FOUNDATION REPORT

Avila Beach Drive at US 101 Interchange Improvements

County of San Luis Obispo, California

Retaining Walls N1 and W1
05-SLO-101-PM 20.9 – 21.3
05-1G4801 – 0515000038

Yeh Project No.: 216-423

May 22, 2023

Prepared for:
Wallace Group, Inc.
612 Clarion Ct.
San Luis Obispo, California 93401
Attn: Mr. Jorge Aguilar, P.E.

Prepared by:
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Yeh and Associates, Inc.
Geotechnical • Geological • Construction Services

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612 Clarion Court
San Luis Obispo, California 93401

Attn: Mr. Jorge Aguilar, P.E.

Subject: Foundation Report, Avila Beach Drive at US 101 Interchange Improvements, Retaining Walls N1 and W1, 05-SLO-101- PM 20.9 – 21.3, 05-1G4800 - 0515000038, San Luis Obispo County, California

Dear Mr. Aguilar:

Yeh and Associates, Inc. is pleased to submit this Foundation Report for the design of improvements at the Avila Beach Drive and US 101 Interchange in San Luis Obispo County, California. This report was prepared in accordance with the terms of agreement between Yeh and Associates and Wallace Group dated August 3, 2017. This report was prepared in general accordance with Caltrans guidelines for Foundation Reports for Earth Retaining Systems (Caltrans 2021a) and provides a discussion of the site conditions, geologic conditions, seismicity and faulting, corrosion, geotechnical recommendations for the design of one soil nail retaining wall, a sub-horizontal ground anchor (SHGA) retaining wall, as well as notes for the specifications.

Primary geotechnical considerations associated with the project include:

- Three borings were drilled at the wall sites to depths of up to approximately 40.6 feet below the road surface on September 16 through 18, 2019. The borings encountered very loose to very dense or stiff to hard existing fill. Groundwater was not encountered during Yeh's 2019 field exploration program and is not anticipated to be encountered within the depths of excavation.
- The site is within a seismically active region of California. The design of the improvements to new and existing structures will need to consider seismic data in accordance with Caltrans design guidelines and methods. The design earthquake is a mean magnitude 6.69 event with a mean site to source distance of 19.9 miles (32.1 kilometers) resulting in a design peak ground acceleration of approximately 0.39g, corresponding to a 5-percent in 50 years probability of exceedance (975-year return period).
- Existing fill has varied consistency where the soil nail wall and SHGA wall will be constructed. Temporary excavations for the construction of the walls may need to be staggered and casing is likely to be needed for drilling and installation of soil nails and anchors.
- The foundation report has been reviewed by Caltrans on two occasions during the design process. Comments and responses are provided in Appendix D of this report. It is our

understanding that comments have been addressed and that no additional revisions will be required by Caltrans.

We appreciate the opportunity to be of service. Please contact Judd King at 805-481-9590 x285 or jking@yeh-eng.com if you have questions or require additional information.

Sincerely,
YEH AND ASSOCIATES, INC.

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1. INTRODUCTION

Wallace Group retained Yeh and Associates to provide geotechnical services for the design of improvements to the Avila Beach Drive at US 101 Interchange for Retaining Walls N1 and W1 (05-SLO-101-PM 20.9 -21.3, 05-1G4800 - 0515000038) at US 101 in San Luis Obispo County, California. The County of San Luis Obispo has identified the US 101 at Avila Beach Drive interchange southbound ramp intersection and Shell Beach Road as a capital improvement project to improve traffic flow. The project proposes to improve the intersections of Avila Beach Drive, Shell Beach Road, and US 101 southbound ramps, as well as provide access to a proposed park and ride lot west of the interchange. The location of the interchange site is shown on Figure 1. The geotechnical evaluation for this report has consisted of a program of project coordination, review of existing geotechnical data, field reconnaissance and exploration, laboratory testing, and analyses. Geotechnical recommendations are provided for the design of a tiered soil nail retaining wall, a sub-horizontal ground anchor (SHGA) retaining wall, as well as notes for the specifications. Geotechnical recommendations for earthwork, pavement design, and other project improvements were provided in a *Geotechnical Design Report* (Yeh 2022) provided under separate cover.

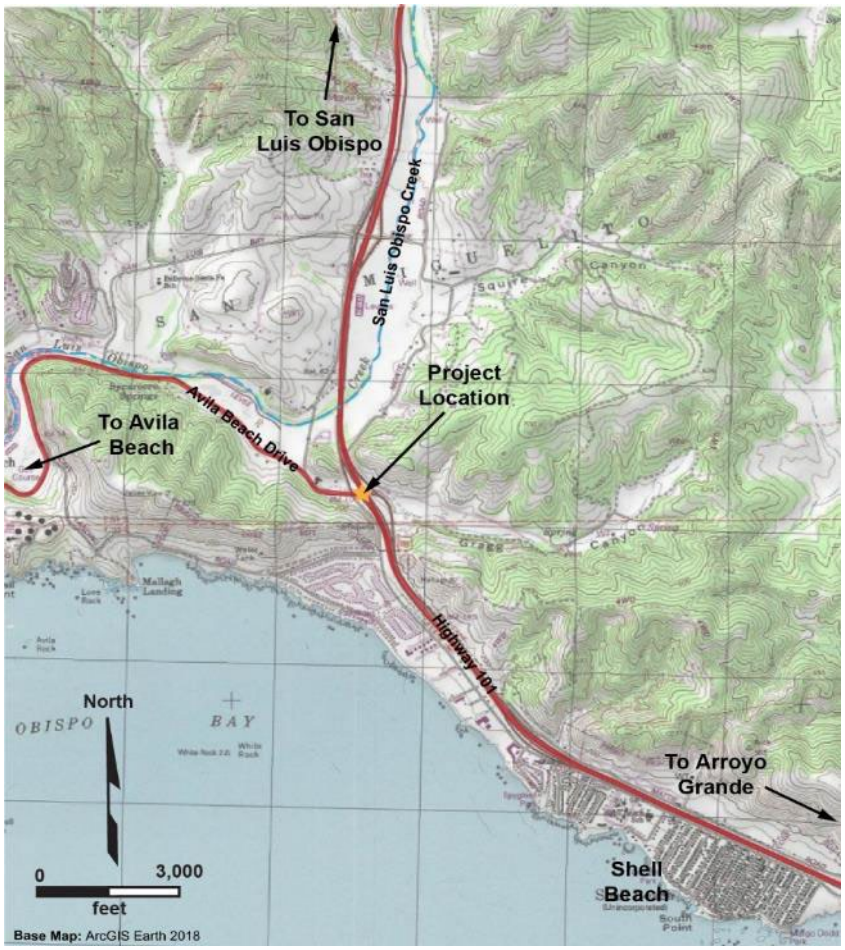

Figure 1: Project Location Map

2. PROJECT DESCRIPTION

2.1 EXISTING FACILITY

The Avila Beach Drive interchange consists of left and right undercrossing bridges on US 101 with a southbound ramp configuration and a controlled stop northbound ramp configuration that connects to the highway via Monte Road about 1,200 feet north of the undercrossing. The undercrossings (Avila Road UC, Bridge No. 49-0191L/R) are 3-span structures that were built in 1964 and are at an average elevation of about 114 feet. Caltrans added an additional southbound lane adjacent to the number 1 lane in 2009. The embankment end slopes are unpaved with a slope ratio of approximately 1.5:1 (horizontal to vertical) and the embankment side slopes between the highway mainlines and ramps have a slope ratio of about 2:1 or flatter. Avila Beach Drive runs west from the northbound off-ramp and is two lanes wide beneath the undercrossing at approximately elevation 97 feet. Elevations in this report reference North American Vertical Datum of 1988 (NAVD-88) unless otherwise noted. The road provides access to Avila Beach, Port San Luis, Diablo Canyon Power Plant, as well as multiple commercial, residential, and recreational areas along the road to Avila Beach. Shell Beach Road is a frontage route on the west side of US 101 that terminates at the intersection of Avila Beach Drive and the southbound off-ramp. Shell Beach Road connects the residential and commercial areas of Shell Beach and Pismo Beach to Avila Beach and other locations along Avila Beach Drive.

2.2 PROPOSED IMPROVEMENTS

The proposed project (see Figure 2) will improve the northbound and southbound ramp intersections of the US 101/Avila Beach Drive interchange to address traffic operational deficiencies and improve multimodal access (WG 2021a, 2021c). This involves realignment of the north and southbound off-ramps to incorporate a roundabout at the intersection of Shell Beach Road, Avila Beach Drive and the US 101 southbound on and off-ramps. The roadway improvements will include the design of new asphalt concrete pavement, sidewalks, a pathway under the freeway overcrossing on the north side of Avila Beach Drive, surface drainage, stormwater infiltration, and a Park and Ride – RTA bus stop facility at the southwest corner of the intersection of Avila Beach Drive and Shell Beach Road. Anticipated final grading will include cuts up to 5 feet and fills up to 10 feet to construct the proposed improvements. Two retaining walls (Retaining Wall “N1” and Retaining Wall (“W1”) will be constructed to support the roadway improvements. Temporary cuts will be made to construct the walls. Retaining Wall N1 will be located on the north side of Avila Beach Drive beneath the Avila Beach Drive UC and wraps westward around the embankment between the proposed realigned southbound off-

ramp and southbound US 101. Retaining Wall W1 will be located between the southbound US 101 onramp and southbound US 101. Information for the retaining walls provided on the project plans (Mark Thomas - MT 2022, 2023) is presented in Table 1. See project plans for specific locations and layout lines.

