.5		6100.00	4477.6	0.7	0.4	0.7	1.0	NON-LIQ.		
53.0	58.0	12	56	2	14	SPT	14.0	1.3	1.00	1.2	1.00	21.8	4765.6	0.6	14.1												
58.0	65.0	13	61	2	15	MC	9.8	1.3	1.00	1.0	1.00	12.7	5053.6	0.6	8.0												
65.0	75.0	14	71	1	15	SPT	15.0	1.3	1.00	1.2	1.00	23.4	5629.6	0.6	13.9	37%	21.7	0.2	8500.00	5629.6	0.6	0.4	0.7	1.0	(0.61)	1.32%	1.58
75.0	85.0	15	81	2	16	MC	10.4	1.3	1.00	1.0	1.00	13.5	6205.6	0.6	7.7												
85.0	95.0	16	91	1	55	SPT	55.0	1.3	1.00	1.2	1.00	85.8	6781.6	0.5	46.6	10%	48.5		10900.00	6781.6	0.5	0.3	0.6	1.0	NON-LIQ.		
95.0	105.0	17	101	1	57	SPT	57.0	1.3	1.00	1.2	1.00	88.9	7357.6	0.5	46.4	10%	48.2		12100.00	7357.6	0.5	0.3	0.6	1.0	NON-LIQ.		
105.0	111.5	18	111	1	65	SPT	65.0	1.3	1.00	1.2	1.00	101.4	7933.6	0.5	50.9	10%	52.9		13300.00	7933.6	0.5	0.3	0.6	1.0	NON-LIQ.		

Fines Content based on visual inspection

Fines Content based on lab results

Notes:

1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner) are per Youd et al. (2001).
2. For correction of overburden, $C_N = (1/\sigma_v')^{0.5}$ with a maximum value of 1.7.
3. The influence of Fines Contents are expressed by the following correction: $(N_1)_{60cs} = a + b\,(N_1)_{60}$

   where a and b = coefficients determined from the following relationships

   for FC $\leq$ 5% a = 0, b = 1.0

   for 5% < FC < 35% a = exp(1.76-(190/FC^2)), b = (0.99+(FC$^{1.5}$/1000))

   for FC $\geq$ 35% a = 5.0, b = 1.2
4. For $(N_1)_{60,cs}$ greater than 30, clean granular soils are too dense to liquefy and are classed as non-liquefiable.

Reference:

Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER Workshops on Evaluation of Liquefaction Resistance of Soils, Youd, et al., ASCE Journal of Geotechnical and Geoenvironmental Engineering, October 2001, Vol. 127 No. 10

Calculations of Shear Wave Velocity

SOIL STRENGTH PARAMETERS & V_{s30}

PROJECT NAME:	***SOUTHBOUND 101 ON-RAMP PEDESTRIAN UNDERCROS***	Calc By:	JZ
PROJECT NO.:	***2016-146-LUC***	Date:	10/10/18
STRUCTURE:			
BORING NO.:	***R-18-SO-002***		

SOIL GROUPS
1. SANDS & GRAVELS
2. CLAYS AND PLASTIC SILTS
3. NON TO LOW PLASTIC SILTS
4. YOUNG SEDIMENTARY ROCKS
5. LIQUEFIABLE SANDS (RESIDUAL STRENGTH)
6. LIQUEFIABLE SILTS (RESIDUAL STRENGTH)

BOREHOLE DIA (in)=	3.3	*HAMMER ENERGY =*	78%	Nd		V_{sd} (m/s)	
GW DEPTH (ft)=	22	*DRILLING RODS (Y/N)=*	Y	N_{30}	24	V_{s30} (m/s)	*232*
						Correlation	1) Caltrans

Sample No	Layer Thickness from	to	Sample Depth (ft)	Soil Type	Field Blow Count	Sampler Type	Unit Weight (pcf)	σ_v (psf)	σ_v' (psf)	SPT-$N_{eq.}$	N_{60} CE Corr.	N_{60} CR,CB,CS Corr.	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60,\,CS}$	Correlated Strength Parameters ϕ (°)	c (psf)	S_r (psf)	Lab Test Results c (psf)	Vs (m/s)
1	0.0	4.5	3	1	57	MC	125	375	375	37	48.2	36.1	1.70	61.4		61.4	45				164
2	4.5	10.0	6	1	41	MC	125	750	750	27	34.6	27.7	1.63	45.3		45.3	43				187
3	10.0	14.0	11	2	11	SPT	125	1375	1375	11	14.3	14.2	1.21	17.2				1788			199
4	14.0	18.0	16	2	31	MC	125	2000	2000	20	26.2	24.9	1.00	24.9				3274		1900	198
5	18.0	22.0	21	2	51	MC	125	2625	2625	33	43.1	40.9	0.87	35.7				5387			286
6	22.0	26.5	26	1	51	SPT	125	3250	3000	51	66.3	86.2	0.82	70.4		70.4	42				276
7	26.5	33.0	31	2	16	MC	125	3875	3313	10	13.5	13.5	0.78	10.5	79%			1690		2100	208
8	33.0	38.5	36	3	25	MC	125	4500	3626	16	21.1	21.1	0.74	15.7				2113			249
9	38.5	43.5	41	1	30	SPT	125	5125	3939	30	39.0	50.7	0.71	36.1		36.1	38				280
10	43.5	48.5	46	1	25	SPT	125	5750	4252	25	32.5	41.8	0.69	28.7		28.7	37				280
11	48.5	53.0	51	1	24	SPT	125	6375	4565	24	31.2	39.3	0.66	26.0	7%	26.4	36				283
12	53.0	61.0	56	1	39	SPT	125	7000	4878	39	50.7	65.9	0.64	42.2		42.2	38				302
13	61.0	64.5	61	1	11	SPT	125	7625	5191	11	14.3	15.7	0.62	9.8	36%	16.7	32				271
14	64.5	76.0	71	2	13	MC	125	8875	5817	8	11.0	11.0	0.59	6.4				1373		900	139
15	76.0	85.0	81	2	28	MC	125	10125	6443	18	23.7	23.7	0.56	13.2				2958			288
16	85.0	96.0	91	1	44	SPT	125	11375	7069	44	57.2	74.4	0.53	39.6		39.6	37				333
17	96.0	106.0	101	1	48	SPT	125	12625	7695	48	62.4	81.1	0.51	41.4	12%	44.1	37				343
18	106.0	116.0	111	1	69	SPT	125	13875	8321	69	89.7	116.6	0.49	57.2		57.2	38				361
19	116.0	121.5	121	1	41	SPT	125	15125	8947	41	53.3	69.3	0.47	32.8		32.8	35				350

Note:
1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner), C_N (Overburden) are per Youd 2001
2. For fine-grained materials, the correlation between blow-counts and shear is based on NAVFAC DM 7.1.
3. The phi angle was estimated based on Meyerhof (1956).
4. Residual Strength (Sr) is based on Caltrans "Guidelines on Foundation Loading and Deformation Due to Liquefaction Induced Lateral Spreading", Caltrans 2011
5. The Vs were correlated based on N_{60} for Soil Types 1,3, 4; based on N_{60} or c_{lab} for Soil Type 2 and based on Sr for Soil Types 5 & 6 per Caltrans Guidelines (2012).
6. Spreadsheet Revision Date: 10/29/13

SOIL STRENGTH PARAMETERS & V_{s30}

PROJECT NAME:	SOUTHBOUND 101 ON-RAMP PEDESTRIAN UNDERCROS	Calc By:	JZ
PROJECT NO.:	2016-146-LUC	Date:	10/10/18
STRUCTURE:			
BORING NO.:	R-18-SO-003		

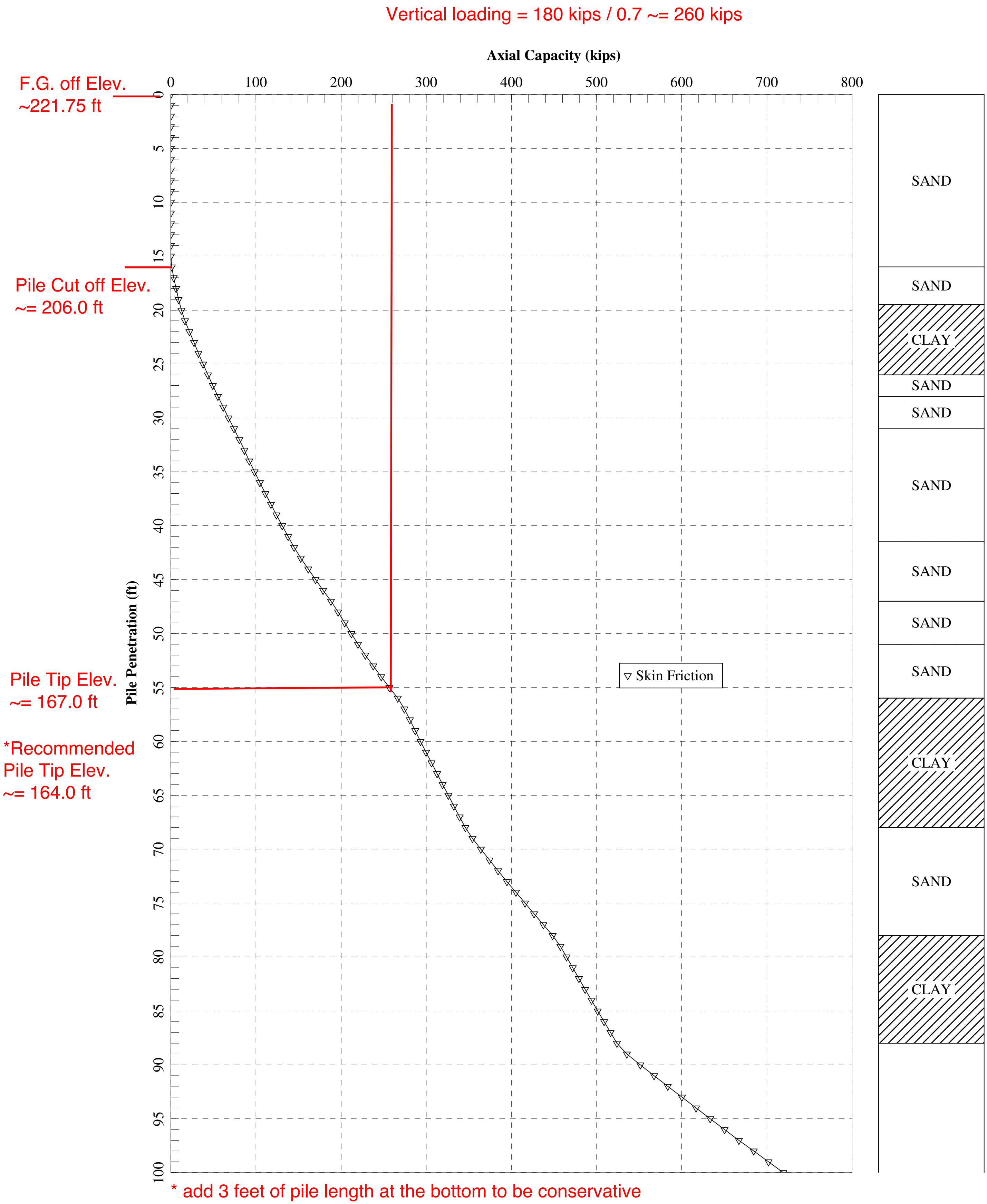
SOIL GROUPS
1. SANDS & GRAVELS
2. CLAYS AND PLASTIC SILTS
3. NON TO LOW PLASTIC SILTS
4. YOUNG SEDIMENTARY ROCKS
5. LIQUEFIABLE SANDS (RESIDUAL STRENGTH)
6. LIQUEFIABLE SILTS (RESIDUAL STRENGTH)

BOREHOLE DIA (in)=	3.3	HAMMER ENERGY =	78%	Nd		V_{sd} (m/s)	
GW DEPTH (ft)=	25	DRILLING RODS (Y/N)=	Y	N_{30}	25	V_{s30} (m/s)	258
						Correlation	1) Caltrans

Sample No	Layer Thickness from	Layer Thickness to	Sample Depth (ft)	Soil Type	Field Blow Count	Sampler Type	Unit Weight (pcf)	σ_v (psf)	σ_v' (psf)	SPT-$N_{eq.}$	N_{60} CE Corr.	N_{60} CR,CB,CS Corr.	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60,CS}$	Correlated Strength Parameters ϕ (°)	Correlated Strength Parameters c (psf)	Correlated Strength Parameters S_r (psf)	Lab Test Results c (psf)	Vs (m/s)
1	0.0	4.0	3	1	52	MC	125	375	375	34	43.9	33.0	1.70	56.0		56.0	45				162
2	4.0	8.0	6	1	56	MC	125	750	750	36	47.3	37.9	1.63	61.8		61.8	45				193
3	8.0	13.0	11	1	44	MC	125	1375	1375	29	37.2	31.6	1.21	38.1		38.1	41				217
4	13.0	16.5	16	1	38	MC	125	2000	2000	25	32.1	30.5	1.00	30.5		30.5	39				234
5	16.5	23.0	21	2	24	MC	125	2625	2625	16	20.3	19.3	0.87	16.8				2535		2400	221
6	23.0	28.0	26	1	60	MC	125	3250	3188	39	50.7	50.7	0.79	40.2	14%	44.1	39				273
7	28.0	33.5	31	1	24	MC	125	3875	3501	16	20.3	20.3	0.76	15.3	19%	20.0	35				255
8	33.5	38.5	36	1	15	SPT	125	4500	3814	15	19.5	22.7	0.72	16.4	7%	16.7	35				260
9	38.5	44.0	41	1	42	SPT	125	5125	4127	42	54.6	71.0	0.70	49.4		49.4	39				292
10	44.0	48.0	46	1	15	SPT	125	5750	4440	15	19.5	22.4	0.67	15.1	15%	18.4	34				269
11	48.0	53.0	51	1	32	SPT	125	6375	4753	32	41.6	54.1	0.65	35.1		35.1	37				294
12	53.0	58.0	56	2	14	SPT	125	7000	5066	14	18.2	20.6	0.63	12.9				2275			261
13	58.0	65.0	61	2	15	MC	125	7625	5379	10	12.7	12.7	0.61	7.7				1584			242
14	65.0	75.0	71	1	15	SPT	125	8875	6005	15	19.5	22.0	0.58	12.7	37%	20.2	33				289
15	75.0	85.0	81	2	16	MC	125	10125	6631	10	13.5	13.5	0.55	7.4				1690			255
16	85.0	95.0	91	1	55	SPT	125	11375	7257	55	71.5	93.0	0.52	48.8		48.8	37				342
17	95.0	105.0	101	1	57	SPT	125	12625	7883	57	74.1	96.3	0.50	48.5	10%	50.2	37				350
18	105.0	111.5	111	1	65	SPT	125	13875	8509	65	84.5	109.9	0.48	53.3		53.3	37				361

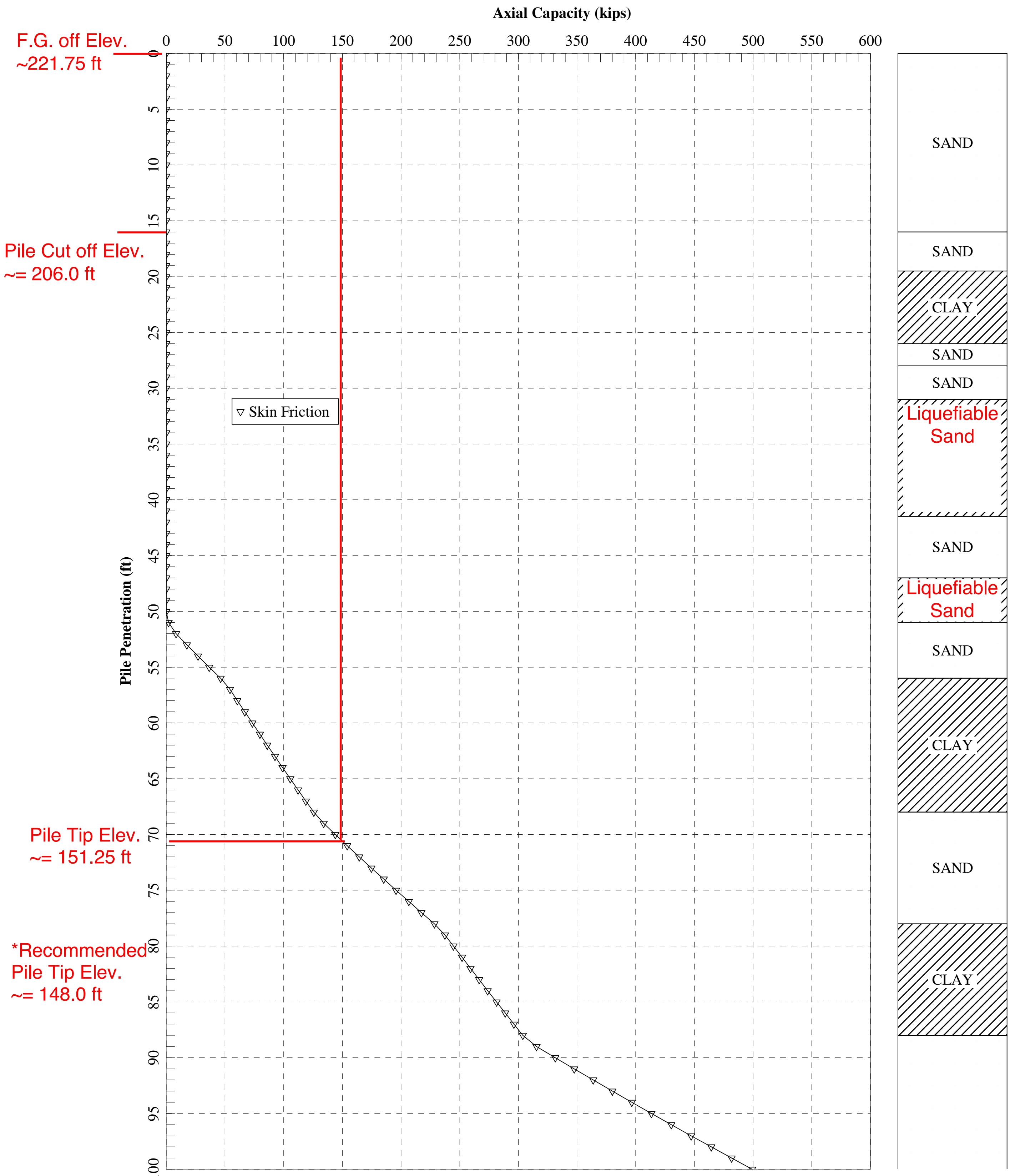
Note:
1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner), C_N (Overburden) are per Youd 2001
2. For fine-grained materials, the correlation between blow-counts and shear is based on NAVFAC DM 7.1.
3. The phi angle was estimated based on Meyerhof (1956).
4. Residual Strength (Sr) is based on Caltrans "Guidelines on Foundation Loading and Deformation Due to Liquefaction Induced Lateral Spreading", Caltrans 2011
5. The Vs were correlated based on N_{60} for Soil Types 1,3, 4; based on N_{60} or c_{lab} for Soil Type 2 and based on Sr for Soil Types 5 & 6 per Caltrans Guidelines (2012).
6. Spreadsheet Revision Date: 10/29/13

VERTICAL PILE CAPACITY ANALYSIS (A-PILE ANALYSIS RESULTS)



Abutment 1_18" x 0.625" Steel Pipe Pile_Strength Limit State

Vertical loading = 90 kips.
Downdrag = 58 kips, therefore,
Total demand = 90 kips + 58 kips = 148 kips



* add ~3 feet of pile length at the bottom to be conservative

Abutment 1_18" x 0.625" Steel Pipe Pile_Extreme Limit State

Downdrag Forces on Circular Piles

Project No	2016-146-LUC	FG Elev.	221.75
Project	SB 101 ON-RAMP PUC	Pile Cut-off.	206
Location	Abutment 1 -1 rows		
Boring	R-18-SO-003		
Single Pile Dia. (ft)	1.5		
GW Depth (ft)	16		
Bulk Unit Weight (pcf)	125		
Pile Length (ft)	100		
# of Equiv. Pile Circumference	5.5		

Analysis By:	JZ
Date:	11/30/2018

Layer Number	Layer Thickness (ft)	Soil Type	Beta	Consider downdrag (y/n)	Total Depth (ft)	Layer Mid-Point Depth (ft)	Effective Stress (psf)	Contributing Thickness (ft)	Unit Negative Friction (ft)	Downdrag Force per Section (ton)	Total Downdrag Force (ton)	Remarks
1a	8.00	SM	0.30	n	8.00	4.00	500	8.0	150	0.0		Above Cut-off
1b	3.50	SM	0.30	y	11.50	9.75	1219	3.5	366	16.6	16.6	Non-Liquefied Contribute to Downdrag
2	6.50	CL/CH	0.20	y	18.00	14.75	1844	6.5	369	31.1	47.6	
3	5.00	SM	0.30	y	23.00	20.50	2282	5.0	685	44.4	92.0	
4	10.50	SP-SM	0.35	n	33.50	28.25	2767	10.5	968	0.0		Liquefied
5	5.50	SP-SM	0.35	y	39.00	36.25	3268	5.5	1144	81.5	173.5	Non-Liqufied Contribute to Downdrag
6	4.00	SM	0.30	n	43.00	41.00	3565	4.0	1070	0.0		Liquefied
7	5.00	SM	0.30	n	48.00	45.50	3847	5.0	1154	0.0		
8	12.00	CL	0.20	n	60.00	54.00	4379	12.0	876	0.0		
9	10.00	SM	0.30	n	70.00	65.00	5067	10.0	1520	0.0		Below Liquefied
10	10.00	CL	0.20	n	80.00	75.00	5693	10.0	1139	0.0		
11	26.50	GP-GM	0.35	n	106.50	93.25	6836	20.0	2393	0.0		

Notes Area

-Layer 1a is above cut-off elevation at Abutment 1. Half thickness (16/2=8ft) assumed for effective stress estimation due to sloping ground.

-Assume total of 6 piles in 1 rows.

-Assume the calculated downdrag load 174 tons is acting on 5.5 equivalent pile circumference.

-If 6 piles with 174 tons of downdrag load, then ~29 tons of downdrag load on an average is acting on each pile.

PILE GROUP SETTLEMENT ANALYSIS

PROJECT NAME **SOUTHBOUND 101 ON-RAMP PUC**
PROJECT NO. **2016-146-LUC**
STRUCTURE **Abutment 1**
REFERENCE BORIN **R-18-SO-003**
Hammer Energy = 78%
GW Level (ft)= 28

Finish Grade Elev. (ft) = 221.75
Pile Cut-off Elev. (ft) = 206
Footing Depth (ft) = 15.75
Pile Length (ft)= 20
Width of Pile Group, B (ft)= 3
Length of Pile Group, L (ft)= 31
Permanent Load Pressure (kip)= 490

Cr/Cc= 25.0%

GROUPS
1. SANDS, GRAVELS AND NON-PLASTIC SILT
2. SATURATED CLAYS AND PLASTIC SILTS
3. OC CLAYS, NON-SATURATED CLAYS, AND NON-SATURATED PLASTIC SILTS

Depth from FG		Soil	BLOW	SAMPLER	AVG	γ_T	γ'	ω	σ_v'	σ_v'	$\Delta\sigma_v'$	Su	Lab Su	Pp	OCR	E	$Cr/1+e_0$	$Cc/1+e_0$	C'	Settlements (in)				
From	To	Type	COUNT	TYPE	$SPT\text{-}N_{60}$	(pcf)	(pcf)		(psf)	(psf)	(psf)	(psf)	(psf)	(psf)		(psf)			(Hough Method)	Elastic	OC	NC	SAND	Sum
0	8	1	53	MC	45	125.0	125.0	2.5%	1000	500														
8	12	1	56	MC	47	125.0	125.0	26.8%	500	1250														
12	16	1	44	MC	37	125.0	125.0	22.2%	500	1750														
16	19.5	1	38	MC	32	125.0	125.0	27.2%	438	2219														
19.5	26	3	24	MC	20	125.0	125.0	17.4%	813	2844			2400	9600	3.4	887250								
26	31	1	60	MC	51	125.0	62.6	26.7%	313	3407														
31	36.5	1	24	MC	20	125.0	62.6	19.2%	344	3735	807.5								36				0.157	0.157
36.5	41.5	1	15	SPT	20	125.0	62.6	6.4%	313	4064	525.8								49				0.065	0.065
41.5	47	1	42	SPT	55	125.0	62.6	6.1%	344	4392	373.5								90				0.026	0.026
47	51	1	15	SPT	20	125.0	62.6	16.7%	250	4690	287.6								47				0.026	0.026
51	56	1	32	SPT	42	125.0	62.6	10.1%	313	4972	231.6								70				0.017	0.017
56	61	2	14	SPT	18	125.0	62.6	23.9%	313	5285	186.9	2275		9100	1.7		0.0358	0.1431			0.032			0.032
61	68	2	15	MC	13	125.0	62.6	27.2%	438	5660	148.7	1584		6338	1.1		0.0335	0.1341			0.032			0.032
68	78	1	15	SPT	20	125.0	62.6	23.6%	626	6192	112.1								44				0.021	0.021
78	88	2	16	MC	14	125.0	62.6	26.8%	626	6818	84.1	1690		6818	1.0		0.0250	0.1000				0.064		0.064
88	98	1	55	SPT	72	125.0	62.6	9.2%	626	7444	65.6								90				0.005	0.005
98	108	1	57	SPT	74	126.0	63.6	7.8%	636	8075	52.5								90				0.004	0.004
108	114.5	1	65	SPT	85	127.0	64.6	8.1%	420	8603	44.5								98				0.002	0.002
																			Estimated Settlement (in)=	*0.0*	*0.1*	*0.1*	*0.3*	*0.5*

Note:
1. Cc is estiamted using empirical equation from "Soil Mechanics" by T. William lambe and Robert V. Whitman, unless there is existing consolidation lab results for Cc and Cr, which is in red font and applied in settlement calculation if soil type falls in Group 2, saturated clays and plastic silts.
2. Cr/Cc ratio of 25% was estimated based on the previous project experience.
3. OCR is calculated based on Su correlations.
4. Clays with OCR>=2.5 is considered as settling elasticly.
5. Soil profile starts from finish grade.

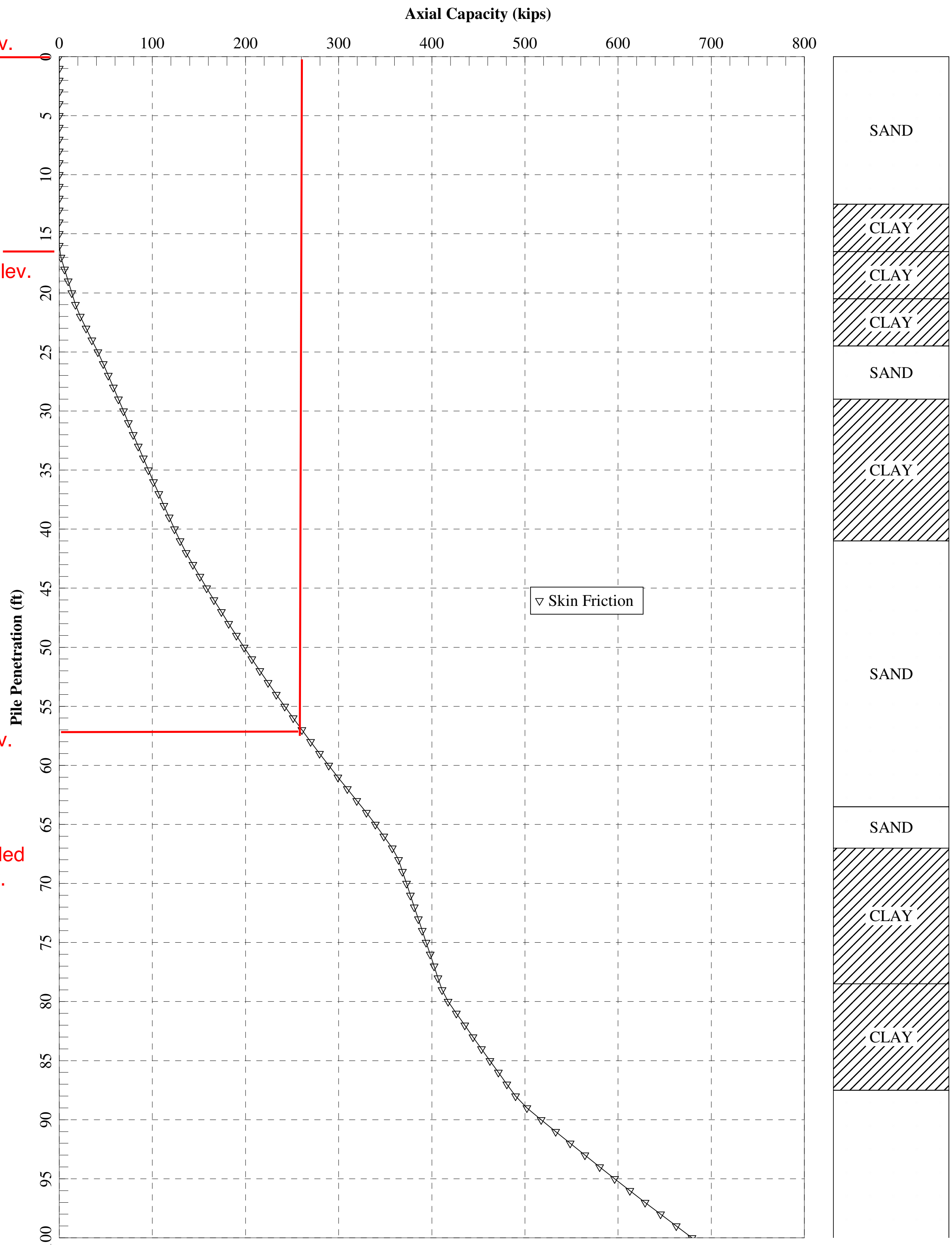
Vertical loading = 180 kips / 0.7 ~= 260 kips

F.G. off Elev.
~222.48 ft

Pile Cut off Elev.
~= 206.0 ft

Pile Tip Elev.
~= 165.5 ft

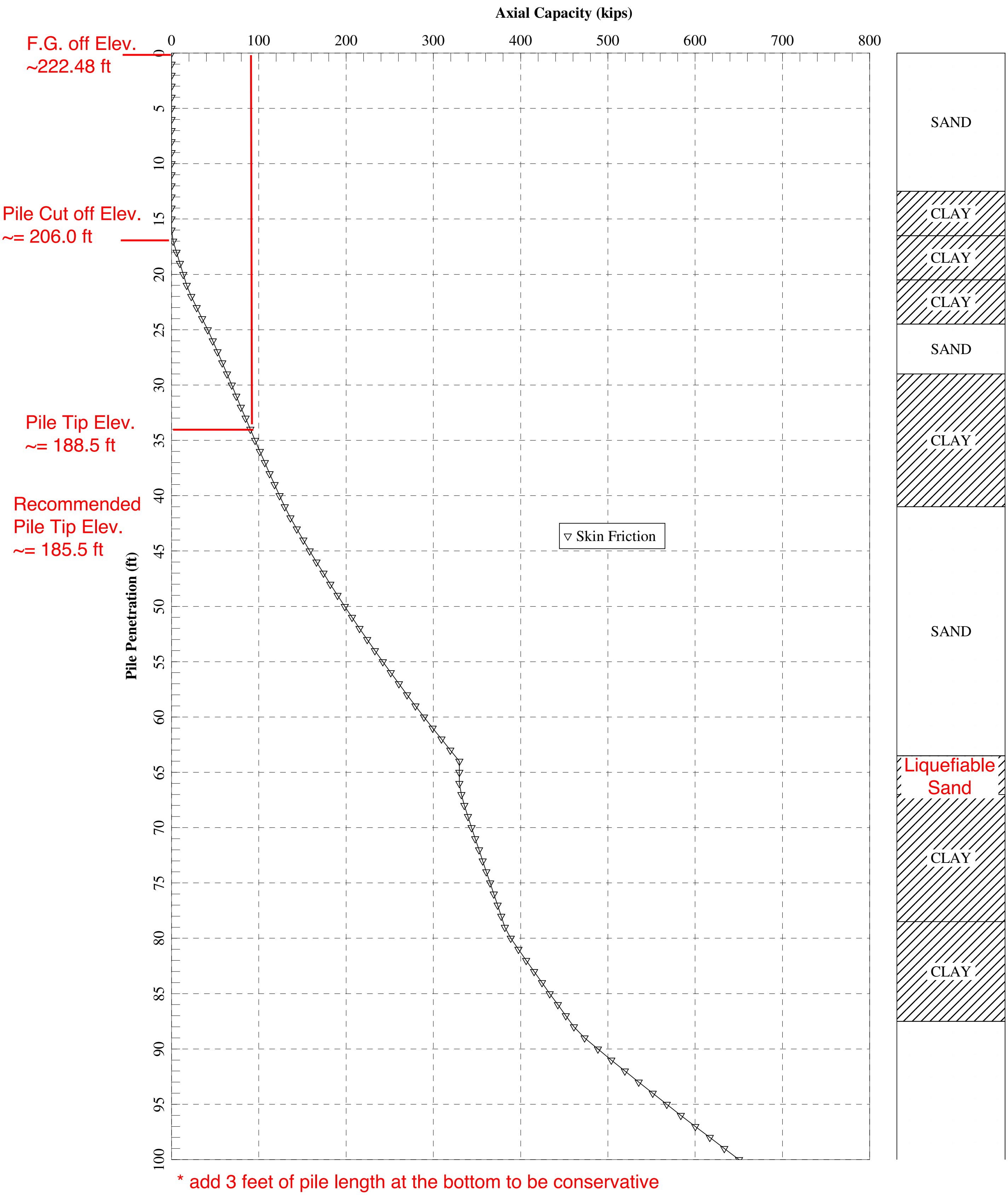
Recommended
Pile Tip Elev.
~= 162.5 ft



* add 3 feet of pile length at the bottom to be conservative

Abutment 2_18" x 0.625" Steel Pipe Pile_Strength Limit State

Vertical loading = 90 kips.
Downdrag was not considered since liquefaction settlement is <= 0.6 inch



Abutment 2_18" x 0.625" Steel Pipe Pile_Extreme Limit State

PILE GROUP SETTLEMENT ANALYSIS

PROJECT NAME ***SOUTHBOUND 101 ON-RAMP PUC***
PROJECT NO. ***2016-146-LUC***
STRUCTURE ***Abutment 2***
REFERENCE BORIN ***R-18-SO-002***
Hammer Energy = 78%
GW Level (ft)= 24.5

Finish Grade Elev. (ft) = 222.48
Pile Cut-off Elev. (ft) = 206
Footing Depth (ft) = 16.48
Pile Length (ft)= 20
Width of Pile Group, B (ft)= 3
Length of Pile Group, L (ft)= 34
Permanent Load Pressure (kip)= 490

Cr/Cc= 25.0%

GROUPS
1. SANDS, GRAVELS AND NON-PLASTIC SILT
2. SATURATED CLAYS AND PLASTIC SILTS
3. OC CLAYS, NON-SATURATED CLAYS, AND NON-SATURATED PLASTIC SILTS

Depth from FG		Soil	BLOW	SAMPLER	AVG	γ_T	γ'	ω	σ_v'	σ_v'	$\Delta\sigma_v'$	Su	Lab Su	Pp	OCR	E	$Cr/1+e_0$	$Cc/1+e_0$	C'	Settlements (in)				
From	To	Type	COUNT	TYPE	$SPT-N_{60}$	(pcf)	(pcf)		(psf)	(psf)	(psf)	(psf)	(psf)	(psf)		(psf)			(Hough Method)	Elastic	OC	NC	SAND	Sum
0	7	1	57	MC	48	125.0	125.0	14.2%	875	438														
7	12.5	1	41	MC	35	125.0	125.0	10.9%	688	1219														
12.5	16.5	2	11	SPT	14	125.0	125.0	21.9%	500	1813														
16.5	20.5	3	31	MC	26	125.0	125.0	20.0%	500	2313			1900	7600	3.3	1146031								
20.5	24.5	2	51	MC	43	125.0	125.0	19.2%	500	2813														
24.5	29	1	51	SPT	66	125.0	62.6	12.1%	282	3203														
29	35.5	3	16	MC	14	125.0	62.6	15.1%	407	3548	939.2	1690	2100	8400	2.4	591500				0.124				0.124
35.5	41	3	25	MC	21	125.0	62.6	13.9%	344	3923	551.2	2641		10563	2.7	924219				0.039				0.039
41	46	1	30	SPT	39	125.0	62.6	7.3%	313	4252	386.0								71				0.032	0.032
46	51	1	25	SPT	33	125.0	62.6	9.9%	313	4565	291.2								62				0.026	0.026
51	55.5	1	24	SPT	31	125.0	62.6	8.4%	282	4862	230.9								59				0.018	0.018
55.5	63.5	1	39	SPT	51	125.0	62.6	8.0%	501	5254	177.0								79				0.017	0.017
63.5	67	1	11	SPT	14	125.0	62.6	16.0%	219	5613	142.8								40				0.011	0.011
67	78.5	2	13	MC	11	125.0	62.6	28.1%	720	6083	111.4	1373	900	3600	0.6		0.0366	0.1466				0.159		0.159
78.5	87.5	2	28	MC	24	125.0	62.6	28.6%	563	6725	83.1	2958		11830	1.8		0.0280	0.1119			0.016			0.016
87.5	98.5	1	44	SPT	57	125.0	62.6	14.7%	689	7351	64.8								77				0.007	0.007
98.5	108.5	1	48	SPT	62	125.0	62.6	6.3%	626	8008	51.4								79				0.004	0.004
108.5	118.5	1	69	SPT	90	126.0	63.6	8.1%	636	8639	42.2								103				0.002	0.002
118.5	124	1	41	SPT	53	127.0	64.6	14.8%	355	9135	36.7								68				0.002	0.002
																			Estimated Settlement (in)=	*0.2*	*0.0*	*0.2*	*0.1*	*0.5*

Note:
1. Cc is estiamted using empirical equation from "Soil Mechanics" by T. William lambe and Robert V. Whitman, unless there is existing consolidation lab results for Cc and Cr, which is in red font and applied in settlement calculation if soil type falls in Group 2, saturated clays and plastic silts.
2. Cr/Cc ratio of 25% was estimated based on the previous project experience.
3. OCR is calculated based on Su correlations.
4. Clays with OCR>=2.5 is considered as settling elasticly.
5. Soil profile starts from finish grade.

GEOTECHNICAL LPILE PARAMETERS

SB101 ON-RAMP PEDESTRIAN UNDERCROSSING
LPILE PARAMETERS

Boring ID: R-18-SO-003 **Date:** 10/11/2018
Station: "AL4" Line 251+90 **By:** JZ

Approx. Ground Surface Elevation: 219.0
Structure ID: Abutment 1

Depth (ft)	Elevation (ft)	LPILE Soil Type	c (psf)	Phi (degrees)	Effective Unit Weight γ' (pcf)
0 to 16.5	219 to 202.5	Sand (Reese)	-	36	125
16.5 to 23	202.5 to 196	Stiff Clay w/o Free Water (Reese)	2400	-	125
23 to 25	196 to 194	Sand (Reese)	-	38	125
25 to 28	194 to 191	Sand (Reese)	-	38	65
28 to 38.5	191 to 180.5	Case I) Sand (Reese)	-	34	65
		Case II) Soft Clay (Matlock)	Sr=700	-	65
38.5 to 44	180.5 to 175	Sand (Reese)	-	38	65
44 to 48	175 to 171	Case I) Sand (Reese)	-	33	65
		Case II) Soft Clay (Matlock)	Sr=800	-	65
48 to 53	171 to 166	Sand (Reese)	-	36	65
53 to 65	166 to 154	Stiff Clay w/o Free Water (Reese)	1600	-	65
65 to 75	154 to 144	Sand (Reese)	-	32	65
75 to 85	144 to 134	Stiff Clay w/o Free Water (Reese)	1600	-	65
85 to 111.5	134 to 107.5	Sand (Reese)	-	38	65

Default values can be used for e_{50} and K except for the liquefied soils (Case II) where e_{50} of 0.05 should be used.
Groundwater was measured at the depth of 25.0 feet below existing ground during drilling at Elevation +194.0 feet.
Soil unit weights of 125 pcf and 65 pcf can be used above and below groundwater level, respectively.

SB101 ON-RAMP PEDESTRIAN UNDERCROSSING
LPILE PARAMETERS

Boring ID: R-18-SO-002 **Date:** 10/11/2018
Station: "AL4" Line 251+90 **By:** JZ

Approx. Ground Surface Elevation: 220.0

Structure ID: Abutment 2

Depth (ft)	Elevation (ft)	LPILE Soil Type	c (psf)	Phi (degrees)	Effective Unit Weight γ' (pcf)
0 to 10	220 to 210	Sand (Reese)	-	36	125
10 to 18	210 to 202	Stiff Clay w/o Free Water (Reese)	1800	-	125
18 to 22	202 to 198	Stiff Clay w/o Free Water (Reese)	3000	-	125
22 to 26.5	198 to 193.5	Sand (Reese)	-	38	65
26.5 to 38.5	193.5 to 181.5	Stiff Clay w/o Free Water (Reese)	2000	-	65
38.5 to 61	181.5 to 159	Sand (Reese)	-	36	65
61 to 64.5	159 to 155.5	Case I) Sand (Reese)	-	32	65
		Case II) Soft Clay (Matlock)	Sr=500	-	65
64.5 to 76	155.5 to 144	Soft Clay (Matlock)	900	-	65
76 to 85	144 to 135	Stiff Clay w/o Free Water (Reese)	2500	-	65
85 to 121.5	135 to 98.5	Sand (Reese)	-	38	65

Default values can be used for e_{50} and K except for the liquefied soils (Case II) where e_{50} of 0.05 should be used.
Groundwater was measured at the depth of 22.0 feet below existing ground during drilling at Elevation +198.0 feet.
Soil unit weights of 125 pcf and 65 pcf can be used above and below groundwater level, respectively.

APPENDIX VII

The appendix for
'Exceptions to Policy'
is not applicable to this report.

APPENDIX VIII

Office of Special Funded Projects
Comment & Response Form

(Revised 08/2011)

General Project Information (OSFP Liaison to complete)		**Review Phase** (OSFP Liaison to complete)	**Reviewer Information** (Reviewer Liaison to complete)	
Dist:	**04**	☐ PSR/PDS (Review No.)	Reviewer Name:	**R. Nashed/ J. Anderson**
Proj ID (Phase):	**0416000224**	☐ APS/PSR (Review No.)	Functional Unit:	**Geotechnical Design- West**
EA:	**1K2801**	☐ APS/PR (Review No.)	Cost Center:	**59-3660**
Project Name:	**Blossom Hill Rd Interchange Improvement**	☐ Type Selection	Phone Number:	**510-622-1773**
OSFP Liaison:	**Shu-Shang Liu**	☐ 65% PS&E Unchecked Details	e-mail:	**Rifaat.nashed@ dot.ca.gov**
Phone:	**916-227-8919**	☐ PS&E (Review No. 1)	Date of Review:	**12/ 26/2018**
E-mail:	**Shu-shang.liu@dot.ca.gov**	☐ Construction	Structure Name*:	**SB101 On-Ramp Pedestrian Undercrossing**
		☑ Other: FR	Br No*:	**37-675K**
			(*Use if necessary to when comment sheets are by individual structure)	

Consultant Information (to be filled in by Consultant)

Consultant Lead (First and Last Name)	Consultant Firm	Phone Number	E-mail	Response Date

#	Doc. (See Note 1)	Page, Section, or SSP	Review Comments	Consultant Responses	Caltrans Responses
	FR	N/A	Review of Geology and subsurface and Related sections items Foundation Report (DRAFT) by Parikh consultants prepared for HMH Engineers dated December 4, 2018		
1	FR & Plans	Section 3 Page 2 & Plan Sheet (General Plan	To avoid confusion, the nomenclature of "Southbound loop on-ramp Pedestrian undercrossing" should be	Comment incorporated. "Southbound loop on-ramp Pedestrian undercrossing" has been replaced by SB101 on-ramp Pedestrian Undercrossing"	

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓= Comment Resolved (for Reviewer's use)

			replaced by SB101 on-ramp Pedestrian Undercrossing". –RN		
2	FR	Section 13.1 Page 9	Table 6- ARS DATA Please add the "Spectral Acceleration" (SA) column including the deterministic data for each listed fault. -RN	The "Spectral Acceleration" (SA) column including the deterministic data for each listed fault will be added to Table 6 – ARS DATA.	
3	FR	Table 3	Please check the consistency/density in the descriptions. -JA	The consistency/density for the soil descriptions has been checked and updated in Table 3 to be consistent with the boring logs in the LOTB.	
4	FR	Section 13.2 - Output	Bullet point 1 in the output is unclear. Please revise -JA	Bullet Point 1 under "Output" has been revised to "The recommended ARS curve is based on the maximum of the comparison of the deterministic data and Caltrans Probabilistic data. The recommended ARS curve at this site is based on the Probabilistic curve".	
5	FR	Section 13.3.2	Section references Section 12.2, which does not exist. Please correct. -JA	Comment noted. The referenced section should be Section 13.2 instead. This has been corrected in the foundation report.	
6	FR	Section 14.3	Section references Table 13. Should this be Table 11? -JA	Comment incorporated. Section references Table 13 has been changed to Table 11.	
7	FR	Table 13A	Table does not match the one found in the appendix. -JA	Table 13A and Table 13B have been revised to match the attached tables in the appendix.	

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓= Comment Resolved
(for Reviewer's use)

8	FR	Table 13B	The elevation for depth 26.5 to 38.5 has overflowed its cell. Please expand the cell so the elevation can be seen. -JA	Comment incorporated. The cell for the elevation for depth 26.5 feet to 38.5 feet has been expanded.	
9	FR	Appendix II – Log of the Borings	All UCs are in ksf, but are shown in tsf. Additionally, the stationing appears to be off. Shouldn't the stationing by 521+50 and 521+90? -JA	The UC values are in the unit of ksf based on the laboratory test result. The UC values are in the unit of tsf in the Log of Test Borings.	
10	FR	Appendix IV	Introductory Page is mislabeled as Appendix B. Additionally, the page references Appendix A. This should be Appendix II. -JA	The appendices referred in the introductory page of Appendix IV has been corrected.	
11	FR	Appendix IV – Laboratory Test Summary	Lab test data sheet was included twice. Please remove one page. -JA	Comment incorporated. The extra lab test data sheet has been removed.	
12	FR	Appendix IV	Fines Content should be defined for all layers for liquefaction calculations. Please add these. -JA	Estimated fine content has been added to the sand layer(s) (without any sieve analyses) based on the visual inspection of the soil samples.	
13	FR	All Sections	Please review report for grammar and consistent formatting/structure across all reports. -JA	Comment incorporated.	

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓= Comment Resolved
(for Reviewer's use)

FOUNDATION REPORT

BLOSSOM HILL ROAD INTERCHANGE IMPROVEMENT
RETAINING WALL NO. 1
(BRIDGE NO. – 37E-0125)
SAN JOSE, CALIFORNIA
04-SCl-101, R28.4/R28.9 EA 04-1K280

For

HMH Engineers
1570 Oakland Road
San Jose, CA 95131

PARIKH CONSULTANTS, INC.
2360 Qume Drive, Suite A, San Jose, CA 95131
(408) 452-9000

October 15, 2019 Job No.: 2016-146-RW1

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Office of Special Funded Projects Comment & Response Form - Parikh Consultants, Inc. Response to Caltrans Review Comments.

FOUNDATION REPORT
BLOSSOM HILL ROAD INTERCHNAGE IMPROVEMENT
RETAINING WALL NO. 1 (BRIDGE NO. 37E-0125)
SAN JOSE, CALIFORNIA
04-SCl-101, R28.4/R28.9 EA 04-1K280

1.0 INTRODUCTION

This foundation report presents the results of our geotechnical engineering investigation for the proposed "US 101/Blossom Hill Road Interchange Improvement Project – Retaining Wall No. 1" in San Jose, California, hereinafter referred to as "PROJECT". The work was performed in general accordance with the scope of work outlined in our proposal to HMH Engineers (Designer).

The geotechnical recommendations presented in this report are intended for design input and are not intended to be used as specifications. In addition, the data provided in this report including these geotechnical recommendations should not be used for bidding purposes or for construction cost estimates. If the report is provided as a reference document, any interpretation of the data and recommendations should be the sole responsibility of the user and PARIKH Consultants, Inc. (PARIKH) shall not be liable for any consequences. PURPOSE AND SCOPE OF WORK

The purpose of this investigation was to evaluate the general subsurface soil conditions at the project site, to evaluate their engineering properties, and to provide geotechnical recommendations for the foundation design of the proposed project. The scope of work performed for this investigation included a review of the readily available soils and geologic literature pertaining to the project site including review of boring data, laboratory testing of the representative soil samples, performing engineering analyses based on the field and laboratory data, and preparation of this foundation report. The recommendations in this report are based on the field exploration performed by Parikh, general plan and foundation plan provided by the Biggs Cardosa Associates (Structural Designer).

2.0 REFERENCES

The following documents were used to develop the recommendations presented in this report:

a) Caltrans Department of Transportation, 2010, Soil & Rock Logging, Classification, and Presentation Manual, Office of Structural Foundations California Department of Transportation.

b) Dibblee, T.W., and Minch, J.A., Geologic Maps of San Jose East (DF-155) and Santa Teresa Hills (DF-158) quadrangles, 2005

c) Caltrans ARS Online Web Tool (http://dap3.dot.ca.gov/ARS_Online/)

d) AASTHO Bridge Design Specifications – Sixth Edition with California Amendments

e) Caltrans Department of Transportation, "Seismic Design Criteria", Version 1.7, April 2013.

f) California Department of Transportation, 2018, Standard Specifications, Sections 1 through 95.

g) California Department of Transportation Division of Engineering Services Materials Engineering and Testing Services Corrosion and Structural Concrete Field Investigation Branch Corrosion Guidelines Version 3.0, March 2018.

h) Caltrans Division of Engineering Services Geotechnical Services "Foundation Reports for Earth Retaining Systems (ERS)", June 2017.

3.0 PROJECT DESCRIPTION

The project proposes to modify the US 101/ Blossom Hill Road Interchange to improve traffic operations and connectivity for pedestrians and bicyclists along Blossom Hill Road. The existing Blossom Hill Road Interchange consists of two separate overcrossing structures over US 101 with partial cloverleaf ramps. The project is located within the City of San Jose, in Santa Clara County. It will be implemented as a locally-funded project with the City of San Jose performing advertisement, award and administration (AAA) of the construction contract through a Caltrans encroachment permit.

Blossom Hill Road is a key connector between job locations, mixed-use housing, commercial development and recreational opportunities in an area where San Jose is focused on developing greater internalization of automobile trips, increased use of transit and expanded active transportation. The level-of-service for existing and forecasted traffic is deficient for existing developments and nearby proposed projects. The configuration of the existing interchange and ramp intersections along Blossom Hill Road are not consistent with the latest standards for accommodating balanced use by vehicles, bicyclists and pedestrians.

The proposed project improvements will occur along Blossom Hill Road from east of the Monterey Road / Blossom Hill Road grade separation to the US 101 Northbound Off-Ramp / Coyote Road intersection. All improvements will be constructed within existing Caltrans and City of San Jose rights-of-way.

In addition, the existing 5-foot sidewalk on the north side of Blossom Hill Road will be replaced with a 10-foot to 12-foot wide Class I Bike/Pedestrian path. The Class I Bike/Pedestrian path will cross over the northbound diagonal on-ramp by constructing a truss type pedestrian overcrossing, with an easterly approach consisting of a short span concrete slab bridge and mechanically stabilized embankment (MSE) walls, and will connect to the existing sidewalk and bike lanes at the US 101/Northbound Off-Ramp / Coyote Road intersection. The northbound diagonal on-ramp will be reconstructed at a lower profile to accommodate the POC crossing over it and a soil nail wall with architectural treatment will be constructed between Blossom Hill Road and this on-ramp.

The following bridge structures and retaining walls would be modified or constructed in association with the "US 101/Blossom Hill Road Interchange Improvement Project" and path:

1. Blossom Hill Road Overcrossing (OC) (Widen) (Bridge No. 37-0348)
2. NB 101 On-Ramp Pedestrian Overcrossing (POC) (Bridge No. 37-676)
3. SB 101 Off-Ramp Pedestrian Undercrossing (PUC) (Bridge No. 37-675J)
4. SB 101 On-Ramp PUC (Bridge No. 37-675K)
5. Retaining Wall No. 1 (Soil Nail Wall)(Bridge No. 37E0125)
6. Retaining Wall No. 2 (MSE Wall)(Bridge No. 37E0126)

This foundation report is for the "Retaining Wall No. 1". A map showing the project location and its vicinity is presented in Appendix I. The following foundation reports will be separately submitted:

1. Foundation Report for Blossom Hill Road OC (Widen) (Bridge No. 37-0348).
2. Foundation Report for NB 101 On-Ramp POC (Bridge No. 37-676).
3. Foundation Report for SB 101 Off-Ramp PUC (Bridge No. 37-675J).
4. Foundation Report for SB 101 On-Ramp PUC (Bridge No. 37-675K).
5. Foundation Report for Retaining Wall No. 2 (MSE Wall)(Bridge No. 37E0126).

The following is the information of approximate wall locations, type of walls, and maximum wall heights for Retaining Wall No. 1 provided by the structural designer.

TABLE 1 – SUMMARY OF PROPOSE RETAINING WALL NO. 1

Wall Type	Location (Along approx. Station.)	Maximum Wall Height (ft)	Bottom of Wall Elev. (ft)	Total Length (ft)
Soil Nail Wall	"RW1" 508+95.86 to "RW1" 510+25.86	4.49 – 19.96 (5 rows of nails)	Varies between +206.05 and +211.74 along the wall	345.86
	"RW1" 506+80.00 to "RW1" 508+95.86	4.59 – 16.28 (3 rows of nails)		

Our recommendations in this report are based on the above information. Any major deviation should be reported to PARIKH for consideration.

The datum used to reference the elevation in this report:

a) All elevations referenced within this report are based on the North American Vertical Datum of 1988 (NAVD 88), unless otherwise noted. To convert elevation at this site from National Geodetic Vertical Datum of 1929 (NGVD 29) to NAVD 88, we added 1.8 feet to the NGVD 29 elevation.

b) Horizontal Datum: CCS83, Zone 3, Epoch 2010.00 in Survey Feet.

4.0 EXCEPTIONS TO POLICY

Normal procedures were used in the field exploration and geotechnical recommendations for the proposed Retaining Wall No. 1. There is no exception to the Caltrans Department policy and procedures relating to the investigation or design of the proposed Retaining Wall No. 1.

5.0 AS-BUILT DATA

No as-built data is available along the wall alignment

6.0 SITE CONDITIONS

The general project area is the existing interchange of Blossom Hill Road at Route 101 in San Jose, Santa Clara County, California. The existing grade of Route 101 in the vicinity of the "Blossom Hill Road OC" is generally level at approximately Elev. 200 feet. The existing topography of Blossom Hill Road at the location of the planned retaining wall is generally sloping from the east to the west. The ground is generally level with the ground at the beginning of the NB 101 on-ramp and sloping down towards the on-ramp as the on-ramp approaches Route 101.

7.0 FIELD EXPLORATION AND FIELD TESTING PROGRAM

Field Exploration

Borings R-18-NO-101 was drilled along the alignment of the proposed retaining wall in August 2018. The field exploration was performed by the drilling contractor, Geo-Ex Subsurface Exploration. We have also referred to Boring R-18-SC-002 which was drilled in the vicinity of the proposed Retaining Wall for the "Blossom Hill Road OC (Widen)"..

The completion date, drill rig type, hammer energy ratio, location, approximate ground elevation and depth of these borings are summarized in the tables below.

TABLE 2 – SUBSURFACE INVESTIGATION SUMMARY

Boring No.	Completion Date	Drill Rig Type	Hammer Type	Hammer Efficiency (%)	Approx. Ground Elev. (ft)	Boring Depth (ft)
R-18-NO-101	9/10/2018	CME 75	Automatic	78	220.0	56.5

TABLE 3 - SUMMARY OF BORINGS

Boring No.	"RW1" Line Station (ft)	Offset (ft)	Boring Depth (ft)	Approx. Ground Elev. (ft)
R-18-NO-101	507+70	9.0 Lt.	56.5	220.0

The approximate locations of the soil borings are shown on the "Boring Location Map", Plate 1. The descriptions of the soil materials encountered in the field exploration and relevant boring information are presented on the LOTB included in Appendix II

Field Testing

a) The current investigation borings (by Parikh) were advanced using a truck-mounted CME-75 drill rig with 8-inch hollow-stem auger and 3 ¼ inch rotary wash drilling method. The soil samples were obtained from the borings during drilling at various depths by driving a 2.5-inch Inside Diameter (I. D.) Modified California Sampler or a 1.375-inch I.D. Standard Penetration Sampler (ASTM Test Method No. 1586). The sampler was driven into the subsurface soils under the impact of a 140 pounds hammer having a free fall of 30 inches. The blow counts required to drive the sampler for the last 12 inches are presented on the LOTB, Appendix II. (When correlating standard penetration data in similar soils, the blow counts for the Modified California sampler can be converted to equivalent Standard Penetration Test sampler by multiplying a factor of safety of 0.65);

b) Pocket penetration tests were also performed on clay samples to evaluate their consistency.