Table 1: Earth Retaining Structure (ERS) Information Table

ERS ID No.	ERS Type	Begin	End	Length (feet)	Maximum Design Height (feet)	Notes
Wall N1	Sub-Horizontal Ground Anchor (SHGA) Wall	"N1" Line Sta. 119+93.48	"N1" Line Sta. 122+73.46	279.98	15.5	--
Wall W1-A	Soil Nail Wall	Sta. 610+88.78 10.00' Rt. Station 150+32.51 "R-22A-1" Line	Sta. 613+24.78 36.36' Rt. Sta. 152+52.26 "R-22A-1" Line	236.00	17.75	Lower Tier
Wall W1-B	Soil Nail Wall	10.00' Rt. Sta. 612+18.21 "W1-A" Line	10.00' Rt. Sta. 613+19.46 "W1-A" Line	92.94	10.0	Upper Tier

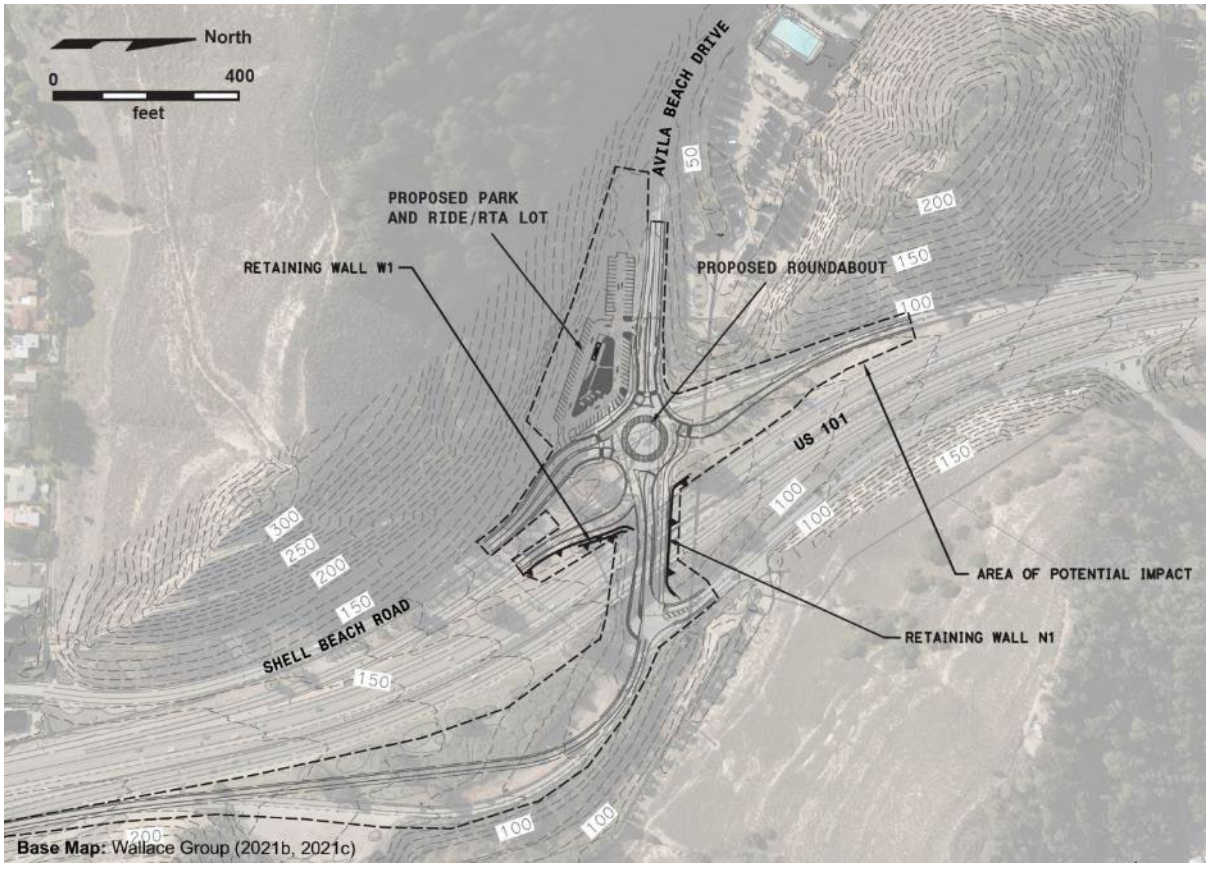

Figure 2: Proposed Layout (Wallace Group 2021b, 2021c)

3. AS-BUILT DATA

The following reports, maps, plans, and documents were reviewed for this project in addition to our site reconnaissance.

- Project Study Report – Project Development Support (PSR-PDS) and Plans, California Department of Transportation, May 2016.
- Avila Road UC (Widen) Second Supplemental Structure Foundation Report, Bridge No. 49-191L, California Department of Transportation, October 11, 2005
- Avila Road UC (Widen) Final Foundation Report, Bridge No. 49-0191L, California Department of Transportation, January 26, 2004.
- Avila Road UC (Widen) Supplemental Final Foundation Report, Bridge No. 49-0191L, California Department of Transportation, July 14, 2004
- Avila Road UC Left Bridge (Widen) Log of Test Borings, California Department of Transportation, January 26, 2004.
- Avila Road UC (Widen) Preliminary Seismic Design Recommendations, Bridge No. 49-191L, California Department of Transportation, March 23, 2001.
- Convert to Freeway Plans for State Highway 101 between North Pismo Separation and 1.0 Mile South of Santa Fe Bridge, California Department of Transportation, April 1, 1963.
- As-built Plans and Log of Test Borings: Plans for Construction on State Highway in San Luis Obispo County between North Pismo Separation in Pismo Beach and 1.0 Mile South of Santa Fe Bridge, California Department of Transportation, April 1, 1963.
- Foundation Study, Avila Road UC (BR 49-0191 L & R), California Department of Transportation, October 10, 1961

4. GEOTECHNICAL EXPLORATION

4.1 SITE RECONNAISSANCE

Site reconnaissance was performed by Yeh and Associates on October 19, 2016, and on March 29, 2018 to observe slope conditions, pavement conditions, and the proposed project layout as it relates to the existing topography, infrastructure, and proposed alternatives.

4.2 EXPLORATORY DRILLING

Yeh subcontracted S/G Drilling Company of Lompoc, California to perform the drilling for the project. S/G used a CME-85 truck-mounted drill rig equipped with 8-inch diameter hollow-stem augers to advance three borings (19W-01 through 19W-03) for the wall as well as nine additional borings for the project (see the *Geotechnical Design Report – Yeh 2022*) between September 16 and 18, 2019. The logs of the borings and field data collected for the wall borings are presented in Appendix A. The boring locations are shown in Figure 3. Refer to the attached

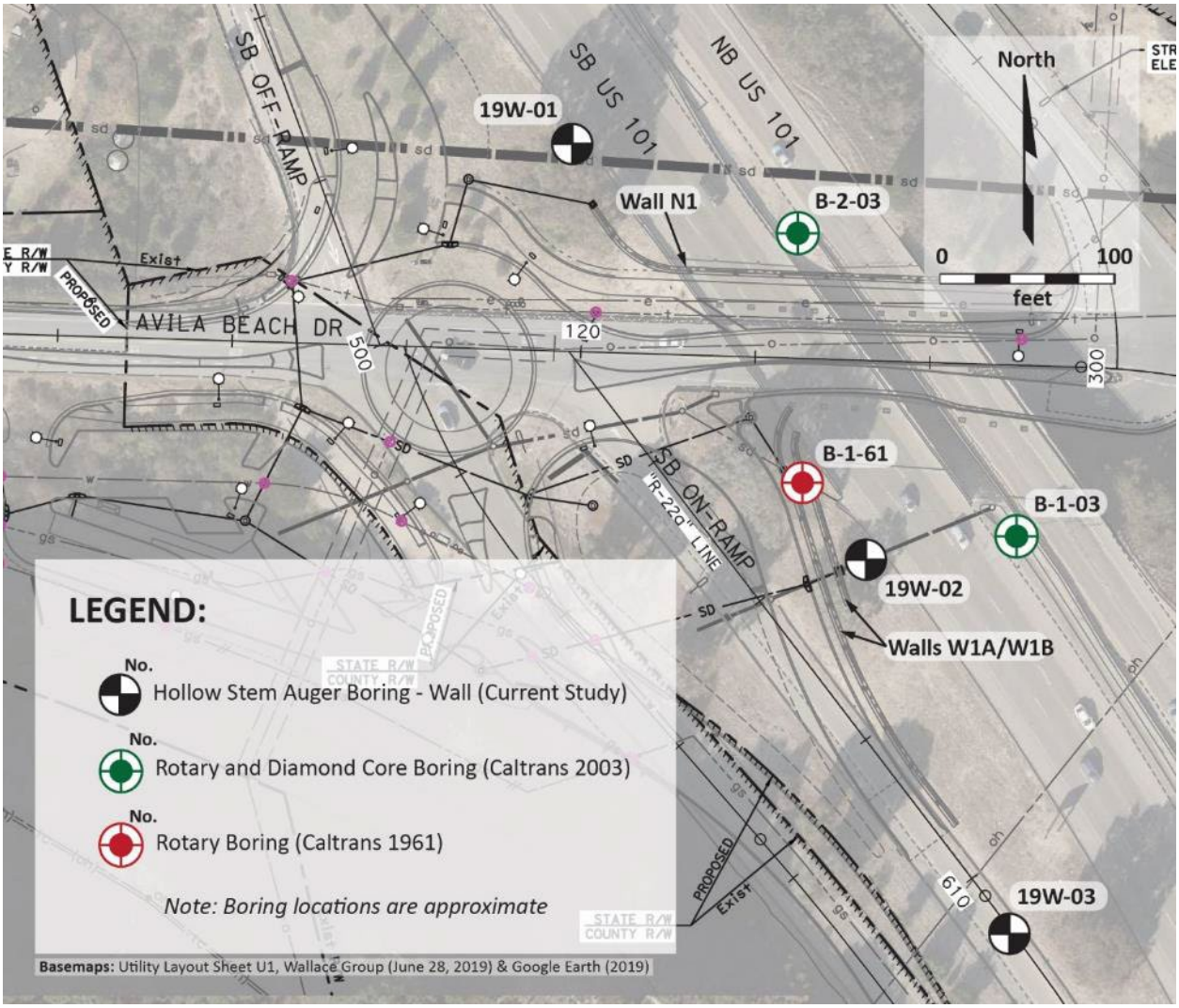

Figure 3: Field Exploration Plan

Log of Test Borings (LOTB) for specific locations of the borings and reviewed LOTB's for this study.

Drilling within the Caltrans right-of-way was performed under Caltrans Encroachment Permit Number 0517 NSV 0606. Drilling for borings greater than 25 feet in depth was performed under San Luis Obispo County Well Permit Application Numbers WP1026524, WP1026525, and WP1026526.

Yeh collected bulk and drive samples for subsequent lab testing, recorded blow counts (N-values) for the driven samples and prepared a field log of subsurface conditions encountered. Sampling within the borings was performed by driving modified California samplers and/or standard penetration test (SPT) split spoon samplers at approximate 5-foot intervals or as

selected for the boring. The SPT sampler has a 2-inch outside diameter, 1-3/8-inch inside diameter and is equipped for but was used without liners. The modified California sampler has a 3-inch outside diameter, 2-3/8-inch inside diameter and was used with 1-inch-high brass liners. Drive samples were collected using a 140-pound automatic trip hammer in accordance with ASTM 1586, the Standard Penetration Test. Bulk samples were collected from the augers as the borings were advanced.

Pocket penetrometer tests were performed in the field on the trimmed end of selected samples to help estimate the undrained shear strength of cohesive materials. The penetrometer was pushed to the designated penetration and the shear strength was read from the spring scale on the device. The undrained shear strength results from the pocket penetrometer tests are noted on the logs in Appendix A. Upon completion, the wall borings were backfilled with sand/cement slurry per the requirements of the Caltrans encroachment permit. Project Log of Test Borings are attached to this report.

Table 2: Boring Summary

Boring No.	Completion Date	Drill Rig Type	Hammer Type	Hammer Efficiency	Approx. Ground Surface Elevation (ft)	Boring Depth (ft)
19W-01	9-17-2019	CME-85	Auto	75%	113.0	35.1
19W-02	9-17-2019	CME-85	Auto	75%	124.0	40.0
19W-03	9-16-2019	CME-85	Auto	75%	116.0	40.6

5. LABORATORY TESTING PROGRAM

Laboratory testing was performed on selected samples recovered from the field exploration program. Tests for moisture content, unit weight, gradation, Atterberg limits, unit weight versus moisture content relation by the modified Proctor test, and pH and resistivity were performed at the Yeh office and laboratory in Grover Beach, California. Tests for R-value and soluble sulfates and chlorides were performed by Cooper Testing Laboratory in Palo Alto, California. Tests for triaxial compressive strength using consolidated undrained (CU) loading were performed at the GEO-E lab at the Cal Poly Civil Engineering Department in San Luis Obispo, California. Testing was performed in accordance with applicable ASTM or Caltrans standards. Laboratory test results are presented in Appendix B and test locations are noted on the Log of Test Borings.

6. GEOTECHNICAL CONDITIONS

6.1 REGIONAL AND SITE GEOLOGY

The project is located in the Coast Ranges geomorphic province, which extends from the Transverse Ranges in southern California to the Klamath Mountains in northern California and into Oregon. The province is characterized by north-northwest trending mountain ranges bounded by the Pacific Ocean to the west and the Central Valley to the east. The basal units are predominantly composed of Jurassic and Cretaceous age rocks with Tertiary to Holocene age rocks commonly overlying the older formations along the flanks and foothills of those ranges. Quaternary sediments are found within intervening drainages, valleys, and coastal areas.

Figure 4 presents the regional geology in the site vicinity, as mapped by Wiegers and Gutierrez (2011). The project area is underlain by bedrock of the upper Pliocene to lower Miocene age

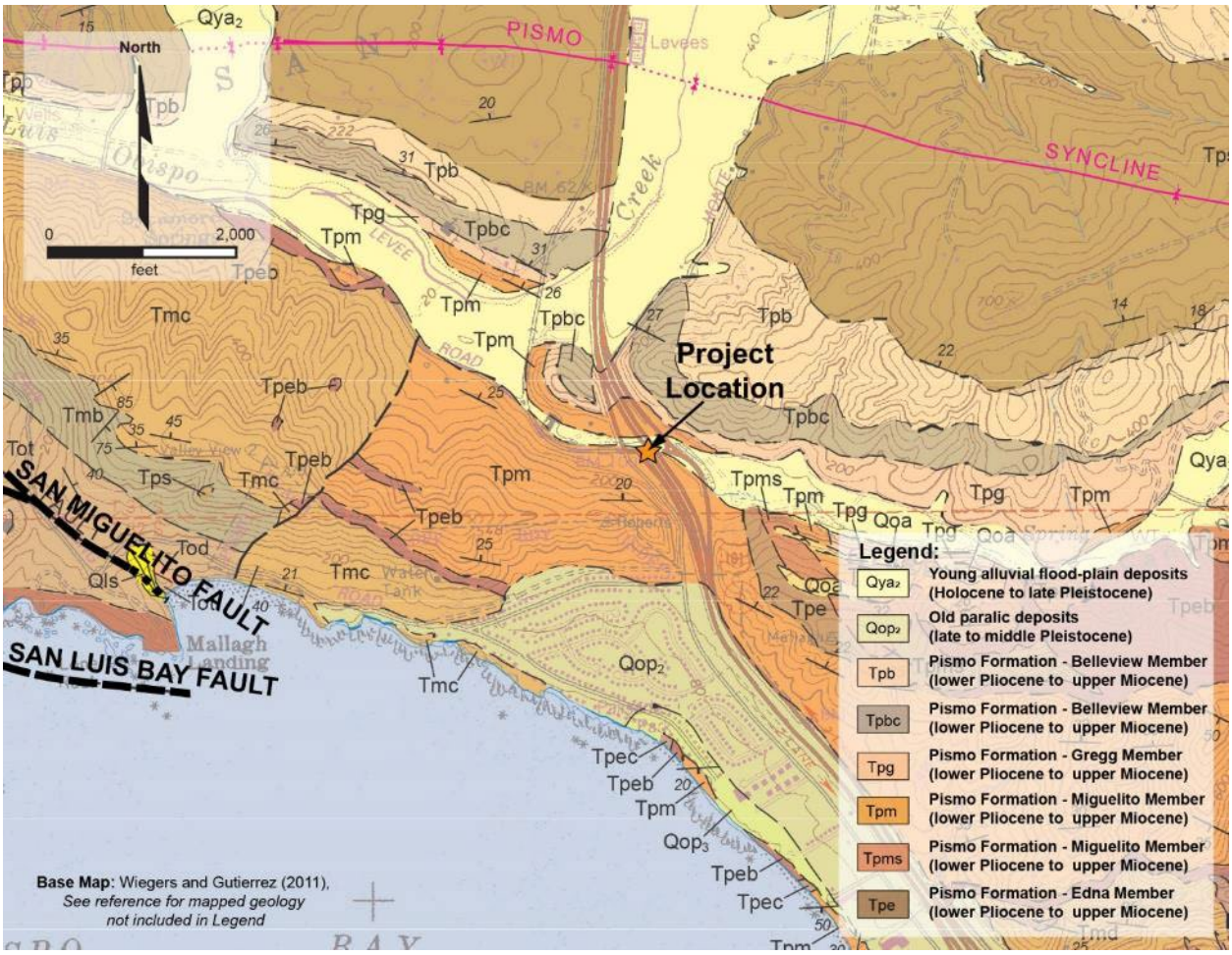

Figure 4: Geologic Map (Wiegers and Gutierrez 2011)

Miguelito and Squire members of the Pismo formation. Holocene to Pleistocene age young alluvial valley deposits are also mapped in the area. The Miguelito member (Tpm) of the Pismo formation is described as brown to buff interbedded siltstone and claystone, moderately resistant, well bedded with beds generally 2 to 4 inches thick. The Squire member (Tps) of the Pismo formation is described as massive, white, calcareous, quartzose to arkosic, silty sandstone. The young alluvial valley deposits (Qya_2) are described as unconsolidated sand, silt, and clay deposited on flood plains and along valley floors. The Qya_2 unit is locally divided by relative age with the youngest unit mapped at the project site.

6.1.1 FAULTING AND SEISMICITY

The site region is within the broad boundary between the Pacific and North American tectonic plates. The majority of relative motion between the plates is accommodated by the right-lateral strike-slip San Andreas Fault zone located approximately 50 miles northeast of the project site. Lesser rates of plate-boundary deformation are accommodated by faults and folds in the coastal and offshore areas around the project site (PG&E 2015).

In the project site vicinity, the San Luis Range and adjacent valleys and ranges are defined by crustal blocks that together make up a larger tectonic element called the Los Osos domain (Lettis et al 2004). The Los Osos domain is a triangular structural region bounded by three Quaternary faults: the northwest-striking, right-lateral oblique strike-slip Oceanic-West Huasna fault zone on the east; the west-striking, left-lateral oblique strike-slip Santa Ynez River fault on the south; and the north-northwest-striking, right-lateral strike-slip Hosgri-San Simeon fault zone on the west. The project site lies within the San Luis/Pismo block of the Los Osos domain, which is topographically the most prominently uplifted block in the Los Osos Domain (Lettis et al 2004).

The closest mapped faults to the site are the San Luis Bay and San Miguelito faults, which Caltrans ARS Online includes in the San Luis Range fault zone and the Edna fault, which Caltrans ARS Online includes in the Los Osos fault zone. Wiegers and Gutierrez (2011) mapped the San Luis Bay and San Miguelito faults trending northwest-southeast approximately 1 mile southwest of the project site, and the Edna fault trending northwest-southeast approximately 2.9 miles north of the project site. Caltrans (2013b) characterized the San Luis Range and Los Osos fault zones as late Quaternary-age and Holocene-age reverse faults, respectively.

6.2 Surface Conditions

The highway in this area of western San Luis Obispo County is characterized by a narrow, gently sloping terrace between the Pacific Ocean and the San Luis Range adjacent to the San Luis Obispo Creek drainage area. The highway was constructed in an area where a through cut transitions to a deep fill within an alluvial valley connected to San Luis Obispo Creek. The highway and Shell Beach Road slopes to the north at grades of 4 to 8 percent in the project vicinity. Hills in undeveloped areas are covered with grass and brush. Agricultural fields are present on the east side of the project area in the alluvial valleys. San Luis Obispo Creek crosses US 101 approximately 1,600 feet north of the undercrossing at the San Luis Obispo Creek Bridge. Surface drainage through the site is generally controlled by drainage inlets along the roadways and culverts beneath the existing embankments that eventually enter the San Luis Obispo Creek drainage.

6.3 Subsurface Conditions

The subsurface conditions encountered at the project site are described below based on Yeh's 2019 field exploration program as well as previous data from Caltrans for the original 1964 construction and 2009 widening of the Avila Beach Undercrossing. Subsurface conditions at the site consist of units of roadway material, artificial fill (Af), young alluvial valley deposits (Qya), and Pismo Formation (Tpm).

Roadway Material. Roadway material was encountered from the ground surface in Yeh's 2019 boring 19W-03. The roadway material consisted of approximately 4.5 inches of asphalt concrete overlying approximately 6 inches of aggregate base. Artificial fill was encountered below the roadway material in borings 19W-03.

Artificial Fill (Af). Artificial fill was encountered in borings drilled for the Caltrans climbing lane project in 2003 to depths of 35 to 47 feet (elevations 62 to 67 feet). The fill was placed during construction of the freeway in the 1960s and consisted of loose to dense clayey gravel (GC), poorly to well-graded gravel with silt and sand (GP-GM, GW-GM), and well-graded sand with gravel (SW) with lenses of medium dense silty sand (SM) and stiff lean clay (CL). Shale and sandstone cobbles to 6 inches in dimension and sandstone boulders up to 2 feet in dimension were encountered in the fill. The cobbles and boulders were described as moderately to intensely weathered, and soft to moderately hard.

Artificial fill was also encountered below the roadway material in Yeh's 2019 boring 19W-03 and below the ground surface in borings 19W-01 and 19W-02. The fill was encountered to the

maximum depths explored, approximately 35.1 to 40.6 feet below the ground surface (elevations 78 to 84 feet). The unit consisted of dense well graded gravel with clay and sand (GW-GC), very dense poorly to well-graded sand with clay and varying amounts of gravel (SP-SC, SW-SC), very loose to very dense clayey sand with gravel (SC), and stiff to hard sandy lean to fat clay with varying amounts of gravel (CL, CH).

Young Alluvial Valley Deposits (Qya). Young alluvial valley deposits were encountered below the artificial fill in the 2003 Caltrans borings to depths of approximately 61 to 83 feet (to elevations 31 to 36 feet). The young alluvial valley deposits consisted of loose to medium dense silt with varying amounts of sand (ML) as well as silty sand with varying amounts of gravel (SM). The unit also included interbedded lenses of very soft to compact silty to clayey sand with varying amounts of gravel (SM, SC) and silty clay with varying amounts of sand (CL-ML).