Details of Field Exploration

All the test borings were drilled with a truck-mounted drill rig using 8-inch hollow-stem auger and rotary-wash drilling method. The borings were drilled under the technical supervision of our engineers, who classified and continuously logged the soils encountered during drilling and supervised the collection of soil samples at various depths for visual examination and laboratory testing. The soil samples were visually classified in the field according to the Unified Soil Classification System and then transported to our laboratory for further evaluation and testing. Upon completion of drilling, the boreholes were backfilled with cement grout.

The logs presented in Appendix II were prepared from the field logs which were edited after visual re-examination of the soil samples in the laboratory and results of classification tests on selected soil samples as indicated on the logs.

It should be noted that the descriptions of the soils encountered and relevant boring information presented on the LOTB depict subsurface conditions only at the locations indicated on the plan and on the particular date noted on the LOTB. Because of the variability from place to place within soil/rock in general, subsurface conditions at other locations may differ from conditions occurring at the boring locations explored. The abrupt stratum changes shown on the logs may be gradational and relatively minor changes in soil types within a stratum may not be noted on the logs due to field limitations. Also, the passage of time may result in a change in the soil conditions at these locations due to environmental changes.

8.0 LABORATORY TESTING PROGRAM

The following laboratory tests were performed on selected soil samples collected during field exploration to evaluate the physical and engineering properties of the subsurface soils at the project site to support the foundation recommendations:

a) Laboratory determination of Moisture Contents (ASTM D-2216);
b) Atterberg Limits (ASTM D-4318);
c) Unconfined Compression Test (ASTM D-2166);
d) Corrosivity Test (California Test Method T-643, T-422, and T-417).

The laboratory test methods and test results are presented on plates included in Appendix III. Laboratory test results for moisture content, total unit weight, unconfined compression, Plasticity Index and grain size classification of the soil samples are summarized in the table in Appendix III.

9.0 SITE GEOLOGY AND SUBSURFACE CONDITIONS

Geology

General geologic features pertaining to the project site were evaluated by reference to the "Dibblee, T.W.; and Minch, J.A., 2005, Geologic Maps of the San Jose East Quadrangle, Santa Clara County, California; Dibblee Geological Foundation DF-155, scale 1:24,000" and "Dibblee, T.W.; and Minch, J.A., 2005, Geologic Maps of the Santa Teresa Hills Quadrangle, Santa Clara County, California; Dibblee Geological Foundation DF-158, scale 1:24,000".

Based on the geologic map, the project site subsurface soils consist of mainly Holocene surficial sediments with alluvial gravel, sand and clay soil of valley areas (Qa). The general geology of the project area is shown on the "Geologic Map", Plate No. I-3.

The descriptions of the subsurface soils encountered in the geotechnical explorations are consistent with the published geologic maps.

Subsurface Conditions

Based on Borings R-18-NO-101 and the reference Boring R-18-SC-002, the descriptions of the subsurface soil materials encountered in each of the exploratory boring are summarized in the table below. Detailed soil descriptions and location of the borings are presented on the LOTBs.

TABLE 4 - SUMMARY OF SUBSURFACE SOIL CONDITIONS

Boring No.	Soil Description
R-18-NO-101	Medium dense to very dense clayey sand/silty sand, underlain by soft to medium stiff lean/fat clay (pocket penetrometer measurement of Sample No. 4 = 2.0 tsf) and silt to the boring depth of 56.5 feet.
R-18-SC-002	Medium dense silty/clayey sand, underlain by very soft to very stiff silt, underlain by interbedded layers of medium dense to very dense sand and stiff to very stiff lean clay/silt to the boring depth of 121.5 feet.

Due to limitations inherent in geotechnical investigations, it is neither uncommon to encounter unforeseen variations in the subsurface soil conditions during construction nor is it practical to determine all such variations during an acceptable program of drilling and sampling for a project of this scope. Such variations, when encountered, generally require additional engineering services to attain properly constructed project. We, therefore, recommend that a contingency fund be provided to accommodate any additional charges resulting from technical services that may be required during construction.

10.0 GROUNDWATER

Groundwater measured during the field exploration is summarized in the table below.

TABLE 5 - SUMMARY OF MEASURED GROUNDWATER LEVEL

Boring No.	Date	Depth (feet)	Elevation (feet)
R-18-NO-101	9/10/2018	14.0	206.0
R-18-SC-002	8/28/2018	25.0	201.0

Groundwater level is anticipated to vary with the passage of time due to seasonal groundwater fluctuations, variations in yearly rainfall, water elevations in the nearby creeks, surface and subsurface flows, ground surface run-off, and other environmental factors that may not be present at the time of the investigation.

Measured groundwater elevation of Elev. 206.0 feet has been used for the engineering analyses.

11.0 SITE SEISMICITY AND ANALYSES

11.1 Seismic Sources

The project is located in a seismically active part of northern California. Many faults exist in the regional area. These faults are capable of producing earthquakes and may cause strong ground shaking at the site.

Maximum magnitudes (M_{max}) of some of the closest faults in the area are based on Caltrans ARS Online Website. These maximum moment magnitudes represent the largest earthquake a fault is capable of generating and is related to the seismic moment. The earthquake data of the active faults in the project vicinity are summarized in the table below.

TABLE 6- ARS DATA

Fault (Fault ID)	Maximum Moment Magnitude of Fault, M_{Max}	Fault Type	Site-to-Fault Distance, R_{rup}* (miles)	Peak Ground Acceleration (PGA) Based on Deterministic Data (g)
Silver Creek (148)	6.9	Strike Slip	2.21	0.367
Hayward (Southern extension) (149)	6.7	Strike Slip	4.15	0.303
Calaveras (Central) 2011 CFM (151)	6.9	Strike Slip	6.81	0.252
Cascade fault (153)	6.7	Reverse	3.16	0.343
Monte Vista-Shannon (154)	6.4	Reverse	4.67	0.283
San Andreas (Santa Cruz Mts) 2011 CFM (158)	8.0	Strike Slip	11.78	0.242

*Closest distance (mi) to the fault rupture plane as obtained from Caltrans ARS Online Website.

11.2 Seismic Design Criteria

The development of the Acceleration Response Spectrum (ARS) followed the standard Caltrans procedure by using Caltrans ARS Online webtool (Ver. 2.3.09). The ARS curve is based on several input parameters, including site location (longitude/latitude), average shear wave velocity for the top 100 feet (Vs_{30m}), and other site parameters, such as fault characteristics and site-to-fault distances.

Average shear wave velocities (Vs_{30m}) for the top 100 feet at the project site was calculated by using established correlations and the procedure provided in the "Caltrans Design Manual (Version 2.0, 2012)". The design method incorporates both deterministic and probabilistic seismic hazards to produce the design response spectrum.

Based on all the available boring data, we have calculated the $Vs_{30m.}$ The Vs_{30m} are summarized in the following table.

TABLE 7- SUMMARY OF CALCULATED Vs_{30m}

Boring No.	Boring Depth	Rock Depth (ft)	Vs_{30m} (m/s)
R-18-NO-101	56.5	Not encountered	195

The ARS was developed based on the shear wave velocity of 195 m/s. Average shear wave velocity calculation is included in Appendix IV.

The site location and the relevant parameters are summarized as follows, and the recommended design curve is presented on Appendix IV.

Input

- Site Location: 37.2579ºN/121.7993ºW
- Average V_{S30m}: 195 m/s
- Depth to rock with a shear wave velocity of 1.0 km/sec ($Z_{1.0}$) = N/A
- Depth to rock with a shear wave velocity of 2.5 km/sec ($Z_{2.5}$) = N/A

Output

- The recommended ARS curve is based on the maximum of the comparison of the deterministic data and Caltrans Probabilistic data. The recommended ARS curve at this site is based on the Probabilistic curve.
- The recommended ARS curve is the envelope of the Caltrans Online Probabilistic and the Deterministic data; at this site by the Probabilistic curve per U.S.G.S. Seismic Hazard Map (2008) based on a 975-year return period.
- An adjustment factor for the near-fault effect was applied to the calculated spectral acceleration values. The increase of 20% to the spectral acceleration values corresponds to period longer than 1 second and linearly tapes to zero at a period of 0.5 seconds.
- Anticipated Peak Ground Acceleration (PGA): 0.612 g
- Near Fault Effect: Yes
- Basin Effect: No. The project site is not located within the limit of the $Z_{2.5}$ contour map for Northern California.

- Governing Fault is the Silver Creek Fault (Fault I.D.=148, Mmax=6.9)

11.3 Seismic Hazards/Liquefaction Potential

Potential seismic hazards may arise from three sources: surface fault rupture, ground shaking and liquefaction. Since no active faults pass through the site, the potential for fault rupture does not exist at the site. As shown on the "ARS Online Map", Plate No. IV-1, the closest active fault is Silver Creek fault, which is located approximately 2.1 miles northeast from the project site.

11.3.1 Seismic Hazards

Potential seismic hazards may arise from three sources: surface fault rupture, ground shaking and liquefaction.

11.3.2 Seismic Ground Shaking

Based on available geological and seismic data, the project site is expected to experience strong ground shaking. PGA of 0.612 g was estimated for the site which is discussed in Section 11.2.

11.3.3 Surface Fault Rupture

Since no known active fault passes through the project site and the project site is not within a state Alquist-Priolo Zone, the potential for fault rupture does not exist.

11.3.4 Liquefaction Potential

Liquefaction is a phenomenon in which saturated cohesionless soils are subject to a temporary but essentially total loss of shear strength under the reversing, cyclic shear stresses associated with earthquake shaking. Submerged cohesionless sands and silts of low relative density are the type of soils, which usually are susceptible to liquefaction. Clays are generally not susceptible to liquefaction.

The liquefaction potential was evaluated in accordance with the methods proposed by Youd, et al. (2001). The evaluation was done using the boring data from all the available borings using a Magnitude 6.9 earthquake and a peak ground acceleration of 0.612 g (Caltrans Online Probabilistic ARS). This method compares the estimates of the earthquake-induced shear stress to the susceptibility of soil liquefaction. According to Bray (2006), liquefaction appears to occur in soils where these fines are either non-plastic or are low plasticity silts and/or silty clays (PI<12%, and LL<37%), and with high water content relative to their liquid limit (w>0.85 LL). Estimated fine content has been added to the sand layers (without any sieve analyses) based on the visual inspection and soil classification of the soil sample.

Based on the results of the liquefaction analyses, liquefaction potential may exist at the project site at the isolated locations for the loose to medium dense cohesionless soil encountered in the borings with the following estimated post-liquefaction settlements.

TABLE 8 - SUMMARY OF ESTIMATED POST-LIQUEFACTION SETTLEMENT

Boring No.	Estimated liquefiable Soil Depth (ft)	Approx. Thickness (ft)	Estimated liquefiable Soil Top Elev.(ft)	Estimated liquefiable Soil Bottom Elev.(ft)	$(N_1)_{60,CS}$	Estimated Post-liquefaction Settlement (inches)
R-18-NO-101	23.0	4.5	197.0	192.5	10.9	0.8
R-18-SC-002	64.5	12.5	161.5	149.0	17.4	2.3

Liquefaction analyses are included in Appendix IV.

Lateral Spreading

Liquefaction-induced spreading has been defined as the *"lateral displacement of large surficial blocks of soil as a result of liquefaction in a subsurface layer"*. Lateral spreading refers to the more moderate movements of gently sloping ground due to soil liquefaction. As described by Bartlett and Youd (1992a; 1992b), liquefaction-induced lateral spreading occurs on mild slopes of 0.3% to 5% underlain by loose sand and shallow water. The geologic conditions conducive to lateral spreading (gentle surface slope, shallow water table, and liquefiable cohesionless soils) are frequently found along streams and other waterfronts in recent alluvial or deltaic deposits, as well as in loosely-packed, saturated, sandy fills.

In our opinion, the potential for lateral spreading does not exist because it appears that there is no continuous layer of liquefiable soil and stream/water course at the project site.

12.0 SCOUR EVALUATION

There is no significant drainage or flowing bodies of water passing through or adjacent to the site. Therefore, scour should not be a design concern and was not considered for foundation design.

13.0 CORROSION EVALUATION

The corrosion investigation for this project was performed on the selected samples from borings drilled in 2018 in general accordance with the provisions of California Test Methods 417, 422 and 643. A summary of the corrosion test results is presented in the table below, and the test results are presented in Appendix III.

TABLE 9 - SUMMARY OF CORROSION TEST RESULT

Boring	Approx. Sample Depth (feet)	Minimum Resistivity (ohms-cm)	PH	Water-soluble Chloride (ppm)	Water-soluble Sulfate (ppm)
R-18-NO-101	16.0	1,630	7.3	6.0	135.6
R-18-SC-002	31.0	1,880	7.3	9.4	29.7

According to the Section 10.7.5. of the AASHTO LRFD Bridge Design Specifications (BDS) – Sixth Edition (2012) with Caltrans Amendment, the following soil, water or site conditions shall be considered as indicators of potential pile corrosion or deterioration:

- Minimum resistivity equal to or less than 1,000 ohm-cm,
- Chloride concentration equal to or greater than 500 ppm,
- Sulfate concentration equal to or greater than 2,000 ppm,
- pH equals to or less than 5.5
- Landfills and cinder fills,
- Mines or industrial drainage,
- Suspected chemical wastes, and
- Stray currents.

Per Caltrans Corrosion Guidelines (Version 3.0, March 2018), Caltrans considers a project site to be corrosive for structural elements if one or more of the following conditions exist for the representative soil and/or water samples taken at the project site:

- Chloride concentration equal to or greater than 500 ppm, or
- Sulfate concentration equal to or greater than 1,500 ppm, or
- pH equals to or less than 5.5.

Therefore, the on-site soil materials should be non-corrosive according to the criteria above.

14.0 GEOTECHNICAL RECOMMENDATIONS

14.1 General

No major adverse condition was noted for the planned retaining wall provided the recommendations presented in this report are incorporated into the final design and construction. Retaining wall plans should be reviewed by PARIKH prior to finalizing the plans to see that the intent of our recommendations is included in the plans.

This report was prepared specifically for the proposed project according to the plans provided to us. Normal construction procedures were assumed throughout our analysis and represent one of the bases of recommendations presented herein. Our design criteria have been based upon the materials and subsurface soil conditions encountered in the soil borings at the project site. Therefore, we should be notified in the event that these conditions are changed, so as to modify or amend our recommendations.

14.2 Earthwork and Grading

All grading operations should be performed in accordance with the project specifications and Caltrans Standard Specifications for Earthwork (Section 19). A representative from PARIKH or regulating agency should observe all excavated areas during grading and perform moisture and density tests on prepared subgrade and compacted fill materials.

15.0 GEOTECHNICAL RECOMMENDATIONS FOR RETAINING WALL

15.1 Description of the Recommended Retaining Wall 1

The proposed Retaining Wall No. 1 is along the westbound Blossom Hill Road (between "RW1" Station 506+80.00 and "RW1" Station 510+25.86) before the Abutment 3 of the

Blossom Hill Road OC. This retaining wall is to retain vertical cut of the existing slope on the north side of the Blossom Hill Road due to the lower of the NB101 On-Ramp and the construction of the NB101 On-Ramp POC. The anticipated total wall length is approximately 345.86 feet with maximum design height of approximately 19.96 feet.

15.2 Description of External Loads (Surcharge)

The external load acting on the proposed Retaining Wall No. 1 is the surcharge load with a varying magnitude depending on the retained wall height in accordance with AASHTO Table 3.11.6.4-2 acting uniformly in vertical direction behind the retaining wall.

15.3 Susceptibility of Foundation Material to Erosion

Based on the available boring data, the surficial soils generally consist of clayey and sandy soils. The project site is not near water body. Therefore, the foundation soils along the wall alignment are not likely to be susceptible to erosion. The project civil/drainage designer should verify the aspect.

15.4 Surface and Subsurface Drainage Systems

There is a dike on the edge of the shoulder that directs the roadway drainage into inlets located west of the retaining wall. Between the face of the wall and roadway, the runoff from the 2(H): 1(V) slope drains towards and flows along the dike combining with the roadway runoff. Along the back of the wall, the runoff from the slope drains away from the wall and into an existing earthen swale. This runoff is then flows into an existing inlet and ultimately discharges through an existing outfall in Coyote Creek.

15.5 Recommended Design Parameters for Soil Nail Wall

Based on the boring data of Boring R-18-NO-101 in the vicinity of the proposed wall, the subsurface soil conditions generally consist of medium dense clayey sand/silty sand, underlain by soft to medium stiff lean/fat clay and silt. Based on Boring R-18-SC-002 in the vicinity of Boring R-18-NO-101, medium dense clayey sand was encountered from 220 feet to 226 feet. The soil parameter for Elev. 220 feet to Elev. 226.0 feet from Boring R-18-SC-002 can be the assumed to be the same as that for Elev. 210 feet to Elev. 220 feet from Boring R-18-NO-101. Groundwater was measured at the depth of 14 feet at Elevation 206.0 feet during drilling in September 2018.

The ultimate bond strengths were estimated with reference to "Soil Nail Walls", published by Federal Highway Administration (Geotechnical Engineering Circular No. 7, Report No.: FHWA-NHI-14-007, 2015) (hereinafter referred to as "FHWA Report").

The recommended design strength parameters for the soils encountered at the site for the proposed soil nail wall are shown in the table below:

TABLE 10 - SUMMARY OF SOIL PROPERTIES FOR SOIL NAIL WALLS

Elevation (ft.)	Unit Weight (pcf)	Friction Angle (degrees)	Cohesion (psf)	Ultimate Bond Strength, q_u (psi)
226.38-210.00	125	33	150	9
210.00-206.00	125	38	50	9
206.00-197.00	125	27	150	9
197.00-192.00(1)	125	28	50	9
192.00-181.00	125	28	50	9

(1) Bond strength = 4 psi should be used under seismic condition with potential liquefaction.

Surcharge (when applicable) = Extra 2 feet of soil with a unit weight of 125 lb/ft^3. A measured groundwater elevation of +206 feet has been used in the analysis.

In addition to the above parameters, the design of the soil nail wall should be in accordance with "FHWA Publication". Based on this publication, bond strength reduction factor (BSRF) should be applied (to the bond strength) and a minimum Pullout Safety Factor (FS_p) of 2.0 should be achieved for the soil nails.

A seismic coefficient of 0.204 g (one-third of the anticipated PGA of 0.612 g) is recommended for pseudo-static analyses under seismic loading condition.

Recommended Design Parameters

The recommended design parameters are summarized in the table below:

TABLE 11-SUMMARY OF RECOMMENDED DESIGN PARAMETERS

Drilled-hole Diameter	6 inches
Soil Nail Inclination	15° from horizontal
1st Soil Nail Row	2.5 feet from the top of excavated face
Soil Nail Spacing	5 feet for both horizontal and vertical spacing. Minimum vertical spacing of 2 feet cam be used.
Nail Bar Diameter and Grade	No. 8 and Grade 75 bar
Soil Nail Minimum Length	Controlled by the "Embedment Length" from the internal stability checked by the structural designer
Design Nail Pullout Resistance (Q_d) (lb/foot)	Based on the ultimate bond strength as shown in Table 10

15.6 Bearing Capacity of Soil Nail Wall

The following are the estimated bearing capacities available for the foundation design of the soil nail wall. The calculations are presented in Appendix IV.

TABLE 12-SUMMARY OF RECOMMENDED BEARING CAPACITY

Undrained Shear Strength/Friction Angle Used in Analyses (psf)	Bearing Capacity (ksf)		
	Extreme Event Limit State (ϕ=1.00)	Strength Limit State (ϕ=0.55)	Service Limit State
ϕ'=35°, c'=0 psf	7.3	4.4	3.2

15.7 Global Stability

The global stability of the soil nail wall and the slope was evaluated under the static long-term drained condition and pseudo-static condition. Global stability analyses were performed using a commercial software "Slope/W 2012" Program with Spencer Method by Geo-Slope International. Slope stability analyses was developed based on the slope geometries and boring logs.

a) Effective strength parameters were assumed for the clayey soil under the long-term condition. Undrained strengths were assumed for the clayey soil under "Pseudo-Static" conditions.

b) The undrained strength and long-term effective strength parameters were based on field exploration and laboratory strength tests performed by PARIKH in 2018, empirical correlation and engineering judgment. The field and laboratory test data include standard penetration tests and strength tests. The assumed effective strength parameters of cohesive soil, apparent cohesion c' are generally between 50 psf and 500 psf as recommended by Lamb and Whitman (1969).

c) Traffic load or live load surcharge of 250 psf on the back of the soil nail wall is recommended.

d) Earthquake loading conditions were modeled by using a seismic loading coefficient for pseudo-static analysis. Per Caltrans "Guidelines for Foundation Investigations and Reports", pseudo-static analyses were performed using a seismic coefficient equal to one third of the horizontal peak ground acceleration.

e) The slip surface does not intersect the proposed soil nail in the global stability analyses.

f) A minimum factor of safety of 1.5 is required for the static condition and 1.1 is required for the pseudo-static condition.

The factors of safety obtained from the global stability analyses are summarized in Table 13.

TABLE 13 –GLOBAL STABILITY ANALYSES SUMMARY OF FACTOR OF SAFETY

Number of Row of Nail	Maximum Wall Height (ft)	Calculated Minimum Factor of Safety	
		Static Condition (Long-term)	Pseudo-static Condition
1	7.9	1.88	1.83
2	10.8	1.87	1.59
3	16.2	1.75	1.34
4	19.9	1.66	1.17
5	19.96	1.76	1.10

Based on the result of the stability analyses, the proposed soil nail wall has adequate factors of safety.

The results of the global stability analyses are included in Appendix IV.

15.8 Internal Drainage

No hydrostatic pore pressure should be allowed to buildup and geocomposite drain is recommended behind the soil nail walls. Two feet wide strip of geocomposite drain is recommended behind the soil nail wall for drainage. The maximum spacing of the geocomposite drain should be at 5 feet center to center.

15.9 Seismic Lateral Earth Pressure

The proposed retaining wall will experience increased lateral loads during earthquake shaking. The design needs to consider seismic event per the AASHTO LRFD (Sections 11.9.6 & 11.8.6). The additional horizontal forces recommended to simulate earthquake loads are dependent upon the magnitude of ground surface accelerations and the retained height of the retaining wall, together with the weight and type of material retained by the retaining walls. In general, the pseudo-static approach developed by Mononobe and Okabe (M-O) may be used to estimate the equivalent static force using a seismic coefficient K_h = 1/3 * Peak Ground Acceleration (PGA) per "Caltrans Geotechnical Manual (Mechanically Stabilized Embankment)". According to Appendix A11.1.1.1 (California Amendment), the seismic incremental lateral earth pressure is assumed to have triangular distribution over wall height. Per Caltrans ARS Online, the anticipated PGA at the project site is about 0.612 g. Therefore, a K_h value of 0.204 g was used to evaluate the seismic lateral earth pressure. For overall project design, a seismic incremental lateral load of $22.2 * H^2$ lb per foot of wall (H is retained backfill height in feet) is recommended. The resultant force from the incremental seismic lateral earth pressure is triangularly distributed acting one-third of the retained height (H in ft) per California Amendments.

The calculations of seismic lateral earth pressure are included in Appendix IV.

15.10 Lateral Earth Pressure Due to Abutment 1 Pile on Soil Nail Wall

The foundation pile of Abutment 1 of NB 101 POC will be behind the soil nail wall. The soil nail wall in front of the CIDH concrete piles of Abutment 1 will be subject to additional lateral pressure due to the seismic deflection of the CIDH concrete under the seismic loading condition.

The relative geometry of the soil nail wall and Abutment 1 of the NB 101 POC, the soil reaction of the Abutment 1 CIDH concrete pile provided by Biggs Cardosa Associates and the calculations for the lateral pressure exerted on the soil nail wall are included in Appendix IV.

15.11 Soil Nail Wall Deflection

The maximum soil nail wall deflection is estimated to be in the order of 0.9 inches provided the soil nail wall is properly constructed with staged construction for excavation and installation of soil nail etc. For the passive earth retaining system, enough deflection at the top of the retaining wall is required for the earth retaining system to be designed in an active condition. The estimated wall deflection, 0.9 inches, is based on the soil type and the wall height and does not depend on the live load surcharge since the live load surcharge is assumed to be negligible. This estimated deflection should be considered acceptable for the soil nail wall of this project.

16.0 CONSTRUCTION CONSIDERATIONS

General

To a degree, the performance of any structure is dependent upon construction procedures and quality. Hence, observation of foundation construction should be carried out by the responsible Agency. If the encountered subsurface conditions differ from the basis of our recommendations, Parikh should be informed in order to assess the need for design changes. Therefore, the recommendations presented in this report are contingent upon good quality control and these geotechnical observations during construction.

Prospective contractors for the project must evaluate construction-related issues on the basis of their own knowledge and experience in the local area, on the basis of similar projects in other localities, or on the basis of field investigation on the site performed by them, taking into account their own proposed construction methods and procedures. In addition, construction activities related to excavation and lateral earth support must conform to safety requirements of OSHA and other applicable municipal and State regulatory agencies.

Existing Utilities

a) A safe working distance from underground and overhead utilities should be provided during construction work. If this is not possible, the utility lines may need to be cleared from the site before the start of construction work.

Excavations

b) The soil nail wall should be constructed by the "Top-Down Construction Method". That is the soil will be installed during the excavation. Traffic load during construction/live load surcharge should be kept at a minimum distance of 10 feet away from the soil nail wall.

c) Based on the available boring data, the subsurface soil conditions at the project site consist of medium dense sand, underlain by soft to medium stiff lean/fat clay and silt. No cobbles and/or cobbles were encountered in the field exploration performed in 2018. In our opinion, conventional equipment could be used to excavate on-site soil materials. It is possible that unknown old buried utilities or abandoned structures, concrete rubble etc. may be encountered during excavation. This might require special equipment and additional efforts to remove these buried objects or obstructions.

   Excavations should not be expected to stand vertically without any support. According to OSHA Safety Standards, temporary excavations with personnel working within the excavations should be sloped or shored if the excavations are deeper than 5 feet. All temporary excavations should be made and supported in accordance with California OSHA Safety Standards.

   The slope height, inclination, and excavation depths should not exceed those specified in local, state, or federal safety regulations. The design of the temporary slopes by the contractor or his specialty subcontractor should conform to the OSHA's "Guidelines for Excavations and Temporary Sloping". The contractor or responsible subcontractor should develop their design based on the existing soil/site condition and subsurface soil conditions exposed at the time of construction.

   For excavations up to 20 feet deep in homogenous soils, OSHA guidelines state that the maximum allowable slope should be 3/4H: 1V, 1H:1V and 1-1/2H:1V for Types A, B and C soil, respectively (In general, Type A soils are stronger; Type B soils are intermediate, and Type C soils are weaker). Based on our evaluation of the materials encountered in our borings and the borings previously performed by others, the native soil on site should be considered as OSHA Type C soil. All un-shored slopes less than 20 feet deep should be excavated to inclination no steeper than 1-1/2H: 1V unless shored with applicable safety standard. It should be noted that the slope ratios recommended by OSHA are for temporary, un-surcharged slopes. Traffic and surcharge loads should be kept back at least 15 feet from the top of the excavations unless they are accounted for in the design of the support system. Exposed slopes should be kept moist (but not saturated) during construction. The temporary cut slopes discussed above assume that the groundwater is maintained below the bottom of excavation at all time during construction.

Strength softening, sloughing and erosion could be expected for the bare surficial soil materials if the temporary slopes are exposed to weather and rain for an extended period of time. Stiff clays also tend to develop soil creep due to seasonal change in moisture content resulting in sloughing. Therefore, adequate surface protection should be provided to protect the slope surface from erosion, excessive drying and/or saturation during construction.

Others

d) Due to sand, gravel and soft soil conditions encountered in the boring, drilling for the soil nails may experience cave-in conditions and it would be difficult to maintain the holes open. Also, special measures such as "Initial Shotcrete" may be required to prevent sloughing of the face during construction.

e) Caltrans specifications for soil nail and stability test for cut prior to construction are recommended. The strength of the soil nails shall be verified during construction using proof tests on nails. Appropriate drainage shall be provided behind the soil nail walls. The facing should be reinforced and shotcreted expeditiously. The contractor should make his own interpretation regarding constructability of the nails. Proper quality control by the contractor and appropriate inspections and testing should be implemented.

17.0 NOTES TO DESIGNER

The design loads and the configuration of the structure were provided by the structural designer. Should the loads exceed the ones provided in the tables given in this report or changes in the structure configuration, the Geotechnical Engineer must be contacted for further recommendations.

18.0 PLAN REVIEW

This report is prepared for the proposed "Blossom Hill Road Interchange Improvement – Retaining Wall No. 1". We recommend that final plans for the proposed project to be reviewed by PARIKH prior to construction so that the intent of our recommendations is included in the project plans and specifications and to further see that no misunderstandings or misinterpretations have occurred. However, design-build elements should be reviewed only from overall compliance standpoint.

19.0 CONSTRUCTION OBSERVATION

To a degree, the performance of any structure is dependent upon construction procedures and quality control measures. Hence, geotechnical observation and testing of grading operations, and foundation excavations should be carried out by the Geotechnical Engineer. If the subsurface conditions different from those forming the basis of our recommendations are encountered, this office should be informed in order to assess the need for design changes. Therefore, the recommendations presented in this report are contingent upon good quality control and these geotechnical observations during construction.

20.0 INVESTIGATION LIMITATIONS

Our services consist of professional opinions and recommendations made in accordance with generally accepted geotechnical engineering principles and practices and are based on our site reconnaissance and the assumption that the subsurface conditions do not deviate from observed conditions. All work done is in accordance with generally accepted geotechnical engineering principles and practices. No warranty, expressed or implied, of merchantability or fitness, is made or intended in connection with our work or by the furnishing of oral or written reports or findings.

The scope of our services did not include any environmental assessment or investigation for the presence or absence of hazardous or toxic materials in structures, soil, surface water, groundwater or air, below or around this site. Unanticipated soil conditions are commonly encountered and cannot be fully determined by taking soil samples and excavating test borings; different soil conditions may require that additional expenditures be made during construction to attain a properly constructed project. Some contingency fund is thus recommended to accommodate these possible extra costs.

This report has been prepared for the proposed project as described earlier, to assist the engineer in the design of this project. In the event any changes in the design or location of the facilities are planned, or if any variations or undesirable conditions are encountered during construction, our conclusions and recommendations shall not be considered valid unless the changes or variations are reviewed and our recommendations modified or approved by us in writing.

This report is issued with the understanding that it is the designer's responsibility to ensure that the information and recommendations contained herein are incorporated into the project and that necessary steps are also taken to see that the recommendations are carried out in the field.

The findings in this report are valid as of the present date. However, changes in the subsurface conditions can occur with the passage of time, whether they are due to natural processes or to the works of man, on this or adjacent properties. In addition, changes in applicable or appropriate standards occur, whether they result from legislation or from the broadening of knowledge. Accordingly, the findings in this report might be invalidated, wholly or partially, by changes outside of our control.

Respectfully submitted,
PARIKH CONSULTANTS, INC.

Alston Lam, P.E., G.E. 2605
Project Engineer

Y. David Wang, Ph.D., P.E., 52911
Senior Engineer

T:\Ongoing Projects\2016\2016-146-RW1 (Retaining Wall No. 1 Soil Nail Wall)\FR (Final) (Words)\Blossom Hill Road IC Improvement Project RW 1 FR (10-2019).DOCX

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	SCI	101	R28.4/R28.9		

REGISTERED STRUCTURAL ENGINEER DATE

PLANS APPROVAL DATE

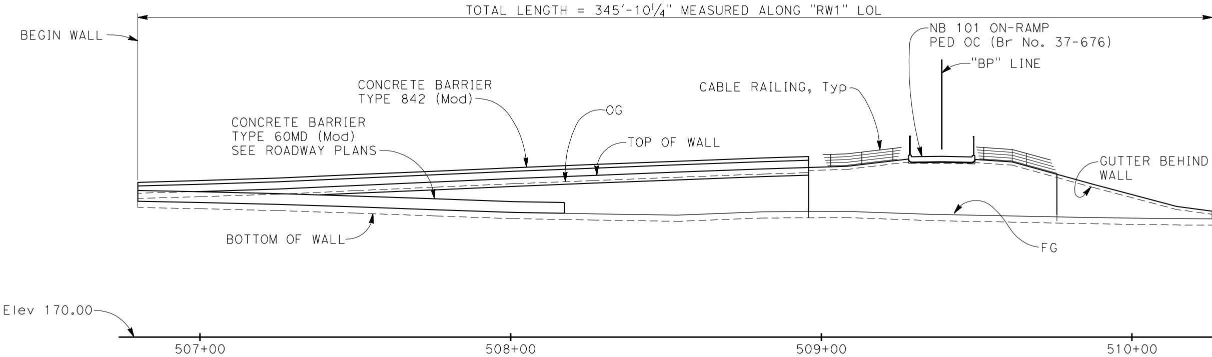
REGISTERED PROFESSIONAL ENGINEER MAHVASH M. HARMS No. 2639 Exp. 12/31/20 STRUCTURAL STATE OF CALIFORNIA

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of scanned copies of this plan sheet.

CITY OF SAN JOSE DOT
200 E. SANTA CLARA St., 8th FLOOR
SAN JOSE, CA 95113

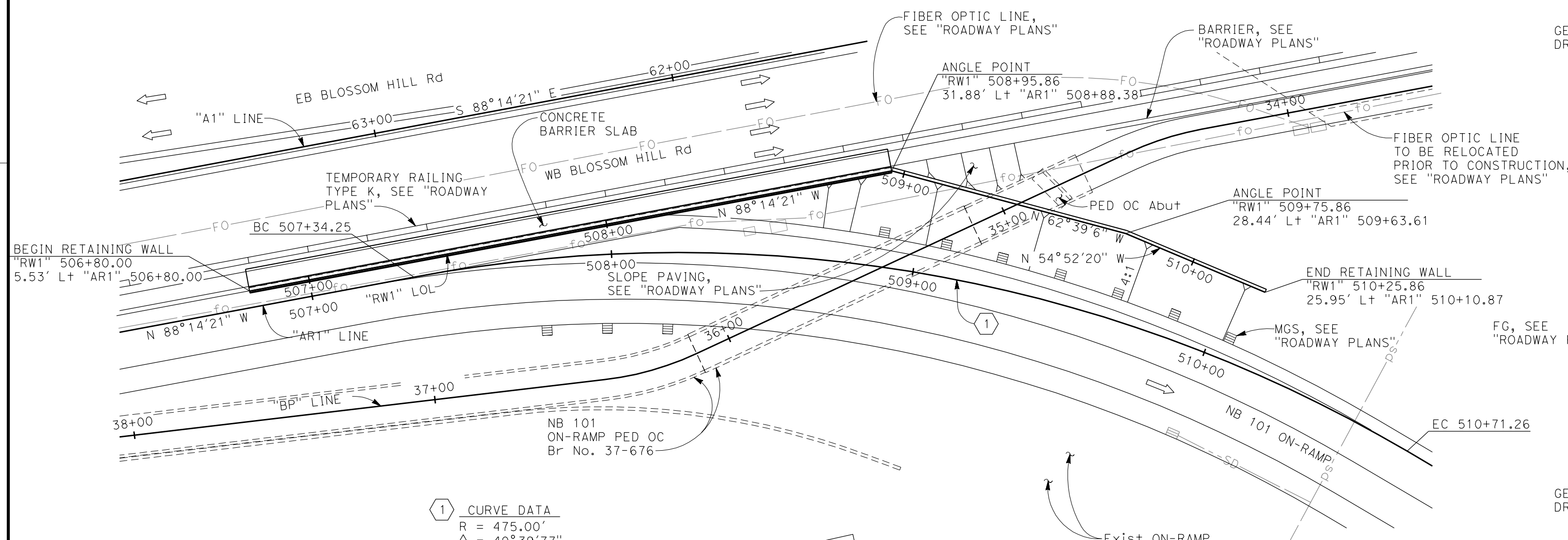
BIGGS CARDOSA ASSOCIATES INC.
865 THE ALAMEDA
SAN JOSE, CALIFORNIA 95126

FOR ACCURATE RIGHT OF WAY CONTACT
RIGHT OF WAY ENGINEERING AT THE DISTRICT OFFICE



DEVELOPED ELEVATION

1" = 20'



1 CURVE DATA
R = 475.00'
Δ = 40°39'77"
T = 175.95'
L = 337.01'

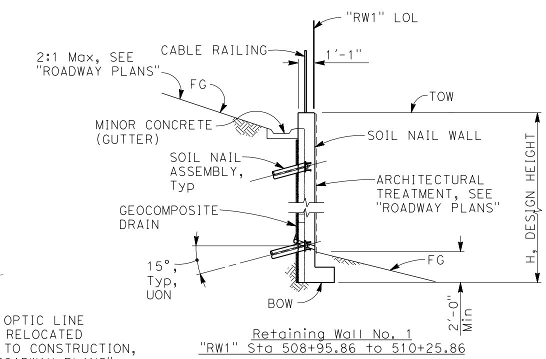
PLAN

1" = 20'

N

NOTES:
1. For "INDEX TO PLANS" and "GENERAL NOTES", see "GENERAL NOTES" sheet.
2. For bottom of wall elevations, see "SOIL NAIL LAYOUT No. 1" and "SOIL NAIL LAYOUT No. 2" sheets.
3. For top of wall elevations, see " Roadway Plans"
4. For utility information, see "Roadway Plans"

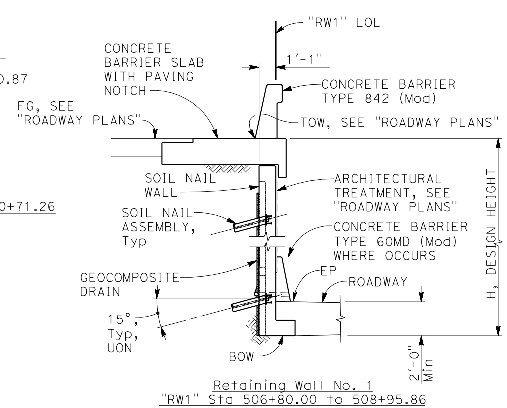
NOTE:
THE CONTRACTOR MUST VERIFY ALL CONTROLLING FIELD DIMENSIONS BEFORE ORDERING OR FABRICATING ANY MATERIAL



Retaining Wall No. 1
"RW1" Sta 508+95.86 to 510+25.86

TYPICAL SECTION

1/4" = 1'-0"



Retaining Wall No. 1
"RW1" Sta 506+80.00 to 508+95.86

TYPICAL SECTION

1/4" = 1'-0"

PLAN CHECK SET/NOT FOR CONSTRUCTION (9/19/19)

DESIGN OVERSIGHT	DESIGN	BY R. YAMANE	CHECKED D. ROZPORKA	LOAD & RESISTANCE FACTOR DESIGN		
	DETAILS	BY R. YAMANE	CHECKED J. ALCIATI	LAYOUT	BY G. KENNING	CHECKED J. ALCIATI
SIGN OFF DATE	QUANTITIES	BY K. HORWALD	CHECKED S. HABIBI	SPECIFICATIONS	BY G. KENNING	PLANS AND SPECS COMPARED A. NOTARO

PREPARED FOR THE
STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

G. KENNING
PROJECT ENGINEER

BRIDGE NO. 37E0125
POST MILES R28.61

RETAINING WALL No. 1-SOIL NAIL WALL
GENERAL PLAN

DESIGN GENERAL PLAN SHEET (ENGLISH) (REV. 7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0000
PROJECT NUMBER & PHASE: 04160002241 CONTRACT NO.: 04-1K2804

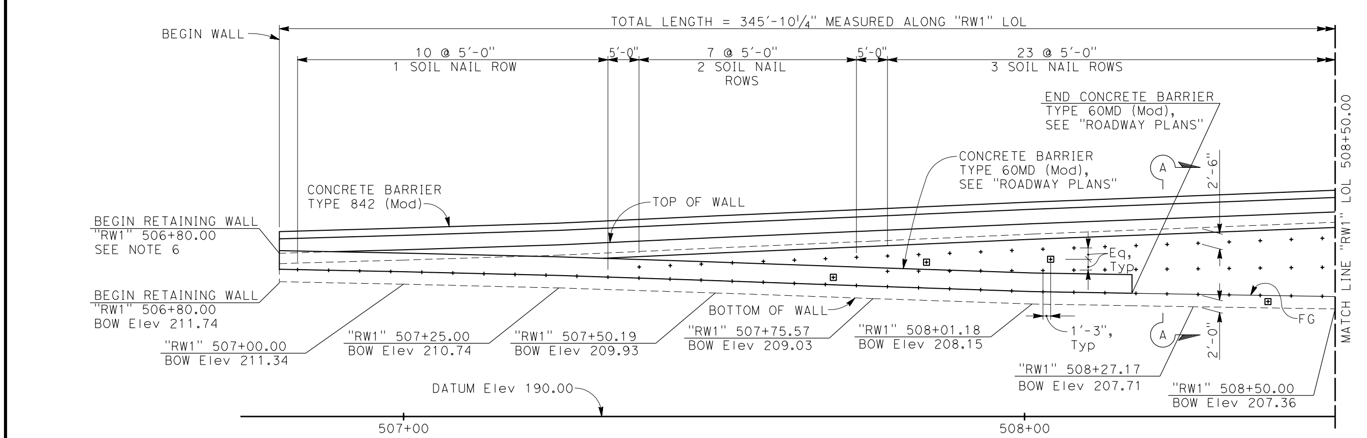
DISREGARD PRINTS BEARING EARLIER REVISION DATES → REVISION DATES 7/11/18 12/5/18 4/17/19

SHEET 1 OF 10

FILE => $REQUEST

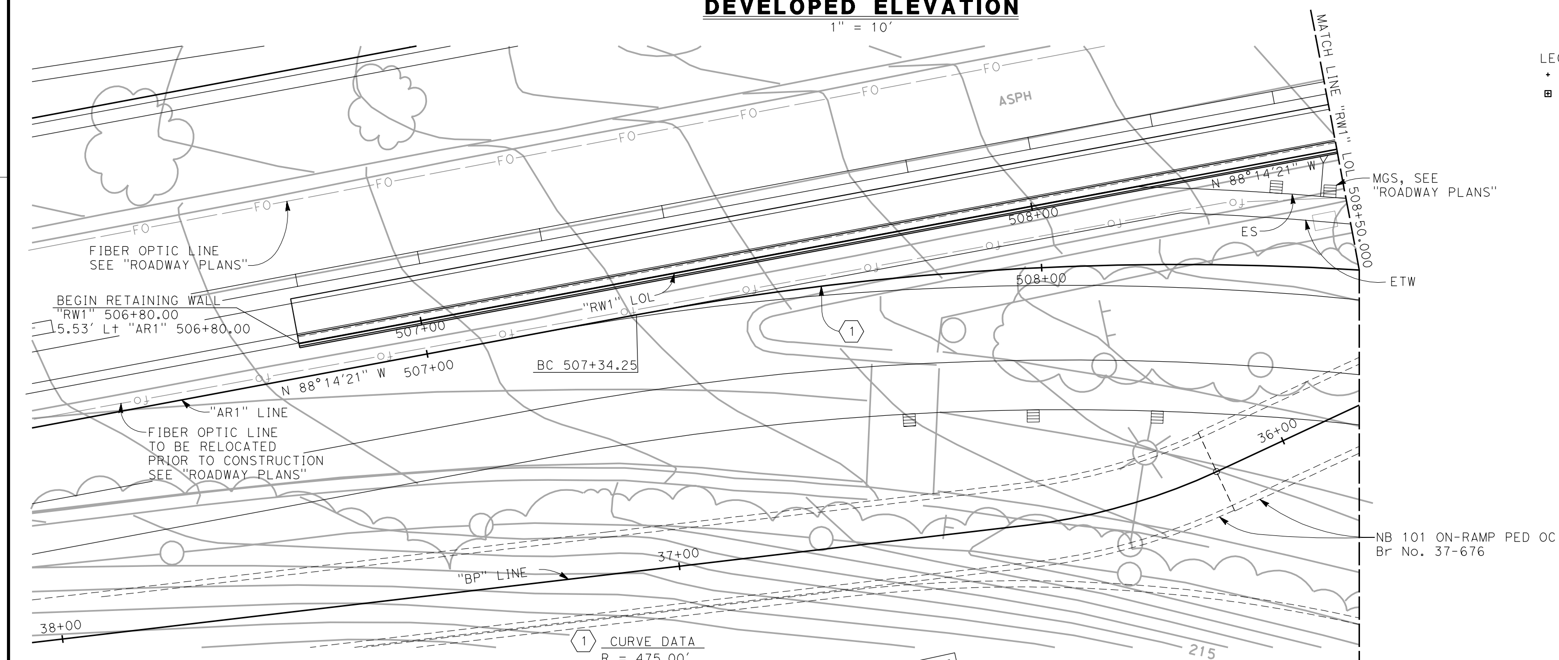
USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

2016309 (2016309R1S1)



DEVELOPED ELEVATION

1" = 10'



1 CURVE DATA
R = 475.00'
Δ = 40°39'77"
T = 175.95'
L = 337.01'

PLAN

1" = 10'

NOTE:
THE CONTRACTOR MUST VERIFY ALL CONTROLLING FIELD DIMENSIONS BEFORE ORDERING OR FABRICATING ANY MATERIAL

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	SCI	101	R28.4/R28.9		

REGISTERED STRUCTURAL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
MAHVASH M. HARMS
No. 2639
Exp. 12/31/20
STRUCTURAL
STATE OF CALIFORNIA

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CITY OF SAN JOSE DOT
200 E. SANTA CLARA St., 8th FLOOR
SAN JOSE, CA 95113

BIGGS CARDOSA ASSOCIATES INC.
865 THE ALAMEDA
SAN JOSE, CALIFORNIA 95126

NOTES:
1. Maximum vertical spacing of soil nails = 5'-0". Minimum vertical spacing of soil nails = 2'-0".
2. Soil nail horizontal spacing measured along "RW1" LOL.
3. Top and bottom of wall profiles are linear between points shown.
4. Maximum excavation lift height = 5'-0".
5. For "SECTION A-A", see "SOIL NAIL WALL DETAILS No. 1" sheet.
6. SEE "ROADWAY PLANS", for top of wall elevations.

LEGEND:
- ✦ Indicates Soil Nail Assembly Location
- ⊞ Indicates Proof Test Soil Nail Location. Location may be adjusted by the Engineer.

SOIL NAIL DATA TABLE

Number of Rows of Soil Nails	LE Embedment Length (ft)
1	24
2	25
3	33
4	37

PLAN CHECK SET/NOT FOR CONSTRUCTION (8/29/19)

	BY	CHECKED
DESIGN	R. YAMANE	D. ROZPORKA
DETAILS	R. YAMANE	J. ALCIATI
QUANTITIES	K. HORWALD	S. HABIBI

DESIGN OVERSIGHT

SIGN OFF DATE

PREPARED FOR THE
STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

G. KENNING
PROJECT ENGINEER

BRIDGE NO. 37E0125
POST MILES R28.61

RETAINING WALL No. 1-SOIL NAIL WALL
SOIL NAIL LAYOUT No. 1

DESIGN DETAIL SHEET (ENGLISH) (REV. 03/14/12)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS
0 1 2 3

UNIT: 0000
PROJECT NUMBER & PHASE: 04160002241
CONTRACT NO.: 04-1K2804

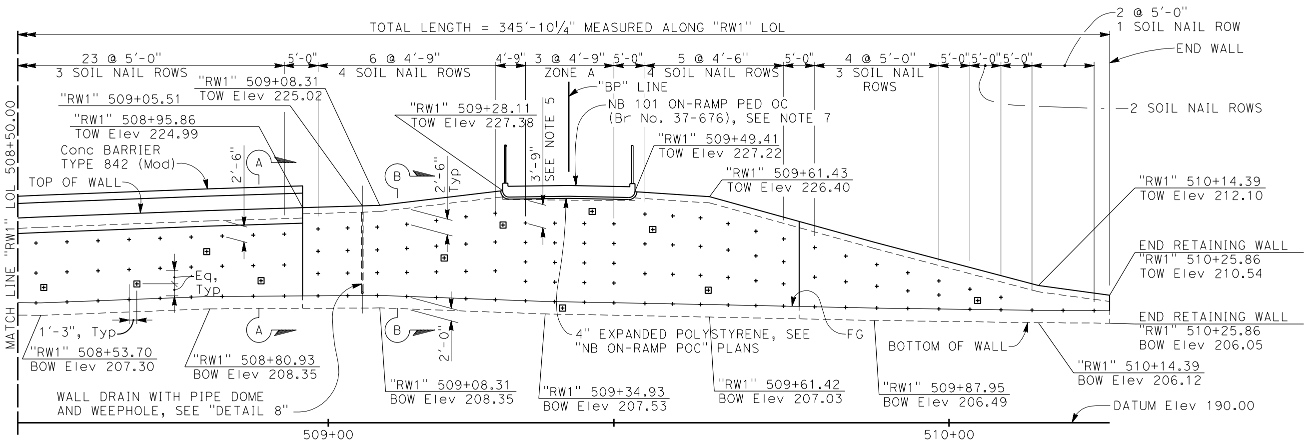
DISREGARD PRINTS BEARING EARLIER REVISION DATES
REVISION DATES 12/5/18 4/17/19

SHEET 3 OF 10

FILE => $REQUEST

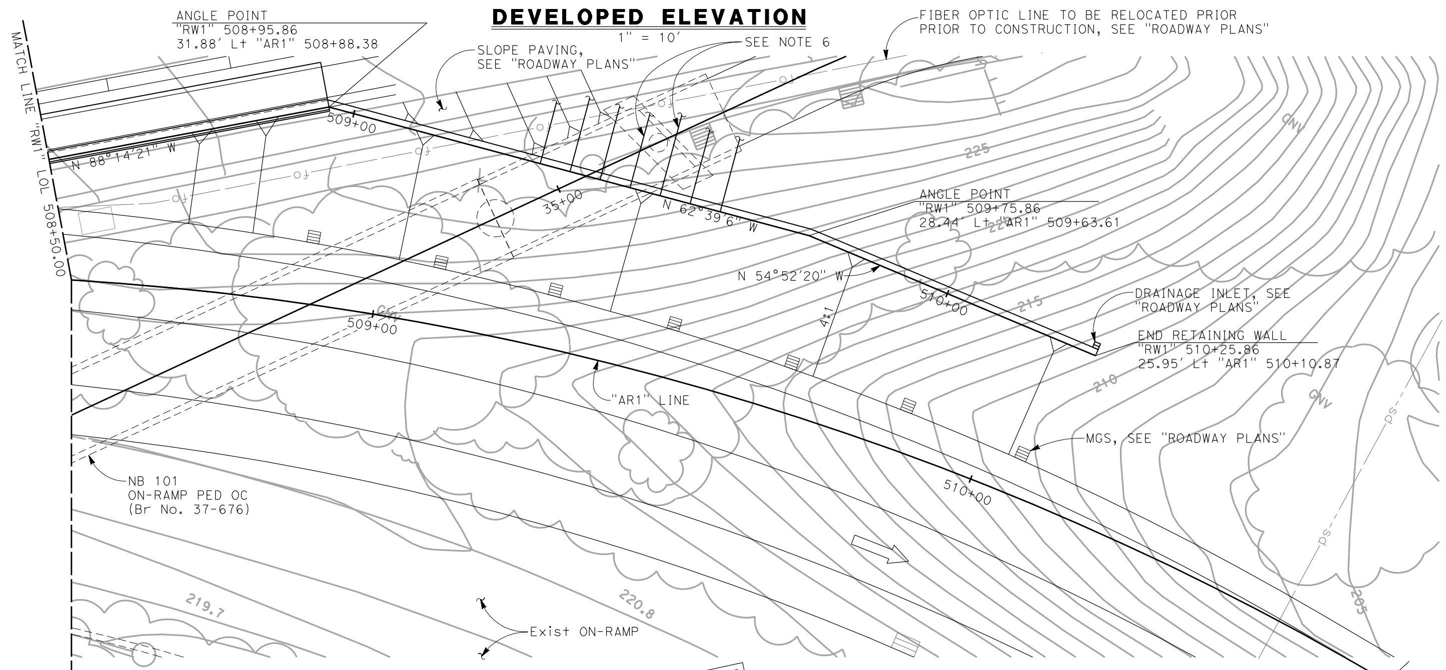
USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

2016309 (2016309R1S3)



DEVELOPED ELEVATION

1" = 10'



NOTE:
THE CONTRACTOR MUST VERIFY ALL CONTROLLING FIELD DIMENSIONS BEFORE ORDERING OR FABRICATING ANY MATERIAL

PLAN

1" = 10'

NOTES:
1. Maximum vertical spacing of soil nails = 5'-0". Minimum vertical spacing of soil nails = 2'-0".
2. Soil nail horizontal spacing measured along "RW1" LOL.
3. Top and bottom of wall profiles are linear between points shown.
4. Cable Railing not shown for clarity.
5. Under NB 101 On-Ramp PED OC edge distance from top of wall to top nail = 3'-9".
6. Maximum 10° horizontal skew to provide clearance to CIDH at Abutment 1 of NB 101 On-Ramp PED OC.
7. Contractor must field verify location of CIDH pile foundation prior to drilling soil nails.
8. For "SECTION A-A", see "SOIL NAIL WALL DETAILS No. 1" sheet.
9. For "SECTION B-B", see "SOIL NAIL WALL DETAILS No. 2" sheet.
10. For "DETAIL 8", see "SOIL NAIL WALL DRAIN DETAILS" sheet.
11. Maximum excavation Lift Height = 5'-0".

LEGEND:
+ Indicates Soil Nail Assembly Location
⊞ Indicates Proof Test Soil Nail Location. Location may be adjusted by the Engineer.

SOIL NAIL DATA TABLE

Number of Rows of Soil Nails	L_E Embedment Length (ft)
1	24
2	25
3	33
4	37
ZONE A (5)	37

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	SCI	101	R28.4/R28.9		

REGISTERED STRUCTURAL ENGINEER DATE

REGISTERED PROFESSIONAL ENGINEER MAHVASH M. HARMS No. 2639 Exp. 12/31/20 STRUCTURAL STATE OF CALIFORNIA

PLANS APPROVAL DATE

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BIGGS CARDOSA ASSOCIATES INC.
865 THE ALAMEDA
SAN JOSE, CALIFORNIA 95126

PLAN CHECK SET/NOT FOR CONSTRUCTION (8/29/19)

DESIGN OVERSIGHT

SIGN OFF DATE

	BY	CHECKED
DESIGN	R. YAMANE	D. ROZPORKA
DETAILS	R. YAMANE	J. ALCIATI
QUANTITIES	K. HORWALD	S. HABIBI

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

G. KENNING
PROJECT ENGINEER

BRIDGE NO. 37E0125
POST MILES R28.61

RETAINING WALL No. 1-SOIL NAIL WALL
SOIL NAIL LAYOUT No. 2

DESIGN DETAIL SHEET (ENGLISH) (REV. 03/14/12)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0000
PROJECT NUMBER & PHASE: 04160002241 CONTRACT NO.: 04-1K2804

FILE => $REQUEST

DISREGARD PRINTS BEARING EARLIER REVISION DATES → REVISION DATES 12/5/18 4/17/19

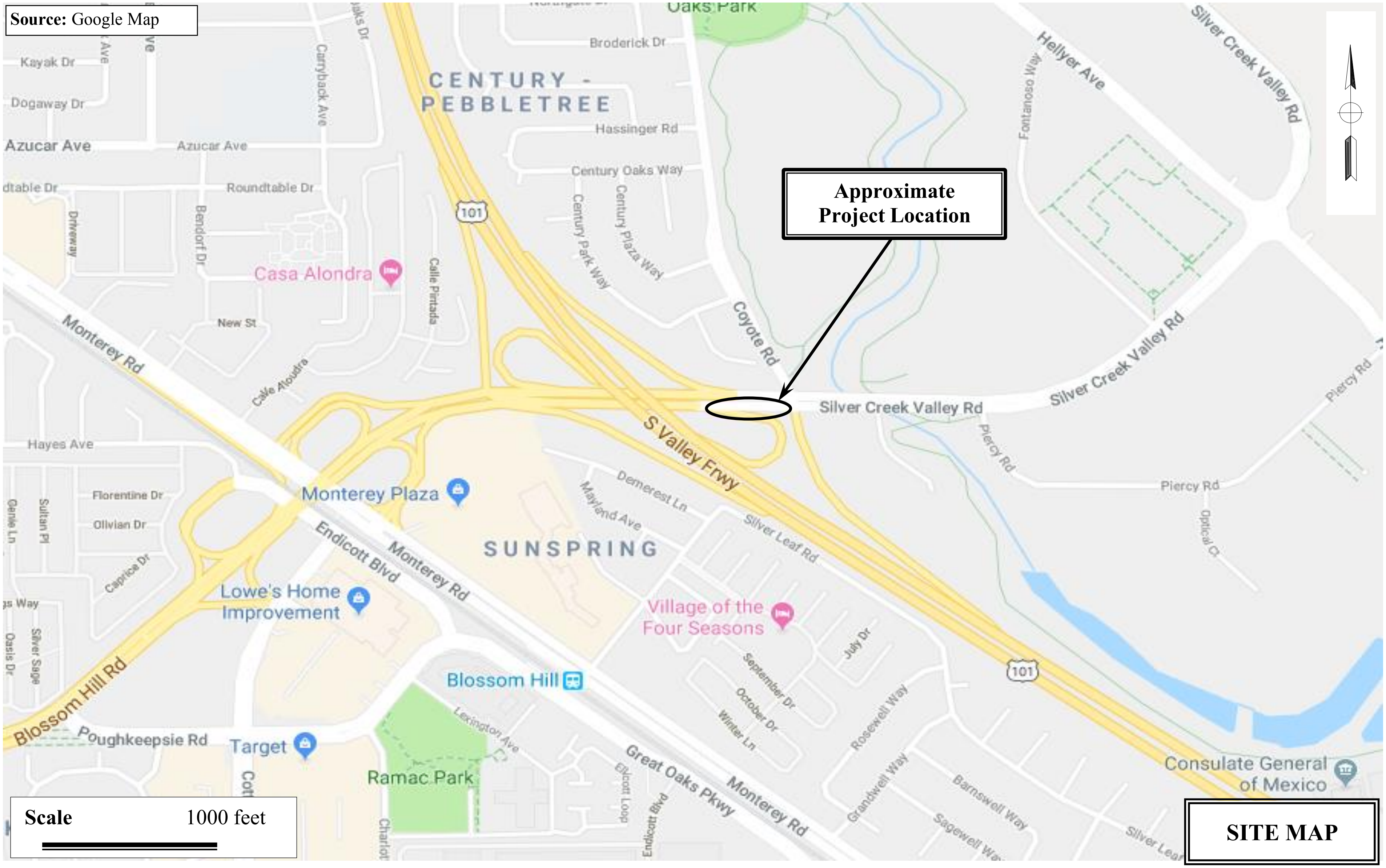
SHEET 4 OF 10

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

2016309 (2016309R1S4)

APPENDIX I

SITE MAP



RETAINING WALL NO. 1
SAN JOSE, CALIFORNIA

JOB NO.: 2016-146-RW1

PLATE NO.: I-1

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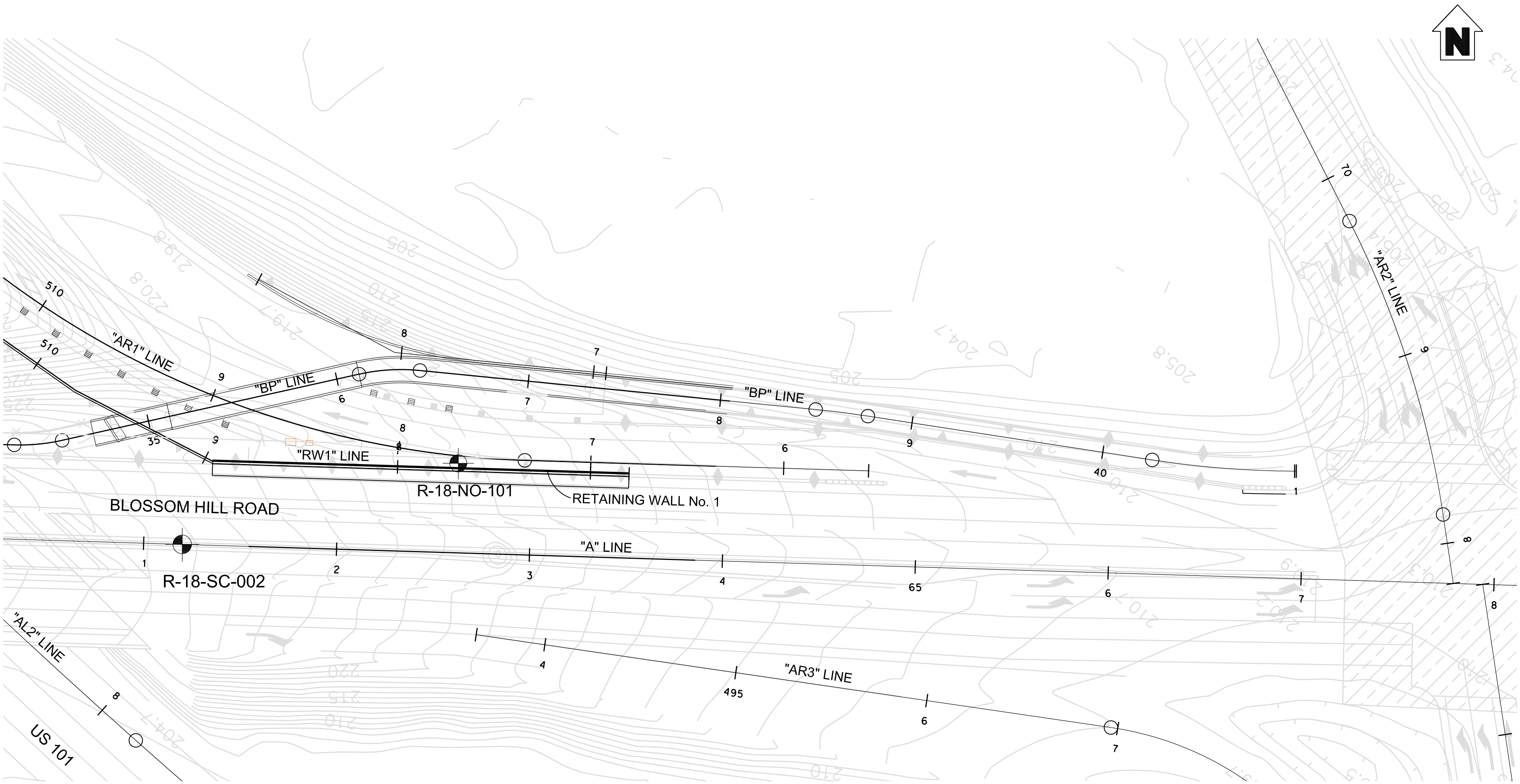

BORING LOCATION MAP

LEGEND

R-18-NO-101

Approx. Boring Location (Drilled by PARIKH in 2018)

SCALE: 1 inch = 100 feet

Note: All units are in feet unless otherwise specified
Reference Map was provided by HMH Engineers.

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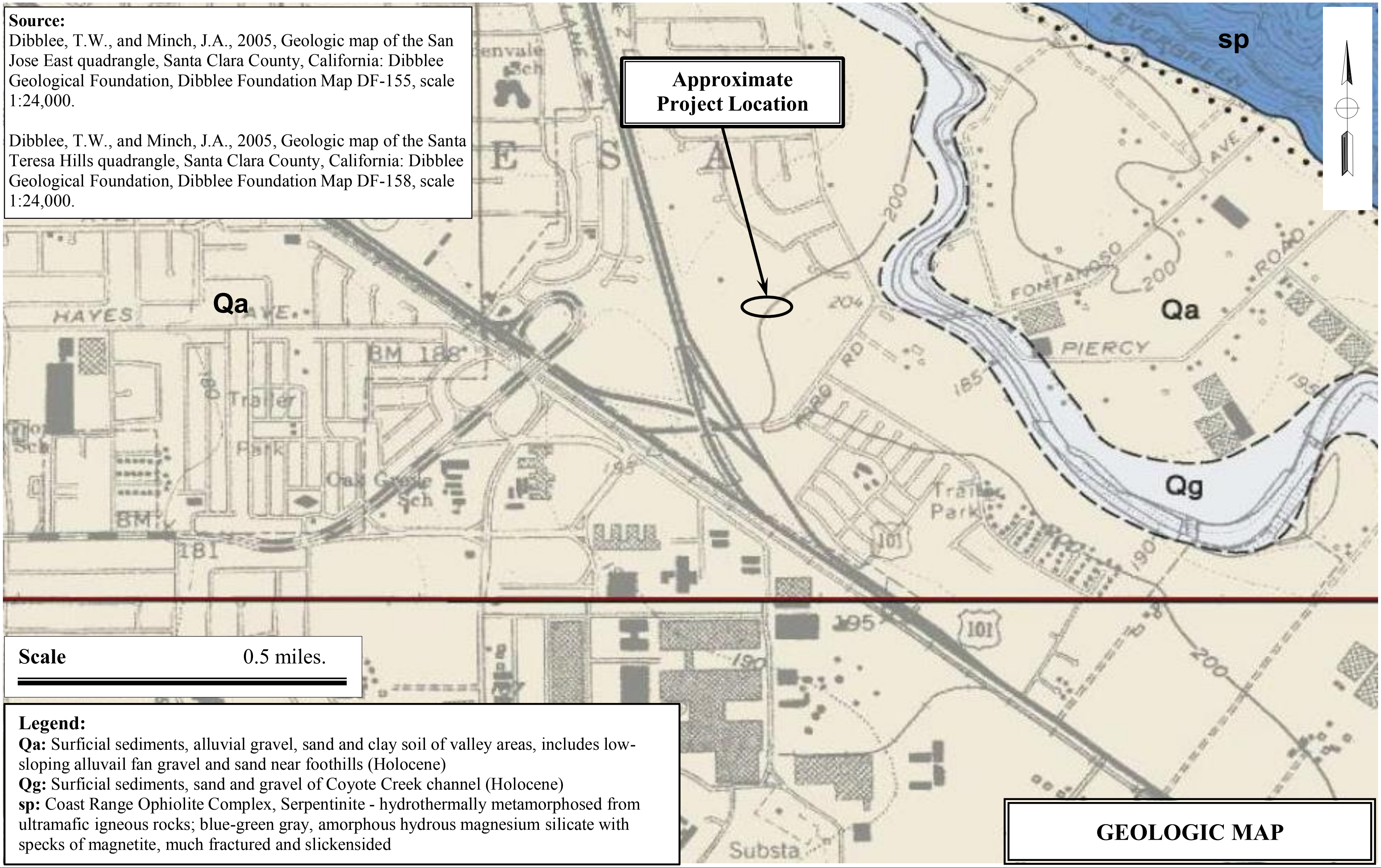
RETAINING WALL NO. 1
SAN JOSE, CALIFORNIA

JOB NO.:2016-146-RW1	PLATE NO: I-2

Source:
Dibblee, T.W., and Minch, J.A., 2005, Geologic map of the San Jose East quadrangle, Santa Clara County, California: Dibblee Geological Foundation, Dibblee Foundation Map DF-155, scale 1:24,000.

Dibblee, T.W., and Minch, J.A., 2005, Geologic map of the Santa Teresa Hills quadrangle, Santa Clara County, California: Dibblee Geological Foundation, Dibblee Foundation Map DF-158, scale 1:24,000.



Scale 0.5 miles.

Legend:
Qa: Surficial sediments, alluvial gravel, sand and clay soil of valley areas, includes low-sloping alluvail fan gravel and sand near foothills (Holocene)
Qg: Surficial sediments, sand and gravel of Coyote Creek channel (Holocene)
sp: Coast Range Ophiolite Complex, Serpentinite - hydrothermally metamorphosed from ultramafic igneous rocks; blue-green gray, amorphous hydrous magnesium silicate with specks of magnetite, much fractured and slickensided

GEOLOGIC MAP

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RETAINING WALL NO. 1
SAN JOSE, CALIFORNIA

JOB NO.: 2016-146-RW1 | **PLATE NO.: I-3**

APPENDIX II

LOG OF TEST BORINGS

APPENDIX II

FIELD EXPLORATION

All the test borings were drilled with a truck-mounted drill rig using 8-inch diameter hollow-stem auger and switched to rotary-wash drilling method with 3.3-inch diameter drilling bit. The soil samples were obtained from the borings during drilling at various depths by driving a 2.5 inches Inside Diameter (I. D.) Modified California Sampler or a 1.375 inches I.D. Standard Penetration Sampler (ASTM Test Method No. 1586). The sampler was driven into the subsurface soils under the impact of a 140 pounds hammer having a free fall of 30 inches. The blow counts required to drive the sampler for the last 12 inches are presented on the Logs of Test Borings, Appendix II. (When correlating standard penetration data in similar soils, the blow counts for the Modified California sampler can be converted to equivalent Standard Penetration Test sampler by multiplying a factor of 0.65). Pocket penetration tests were also performed on clay samples to evaluate their consistency. Upon completion of drilling, the boreholes were backfilled with cement grout.

The borings were drilled under the technical supervision of our engineers, who classified and continuously logged the soils encountered during drilling and supervised the collection of soil samples at various depths for visual examination and laboratory testing. The soil samples were visually classified in the field according to the Caltrans "Soil and Rock Logging, Classification and Presentation Manual" (2010 Edition) and then transported to our laboratory for further evaluation and testing.

The descriptions of the soils encountered and relevant boring information are presented on the Log of Test Borings attached in Appendix II. The laboratory test methods and results are presented in Appendix IV. The logs presented in Appendix II were prepared from the field logs which were edited after visual re-examination of the soil samples in the laboratory and results of classification tests on selected soil samples as indicated on the logs.

The descriptions and related information presented on these logs of test borings depict subsurface conditions only at the locations indicated on the plan and on the particular date noted on the logs. Because of the variability from place to place within soil/rock in general, subsurface conditions at other locations may differ from conditions occurring at the location explored. The abrupt stratum changes shown on the logs may be gradational and relatively minor changes in soil types within a stratum may not be noted on the logs due to field limitations. Also, the passage of time may result in a change in the soil conditions at these locations due to environmental changes.

LOG OF TEST BORINGS
(BORING R-18-NO-101)

NOTES:

Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2" Modified California Sampler: I.D. = 2.5"; O.D. = 3" Hammer Assembly: A 140 lb hammer with a 30" drop (Automatic Hammer)

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock, Logging, Classification, and Presentation Manual (2010)

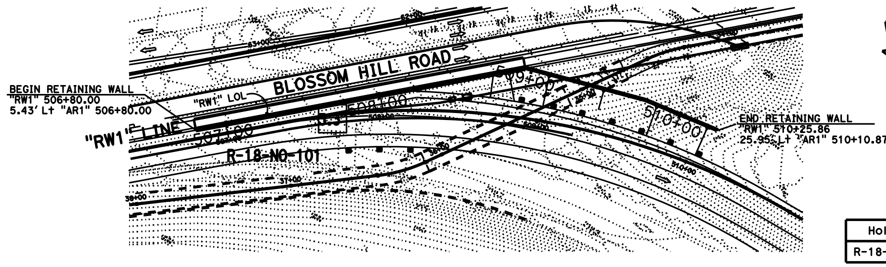
See Caltrans 2015 Standard Plans A10F, A10G and A10H for Soil and Rock Legend.

All dimensions are in feet unless otherwise shown

BENCH MARK:

NGS QQ453 (HS 2787)
Elev. 190.83
4.7 miles northwest along the southern Pacific Company Railroad from the station at Coyote.

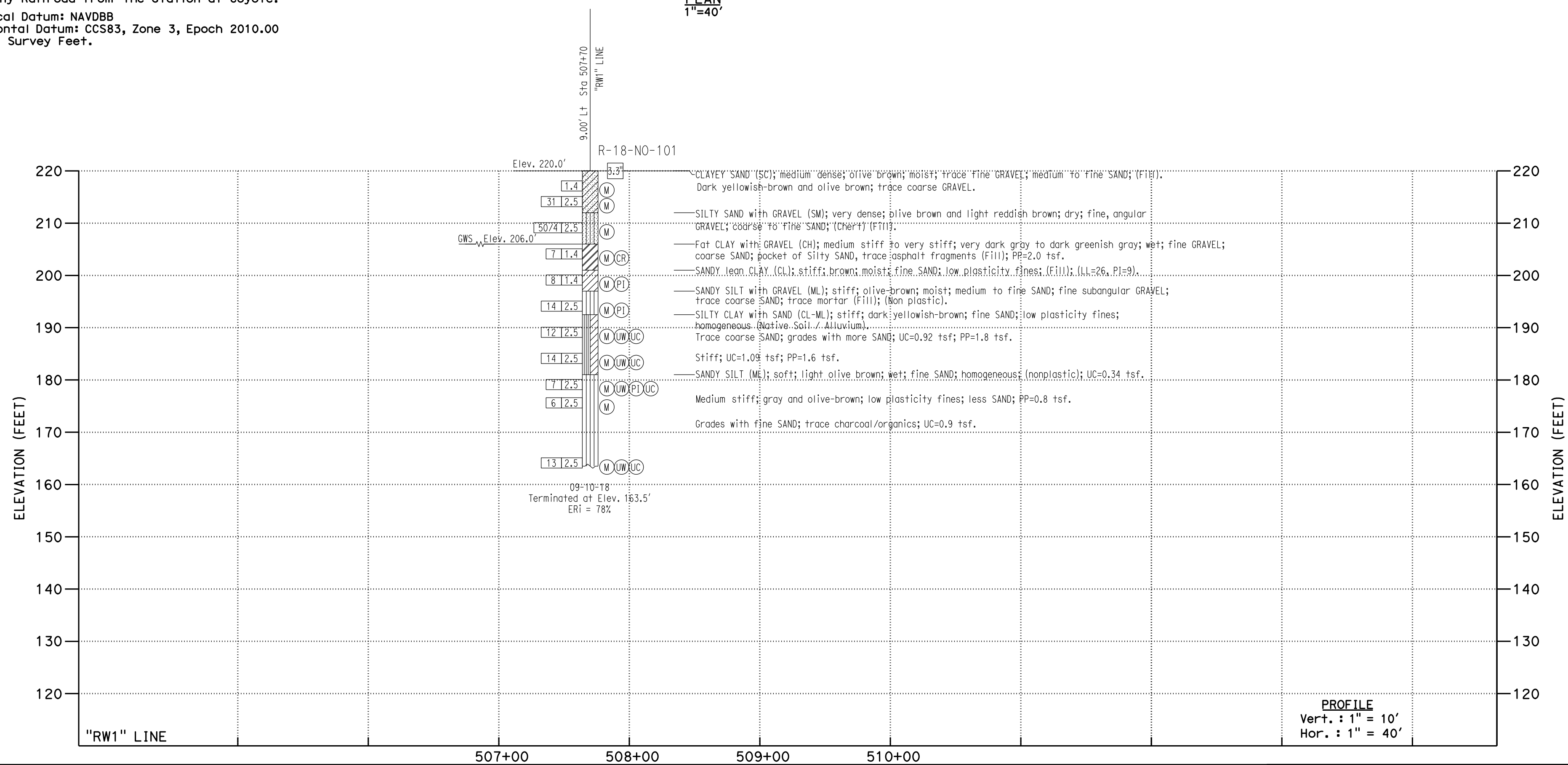
Vertical Datum: NAVDBB
Horizontal Datum: CCS83, Zone 3, Epoch 2010.00 in U.S Survey Feet.



PLAN
1"=40'

BOREHOLE LOCATION TABLE

Hole ID	Alignment Name	Station and Offset
R-18-NO-101	"RW1" Line	507+70 9' Lt.



DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	SCI	101	R28.4/R28.9		

GEOTECHNICAL PROFESSIONAL — DATE 10-15-19

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. 666 — Exp. 12/31/19 — GEOTECHNICAL — STATE OF CALIFORNIA

PLANS APPROVAL DATE

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200 E. SANTA CLARA St., 8th FLOOR
SAN JOSE, CA 95113

PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131

DESIGN OVERSIGHT — SIGN OFF DATE

DRAWN BY: KIM OUYANG — CHECKED BY: ALSTON LAM

L.S. BHANGOO — FIELD INVESTIGATION BY:
DATE: AUGUST 2018 TO SEPTEMBER 2018

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

ALSTON LAM — PROJECT ENGINEER

BRIDGE NO. 37E0125 — POST MILES R28.61

RETAINING WALL NO. 1-SOIL NAIL WALL
LOG OF TEST BORINGS 1 OF 1

GS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 03/14/12)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0000
PROJECT NUMBER & PHASE: 04160002241 — CONTRACT NO.: 04-1K2804

DISREGARD PRINTS BEARING EARLIER REVISION DATES — REVISION DATES: 1-11-18, 4-9-19, 10-15-19 — SHEET 10 OF 10

FILE => RW1-ltb01.dgn

USERNAME => ogouthier DATE PLOTTED => 19-SEP-2019 TIME PLOTTED => 13:37

REFERENCE LOG OF TEST BORINGS
(BORING R-18-SC-002)

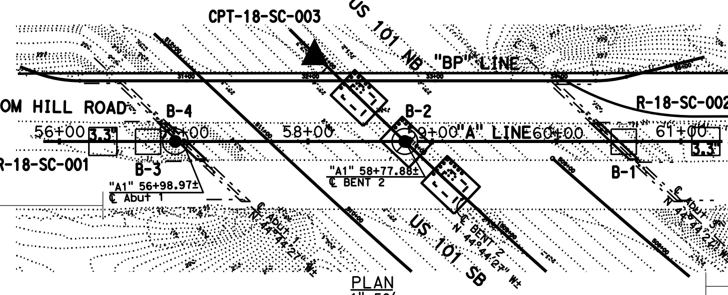
NOTES:

Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2" Modified California Sampler: I.D. = 2.5"; O.D. = 3" Hammer Assembly: A 140 lb hammer with a 30" drop (Automatic Hammer)

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock, Logging, Classification, and Presentation Manual (2010)

See Caltrans 2015 Standard Plans A10F, A10G and A10H for Soil and Rock Legend.

All dimensions are in feet unless otherwise shown



PLAN
1"=50'

BENCH MARK:

NGS QQ453 (HS 2787)
Elev. 190.83
4.7 miles northwest along the southern Pacific Company Railroad from the station at Coyote.
Vertical Datum: NAVDBB
Horizontal Datum: CCS83, Zone 3, Epoch 2010.00
in U.S Survey Feet.

BOREHOLE LOCATION TABLE

Hole ID	Alignment Name	Station and Offset
R-18-SC-001	"A" Line	56+35 0' Lt.
R-18-SC-002	"A" Line	61+20 0' Lt.
CPT-18-SC-003	"A" Line	58+05 70' Rt.

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	SCI	101	R28.4/R28.9		

GEOTECHNICAL PROFESSIONAL 10-15-19 DATE

REGISTERED PROFESSIONAL ENGINEER GARY PARIKH No. 666 Exp. 12/31/19 GEOTECHNICAL STATE OF CALIFORNIA

PLANS APPROVAL DATE

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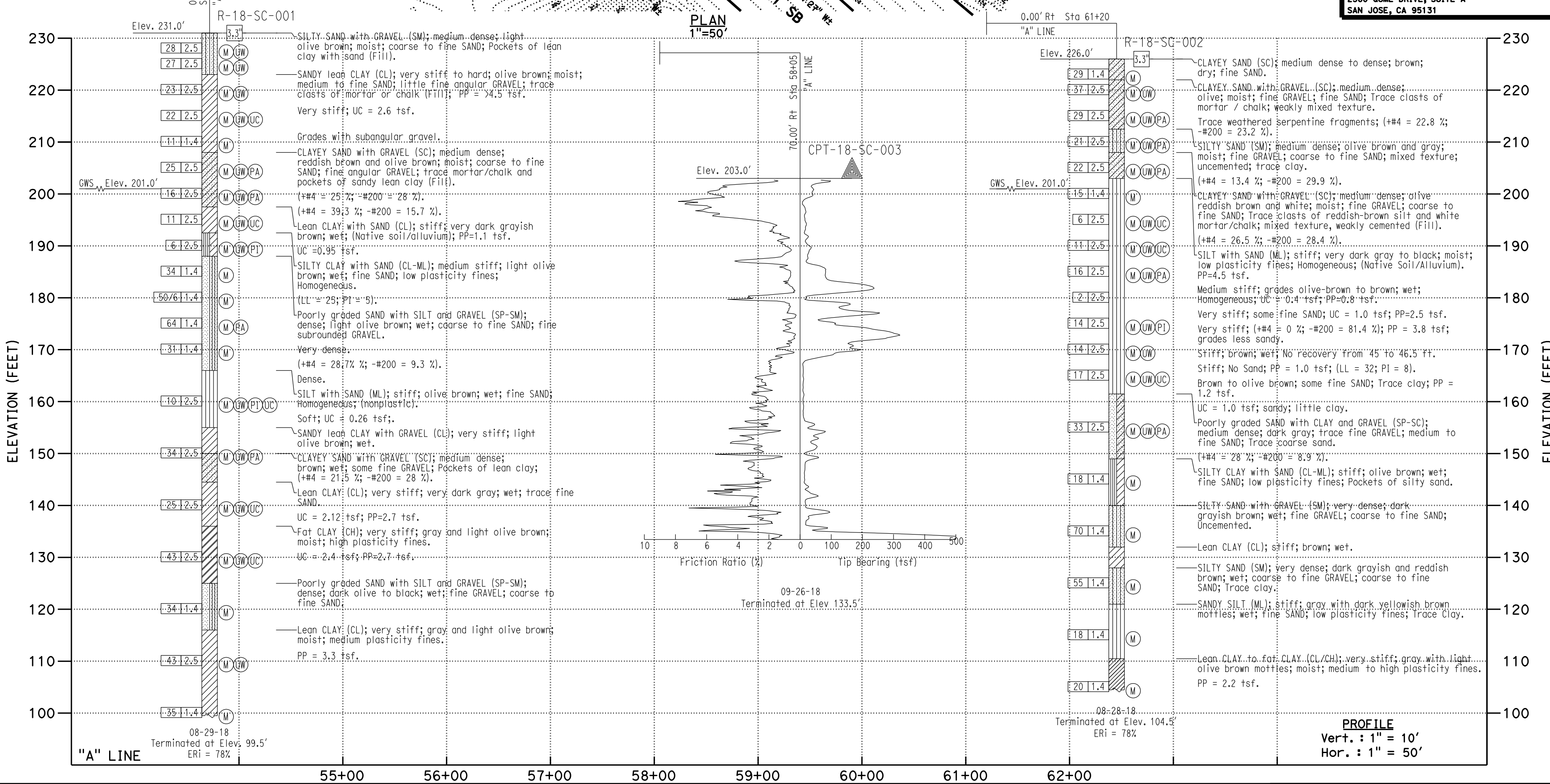
SAN JOSE, CA 95113

PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131



PROFILE
Vert. : 1" = 10'
Hor. : 1" = 50'

DESIGN OVERSIGHT	DRAWN BY	KIM OUYANG	L.S. BHANGOO FIELD INVESTIGATION BY:
SIGN OFF DATE	CHECKED BY	ALSTON LAM	DATE: AUGUST 2018 TO SEPTEMBER 2018

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

ALSTON LAM
PROJECT ENGINEER

BRIDGE NO. 37-0348
POST MILES R28.61

BLOSSOM HILL ROAD OC (WIDEN)
LOG OF TEST BORINGS 1 OF 2

GS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 03/14/12)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0000
PROJECT NUMBER & PHASE: 04160002241
CONTRACT NO.: 04-1K2804

DISREGARD PRINTS BEARING EARLIER REVISION DATES 7-11-18 4-9-19 10-15-19

SHEET 25 OF 26

FILE => Blossom_Hill_Rd-ltb01.dgn

USERNAME => ogouthier DATE PLOTTED => 19-SEP-2019 TIME PLOTTED => 13:52

APPENDIX III

LABORATORY TEST RESULTS

LABORATORY TEST SUMMARY

APPENDIX III
LABORATORY TESTS

Classification Tests

The field classification of the samples was visually verified in the laboratory according to the Unified Soil Classification System. The results are presented on "Log of Test Borings", Appendix II.

Moisture-Density

The natural moisture contents were determined for selected undisturbed samples of the soils in accordance with American Standard Test Method (ASTM) D-2216 and dry unit weights were calculated based on natural moisture contents and total unit weights. This information was used to classify and correlate the soils. The results are presented on Plate III-1, "Laboratory Test Summary ", Appendix III.

Atterberg Limits

The Atterberg Limits were determined for selected samples of the fine-grained materials. These results were used to classify the soils, as well as to obtain an indication of the expansion potential with variations in moisture content. The Atterberg Limits were determined in accordance with ASTM D-4318. The results of the test are presented on Plate III-2, "Plasticity Chart", Appendix III.

Unconfined Compression Tests

Strength tests were performed on selected undisturbed samples using unconfined compression machine. Unconfined compression tests were performed in accordance with ASTM D 2166. The results are presented on Plates III-3A through III-3D, "Unconfined Compression Test", Appendix III.

Corrosion Tests

Corrosion tests were performed on selected samples to determine the corrosion potential of the soils. The pH and minimum resistivity tests were performed according to California Test Method CT-643. Sulfate (California Test Method CT-417) and chloride (California Test Method CT-422) tests were performed by Sunland Analytical. The test results are presented on Plates III-4A and III-4B, Appendix III.

Borehole	Sample Number	Depth	Classi-fication	Water Content	Dry Density	Liquid Limit	Plastic Limit	Plasticity Index	% > Sieve 4	% < Sieve 200	Unconfined Shear Strength (tsf)
R-18-NO-101	1	3.0	SC	19.3	-						
R-18-NO-101	2	6.0	SC	21.1	-						
R-18-NO-101	3	11.0	SM	12.2	-						
R-18-NO-101	4	16.0	CH	18.1	-						
R-18-NO-101	5	21.0	CL	17.4	-	26	17	9			
R-18-NO-101	6	26.0	ML	9.1	-	NP	NP	NP			
R-18-NO-101	7	31.0	CL-ML	18.9	106.3						0.46
R-18-NO-101	8	36.0	CL-ML	18.2	108.9						0.55
R-18-NO-101	9	41.0	ML	25.5	98.7	NP	NP	NP			0.17
R-18-NO-101	10	44.5	ML	30.3	-						
R-18-NO-101	11	56.0	ML	21.6	104.5						0.43

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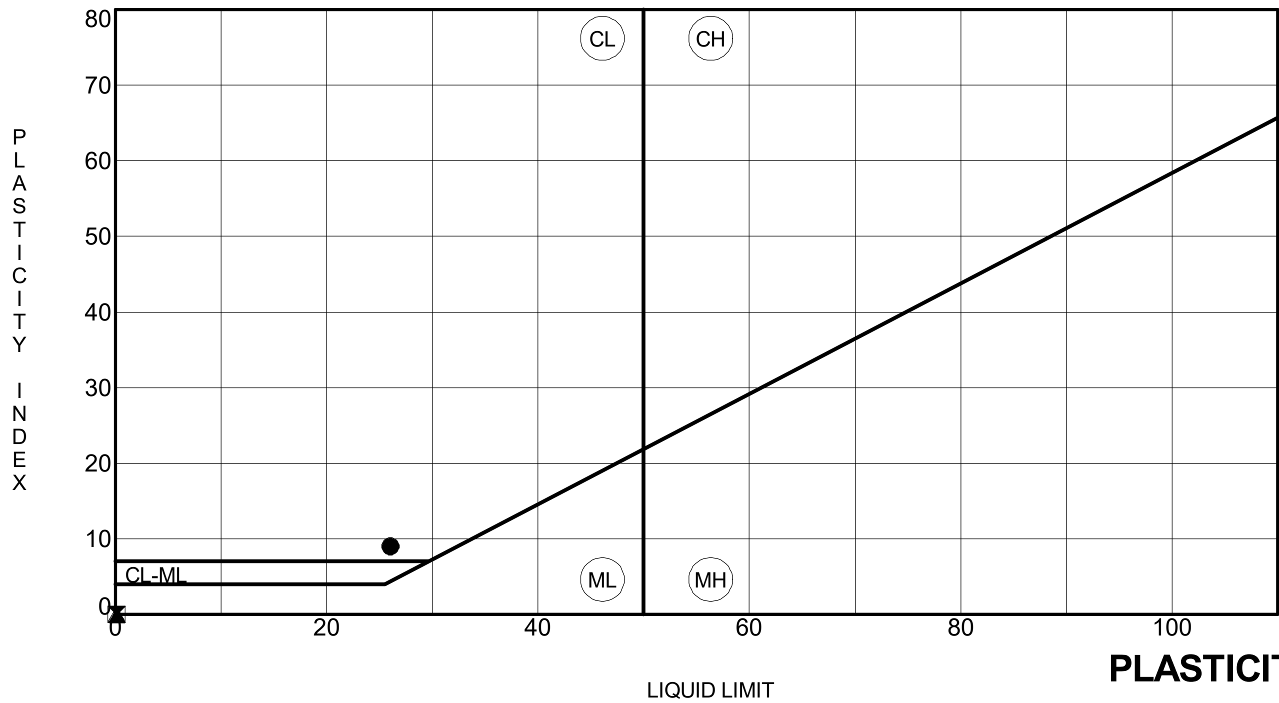
RETAINING WALL NO. 1
SAN JOSE, CALIFORNIA

JOB NO: 2016-146-RW1 PLATE NO: III-1

ATTERBERG LIMITS



PLASTICITY

	BOREHOLE	SAMPLE #	DEPTH	LL	PL	PI	Fines	Classification
●	**R-18-NO-101**	**5**	**21.0**	**26**	**17**	**9**		**SANDY lean CLAY**
⧗	**R-18-NO-101**	**6**	**26.0**	**NP**	**NP**	**NP**		**SANDY SILT with GRAVEL**
▲	**R-18-NO-101**	**9**	**41.0**	**NP**	**NP**	**NP**		**SANDY SILT**

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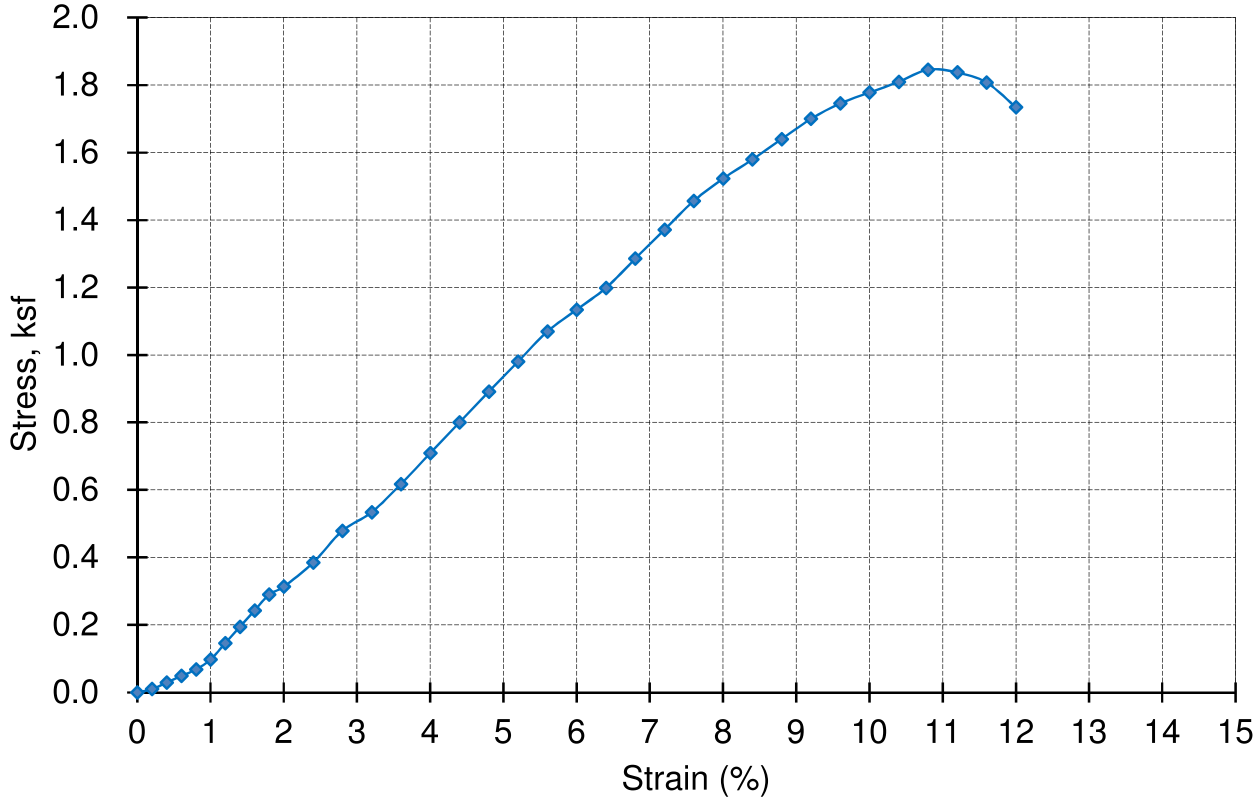
RETAINING WALL NO. 1
SAN JOSE, CALIFORNIA

JOB NO: 2016-146-RW1 | **PLATE NO: III-2**

UNCONFINED COMPRESSION TEST

UNCONFINED COMPRESSION TEST



Boring No.:	R-18-NO-101	**Unconfined Compressive Strength (ksf):**	1.85
Sample No. :	7	**Shear Strength (ksf)**	0.92
Depth (feet):	31	**Strain @ Failure (%):**	10.8
Sample Type:	MC - 2.416 inch dia.	**Initial Dry Density (pcf):**	106
Test Method	ASTM D2166	**Water Content (%):**	18.9
Material Type:	CL-ML		
Material Description:	SILTY CLAY WITH SAND		

Initial Height (inch): 5.00
Initial Diameter (inch) 2.42
Initial Area (ft^2): 0.032
Strain Rate (inch/min) 0.1

Remarks:

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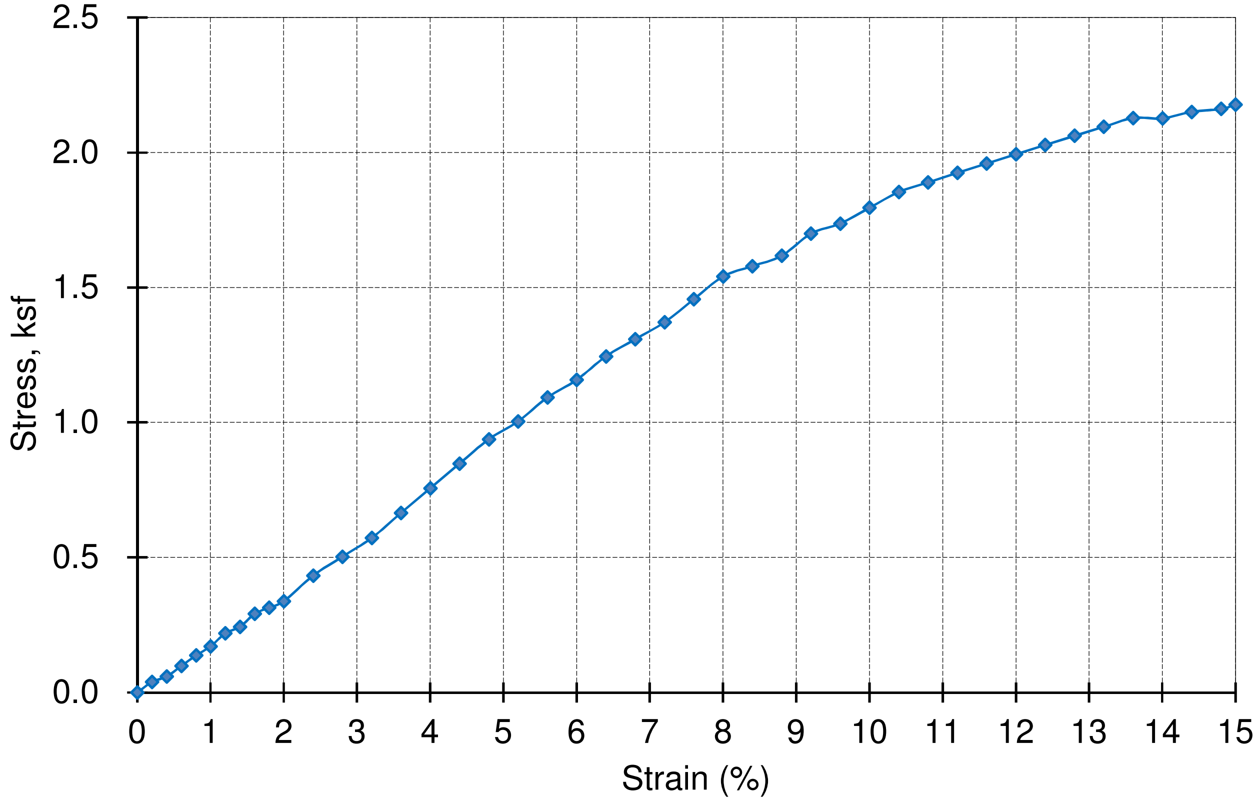
RETAINING WALL NO. 1 **SAN JOSE, CALIFORNIA**	
JOB NO.: 2016-146-RW1	**PLATE NO.: III-3A**

UNCONFINED COMPRESSION TEST



Boring No.:	R-18-NO-101	**Unconfined Compressive Strength (ksf):**	2.18
Sample No. :	8	**Shear Strength (ksf)**	1.09
Depth (feet):	36	**Strain @ Failure (%):**	15.0
Sample Type:	MC - 2.416 inch dia.	**Initial Dry Density (pcf):**	109
Test Method	ASTM D2166	**Water Content (%):**	18.2
Material Type:	CL-ML		
Material Description:	SILTY CLAY WITH SAND		

Initial Height (inch): 5.00
Initial Diameter (inch) 2.42
Initial Area (ft^2): 0.032
Strain Rate (inch/min) 0.1

Remarks:

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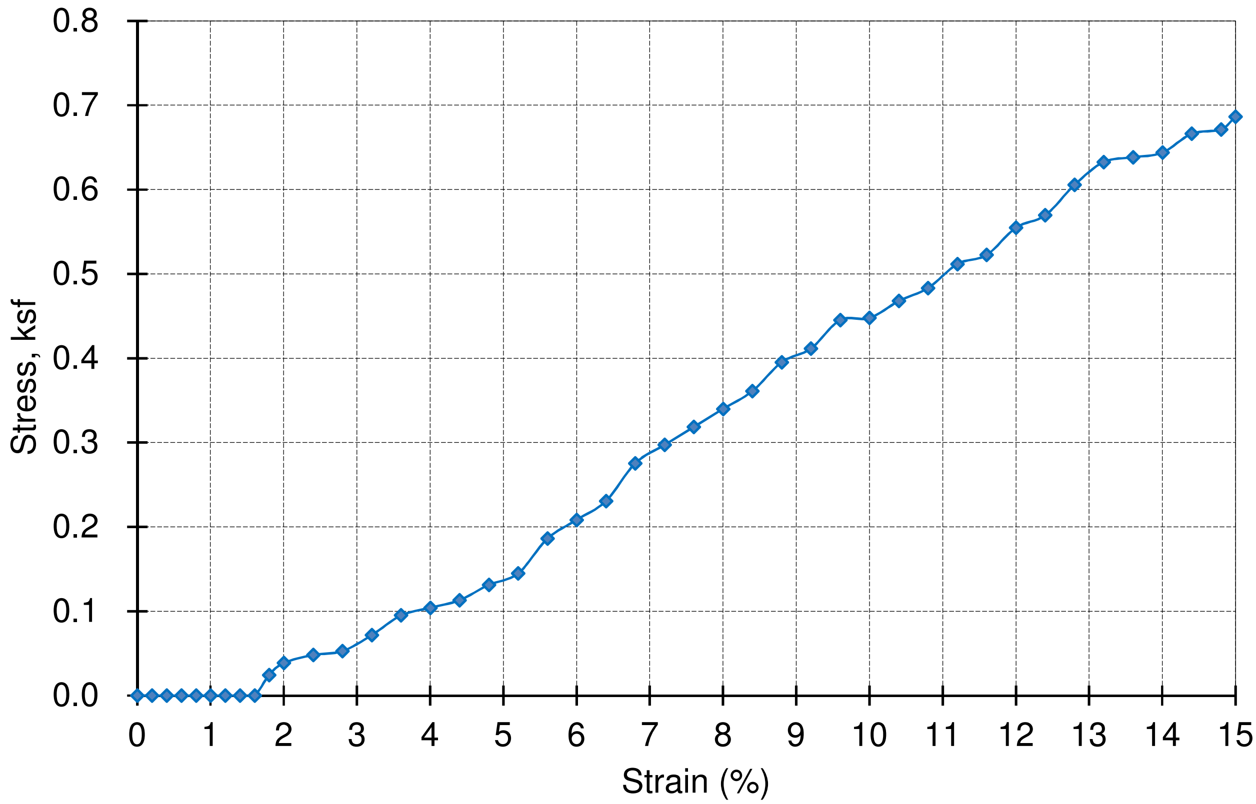
RETAINING WALL NO. 1 SAN JOSE, CALIFORNIA	
JOB NO.: 2016-146-RW1	PLATE NO.: III-3B

UNCONFINED COMPRESSION TEST



Boring No.:	R-18-NO-101	**Unconfined Compressive Strength (ksf):**	0.69
Sample No. :	9	**Shear Strength (ksf)**	0.34
Depth (feet):	41	**Strain @ Failure (%):**	15.0
Sample Type:	MC - 2.416 inch dia.	**Initial Dry Density (pcf):**	99
Test Method	ASTM D2166	**Water Content (%):**	25.5
Material Type:	ML		
Material Description:	SANDY SILT		

Initial Height (inch):	5.00
Initial Diameter (inch)	2.42
Initial Area (ft^2):	0.032
Strain Rate (inch/min)	0.1

Remarks:

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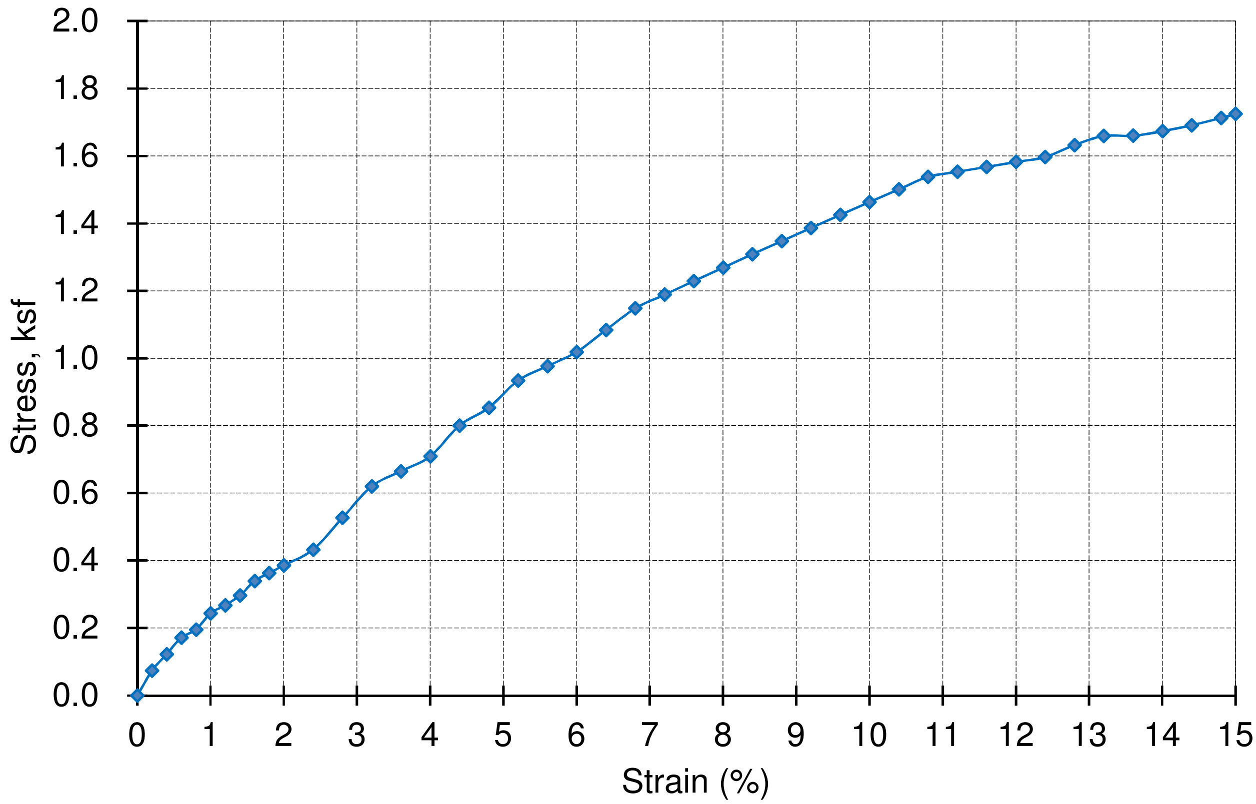
RETAINING WALL NO. 1
SAN JOSE, CALIFORNIA

JOB NO.: 2016-146-RW1 | PLATE NO.: III-3C

UNCONFINED COMPRESSION TEST



Boring No.:	R-18-NO-101	**Unconfined Compressive Strength (ksf):**	1.72
Sample No. :	11	**Shear Strength (ksf)**	0.86
Depth (feet):	56	**Strain @ Failure (%):**	15.0
Sample Type:	MC - 2.416 inch dia.	**Initial Dry Density (pcf):**	105
Test Method	ASTM D2166	**Water Content (%):**	21.6
Material Type:	ML		
Material Description:	SANDY SILT		

Initial Height (inch): 5.00
Initial Diameter (inch) 2.42
Initial Area (ft^2): 0.032
Strain Rate (inch/min) 0.1

Remarks:

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RETAINING WALL NO. 1
SAN JOSE, CALIFORNIA

JOB NO.: 2016-146-RW1 | **PLATE NO.: III-3D**

CORROSION TEST

Sunland Analytical
11419 Sunrise Gold Circle, #10
Rancho Cordova, CA 95742
(916) 852-8557

Date Reported 10/10/2018
Date Submitted 10/05/2018

To: Nasir Ahmad
Parikh Consultants, Inc.
2360 Qume Dr. Suite A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 2016-146-RW1 Site ID : R18-N0-101.
Thank you for your business.

* For future reference to this analysis please use SUN # 78232-163610.

EVALUATION FOR SOIL CORROSION

Soil pH	7.32		
Minimum Resistivity	1.63	ohm-cm (x1000)	
Chloride	6.0 ppm	00.00060	%
Sulfate	135.6 ppm	00.01356	%

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

PLATE NO.: III-4A

Sunland Analytical
11419 Sunrise Gold Cir.#10
Rancho Cordova, CA 95742
(916) 852-8557

Date Reported 09/26/18
Date Submitted 09/21/18

To: Nasir Ahmad
Parikh Consultants Inc.
2360 Qume Dr. Suite A
San Jose, CA, 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following:
Location : 2016-146-BOC Site ID: R18-SC-002
Thank you for your business.

* For future reference to this analysis please use SUN # 78103 - 163333

EVALUATION FOR SOIL CORROSION

Soil pH	7.36	
Minimum Resistivity	1.88	ohm-cm (x1000)
Chloride	9.4 ppm	0.0009 %
Sulfate-S	29.7 ppm	0.003 %

METHODS:
pH and Min.Resistivity CA DOT Test #643 Mod.(Sm.Cell)
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

PLATE NO.: III-4B

APPENDIX IV

ANALYSES AND CALCULATIONS

ACCELERATION RESPONSE SPECTRUM (ARS)

FAULT MAP

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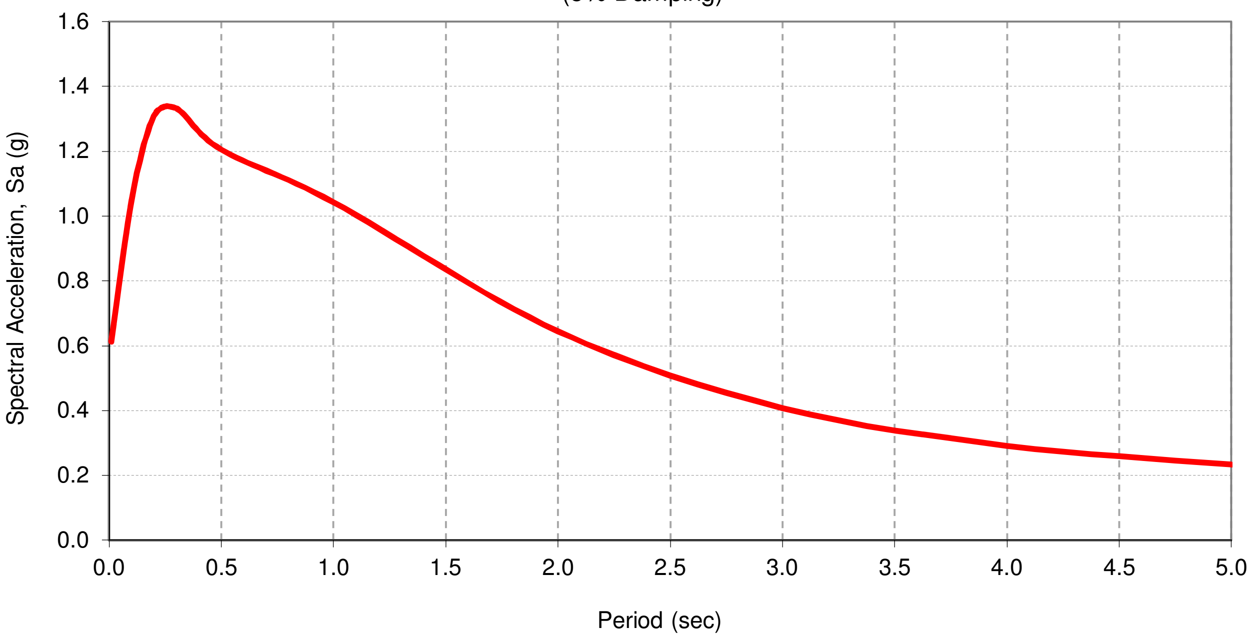
RETAINING WALL NO. 1
SAN JOSE, CALIFORNIA

JOB NO.: 2016-146-RW1	**PLATE NO.: IV-1**

ARS CURVE

RECOMMENDED ACCELERATION RESPONSE SPECTRUM

(5% Damping)



Site Information

Latitude:	37.2579
Longitude	-121.7993
V_{S30} (m/s) =	195
$Z_{1.0}$ (m) =	N/A
$Z_{2.5}$ (km) =	N/A
Near Fault Factor, Derived from USGS Unified Hazard Tool. Dist (km) =	6.89

Governing Curve:

Caltrans Online Probabilistic ARS

Recommended Response Spectrum				
Period (sec)	Caltrans Online Probabilistic Spectral Acceleration (g)	Adjusted for Near Fault Effect	Adjusted For Basin Effect	Final Adjusted Spectral Acceleration (g)
0.0	0.612	1	1	0.612
0.1	1.05	1	1	1.050
0.2	1.309	1	1	1.309
0.3	1.332	1	1	1.332
0.5	1.205	1	1	1.205
1.0	0.869	1.2	1	1.043
2.0	0.537	1.2	1	0.644
3.0	0.34	1.2	1	0.408
4.0	0.243	1.2	1	0.292
5.0	0.194	1.2	1	0.233

Source:

1. Caltrans ARS Online tool (V.2.3.09, http://dap3.dot.ca.gov/ARS_Online/)

2. Caltrans Methodology for Developing Design Response Spectrum for Use in Seismic Design Recommendations, November 2012

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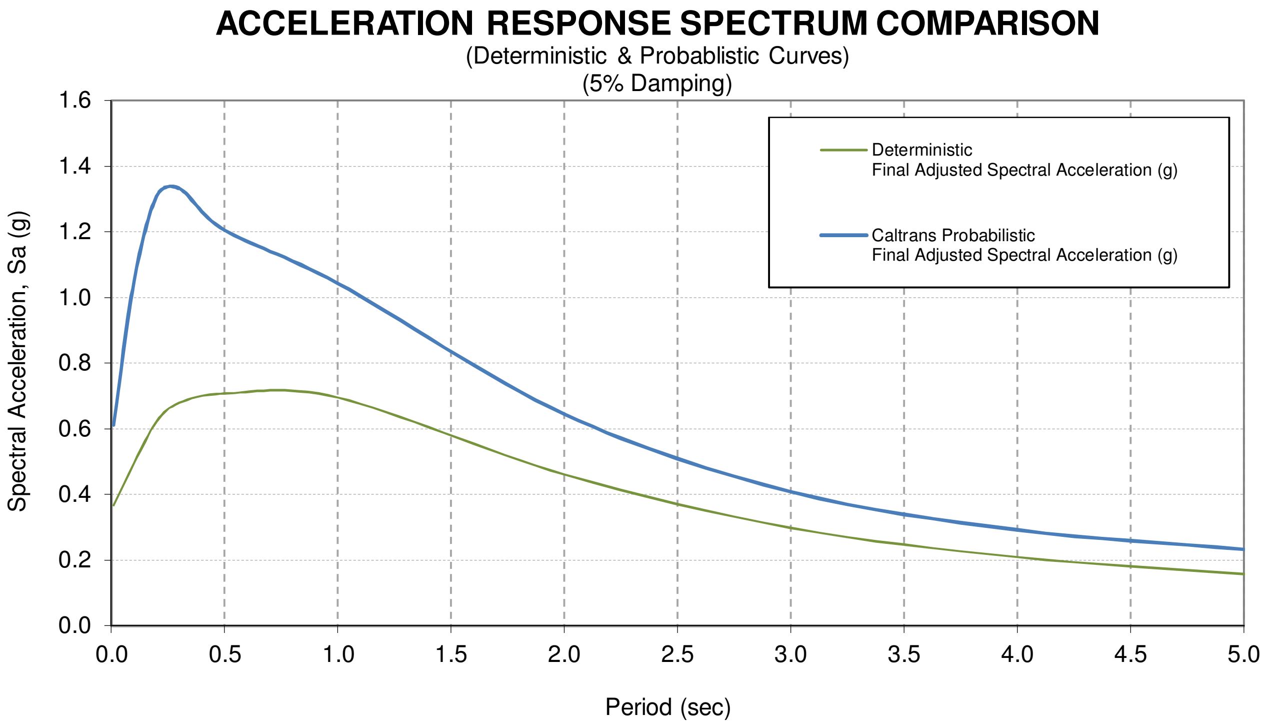
RETAINING WALL NO. 1
SAN JOSE, CALIFORNIA

Project No.: 2016-146-RW1	**APPENDIX IV-2A**

SPECTRUM COMPARISON



Period (sec)	Deterministic Final Adjusted Spectral Acceleration (g)	Caltrans Probabilistic Final Adjusted Spectral Acceleration (g)
0.0	0.367	0.612
0.1	0.496	1.050
0.2	0.622	1.309
0.3	0.679	1.332
0.5	0.707	1.205
1.0	0.695	1.043
2.0	0.461	0.644
3.0	0.298	0.408
4.0	0.209	0.292
5.0	0.157	0.233

Site Information

Latitude:	37.2579
Longitude	-121.7993
V_{S30} (m/s) =	195
$Z_{1.0}$ (m) =	N/A
$Z_{2.5}$ (km) =	N/A
Near Fault Factor, Derived from USGS Unified Hazard Tool. Dist (km) =	6.89

Source:

1. Caltrans ARS Online tool (V.2.3.09, http://dap3.dot.ca.gov/ARS_Online/)

2. USGS Unified Hazard Tool (https://earthquake.usgs.gov/hazards/interactive/)

3. Caltrans Methodology for Developing Design Response Spectrum for Use in Seismic Design Recommendations, November 2012

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RETAINING WALL NO. 1
SAN JOSE, CALIFORNIA

Project No.: 2016-146-RW1	**APPENDIX IV-2B**

LIQUEFACTION ANALYSES

LIQUEFACTION POTENTIAL ANALYSIS (SPT procedures per Youd et al, 2001)

PROJECT NAME	***RETAINING WALL NO. 1***	*SOIL GROUPS*	*FAULT INFO*
PROJECT NO.	***2016-146-RW1***	1. GRAVELS, SANDS AND NONPLASTIC SILTS	*Silver Creek Fault*
BORING NO.	***R-18-NO-101***	2. CLAYS AND PLASTIC SILTS	*a_{max} (g)=* 0.612
			FAULT M_w = 6.9

GW DEPTH (ft)=	14	*BOREHOLE DIA (in)=*	3.3	*CUT(-)/FILL(+) (ft) =*	0		*MSF =* 1.24
		HAMMER ENERGY =	78%	*DESIGN GW DEPTH (ft)=*	14	*(below OG)*	

SOIL STRATA							*LIQUEFACTION RESISTANCE ($CRR_{7.5}$)*												*CYCLIC STRESS RATIO (CSR)*				*F.S.=($CRR_{7.5}$/CSR)*MSF*Ks*Ka*			*POST-LIQ. SETTLEMENT*	
Layer Thickness from	to	Sample No	Depth (ft)	Soil Type	Blow Count	Sampler Type	SPT-$N_{eq.}$	C_E	C_R	C_S	C_B	N_{60}	σ_v' (psf)	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60,cs}$	$CRR_{7.5}$	σ_v (psf)	σ_v' (psf)	r_d	CSR	Ks	Ka	F.S.	Vol. Strain (%)	ΔD (in)
0	4.0	1	3	1	31	SPT	31.0	1.3	0.75	1.2	1.00	36.3	345.0	1.7	61.7	15%	67.1		345.0	345.0	1.0	0.4	1.0	1.0			
4.0	8.0	2	6	1	31	MC	20.2	1.3	0.80	1.0	1.00	21.0	700.0	1.7	35.4	15%	39.6		700.0	700.0	1.0	0.4	1.0	1.0			
8.0	14.0	3	10	1	100	MC	65.0	1.3	0.85	1.0	1.00	71.8	1180.0	1.3	93.5	15%	100.5		1180.0	1180.0	1.0	0.4	1.0	1.0			
14.0	19.0	4	16	2	7	SPT	7.0	1.3	0.95	1.2	1.00	10.4	1775.2	1.1	11.0												
19.0	23.0	5	21	2	8	SPT	8.0	1.3	0.95	1.2	1.00	11.9	2063.2	1.0	11.7												
23.0	27.5	6	26	1	14	MC	9.1	1.3	1.00	1.0	1.00	11.8	2351.2	0.9	10.9	50%	18.1	0.2	3100.0	2351.2	0.9	0.5	1.0	1.0	(0.46)	1.51%	0.81
27.5	33.0	7	31	2	12	MC	7.8	1.3	1.00	1.0	1.00	10.1	2639.2	0.9	8.8												
33.0	39.0	8	36	2	14	MC	9.1	1.3	1.00	1.0	1.00	11.8	2927.2	0.8	9.8												
39.0	43.0	9	41	2	7	MC	4.6	1.3	1.00	1.0	1.00	5.9	3215.2	0.8	4.7												
43.0	50.0	10	44.5	2	6	MC	3.9	1.3	1.00	1.0	1.00	5.1	3416.8	0.8	3.9												
50.0	56.5	11	56	2	13	MC	8.5	1.3	1.00	1.0	1.00	11.0	4079.2	0.7	7.7												

Fines Content based on visual inspection

Fines Content based on lab results

Notes:

1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner) are per Youd et al. (2001).
2. For correction of overburden, $C_N = (1/\sigma_v')^{0.5}$ with a maximum value of 1.7.
3. The influence of Fines Contents are expressed by the following correction: $(N_1)_{60cs} = a + b\,(N_1)_{60}$
   where a and b = coefficients determined from the following relationships
   for FC $\leq$ 5% a = 0, b = 1.0
   for 5% < FC < 35% a = exp(1.76-(190/FC^2)), b = (0.99+(FC$^{1.5}$/1000))
   for FC $\geq$ 35% a = 5.0, b = 1.2
4. For $(N_1)_{60,cs}$ greater than 30, clean granular soils are too dense to liquefy and are classed as non-liquefiable.