Pismo Formation (Tpm). Shale and sandstone bedrock units of the Pismo Formation (Miguelito member) were encountered below the artificial fill and alluvium in the 2003 Caltrans borings to the maximum depth explored, approximately 92 to 109 feet below the ground surface. The bedrock was logged as fresh, hard, slightly fractured sandstone. The original foundation study noted the erratic nature and elevations of the bedrock and the difficulty estimating pile tip elevations with the intention of driving the piles to bedrock (Caltrans 1961).

7. GROUNDWATER

Groundwater was measured at approximately elevation 70 feet (27 feet below Avila Beach Drive) on December 11, 2003 (Caltrans 2006) and at approximately elevation 45 feet (52 feet below Avila Beach Drive) on May 25, 1961 (Caltrans 1961). Groundwater was not encountered during Yeh's September 2019 field exploration program. Groundwater and soil moisture conditions will vary seasonally and with changes in storm runoff, irrigation, groundwater pumping, and stream flow. Yeh did not observe any springs at the project site during our site visits.

8. AS-BUILT DATA

As-built plans for Caltrans Contract No. 05-039814 (Caltrans 1963b) dated April 1, 1963, show that 40-foot-deep vertical sand drains were constructed below highway embankments approximately between stations 413+50 and 416+50- and 45-foot-deep sand drains were constructed approximately between stations 428+50 to 431+50. The left shoulder and left lane received the foundation treatment between stations 428+50 to 431+50 and a 5-foot-thick surcharge was placed over the treated area. A 10-foot-thick surcharge was placed over the

treated area between stations 413+50 and 416+50. The surcharge was placed to consolidate the underlying young alluvial material below the freeway embankments. No reports were available that described the results of the pre-consolidation of the young alluvium.

A construction report (Caltrans 1964) stated that the fill material underlying the bridge site at footing level is composed entirely of rocky fill material from adjacent mountain excavation. Approximately 47 feet of fill overlies original ground at Abutment 1 (south abutment), 30 feet at the bents and 35 feet at Abutment 4 (north abutment). Difficult drilling conditions were encountered during predrilling for pile installation. Several boulder-size rocks were hit and could not be removed, resulting in numerous holes drilled out of position that required enlargement of the footing to incorporate the misaligned piles.

The Final Structure Foundation Report (Caltrans 2004b) dated January 26, 2004, for the left bridge widening recommended that a heavier H-pile section or cast steel driving points were to be used for the driven piles. Pre-drilling was not recommended for pile installation through the rocky fill material. Pile driving records indicate that piles were installed to approximate depths of 78 to 82 feet below the foundations for the abutments and 62 to 65 feet at the bents (Caltrans 2008).

The following features could impact the design of the project:

- Existing embankments were constructed with rocky fill material derived from adjacent cut slopes. Difficult excavation and drilling conditions were experienced during the construction of the bridge foundations in the 1960's, and similar conditions are anticipated for excavations extending below grade. Unstable temporary cuts and casing for soil nail and anchor holes should be anticipated.
- The embankments were constructed atop soft alluvial material that could be subject to consolidation under increased loading. Sand drains coupled with surcharge fills were used in the area where up to 60 feet of fill was placed to construct the highway in the early 1960's. The proposed improvements are not anticipated to substantially change the loading of the subsurface conditions and consolidation settlement of the underlying alluvium is not a design consideration.
- Utilities and drainage structures located throughout the project area could conflict with project improvements and staging. Water mains, high-pressure gas mains, and communication lines are all present.

9. CORROSION

Corrosion tests were performed on selected soil samples from Caltrans' 2003 bridge subsurface exploration as well as Yeh's 2019 subsurface exploration program in accordance with Caltrans

test methods. According to the Caltrans *Corrosion Guidelines* (Caltrans 2021b), soil with minimum resistivities less than 1,500 Ω-cm should be tested for soluble sulfates and chlorides. Results for this testing are presented in Appendix B and in Table 3 below.

Table 3: Soil Corrosion Test Summary

Boring No.	Elevation (ft)	Minimum Resistivity (Ohm-cm)	pH	Chloride Content (mg/kg)	Sulfate Content (mg/kg)	Corrosive (Yes/No)
B-1-03	59.4	--	--	--	2,407	Yes
B-2-03	86.3	--	4.50	--	--	Yes
B-2-03	106.0	--	4.10	--	--	Yes
19W-01	94.5	656	6.88	14	4,885	Yes
19W-02	122.0	1169	5.49	--	--	Yes
19W-02	115.5	1842	5.51	--	--	No
19W-02	105.5	1968	6.08	--	--	No
19W-03	116.0	3087	6.58	--	--	No

For structural elements, Caltrans considers a site to be corrosive if one or more of the following conditions exist for the representative soil samples taken at the site: *Chloride concentration is greater than or equal to 500 ppm, sulfate concentration is greater than or equal to 1,500 ppm, or the pH is 5.5 or less* (Caltrans 2021b). Based on Caltrans test methods and standards, the sulfate content and pH results for the 2003 subsurface samples indicate that the soils tested are corrosive and corrosion mitigation is required. Design of the project should consider corrosivity test results using Caltrans design standards.

10. Seismic Information

10.1 Ground Motion Hazard

The following presents seismic data that can be used to evaluate the project area. Figure 5 presents the design acceleration response spectrum (ARS) for the site estimated using ARS Online and guidelines set forth in Appendix B of the Caltrans (2019a) *Seismic Design Criteria*. The site coordinates were estimated as 35.1798 degrees latitude and -120.6997 degrees longitude. The shear wave velocity for the site was estimated to be approximately 972 feet per second (296 meters per second), corresponding to Site Class D defined in Appendix B of the

Seismic Design Criteria (Caltrans 2019a). The shear wave velocity estimate is based on subsurface exploration field blow counts and classifications for the soil the site from borings performed by both Yeh (current study) and Caltrans (2006) in conjunction with Caltrans' *Seismic Design Criteria* (Caltrans 2019a) and Caltrans' *Geotechnical Manual Design Response Spectrum* (Caltrans 2021c) for estimation of shear wave velocity. The design earthquake is a mean magnitude 6.69 event with a mean site to source distance of 19.9 miles (32.1 kilometers) resulting in a design peak ground acceleration of approximately 0.39g, corresponding to a 5-percent in 50 years probability of exceedance (975-year return period). Refer to section 11.3 for design kh values for the retaining walls.

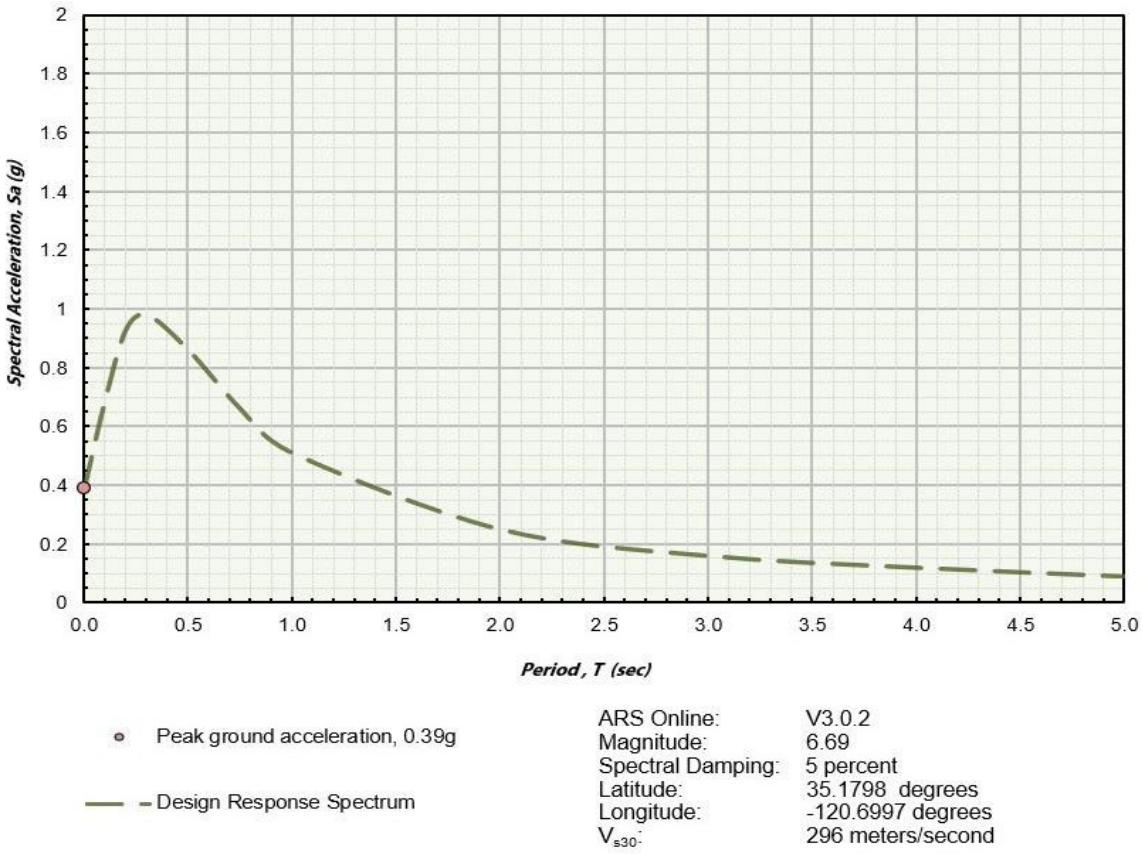

Figure 5: Caltrans ARS Curve

10.2 Surface Fault Rupture

The project site is not mapped within an Alquist-Priolo Fault Zone, is not within 1,000 feet of a Holocene-age fault, and there are no faults mapped crossing the project site. Therefore, there is a low potential for fault rupture to impact the site and ground surface rupture does not need to be considered for the design of this project.

10.3 Liquefaction

The project site is predominantly underlain by dense silty sand and clayey gravel fill to depths of about 35 to 47 feet below the ground surface (approximately elevation 62 to 67 feet) and above the groundwater table (at approximately elevation 70 feet). Layers of silt and loose sandy conditions associated with young alluvial deposits were found below the groundwater table between depths of approximately 45 to 80 feet below the ground surface (approximately elevations 69.4 to 34.4 feet) (Caltrans 2006). Potential liquefaction hazards for the project site were assessed using NCEER procedures (Youd and Idriss 2001) with calculations included in Appendix C.

The medium dense to dense fill is not considered vulnerable to liquefaction based on Yeh's analyses. Silt and sandy layers within the alluvium located between the artificial fill and underlying sandstone bedrock are potentially liquefiable. Case studies (Ishihara 1985) have shown that if a layer of non-liquefiable soil overlying a layer of liquefiable material is thick enough, the potential for the liquefiable layer to manifest at the surface and affect surface improvements decreases as the thickness of the overburden layer increases. The layer of artificial fill is considered sufficiently thick such that the potential for surface manifestation and effect on near surface structures is low (Ishihara 1985). The potential for liquefaction to affect surface improvements and shallow foundations for structures is considered to be low to nil, and no special recommendations are needed for design to address liquefaction or seismic settlement related hazards for such structures or improvements.