Reference:

Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER Workshops on Evaluation of Liquefaction Resistance of Soils, Youd, et al., ASCE Journal of Geotechnical and Geoenvironmental Engineering, October 2001, Vol. 127 No. 10

CALCULATIONS OF SHEAR WAVE VELOCITY

SOIL STRENGTH PARAMETERS & V_{s30}

Calc By: JZ
Date: 10/9/18

PROJECT NAME: ***RETAINING WALL NO. 1***
PROJECT NO.: ***2016-146-RW1***
STRUCTURE: ***Retaining Wall 1***
BORING NO.: ***R-18-NO-101***

SOIL GROUPS
1. SANDS & GRAVELS
2. CLAYS AND PLASTIC SILTS
3. NON TO LOW PLASTIC SILTS
4. YOUNG SEDIMENTARY ROCKS
5. LIQUEFIABLE SANDS (RESIDUAL STRENGTH)
6. LIQUEFIABLE SILTS (RESIDUAL STRENGTH)

BOREHOLE DIA (in)= 3.3 | *HAMMER ENERGY =* 78%
GW DEPTH (ft)= 14 | *DRILLING RODS (Y/N)=* Y

Nd 11 | V_{sd} (m/s) *163*
N_{30} 13 | V_{s30} (m/s) *195*

Correlation: 1) Caltrans

Sample No	Layer Thickness from	Layer Thickness to	Sample Depth (ft)	Soil Type	Field Blow Count	Sampler Type	Unit Weight (pcf)	σ_v (psf)	σ_v' (psf)	SPT-$N_{eq.}$	N_{60} CE Corr.	N_{60} CR,CB,CS Corr.	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60,CS}$	Correlated Strength Parameters ϕ (°)	Correlated Strength Parameters c (psf)	Correlated Strength Parameters S_r (psf)	Lab Test Results c (psf)	Vs (m/s)
1	0.0	4.0	3	1	31	SPT	125	375	375	31	40.3	39.3	1.70	66.8		66.8	46				161
2	4.0	8.0	6	1	31	MC	125	750	750	20	26.2	21.0	1.63	34.2		34.2	41				182
3	8.0	14.0	10	1	100	MC	125	1250	1250	65	84.5	71.8	1.26	90.9		90.9	47				230
4	14.0	19.0	16	2	7	SPT	125	2000	1875	7	9.1	9.5	1.03	9.8				1138			189
5	19.0	23.0	21	2	8	SPT	125	2625	2188	8	10.4	10.9	0.96	10.4				1300			200
6	23.0	27.5	26	3	14	MC	125	3250	2501	9	11.8	11.8	0.89	10.6				1183			206
7	27.5	33.0	31	1	12	MC	125	3875	2814	8	10.1	10.1	0.84	8.5		8.5	33			920	140
8	33.0	39.0	36	1	14	MC	125	4500	3127	9	11.8	11.8	0.80	9.5		9.5	33			1090	152
9	39.0	43.0	41	3	7	MC	125	5125	3440	5	5.9	5.9	0.76	4.5				592		340	100
10	43.0	50.0	44.5	2	6	MC	125	5562.5	3659	4	5.1	5.1	0.74	3.7				634			184
11	50.0	56.5	56	2	13	MC	125	7000	4379	8	11.0	11.0	0.68	7.4				1373		860	136

Note:
1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner), C_N (Overburden) are per Youd 2001
2. For fine-grained materials, the correlation between blow-counts and shear is based on NAVFAC DM 7.1.
3. The phi angle was estimated based on Meyerhof (1956).
4. Residual Strength (Sr) is based on Caltrans "Guidelines on Foundation Loading and Deformation Due to Liquefaction Induced Lateral Spreading", Caltrans 2011
5. The Vs were correlated based on N_{60} for Soil Types 1,3, 4; based on N_{60} or c_{lab} for Soil Type 2 and based on Sr for Soil Types 5 & 6 per Caltrans Guidelines (2012).
6. Spreadsheet Revision Date: 10/29/13

LATERAL EARTH PRESSURES

Coulomb Active Lateral Pressure Coefficient (K_a)

Project Name/Number:	2014-136-RW1	**By:**	EO
Structure Name/Number:	Blossom Hill Road Soil Nail	**Date:**	11/27/2018

Parameters	Angle in degrees	
ϕ	33	(Friction Angle of Soil)
α	18.5	(Backfill angle with horizontal)
β	90	(Wall backface angle **with horizontal**)
δ	22.78	(Friction Angle between Soil and the backface of the wall)

K_a	0.345

K_a = Coulomb's active earth pressure coefficient

$$= \frac{\sin^2(\beta + \phi')}{\sin^2\beta \sin(\beta - \delta)\left[1 + \sqrt{\frac{\sin(\phi' + \delta)\sin(\phi' - \alpha)}{\sin(\beta - \delta)\sin(\alpha + \beta)}}\right]^2}$$

7.5 Coulomb's Active Earth Pressure

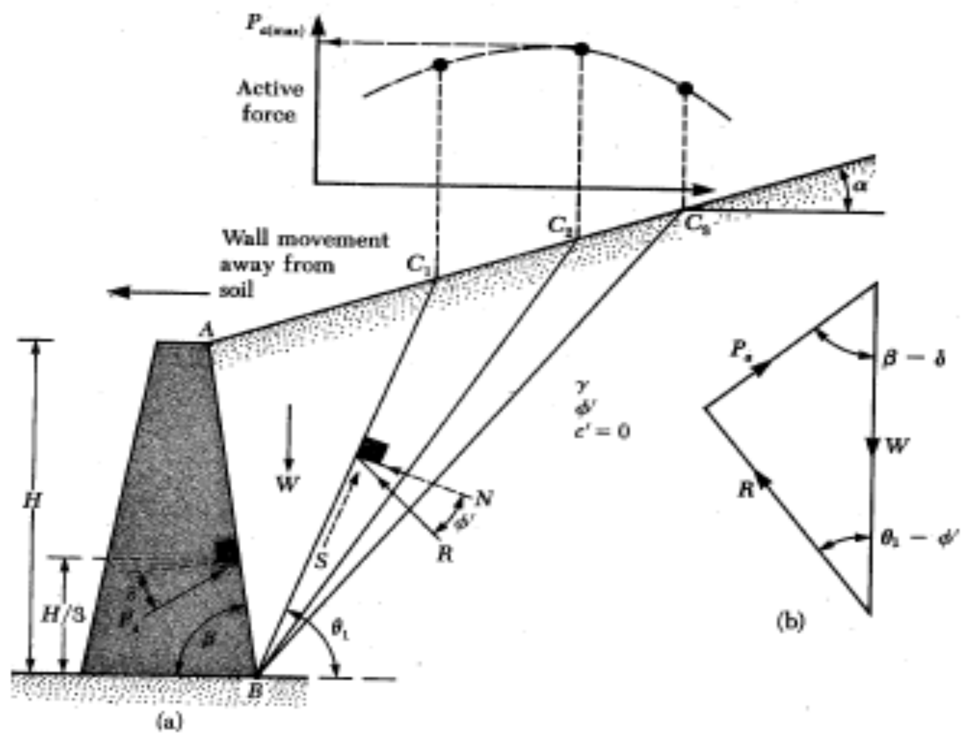


Figure 7.10 Coulomb's active pressure

M-O Seismic Active Lateral Pressure Coefficient (K_{AE})

Project Name/Number:	2014-136-RW1	**By:**	EO
Structure Name/Number:	Blossom Hill Road Soil Nail	**Date:**	11/27/2018

Parameters	Angle in degrees	Angle in Radians	
ϕ	33	0.576	(Friction Angle of Soil)
i	18.5	0.323	(Backfill angle with horizontal)
β	0	0.000	(Wall backface angle **with vertical**)
δ	22.11	0.386	(Friction Angle between Soil and the backface of the wall)
kh (no unit)	0.204		
kv (no unit)	0		
θ_{MO} (rad)		0.201	

K_{ae}	0.70

Incremental Lateral Seismic Earth pressure=(K_{ae}-K_a)*UW/2*H^2 = 22.2H^2 lb/ft

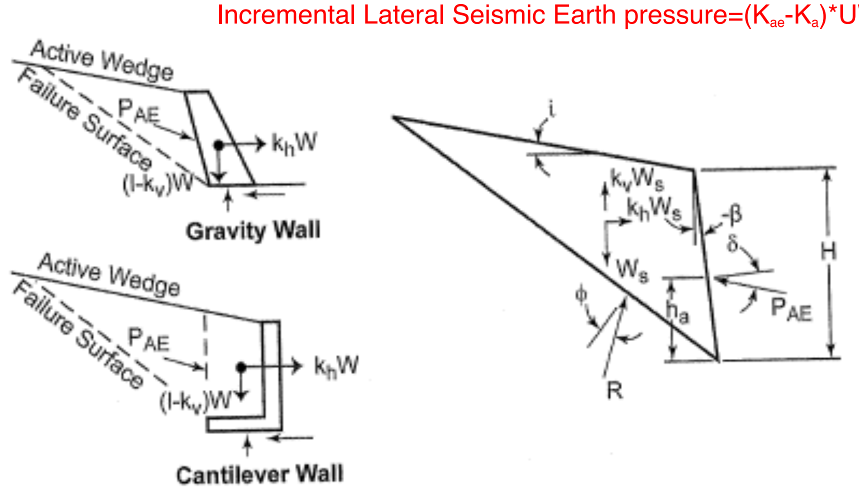


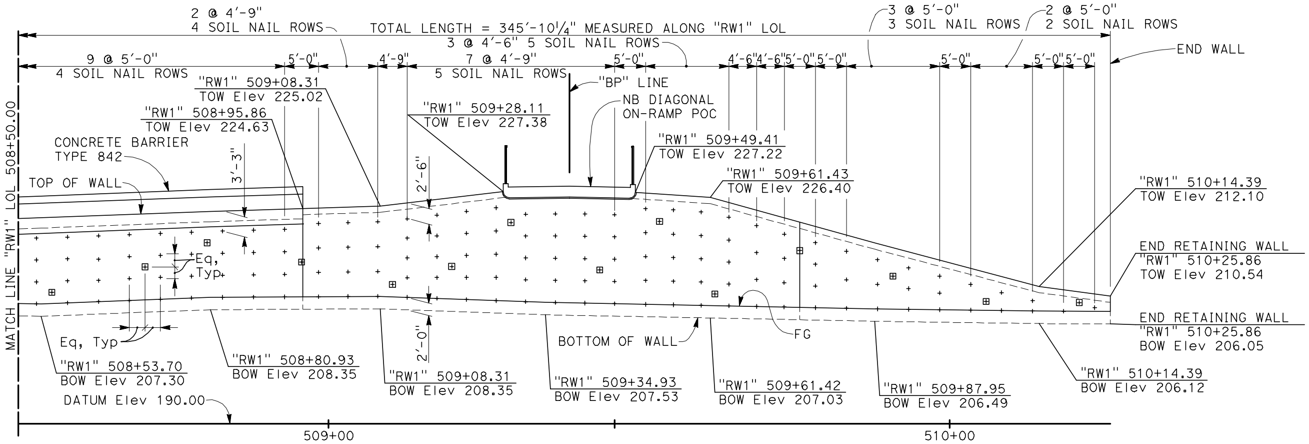
Figure A11.3.1-1—Mononobe-Okabe Method Force Diagrams

$$K_{AE} = \frac{\cos^2(\phi-\theta_{MO}-\beta)}{\cos\theta_{MO}\cos^2\beta\cos(\delta+\beta+\theta_{MO})} \times \left[1+\sqrt{\frac{\sin(\phi+\delta)\sin(\phi-\theta_{MO}-i)}{\cos(\delta+\beta+\theta_{MO})\cos(i-\beta)}}\right]^{-2} \quad \text{(A11.3.1-1)}$$

where:

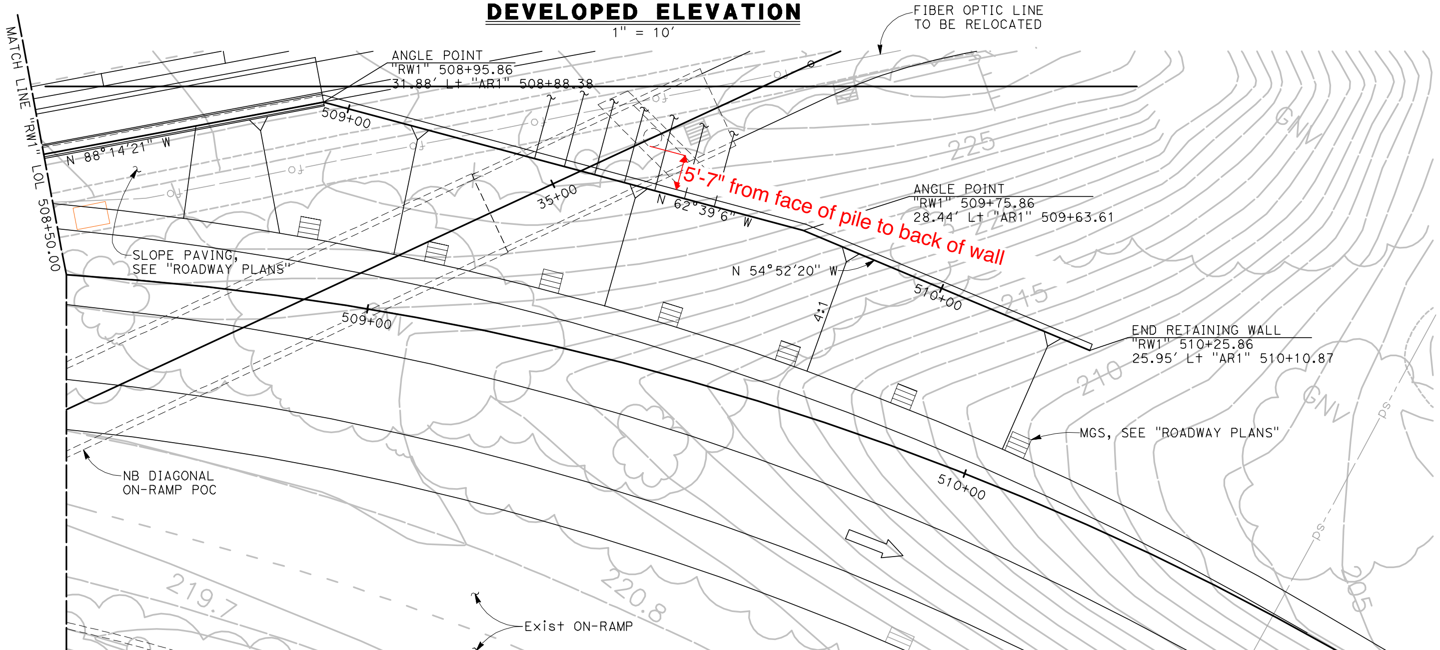
- K_{AE} = seismic active earth pressure coefficient (dim)
- γ = unit weight of soil (kcf)
- H = height of wall (ft)
- h = height of wall at back of wall heel considering height of sloping surcharge, if present (ft)
- ϕ_f = friction angle of soil (degrees)
- θ_{MO} = arc tan $[k_h/(1-k_v)]$ (degrees)
- δ = wall backfill interface friction angle (degrees)
- k_h = horizontal seismic acceleration coefficient (dim.)
- k_v = vertical seismic acceleration coefficient (dim.)
- i = backfill slope angle (degrees)
- β = slope of wall to the vertical, negative as shown (degrees)

LATERAL LOAD FROM NB101 POC ABUTMENT 1 PILE TO SOIL NAIL WALL



DEVELOPED ELEVATION

1" = 10'



PLAN

1" = 10'

NOTE:
THE CONTRACTOR MUST VERIFY ALL CONTROLLING FIELD DIMENSIONS BEFORE ORDERING OR FABRICATING ANY MATERIAL

NOTES:
1. Maximum vertical spacing of soil nails = 5'-0".
   Minimum vertical spacing of soil nails = 1'-6".
2. Soil nail horizontal spacing measured along "RW1" LOL.
3. Top and bottom of wall are to be linear in between points shown.
4. Chain Link fence not shown for clarity.

LEGEND:
+ Indicates Soil Nail Assembly Location
⊞ Indicates Proof Test Soil Nail Location. Location may be adjusted by the Engineer.

SOIL NAIL DATA TABLE

Number of Rows of Soil Nails	L_E Embedment Length (ft)
1	26
2	35
3	55
4	55
5	60

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	SCI	101	R28.4/R28.9		

REGISTERED STRUCTURAL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
MAHVASH M. HARMS
No. 2639
Exp. 12/31/18
STRUCTURAL
STATE OF CALIFORNIA

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of scanned copies of this plan sheet.

CITY OF SAN JOSE DOT
200 E. SANTA CLARA St., 8th FLOOR
SAN JOSE, CA 95113

BIGGS CARDOSA ASSOCIATES INC.
865 THE ALAMEDA
SAN JOSE, CALIFORNIA 95126

PLAN CHECK SET/NOT FOR CONSTRUCTION (12/5/18)

DESIGN OVERSIGHT

SIGN OFF DATE

DESIGN	BY R. YAMANE	CHECKED
DETAILS	BY R. YAMANE	CHECKED
QUANTITIES	BY D. ROZPORKA	CHECKED

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

G. KENNING
PROJECT ENGINEER

BRIDGE NO.

POST MILES R28.61

RETAINING WALL No. 1-SOIL NAIL WALL
SOIL NAIL LAYOUT No. 2

DESIGN DETAIL SHEET (ENGLISH) (REV. 03/14/12)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0000
PROJECT NUMBER & PHASE: 04160002241
CONTRACT NO.: 04-1K2804

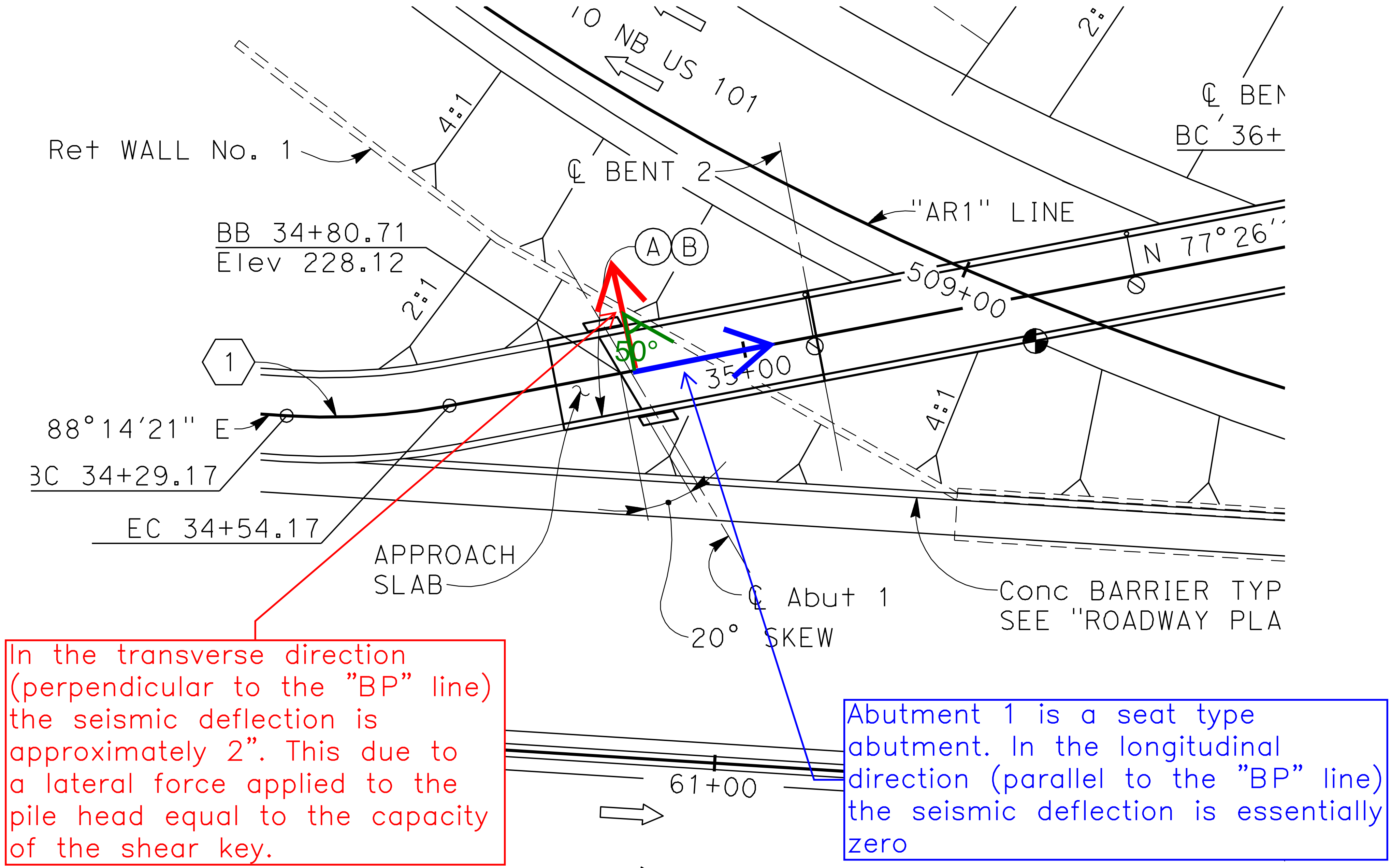
DISREGARD PRINTS BEARING EARLIER REVISION DATES 12/5/18

SHEET 4 OF 10

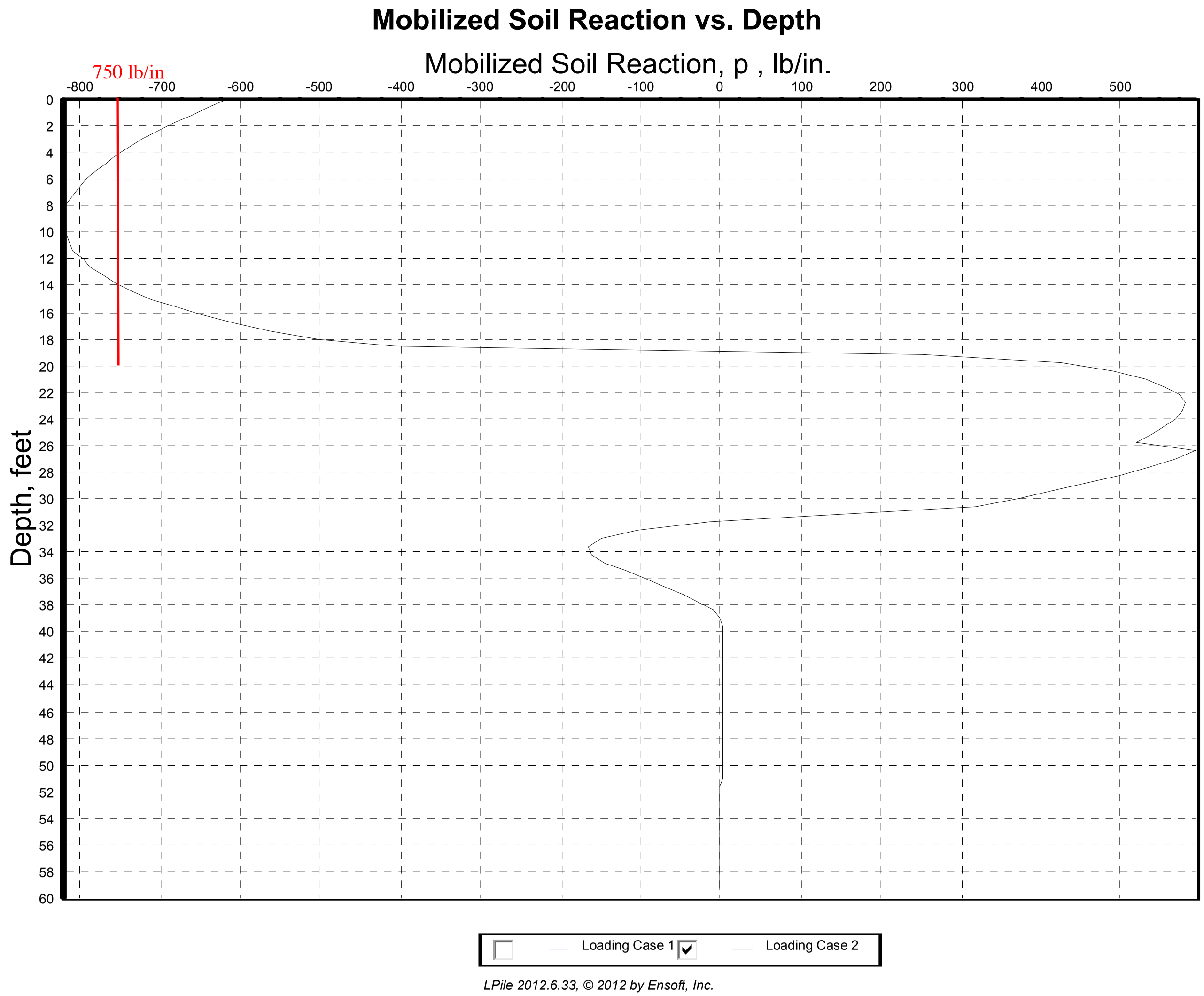
FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

2016309 (2016309R1S4)



PORTION OF GENERAL PLAN FOR NB ON-RAMP POC



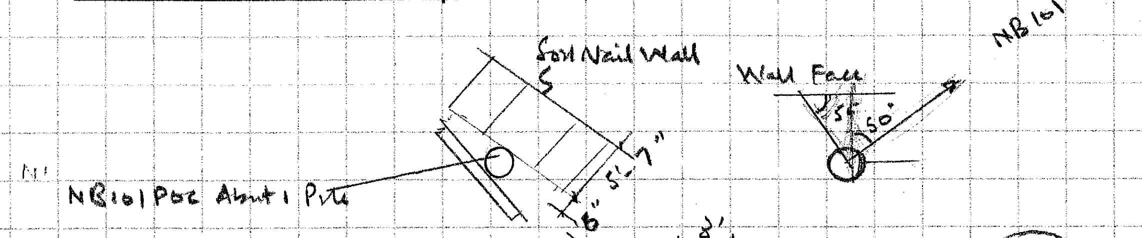
Mobilized Soil Reaction vs. Depth
Mobilized Soil Reaction, p , lb/in.
750 lb/in
-800
-700
-600
-500
-400
-300
-200
-100
0
100
200
300
400
500
Depth, feet
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
42
44
46
48
50
52
54
56
58
60
Loading Case 1
Loading Case 2
LPile 2012.6.33, © 2012 by Ensoft, Inc.

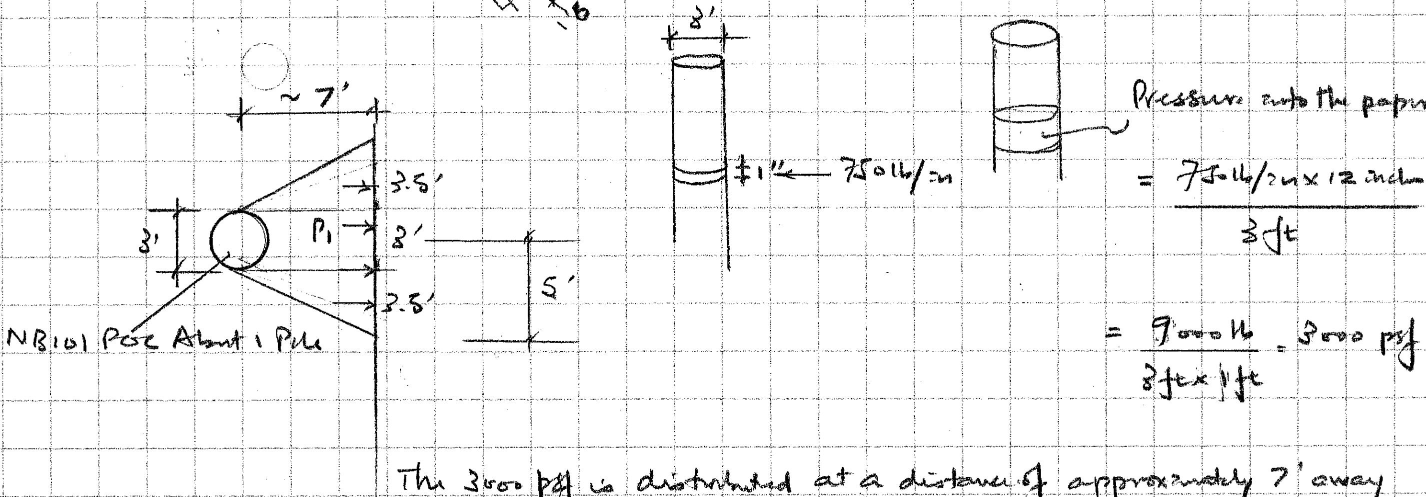
PARIKH
Practicing in the Geosciences

PROJECT NO. 2016-146-RW1
PROJECT NAME Blossom Hill Road - RW1
CALCULATED BY A Lam DATE 2/2019
CHECKED BY DATE
VERIFIED BY DATE
BACK CHECKED BY DATE

SUBJECT Retaining Wall No. 1

Lateral Load due to pile on the soil nail





$= \frac{750\ lb/in \times 12\ inch}{3\ ft}$

$= \frac{9000\ lb}{3\ ft \times 1\ ft} = 3000\ psf$

The 3000 psf is distributed at a distance of approximately 7' away from the center line

$$P_1 = \frac{3000\ psf \times 3\ ft}{(3.5 + 3 + 3.5)\ ft} = 900\ psf$$

Component of P_1 acting on the soil nail wall face

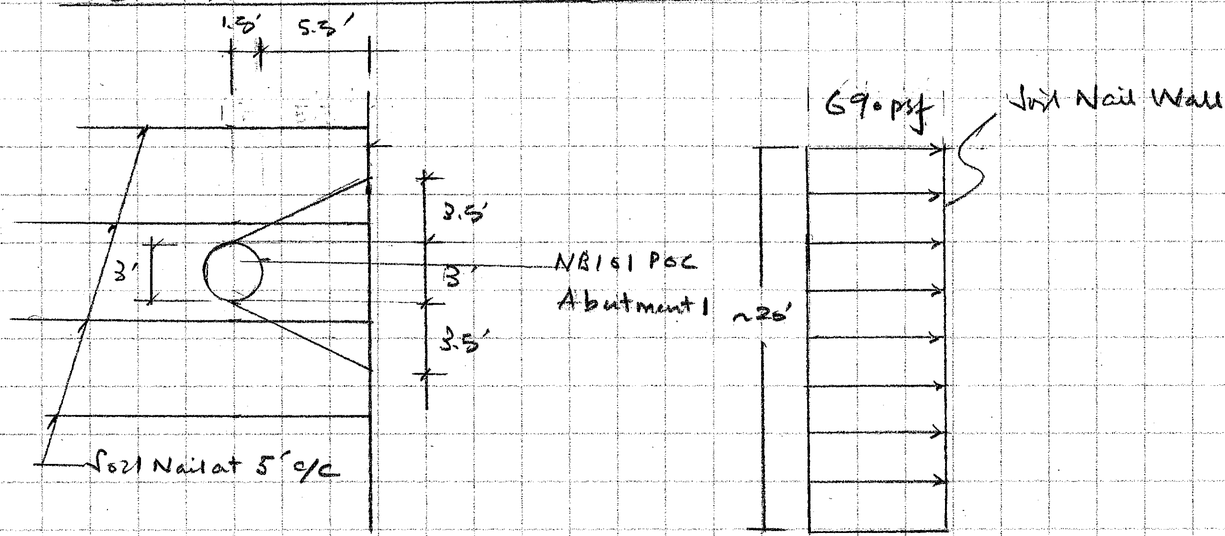
$= 900 \sin 50°$
$= 689.4\ psf$ say $\underline{690\ psf}$

PARIKH
Practicing in the Geosciences

PROJECT NO. 2016-146-RW1
PROJECT NAME Blossom Hill Road Retaining Wall No. 1
CALCULATED BY A Loun DATE 2/2019
CHECKED BY DATE
VERIFIED BY DATE
BACK CHECKED BY DATE

SUBJECT Retaining Wall No. 1

NB101 POC Lateral Load on Soil Nail Wall



The 690 psf is uniformly distributed over the width of 10 feet in front of the 36" diameter CIDH concrete pile of NB101 POC Abutment 1

BEARING CAPACITY ANALYSES

Meyerhof Bearing Capacity Calculation

Project No:	2016-146-RW1	**Date:**	3/19/2019
Project Name:	Blossom Hill RW1	**By:**	EO
Structure	Soil Nail Wall		

Input Parameters		**LRFD Resistance Factors**	
Unit weight, γ (pcf)	125	Strength	0.55
Cohesion, c (psf)	0	Seismic	1.00
Friction Angle, ϕ (deg)	35		
Width, B (feet)	2.25		
Length, L (feet)	150		
Depth, D (feet)	2		
Load Inclination, θ (deg)	0		
Water Depth, Dw (feet)	0		
Factor of Safety, FS	3		

Calculated Parameters		**Bearing Capacity**	
Kp	3.69	(Under Vertical Load)	
sc	1.01	q_{ult} (ksf)	7.99
sq	1.01		
sγ	1.01	$q_{service,all}$ (ksf)	2.66
dc	1.34	q_{str} (ksf)	4.39
dq	1.17	q_{seis} (ksf)	7.99
dγ	1.17		
ic	1.00		
iq	1.00		
iγ	1.00		
Nq	33.30		
Nc	46.12		
Nγ	37.15		
Overburden above footing, $\sigma_{zD'}$ (psf)	125.20		
Eff. UW below footing, γ' (pcf)	62.60		

SETTLEMENT ANALYSIS

PROJECT NAME ***RETAINING WALL NO. 1***
PROJECT NO. ***2016-146-***
STRUCTURE ***Soil Nail Wall***
REFERENCE BORI ***R-18-NO-101***
Hammer Energy = 78%
GW Level (ft)= 2

Footing Depth (ft) =	2
Fill Height (ft)=	-
Base Width, B (ft)=	2.5
Side Slope (XH:1V)=	-
Effective Width, B' (ft)=	2.5
Length, L (ft)=	150
Plane Strain? (Y/N)	n
Contact Pressure (psf)=	3200

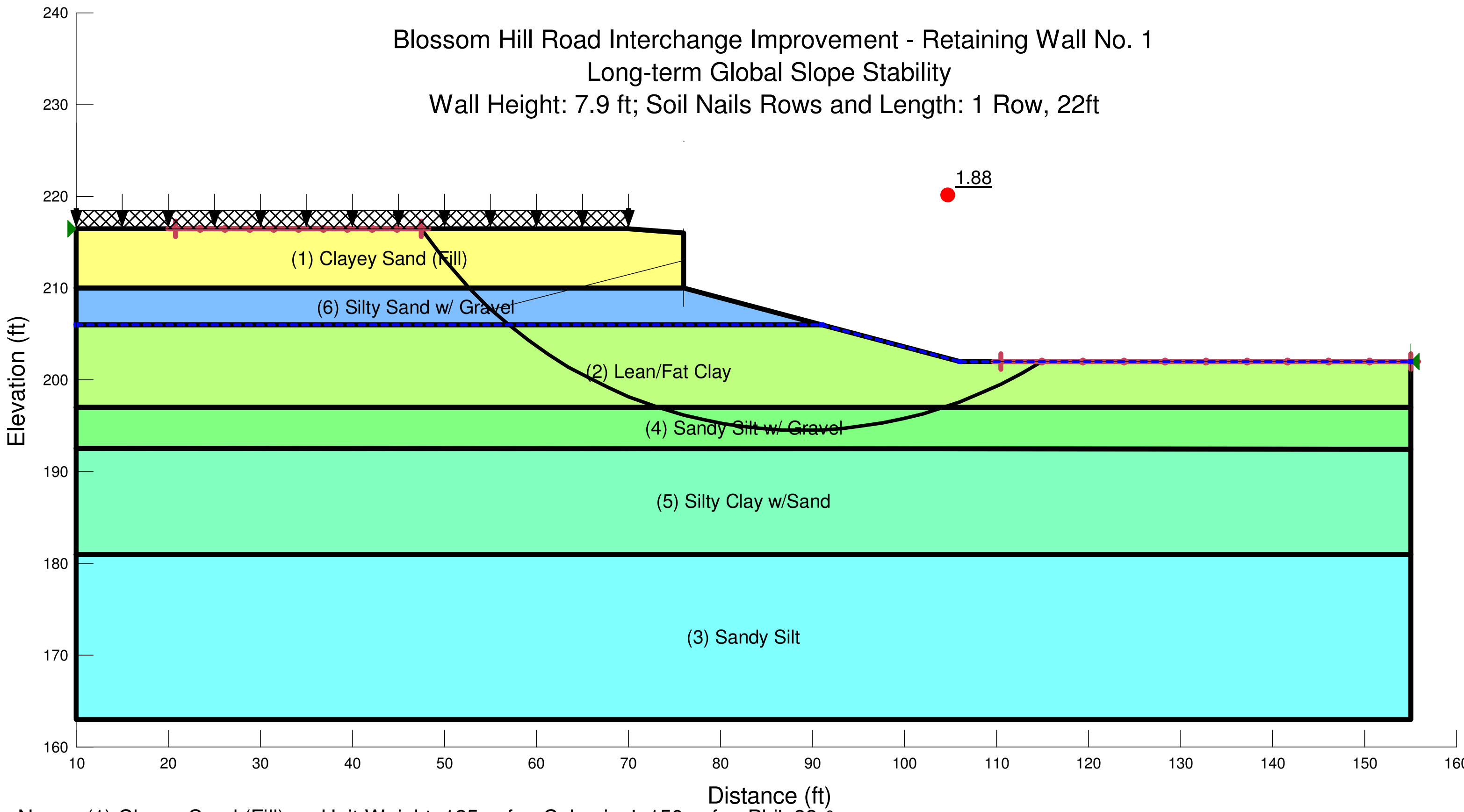
Cr/Cc= 25.0%

GROUPS
1. SANDS, GRAVELS AND NON-PLASTIC SILT
2. SATURATED CLAYS AND PLASTIC SILTS
3. OC CLAYS, NON-SATURATED CLAYS, AND NON-SATURATED PLASTIC SILTS

Depth from FG		Soil	BLOW	SAMPLER	AVG	γ_T	γ'	ω	σ_v'	$\Delta\sigma_v'$	Su	Lab Su	Pp	OCR	E	$Cr/1+e_0$	$Cc/1+e_0$	C'	Settlements (in)				
From	To	Type	COUNT	TYPE	$SPT\text{-}N_{60}$	(pcf)	(pcf)		(psf)	(psf)	(psf)	(psf)	(psf)		(psf)			(Hough Method)	Elastic	OC	NC	SAND	Sum
0	4	1	100	MC	85	125.0	62.6	12.2%	125	3200.0								422				0.162	0.162
4	9	3	7	SPT	9	125.0	62.6	18.1%	407	1109.6	1138		4550	11.2	398125				0.167				0.167
9	13	3	8	SPT	10	125.0	62.6	17.4%	689	656.3	1300		5200	7.6	455000				0.069				0.069
13	17.5	3	14	MC	12	125.0	62.6	9.1%	955	466.7	1479		5915	6.2	517563				0.049				0.049
17.5	23	1	12	MC	10	125.0	62.6	18.9%	1268	343.7		920	3680					33				0.208	0.208
23	29	1	14	MC	12	125.0	62.6	18.2%	1628	260.2		1100	4400					34				0.138	0.138
29	33	3	7	MC	6	125.0	62.6	25.5%	1941	212.8	739	340	1360	0.7	258781				0.039				0.039
33	40	2	6	MC	5	125.0	62.6	30.3%	2285	175.8	634		2535	1.1		0.0323	0.1292			0.087			0.087
40	46.5	2	13	MC	11	125.0	62.6	21.6%	2707	143.4	1373	860	3440	1.3		0.0250	0.1000			0.044			0.044
																		Estimated Settlement (in)=	*0.3*	*0.1*	*0.0*	*0.5*	*1.0*

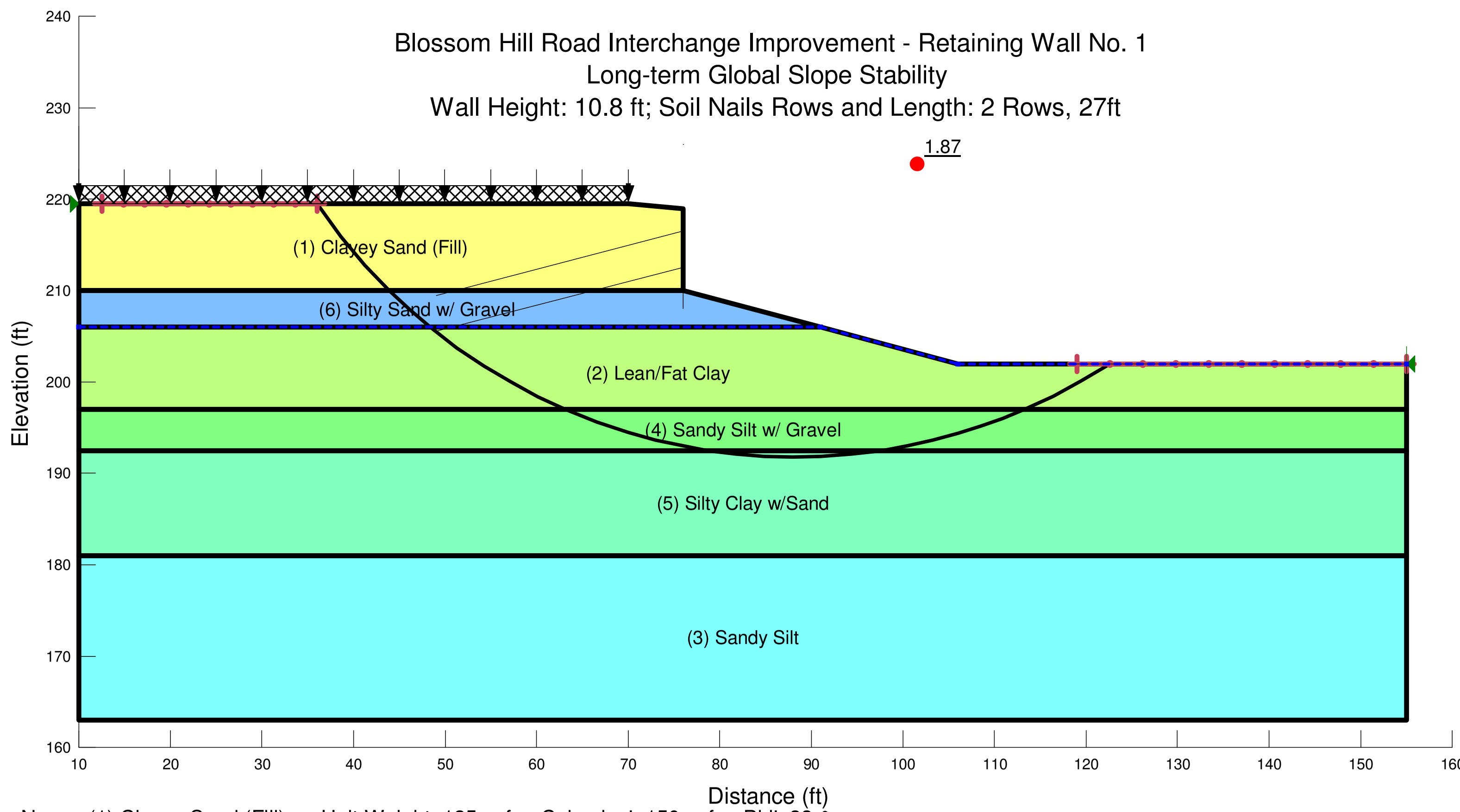
Note:
1. Cc is estiamted using empirical equation from "Soil Mechanics" by T. William lambe and Robert V. Whitman, unless there is existing consolidation lab results for Cc and Cr, which is in red font and applied in settlement calculation if soil type falls in Group 2, saturated clays and plastic silts.
2. Cr/Cc ratio of 25% was estimated based on the previous project experience.
3. OCR is calculated based on Su correlations.
4. Clays with OCR>=2.5 is considered as settling elasticly.
5. Soil profile starts from finish grade.

GLOBAL STABILITY ANALYSES



Name: (1) Clayey Sand (Fill)   Unit Weight: 125 pcf   Cohesion': 150 psf   Phi': 33 °
Name: (2) Lean/Fat Clay   Unit Weight: 125 pcf   Cohesion': 150 psf   Phi': 27 °
Name: (4) Sandy Silt w/ Gravel   Unit Weight: 125 pcf   Cohesion': 50 psf   Phi': 28 °
Name: (5) Silty Clay w/Sand   Unit Weight: 125 pcf   Cohesion': 50 psf   Phi': 28 °
Name: (3) Sandy Silt   Unit Weight: 125 pcf   Cohesion': 50 psf   Phi': 28 °
Name: (6) Silty Sand w/ Gravel   Unit Weight: 125 pcf   Cohesion': 50 psf   Phi': 38 °

Blossom Hill Road Interchange Improvement - Retaining Wall No. 1
Long-term Global Slope Stability
Wall Height: 10.8 ft; Soil Nails Rows and Length: 2 Rows, 27ft



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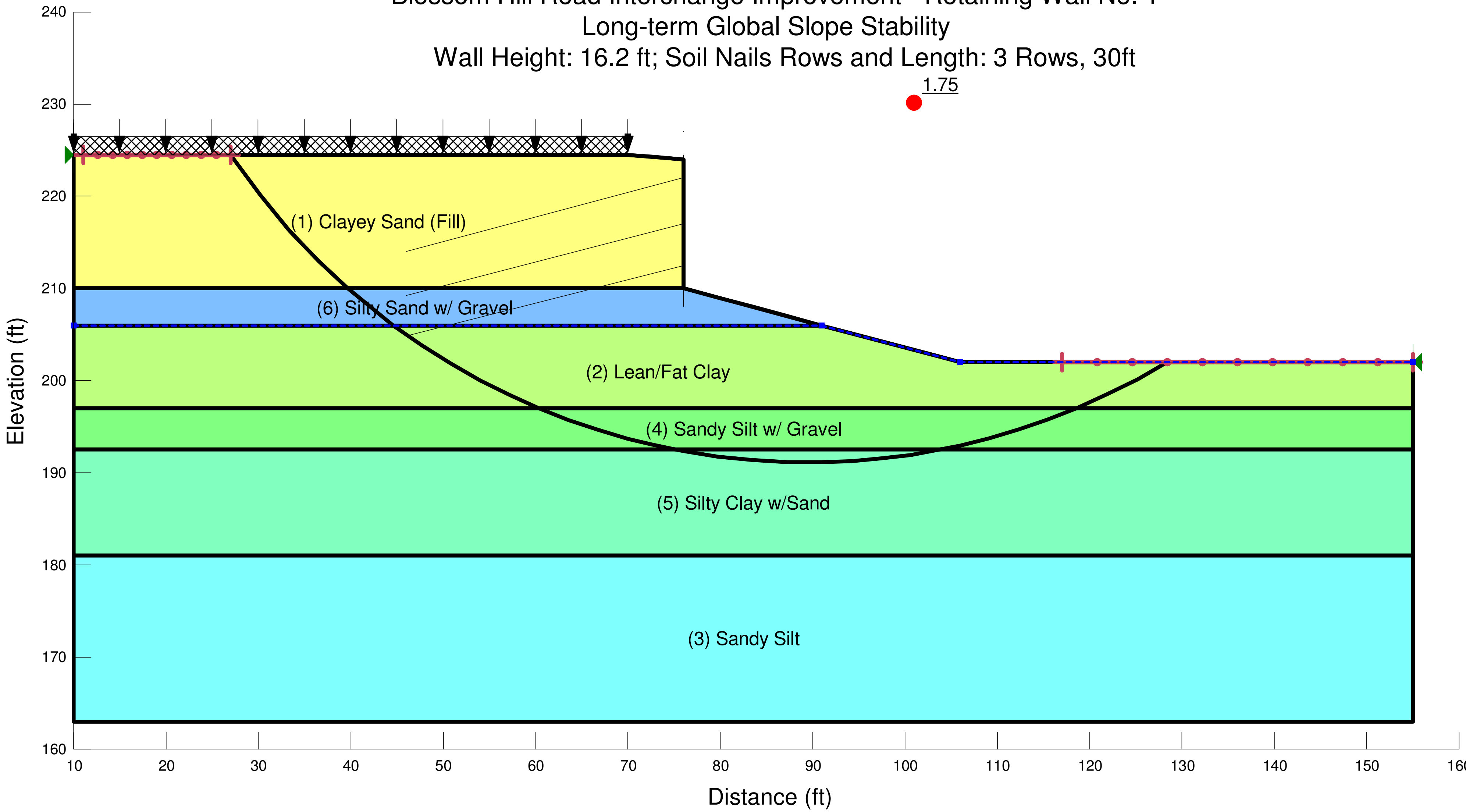
Name: (2) Lean/Fat Clay Unit Weight: 125 pcf Cohesion': 150 psf Phi': 27 °
Name: (4) Sandy Silt w/ Gravel Unit Weight: 125 pcf Cohesion': 50 psf Phi': 28 °
Name: (5) Silty Clay w/Sand Unit Weight: 125 pcf Cohesion': 50 psf Phi': 28 °
Name: (3) Sandy Silt Unit Weight: 125 pcf Cohesion': 50 psf Phi': 28 °
Name: (6) Silty Sand w/ Gravel Unit Weight: 125 pcf Cohesion': 50 psf Phi': 38 °

Blossom Hill Road Interchange Improvement - Retaining Wall No. 1
Long-term Global Slope Stability
Wall Height: 16.2 ft; Soil Nails Rows and Length: 3 Rows, 30ft



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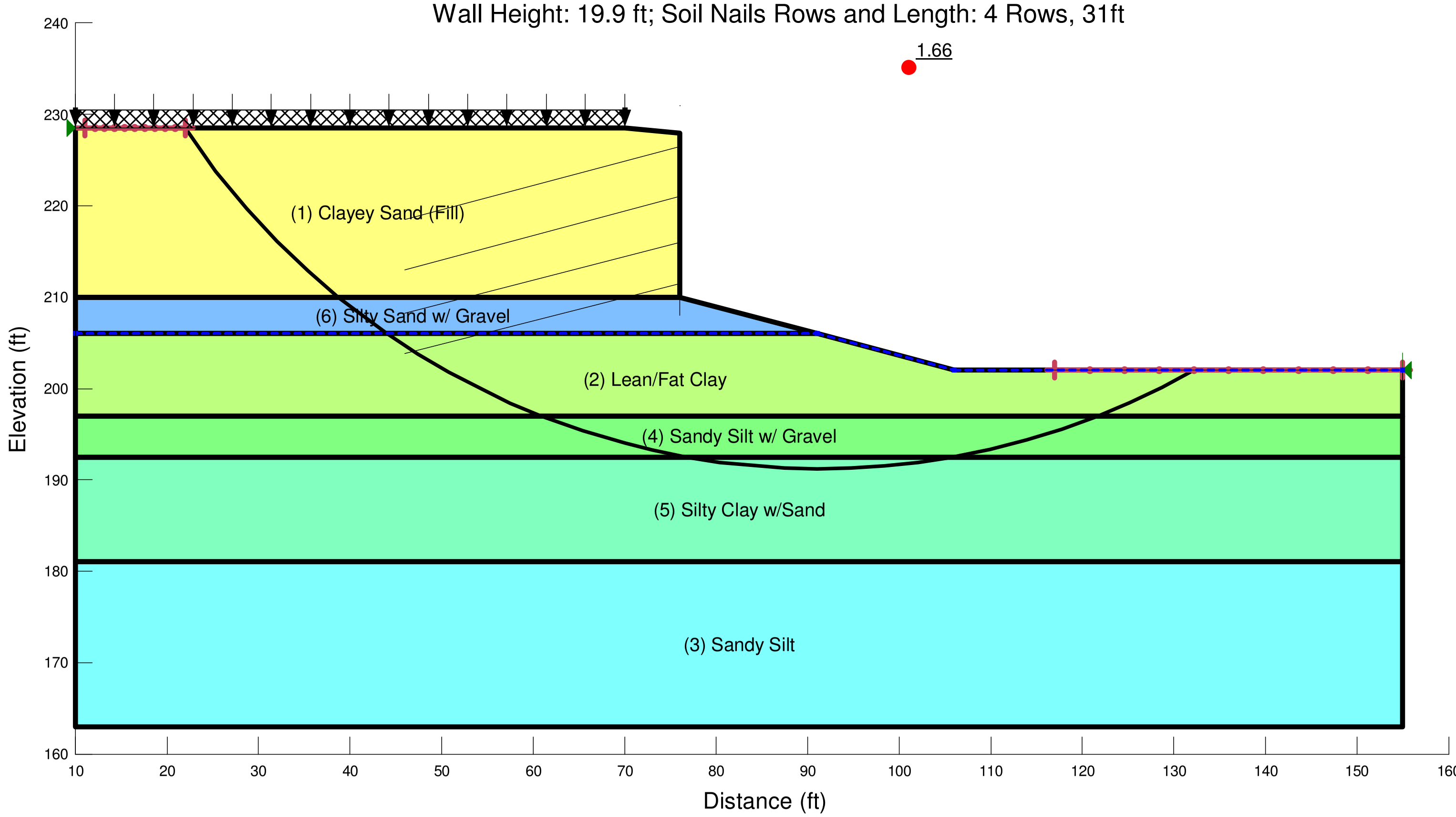
Name: (2) Lean/Fat Clay Unit Weight: 125 pcf Cohesion': 150 psf Phi': 27 °
Name: (4) Sandy Silt w/ Gravel Unit Weight: 125 pcf Cohesion': 50 psf Phi': 28 °
Name: (5) Silty Clay w/Sand Unit Weight: 125 pcf Cohesion': 50 psf Phi': 28 °
Name: (3) Sandy Silt Unit Weight: 125 pcf Cohesion': 50 psf Phi': 28 °
Name: (6) Silty Sand w/ Gravel Unit Weight: 125 pcf Cohesion': 50 psf Phi': 38 °

Blossom Hill Road Interchange Improvement - Retaining Wall No. 1
Long-term Global Slope Stability
Wall Height: 19.9 ft; Soil Nails Rows and Length: 4 Rows, 31ft



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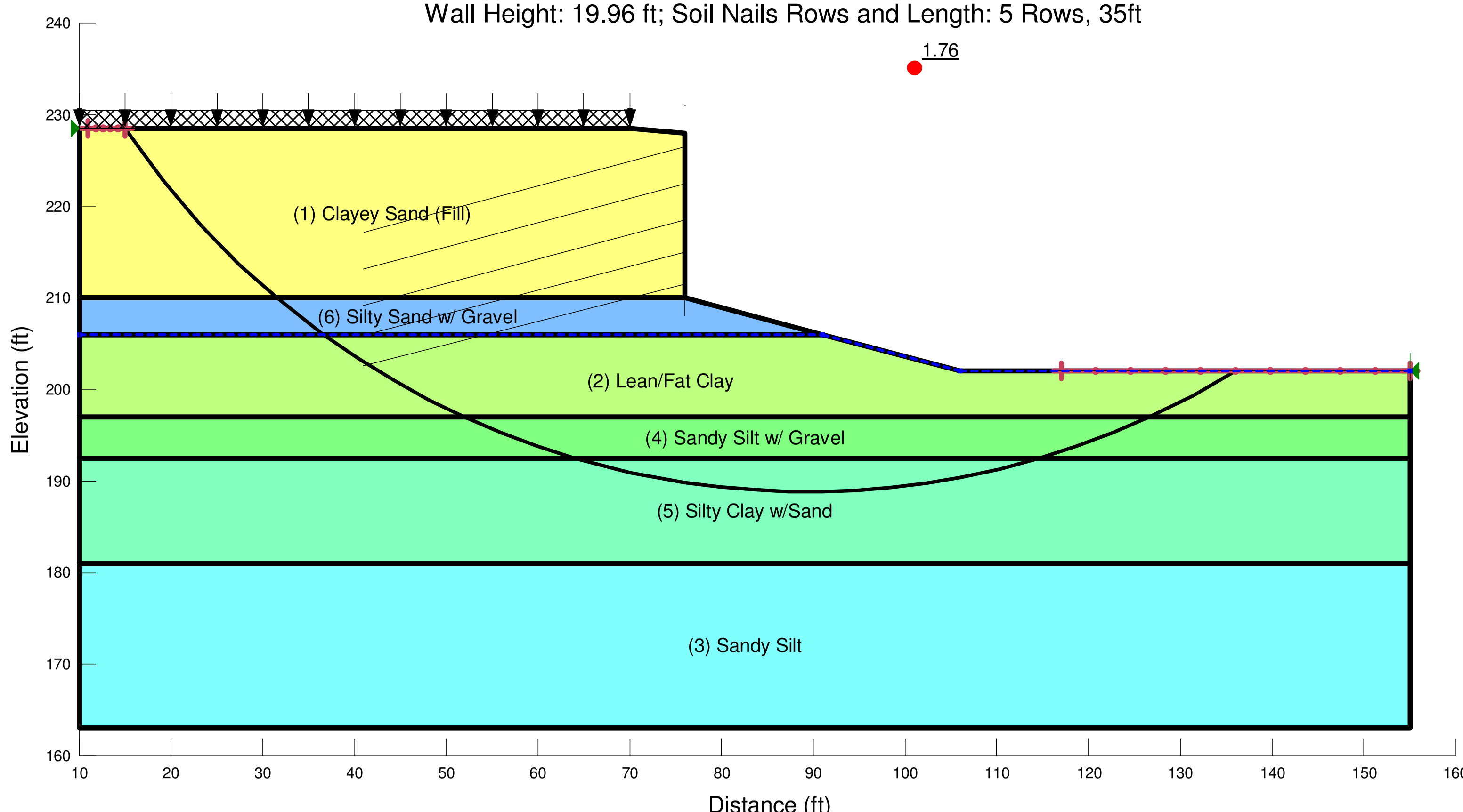
Name: (2) Lean/Fat Clay Unit Weight: 125 pcf Cohesion': 150 psf Phi': 27 °
Name: (4) Sandy Silt w/ Gravel Unit Weight: 125 pcf Cohesion': 50 psf Phi': 28 °
Name: (5) Silty Clay w/Sand Unit Weight: 125 pcf Cohesion': 50 psf Phi': 28 °
Name: (3) Sandy Silt Unit Weight: 125 pcf Cohesion': 50 psf Phi': 28 °
Name: (6) Silty Sand w/ Gravel Unit Weight: 125 pcf Cohesion': 50 psf Phi': 38 °

Blossom Hill Road Interchange Improvement - Retaining Wall No. 1

Long-term Global Slope Stability

Wall Height: 19.96 ft; Soil Nails Rows and Length: 5 Rows, 35ft



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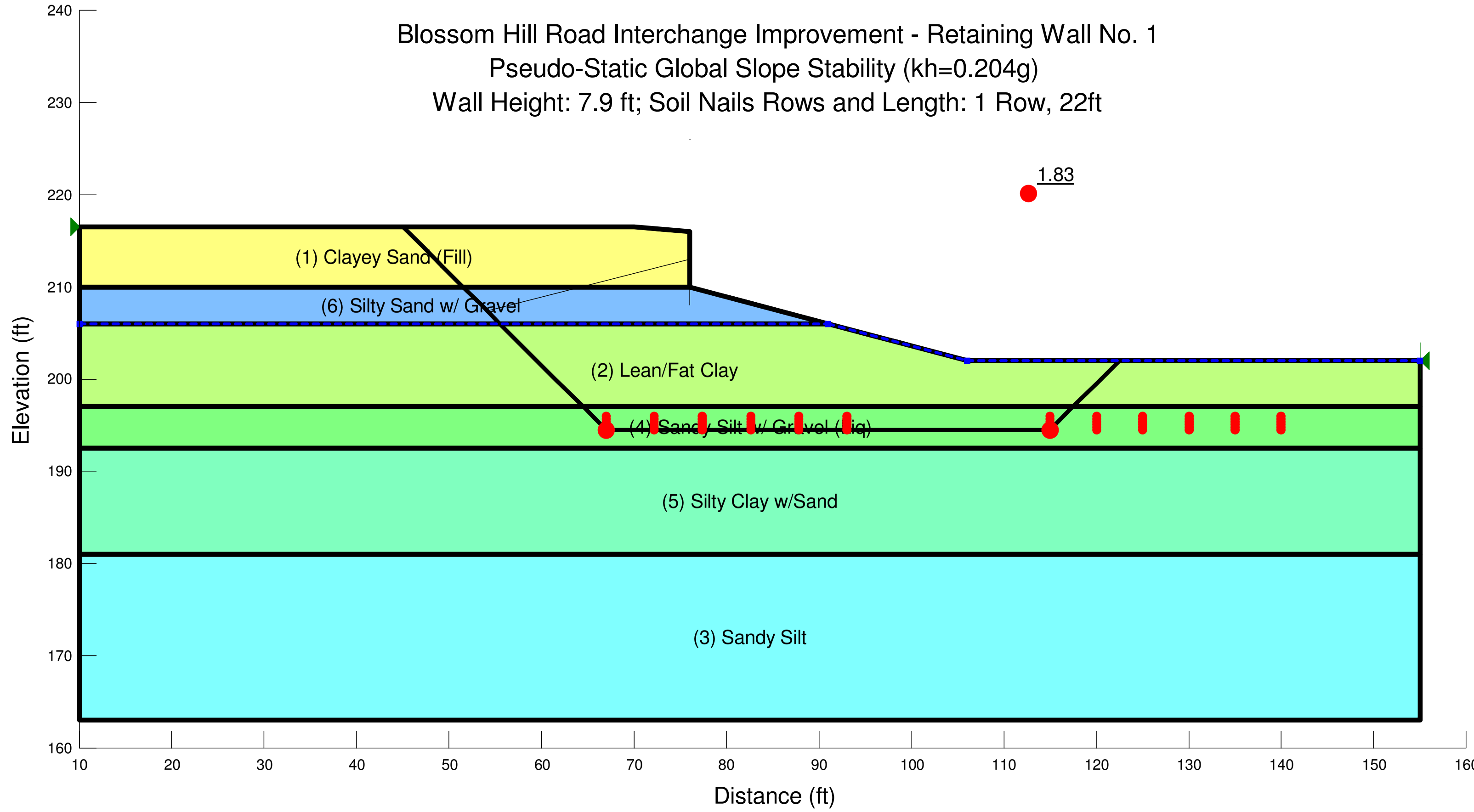
Name: (2) Lean/Fat Clay Unit Weight: 125 pcf Cohesion': 150 psf Phi': 27 °

Name: (4) Sandy Silt w/ Gravel Unit Weight: 125 pcf Cohesion': 50 psf Phi': 28 °

Name: (5) Silty Clay w/Sand Unit Weight: 125 pcf Cohesion': 50 psf Phi': 28 °

Name: (3) Sandy Silt Unit Weight: 125 pcf Cohesion': 50 psf Phi': 28 °

Name: (6) Silty Sand w/ Gravel Unit Weight: 125 pcf Cohesion': 50 psf Phi': 38 °



Name: (1) Clayey Sand (Fill) Unit Weight: 125 pcf Cohesion': 1,500 psf Phi': 0 °

Name: (2) Lean/Fat Clay Unit Weight: 125 pcf Cohesion': 1,375 psf Phi': 0 °

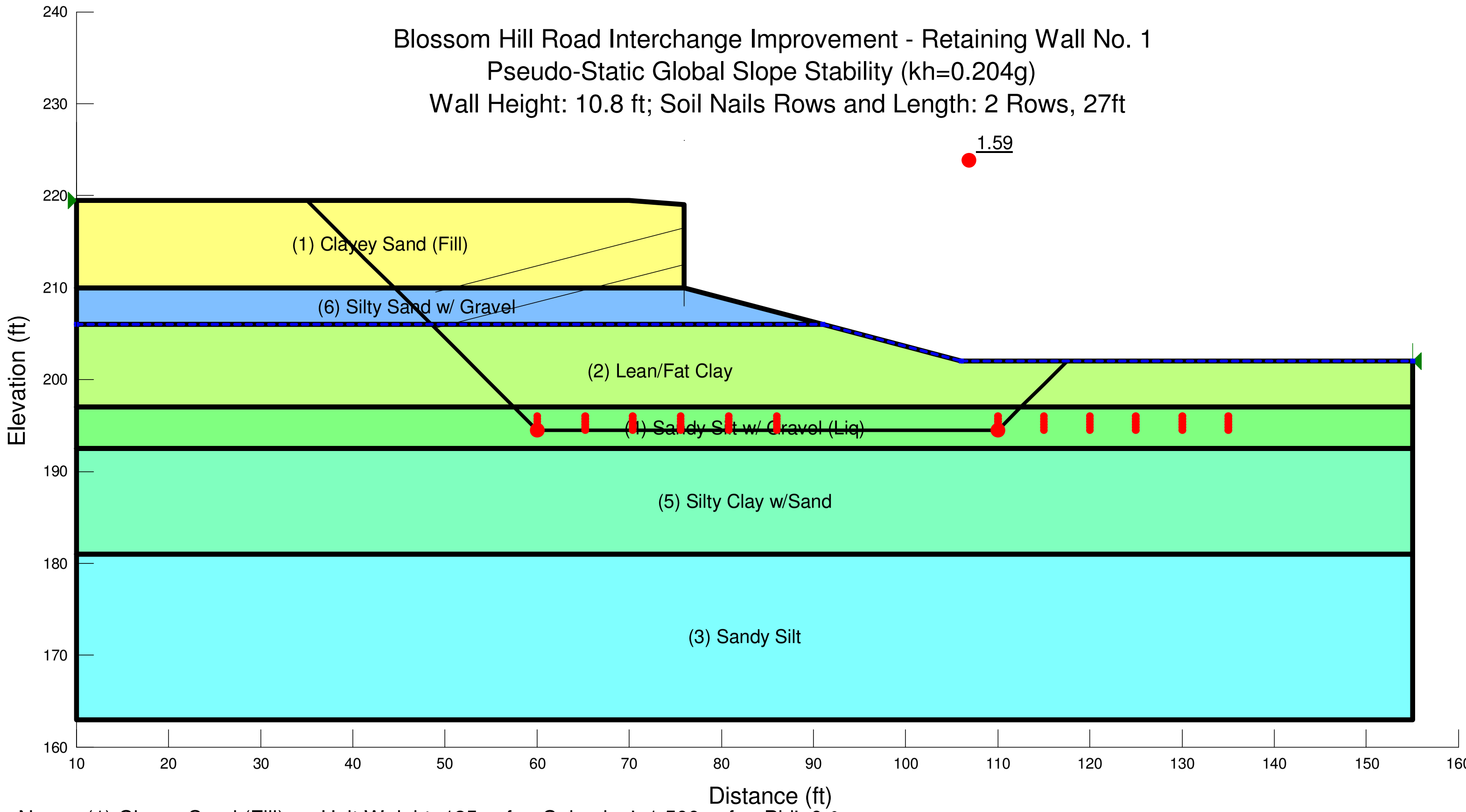
Name: (4) Sandy Silt w/ Gravel (Liq) Unit Weight: 125 pcf Cohesion': 415 psf Phi': 0 °

Name: (5) Silty Clay w/Sand Unit Weight: 125 pcf Cohesion': 1,000 psf Phi': 0 °

Name: (3) Sandy Silt Unit Weight: 125 pcf Cohesion': 500 psf Phi': 28 °

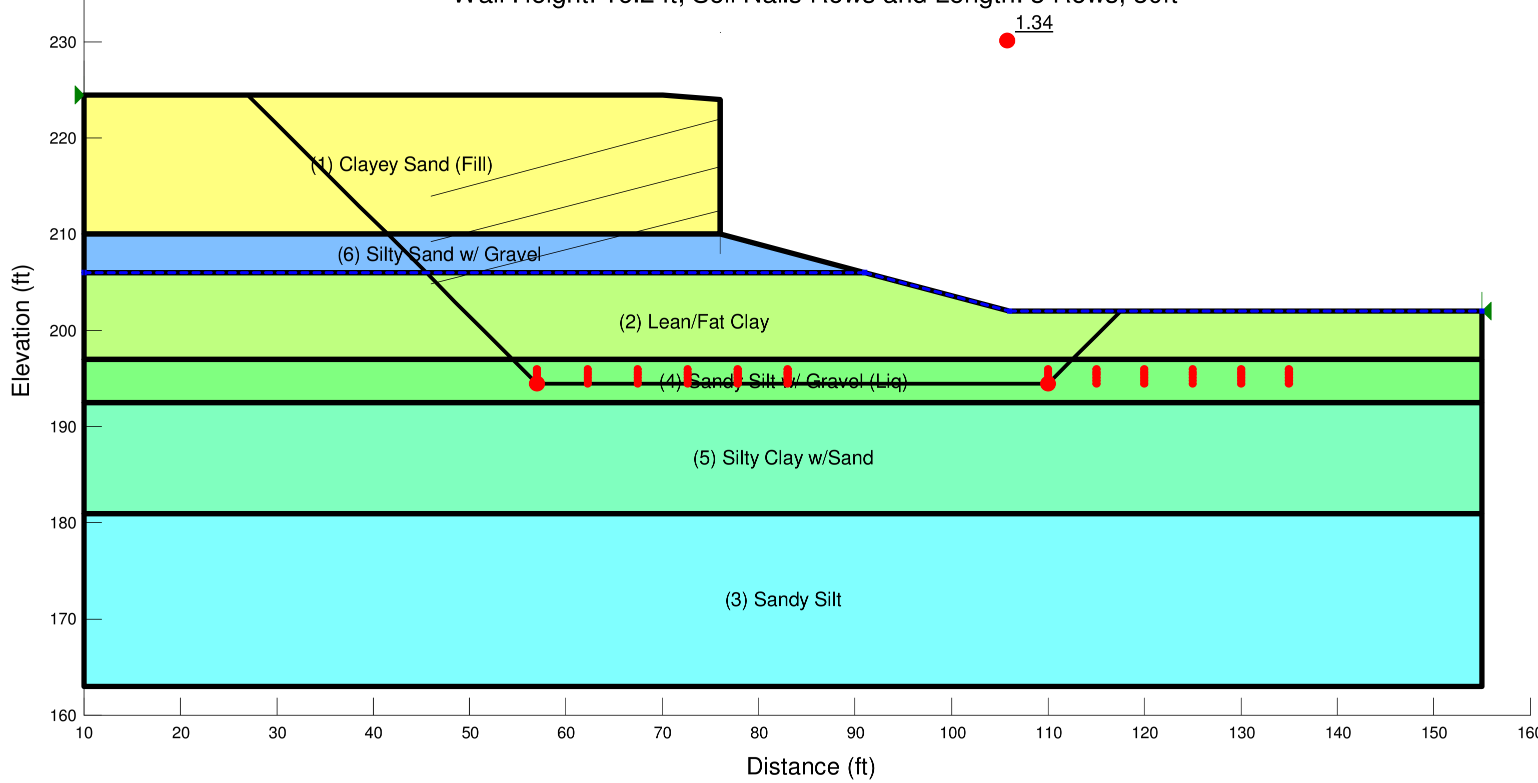
Name: (6) Silty Sand w/ Gravel Unit Weight: 125 pcf Cohesion': 50 psf Phi': 38 °

Blossom Hill Road Interchange Improvement - Retaining Wall No. 1
Pseudo-Static Global Slope Stability (kh=0.204g)
Wall Height: 10.8 ft; Soil Nails Rows and Length: 2 Rows, 27ft



Name: (1) Clayey Sand (Fill) Unit Weight: 125 pcf Cohesion': 1,500 psf Phi': 0 °
Name: (2) Lean/Fat Clay Unit Weight: 125 pcf Cohesion': 1,375 psf Phi': 0 °
Name: (4) Sandy Silt w/ Gravel (Liq) Unit Weight: 125 pcf Cohesion': 415 psf Phi': 0 °
Name: (5) Silty Clay w/Sand Unit Weight: 125 pcf Cohesion': 1,000 psf Phi': 0 °
Name: (3) Sandy Silt Unit Weight: 125 pcf Cohesion': 500 psf Phi': 28 °
Name: (6) Silty Sand w/ Gravel Unit Weight: 125 pcf Cohesion': 50 psf Phi': 38 °

Blossom Hill Road Interchange Improvement - Retaining Wall No. 1
Pseudo-Static Global Slope Stability (kh=0.204g)
Wall Height: 16.2 ft; Soil Nails Rows and Length: 3 Rows, 30ft



Name: (1) Clayey Sand (Fill) Unit Weight: 125 pcf Cohesion': 1,500 psf Phi': 0 °
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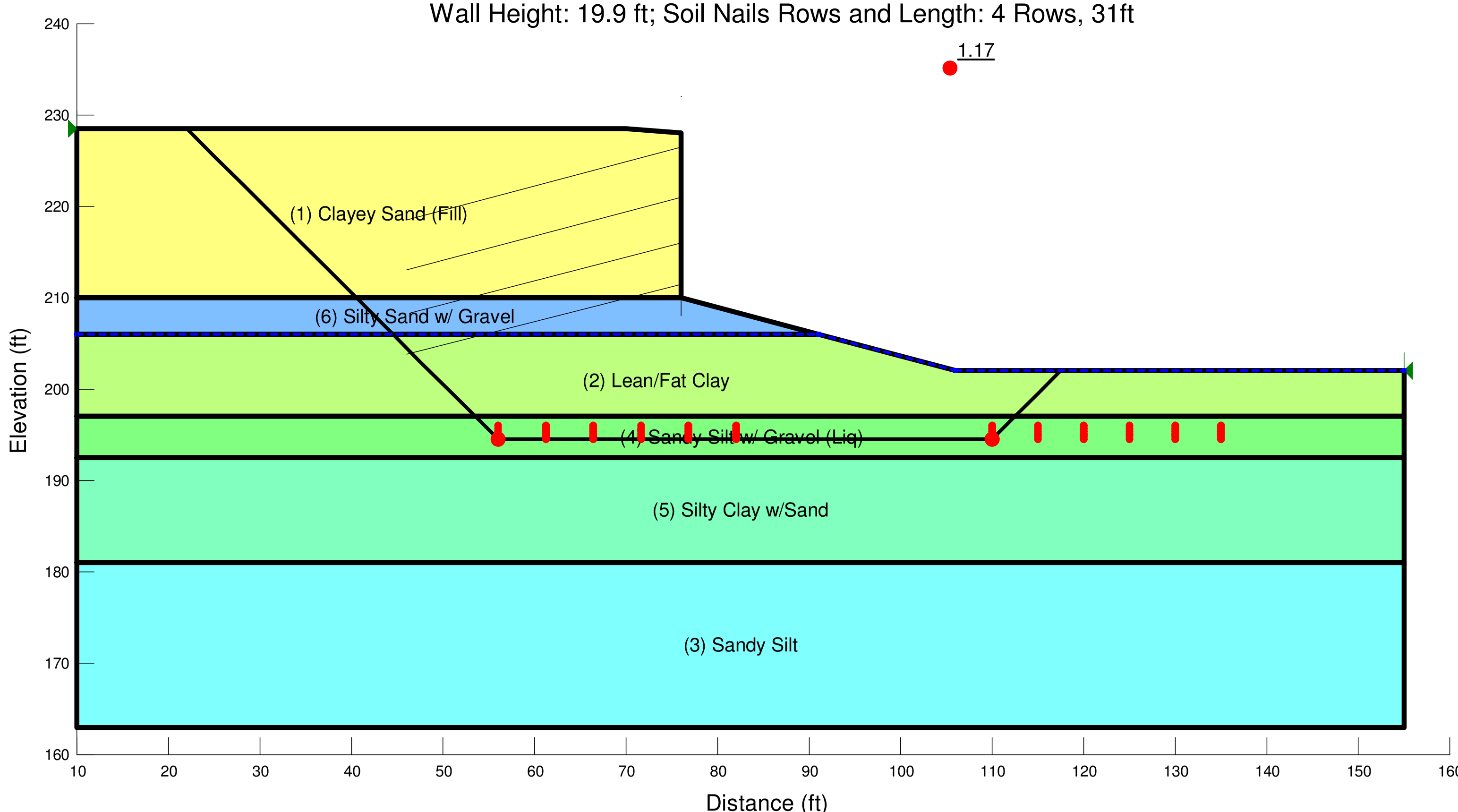
Name: (4) Sandy Silt w/ Gravel (Liq) Unit Weight: 125 pcf Cohesion': 415 psf Phi': 0 °
Name: (5) Silty Clay w/Sand Unit Weight: 125 pcf Cohesion': 1,000 psf Phi': 0 °
Name: (3) Sandy Silt Unit Weight: 125 pcf Cohesion': 500 psf Phi': 28 °
Name: (6) Silty Sand w/ Gravel Unit Weight: 125 pcf Cohesion': 50 psf Phi': 38 °

Blossom Hill Road Interchange Improvement - Retaining Wall No. 1
Pseudo-Static Global Slope Stability (kh=0.204g)
Wall Height: 19.9 ft; Soil Nails Rows and Length: 4 Rows, 31ft



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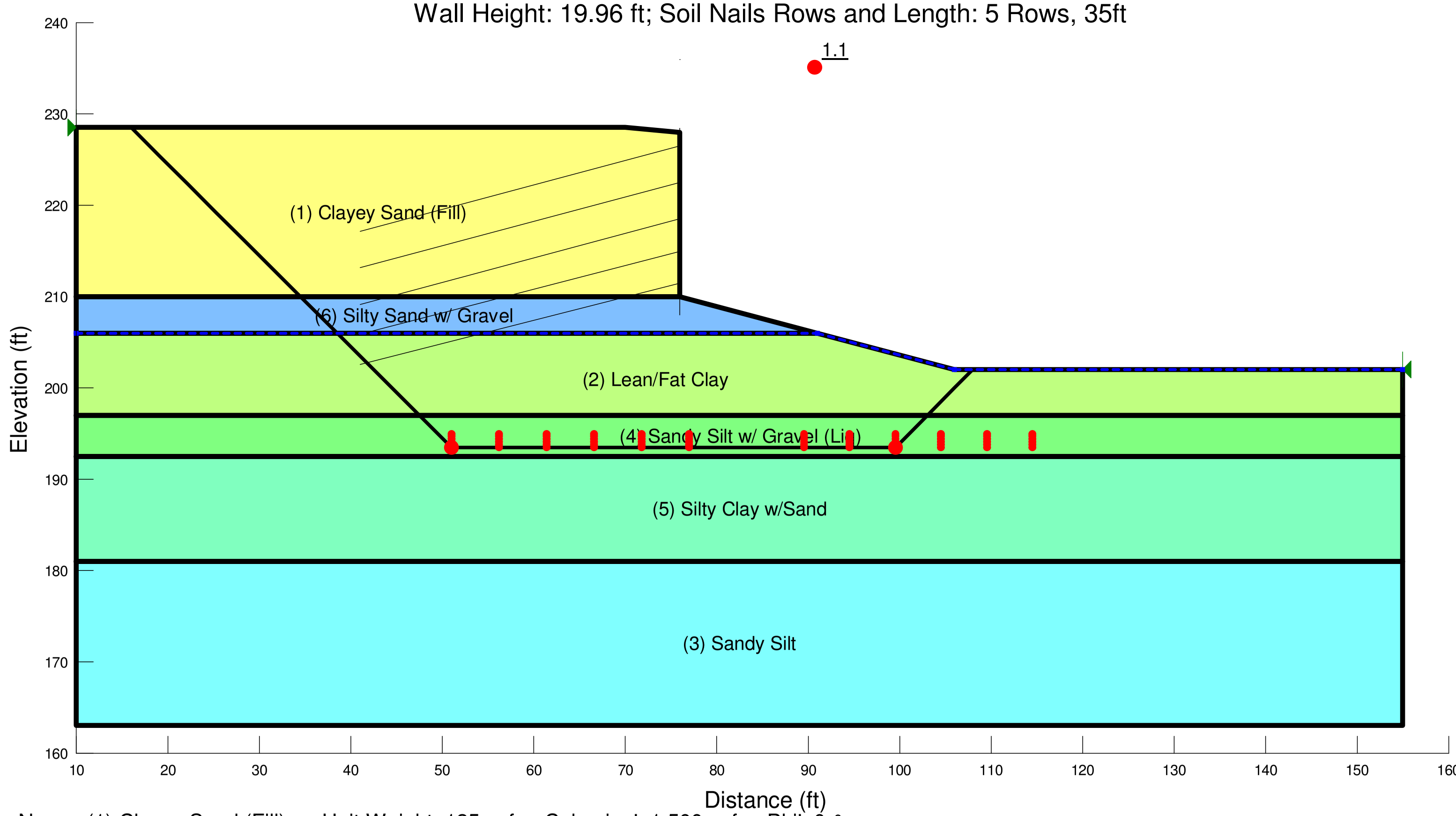
Name: (6) Silty Sand w/ Gravel Unit Weight: 125 pcf Cohesion': 50 psf Phi': 38 °

Blossom Hill Road Interchange Improvement - Retaining Wall No. 1
Pseudo-Static Global Slope Stability (kh=0.204g)
Wall Height: 19.96 ft; Soil Nails Rows and Length: 5 Rows, 35ft



Name: (1) Clayey Sand (Fill) Unit Weight: 125 pcf Cohesion': 1,500 psf Phi': 0 °
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APPENDIX V

RESPONSE TO CALTRANS' REVIEW COMMENTS

Office of Special Funded Projects
Comment & Response Form

(Revised 08/2011)

General Project Information (OSFP Liaison to complete)		**Review Phase** (OSFP Liaison to complete)	**Reviewer Information** (Reviewer Liaison to complete)	
Dist:	**04**	☐ PSR/PDS (Review No.)	Reviewer Name:	**R. Nashed/ J. Anderson**
Proj ID (Phase):	**0416000224**	☐ APS/PSR (Review No.)	Functional Unit:	**Geotechnical Design- West**
EA:	**1K2801**	☐ APS/PR (Review No.)	Cost Center:	**59-3660**
Project Name:	**Blossom Hill Rd Interchange Improvement**	☐ Type Selection	Phone Number:	**510-622-1773**
OSFP Liaison:	**Shu-Shang Liu**	☐ 65% PS&E Unchecked Details	e-mail:	**Rifaat.nashed@ dot.ca.gov**
Phone:	**916-227-8919**	☐ PS&E (Review No. 1)	Date of Review:	**12/ 27/2018**
E-mail:	**Shu-shang.liu@dot.ca.gov**	☐ Construction	Structure Name*:	**Retaining Wall No.1**
		☑ Other: FR	Br No*:	
			(*Use if necessary to when comment sheets are by individual structure)	

Consultant Information (to be filled in by Consultant)

Consultant Lead (First and Last Name)	Consultant Firm	Phone Number	E-mail	Response Date

#	Doc. (See Note 1)	Page, Section, or SSP	Review Comments	Consultant Responses	Caltrans Responses
	FR	N/A	Review of Geology and subsurface and Related sections items Foundation Report (DRAFT) by Parikh consultants prepared for HMH Engineers dated December 4, 2018		
1	FR	Section 9.0 Subsurface condition Page 11	Table 4 For boring # R-18-NO-101 The fat clay/lean clay layers between elevation	The pocket penetrometer measurement of Sample No. 4 (at the depth of 16 feet) of the fat clay/lean clay layers between Elev. 195 feet and Elev. 205	

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓= Comment Resolved (for Reviewer's use)

			195 and 205 the pocket penetrometer measurement is missing.	feet of Boring R-18-NO-101 has been added to the boring log in the LOTB	
2	FR	Section 10.0 Page 8	Table 6- ARS DATA Please add the "Spectral Acceleration" (SA) column including the deterministic data for each listed fault.	The "Spectral Acceleration" (SA) column including the deterministic data for each listed fault will be added to Table 6 – ARS DATA.	
3	FR	Section 9.0	Geology section references Plate No. 2, which does not exist. Please correct reference. -JA	Comment incorporated. Plate No. 2 has been changed to Plate No. I-3.	
4	FR	Table 4	The font size for R-18-NO-101 is smaller than for R-18-SC-002. Please use only one font size. -JA	Comment incorporated. The font size of for R-18-NO-101 has been changed to be consistent with R-18-SC-002.	
5	FR	Section 11.2 - Output	Bullet point 1 in the output is unclear. Please revise -JA	Bullet Point 1 under "Output" has been revised to "The recommended ARS curve is based on the maximum of the comparison of the deterministic data and Caltrans Probabilistic data. The recommended ARS curve at this site is based on the Probabilistic curve".	
6	FR	Section 11.3	Section references Plate No, IV-1, which does not exist. Please correct. -JA	Comment not clear. ARS Online Map, Plate No. IV-1 is after the "Fault Map" in Appendix IV in the foundation report.	
7	FR	Section 11.3.2	Section references Section 12.2, which does not exist. Please correct. -JA	Comment noted. The referenced section should be Section 11.2 instead. This has been corrected in the foundation report.	

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓= Comment Resolved
(for Reviewer's use)

8	FR	Section 11.3.4	PGA listed as 0.628g, which does not match Section 11.3.2. Please correct. -JA	The PGA in Section 11.3.4 has been revised to 0.612g to match the PGA in Section 11.3.2.	
9	FR	Section 13.0 Table 9	No corrosion results in appendix for R-18-SC-002. Please add these	Comment incorporated. Corrosion test result for R-18-SC-002 has been added in Appendix III.	
10	FR	Section 15.5	There appears to two introductory sentences for Table 10. -JA	Comment incorporated. The extra sentence for Table 10 has been deleted.	
11	FR	Appendix II - Log of Test Borings	All UC values are in ksf, but are shown as tsf. Please correct. -JA	The UC values are in the unit of ksf based on the laboratory test result. The UC values are in the unit of tsf in the Log of Test Borings.	
12	FR	Appendix III – Laboratory Test Results	Introductory page is mislabeled as Appendix B and references Appendix A rather than Appendix II. Please correct this. -JA	The appendices referred in the introductory page of Appendix III has been corrected.	
13	FR	Appendix IV – Liquefaction Analyses	All layers should have a Fines Content for calculations -JA	Estimated fine content has been added to the sand layer(s) (without any sieve analyses) based on the visual inspection of the soil samples.	
14	FR	All Sections	Please review report for grammar and consistent formatting/structure across all reports. -JA	Comment incorporated.	

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓= Comment Resolved
(for Reviewer's use)

FOUNDATION REPORT

BLOSSOM HILL ROAD INTERCHANGE IMPROVEMENT
RETAINING WALL NO. 2
(BRIDGE NO. 37E0126)
SAN JOSE, CALIFORNIA
04-SCl-101, R28.4/R28.9 EA 04-1K280

For

HMH Engineers
1570 Oakland Road
San Jose, CA 95131

PARIKH CONSULTANTS, INC.
2360 Qume Drive, Suite A, San Jose, CA 95131
(408) 452-9000

October 15, 2019 Job No.: 2016-146-MSE

TABLE OF CONTENTS

Plate IV-2B: Spectrum Comparison

Liquefaction Analyses

Calculations of Shear Wave Velocity

Lateral Earth Pressures

Bearing Capacity Analyses (Strength and Extreme Event Limit Cases)

Bearing Capacity Analyses (Settlement Controlled)

Settlement Analyses

Global Stability Analyses

APPENDIX V

Office of Special Funded Projects Comment & Response Form - Parikh Consultants, Inc. Response to Caltrans Review Comments.

FOUNDATION REPORT
BLOSSOM HILL ROAD INTERCHNAGE IMPROVEMENT
RETAINING WALL NO. 2 (BRIDGE NO. 37E0126)
SAN JOSE, CALIFORNIA
04-SCl-101, R28.4/R28.9 EA 04-1K280

1.0 INTRODUCTION

This foundation report presents the results of our geotechnical engineering investigation for the proposed "US 101/Blossom Hill Road Interchange Improvement Project – Retaining Wall No. 2" in San Jose, California, hereinafter referred to as "PROJECT". The work was performed in general accordance with the scope of work outlined in our proposal to HMH Engineers (Designer).

The geotechnical recommendations presented in this report are intended for design input and are not intended to be used as specifications. In addition, the data provided in this report including these geotechnical recommendations should not be used for bidding purposes or for construction cost estimates. If the report is provided as a reference document, any interpretation of the data and recommendations should be the sole responsibility of the user and PARIKH Consultants, Inc. (PARIKH) shall not be liable for any consequences. PURPOSE AND SCOPE OF WORK

The purpose of this investigation was to evaluate the general subsurface soil conditions at the project site, to evaluate their engineering properties, and to provide geotechnical recommendations for the foundation design of the proposed project. The scope of work performed for this investigation included a review of the readily available soils and geologic literature pertaining to the project site including review of boring data, laboratory testing of the representative soil samples, performing engineering analyses based on the field and laboratory data, and preparation of this foundation report. The recommendations in this report are based on the field exploration performed by Parikh, general plan and foundation plan provided by the Biggs Cardosa Associates (Structural Designer).

2.0 REFERENCES

The following documents were used to develop the recommendations presented in this report:

a) Caltrans Department of Transportation, 2010, Soil & Rock Logging, Classification, and Presentation Manual, Office of Structural Foundations California Department of Transportation.

b) Dibblee, T.W., and Minch, J.A., Geologic Maps of San Jose East (DF-155) and Santa Teresa Hills (DF-158) quadrangles, 2005

c) Caltrans ARS Online Web Tool (http://dap3.dot.ca.gov/ARS_Online/)

d) AASTHO Bridge Design Specifications – Sixth Edition with California Amendments

e) Caltrans Department of Transportation, "Seismic Design Criteria", Version 1.7, April 2013.

f) California Department of Transportation, 2018, Standard Specifications, Sections 1 through 95.

g) California Department of Transportation Division of Engineering Services Materials Engineering and Testing Services Corrosion and Structural Concrete Field Investigation Branch Corrosion Guidelines Version 3.0, March 2018.

h) Caltrans Division of Engineering Services Geotechnical Services "Foundation Reports for Earth Retaining Systems (ERS)", June 2017.

3.0 PROJECT DESCRIPTION

The project proposes to modify the US 101/ Blossom Hill Road Interchange to improve traffic operations and connectivity for pedestrians and bicyclists along Blossom Hill Road. The existing Blossom Hill Road Interchange consists of two separate overcrossing structures over US 101 with partial cloverleaf ramps. The project is located within the City of San Jose, in Santa Clara County. It will be implemented as a locally-funded project with the City of San Jose performing advertisement, award and administration (AAA) of the construction contract through a Caltrans encroachment permit.

Blossom Hill Road is a key connector between job locations, mixed-use housing, commercial development and recreational opportunities in an area where San Jose is focused on developing greater internalization of automobile trips, increased use of transit and expanded active transportation. The level-of-service for existing and forecasted traffic is deficient for existing developments and nearby proposed projects. The configuration of the existing interchange and ramp intersections along Blossom Hill Road are not consistent with the latest standards for accommodating balanced use by vehicles, bicyclists and pedestrians.

The proposed project improvements will occur along Blossom Hill Road from east of the Monterey Road / Blossom Hill Road grade separation to the US 101 Northbound Off-Ramp / Coyote Road intersection. All improvements will be constructed within existing Caltrans and City of San Jose rights-of-way.

In addition, the existing 5-foot sidewalk on the north side of Blossom Hill Road will be replaced with a 10-foot to 12-foot wide Class I Bike/Pedestrian path. The Class I Bike/Pedestrian path will cross over the northbound diagonal on-ramp by constructing a truss type pedestrian overcrossing, with an easterly approach consisting of a short span concrete slab bridge and Mechanically Stabilized Embankment (MSE) walls, and will connect to the existing sidewalk and bike lanes at the US 101/Northbound Off-Ramp / Coyote Road intersection.

The following bridge structures and retaining walls would be modified or constructed in association with the "US 101/Blossom Hill Road Interchange Improvement Project" and path:

1. Blossom Hill Road Overcrossing (OC) (Widen) (Bridge No. 37-0348).
2. NB 101 On-Ramp Pedestrian Overcrossing (POC) (Bridge No. 37-676).
3. SB 101 Off-Ramp Pedestrian Undercrossing (PUC) (Bridge No. 37-675J).
4. SB 101 On-Ramp PUC (Bridge No. 37-675K).
5. Retaining Wall No. 1 (Soil Nail Wall)(Bridge No. 37E0125).
6. Retaining Wall No. 2 (MSE Wall)(Bridge No. 37E0126).

This foundation report is for the "Retaining Wall No. 2". A map showing the project location and its vicinity is presented in Appendix I. The following foundation reports will be separately submitted:

1. Foundation Report for Blossom Hill Road OC (Widen) (Bridge No. 37-0348).
2. Foundation Report for NB101 On-Ramp POC (Bridge No. 37-676).
3. Foundation Report for SB101 Off-Ramp PUC (Bridge No. 37-675J).
4. Foundation Report for SB101 On-Ramp PUC (Bridge No. 37-675K).
5. Foundation Report for Retaining Wall No. 1 (Soil Nail Wall)(Bridge No. 37E0125).

The following is the information of approximate wall locations, type of walls, and maximum wall heights for Retaining Wall No. 2 provided by the structural designer.

TABLE 1 – SUMMARY OF PROPOSE RETAINING WALL NO. 2

Retaining Wall	Wall Type	Location (Along approx. Station.)	Retaining Wall Maximum Design Height (ft)	Top of Footing Elev. (ft)	Total Length (ft)
Retaining Wall No. 2	MSE (Back-to-Back)	"RW2" 1+00.00 to "RW2"6+34.75	14.17	Varies between +208.42 ft, and +213.02 along the wall	534.75

Our recommendations in this report are based on the above information. Any major deviation should be reported to PARIKH for consideration.

The datum used to reference the elevation in this report:

a) All elevations referenced within this report are based on the North American Vertical Datum of 1988 (NAVD 88), unless otherwise noted. To convert elevation at this site from National Geodetic Vertical Datum of 1929 (NGVD 29) to NAVD 88, we added 1.8 feet to the NGVD 29 elevation.

b) Horizontal Datum: CCS83, Zone 3, Epoch 2010.00 in Survey Feet.

4.0 EXCEPTIONS TO POLICY

Normal procedures were used in the field exploration and geotechnical recommendations for the proposed Retaining Wall No. 2. There is no exception to the Caltrans Department policy and procedures relating to the investigation or design of the proposed Retaining Wall No. 2.

5.0 AS-BUILT DATA

No as-built data is available along the wall alignment

6.0 SITE CONDITIONS

The general project area is the existing interchange of Blossom Hill Road at Route 101 in San Jose, Santa Clara County, California. The existing grade of Route 101 in the vicinity of the "Blossom Hill Road OC" is generally level at approximately Elev. 200 feet. The existing elevation of Blossom Hill Road at the location of the planned retaining wall ranges from approximately 210 feet to 215 feet.

7.0 FIELD EXPLORATION AND FIELD TESTING PROGRAM

Field Exploration

Borings R-18-NO-102 and R-18-NO-103 were drilled along the alignment of the proposed retaining wall in August 2018. The field exploration was performed by the drilling contractor, Geo-Ex Subsurface Exploration. The completion date, drill rig type, hammer energy ratio, location, approximate ground elevation and depth of these borings are summarized in the tables below.

TABLE 2 – SUBSURFACE INVESTIGATION SUMMARY

Boring No.	Completion Date	Drill Rig Type	Hammer Type	Hammer Efficiency (%)	Approx. Ground Elev. (ft)	Boring Depth (ft)
R-18-NO-102	9/10/2018	CME 75	Automatic	78	213.0	51.5
R-18-NO-103	8/13/2018	CME 75	Automatic	78	210.0	46.5

TABLE 3 - SUMMARY OF BORINGS

Boring No.	"BP" Line Station (ft)	Offset (ft)	Boring Depth (ft)	Approx. Ground Elev. (ft)
R-18-NO-102	38+65	16.0 Rt.	51.5	213.0
R-18-NO-103	40+85	4.0 Rt.	46.5	210.0

The approximate locations of the soil borings are shown on the "Boring Location Map", Plate 1. The descriptions of the soil materials encountered in the field exploration and relevant boring information are presented on the LOTB included in Appendix II.

Field Testing

a) The current investigation borings (by Parikh) were advanced using a truck-mounted CME-75 drill rig with 8-inch hollow-stem auger and 3 ¼ inch rotary wash drilling method. The soil samples were obtained from the borings during drilling at various depths by driving a 2.5-inch Inside Diameter (I. D.) Modified California Sampler or a 1.375-inch I.D. Standard Penetration Sampler (ASTM Test Method No. 1586). The sampler was driven into the subsurface soils under the impact of a 140 pounds hammer having a free fall of 30 inches. The blow counts required to drive the sampler for the last 12 inches are presented on the LOTB, Appendix II. (When correlating standard penetration data in similar soils, the blow counts for the Modified California sampler can be converted to equivalent Standard Penetration Test sampler by multiplying a factor of safety of 0.65);

b) Pocket penetration tests were also performed on clay samples to evaluate their consistency.

Details of Field Exploration

All the test borings were drilled with a truck-mounted drill rig using 8-inch hollow-stem auger with rotary-wash drilling method. The borings were drilled under the technical supervision of our engineers, who classified and continuously logged the soils encountered during drilling and supervised the collection of soil samples at various depths for visual examination and laboratory testing. The soil samples were visually classified in the field according to the Unified Soil Classification System and then transported to our laboratory for further evaluation and testing. Upon completion of drilling, the boreholes were backfilled with cement grout.

The logs presented in Appendix II were prepared from the field logs which were edited after visual re-examination of the soil samples in the laboratory and results of classification tests on selected soil samples as indicated on the logs.

It should be noted that the descriptions of the soils encountered and relevant boring information presented on the LOTB depict subsurface conditions only at the locations indicated on the plan and on the particular date noted on the LOTB. Because of the variability from place to place within soil/rock in general, subsurface conditions at other locations may differ from conditions occurring at the boring locations explored. The abrupt stratum changes shown on the logs may be gradational and relatively minor changes in soil types within a stratum may not be noted on the logs due to field limitations. Also, the passage of time may result in a change in the soil conditions at these locations due to environmental changes.

8.0 LABORATORY TESTING PROGRAM

The following laboratory tests were performed on selected soil samples collected during field exploration to evaluate the physical and engineering properties of the subsurface soils at the project site to support the foundation recommendations:

a) Laboratory determination of Moisture Contents (ASTM D-2216);
b) Atterberg Limits (ASTM D-4318);
c) Particle Size Analysis (ASTM D-422);
d) Unconfined Compression Test (ASTM D-2166);
e) Corrosivity Test (California Test Method T-643, T-422, and T-417).

The laboratory test methods and test results are presented on plates included in Appendix III. Laboratory test results for moisture content, total unit weight, unconfined compression, Plasticity Index and grain size classification of the soil samples are summarized in the table in Appendix III.

9.0 SITE GEOLOGY AND SUBSURFACE CONDITIONS

Geology

General geologic features pertaining to the project site were evaluated by reference to the "Dibblee, T.W.; and Minch, J.A., 2005, Geologic Maps of the San Jose East Quadrangle, Santa Clara County, California; Dibblee Geological Foundation DF-155, scale 1:24,000" and "Dibblee, T.W.; and Minch, J.A., 2005, Geologic Maps of the Santa Teresa Hills Quadrangle, Santa Clara County, California; Dibblee Geological Foundation DF-158, scale 1:24,000".

Based on the geologic map, the project site subsurface soils consist of mainly Holocene surficial sediments with alluvial gravel, sand and clay soil of valley areas (Qa). The general geology of the project area is shown on the "Geologic Map", Plate No. I-3.

The descriptions of the subsurface soils encountered in the geotechnical explorations are consistent with the published geologic maps.

Subsurface Conditions

Based on Borings R-18-NO-102 and R-18-NO-103, the descriptions of the subsurface soil materials encountered in each of the exploratory boring are summarized in the table below. Detailed soil descriptions and location of the borings are presented on the LOTBs.

TABLE 4 - SUMMARY OF SUBSURFACE SOIL CONDITIONS

Boring No.	Soil Description
R-18-NO-102	Approximately 8 feet of medium dense silty sand with gravel and very dense silty gravel with sand, underlain by approximately 30 feet of very stiff to hard silt with sand, underlain by approximately 4 feet of medium stiff silt, underlain by approximately 5 feet of medium stiff lean clay, underlain by medium dense silty sand to the boring depth of 51.5 feet.
R-18-NO-103	Approximately 4.5 feet of medium dense silty sand with gravel, underlain by approximately 15 feet of stiff to hard sandy silt, underlain by medium dense silty gravel/poorly graded gravel with silt and clayey sand to the boring depth of 46.5 feet.

Due to limitations inherent in geotechnical investigations, it is neither uncommon to encounter unforeseen variations in the subsurface soil conditions during construction nor is it practical to determine all such variations during an acceptable program of drilling and sampling for a project of this scope. Such variations, when encountered, generally require additional engineering services to attain properly constructed project. We, therefore, recommend that a contingency fund be provided to accommodate any additional charges resulting from technical services that may be required during construction.

10.0 GROUNDWATER

Groundwater measured during the field exploration is summarized in the table below.

TABLE 5 - SUMMARY OF MEASURED GROUNDWATER LEVEL

Boring No.	Date	Depth (feet)	Elevation (feet)
R-18-NO-102	9/10/2018	28.0	185.0
R-18-NO-103	8/13/2018	29.0	181.0

Groundwater level is anticipated to vary with the passage of time due to seasonal groundwater fluctuations, variations in yearly rainfall, water elevations in the nearby creeks, surface and subsurface flows, ground surface run-off, and other environmental factors that may not be present at the time of the investigation.

Measured groundwater elevation of Elev. 185.0 feet has been used for the engineering analyses.

11.0 SITE SEISMICITY AND ANALYSES

11.1 Seismic Sources

The project is located in a seismically active part of northern California. Many faults exist in the regional area. These faults are capable of producing earthquakes and may cause strong ground shaking at the site.

Maximum magnitudes (M_{max}) of some of the closest faults in the area are based on Caltrans ARS Online Website. These maximum moment magnitudes represent the largest earthquake a fault is capable of generating and is related to the seismic moment. The earthquake data of the active faults in the project vicinity are summarized in the table below.

TABLE 6- ARS DATA

Fault (Fault ID)	Maximum Magnitude of Fault, M_{Max}	Fault Type	Site-to-Fault Distance, R_{rup}* (miles)	Peak Ground Acceleration (PGA) Based on Deterministic Data (g)
Silver Creek (148)	6.9	Strike Slip	2.06	0.417
Hayward (Southern extension) (149)	6.7	Strike Slip	3.92	0.335
Calaveras (Central) 2011 CFM (151)	6.9	Strike Slip	6.56	0.270
Cascade fault (153)	6.7	Reverse	3.14	0.380
Monte Vista-Shannon (154)	6.4	Reverse	4.93	0.293
San Andreas (Santa Cruz Mts) 2011 CFM (158)	8.0	Strike Slip	11.95	0.251

*Closest distance (mi) to the fault rupture plane as obtained from Caltrans ARS Online Website.

11.2 Seismic Design Criteria

The development of the Acceleration Response Spectrum (ARS) followed the standard Caltrans procedure by using Caltrans ARS Online webtool (Ver. 2.3.09). The ARS curve is based on several input parameters, including site location (longitude/latitude), average shear wave velocity for the top 100 feet (Vs_{30m}), and other site parameters, such as fault characteristics and site-to-fault distances.

Average shear wave velocities (Vs_{30m}) for the top 100 feet at the project site was calculated by using established correlations and the procedure provided in the "Caltrans Design Manual (Version 2.0, 2012)". The design method incorporates both deterministic and probabilistic seismic hazards to produce the design response spectrum.

Based on all the available boring data, we have calculated the $Vs_{30m.}$ The Vs_{30m} are summarized in the following table.

TABLE 7- SUMMARY OF CALCULATED Vs_{30m}

Boring No.	Boring Depth (ft)	Rock Depth (ft)	Vs_{30m} (m/s)
R-18-NO-102	51.5	Not encountered	263
R-18-NO-103	46.5	Not encountered	279

The ARS was developed based on the shear wave velocity of 260 m/s. Average shear wave velocity calculation is included in Appendix IV.

The site location and the relevant parameters are summarized as follows, and the recommended design curve is presented on Appendix IV.

Input

- Site Location: 37.2573ºN/121.7943ºW
- Average V_{S30m}: 260 m/s
- Depth to rock with a shear wave velocity of 1.0 km/sec ($Z_{1.0}$) = N/A
- Depth to rock with a shear wave velocity of 2.5 km/sec ($Z_{2.5}$) = N/A

Output

- The recommended ARS curve is based on the maximum of the comparison of the deterministic data and Caltrans Probabilistic data. The recommended ARS curve at this site is based on the Probabilistic curve.
- An adjustment factor for the near-fault effect was applied to the calculated spectral acceleration values. The increase of 20% to the spectral acceleration values corresponds to period longer than 1 second and linearly tapes to zero at a period of 0.5 seconds.
- Anticipated Peak Ground Acceleration (PGA): 0.648 g
- Near Fault Effect: Yes
- Basin Effect: No. The project site is not located within the limit of the $Z_{2.5}$ contour map for Northern California.
- Governing Fault is the Silver Creek Fault (Fault I.D.=148, Mmax=6.9)

11.3 Seismic Hazards/Liquefaction Potential

Potential seismic hazards may arise from three sources: surface fault rupture, ground shaking and liquefaction. Since no active faults pass through the site, the potential for fault rupture does not exist at the site. As shown on the ARS Online Map, Plate No. IV-1, the closest active fault is Silver Creek fault, which is located approximately 2.1 miles northeast from the project site.

11.3.1 Seismic Hazards

Potential seismic hazards may arise from three sources: surface fault rupture, ground shaking and liquefaction.

11.3.2 Seismic Ground Shaking

Based on available geological and seismic data, the project site is expected to experience strong ground shaking. PGA of 0.648 g was estimated for the site which is discussed in Section 11.2.

11.3.3 Surface Fault Rupture

Since no known active fault passes through the project site and the project site is not within a state Alquist-Priolo Zone, the potential for fault rupture does not exist.

11.3.4 Liquefaction Potential

Liquefaction is a phenomenon in which saturated cohesionless soils are subject to a temporary but essentially total loss of shear strength under the reversing, cyclic shear stresses associated with earthquake shaking. Submerged cohesionless sands and silts of low relative density are the type of soils, which usually are susceptible to liquefaction. Clays are generally not susceptible to liquefaction.

The liquefaction potential was evaluated in accordance with the methods proposed by Youd, et al. (2001). The evaluation was done using the boring data from all the available borings using a Magnitude 6.9 earthquake and a peak ground acceleration of 0.648 g (Caltrans Online Probabilistic ARS). This method compares the estimates of the earthquake-induced shear stress to the susceptibility of soil liquefaction. According to Bray (2006), liquefaction appears to occur in soils where these fines are either non-plastic or are low plasticity silts and/or silty clays (PI<12%, and LL<37%), and with high water content relative to their liquid limit (w>0.85 LL). Estimated fine content has been added to the sand layers (without any sieve analyses) based on the visual inspection and soil classification of the soil sample.

Based on the results of the liquefaction analyses, liquefaction potential may exist at the project site at the isolated locations for the loose to medium dense cohesionless soil encountered in the borings with the following estimated post-liquefaction settlements.

TABLE 8 - SUMMARY OF ESTIMATED POST-LIQUEFACTION SETTLEMENT

Boring No.	Estimated liquefiable Soil Depth (ft)	Approx. Thickness (ft)	Estimated liquefiable Soil Top Elev.(ft)	Estimated liquefiable Soil Bottom Elev.(ft)	$(N_1)_{60,CS}$	Estimated Post-liquefaction Settlement (inches)
R-18-NO-102	38.5	4.0	174.5	170.5	4.7	1.1
R-18-NO-103	28.0	5.0	182.0	177.0	13.4	1.1

Based on the evaluation of liquefaction potential as shown above, it appears that the potentially liquefiable soils encountered are relatively deep and will not affect the bearing capacity of the wall. Liquefaction analyses are included in Appendix IV.

Lateral Spreading

Liquefaction-induced spreading has been defined as the *"lateral displacement of large surficial blocks of soil as a result of liquefaction in a subsurface layer"*. Lateral spreading refers to the more moderate movements of gently sloping ground due to soil liquefaction. As described by Bartlett and Youd (1992a; 1992b), liquefaction-induced lateral spreading occurs on mild slopes of 0.3% to 5% underlain by loose sand and shallow water. The geologic conditions conducive to lateral spreading (gentle surface slope, shallow water table, and liquefiable cohesionless soils) are frequently found along streams and other waterfronts in recent alluvial or deltaic deposits, as well as in loosely-packed, saturated, sandy fills.

In our opinion, the potential for lateral spreading does not exist because it appears that there is no continuous layer of liquefiable soil or liquefiable layers at depths near ground surface.

12.0 SCOUR EVALUATION

There is no significant drainage or flowing bodies of water passing through or adjacent to the site. Therefore, scour should not be a design concern and was not considered for foundation design.

13.0 CORROSION EVALUATION

The corrosion investigation for this project was performed on a selected sample from borings drilled in 2018 in general accordance with the provisions of California Test Methods 417, 422 and 643. A summary of the corrosion test results is presented in the table below, and the test results are presented in Appendix III.