11. Geotechnical Recommendations

Two retaining walls (Retaining Wall N1 and Retaining Wall W1) are proposed for this project. Geotechnical recommendations for the proposed retaining walls are provided in the following sections. Recommendations are based on the retaining wall layouts, cross sections, and topography shown on the project plans (WG 2021c, MT 2022) as well as structural design parameters provided by Mark Thomas & Company (MT 2021). Mark Thomas is performing the structural design and internal design calculations for the retaining walls. Yeh performed a check of the recommended parameters and soil nail wall design using SNAIL (Caltrans 2020). Pertinent output graphics are presented in Appendix C.

11.1 Geotechnical Parameters

Recommended soil parameters for the wall design are presented in Table 4. These parameters were used in Yeh's external stability calculations. The soil parameters presented in Table 4 are for the artificial fill that underlies each wall location and are based on the borings drilled for the

Caltrans climbing lane project in 2003 as well as the 2019 Yeh borings. Groundwater conditions at the wall sites are described in Section 7.0. Groundwater is not expected to influence the performance of the retaining wall. Apparent Earth Pressures (AEP) should be estimated using Figure 3.11.5.7-1 (b) of the AASHTO *LRFD Bridge Design Specifications 8 Edition (AASHTO 2017)* and the parameters provided in Table 4.

Table 4: Design Analysis Soil Parameters

Layer No. (Material)	Layer Boundaries	Group Name	Engineering Parameters
1 (Existing Embankment Fill)	Finished grade elevation to elev. 70, Walls N1 and W1	Gravel with Sand / Clayey Sand with Gravel (Fill)	$\phi = 30$ degrees cohesion = 50 psf γ = 115 pcf

11.2 External Stability Recommendations

11.2.1 Retaining Wall N1

The proposed Retaining Wall N1 will be a sub-horizontal ground anchor (SHGA) retaining wall with ground anchors located beneath the Avila Road UC. Retaining Wall N1 will be approximately 280 feet long and extends from approximately 45.6 feet left of Station 77+07.36 "AV1-8" Line ("N1" 119+93.48) to 37.3 feet left of Station 300+76.01 "F-21" Line ("N1" 122+73.46). The maximum design height is approximately 15.5 feet, including a minimum wall embedment depth of 2 feet below finished grade elevation.

External stability was calculated using limit equilibrium methods in the computer program SLIDE2. Results of Yeh's external stability analyses are presented in Appendix C. The cross-sectional geometry and anchor layout used in Yeh's analysis are based on the typical section and topography shown on the project plans (WG 2021c, MT 2022). External surcharge loading on the wall was provided by Mark Thomas (MT 2021) and includes a uniform horizontal 85 pounds per square foot traffic load for Highway 101 as well as a uniform horizontal 38.33 pounds per square foot static load for the existing abutment. A resistance factor of 0.33 (factor of safety of 3.06) was calculated for static global and a resistance factor of 0.81 (factor of safety of 1.23) was calculated for seismic stability.

Recommendations. Recommendations for Retaining Wall N1 are presented in Table 5. Determination of bond length and anchor pull-out resistance are the contractor's responsibility.

Table 5: Retaining Wall N1 Geotechnical Design Recommendations

Retaining Wall	Max. Wall Design Height (feet)	Min. Wall Face Embedment Below Finished Grade Elevation (feet)	Min. Ground Anchor Unbonded Length (feet)	Max. Ground Anchor Vertical Spacing (feet)	Max. Ground Anchor Horizontal Spacing (feet)	Ground Anchor Declination from Horizontal (degrees)	Foundation Soil Factored Nominal Bearing Resistance for Facing Footing (psf)
N1	15.5	2.0	15.0	4.0	10.0	15.0	3,000

11.2.2 RETAINING WALL W1

Retaining Wall W1 will be a tiered soil nail wall with the lower wall designated Wall W1-A and the upper wall designated Wall W1-B. Retaining Wall W1 will be located along the southbound on-ramp to Highway 101 between the on-ramp and the highway. Wall W1-A will be approximately 236 feet long from Station 610+88.78 at 10.0 feet right of Station 150+32.51 "R-22A-1" line to Station 613+24.78 at 36.4 feet right of Station 152+52.26 "R-22A-1" line. Wall W1-B will be approximately 92.94 feet long from 10.0 feet right of Station 612+18.21 "W1-A" line to 10.0 feet right of Station 613+19.46 "W1-A" line (MT 2023).

External stability was calculated using limit equilibrium methods in the computer program SLIDE2 (Rocscience 2023). Internal stability was checked using the computer program SNAIL (Caltrans 2020). Results of Yeh's analyses are presented in Appendix C. The cross-sectional geometry and soil nail layout used in Yeh's analysis are based on the typical section shown on the project plans (WG 2021c, MT 2023). External loading on the wall includes a 240 pounds per square foot traffic surcharge load for Highway 101. Resistance factors of 0.59 to 0.61 (factors of safety of 1.63 to 1.68) were calculated for static global stability for retaining wall W1 for Stations 611+67, 612+12, and 612+68 ("W1-A" Line). Resistance factors of 0.83 to 0.90 (factors of safety of 1.11 to 1.20) were calculated for seismic global stability for retaining wall W1 for Stations 611+67, 612+12, and 612+68 ("W1-A" Line).

Recommendations. Retaining Wall W1 should be designed with the following recommendations and the data presented in Table 6.

- Excavation height is the vertical distance from the original grade behind the wall to the bottom of excavation for the wall.
- Use a columnar nail layout pattern.
- Set nail inclination angle at 15 degrees from the horizontal.
- Set wall batter at 1(H):10(V).

- Place the first row of nails no more than 2.5 feet below the original grade behind the wall.
- Place the bottom row of nails no more than 2.5 feet above the bottom of excavation of the wall.
- For structural wall facing design, apply the appropriate structural resistance factor to the required minimum unfactored facing resistance provided in the following Table 6.

Table 6: Retaining Wall W1 Geotechnical Design Recommendations

Wall No.	Station ("W1-A" Line)	Max. Design Height (ft)	Min. Front Face Embedment Depth (ft)	Min. Nail Length (ft)	Max. Vertical Nail Spacing (ft)	Max. Horizontal Nail Spacing (ft)	Nail Bar		Nominal Pullout Resistance Qb[1] (lbf/ft)	Unfactored Tensile Force at Soil Nail Head T_o(kips)	
							Yield Strength (ksi)	Diameter (inch)		Static[2]	Seismic
W1-A	610+88.78 to 611+67.00	10.0	2.0	19.0	5.0	5.0	75	1.0	4,000	12.2	27.4
	611+67 to 612+18.21	15.0	2.0	27.0	5.0	5.0	75	1.0	4,000	23.4	31.5
	612+18.21 to 613+24.78	20.0	2.0	30.0	5.0	5.0	75	1.125	4,000	29.6	39.9
W1-B	612+18.21 to 613+19.46	10.0	2.0	30.0	5.0	5.0	75	1.0	4,000	19.2	31.5

1. Based upon an assumed 6.5-inch diameter hole and a nominal bond stress of 16 psi.
2. Permanent Static Load

11.3 Pseudo-Static Design Parameters

The retaining walls should be designed to resist lateral pressures from the design earthquake. Pseudo-static design parameters for the two retaining walls (Retaining Wall N1 – Ground Anchor Wall and Retaining Wall W1 – Soil Nail Wall) are presented below.

11.3.1 Retaining Wall N1

The horizontal coefficient of ground acceleration (k_h) for the pseudo-static analysis performed as part of Yeh's external wall stability calculations for Wall N1 was estimated using procedures referenced in Section 11.6.5.2 of the AASHTO (2017) *LRFD Bridge Design.* The procedures presented in AASHTO (2017) consider the design earthquake and zero wall displacement ($k_h = k_{h0}$). The design peak ground acceleration, magnitude, and site class used to estimate the horizontal coefficient of ground acceleration (k_h) is presented in Section 10.1. An estimated

horizontal coefficient of ground acceleration (k_h) of 0.43 should be used for Wall N1 in lieu of the assumed k_h values in standardized ERS designs.

The Generalized Limit Equilibrium (GLE) method (AASHTO 2017) and the computer program SLIDE2 was used to estimate additional seismic loading needed for design of Wall N1 assuming *no wall deflection as requested by MTCO*. The design static earth pressure was modeled as a trapezoidal distributed load using the apparent earth pressure diagram presented in AASHTO (2017) Figure 3.11.5.7.1-1 (b) (see Figure 6) and the wall layout presented on the structural plans (MT 2022). The design static earth pressure was modeled resisting movement on the vertical face of the slope (wall) and estimated using the geotechnical properties described in Section 11.1. SLIDE2 (output in Appendix C) was then used to iteratively estimate the additional seismic load needed to provide a factor of safety for slope stability of 1.0 or greater for the when the horizontal coefficient of ground acceleration (k_h) was applied for the design earthquake. *An additional seismic load of 140 pounds per square foot should be used for the design of Wall N1.* The load should be a trapezoidal distribution (matching the distribution shape of the static/apparent earth pressure).

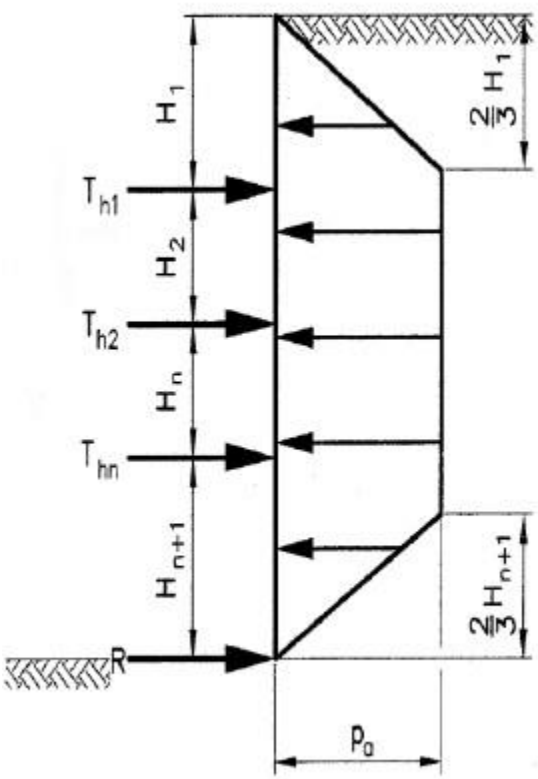

Figure 6: AEP Distribution for Anchored Walls with More than one Anchor (AAHSTO 2017)

11.3.2 Retaining Wall W1

The horizontal coefficient of ground acceleration (k_h) for the pseudo-static analysis performed as part of Yeh's external wall stability calculations for Wall W1 was estimated using procedures described in the FHWA (2011) *LRFD Seismic Analysis and Design of Transportation Features and Structural Foundations Reference Manual* and referenced in Section A11.5.2 of the AASHTO (2017) *LRFD Bridge Design Specifications.* The procedures presented in FHWA (2011) consider the design earthquake, duration, and a displacement of up to 2 inches for the soil nail wall(s). The design peak ground acceleration used to estimate the horizontal coefficient of ground

acceleration (k_h) is presented in Section 10.1. An estimated horizontal coefficient of ground acceleration (k_h) of 0.21 should be used for the site in lieu of the assumed k_h values in standardized ERS designs. This horizontal coefficient was used in the external wall stability calculations using SNAIL.

12. Notes For Specifications

12.1 Retaining Wall N1

Geocomposite drainage strips shall be installed with the horizontal spacing equal to the ground anchor horizontal spacing. Weepholes or an underdrain system may be used to discharge water from the strip drains. Geocomposite drainage strips shall conform to Caltrans (2022b) *Standard Specifications* Section 96-1.02C.

Based on Caltrans test methods and standards, the sulfate content and pH results indicate that the soils tested are corrosive and corrosion mitigation is required. Ground anchors should be encapsulated in sheathing conforming to Section 46-2.02C, Sheathing, in the Caltrans (2022b) *Standard Specifications* for corrosion protection.

Piles are present below the undercrossing abutment. The piles should be noted on the plans and layout of the existing piles provided to the contractor in bid documents.

12.2 Retaining Wall W1

Geocomposite drainage strips should be installed with the horizontal spacing equal to the soil nail horizontal spacing. Weepholes or an underdrain system may be used to discharge water from the strip drains. Geocomposite drainage strips shall conform to Caltrans (2022b) *Standard Specifications* Section 96-1.02C.

Based on Caltrans test methods and standards, the sulfate content and pH results indicate that the soils tested are corrosive and corrosion mitigation is required. Soil nails should be epoxy coated with partial or full encapsulated in sheathing conforming to Section 46-3.02A, Materials, in the Caltrans (2022b) *Standard Specifications* for corrosion protection.

Wall layout plan and elevation view should show locations of proof test nails in locations provided by the Geotechnical Engineer. Plans should show at least 0.08N proof test nails where N is the number of production nails in each wall zone. Proof testing should be performed per Section 46-3.01D(2)(b)(ii)(C) of the Caltrans (2022b) *Standard Specifications*.

Minimum soil nail lengths for walls W1-A and W1-B between stations 612+18.21 and 613+24.78 along line "W1-A" will be 30 feet long. Between approximately station 612+50 to 613+24.78 on line "W1-A", the lengths of the nails could be in close proximity to the foundations for the undercrossing and the nails may intersect due to the configuration of the wall. Plans should show existing foundation elements and provide direction for adjusting nail orientations to avoid intersecting bridge abutments, soil nails and/or piles.

13. Notes for Construction

13.1 Temporary Excavations

Difficult front face excavation conditions are expected for Retaining Walls N1 and W1. Boulders and cobbles are preset in the embankment fill that will slow excavation and may result in an uneven wall excavation or voids in the excavation face. The uneven wall excavations should be disclosed in the project documents so that contractors can allow for additional shotcrete in bidding.

To determine the excavation lift height and exposure time during the excavation, stability testing should be performed prior to the construction of the retaining walls per Caltrans (2022b) *Standard Specifications* Section 19-3.01D(2), Stability Test for Ground Anchor and Soil Nail Walls. In absence of any other requirements, excavations made to construct the retaining walls should not remain open longer than an 8-hour work shift and all excavations made during this 8-hour work shift are required to either have the complete shotcrete facing applied or completely backfilled at the end of one 8-hour shift.

The design of temporary slopes or shoring systems needed for construction is the responsibility of the contractor. Temporary slopes should be braced or sloped according to the requirements of (Cal) OSHA. The soil encountered at the project site generally consisted of artificial fill and alluvium that can be classified as Type B soil or better. Type B soil can be sloped to 1h:1v (horizontal to vertical) for slope heights of up to 20 feet. The actual slope inclination of temporary slopes will be determined by the contractor's competent person per OSHA guidelines and the subsurface conditions encountered at the time of construction.

13.2 Drilling Conditions

Hard drilling is anticipated for ground anchors and soil nails due to the presence of cobbles and boulders. The fill was placed during construction of the freeway in the 1960s and is composed entirely of rocky fill material from adjacent mountain excavation. During bridge construction

difficult drilling conditions were encountered during predrilling for pile installation. Several boulder-size rocks were hit and could not be removed, resulting in numerous holes drilled out of position that required enlargement of the footing to incorporate the misaligned piles.

Where such drilling conditions are anticipated, Caltrans (2022b) *Standard Specifications* Section 46-1.03B, Drilling, states that a down-hole pneumatic drill rig and bit are to be available on the jobsite for drilling holes. Caving conditions are also anticipated in the rocky fill material at the site. *Standard Specification*s Section 46-1.03B says that where caving conditions are anticipated, keep enough casing on the jobsite to maintain uninterrupted anchor or nail installation. The presence of voids may also be expected due to the presence of cobbles and boulders. Methods to prevent excessive grout takes such as casing, grout socks, or approved grout additives during ground anchor or soil nail construction may be necessary.

Bridge foundation piles are present in the ground anchor zone at retaining wall N1 and W1. Drill holes for ground anchors and soil nails that encounter a steel H-pile should be abandoned and re-drilled to miss the pile.

13.3 Groundwater Considerations

Groundwater is not expected to be encountered during the excavations for the retaining walls based on the reviewed geotechnical data. Yeh did not observe any springs or seepage on slopes during site visits.

13.4 Differing Site Conditions

The conclusions and recommendations submitted in this report are based upon the data obtained from field reconnaissance, subsurface exploration, and existing reports and data. If there are any changes in the site conditions, Yeh should review those changes and provide additional recommendations, if needed.

13.5 Adjacent Structures

Retaining walls N1 and W1 will be constructed near the existing Avila Beach undercrossings, Avila Beach Drive, the US-101 southbound offramp and onramp, the US-101 embankment slopes, and multiple existing utilities. Excavation for and construction of the retaining walls should consider support of adjacent structures, slopes, and utilities.

13.6 Load Testing

Load testing should be performed on the ground anchors and soil nails following installation. Load testing of the ground anchors should be performed according to Section 46-2.01D(2)(b),

Load Testing, of the Caltrans (2022b) *Standard Specifications*. Load testing of the soil nails should be performed according to Section 46-3.01D(2)(b), Load Testing, of the Caltrans (2022b) *Standard Specifications*.

14. LIMITATIONS

This study has been conducted in general accordance with currently accepted geotechnical practices in this area for use by the client for design purposes. The conclusions and recommendations submitted in this report are based upon the data obtained from field reconnaissance, existing reports and data, and our understanding of the proposed project and type of construction described in this report. If there are any changes in the project or site conditions, Yeh should review those changes and provide additional recommendations, if needed. Any modifications to the recommendations of this report or approval of changes made to the project should not be considered valid unless they are made in writing. The report and drawings contained in this report are intended for preliminary design input; and are not intended to act as design level recommendations or construction drawings or specifications.

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Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
05	SLO	101	20.9/21.3	113	124

GEOTECHNICAL PROFESSIONAL — DATE 3-2-2022

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — JUDD J. KING — No. 2903 — GEOTECHNICAL — STATE OF CALIFORNIA

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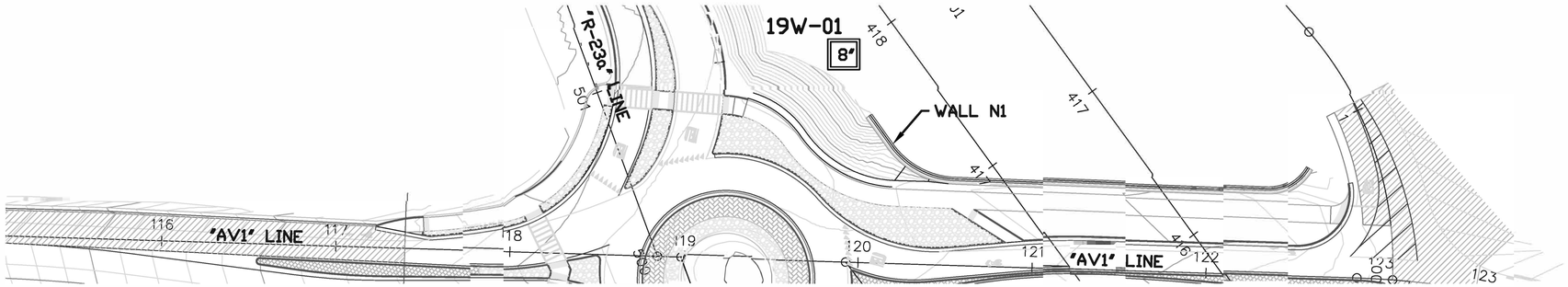
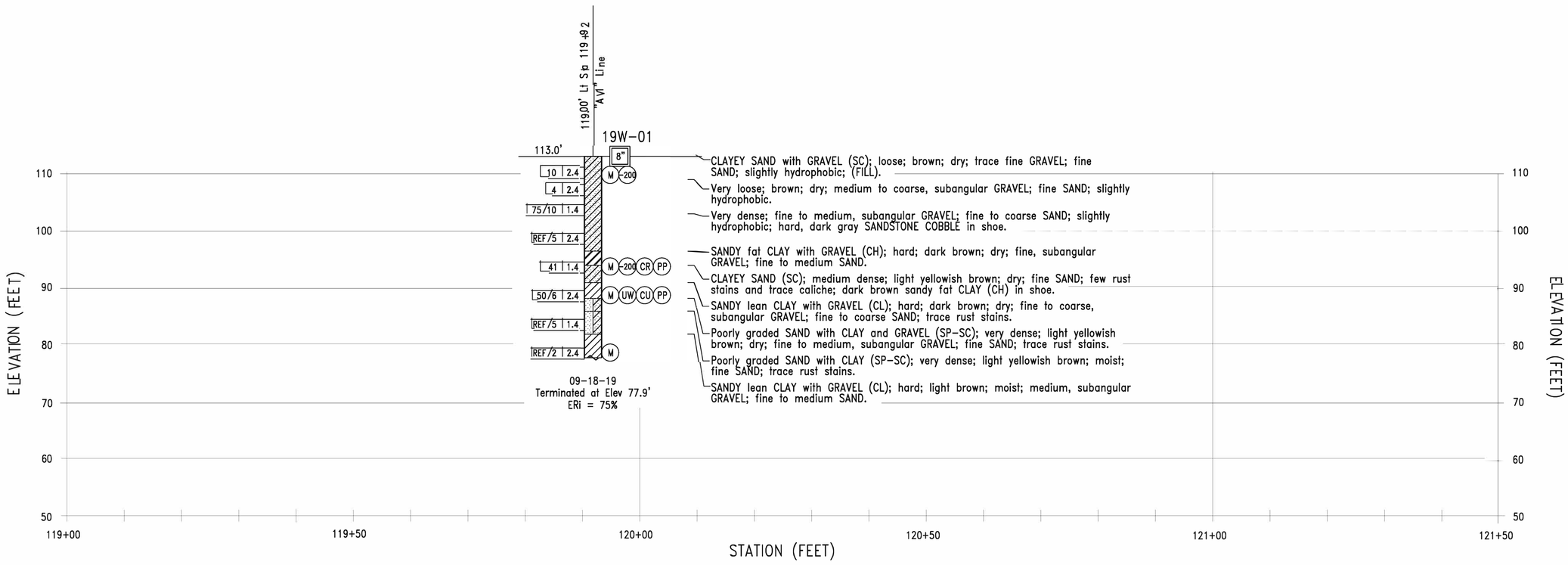
YEH AND ASSOCIATES, INC.
391 FRONT STREET, SUITE D
GROVER BEACH, CA