TABLE 9 - SUMMARY OF CORROSION TEST RESULT

Boring	Approx. Sample Depth (feet)	Minimum Resistivity (ohms-cm)	PH	Water-soluble Chloride (ppm)	Water-soluble Sulfate (ppm)
R-18-NO-102	26.0	1,150	7.89	15.8	74.8

According to the Section 10.7.5. of the AASHTO LRFD Bridge Design Specifications (BDS) – Sixth Edition (2012) with Caltrans Amendment, the following soil, water or site conditions shall be considered as indicators of potential pile corrosion or deterioration:

- Minimum resistivity equal to or less than 1,000 ohm-cm,
- Chloride concentration equal to or greater than 500 ppm,
- Sulfate concentration equal to or greater than 2,000 ppm,
- pH equals to or less than 5.5
- Landfills and cinder fills,
- Mines or industrial drainage,
- Suspected chemical wastes, and
- Stray currents.

Per Caltrans Corrosion Guidelines (Version 3.0, March 2018), Caltrans considers a project site to be corrosive for structural elements if one or more of the following conditions exist for the representative soil and/or water samples taken at the project site:

- Chloride concentration equal to or greater than 500 ppm, or
- Sulfate concentration equal to or greater than 1,500 ppm, or
- pH equals to or less than 5.5.

Therefore, the on-site soil materials should be non-corrosive according to the criteria above.

14.0 GEOTECHNICAL RECOMMENDATIONS

14.1 General

No major adverse condition was noted for the planned retaining wall provided the recommendations presented in this report are incorporated into the final design and construction. Retaining wall plans should be reviewed by PARIKH prior to finalizing the plans to see that the intent of our recommendations is included in the plans.

This report was prepared specifically for the proposed project according to the plans provided to us. Normal construction procedures were assumed throughout our analysis and represent one of the bases of recommendations presented herein. Our design criteria have been based upon the materials and subsurface soil conditions encountered in the soil borings at the project site. Therefore, we should be notified in the event that these conditions are changed, so as to modify or amend our recommendations.

14.2 Earthwork and Grading

All grading operations should be performed in accordance with the project specifications and Caltrans Standard Specifications for Earthwork (Section 19). A representative from PARIKH or regulating agency should observe all excavated areas during grading and perform moisture and density tests on prepared subgrade and compacted fill materials.

15.0 GEOTECHNICAL RECOMMENDATIONS FOR RETAINING WALL

15.1 Description of the Recommended Retaining Wall 2

This retaining wall is along the shoulder of Westbound Blossom Hill Road with Station from “RW2” 1+00 to “RW2” 6+34.75. This wall will be a back to back Mechanically Stabilized Earth Wall (MSE) supporting the eastern approach embankment for the planned “Northbound 101 On-Ramp Pedestrian Overcrossing Structure”. The anticipated total wall length is 534.75 feet with design height to a maximum height of 14.17 feet.

15.2 Geotechnical Design Parameters

Based on the boring data (R-18-NO-102 and R-18-NO-103) in the vicinity of the proposed wall, the subsurface soil conditions generally consist of interbedded layers of medium dense Silty Sands / very dense Silty Gravel within the first 10 feet followed by hard Silt/Sandy Silt layers up to about 35 feet (R-10-NO-103) and 15 feet (R-18-NO-102) thick. Generalized soil profile and recommended parameters are shown in the table below. Groundwater was measured at Elev. +185.0 foot in Boring R-18-NO-

102 and Elev. +181.0 feet in Boring R-18-NO-103 during drilling in September and August of 2018, respectively.

TABLE 10 –DESIGN ANALYSIS SOIL PARAMETERS

Layer No.	Layer Boundaries	Group Name	Engineering Parameters**
1	Existing Ground Elev. 213.0 to Elev. 205.0	Sand	Φ = 34 deg., γ = 125 pcf
2	Elev. 205.0 to Elev. 200.0	Clay	Su = 1500 psf, γ = 125 pcf
3	Elev. 200.0 to Elev. 185.0	Clay	Su = 2000 psf, γ = 125 pcf
4	Elev. 185.0 to Elev. 174.5	Clay	Su = 1000 psf, γ = 65 pcf
5	Elev. 174.5 to Elev. 170.5	Sand (Liquefiable*)	Φ = 30 deg., γ = 65 pcf
			Sr = 200 psf, γ = 65 pcf
6	Elev. 170.5 to Elev. 166.0	Clay	Su = 900 psf, γ = 65 pcf
7	Elev. 166.0 to Elev. 161.5	Sand	Φ = 35 deg., γ = 65 pcf

15.3 Description of External Loads (Surcharge)

The external load acting on the proposed Retaining Wall No. 2 is the surcharge load with a varying magnitude depending on the retained wall height in accordance with AASHTO Table 3.11.6.4-2 acting uniformly in vertical direction behind the retaining wall.

15.4 Susceptibility of Foundation Material to Erosion

Based on the available boring data, the surficial soils generally consist of clayey and sandy soils. The proposed retaining wall is located more than 300 feet away from the nearby Coyote Creek. Therefore, the foundation soils along the wall alignment are not likely to be susceptible to erosion. The project civil/drainage designer should verify the aspect.

15.5 Surface and Subsurface Drainage Systems

According to the designer, the roadway runoff drains along the concrete barrier next to the wall. The runoff flows along this barrier until it reaches a dike along the roadway shoulder and drains into two inlets west of the retaining wall. The runoff from the 2(H): 1(V) slope drains away from the wall into an unlined V-ditch running from “BP” Station 37+13.17 to Station 39+51.59. This V-ditch drains into an inlet and ultimately discharge through an existing outfall in Coyote Creek.

15.6 Earth Retaining Structure Foundations

The project will require the construction of Mechanical Stabilized Embankment (MSE) walls based on the plan provided by the structural designer. Retaining Wall No. 2 will be to retain the embankment fill behind the Abutment 6 of the NB101 On-Ramp POC. According to the structural designer, the wall type, the stations, the length and the retained height of the proposed MSE walls are summarized in Table 1.

According to Caltrans "Bridge Design Aids 3-8 (April 2013)", the embedment depth for the MSE wall should be a minimum of 0.1 H (H is the retained height of the MSE wall measured to the top of MSE panels) but not less than 2 feet. Based on the retained height of the proposed MSE walls, the embedment depth should be 2 feet minimum for this project. Based on the available boring information and anticipated embedment depth, the subsurface soil conditions generally consists of interbedded layers of medium dense sand/gravel and medium stiff to stiff lean/fat clay and silt, underlain by medium dense to dense sand.

We have summarized the geotechnical recommendations for the proposed MSE wall below:

a) Internal Design: $\phi = 34^{o}$, $\gamma = 120$ pcf

b) External Design:
   - ϕ (Retained Backfill) = $34^{o}/\gamma = 125$ pcf
   - ϕ (Foundation) = 34^{o}

c) Live Load Surcharge (Location A only) = 120 lb/ft^2; Live Load Surcharge (Pedestrian Load other than Location A) = 90 lb/ft^2

d) Dead Load Surcharge (Location A only) = 120 lb/ft^2

e) Average Soil Friction Angle of Embankment: $\phi = 34^{o}$ (MSE wall backfill)

f) Active Earth Pressure: A minimum active earth pressure of 36 pcf Equivalent Fluid Pressure (EFP) is recommended for design for level backslope per Caltrans Standard design practice. An active earth pressure coefficient (Ka) of 0.28 (based on ϕ of 34^{o}) can be used to estimate additional loads due to the potential surcharge.

g) Passive earth pressure should be ignored for the MSE Wall.

h) Incremental Seismic Lateral Pressure Coefficient: $\Delta K_{AE} = 0.14$ ($\Delta K_{AE} = K_{AE} - K_A = 0.42 - 0.28$), based on NCHRP 611 approach, with ϕ of 34°, no cohesion, and a seismic coefficient, $k_h = 0.22$ (~1/3*PGA).

i) In accordance with AASHTO LRFD Section 11.10.5.3, the lateral resistance at the base of the MSE walls was estimated using the friction angle of the foundation soil. We recommend an ultimate friction coefficient of 0.58. Appropriate resistance factors should be applied per AASHTO LRFD BDS with California Amendments.

j) Horizontal berm in front of the MSE wall founded on slopes to provide access for future maintenance activity or to act as a buffer to minor erosion should not be required for this project from geotechnical standpoint.

k) The base width as recommended for Load Case 1 (BW ≥ 0.7H +18 inches) in Caltrans Bridge Design Aids (2011) is appropriate and can be used. "H", the design height is the maximum height of a given section of the MSE.

15.6.1 Bearing Capacity

The recommended bearing capacities for various effective footing width are summarized in the table below:

TABLE 11 – BEARING CAPACITY OF MSE WALL (RETAINING WALL NO. 2)

H[(4)] (ft)	Bearing Resistance				
	Effective Width B'[(4)] (ft)	Ultimate, q_{ult} (ksf)	Service Limit State Permissible Net Contact Stress[(1)] (ksf)	Strength Factored Gross Nominal Bearing Resistance for Controlling Load Case, $\varphi_h^{(2)} = 0.65$ (ksf)	Extreme Event Factored Gross Nominal Bearing Resistance $\varphi_h^{(3)} = 0.90$ (ksf)
5.0	6.84	9.60	3.00	6.20	8.60
7.5	6.10	9.60	3.10	6.20	8.60
10.0	5.18	9.60	3.50	6.20	8.60
12.5	6.87	9.60	2.90	6.20	8.60

Notes:
(1) The tolerable settlement under service load is assumed to be 3 inch.
(2) Per Table 11.5.7-1 of the AASHTO LRFD BDS with California Amendment.
(3) Per Section 11.5.8 of the AASHTO LRFD.
(4) Based on Bridge Design Aids (April 2013 Attachment 2).

15.6.2 Settlement

The following parameters were assumed for the settlement evaluation based on the empirical correlations, consolidation test results and our engineering judgements.

a) Unconfined Compressive Strength tests result, when available, is used in the settlement calculations (if it is shown in the calculations spreadsheet).

b) The pre-consolidation pressure (Pc) for the samples were estimated by using a factor of 0.25 (Su/p, Skempton 1954, 1957) and dividing the undrained strength (correlated/lab) with this factor. OCR is then calculated by dividing in-situ effective stress to Pc. Over-consolidated clays can be considered settling elastically per ASHTO LFRD Section C10.6.2.4.3. Clays with OCR greater than or equal to 2.5 is considered to be settling elastically and not considered in primary consolidation settlement calculations.

c) In addition, the $C_c/(1+e0)$ values are calculated based on our calibration/refitting of the original Lambe & Whitman correlations based on in-house lab results from previous projects. The water content from laboratory tests is used as an input to this correlation.

d) For selected consolidation test samples, the parameters calculated from the consolidation tests are directly used for settlement calculations.

Results of Settlement Evaluations

Settlement analyses indicate that the upper-bound total settlement (elastic & consolidation) may be about 2.5 inches. The consolidation settlement by itself is about 1.7 inches. The estimated settlements consist of settlement in the over-consolidated (OC) range for clay and elastic settlements for sands and clays (with OCR greater than or equal to 2.5) and normally-consolidated (NC) range for clays/silts. A consolidation coefficient of 0.08 ft^2/day was used in the calculation based on the laboratory consolidation test results. Based on our calculations, a waiting period of 51 days is recommended after the placement of fill prior to the pavement construction. A maximum residual settlement of about 0.24 inches is expected after the waiting period along the wall alignment. A residual settlement of 0.24 inches is also estimated at "Location A" shown on General Plan provided by Designer.

It appears that the estimated settlement should be acceptable for the proposed MSE wall considering the estimated settlements consist of settlement in the NC range for clay/silt and OC range for clay and elastic settlements for sands and clays. It is anticipated that some of the estimated settlement should have been completed during the fill placement and construction of MSE wall panels.

Settlement Monitoring

It is recommended that settlement platforms be installed and settlement be monitored (per California Test 112) by the contractor during construction. Based on this, the settlement period may have to be modified. A minimum of four settlement platforms is recommended to be installed along the approach embankment. These settlement platforms should be evenly distributed along the length of the approach embankment. The settlement period may have to be adjusted base on the results of settlement monitoring.

The settlement calculations are included in Appendix IV.

15.6.3 Global Stability

The global stability of the proposed MSE wall was evaluated under the static long-term drained condition and short-term undrained pseudo-static condition. A commercial software "Slope/W 2012" Program by Geo-Slope International was used for the stability analyses with Spencer Method.

Per Caltrans "Guidelines for Foundation Investigations and Reports", pseudo-static analyses may be performed using a seismic coefficient equal to one third of the horizontal peak ground acceleration (1/3 x 0.648 g ~= 0.21g). A minimum factor of safety of 1.5 is required for the static condition and 1.1 is required for the pseudo-static condition.

Minimum Factor of Safety of obtained under the static and "pseudo-static" conditions are summarized in the table below.

TABLE 13 - SUMMARY OF PROPOSED MSE WALL STABILITY

MSE Wall No.	Direction	Minimum Factor of Safety	
		Static (Long-Term)	Pseudo-static
Retaining Wall No. 2	Longitudinal	3.79	1.52

Based on the results of the stability analyses, the proposed retaining wall has the adequate global stability under static long-term condition and pseudo-static conditions.

The global stability analyses are included in Appendix IV.

15.7 Seismic Lateral Earth Pressure

The proposed retaining wall will experience increased lateral loads during earthquake shaking. The design needs to consider seismic event per the AASHTO LRFD (Sections 11.9.6 & 11.8.6). The additional horizontal forces recommended to simulate earthquake loads are dependent upon the magnitude of ground surface accelerations and the retained height of the retaining wall, together with the weight and type of material retained by the retaining walls. In general, the pseudo-static approach developed by Mononobe and Okabe (M-O) may be used to estimate the equivalent static force using a seismic coefficient K_h = 1/3 * Peak Ground Acceleration (PGA) per "Caltrans Geotechnical Manual (Mechanically Stabilized Embankment)". According to Appendix A11.1.1.1 (California Amendment), the seismic incremental lateral earth pressure is assumed to have triangular distribution over wall height. Per Caltrans ARS Online, the anticipated PGA at the project site is about 0.648 g. Therefore, a K_h value of 0.22 g was used to evaluate the seismic lateral earth pressure. For overall project design, a seismic incremental lateral load of $8.75*H^2$ lb per foot of wall (H is retained backfill height in feet) is recommended. The resultant force from the incremental seismic lateral earth pressure is triangularly distributed acting one-third of the retained height (H in ft) per California Amendments.

The calculations of seismic lateral earth pressure are included in Appendix IV.

16.0 CONSTRUCTION CONSIDERATIONS

The sections are written primarily for the engineer responsible for the preparation of plans and specifications. The field investigation performed by us primarily address some of the design issues that will be encountered in the field during construction (such as temporary excavated slope) and was not intended to identify construction-related issues

Prospective contractors for the project must evaluate construction-related issues on the basis of their own knowledge and experience in the local area, on the basis of similar projects in other localities, or on the basis of field investigation on the site performed by them, taking into account their own proposed construction methods and procedures. In addition, construction activities related to excavation and lateral earth support must conform to safety requirements of OSHA and other applicable municipal and State regulatory agencies.

Existing Utilities

A safe working distance from underground and overhead utilities should be provided during construction work. If this is not possible, the utility lines may need to be cleared from the site before the start of construction work.

Excavations

Based on the available boring data, the subsurface soil conditions at the project site consist of medium dense to very dense Silty Sand/Gravel and hard Sandy Silt within the first 10 feet of the existing ground surface. No cobbles and/or cobbles were encountered in the field exploration performed in 2018. In our opinion, conventional equipment could be used to excavate on-site soil materials. It is possible that unknown old buried utilities or abandoned structures, concrete rubble etc. may be encountered during excavation. This might require special equipment and additional efforts to remove these buried objects or obstructions.

Excavations should not be expected to stand vertically without any support. According to OSHA Safety Standards, temporary excavations with personnel working within the excavations should be sloped or shored if the excavations are deeper than 5 feet. All temporary excavations should be made and supported in accordance with California OSHA Safety Standards.

The slope height, inclination, and excavation depths should not exceed those specified in local, state, or federal safety regulations. The design of the temporary slopes by the contractor or his specialty subcontractor should conform to the OSHA's "Guidelines for Excavations and Temporary Sloping". The contractor or responsible subcontractor should develop their design based on the existing soil/site condition and subsurface soil conditions exposed at the time of construction.

For excavations up to 20 feet deep in homogenous soils, OSHA guidelines state that the maximum allowable slope should be 3/4H: 1V, 1H:1V and 1-1/2H:1V for Types A, B and C soil, respectively (In general, Type A soils are stronger; Type B soils are intermediate, and Type

C soils are weaker). Based on our evaluation of the materials encountered in our borings and the borings previously performed by others, the native soil on site should be considered as OSHA Type C soil. All un-shored slopes less than 20 feet deep should be excavated to inclination no steeper than 1-1/2H: 1V unless shored with applicable safety standard. It should be noted that the slope ratios recommended by OSHA are for temporary, un-surcharged slopes. Traffic and surcharge loads should be kept back at least 15 feet from the top of the excavations unless they are accounted for in the design of the support system. Exposed slopes should be kept moist (but not saturated) during construction. The temporary cut slopes discussed above assume that the groundwater is maintained below the bottom of excavation at all time during construction.

All excavations should be closely monitored during excavation/construction to detect any evidence of instability, soil creep, settlements, etc. Appropriate mitigation measures and a comprehensive monitoring plan should be implemented to correct such situations.

Fills to be placed on temporary slope excavation should be keyed and benched into the temporary slope material. The height of the key should not be more than 4 feet and the minimum width should be 6 feet. The frequency and location of the benches may be adjusted and modified in the field as necessary.

Strength softening, sloughing and erosion could be expected for the bare surficial soil materials if the temporary slopes are exposed to weather and rain for an extended period of time. Stiff clays also tend to develop soil creep due to seasonal change in moisture content resulting in sloughing. Therefore, adequate surface protection should be provided to protect the slope surface from erosion, excessive drying and/or saturation during construction.

17.0 NOTES TO DESIGNER

The design loads and the configuration of the structure were provided by the structural designer. Should the loads exceed the ones provided in the tables given in this report or changes in the structure configuration, the Geotechnical Engineer must be contacted for further recommendations.

18.0 PLAN REVIEW

This report is prepared for the proposed "Blossom Hill Road Interchange Improvement – Retaining Wall No. 2". We recommend that final plans for the proposed project to be reviewed by PARIKH prior to construction so that the intent of our recommendations is included in the project plans and specifications and to further see that no misunderstandings or misinterpretations have occurred. However, design-build elements should be reviewed only from overall compliance standpoint.

19.0 CONSTRUCTION OBSERVATION

To a degree, the performance of any structure is dependent upon construction procedures and quality control measures. Hence, geotechnical observation and testing of grading operations, foundation excavations, and observation of pile installations should be carried out by the Geotechnical Engineer. If the subsurface conditions different from those forming the basis of our recommendations are encountered, this office should be informed in order to assess the need for design changes. Therefore, the recommendations presented in this report are contingent upon good quality control and these geotechnical observations during construction.

20.0 INVESTIGATION LIMITATIONS

Our services consist of professional opinions and recommendations made in accordance with generally accepted geotechnical engineering principles and practices and are based on our site reconnaissance and the assumption that the subsurface conditions do not deviate from observed conditions. All work done is in accordance with generally accepted geotechnical engineering principles and practices. No warranty, expressed or implied, of merchantability or fitness, is made or intended in connection with our work or by the furnishing of oral or written reports or findings.

The scope of our services did not include any environmental assessment or investigation for the presence or absence of hazardous or toxic materials in structures, soil, surface water, groundwater or air, below or around this site. Unanticipated soil conditions are commonly encountered and cannot be fully determined by taking soil samples and excavating test borings;

different soil conditions may require that additional expenditures be made during construction to attain a properly constructed project. Some contingency fund is thus recommended to accommodate these possible extra costs.

This report has been prepared for the proposed project as described earlier, to assist the engineer in the design of this project. In the event any changes in the design or location of the facilities are planned, or if any variations or undesirable conditions are encountered during construction, our conclusions and recommendations shall not be considered valid unless the changes or variations are reviewed and our recommendations modified or approved by us in writing.

This report is issued with the understanding that it is the designer's responsibility to ensure that the information and recommendations contained herein are incorporated into the project and that necessary steps are also taken to see that the recommendations are carried out in the field.

The findings in this report are valid as of the present date. However, changes in the subsurface conditions can occur with the passage of time, whether they are due to natural processes or to the works of man, on this or adjacent properties. In addition, changes in applicable or appropriate standards occur, whether they result from legislation or from the broadening of knowledge. Accordingly, the findings in this report might be invalidated, wholly or partially, by changes outside of our control.

Respectfully submitted,
PARIKH CONSULTANTS, INC.

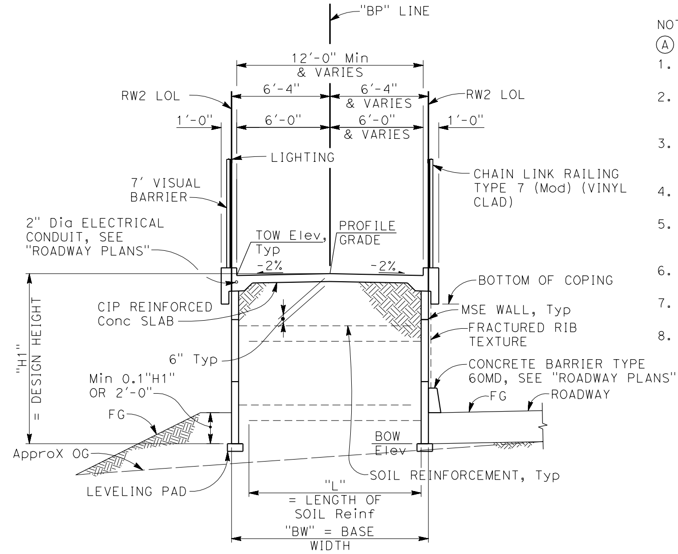
REGISTERED PROFESSIONAL ENGINEER
Y. DAVID WANG
No. P.E. 52911
Exp. 12/31/20
CIVIL
STATE OF CALIFORNIA

Alston Lam, P.E., G.E. 2605
Project Engineer

Y. David Wang, Ph.D., P.E., 52911
Senior Engineer

QUANTITIES

MECHANICALLY STABILIZED EMBANKMENT	4855	SF
STRUCTURAL CONCRETE, BRIDGE (POLYMER FIBER)	115	CY
BAR REINFORCING STEEL (BRIDGE)	25700	LB
CHAIN LINK RAILING (TYPE 7 MODIFIED) (VINYL CLAD)	261	LF



TYPICAL SECTION
1/4" = 1'-0"

NOTES:

(A) Paint "BRIDGE NO. 37E0126"

1. This plan is accurate for retaining wall work only.
2. Top of wall profiles are linear between points shown unless otherwise noted.
3. Utilities shown are for illustrative purposes only. Verify with "ROADWAY PLANS".
4. For "INDEX TO PLANS", see "GENERAL PLAN No. 2" sheet.
5. For MSE wall "GENERAL NOTES", see "MECHANICALLY STABILIZED EMBANKMENT DETAILS No. 2" sheet.
6. For electroliers, see "SCHEDULE OF ELECTROLIER LOCATIONS" and "ROADWAY PLANS".
7. For electrolier anchorage, see "MISCELLANEOUS DETAILS No. 1" sheet.
8. For Profile Grade, see "ROADWAY PLANS"

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	SCI	101	R28.4/R28.9		

REGISTERED STRUCTURAL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER MAHVASH M. HARMS No. 2639 Exp. 12/31/20 STRUCTURAL STATE OF CALIFORNIA

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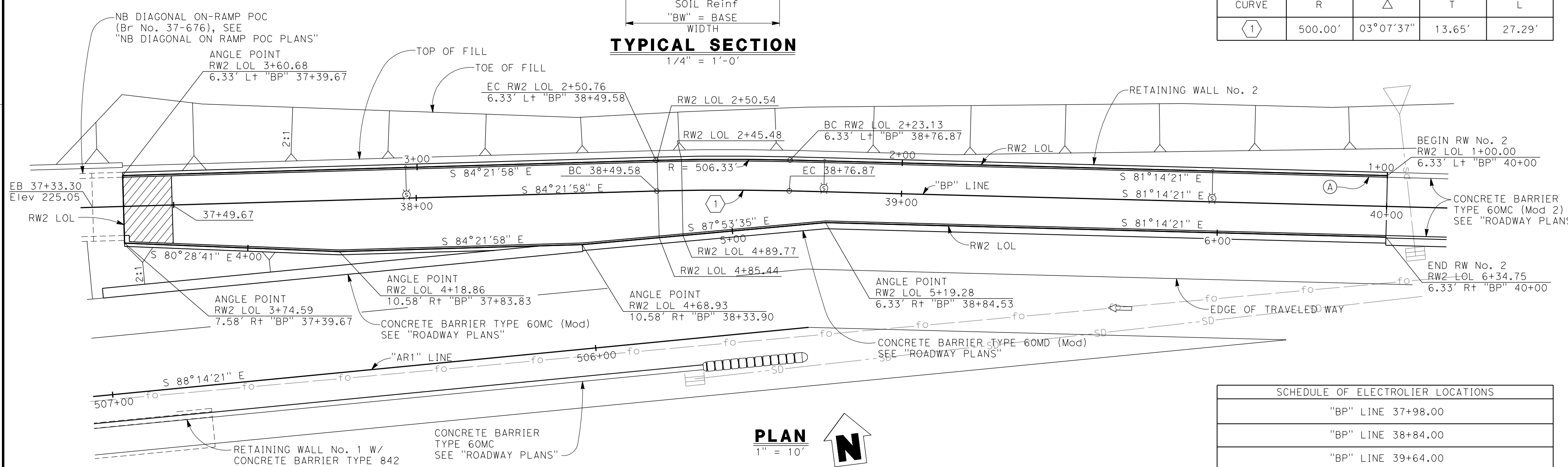
SAN JOSE, CA 95113

BIGGS CARDOSA ASSOCIATES INC.
865 THE ALAMEDA
SAN JOSE, CALIFORNIA 95126

LEGEND:
- Indicates Traffic Direction
- Indicates Location A
- Indicates Electrolier

CURVE DATA				
CURVE	R	△	T	L
1	500.00'	03°07'37"	13.65'	27.29'



PLAN
1" = 10'

SCHEDULE OF ELECTROLIER LOCATIONS
"BP" LINE 37+98.00
"BP" LINE 38+84.00
"BP" LINE 39+64.00

BLOSSOM HILL RD

NOTE:
THE CONTRACTOR MUST VERIFY ALL CONTROLLING FIELD DIMENSIONS BEFORE ORDERING OR FABRICATING ANY MATERIAL

PLAN CHECK SET/NOT FOR CONSTRUCTION (9/11/19)

DESIGN OVERSIGHT	DESIGN	BY G. TOLAN	CHECKED P. GONGIDI	
	DETAILS	BY G. TOLAN	CHECKED P. GONGIDI	
SIGN OFF DATE	QUANTITIES	BY A. VASQUEZ	CHECKED F. KIANMOFRAD	

LOAD & RESISTANCE FACTOR DESIGN	LIVE LOADING: 90 PSF PEDESTRIAN LOAD AND H10 MAINTENANCE VEHICLE	
LAYOUT	BY G. TOLAN	CHECKED A. NOTARO
SPECIFICATIONS	BY G. KENNING	PLANS AND SPECS COMPARED A. NOTARO

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

G. KENNING
PROJECT ENGINEER

BRIDGE NO. 37E0126
POST MILES R28.61

RETAINING WALL No. 2
GENERAL PLAN No. 1

DESIGN GENERAL PLAN SHEET (ENGLISH) (REV. 03/14/12)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0000
PROJECT NUMBER & PHASE: 04160002241
CONTRACT NO.: 04-1K2804

DISREGARD PRINTS BEARING EARLIER REVISION DATES → REVISION DATES 12/5/18 4/17/19

SHEET 1 OF 10

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

2016309 (2016309R2S11)

INDEX TO PLANS

SHEET	TITLE
1	GENERAL PLAN No. 1
2	GENERAL PLAN No. 2
3	MISCELLANEOUS DETAILS No. 1
4	MISCELLANEOUS DETAILS No. 2
5	MECHANICALLY STABILIZED EMBANKEMENT DETAILS No. 1
6	MECHANICALLY STABILIZED EMBANKEMENT DETAILS No. 2
7	MECHANICALLY STABILIZED EMBANKEMENT DETAILS No. 3
8	MECHANICALLY STABILIZED EMBANKEMENT DETAILS No. 4
9	UNDERDRAIN DETAILS
10	LOG OF TEST BORINGS 1 OF 1

ABBREVIATIONS:
Arch. ARCHITECTURAL
BOW BOTTOM OF WALL
TOW TOP OF WALL

2018 STANDARD PLANS

A3A	ABBREVIATIONS (SHEET 1 OF 3)
A3B	ABBREVIATIONS (SHEET 2 OF 3)
A3C	ABBREVIATIONS (SHEET 3 OF 3)
A10A	LEGEND - LINES AND SYMBOLS (SHEET 1 OF 5)
A10B	LEGEND - LINES AND SYMBOLS (SHEET 2 OF 5)
A10C	LEGEND - LINES AND SYMBOLS (SHEET 3 OF 5)
A10D	LEGEND - LINES AND SYMBOLS (SHEET 4 OF 5)
A10E	LEGEND - LINES AND SYMBOLS (SHEET 5 OF 5)
A10F	LEGEND - SOIL (SHEET 1 OF 2)
A10G	LEGEND - SOIL (SHEET 2 OF 2)
B11-7	CHAIN LINK RAILING
B11-52	CHAIN LINK RAILING TYPE 7
D102	UNDERDRAINS
ES-6B	ELECTRICAL SYSTEMS (ELECTROLIER ANCHORAGE AND GROUTING FOR TYPE 15 AND TYPE 21 BARRIER RAIL MOUNTED)

NOTE:
See "GENERAL PLAN No. 1" for notes.

LEGEND:
- Indicates Standard Plan sheet No.
- Indicates Detail No.
- Indicates Location of Inspection Wire Placement
- 20 Indicates Interval in Years from Construction

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	SCI	101	R28.4/R28.9		

REGISTERED STRUCTURAL ENGINEER DATE

REGISTERED PROFESSIONAL ENGINEER MAHVASH M. HARMS No. 2639 Exp. 12/31/20 STRUCTURAL STATE OF CALIFORNIA

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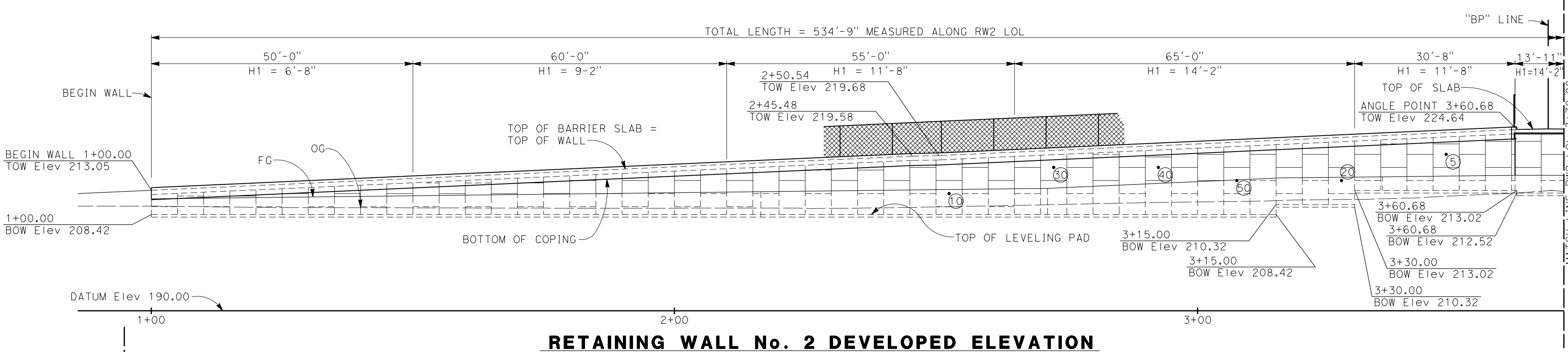
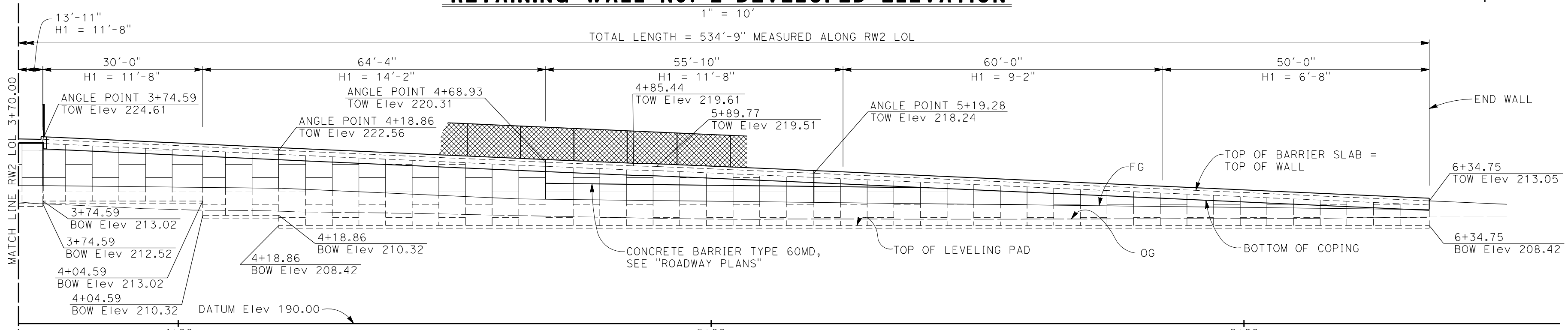


RETAINING WALL No. 2 DEVELOPED ELEVATION

1" = 10'



NOTE:
THE CONTRACTOR MUST VERIFY ALL CONTROLLING FIELD DIMENSIONS BEFORE ORDERING OR FABRICATING ANY MATERIAL

RETAINING WALL No. 2 DEVELOPED ELEVATION

1" = 10'

PLAN CHECK SET/NOT FOR CONSTRUCTION (9/11/19)

		BY	CHECKED		BY	CHECKED
DESIGN OVERSIGHT	DESIGN	G. TOLAN	P. GONGIDI	LOAD & RESISTANCE FACTOR DESIGN	LIVE LOADING: 90 PSF PEDESTRIAN LOAD AND H10 MAINTENANCE VEHICLE	
	DETAILS	G. TOLAN	P. GONGIDI	LAYOUT	G. TOLAN	A. NOTARO
SIGN OFF DATE	QUANTITIES	A. VASQUEZ	F. KIANMOFRAD	SPECIFICATIONS	G. KENNING	PLANS AND SPECS COMPARED A. NOTARO

DESIGN GENERAL PLAN SHEET (ENGLISH) (REV. 03/14/12)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

G. KENNING
PROJECT ENGINEER

BRIDGE NO. 37E0126
POST MILES R28.61

RETAINING WALL No. 2
GENERAL PLAN No. 2

UNIT: 0000
PROJECT NUMBER & PHASE: 04160002241 CONTRACT NO.: 04-1K2804

DISREGARD PRINTS BEARING EARLIER REVISION DATES → REVISION DATES 12/5/18 4/17/19

SHEET 2 OF 10

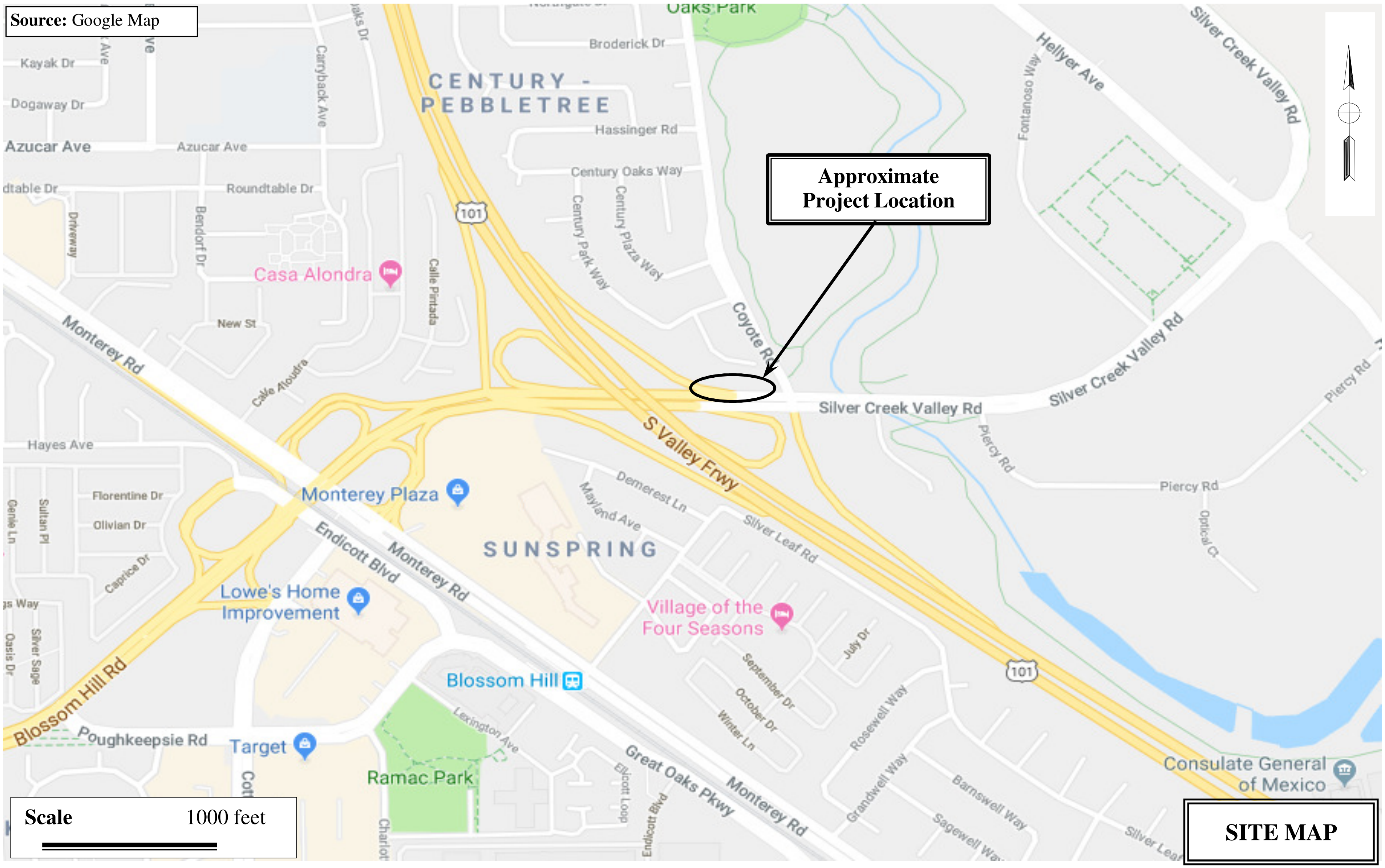
FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

2016309 (2016309R2S2)

APPENDIX I

SITE MAP



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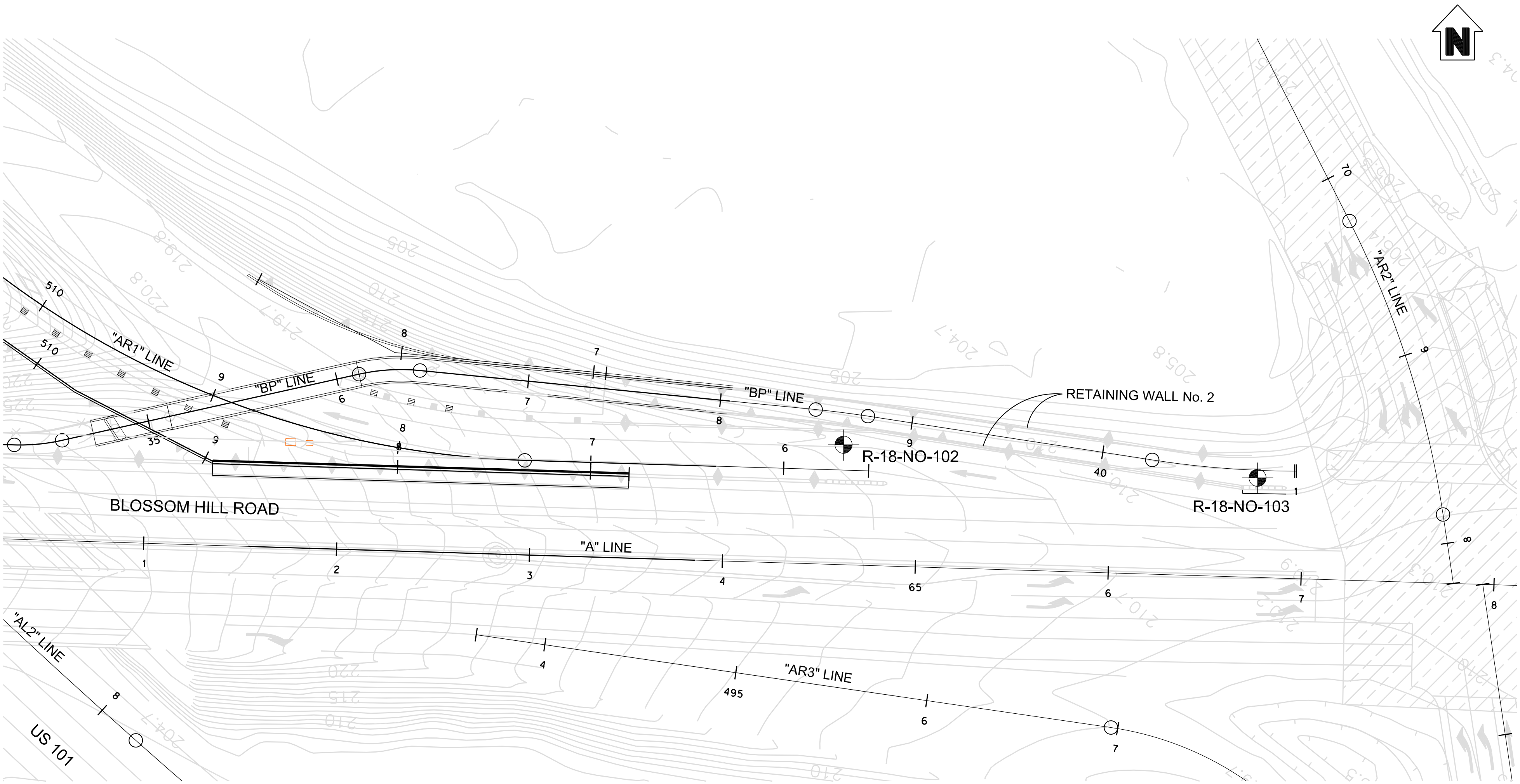
RETAINING WALL NO. 2
SAN JOSE, CALIFORNIA

JOB NO.: 2016-146-MSE	PLATE NO.: I-1



BORING LOCATION MAP

LEGEND

R-18-NO-101

Approx. Boring Location (Drilled by PARIKH in 2018)

SCALE: 1 inch = 100 feet

Note: All units are in feet unless otherwise specified
Reference Map was provided by HMH Engineers.

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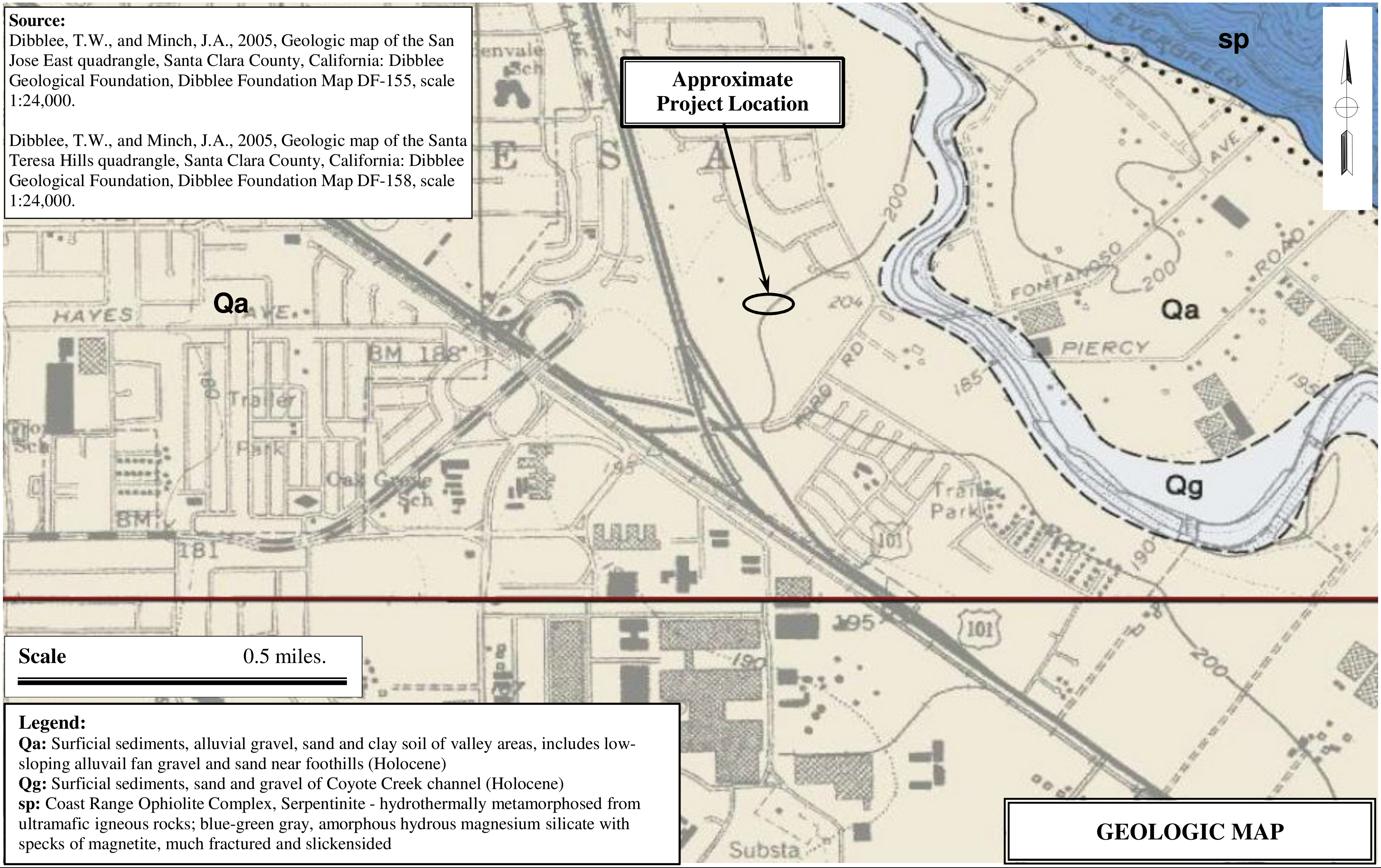
RETAINING WALL NO. 2
SAN JOSE, CALIFORNIA

JOB NO.:2016-146-MSE

PLATE NO: I-2



Source:
Dibblee, T.W., and Minch, J.A., 2005, Geologic map of the San Jose East quadrangle, Santa Clara County, California: Dibblee Geological Foundation, Dibblee Foundation Map DF-155, scale 1:24,000.

Dibblee, T.W., and Minch, J.A., 2005, Geologic map of the Santa Teresa Hills quadrangle, Santa Clara County, California: Dibblee Geological Foundation, Dibblee Foundation Map DF-158, scale 1:24,000.

Scale 0.5 miles.

Legend:
Qa: Surficial sediments, alluvial gravel, sand and clay soil of valley areas, includes low-sloping alluvail fan gravel and sand near foothills (Holocene)
Qg: Surficial sediments, sand and gravel of Coyote Creek channel (Holocene)
sp: Coast Range Ophiolite Complex, Serpentinite - hydrothermally metamorphosed from ultramafic igneous rocks; blue-green gray, amorphous hydrous magnesium silicate with specks of magnetite, much fractured and slickensided

GEOLOGIC MAP

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RETAINING WALL NO. 2
SAN JOSE, CALIFORNIA

JOB NO.: 2016-146-MSE	**PLATE NO.: I-3**

APPENDIX II

LOG OF TEST BORINGS

APPENDIX II

FIELD EXPLORATION

All the test borings were drilled with a truck-mounted drill rig using 7-inch diameter hollow-stem auger and switched to rotary-wash drilling method with 3.3-inch diameter drilling bit. The soil samples were obtained from the borings during drilling at various depths by driving a 2.5 inches Inside Diameter (I. D.) Modified California Sampler or a 1.375 inches I.D. Standard Penetration Sampler (ASTM Test Method No. 1586). The sampler was driven into the subsurface soils under the impact of a 140 pounds hammer having a free fall of 30 inches. The blow counts required to drive the sampler for the last 12 inches are presented on the Logs of Test Borings, Appendix II. (When correlating standard penetration data in similar soils, the blow counts for the Modified California sampler can be converted to equivalent Standard Penetration Test sampler by multiplying a factor of 0.65). Pocket penetration tests were also performed on clay samples to evaluate their consistency. Upon completion of drilling, the boreholes were backfilled with cement grout.

The borings were drilled under the technical supervision of our engineers, who classified and continuously logged the soils encountered during drilling and supervised the collection of soil samples at various depths for visual examination and laboratory testing. The soil samples were visually classified in the field according to the Caltrans "Soil and Rock Logging, Classification and Presentation Manual" (2010 Edition) and then transported to our laboratory for further evaluation and testing.

The descriptions of the soils encountered and relevant boring information are presented on the Log of Test Borings attached in Appendix II. The laboratory test methods and results are presented in Appendix IV. The logs presented in Appendix II were prepared from the field logs which were edited after visual re-examination of the soil samples in the laboratory and results of classification tests on selected soil samples as indicated on the logs.

The descriptions and related information presented on these logs of test borings depict subsurface conditions only at the locations indicated on the plan and on the particular date noted on the logs. Because of the variability from place to place within soil/rock in general, subsurface conditions at other locations may differ from conditions occurring at the location explored. The abrupt stratum changes shown on the logs may be gradational and relatively minor changes in soil types within a stratum may not be noted on the logs due to field limitations. Also, the passage of time may result in a change in the soil conditions at these locations due to environmental changes.

NOTES:

Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2" Modified California Sampler: I.D. = 2.5"; O.D. = 3" Hammer Assembly: A 140 lb hammer with a 30" drop (Automatic Hammer)

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock, Logging, Classification, and Presentation Manual (2010)

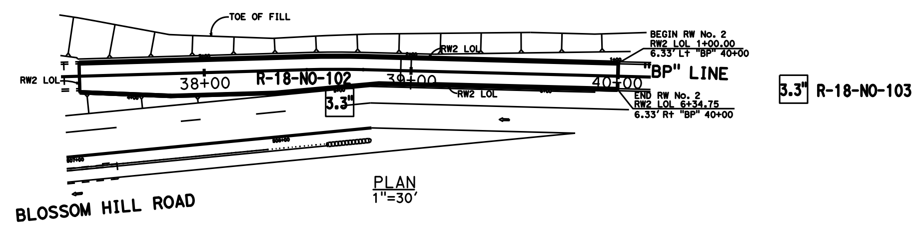
See Caltrans 2015 Standard Plans A10F, A10G and A10H for Soil and Rock Legend.

All dimensions are in feet unless otherwise shown

BENCH MARK:

NGS QQ453 (HS 2787)
Elev. 190.83
4.7 miles northwest along the southern Pacific Company Railroad from the station at Coyote.

Vertical Datum: NAVDBB
Horizontal Datum: CCS83, Zone 3, Epoch 2010.00 in U.S Survey Feet.



PLAN
1"=30'

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	SCI	101	R28.4/R28.9		

GEOTECHNICAL PROFESSIONAL 10-15-19 DATE

REGISTERED PROFESSIONAL ENGINEER GARY PARIKH No. 666 Exp. 12/31/19 GEOTECHNICAL STATE OF CALIFORNIA

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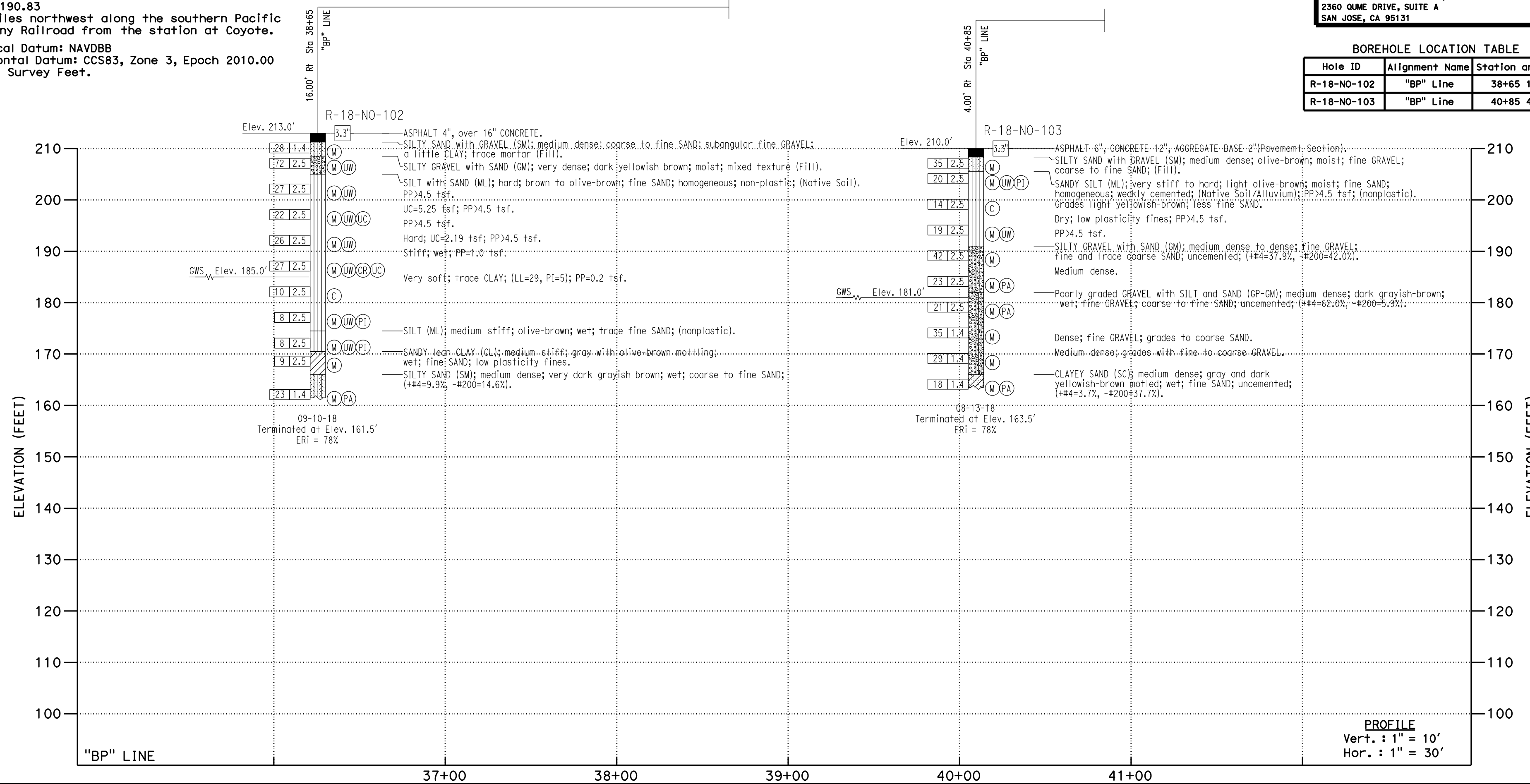
200 E. SANTA CLARA St., 8th FLOOR
SAN JOSE, CA 95113

PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131

BOREHOLE LOCATION TABLE

Hole ID	Alignment Name	Station and Offset
R-18-NO-102	"BP" Line	38+65 16' Rt.
R-18-NO-103	"BP" Line	40+85 4' Rt.



PROFILE
Vert. : 1" = 10'
Hor. : 1" = 30'

DESIGN OVERSIGHT
SIGN OFF DATE

DRAWN BY: KIM OUYANG
CHECKED BY: ALSTON LAM

L.S. BHANGOO
FIELD INVESTIGATION BY:
DATE: AUGUST 2018 TO SEPTEMBER 2018

PREPARED FOR THE
STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

ALSTON LAM
PROJECT ENGINEER

BRIDGE NO. 37E0126
POST MILES R28.61

RETAINING WALL NO. 2
LOG OF TEST BORINGS 1 OF 1

GS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 03/14/12)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0000
PROJECT NUMBER & PHASE: 04160002241
CONTRACT NO.: 04-1K2804

DISREGARD PRINTS BEARING EARLIER REVISION DATES
REVISION DATES: 7-11-18 4-9-19 10-15-19
SHEET 11 OF 11

FILE => RW2-ltb01.dgn

USERNAME => ogouthier DATE PLOTTED => 17-SEP-2019 TIME PLOTTED => 18:56

APPENDIX III

LABORATORY TEST RESULTS

APPENDIX III
LABORATORY TESTS

Classification Tests

The field classification of the samples was visually verified in the laboratory according to the Unified Soil Classification System. The results are presented on "Log of Test Borings", Appendix II.

Moisture-Density

The natural moisture contents were determined for selected undisturbed samples of the soils in accordance with American Standard Test Method (ASTM) D-2216 and dry unit weights were calculated based on natural moisture contents and total unit weights. This information was used to classify and correlate the soils. The results are presented on Plate III-1, "Laboratory Test Summary ", Appendix III.