SAN LUIS OBISPO COUNTY DEPARTMENT OF PUBLIC WORKS
976 OSOS STREET, ROOM 206
SAN LUIS OBISPO, CA 93408

PLAN:
1" = 40'





NOTES:

1. Auger borings excavated with a CME-85 drill rig equipped with 8-inch hollow stem augers and an automatic trip hammer weighing 140 pounds falling 30 inches with estimated 75% efficiency.
2. "1.4" Standard Penetration Test (SPT) sampler has a 1-3/8 inch inside diameter and a 2 inch outside diameter.
3. "2.4" Modified California sampler has a 2-3/8 inch inside diameter and a 3 inch outside diameter with brass liners.
4. "ref/#" indicates drive exceeded 50 blows during initial 6-inch seating.
5. "##/##" indicates partial drive having number of blows over depth interval noted.
6. All blow counts are uncorrected field blow counts.
7. See 2018 Caltrans Standard Plans A10F, A10G, and A10H for legend of soil and rock classification and boring notations.
8. This Log of Test Borings (LOTB) was prepared in accordance with the Caltrans Soil and Rock Logging, Classification, and Presentation Manual (2010).

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

SAYGUNN LOW DESIGN OVERSIGHT	DRAWN	BY J. CRAVENS	J. CRAVENS/J. KING FIELD INVESTIGATOR	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	ERIC FREDERICKSON PROJECT ENGINEER	BRIDGE No. 49E0028 POST MILE R21.13	RETAINING WALL No. 1 ("N1") LOG OF TEST BORINGS (1 OF 1)
X SIGN OFF DATE	CHECKED	BY J. KING	9/16/2019 TO 9/18/2019 DATE				

GS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REVISION 4/19/2018)

DATE PLOTTED => 7/12/2021 TIME PLOTTED => 2:39 PM
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ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: X
PROJECT NUMBER & PHASE: X
CONTRACT No.: 05-1G4801

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES				SHEET	OF
3/2/22				8	11

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
05	SLO	101	20.9/21.3	121	124

GEOTECHNICAL PROFESSIONAL — 3-2-2022 DATE

REGISTERED PROFESSIONAL ENGINEER — JUDD J. KING No. 2903 GEOTECHNICAL STATE OF CALIFORNIA

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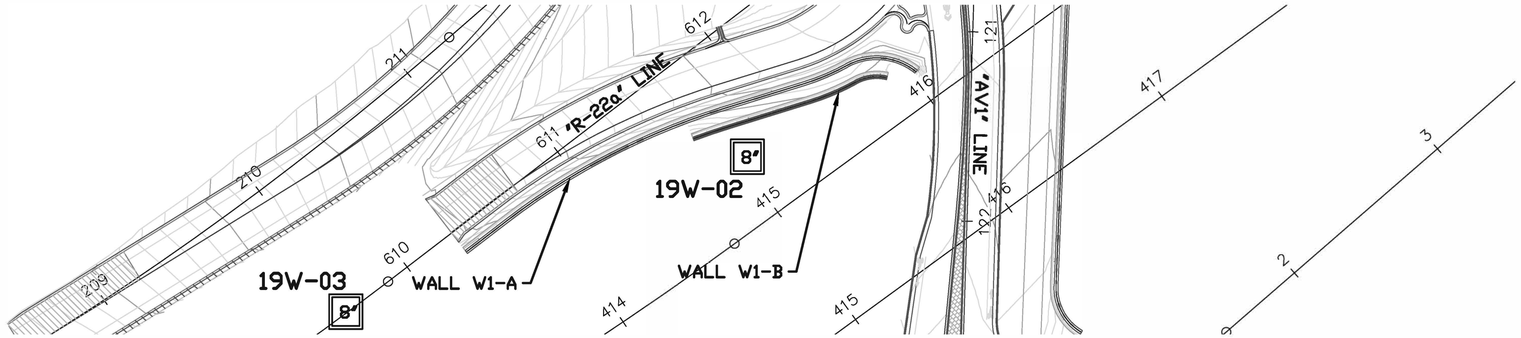
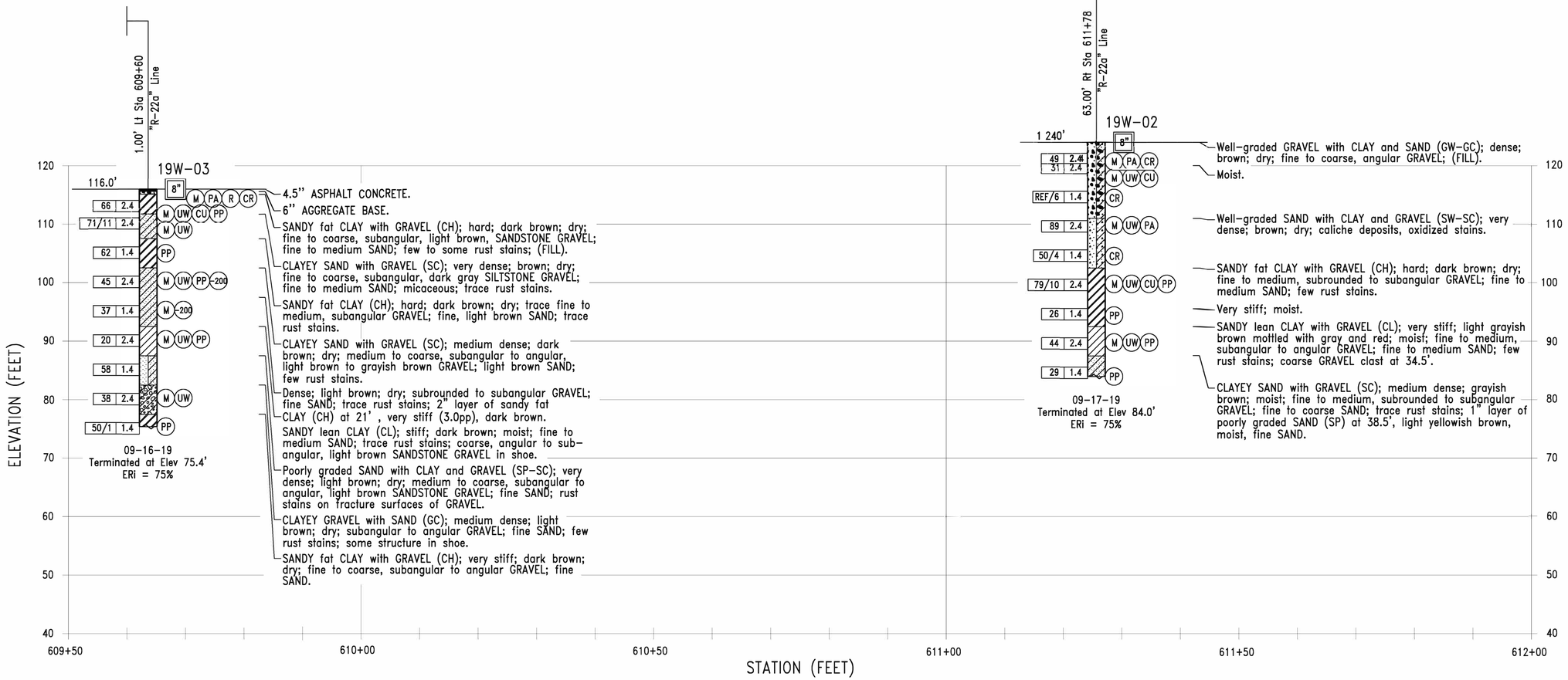
PLAN:
1" = 40'





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

NOTES:

1. Auger borings excavated with a CME-85 drill rig equipped with 8-inch hollow stem augers and an automatic trip hammer weighing 140 pounds falling 30 inches with estimated 75% efficiency.
2. "1.4" Standard Penetration Test (SPT) sampler has a 1-3/8 inch inside diameter and a 2 inch outside diameter.
3. "2.4" Modified California sampler has a 2-3/8 inch inside diameter and a 3 inch outside diameter with brass liners.
4. "ref/#" indicates drive exceeded 50 blows during initial 6-inch seating.
5. "##/##" indicates partial drive having number of blows over depth interval noted.
6. All blow counts are uncorrected field blow counts.
7. See 2018 Caltrans Standard Plans A10F, A10G, and A10H for legend of soil and rock classification and boring notations.
8. This Log of Test Borings (LOTB) was prepared in accordance with the Caltrans Soil and Rock Logging, Classification, and Presentation Manual (2010).