Atterberg Limits

The Atterberg Limits were determined for selected samples of the fine-grained materials. These results were used to classify the soils, as well as to obtain an indication of the expansion potential with variations in moisture content. The Atterberg Limits were determined in accordance with ASTM D-4318. The results of the test are presented on Plate III-2, "Plasticity Chart", Appendix III.

Grain Size Classification

Grain size classification tests (ASTM D-422) were performed on selected samples of granular soil to aid in the classification. The results are presented on Plates III-3, "Grain Size Distribution Curves", Appendix III.

Unconfined Compression Tests

Strength tests were performed on selected undisturbed samples using unconfined compression machine. Unconfined compression tests were performed in accordance with ASTM D 2166. The results are presented on Plates III-4A and III-4B, "Unconfined Compression Test", Appendix III.

Corrosion Tests

Corrosion tests were performed on selected samples to determine the corrosion potential of the soils. The pH and minimum resistivity tests were performed according to California Test Method CT-643. Sulfate (California Test Method CT-417) and chloride (California Test Method CT-422) tests were performed by Sunland Analytical. The test results are presented on Plate III-5, Appendix III.

Consolidation Tests

Consolidation tests were performed on selected samples to determine the consolidation potential of the soils. The consolidation test was performed in general accordance with ASTM D 2435. The test results are presented on Plates III-6A through III-6F, Appendix III.

LABORATORY TEST SUMMARY

Borehole	Sample Number	Depth	Classi-fication	Water Content	Dry Density	Liquid Limit	Plastic Limit	Plasticity Index	% > Sieve 4	% < Sieve 200	Unconfined Shear Strength (tsf)
R-18-NO-102	1	3.0	SM	15.1	-						
R-18-NO-102	2	6.0	GM	6.6	142.2						
R-18-NO-102	3	11.0	ML	13.6	105.8						
R-18-NO-102	4	16.0	ML	11.9	105.8						2.63
R-18-NO-102	5	21.0	ML	13.9	102.6						
R-18-NO-102	6	26.0	ML	14.0	106.2						1.10
R-18-NO-102	7	31.0	ML	-	-						
R-18-NO-102	8	36.0	ML	28.4	95.5	29	24	5			
R-18-NO-102	9	41.0	ML	26.6	105.4	NP	NP	NP			
R-18-NO-102	10	44.5	CL	19.3	-						
R-18-NO-102	11	51.0	SM	13.1	-				9.9	14.6	
R-18-NO-103	1	3.0	SM	9.8	-						
R-18-NO-103	2	6.0	ML	9.7	92.7	NP	NP	NP			
R-18-NO-103	3	11.0	ML	-	-						
R-18-NO-103	4	16.0	ML	8.7	91.2						
R-18-NO-103	5	21.0	GM	3.0	-						
R-18-NO-103	6	26.0	GM	5.8	-				37.9	42.0	
R-18-NO-103	7	31.0	GP-GM	9.7	-				62.0	5.9	
R-18-NO-103	8	36.0	GP-GM	8.1	-						
R-18-NO-103	9	41.0	GP-GM	6.6	-						
R-18-NO-103	10	46.0	SC	21.7	-				3.7	37.7	

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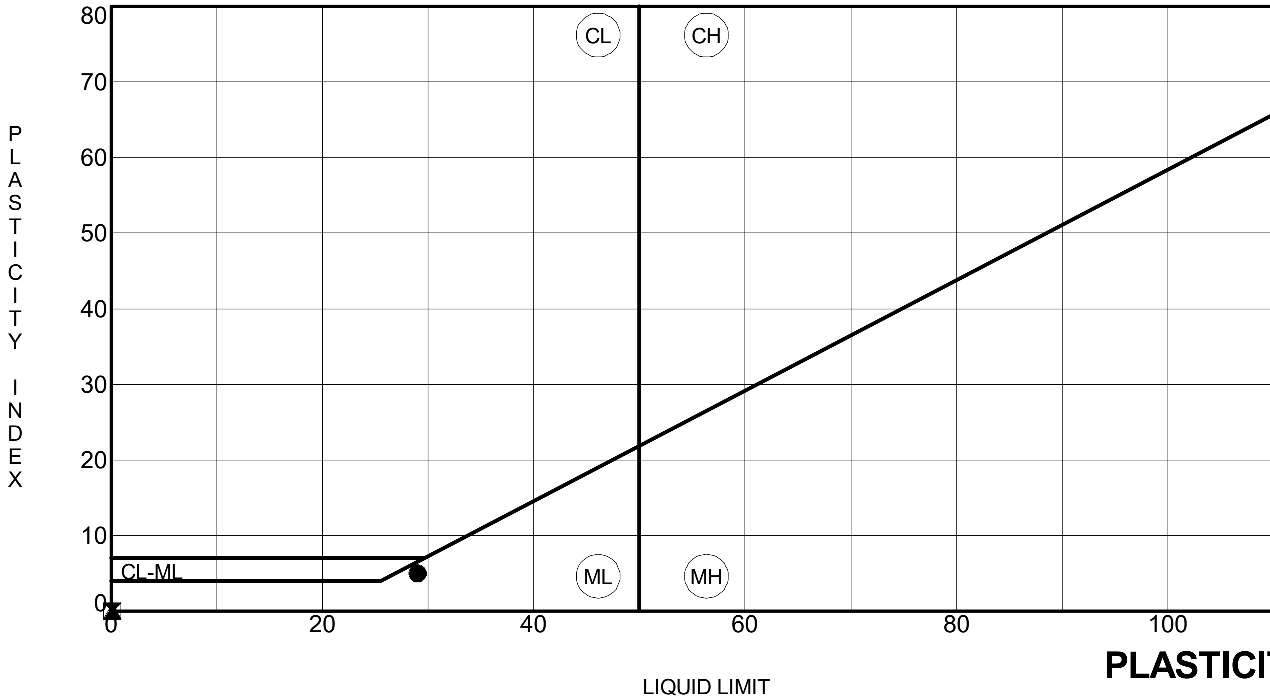
RETAINING WALL NO. 2
SAN JOSE, CALIFORNIA

JOB NO: 2016-146-MSE | **PLATE NO: III-1**

ATTERBERG LIMITS



PLASTICITY

	BOREHOLE	SAMPLE #	DEPTH	LL	PL	PI	Fines	Classification
●	**R-18-NO-102**	**8**	**36.0**	**29**	**24**	**5**		**SILT with SAND**
⧗	**R-18-NO-102**	**9**	**41.0**	**NP**	**NP**	**NP**		**SILT**
▲	**R-18-NO-103**	**2**	**6.0**	**NP**	**NP**	**NP**		**SANDY SILT**

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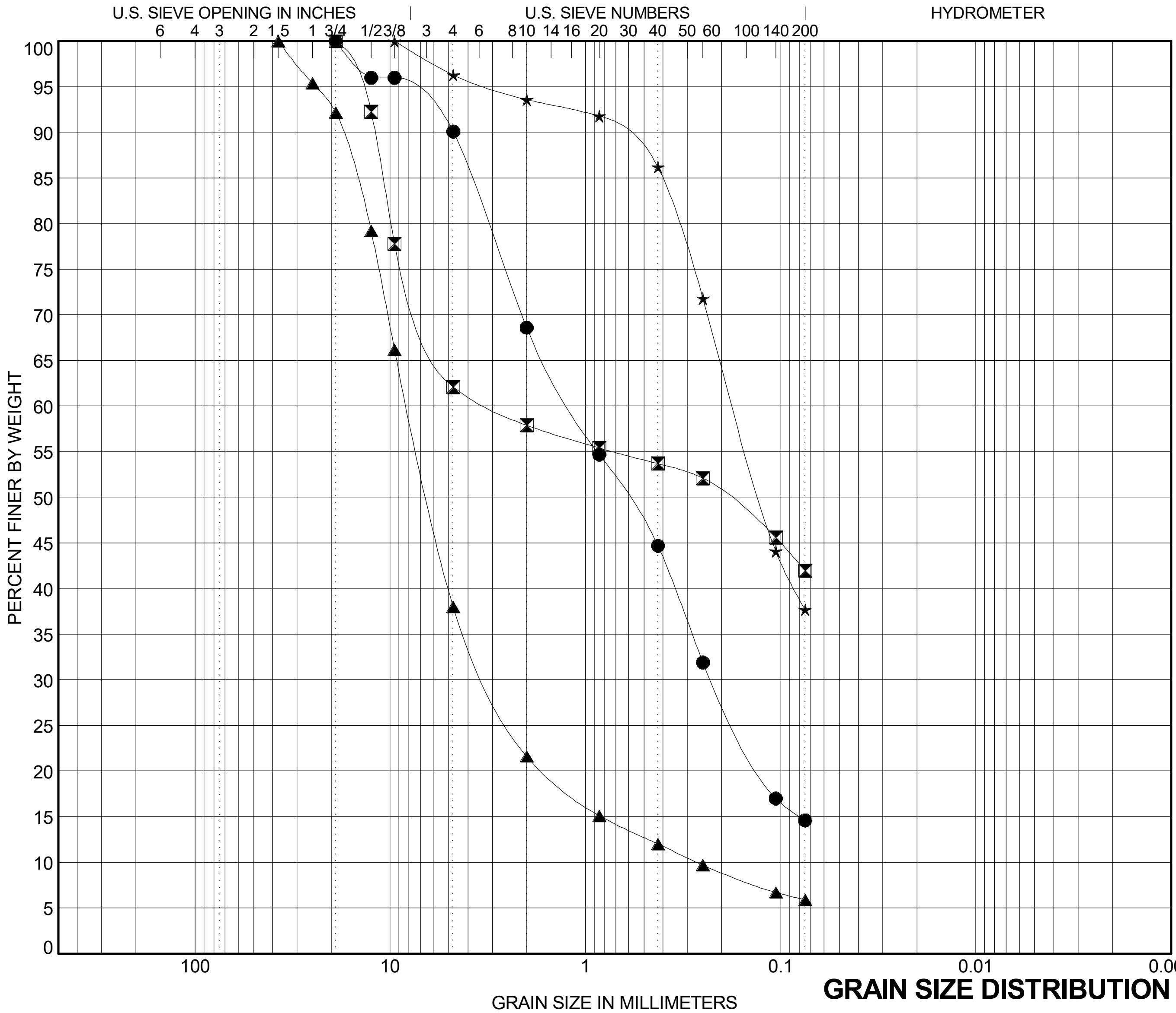
RETAINING WALL NO. 2
SAN JOSE, CALIFORNIA

JOB NO: 2016-146-MSE
PLATE NO: III-2

GRAIN SIZE DISTRIBUTION CURVE



GRAIN SIZE DISTRIBUTION

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING	SAMPLE #	DEPTH	Classification	LL	PL	PI	Cc	Cu
●	**R-18-NO-102**	**11**	**51.0**	**SILTY SAND**					
⧗	**R-18-NO-103**	**6**	**26.0**	**SILTY GRAVEL with SAND**					
▲	**R-18-NO-103**	**7**	**31.0**	**Poorly graded GRAVEL with SILT and SAND**				**4.44**	**30.45**
★	**R-18-NO-103**	**10**	**46.0**	**CLAYEY SAND**					

	BORING	SAMPLE #	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**R-18-NO-102**	**11**	**51.0**	**19**	**1.178**	**0.224**		**9.9**	**75.5**	**14.6**	
⧗	**R-18-NO-103**	**6**	**26.0**	**19**	**3.082**			**37.9**	**20.1**	**42.0**	
▲	**R-18-NO-103**	**7**	**31.0**	**37.5**	**8.157**	**3.115**	**0.268**	**62.0**	**32.1**	**5.9**	
★	**R-18-NO-103**	**10**	**46.0**	**9.5**	**0.173**			**3.7**	**58.6**	**37.7**	

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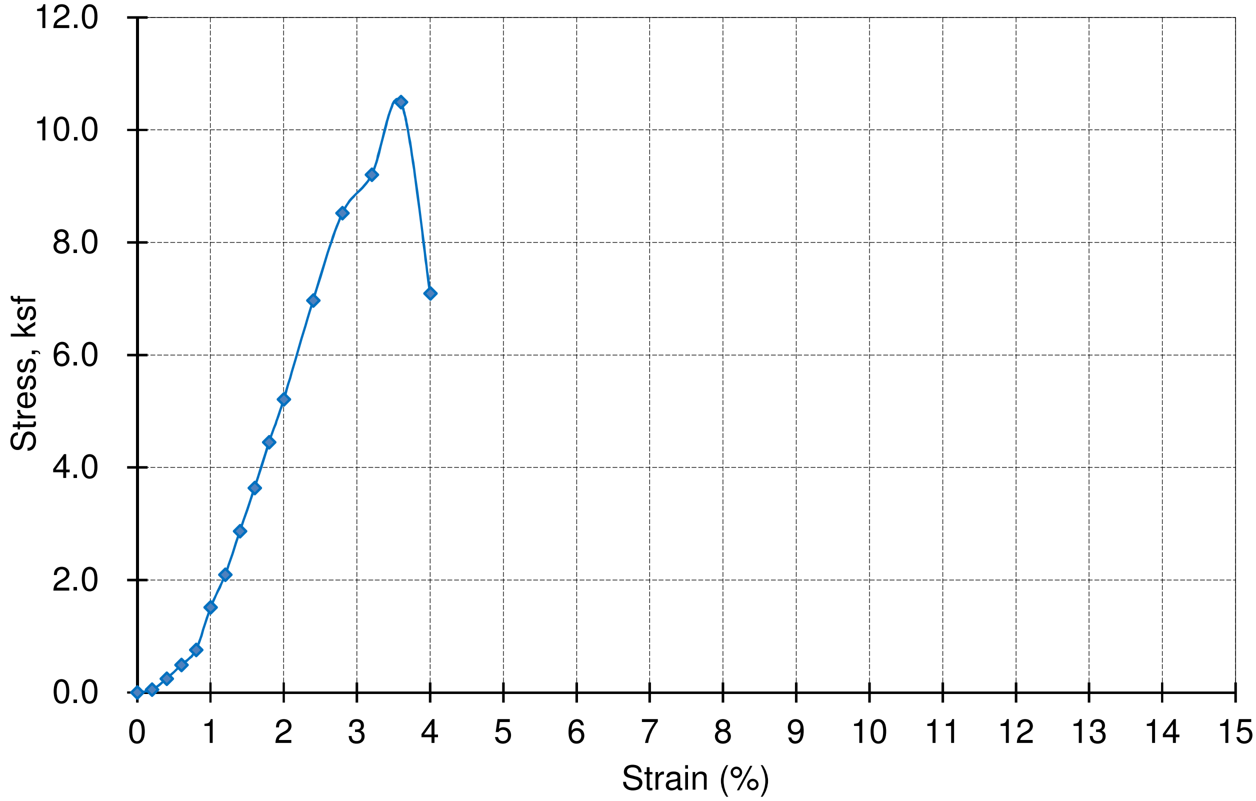
RETAINING WALL NO. 2
SAN JOSE, CALIFORNIA

JOB NO: 2016-146-MSE | **PLATE NO: III-3**

UNCONFINED COMPRESSION TEST

UNCONFINED COMPRESSION TEST



Boring No.:	R-18-NO-102
Sample No. :	4
Depth (feet):	16
Sample Type:	MC - 2.416 inch dia.
Test Method	ASTM D2166
Material Type:	ML
Material Description:	SILT WITH SAND

Unconfined Compressive Strength (ksf):	10.49
Shear Strength (ksf)	5.25
Strain @ Failure (%):	3.6
Initial Dry Density (pcf):	106
Water Content (%):	11.9

Initial Height (inch):	5.00
Initial Diameter (inch)	2.42
Initial Area (ft^2):	0.032
Strain Rate (inch/min)	0.1

Remarks:

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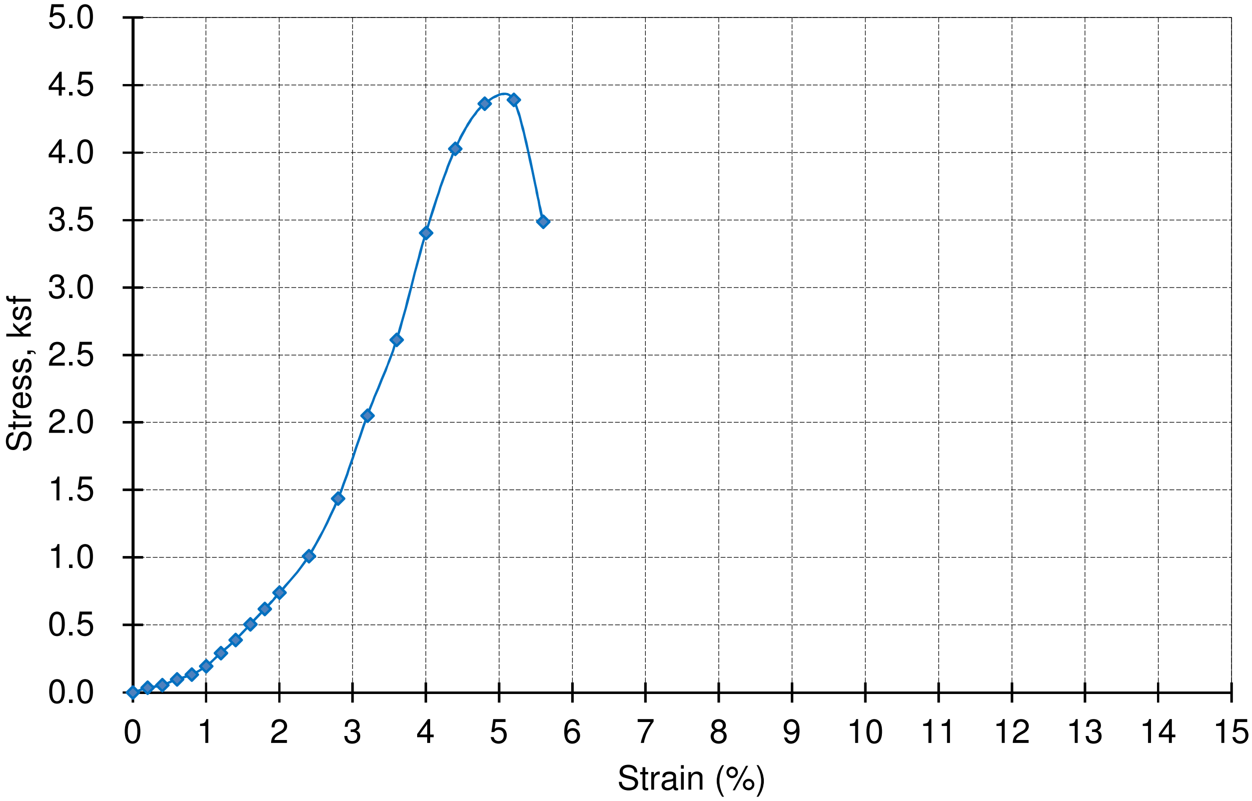
RETAINING WALL NO. 2
SAN JOSE, CALIFORNIA

JOB NO.: 2016-146-MSE | PLATE NO.: III-4A

UNCONFINED COMPRESSION TEST



Boring No.:	R-18-NO-102	**Unconfined Compressive Strength (ksf):**	4.39
Sample No. :	6	**Shear Strength (ksf)**	2.19
Depth (feet):	26	**Strain @ Failure (%):**	5.2
Sample Type:	MC - 2.416 inch dia.	**Initial Dry Density (pcf):**	106
Test Method	ASTM D2166	**Water Content (%):**	14.0
Material Type:	ML		
Material Description:	SILT WITH SAND		

Initial Height (inch): 5.00
Initial Diameter (inch) 2.42
Initial Area (ft^2): 0.032
Strain Rate (inch/min) 0.1

Remarks:

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RETAINING WALL NO. 2 **SAN JOSE, CALIFORNIA**	
JOB NO.: 2016-146-MSE	**PLATE NO.: III-4B**

CORROSION TEST

Sunland Analytical
11419 Sunrise Gold Circle, #10
Rancho Cordova, CA 95742
(916) 852-8557

Date Reported 10/17/2018
Date Submitted 10/10/2018

To: Nasir Ahmad
Parikh Consultants, Inc.
2360 Qume Dr. Suite A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 2016-146-NOC Site ID : R18NO102 6@26FT.
Thank you for your business.

* For future reference to this analysis please use SUN # 78267-163687.

EVALUATION FOR SOIL CORROSION

Soil pH	7.89		
Minimum Resistivity	1.15	ohm-cm (x1000)	
Chloride	15.8 ppm	00.00158	%
Sulfate	74.8 ppm	00.00748	%

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

CONSOLIDATION TEST

One Dimensional Consolidation Properties
(Oedometer)

Client	PARIKH CONSULTANTS	**Lab Ref**	
Project	Blossom Hill Road Interchange Improv. RW2	**Job**	2016-146-MSE
Borehole	R18-NO-102	**Sample**	7
Location		**Depth**	31

Test Details			
Standard	ASTM D2435-96 / AASHTO T216-94	**Particle Specific Gravity**	2.65
Sample Type	Modified California Test Sample	**Lab. Temperature**	72.0 deg.F
Method of Testing (A/B)	A		
Sample Description	Stiff Silt with Sand, brown		
Variations from Procedure	None		

Specimen Details			
Specimen Reference	A	**Description**	
Depth within Sample	0.0000 in	**Orientation within Sample**	
Specimen Mass	0.1723 lb	**Condition**	Natural Moisture
Specimen Height	0.7500 in	**Preparation**	
Comments			

Apparatus			
Ring Number	1	**Ring Diameter**	2.0000 in
Ring Height	0.7500 in	**Ring Weight**	0.1367 lb
Lever Ratio	1.00 : 1	**Drainage**	Double-Sided

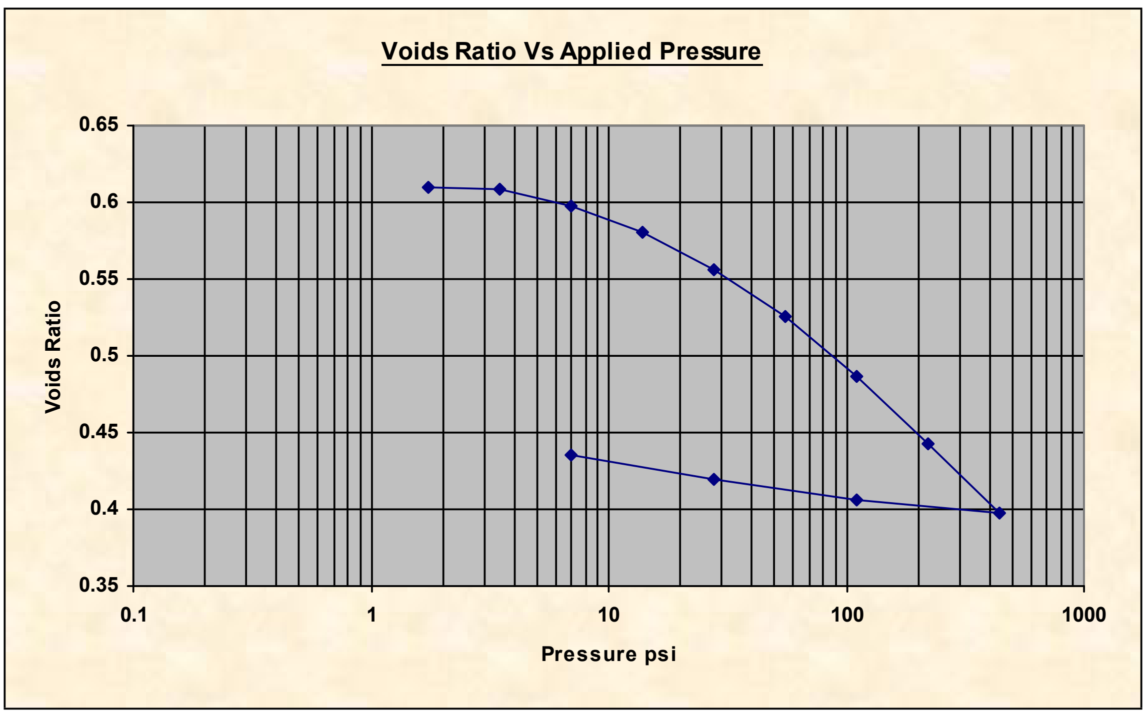


Plate III-6A

One Dimensional Consolidation Properties
(Oedometer)

Client	PARIKH CONSULTANTS	**Lab Ref**	
Project	Blossom Hill Road Interchange Improv. RW2	**Job**	2016-146-MSE
Borehole	R18-NO-102	**Sample**	7
Location		**Depth**	31

Initial Moisture Content*	23.0 % (trimmings: 23.9 %)	**Final Moisture Content**	18.2 %
Initial Bulk Density	126.36 lb/ft3	**Final Bulk Density**	136.19 lb/ft3
Initial Dry Density	102.72 lb/ft3	**Final Dry Density**	115.25 lb/ft3
Initial Void Ratio	0.6106	**Final Void Ratio**	0.4354
Initial Degree of Saturation	99.91%	**Final Degree of Saturation**	110.56%
Pre-consolidation Pressure	0.00 psi		

* Calculated from initial and dry weights of whole specimen

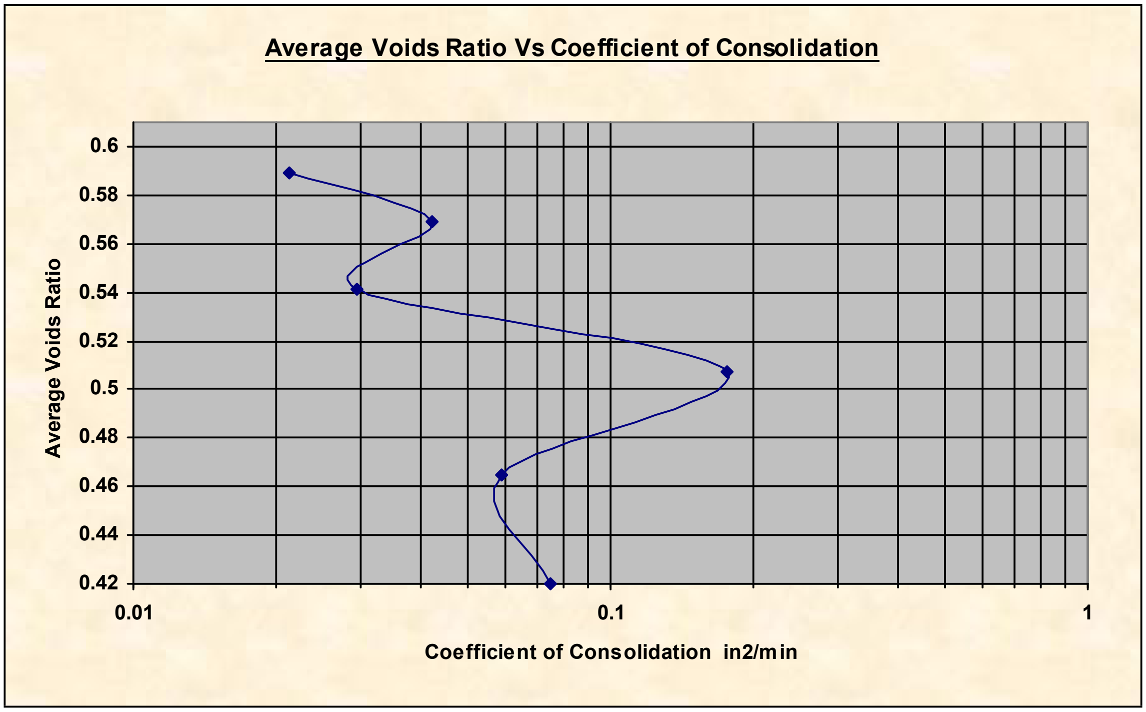
Pressure (Loading)	Load Increment Duration	Deformation (Corrected)	d_{100} (Corrected)	Coefficient of Consolidation (c_v)
0.00				
1.74 psi	9.000 min	0.0002 in	-0.0014 in	----------
3.48 psi	1260.000 min	0.0013 in	0.0004 in	----------
6.96 psi	4080.000 min	0.0060 in	0.0035 in	----------
13.92 psi	1440.000 min	0.0136 in	0.0132 in	0.02127 in2/min
27.85 psi	1260.000 min	0.0254 in	0.0240 in	0.04234 in2/min
55.55 psi	1260.000 min	0.0392 in	0.0376 in	0.02934 in2/min
111.10 psi	1260.000 min	0.0577 in	0.0542 in	0.17582 in2/min
222.20 psi	4080.000 min	0.0779 in	0.0739 in	0.05896 in2/min
444.40 psi	1440.000 min	0.0994 in	0.0935 in	0.07490 in2/min
111.10 psi	381.000 min	0.0953 in	---------	---------
27.85 psi	960.000 min	0.0888 in	---------	---------
6.96 psi	381.000 min	0.0816 in	---------	---------

Method of Time Fitting Used	Log Time

Plate III-6B

One Dimensional Consolidation Properties
(Oedometer)

Client	PARIKH CONSULTANTS	**Lab Ref**	
Project	Blossom Hill Road Interchange Improv. RW2	**Job**	2016-146-MSE
Borehole	R18-NO-102	**Sample**	7
Location		**Depth**	31



Tested By and Date:	Saman Mostafazadeh-Fard 11/15/18
Checked By and Date:	Emre Ortakci 11/19/18
Approved By and Date:	Emre Ortakci 11/19/18

Plate No:

Plate III-6C

One Dimensional Consolidation Properties
(Oedometer)

Client	PARIKH CONSULTANTS	**Lab Ref**	
Project	Blossom Hill Road Interchange Improv. RW2	**Job**	2016-146-MSE
Borehole	R18-NO-103	**Sample**	3
Location		**Depth**	11

Test Details			
Standard	ASTM D2435-96 / AASHTO T216-94	**Particle Specific Gravity**	2.65
Sample Type	Modified California Test Sample	**Lab. Temperature**	72.0 deg.F
Method of Testing (A/B)	A		
Sample Description	Hard Sandy Silt, brown		
Variations from Procedure	None		

Specimen Details			
Specimen Reference	A	**Description**	
Depth within Sample	0.0000 in	**Orientation within Sample**	
Specimen Mass	0.1100 lb	**Condition**	Natural Moisture
Specimen Height	0.7500 in	**Preparation**	
Comments			

Apparatus			
Ring Number	2	**Ring Diameter**	2.0000 in
Ring Height	0.7500 in	**Ring Weight**	0.1370 lb
Lever Ratio	1.00 : 1	**Drainage**	Double-Sided

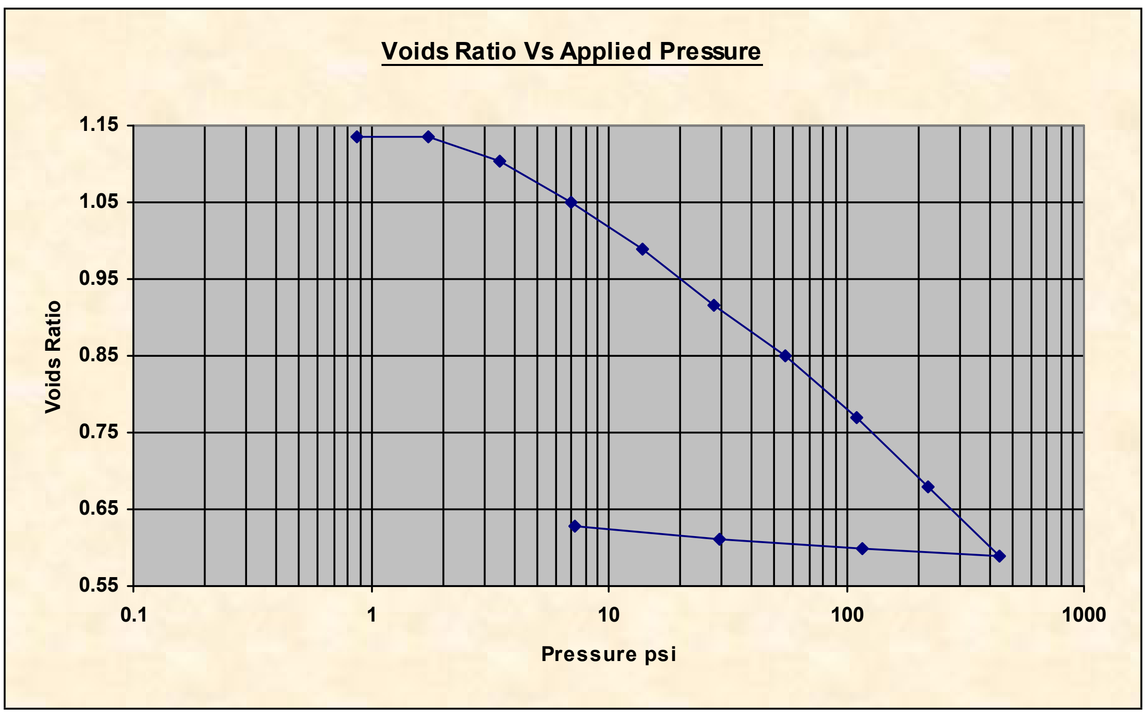


Plate III-6D

One Dimensional Consolidation Properties
(Oedometer)

Client	PARIKH CONSULTANTS	**Lab Ref**	
Project	Blossom Hill Road Interchange Improv. RW2	**Job**	2016-146-MSE
Borehole	R18-NO-103	**Sample**	3
Location		**Depth**	11

Initial Moisture Content*	4.5 % (trimmings: 5.2 %)	**Final Moisture Content**	23.7 %
Initial Bulk Density	80.67 lb/ft3	**Final Bulk Density**	125.76 lb/ft3
Initial Dry Density	77.22 lb/ft3	**Final Dry Density**	101.63 lb/ft3
Initial Void Ratio	1.1424	**Final Void Ratio**	0.6278
Initial Degree of Saturation	10.37%	**Final Degree of Saturation**	100.22%
Pre-consolidation Pressure	0.00 psi		

* Calculated from initial and dry weights of whole specimen

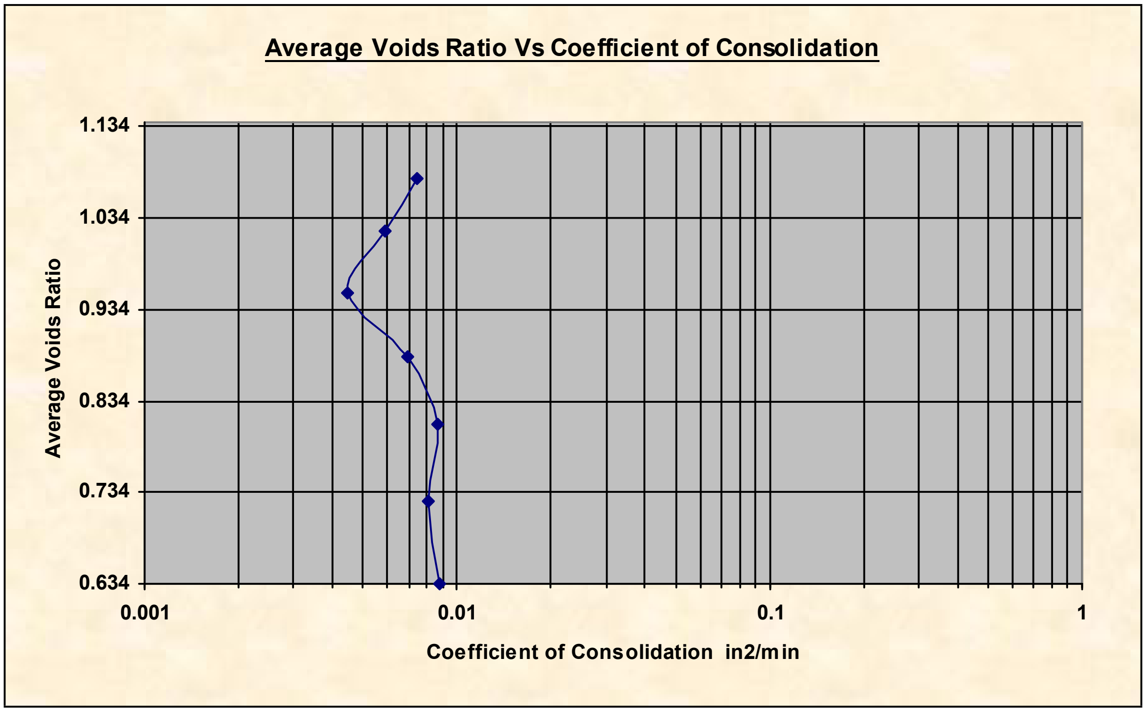
Pressure (Loading)	**Load Increment Duration**	**Deformation (Corrected)**	**d_{100} (Corrected)**	**Coefficient of Consolidation (c_v)**
0.00				
0.87 psi	15.000 min	0.0026 in	0.0024 in	---------
1.74 psi	30.000 min	0.0027 in	0.0025 in	---------
3.48 psi	1260.000 min	0.0133 in	0.0135 in	---------
6.96 psi	1260.000 min	0.0322 in	0.0308 in	0.00749 in2/min
13.92 psi	1260.000 min	0.0533 in	0.0522 in	0.00588 in2/min
27.85 psi	4080.000 min	0.0792 in	0.0756 in	0.00448 in2/min
55.55 psi	1440.000 min	0.1028 in	0.1004 in	0.00693 in2/min
111.10 psi	1260.000 min	0.1306 in	0.1285 in	0.00870 in2/min
222.20 psi	1260.000 min	0.1620 in	0.1588 in	0.00813 in2/min
444.40 psi	1260.000 min	0.1941 in	0.1921 in	0.00873 in2/min
116.03 psi	4080.000 min	0.1901 in	---------	---------
29.01 psi	190.000 min	0.1858 in	---------	---------
7.25 psi	1080.000 min	0.1801 in	---------	---------

Method of Time Fitting Used	Log Time

Plate III-6E

One Dimensional Consolidation Properties
(Oedometer)

Client	PARIKH CONSULTANTS	**Lab Ref**	
Project	Blossom Hill Road Interchange Improv. RW2	**Job**	2016-146-MSE
Borehole	R18-NO-103	**Sample**	3
Location		**Depth**	11



Tested By and Date:	Saman Mostafazadeh-Fard 11/15/18
Checked By and Date:	Emre Ortakci 11/19/18
Approved By and Date:	Emre Ortakci 11/19/18

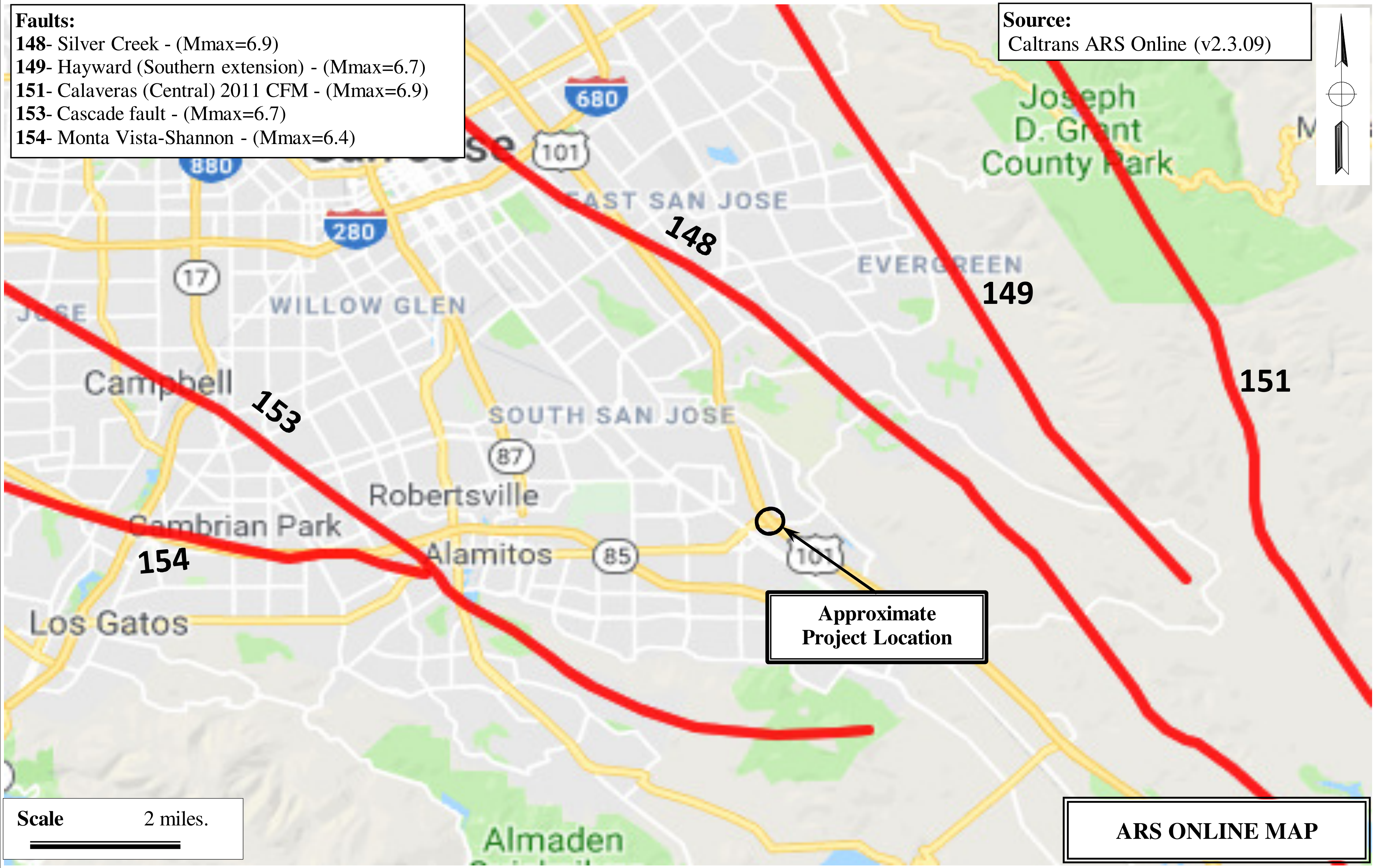
Plate III-6F

APPENDIX IV

ANALYSES AND CALCULATIONS

ACCELERATION RESPONSE SPECTRUM (ARS)

FAULT MAP



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RETAINING WALL NO. 2
SAN JOSE, CALIFORNIA

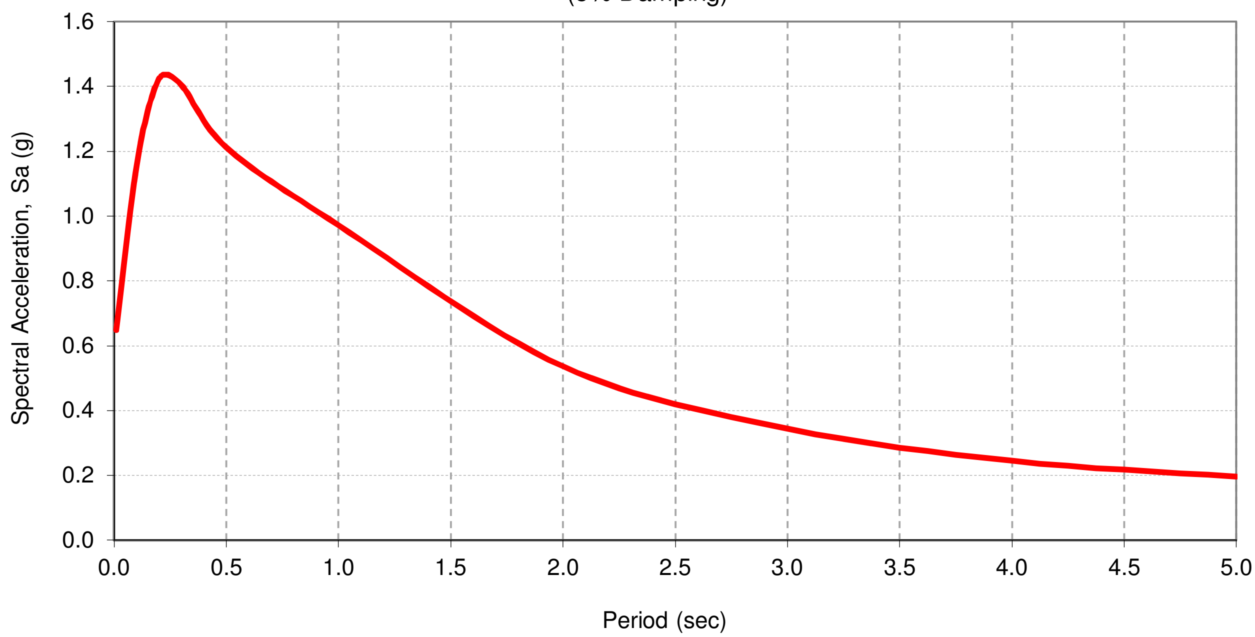
JOB NO.: 2016-146-MSE

PLATE NO.: IV-1

ARS CURVE

RECOMMENDED ACCELERATION RESPONSE SPECTRUM

(5% Damping)



Site Information

Latitude:	37.2573
Longitude	-121.7943
V_{S30} (m/s) =	260
$Z_{1.0}$ (m) =	N/A
$Z_{2.5}$ (km) =	N/A
Near Fault Factor, Derived from USGS Unified Hazard Tool. Dist (km) =	7.91

Governing Curve:

Caltrans Online Probabilistic ARS

Recommended Response Spectrum

Period (sec)	Caltrans Online Probabilistic Spectral Acceleration (g)	Adjusted for Near Fault Effect	Adjusted For Basin Effect	Final Adjusted Spectral Acceleration (g)
0.0	0.648	1	1	0.648
0.1	1.156	1	1	1.156
0.2	1.423	1	1	1.423
0.3	1.404	1	1	1.404
0.5	1.212	1	1	1.212
1.0	0.81	1.2	1	0.972
2.0	0.447	1.2	1	0.536
3.0	0.287	1.2	1	0.344
4.0	0.204	1.2	1	0.245
5.0	0.163	1.2	1	0.196

Source:

1. Caltrans ARS Online tool (V.2.3.09, http://dap3.dot.ca.gov/ARS_Online/)

2. Caltrans Methodology for Developing Design Response Spectrum for Use in Seismic Design Recommendations, November 2012

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Practicing in the Geosciences

RETAINING WALL NO. 2
SAN JOSE, CALIFORNIA

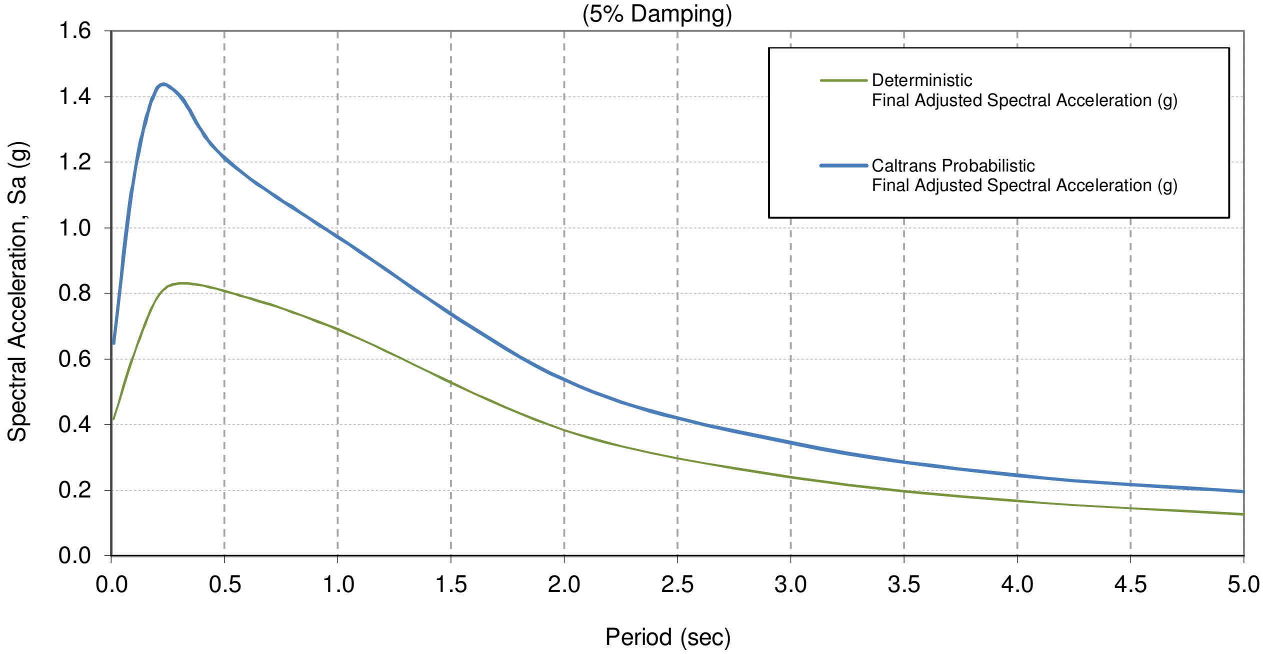
Project No.: 2016-146-MSE	**APPENDIX IV-2A**

SPECTRUM COMPARISON

ACCELERATION RESPONSE SPECTRUM COMPARISON

(Deterministic & Probablistic Curves)

(5% Damping)



Site Information

Latitude:	37.2573
Longitude	-121.7943
V_{S30} (m/s) =	260
$Z_{1.0}$ (m) =	N/A
$Z_{2.5}$ (km) =	N/A
Near Fault Factor, Derived from USGS Unified Hazard Tool. Dist (km) =	7.91

Period (sec)	Deterministic Final Adjusted Spectral Acceleration (g)	Caltrans Probabilistic Final Adjusted Spectral Acceleration (g)
0.0	0.417	0.648
0.1	0.615	1.156
0.2	0.784	1.423
0.3	0.830	1.404
0.5	0.807	1.212
1.0	0.690	0.972
2.0	0.383	0.536
3.0	0.240	0.344
4.0	0.167	0.245
5.0	0.126	0.196

Source:

1. Caltrans ARS Online tool (V.2.3.09, http://dap3.dot.ca.gov/ARS_Online/)

2. USGS Unified Hazard Tool (https://earthquake.usgs.gov/hazards/interactive/)

3. Caltrans Methodology for Developing Design Response Spectrum for Use in Seismic Design Recommendations, November 2012

PARIKH
Practicing in the Geosciences

RETAINING WALL NO. 2
SAN JOSE, CALIFORNIA

Project No.: 2016-146-MSE | **APPENDIX IV-2B**

LIQUEFACTION ANALYSES

LIQUEFACTION POTENTIAL ANALYSIS (SPT procedures per Youd et al, 2001)

PROJECT NAME	***RETAINING WALL NO. 2***	*SOIL GROUPS*		*FAULT INFO*	
PROJECT NO.	***2016-146-MSE***	1. GRAVELS, SANDS AND NONPLASTIC SILTS		*Silver Creek Fault*	
BORING NO.	***R-18-NO-102***	2. CLAYS AND PLASTIC SILTS		*a_{max} (g)=*	0.648
				FAULT M_w =	6.9
GW DEPTH (ft)=	28	*BOREHOLE DIA (in)=*	3.3	*CUT(-)/FILL(+) (ft) =* 0	*MSF =* 1.24
		HAMMER ENERGY =	78%	*DESIGN GW DEPTH (ft)=* 28 *(below OG)*	

SOIL STRATA							LIQUEFACTION RESISTANCE ($CRR_{7.5}$)												CYCLIC STRESS RATIO (CSR)				F.S.=($CRR_{7.5}$/CSR)*MSF*Ks*Ka			POST-LIQ. SETTLEMENT	
Layer Thickness from	to	Sample No	Depth (ft)	Soil Type	Blow Count	Sampler Type	SPT-$N_{eq.}$	C_E	C_R	C_S	C_B	N_{60}	σ_v' (psf)	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60,CS}$	$CRR_{7.5}$	σ_v (psf)	σ_v' (psf)	r_d	CSR	Ks	Ka	F.S.	Vol. Strain (%)	ΔD (in)
0	4.5	1	3	1	28	SPT	28.0	1.3	0.75	1.2	1.00	32.8	345.0	1.7	55.7	15%	60.9		345.0	345.0	1.0	0.4	1.0	1.0			
4.5	8.0	2	6	1	72	MC	46.8	1.3	0.80	1.0	1.00	48.7	697.5	1.7	82.4	15%	88.9		697.5	697.5	1.0	0.4	1.0	1.0			
8.0	13.0	3	11	1	27	MC	17.6	1.3	0.85	1.0	1.00	19.4	1297.5	1.2	24.1	50%	33.9		1297.5	1297.5	1.0	0.4	1.0	1.0			
13.0	18.0	4	16	2	22	MC	14.3	1.3	0.95	1.0	1.00	17.7	1897.5	1.0	18.1												
18.0	23.0	5	21	2	26	MC	16.9	1.3	0.95	1.0	1.00	20.9	2497.5	0.9	18.7												
23.0	28.0	6	26	2	27	MC	17.6	1.3	1.00	1.0	1.00	22.8	3097.5	0.8	18.3												
28.0	33.0	7	31	2	10	MC	6.5	1.3	1.00	1.0	1.00	8.5	3510.3	0.8	6.4												
33.0	38.5	8	36	2	8	MC	5.2	1.3	1.00	1.0	1.00	6.8	3798.3	0.7	4.9												
38.5	42.5	9	41	1	8	MC	5.2	1.3	1.00	1.0	1.00	6.8	4086.3	0.7	4.7	50%	10.7	0.1	4897.50	4086.3	0.8	0.4	0.9	1.0	(0.30)	2.24%	1.08
42.5	47.0	10	44.5	2	9	MC	5.9	1.3	1.00	1.0	1.00	7.6	4287.9	0.7	5.2												
47.0	51.5	11	51.5	1	23	SPT	23.0	1.3	1.00	1.2	1.00	35.9	4691.1	0.7	23.4	15%	27.1	0.3	6157.50	4691.1	0.7	0.4	0.7	1.0	NON-LIQ.		

Fines Content based on visual inspection

Fines Content based on lab results

Notes:

1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner) are per Youd et al. (2001).
2. For correction of overburden, $C_N = (1/\sigma_v')^{0.5}$ with a maximum value of 1.7.
3. The influence of Fines Contents are expressed by the following correction: $(N_1)_{60cs} = a + b\,(N_1)_{60}$
   where a and b = coefficients determined from the following relationships
   - for FC $\leq$ 5%   a = 0,   b = 1.0
   - for 5% < FC < 35%   a = exp(1.76-(190/FC^2)),   b = (0.99+(FC$^{1.5}$/1000))
   - for FC $\geq$ 35%   a = 5.0,   b = 1.2
4. For $(N_1)_{60,cs}$ greater than 30, clean granular soils are too dense to liquefy and are classed as non-liquefiable.

Reference:

Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER Workshops on Evaluation of Liquefaction Resistance of Soils, Youd, et al., ASCE Journal of Geotechnical and Geoenvironmental Engineering, October 2001, Vol. 127 No. 10

LIQUEFACTION POTENTIAL ANALYSIS (SPT procedures per Youd et al, 2001)

PROJECT NAME	***RETAINING WALL NO. 2***	*SOIL GROUPS*				*FAULT INFO*	
PROJECT NO.	***2016-146-MSE***	1. GRAVELS, SANDS AND NONPLASTIC SILTS				*Silver Creek Fault*	
BORING NO.	***R-18-NO-103***	2. CLAYS AND PLASTIC SILTS				*a_{max} (g)=*	0.648
						FAULT M_w =	6.9
GW DEPTH (ft)=	29	*BOREHOLE DIA (in)=*	3.3	*CUT(-)/FILL(+) (ft) =*	0	*MSF =*	1.24
		HAMMER ENERGY =	78%	*DESIGN GW DEPTH (ft)=*	29 *(below OG)*		

SOIL STRATA							*LIQUEFACTION RESISTANCE ($CRR_{7.5}$)*												*CYCLIC STRESS RATIO (CSR)*				*F.S.=($CRR_{7.5}$/CSR)*MSF*Ks*Ka*			*POST-LIQ. SETTLEMENT*	
Layer Thickness from	to	Sample No	Depth (ft)	Soil Type	Blow Count	Sampler Type	SPT-$N_{eq.}$	C_E	C_R	C_S	C_B	N_{60}	σ_v' (psf)	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60,CS}$	$CRR_{7.5}$	σ_v (psf)	σ_v' (psf)	r_d	CSR	Ks	Ka	F.S.	Vol. Strain (%)	ΔD (in)
0	4.5	1	3	1	35	MC	22.8	1.3	0.75	1.0	1.00	22.2	345.0	1.7	37.7	15%	42.0		345.0	345.0	1.0	0.4	1.0	1.0			
4.5	8.0	2	6	1	20	MC	13.0	1.3	0.80	1.0	1.00	13.5	697.5	1.7	22.9	50%	32.5		697.5	697.5	1.0	0.4	1.0	1.0			
8.0	13.0	3	11	2	14	MC	9.1	1.3	0.85	1.0	1.00	10.1	1297.5	1.2	12.5												
13.0	19.0	4	16	2	19	MC	12.4	1.3	0.95	1.0	1.00	15.3	1897.5	1.0	15.7												
19.0	23.0	5	21	1	42	MC	27.3	1.3	0.95	1.0	1.00	33.7	2497.5	0.9	30.2	15%	34.1		2497.5	2497.5	1.0	0.4	0.9	1.0			
23.0	28.0	6	26	1	23	MC	15.0	1.3	1.00	1.0	1.00	19.4	3097.5	0.8	15.6	42%	23.7		3097.5	3097.5	0.9	0.4	0.9	1.0			
28.0	33.0	7	31	1	21	MC	13.7	1.3	1.00	1.0	1.00	17.7	3572.7	0.7	13.3	6%	13.4	0.1	3697.5	3572.7	0.9	0.4	0.8	1.0	(0.37)	1.89%	1.14
33.0	38.0	8	36	1	35	SPT	35.0	1.3	1.00	1.2	1.00	54.6	3860.7	0.7	39.3	10%	41.0		4297.5	3860.7	0.9	0.4	0.8	1.0	NON-LIQ.		
38.0	44.0	9	41	1	29	SPT	29.0	1.3	1.00	1.2	1.00	45.2	4148.7	0.7	31.4	10%	33.0		4897.50	4148.7	0.8	0.4	0.8	1.0	NON-LIQ.		
44.0	46.5	10	46	1	18	SPT	18.0	1.3	1.00	1.2	1.00	28.1	4436.7	0.7	18.9	38%	27.6	0.4	5497.50	4436.7	0.8	0.4	0.8	1.0	NON-LIQ.		

Fines Content based on visual inspection

Fines Content based on lab results

Notes:

1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner) are per Youd et al. (2001).
2. For correction of overburden, $C_N = (1/\sigma_v')^{0.5}$ with a maximum value of 1.7.
3. The influence of Fines Contents are expressed by the following correction: $(N_1)_{60cs} = a + b\,(N_1)_{60}$
   where a and b = coefficients determined from the following relationships
   for FC $\le$ 5% a = 0, b = 1.0
   for 5% < FC < 35% a = exp(1.76-(190/FC^2)), b = (0.99+(FC$^{1.5}$/1000))
   for FC $\ge$ 35% a = 5.0, b = 1.2
4. For $(N_1)_{60,cs}$ greater than 30, clean granular soils are too dense to liquefy and are classed as non-liquefiable.

Reference:

Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER Workshops on Evaluation of Liquefaction Resistance of Soils, Youd, et al., ASCE Journal of Geotechnical and Geoenvironmental Engineering, October 2001, Vol. 127 No. 10

CALCULATIONS OF SHEAR WAVE VELOCITY

SOIL STRENGTH PARAMETERS & V_{s30}

Calc By: JZ
Date: 10/9/18

PROJECT NAME: ***RETAINING WALL NO. 2***
PROJECT NO.: ***2016-146-MSE***
STRUCTURE: ***Retaining Wall 2***
BORING NO.: ***R-18-NO-102***

BOREHOLE DIA (in)= 3.3
GW DEPTH (ft)= 28

HAMMER ENERGY = 78%
DRILLING RODS (Y/N)= Y

SOIL GROUPS
1. SANDS & GRAVELS
2. CLAYS AND PLASTIC SILTS
3. NON TO LOW PLASTIC SILTS
4. YOUNG SEDIMENTARY ROCKS
5. LIQUEFIABLE SANDS (RESIDUAL STRENGTH)
6. LIQUEFIABLE SILTS (RESIDUAL STRENGTH)

Nd 13
N_{30} 16

V_{sd} (m/s) *216*
V_{s30} (m/s) *263*
Correlation 1) Caltrans

Sample No	Layer Thickness from	to	Sample Depth (ft)	Soil Type	Field Blow Count	Sampler Type	Unit Weight (pcf)	σ_v (psf)	σ_v' (psf)	SPT-$N_{eq.}$	N_{60} CE Corr.	N_{60} CR,CB,CS Corr.	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60, CS}$	Correlated Strength Parameters φ (°)	c (psf)	S_r (psf)	Lab Test Results c (psf)	Vs (m/s)
1	0.0	4.5	3	1	28	SPT	125	375	375	28	36.4	35.5	1.70	60.3		60.3	45				159
2	4.5	8.0	6	1	72	MC	125	750	750	47	60.8	48.7	1.63	79.5		79.5	47				197
3	8.0	13.0	11	3	27	MC	125	1375	1375	18	22.8	19.4	1.21	23.4				2282			202
4	13.0	18.0	16	2	22	MC	125	2000	2000	14	18.6	17.7	1.00	17.7				2324		5250	321
5	18.0	23.0	21	2	26	MC	125	2625	2625	17	22.0	20.9	0.87	18.2				2746			245
6	23.0	28.0	26	2	27	MC	125	3250	3250	18	22.8	22.8	0.78	17.9				2852		2190	212
7	28.0	33.0	31	2	10	MC	125	3875	3688	7	8.5	8.5	0.74	6.2				1056			208
8	33.0	38.5	36	2	8	MC	125	4500	4001	5	6.8	6.8	0.71	4.8				845			200
9	38.5	42.5	41	3	8	MC	125	5125	4314	5	6.8	6.8	0.68	4.6				676			212
10	42.5	47.0	44.5	2	9	MC	125	5562.5	4533	6	7.6	7.6	0.66	5.1				951			210
11	47.0	51.5	51.5	1	23	SPT	125	6437.5	4971	23	29.9	36.9	0.63	23.4	10%	24.7	35				288

Note:
1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner), C_N (Overburden) are per Youd 2001
2. For fine-grained materials, the correlation between blow-counts and shear is based on NAVFAC DM 7.1.
3. The phi angle was estimated based on Meyerhof (1956).
4. Residual Strength (Sr) is based on Caltrans "Guidelines on Foundation Loading and Deformation Due to Liquefaction Induced Lateral Spreading", Caltrans 2011
5. The Vs were correlated based on N_{60} for Soil Types 1,3, 4; based on N_{60} or c_{lab} for Soil Type 2 and based on Sr for Soil Types 5 & 6 per Caltrans Guidelines (2012).
6. Spreadsheet Revision Date: 10/29/13

SOIL STRENGTH PARAMETERS & V_{s30}

Calc By:	JZ		
Date:	10/9/18		

PROJECT NAME: ***RETAINING WALL NO. 2***
PROJECT NO.: ***2016-146-MSE***
STRUCTURE: ***Retaining Wall 2***
BORING NO.: ***R-18-NO-103***

BOREHOLE DIA (in)= 3.3 *HAMMER ENERGY =* 78%
GW DEPTH (ft)= 29 *DRILLING RODS (Y/N)=* Y

SOIL GROUPS
1. SANDS & GRAVELS
2. CLAYS AND PLASTIC SILTS
3. NON TO LOW PLASTIC SILTS
4. YOUNG SEDIMENTARY ROCKS
5. LIQUEFIABLE SANDS (RESIDUAL STRENGTH)
6. LIQUEFIABLE SILTS (RESIDUAL STRENGTH)

Nd	21	V_{sd} (m/s)	*225*
N_{30}	26	V_{s30} (m/s)	*279*
		Correlation	1) Caltrans

Sample No	Layer Thickness from	Layer Thickness to	Sample Depth (ft)	Soil Type	Field Blow Count	Sampler Type	Unit Weight (pcf)	σ_v (psf)	σ_v' (psf)	SPT-$N_{eq.}$	N_{60} CE Corr.	N_{60} CR,CB,CS Corr.	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60,CS}$	Correlated Strength Parameters ϕ (°)	Correlated Strength Parameters c (psf)	Correlated Strength Parameters S_r (psf)	Lab Test Results c (psf)	Vs (m/s)
1	0.0	4.5	3	1	35	MC	125	375	375	23	29.6	22.2	1.70	37.7		37.7	42				156
2	4.5	8.0	6	3	20	MC	125	750	750	13	16.9	13.5	1.63	22.1				1690			166
3	8.0	13.0	11	2	14	MC	125	1375	1375	9	11.8	10.1	1.21	12.1				1479			191
4	13.0	19.0	16	2	19	MC	125	2000	2000	12	16.1	15.3	1.00	15.3				2007			218
5	19.0	23.0	21	1	42	MC	125	2625	2625	27	35.5	33.7	0.87	29.4		29.4	38				252
6	23.0	28.0	26	1	23	MC	125	3250	3250	15	19.4	19.4	0.78	15.2	42%	23.3	35				250
7	28.0	33.0	31	1	21	MC	125	3875	3750	14	17.7	17.7	0.73	13.0	6%	13.0	34				256
8	33.0	38.0	36	1	35	SPT	125	4500	4063	35	45.5	59.2	0.70	41.5		41.5	38				286
9	38.0	44.0	41	1	29	SPT	125	5125	4376	29	37.7	49.0	0.68	33.1		33.1	37				286
10	44.0	46.5	46	1	18	SPT	125	5750	4689	18	23.4	27.6	0.65	18.0	38%	26.6	35				277

Note:
1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner), C_N (Overburden) are per Youd 2001
2. For fine-grained materials, the correlation between blow-counts and shear is based on NAVFAC DM 7.1.
3. The phi angle was estimated based on Meyerhof (1956).
4. Residual Strength (Sr) is based on Caltrans "Guidelines on Foundation Loading and Deformation Due to Liquefaction Induced Lateral Spreading", Caltrans 2011
5. The Vs were correlated based on N_{60} for Soil Types 1,3, 4; based on N_{60} or c_{lab} for Soil Type 2 and based on Sr for Soil Types 5 & 6 per Caltrans Guidelines (2012).
6. Spreadsheet Revision Date: 10/29/13

LATERAL EARTH PRESSURES

Rankine Active Lateral Pressure Coefficient (K_a)

Project Name/Number: Blossom Hill RW2 **By:** EO
Structure Name/Number: MSE Wall **Date:** 11/19/2018

Parameters	Angle in degrees	Angle in radians	
ϕ	34	0.593	(Friction Angle of Soil)
β	0	0.000	(Backfill angle with horizontal)

K_a	0.283

$$K_a = \frac{\cos\beta - \left(\cos^2\beta - \cos^2\phi\right)^{1/2}}{\cos\beta + \left(\cos^2\beta - \cos^2\phi\right)^{1/2}}$$

M-O Seismic Active Lateral Pressure Coefficient (K_{AE})

Project Name/Number:	Blossom Hill RW2	**By:**	EO
Structure Name/Number:	MSE Wall	**Date:**	11/19/2018

Parameters	Angle in degrees	Angle in Radians	
ϕ	34	0.593	(Friction Angle of Soil)
i	0	0.000	(Backfill angle with horizontal)
β	0	0.000	(Wall backface angle **with vertical**)
δ	22.78	0.398	(Friction Angle between Soil and the backface of the wall)
kh (no unit)	0.22		
kv (no unit)	0		
θ_{MO} (rad)		0.217	

K_{ae}	0.42

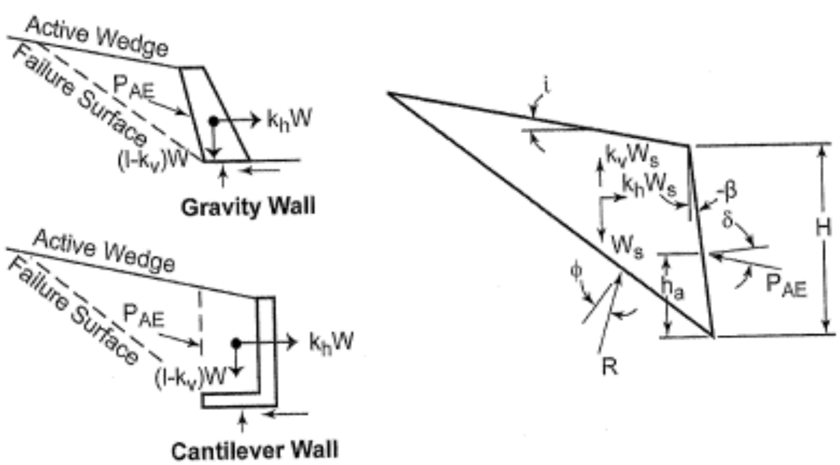


Figure A11.3.1-1—Mononobe-Okabe Method Force Diagrams

$$K_{AE} = \frac{\cos^2(\phi - \theta_{MO} - B)}{\cos\theta_{MO}\cos^2\beta\cos(\delta+\beta+\theta_{MO})} \times \left[1 + \sqrt{\frac{\sin(\phi+\delta)\sin(\phi-\theta_{MO}-i)}{\cos(\delta+\beta+\theta_{MO})\cos(i-\beta)}}\right]^{-2} \qquad \text{(A11.3.1-1)}$$

where:

K_{AE} = seismic active earth pressure coefficient (dim)
γ = unit weight of soil (kcf)
H = height of wall (ft)
h = height of wall at back of wall heel considering height of sloping surcharge, if present (ft)
ϕ_f = friction angle of soil (degrees)
θ_{MO} = arc tan $[k_h/(1-k_v)]$ (degrees)
δ = wall backfill interface friction angle (degrees)
k_h = horizontal seismic acceleration coefficient (dim.)
k_v = vertical seismic acceleration coefficient (dim.)
i = backfill slope angle (degrees)
β = slope of wall to the vertical, negative as shown (degrees)

BEARING CAPACITY ANALYSES (STRENGTH AND EXTREME EVENT LIMIT CASE)

PARIKH
Practicing in the Geosciences

PROJECT NO. 2016-146-MSE
PROJECT NAME Blossom Hill Road RW2
CALCULATED BY EO DATE 2/8/19
CHECKED BY BL DATE 2/8/19
VERIFIED BY DATE
BACK CHECKED BY DATE

SUBJECT MSE Wall Bearing Capacity

Assume average $S_u = 1750$ psf for the site based on the soil borings

Ultimate Bearing Capacity $= N_c \cdot S_u = 5.53 \times 1750 \cong 9.6$ ksf //
Bearing Capacity (Extreme) $= q_{ult} \times \varphi_E = 9.6 \times 0.9 = 8.6$ ksf //
Bearing Capacity (Strength) $= q_{ult} \times \varphi_S = 9.6 \times 0.65 \cong 6.2$ ksf //

Bearing Capacity Analyses (Settlement Controlled)

SETTLEMENT ANALYSIS

PROJECT NAME	***RETAINING WALL NO. 2***	*Footing Depth (ft) =*	2.5
PROJECT NO.	***2016-146-MSE***	*Fill Height (ft)=*	-
STRUCTURE	***MSE WALL H=5ft***	*Base Width, B (ft)=*	-
REFERENCE BORII	***R-18-NO-102***	*Side Slope (XH:1V)=*	-
Hammer Energy =	78%	*Effective Width, B' (ft)=*	6.84
GW Level (ft)=	28	*Length, L (ft)=*	-
		Plane Strain? (Y/N)	Y
		Contact Pressure (psf)=	5100

Cr/Cc= 25.0%

GROUPS
1. SANDS, GRAVELS AND NON-PLASTIC SILT
2. SATURATED CLAYS AND PLASTIC SILTS
3. OC CLAYS, NON-SATURATED CLAYS, AND NON-SATURATED PLASTIC SILTS

Depth from FG From	To	Soil Type	BLOW COUNT	SAMPLER TYPE	AVG $SPT\text{-}N_{60}$	γ_T (pcf)	γ' (pcf)	ω	σ_v' (psf)	$\Delta\sigma_v'$ (psf)	Su (psf)	Lab Su (psf)	Pp (psf)	OCR	E (psf)	$Cr/1+e_0$	$Cc/1+e_0$	C' (Hough Method)	Settlements (in) Elastic	OC	NC	SAND	Sum
0	2.5	1	28	SPT	36	125.0	125.0	15.1%	156														
2.5	4.5	1	28	SPT	36	125.0	125.0	15.1%	438	4449.5								144				0.174	0.174
4.5	8	1	72	MC	61	125.0	125.0	6.6%	781	3294.1								243				0.124	0.124
8	13	1	27	MC	23	125.0	125.0	13.6%	1313	2350.7								53				0.508	0.508
13	18	3	22	MC	19	125.0	125.0	11.9%	1938	1758.3	2324	5260	21040	10.9	813313				0.130				0.130
18	23	3	26	MC	22	125.0	125.0	13.9%	2563	1404.3	2746		10985	4.3	961188				0.088				0.088
23	28	3	27	MC	23	125.0	125.0	14.0%	3188	1169.0	2852	2200	8800	2.8	998156				0.070				0.070
28	33	2	10	MC	8	125.0	62.6	14.0%	3657	1001.3	1056		3800	1.0		0.0100	0.0940			0.010	0.499		0.509
33	38.5	2	8	MC	7	125.0	62.6	28.4%	3985	870.1	845		3985	1.0		0.0354	0.1416				0.802		0.802
38.5	42.5	1	8	MC	7	125.0	62.6	26.6%	4283	778.0								24				0.147	0.147
42.5	47	2	9	MC	8	125.0	62.6	19.3%	4408	710.6	951		4408	1.0		0.0270	0.1079				0.378		0.378
47	51.5	1	23	SPT	30	125.0	62.6	13.1%	4408	650.9								59				0.054	0.054
																		Estimated Settlement (in)=	*0.3*	*0.0*	*1.7*	*1.0*	*3.0*

Note:
1. Cc is estiamted using empirical equation from "Soil Mechanics" by T. William lambe and Robert V. Whitman, unless there is existing consolidation lab results for Cc and Cr, which is in red font and applied in settlement calculation if soil type falls in Group 2, saturated clays and plastic silts.
2. Cr/Cc ratio of 25% was estimated based on the previous project experience.
3. OCR is calculated based on Su correlations.
4. Clays with OCR>=2.5 is considered as settling elasticly.
5. Soil profile starts from finish grade.

SETTLEMENT ANALYSIS

PROJECT NAME ***RETAINING WALL NO. 2***
PROJECT NO. ***2016-146-MSE***
STRUCTURE ***MSE WALL H=5ft***
REFERENCE BORI ***R-18-NO-103***
Hammer Energy = 78%
GW Level (ft)= 29

Footing Depth (ft) = 2.5
Fill Height (ft)= -
Base Width, B (ft)= -
Side Slope (XH:1V)= -
Effective Width, B' (ft)= 6.84
Length, L (ft)= -
Plane Strain? (Y/N) Y
Contact Pressure (psf)= 3000

Cr/Cc= 25.0%

GROUPS
1. SANDS, GRAVELS AND NON-PLASTIC SILT
2. SATURATED CLAYS AND PLASTIC SILTS
3. OC CLAYS, NON-SATURATED CLAYS, AND NON-SATURATED PLASTIC SILTS

Depth from FG From	To	Soil Type	BLOW COUNT	SAMPLER TYPE	AVG $SPT\text{-}N_{60}$	γ_T (pcf)	γ' (pcf)	ω	σ_v' (psf)	$\Delta\sigma_v'$ (psf)	Su (psf)	Lab Su (psf)	Pp (psf)	OCR	E (psf)	$Cr/1+e_0$	$Cc/1+e_0$	C' (Hough Method)	Elastic	OC	NC	SAND	Sum
0	2.5	1	35	MC	30	125.0	125.0	9.8%	156														
2.5	8	1	35	MC	30	125.0	125.0	9.8%	656	2139.7								118				0.353	0.353
4.5	8	1	20	MC	17	125.0	125.0	9.7%	1219	1937.7								62				0.280	0.280
8	13	2	14	MC	12	125.0	125.0	8.7%	1750	1382.7	1479		1800	1.0		0.0100	0.1400			0.007	2.021		2.029
13	19	3	19	MC	16	125.0	125.0	3.0%	2438	1008.8	2007		8028	3.3	702406				0.103				0.103
19	23	1	42	MC	35	125.0	125.0	5.8%	3063	809.8								99				0.049	0.049
23	28	1	23	MC	19	125.0	125.0	9.7%	3625	687.7								65				0.070	0.070
28	33	1	21	MC	18	125.0	62.6	8.1%	4094	589.0								60				0.058	0.058
33	38	1	35	SPT	46	125.0	62.6	6.6%	4407	515.1								105				0.028	0.028
38	44	1	29	SPT	38	125.0	62.6	21.7%	4751	452.6								88				0.032	0.032
44	46.5	1	18	SPT	23	125.0	62.6	121.7%	5017	413.8								50				0.021	0.021
																		Estimated Settlement (in)=	*0.1*	*0.0*	*2.0*	*0.9*	*3.0*

(Elastic, OC, NC, SAND and Sum are under the heading Settlements (in).)

Note:
1. Cc is estiamted using empirical equation from "Soil Mechanics" by T. William lambe and Robert V. Whitman, unless there is existing consolidation lab results for Cc and Cr, which is in red font and applied in settlement calculation if soil type falls in Group 2, saturated clays and plastic silts.
2. Cr/Cc ratio of 25% was estimated based on the previous project experience.
3. OCR is calculated based on Su correlations.
4. Clays with OCR>=2.5 is considered as settling elasticly.
5. Soil profile starts from finish grade.

SETTLEMENT ANALYSIS

PROJECT NAME **_RETAINING WALL NO. 2_**
PROJECT NO. **_2016-146-MSE_**
STRUCTURE **_MSE WALL H=7.5ft_**
REFERENCE BORII **_R-18-NO-102_**
Hammer Energy = 78%
GW Level (ft)= 28

Footing Depth (ft) = 2.5
Fill Height (ft)= -
Base Width, B (ft)= -
Side Slope (XH:1V)= -
Effective Width, B' (ft)= 6.1
Length, L (ft)= -
Plane Strain? (Y/N) Y
Contact Pressure (psf)= 5500

Cr/Cc= 25.0%

GROUPS
1. SANDS, GRAVELS AND NON-PLASTIC SILT
2. SATURATED CLAYS AND PLASTIC SILTS
3. OC CLAYS, NON-SATURATED CLAYS, AND NON-SATURATED PLASTIC SILTS

Depth from FG From	To	Soil Type	BLOW COUNT	SAMPLER TYPE	AVG $SPT\text{-}N_{60}$	γ_T (pcf)	γ' (pcf)	ω	σ_v' (psf)	$\Delta\sigma_v'$ (psf)	Su (psf)	Lab Su (psf)	Pp (psf)	OCR	E (psf)	$Cr/1+e_0$	$Cc/1+e_0$	C' (Hough Method)	Settlements (in) Elastic	OC	NC	SAND	Sum
0	2.5	1	28	SPT	36	125.0	125.0	15.1%	156														
2.5	4.5	1	28	SPT	36	125.0	125.0	15.1%	438	4725.4								144				0.178	0.178
4.5	8	1	72	MC	61	125.0	125.0	6.6%	781	3406.1								243				0.126	0.126
8	13	1	27	MC	23	125.0	125.0	13.6%	1313	2379.4								53				0.512	0.512
13	18	3	22	MC	19	125.0	125.0	11.9%	1938	1756.5	2324	5260	21040	10.9	813313				0.130				0.130
18	23	3	26	MC	22	125.0	125.0	13.9%	2563	1392.1	2746		10985	4.3	961188				0.087				0.087
23	28	3	27	MC	23	125.0	125.0	14.0%	3188	1152.9	2852	2200	8800	2.8	998156				0.069				0.069
28	33	2	10	MC	8	125.0	62.6	14.0%	3657	983.9	1056		3800	1.0		0.0100	0.0940			0.010	0.489		0.499
33	38.5	2	8	MC	7	125.0	62.6	28.4%	3985	852.6	845		3985	1.0		0.0354	0.1416				0.787		0.787
38.5	42.5	1	8	MC	7	125.0	62.6	26.6%	4283	760.8								24				0.144	0.144
42.5	47	2	9	MC	8	125.0	62.6	19.3%	4408	693.9	951		4408	1.0		0.0270	0.1079				0.370		0.370
47	51.5	1	23	SPT	30	125.0	62.6	13.1%	4408	634.8								59				0.053	0.053
																		Estimated Settlement (in)=	*0.3*	*0.0*	*1.6*	*1.0*	*3.0*

Note:
1. Cc is estiamted using empirical equation from "Soil Mechanics" by T. William lambe and Robert V. Whitman, unless there is existing consolidation lab results for Cc and Cr, which is in red font and applied in settlement calculation if soil type falls in Group 2, saturated clays and plastic silts.
2. Cr/Cc ratio of 25% was estimated based on the previous project experience.
3. OCR is calculated based on Su correlations.
4. Clays with OCR>=2.5 is considered as settling elasticly.
5. Soil profile starts from finish grade.

SETTLEMENT ANALYSIS

PROJECT NAME ***RETAINING WALL NO. 2***
PROJECT NO. ***2016-146-MSE***
STRUCTURE ***MSE WALL H=7.5ft***
REFERENCE BORII ***R-18-NO-103***
Hammer Energy = 78%
GW Level (ft)= 29

Footing Depth (ft) =	2.5
Fill Height (ft)=	-
Base Width, B (ft)=	-
Side Slope (XH:1V)=	-
Effective Width, B' (ft)=	6.1
Length, L (ft)=	-
Plane Strain? (Y/N)	Y
Contact Pressure (psf)=	3100

Cr/Cc= 25.0%

GROUPS
1. SANDS, GRAVELS AND NON-PLASTIC SILT
2. SATURATED CLAYS AND PLASTIC SILTS
3. OC CLAYS, NON-SATURATED CLAYS, AND NON-SATURATED PLASTIC SILTS

Depth from FG From	To	Soil Type	BLOW COUNT	SAMPLER TYPE	AVG SPT-N_{60}	γ_T (pcf)	γ' (pcf)	ω	σ_v' (psf)	$\Delta\sigma_v'$ (psf)	Su (psf)	Lab Su (psf)	Pp (psf)	OCR	E (psf)	$Cr/1+e_0$	$Cc/1+e_0$	C' (Hough Method)	Settlements (in) Elastic	OC	NC	SAND	Sum
0	2.5	1	35	MC	30	125.0	125.0	9.8%	156														
2.5	8	1	35	MC	30	125.0	125.0	9.8%	656	2136.7								118				0.353	0.353
4.5	8	1	20	MC	17	125.0	125.0	9.7%	1219	1919.8								62				0.278	0.278
8	13	2	14	MC	12	125.0	125.0	8.7%	1750	1341.1	1479		1800	1.0		0.0100	0.1400			0.007	1.973		1.980
13	19	3	19	MC	16	125.0	125.0	3.0%	2438	964.8	2007		8028	3.3	702406				0.099				0.099
19	23	1	42	MC	35	125.0	125.0	5.8%	3063	768.7								99				0.047	0.047
23	28	1	23	MC	19	125.0	125.0	9.7%	3625	649.8								65				0.067	0.067
28	33	1	21	MC	18	125.0	62.6	8.1%	4094	554.5								60				0.055	0.055
33	38	1	35	SPT	46	125.0	62.6	6.6%	4407	483.6								105				0.026	0.026
38	44	1	29	SPT	38	125.0	62.6	21.7%	4751	424.0								88				0.030	0.030
44	46.5	1	18	SPT	23	125.0	62.6	121.7%	5017	387.1								50				0.019	0.019
																		Estimated Settlement (in)=	*0.1*	*0.0*	*2.0*	*0.9*	*3.0*

Note:
1. Cc is estiamted using empirical equation from "Soil Mechanics" by T. William lambe and Robert V. Whitman, unless there is existing consolidation lab results for Cc and Cr, which is in red font and applied in settlement calculation if soil type falls in Group 2, saturated clays and plastic silts.
2. Cr/Cc ratio of 25% was estimated based on the previous project experience.
3. OCR is calculated based on Su correlations.
4. Clays with OCR>=2.5 is considered as settling elasticly.
5. Soil profile starts from finish grade.

SETTLEMENT ANALYSIS

PROJECT NAME ***RETAINING WALL NO. 2***
PROJECT NO. ***2016-146-MSE***
STRUCTURE ***MSE WALL H=10ft***
REFERENCE BORII ***R-18-NO-102***
Hammer Energy = 78%
GW Level (ft)= 28

Footing Depth (ft) = 2.5
Fill Height (ft)= -
Base Width, B (ft)= -
Side Slope (XH:1V)= -
Effective Width, B' (ft)= 5.18
Length, L (ft)= -
Plane Strain? (Y/N) Y
Contact Pressure (psf)= 6400

Cr/Cc= 25.0%

GROUPS
1. SANDS, GRAVELS AND NON-PLASTIC SILT
2. SATURATED CLAYS AND PLASTIC SILTS
3. OC CLAYS, NON-SATURATED CLAYS, AND NON-SATURATED PLASTIC SILTS

Depth from FG		Soil	BLOW	SAMPLER	AVG	γ_T	γ'	ω	σ_v'	$\Delta\sigma_v'$	Su	Lab Su	Pp	OCR	E	$Cr/1+e_0$	$Cc/1+e_0$	C'	Settlements (in)				
From	To	Type	COUNT	TYPE	$SPT\text{-}N_{60}$	(pcf)	(pcf)		(psf)	(psf)	(psf)	(psf)	(psf)		(psf)			(Hough Method)	Elastic	OC	NC	SAND	Sum
0	2.5	1	28	SPT	36	125.0	125.0	15.1%	156														
2.5	4.5	1	28	SPT	36	125.0	125.0	15.1%	438	5364.4								144				0.187	0.187
4.5	8	1	72	MC	61	125.0	125.0	6.6%	781	3712.4								243				0.131	0.131
8	13	1	27	MC	23	125.0	125.0	13.6%	1313	2515.3								53				0.530	0.530
13	18	3	22	MC	19	125.0	125.0	11.9%	1938	1823.5	2324	5260	21040	10.9	813313				0.135				0.135
18	23	3	26	MC	22	125.0	125.0	13.9%	2563	1430.2	2746		10985	4.3	961188				0.089				0.089
23	28	3	27	MC	23	125.0	125.0	14.0%	3188	1176.4	2852	2200	8800	2.8	998156				0.071				0.071
28	33	2	10	MC	8	125.0	62.6	14.0%	3657	999.2	1056		3800	1.0		0.0100	0.0940			0.010	0.497		0.507
33	38.5	2	8	MC	7	125.0	62.6	28.4%	3985	862.7	845		3985	1.0		0.0354	0.1416				0.795		0.795
38.5	42.5	1	8	MC	7	125.0	62.6	26.6%	4283	767.8								24				0.145	0.145
42.5	47	2	9	MC	8	125.0	62.6	19.3%	4408	699.0	951		4408	1.0		0.0270	0.1079				0.372		0.372
47	51.5	1	23	SPT	30	125.0	62.6	13.1%	4408	638.4								59				0.053	0.053
																		Estimated Settlement (in)=	*0.3*	*0.0*	*1.7*	*1.0*	*3.0*

Note:
1. Cc is estiamted using empirical equation from "Soil Mechanics" by T. William lambe and Robert V. Whitman, unless there is existing consolidation lab results for Cc and Cr, which is in red font and applied in settlement calculation if soil type falls in Group 2, saturated clays and plastic silts.
2. Cr/Cc ratio of 25% was estimated based on the previous project experience.
3. OCR is calculated based on Su correlations.
4. Clays with OCR>=2.5 is considered as settling elasticly.
5. Soil profile starts from finish grade.

SETTLEMENT ANALYSIS

PROJECT NAME	***RETAINING WALL NO. 2***	*Footing Depth (ft) =*	2.5
PROJECT NO.	***2016-146-MSE***	*Fill Height (ft)=*	-
STRUCTURE	***MSE WALL H=10ft***	*Base Width, B (ft)=*	-
REFERENCE BORII	***R-18-NO-103***	*Side Slope (XH:1V)=*	-
Hammer Energy =	78%	*Effective Width, B' (ft)=*	5.18
GW Level (ft)=	29	*Length, L (ft)=*	-
		Plane Strain? (Y/N)	Y
		Contact Pressure (psf)=	3500

Cr/Cc= 25.0%

GROUPS

1. SANDS, GRAVELS AND NON-PLASTIC SILT
2. SATURATED CLAYS AND PLASTIC SILTS
3. OC CLAYS, NON-SATURATED CLAYS, AND NON-SATURATED PLASTIC SILTS

Depth from FG From	To	Soil Type	BLOW COUNT	SAMPLER TYPE	AVG $SPT\text{-}N_{60}$	γ_T (pcf)	γ' (pcf)	ω	σ_v' (psf)	$\Delta\sigma_v'$ (psf)	Su (psf)	Lab Su (psf)	Pp (psf)	OCR	E (psf)	$Cr/1+e_0$	$Cc/1+e_0$	C' (Hough Method)	Elastic	OC	NC	SAND	Sum
																			Settlements (in)				
0	2.5	1	35	MC	30	125.0	125.0	9.8%	156														
2.5	8	1	35	MC	30	125.0	125.0	9.8%	656	2286.3								118				0.365	0.365
4.5	8	1	20	MC	17	125.0	125.0	9.7%	1219	2030.2								62				0.288	0.288
8	13	2	14	MC	12	125.0	125.0	8.7%	1750	1375.6	1479		1800	1.0		0.0100	0.1400			0.007	2.013		2.020
13	19	3	19	MC	16	125.0	125.0	3.0%	2438	970.6	2007		8028	3.3	702406				0.099				0.099
19	23	1	42	MC	35	125.0	125.0	5.8%	3063	765.6								99				0.047	0.047
23	28	1	23	MC	19	125.0	125.0	9.7%	3625	643.4								65				0.066	0.066
28	33	1	21	MC	18	125.0	62.6	8.1%	4094	546.4								60				0.054	0.054
33	38	1	35	SPT	46	125.0	62.6	6.6%	4407	474.9								105				0.026	0.026
38	44	1	29	SPT	38	125.0	62.6	21.7%	4751	415.1								88				0.030	0.030
44	46.5	1	18	SPT	23	125.0	62.6	121.7%	5017	378.3								50				0.019	0.019
																	Estimated Settlement (in)=		*0.1*	*0.0*	*2.0*	*0.9*	*3.0*

Note:
1. Cc is estiamted using empirical equation from "Soil Mechanics" by T. William lambe and Robert V. Whitman, unless there is existing consolidation lab results for Cc and Cr, which is in red font and applied in settlement calculation if soil type falls in Group 2, saturated clays and plastic silts.
2. Cr/Cc ratio of 25% was estimated based on the previous project experience.
3. OCR is calculated based on Su correlations.
4. Clays with OCR>=2.5 is considered as settling elasticly.
5. Soil profile starts from finish grade.

SETTLEMENT ANALYSIS

PROJECT NAME ***RETAINING WALL NO. 2***
PROJECT NO. ***2016-146-MSE***
STRUCTURE ***MSE WALL H=12.5ft***
REFERENCE BORII ***R-18-NO-102***
Hammer Energy = 78%
GW Level (ft)= 28

Footing Depth (ft) = 2.5
Fill Height (ft)= -
Base Width, B (ft)= -
Side Slope (XH:1V)= -
Effective Width, B' (ft)= 6.87
Length, L (ft)= -
Plane Strain? (Y/N) Y
Contact Pressure (psf)= 5200

Cr/Cc= 25.0%

GROUPS
1. SANDS, GRAVELS AND NON-PLASTIC SILT
2. SATURATED CLAYS AND PLASTIC SILTS
3. OC CLAYS, NON-SATURATED CLAYS, AND NON-SATURATED PLASTIC SILTS

Depth from FG From	To	Soil Type	BLOW COUNT	SAMPLER TYPE	AVG $SPT\text{-}N_{60}$	γ_T (pcf)	γ' (pcf)	ω	σ_v' (psf)	$\Delta\sigma_v'$ (psf)	Su (psf)	Lab Su (psf)	Pp (psf)	OCR	E (psf)	$Cr/1+e_0$	$Cc/1+e_0$	C' (Hough Method)	Settlements (in) Elastic	OC	NC	SAND	Sum
0	2.5	1	28	SPT	36	125.0	125.0	15.1%	156														
2.5	4.5	1	28	SPT	36	125.0	125.0	15.1%	438	4539.3								144				0.176	0.176
4.5	8	1	72	MC	61	125.0	125.0	6.6%	781	3363.8								243				0.125	0.125
8	13	1	27	MC	23	125.0	125.0	13.6%	1313	2402.4								53				0.515	0.515
13	18	3	22	MC	19	125.0	125.0	11.9%	1938	1797.9	2324	5260	21040	10.9	813313				0.133				0.133
18	23	3	26	MC	22	125.0	125.0	13.9%	2563	1436.4	2746		10985	4.3	961188				0.090				0.090
23	28	3	27	MC	23	125.0	125.0	14.0%	3188	1196.0	2852	2200	8800	2.8	998156				0.072				0.072
28	33	2	10	MC	8	125.0	62.6	14.0%	3657	1024.5	1056		3800	1.0		0.0100	0.0940			0.010	0.511		0.521
33	38.5	2	8	MC	7	125.0	62.6	28.4%	3985	890.4	845		3985	1.0		0.0354	0.1416				0.819		0.819
38.5	42.5	1	8	MC	7	125.0	62.6	26.6%	4283	796.2								24				0.150	0.150
42.5	47	2	9	MC	8	125.0	62.6	19.3%	4408	727.3	951		4408	1.0		0.0270	0.1079				0.386		0.386
47	51.5	1	23	SPT	30	125.0	62.6	13.1%	4408	666.2								59				0.056	0.056
																		Estimated Settlement (in)=	*0.3*	*0.0*	*1.7*	*1.0*	*3.0*

Note:
1. Cc is estiamted using empirical equation from "Soil Mechanics" by T. William lambe and Robert V. Whitman, unless there is existing consolidation lab results for Cc and Cr, which is in red font and applied in settlement calculation if soil type falls in Group 2, saturated clays and plastic silts.
2. Cr/Cc ratio of 25% was estimated based on the previous project experience.
3. OCR is calculated based on Su correlations.
4. Clays with OCR>=2.5 is considered as settling elasticly.
5. Soil profile starts from finish grade.

SETTLEMENT ANALYSIS

PROJECT NAME ***RETAINING WALL NO. 2***
PROJECT NO. ***2016-146-MSE***
STRUCTURE ***MSE WALL H=12.5ft***
REFERENCE BORII ***R-18-NO-103***
Hammer Energy = 78%
GW Level (ft)= 29

Footing Depth (ft) = 2.5
Fill Height (ft)= -
Base Width, B (ft)= -
Side Slope (XH:1V)= -
Effective Width, B' (ft)= 6.87
Length, L (ft)= -
Plane Strain? (Y/N) Y
Contact Pressure (psf)= 2900

Cr/Cc= 25.0%

GROUPS
1. SANDS, GRAVELS AND NON-PLASTIC SILT
2. SATURATED CLAYS AND PLASTIC SILTS
3. OC CLAYS, NON-SATURATED CLAYS, AND NON-SATURATED PLASTIC SILTS

Depth from FG From	To	Soil Type	BLOW COUNT	SAMPLER TYPE	AVG $SPT\text{-}N_{60}$	γ_T (pcf)	γ' (pcf)	ω	σ_v' (psf)	$\Delta\sigma_v'$ (psf)	Su (psf)	Lab Su (psf)	Pp (psf)	OCR	E (psf)	$Cr/1+e_0$	$Cc/1+e_0$	C' (Hough Method)	Settlements (in) Elastic	OC	NC	SAND	Sum
0	2.5	1	35	MC	30	125.0	125.0	9.8%	156														
2.5	8	1	35	MC	30	125.0	125.0	9.8%	656	2071.0								118				0.347	0.347
4.5	8	1	20	MC	17	125.0	125.0	9.7%	1219	1876.0								62				0.274	0.274
8	13	2	14	MC	12	125.0	125.0	8.7%	1750	1339.8	1479		1800	1.0		0.0100	0.1400			0.007	1.971		1.978
13	19	3	19	MC	16	125.0	125.0	3.0%	2438	978.1	2007		8028	3.3	702406				0.100				0.100
19	23	1	42	MC	35	125.0	125.0	5.8%	3063	785.3								99				0.048	0.048
23	28	1	23	MC	19	125.0	125.0	9.7%	3625	667.0								65				0.068	0.068
28	33	1	21	MC	18	125.0	62.6	8.1%	4094	571.4								60				0.057	0.057
33	38	1	35	SPT	46	125.0	62.6	6.6%	4407	499.7								105				0.027	0.027
38	44	1	29	SPT	38	125.0	62.6	21.7%	4751	439.1								88				0.031	0.031
44	46.5	1	18	SPT	23	125.0	62.6	121.7%	5017	401.5								50				0.020	0.020
																		Estimated Settlement (in)=	*0.1*	*0.0*	*2.0*	*0.9*	*3.0*

Note:
1. Cc is estiamted using empirical equation from "Soil Mechanics" by T. William lambe and Robert V. Whitman, unless there is existing consolidation lab results for Cc and Cr, which is in red font and applied in settlement calculation if soil type falls in Group 2, saturated clays and plastic silts.
2. Cr/Cc ratio of 25% was estimated based on the previous project experience.
3. OCR is calculated based on Su correlations.
4. Clays with OCR>=2.5 is considered as settling elasticly.
5. Soil profile starts from finish grade.

SETTLEMENT ANALYSES

SETTLEMENT ANALYSIS

PROJECT NAME	***RETAINING WALL NO. 2***
PROJECT NO.	***2016-146-MSE***
STRUCTURE	***MSE WALL***
REFERENCE BORII	***R-18-NO-103***
Hammer Energy =	78%
GW Level (ft)=	29

Footing Depth (ft) =	2.5
Fill Height (ft)=	14.25
Base Width, B (ft)=	12
Side Slope (XH:1V)=	-
Effective Width, B' (ft)=	12
Length, L (ft)=	-
Plane Strain? (Y/N)	Y
Contact Pressure (psf)=	1853

Cr/Cc= 25.0%

GROUPS
1. SANDS, GRAVELS AND NON-PLASTIC SILT
2. SATURATED CLAYS AND PLASTIC SILTS
3. OC CLAYS, NON-SATURATED CLAYS, AND NON-SATURATED PLASTIC SILTS

Depth from FG From	To	Soil Type	BLOW COUNT	SAMPLER TYPE	AVG $SPT\text{-}N_{60}$	γ_T (pcf)	γ' (pcf)	ω	σ_v' (psf)	$\Delta\sigma_v'$ (psf)	Su (psf)	Lab Su (psf)	Pp (psf)	OCR	E (psf)	$Cr/1+e_0$	$Cc/1+e_0$	C' (Hough Method)	Settlements (in) Elastic	OC	NC	SAND	Sum
0	2.5	1	35	MC	30	125.0	125.0	9.8%	156														
2.5	8	1	35	MC	30	125.0	125.0	9.8%	656	1507.1								118				0.290	0.290
4.5	8	1	20	MC	17	125.0	125.0	9.7%	1219	1411.4								62				0.226	0.226
8	13	2	14	MC	12	125.0	125.0	8.7%	1750	1111.5	1479		1800	1.0		0.0100	0.1400			0.007	1.691		1.698
13	19	3	19	MC	16	125.0	125.0	3.0%	2438	871.8	2007		8028	3.3	702406				0.089				0.089
19	23	1	42	MC	35	125.0	125.0	5.8%	3063	728.9								99				0.045	0.045
23	28	1	23	MC	19	125.0	125.0	9.7%	3625	635.1								65				0.065	0.065
28	33	1	21	MC	18	125.0	62.6	8.1%	4094	555.8								60				0.055	0.055
33	38	1	35	SPT	46	125.0	62.6	6.6%	4407	494.0								105				0.026	0.026
38	44	1	29	SPT	38	125.0	62.6	21.7%	4751	440.2								88				0.031	0.031
44	46.5	1	18	SPT	23	125.0	62.6	121.7%	5017	406.0								50				0.020	0.020
																		Estimated Settlement (in)=	*0.1*	*0.0*	*1.7*	*0.8*	2.5

Note:
1. Cc is estiamted using empirical equation from "Soil Mechanics" by T. William lambe and Robert V. Whitman, unless there is existing consolidation lab results for Cc and Cr, which is in red font and applied in settlement calculation if soil type falls in Group 2, saturated clays and plastic silts.
2. Cr/Cc ratio of 25% was estimated based on the previous project experience.
3. OCR is calculated based on Su correlations.
4. Clays with OCR>=2.5 is considered as settling elasticly.
5. Soil profile starts from finish grade.

PARIKH
Practicing in the Geosciences

PROJECT NO. 2016-146-MSE
PROJECT NAME Blossom Hill
CALCULATED BY EO DATE 1/31/19
CHECKED BY [illegible] DATE 2/1/19
VERIFIED BY DATE
BACK CHECKED BY DATE

SUBJECT MSE Wall Settlement (NC)

Per Boring R-18-NO-103

Based on consol $c_v = 0.008\ in^2/min = 0.08\ ft^2/day$

Assume 86% consolidation : 1.8 in reduced to 0.25 in or less

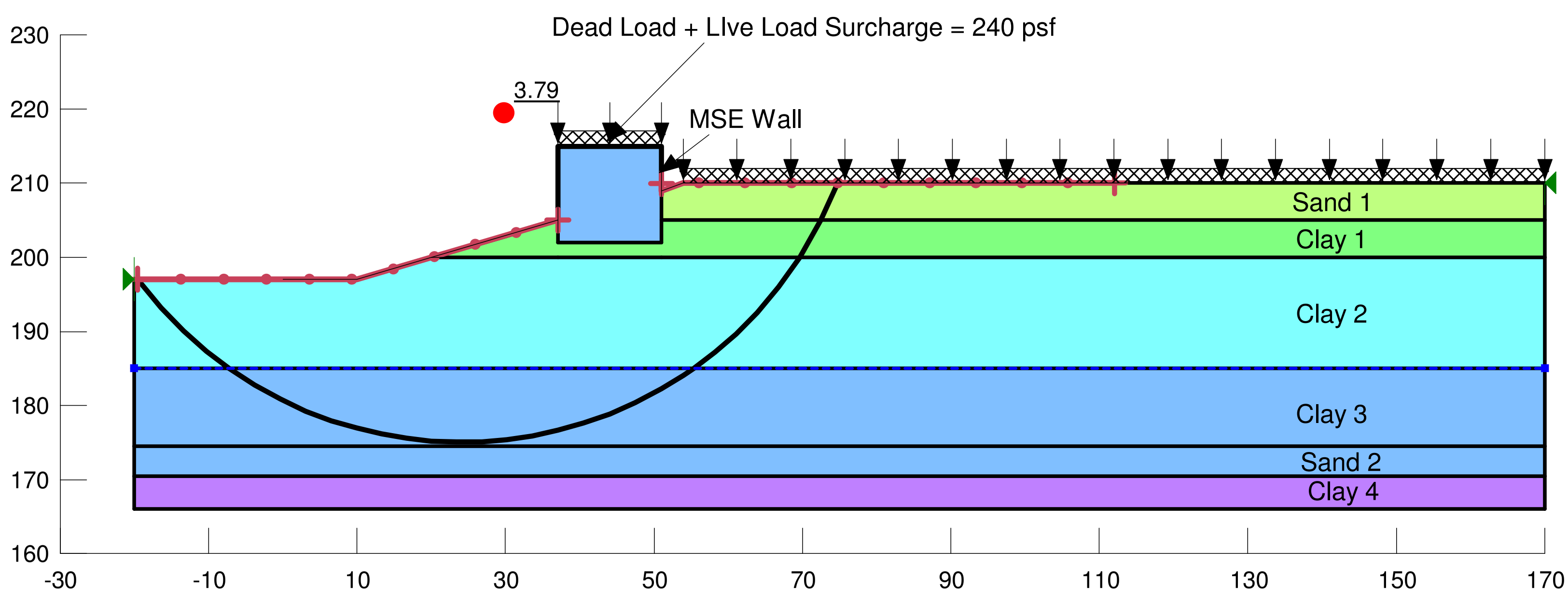
$T_v \cong 0.65$ from Fig 9.5(a) Intro to Geotech Eng. Holz, Kovacs

$t = T_v \cdot (H_{dr})^2 / c_v = 0.65 \times (5/2)^2 / 0.08$

$t \cong 51$ days

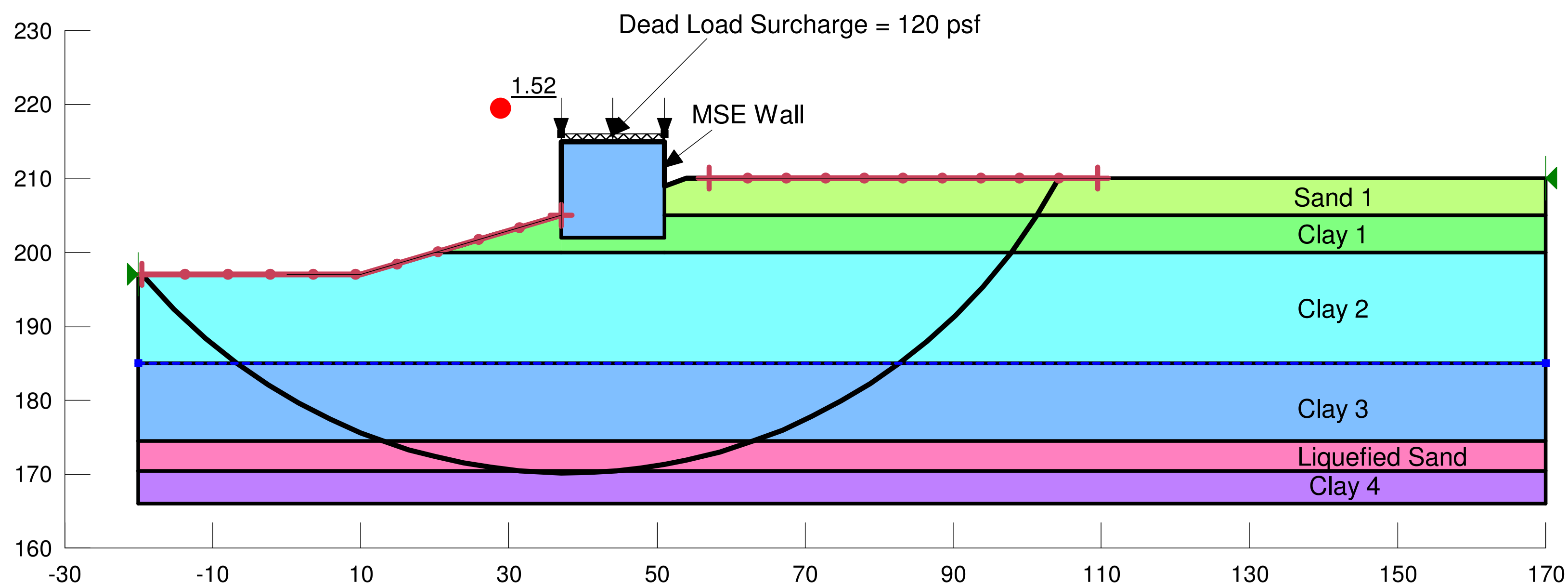
GLOBAL STABILITY ANALYSES

Blossom Hill Road Interchange Improvement Project
NB Diagonal On-Ramp POC East Approach - Global Stability
Station "A1" 64+52 to "A1" 67+10
(ref. Boring R-18-NO-102)
Static Analysis



Name: Sand 1 Unit Weight: 125 pcf Cohesion': 0 psf Phi': 36 °
Name: Clay 1 Unit Weight: 125 pcf Cohesion': 1,500 psf Phi': 0 °
Name: Clay 2 Unit Weight: 125 pcf Cohesion': 2,000 psf Phi': 0 °
Name: MSE Wall Unit Weight: 125 pcf
Name: Clay 3 Unit Weight: 125 pcf Cohesion': 1,000 psf Phi': 0 °
Name: Sand 2 Unit Weight: 125 pcf Cohesion': 0 psf Phi': 30 °
Name: Clay 4 Unit Weight: 125 pcf Cohesion': 900 psf Phi': 0 °

Blossom Hill Road Interchange Improvement Project
NB Diagonal On-Ramp POC East Approach - Global Stability
Station "A1" 64+52 to "A1" 67+10
(ref. Boring R-18-NO-102)
Pseudo-Static Analysis (Kh=0.21)



Name: Sand 1 Unit Weight: 125 pcf Cohesion': 0 psf Phi': 36 °
Name: Clay 1 Unit Weight: 125 pcf Cohesion': 1,500 psf Phi': 0 °
Name: Clay 2 Unit Weight: 125 pcf Cohesion': 2,000 psf Phi': 0 °
Name: MSE Wall Unit Weight: 125 pcf
Name: Clay 3 Unit Weight: 125 pcf Cohesion': 1,000 psf Phi': 0 °
Name: Clay 4 Unit Weight: 125 pcf Cohesion': 900 psf Phi': 0 °
Name: Liquefied Sand Unit Weight: 125 pcf Cohesion': 200 psf Phi': 0 °

APPENDIX V

RESPONSE TO CALTRANS' REVIEW COMMENTS

Office of Special Funded Projects
Comment & Response Form

(Revised 08/2011)

General Project Information (OSFP Liaison to complete)		**Review Phase** (OSFP Liaison to complete)	**Reviewer Information** (Reviewer Liaison to complete)	
Dist:	**04**	☐ PSR/PDS (Review No.)	Reviewer Name:	**R. Nashed/ J. Anderson**
Proj ID (Phase):	**0416000224**	☐ APS/PSR (Review No.)	Functional Unit:	**Geotechnical Design- West**
EA:	**1K2801**	☐ APS/PR (Review No.)	Cost Center:	**59-3660**
Project Name:	**Blossom Hill Rd Interchange Improvement**	☐ Type Selection	Phone Number:	**510-622-1773**
OSFP Liaison:	**Shu-Shang Liu**	☐ 65% PS&E Unchecked Details	e-mail:	**Rifaat.nashed@ dot.ca.gov**
Phone:	**916-227-8919**	☐ PS&E (Review No. 1)	Date of Review:	**12/ 27/2018**
E-mail:	**Shu-shang.liu@dot.ca.gov**	☐ Construction	Structure Name*:	**Retaining Wall No.2 (MSE wall)**
		☑ Other: FR	Br No*:	
			(*Use if necessary to when comment sheets are by individual structure)	

Consultant Information (to be filled in by Consultant)

Consultant Lead (First and Last Name)	Consultant Firm	Phone Number	E-mail	Response Date

#	Doc. (See Note 1)	Page, Section, or SSP	Review Comments	Consultant Responses	Caltrans Responses
	FR	N/A	Review of Geology and subsurface and Related sections items Foundation Report (DRAFT) by Parikh consultants prepared for HMH Engineers dated December 4, 2018		
1	FR	Section 11.0 Seismic Sources Page 9	Table 6- ARS DATA Please add the “Spectral Acceleration” (SA) column including the	The “Spectral Acceleration” (SA) column including the deterministic data for each listed fault will be added to Table 6 – ARS DATA.	

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓= Comment Resolved
(for Reviewer’s use)

			deterministic data for each listed fault. -RN		
2	FR	Section 9.0	Geology section references Plate No. 2, which does not exist. Please correct reference. - JA	Comment incorporated. Plate No. 2 has been changed to Plate No. I-3.	
3	FR	Table 4	Density and Consistency descriptors don't match the LOTBs. Please correct. - JA	The consistency/density for the soil descriptions has been checked and updated in Table 4 to be consistent with the boring logs in the LOTB.	
4	FR	Section 11.2 - Output	Bullet point 1 in the output is unclear. Please revise - JA	Bullet Point 1 under "Output" has been revised to "The recommended ARS curve is based on the maximum of the comparison of the deterministic data and Caltrans Probabilistic data. The recommended ARS curve at this site is based on the Probabilistic curve".	
4	FR	Section 11.3.2	Section references Section 12.2, which does not exist. Please correct reference. - JA	Comment noted. The referenced section should be Section 11.2 instead. This has been corrected in the foundation report.	
5	FR	Section 11.3.4	PGA is listed as 0.628g, but Liquefaction analyses use 0.648g. Please correct. -JA	The PGA in section has been changed to 0.648.	
6	FR	Section 15.4	Section says the project site is near a water body. Is this correct? If so, why isn't the wall alignment susceptible to erosion? -JA	Section 15.4 has been clarified that "the proposed retaining wall is located more than 300 feet away from the nearby Coyote Creek. Therefore, the foundation soils along the wall alignment are not likely to be susceptible to erosion."	

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
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✓= Comment Resolved
(for Reviewer's use)

7	FR	Section 15.6.1 Table 11,	Table appears to be correct. However, the calculations in the appendix show Strength Factored and Extreme event reversed. Please correct -JA	Comment incorporated. The factor for the “Strength” and “Extreme Event” have been corrected.	
8	FR	LOTB	All UC values currently show as tsf. However, the values are actually in ksf. Please correct. -JA	The UC values are in the unit of ksf based on the laboratory test result. The UC values are in the unit of tsf in the Log of Test Borings.	
9	FR	LOTB – R-18-NO-103	Sandy Silt at elevation 205 ft is labeled as “hard” and “stiff to hard”. Which is correct? -JA	Comment incorporated. The sandy silt is labeled as “very stiff to hard”.	
10	FR	Appendix III	Introductory page is labeled Appendix B and refers to Appendix A and B, which don’t exist. Please relabel. -JA	The appendices referred in the introductory page of Appendix III has been corrected.	
11	FR	Appendix IV Liquefaction Analyses	All layers should have a fines content inputted for liquefaction calculations. Please estimate based on visual inspection of the soil samples. -JA	Estimated fine content has been added to the sand layer(s) (without any sieve analyses) based on the visual inspection of the soil samples.	
12	FR	Appendix IV Bearing Capacity Analyses (settlement controlled)	Total unit weight at the bottom of the soil profile increased by 1 for all analyses. Is this an error? -JA	Total unit weight at the bottom of the soil profile has been changed to 125 pcf.	

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
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✓= Comment Resolved
(for Reviewer’s use)

13	FR	Settlement Analyses	Total unit weight at the bottom of the soil profile increased by 1 for analysis. Is this an error? -JA	Total unit weight at the bottom of the soil profile has been changed to 125 pcf.	
14	FR	All Sections	Please review report for grammar and consistent formatting/structure across all reports. -JA	Comment incorporated.	

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
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✓= Comment Resolved
(for Reviewer's use)