SAYGUNN LOW DESIGN OVERSIGHT	DRAWN	BY J. CRAVENS	J. CRAVENS/J. KING FIELD INVESTIGATOR		PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	ERIC FREDERICKSON PROJECT ENGINEER	BRIDGE No. 49E0028 POST MILE R21.13	RETAINING WALL No. 2 ("W1") LOG OF TEST BORINGS (1 OF 1)
X SIGN OFF DATE	CHECKED	BY J. KING	9/16/2019 TO 9/18/2019 DATE					

GS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REVISION 4/19/2018)
DATE PLOTTED => 7/12/2021 FILE => 216-423 DRAFT LOTB.dwg
TIME PLOTTED => 2:40 PM USERNAME => Jcravens
ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3
UNIT: X PROJECT NUMBER & PHASE: X CONTRACT No.: 05-1G4801
DISREGARD PRINTS BEARING EARLIER REVISION DATES
REVISION DATES 3/2/22
SHEET 7 OF 10

As Built LOTB

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
05	SLO	101	R31.5/R35.4	103	105

Caltrans Metric

Michael S. Finegan 4-25-05
REGISTERED CIVIL ENGINEER

8-21-06
PLANS APPROVAL DATE

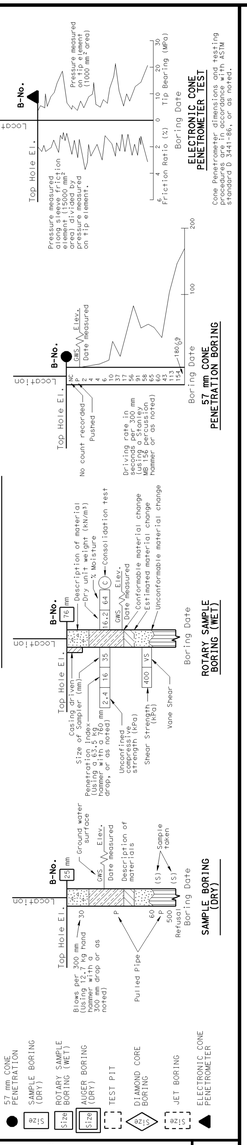
The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

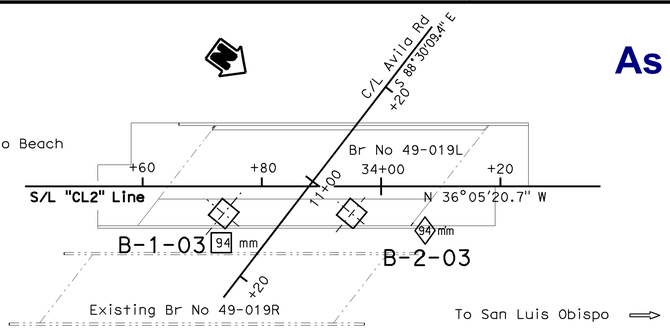
REGISTERED PROFESSIONAL ENGINEER — Michael S. Finegan — No. C50138 — Exp. 6-30-05 — CIVIL — STATE OF CALIFORNIA

Caltrans web site, go to: http://www.dot.ca.gov

CONTRACT NO: 05-485604
TRANSFER DATE: 11-09-2009
FIELD CORRECTION DATE: 5-4-2009
CORRECTIONS TRANSFERED BY: AV
FIELD CORRECTIONS BY: Nicholas Helsdorf

NO AS BUILT CORRECTIONS





BENCH MARK

PM 21.14, Std C/L Ref. Mon, stamped 6-17

Elev. 32.067

PLAN

1:500

GEOTECHNICAL SERVICES - DIVISION OF ENGINEERING SERVICES

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	POST MILES - TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
05	SLO	101	20.9/21.3	X	X

REGISTERED ENGINEER - CIVIL — 3-2-22 DATE

AVILA BEACH DRIVE AT US 101 INTERCHANGE

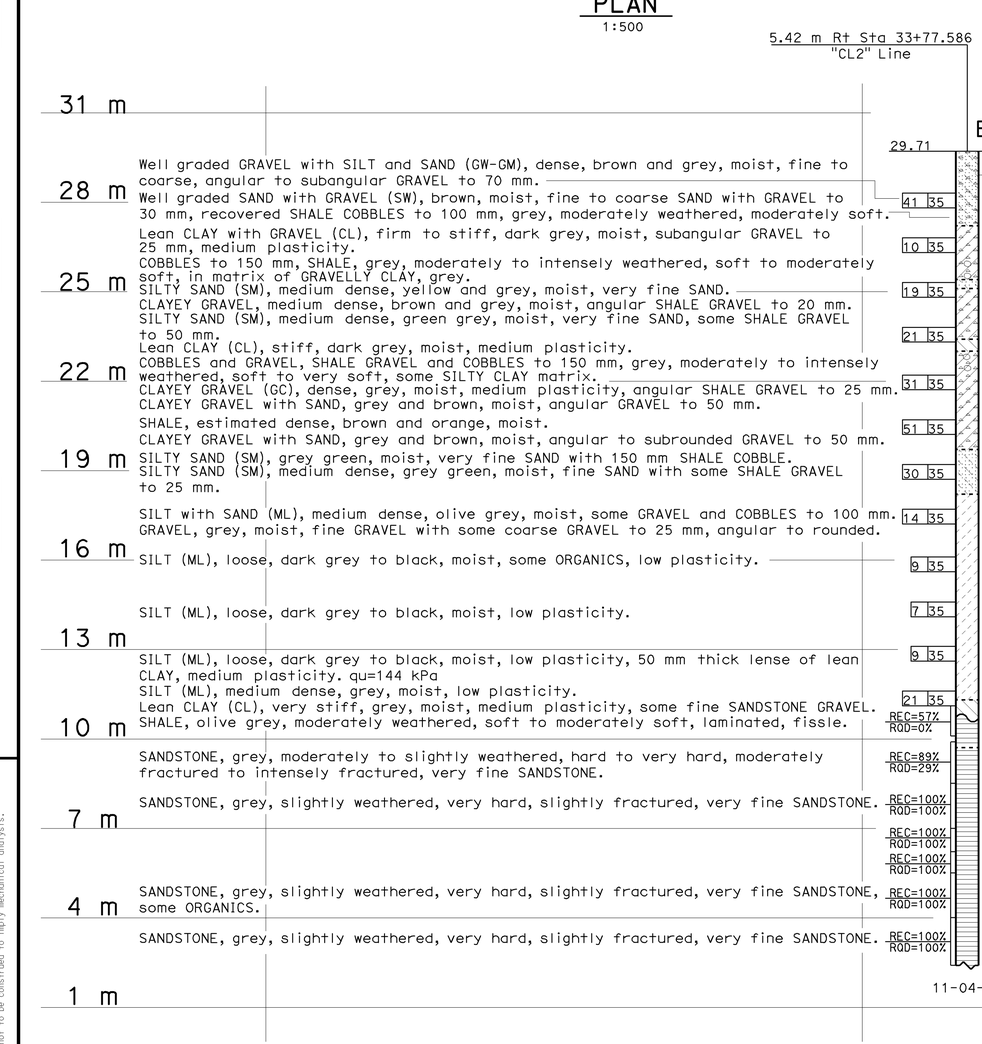
RETAINING WALL NO. 1 ("N1")/RETAINING WALL NO. 2 ("W1")

As-Built Vertical Datum: — Datum Conversion:

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

CU: 05 EA: 05-1G4801 — BRIDGE NO. 49-E0027/49E-0028

REGISTERED PROFESSIONAL ENGINEER — JUDD J. KING — No. 2903 — GEOTECHNICAL — STATE OF CALIFORNIA



PROFILE

HOR. 1:500
VER. 1:100

32+60 33+60 34+40 35+40

ENGINEERING SERVICES	GEOTECHNICAL SERVICES
DRAWN BY	F. Nguyen 03/04
CHECKED BY	M. Finegan

FIELD INVESTIGATION BY: M. Finegan

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION
DIVISION OF STRUCTURES
STRUCTURE DESIGN 7

CU 05
EA 485611

BRIDGE NO. 49-0191L
KILOMETER POST 33.9

AVILA RD UC - LEFT BRIDGE (WIDEN)

LOG OF TEST BORINGS 1 OF 3

OGS GEOLOGIST LOG OF TEST BORINGS SHEET (METRIC) (REV. 3/02)

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

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY): 4-15-04 | 5-11-04 | 4-15-05 | 6-27-05 | 2-27-06

SHEET 16 OF 18

USERNAME => ovoldez DATE PLOTTED => 10-NOV-2009 TIME PLOTTED => 12:20

FILE => 49-0191-z-lotb1.dgn

CORRECTIONS TRANSFERED BY: AV
FIELD CORRECTIONS BY: Nicholas Helsdorf

TRANSFER DATE: 11-09-2009
FIELD CORRECTION DATE: 5-4-2009

CONTRACT No: 05-485604

NO AS BUILT CORRECTIONS

WEATHERING DESCRIPTORS

Modified from United States Bureau of Reclamation, Engineering Geology Field Manual.

Descriptors		Diagnostic features: Chemical weathering-Discoloration and/or oxidation		Diagnostic features: Mechanical weathering-Grain boundary conditions (disaggregation) primarily for granitics and some coarse-grained sediments	Diagnostic features: Texture and solutioning		General characteristics (strength, excavation, etc.)§
Alphanumeric descriptor	Descriptive term	Body of rock	Fracture surfaces†		Texture	Solutioning	
W1	Fresh	No discoloration, not oxidized.	No discoloration or oxidation.	No separation, intact (tight).	No change.	No solutioning.	Hammer rings when crystalline rocks are struck. Almost always rock excavation except for naturally weak or weakly cemented rocks such as siltstones or shales.
W2	Slightly weathered to fresh○						
W3	Slightly weathered	Discoloration or oxidation is limited to surface of, or short distance from, fractures; some feldspar crystals are dull.	Minor to complete discoloration or oxidation of most surfaces.	No visible separation, intact (tight).	Preserved.	Minor leaching of some soluble minerals may be noted.	Hammer rings when crystalline rocks are struck. Body of rock not weakened. With few exceptions, such as siltstones or shales, classified as rock excavation.
W4	Moderately to slightly weathered○						
W5	Moderately weathered	Discoloration or oxidation extends from fractures usually throughout; Fe-Mg minerals are "rusty," feldspar crystals are "cloudy."	All fracture surfaces are discolored or oxidized.	Partial separation of boundaries visible.	Generally preserved.	Soluble minerals may be mostly leached.	Hammer does not ring when rock is struck. Body of rock is slightly weakened. Depending on fracturing, usually is rock excavation except in naturally weak rocks such as siltstones or shales.
W6	Intensely to moderately weathered○						
W7	Intensely weathered	Discoloration or oxidation throughout; all feldspars and Fe-Mg minerals are altered to clay to some extent; or chemical alteration produces in-situ disaggregation, see grain boundary conditions.	All fracture surfaces are discolored or oxidized, surfaces friable.	Partial separation, rock is friable; in semiarid conditions granitics are disaggregated.	Texture altered by chemical disintegration (hydration, argillation).	Leaching of soluble minerals may be complete.	Dull sound when struck with hammer, usually can be broken with moderate to heavy manual pressure or by light hammer blow without reference to planes of weakness such as incipient or hairline fractures, or veinlets. Rock is significantly weakened. Usually common excavation.
W8	Very intensely weathered						
W9	Decomposed	Discolored or oxidized throughout, but resistant minerals such as quartz may be unaltered; all feldspars and Fe-Mg minerals are completely altered to clay.		Complete separation of grain boundaries (disaggregated).	Resembles a soil, partial or complete remnant rock structure may be preserved; leaching of soluble minerals usually complete.		Can be granulated by hand. Always common excavation. Resistant minerals such as quartz may be present as "stringers" or "dikes."

Note: This chart and its horizontal categories are more readily applied to rocks with feldspars and mafic minerals. Weathering in various sedimentary rocks, particularly limestones and poorly indurated sediments, will not always fit the categories established. This chart and weathering categories may have to be modified for particular site conditions or alteration such as hydrothermal effects; however, the basic framework and similar descriptors are to be used.

○ Combination descriptors are permissible where equal distribution of both weathering characteristics are present over significant intervals or where characteristics present are "in between" the diagnostic feature. However, dual descriptors should not be used where significant, identifiable zones can be delineated. When given as a range only two adjacent terms may be combined. "Decomposed to slightly weathered," or "moderately weathered to fresh" are not acceptable.

† Does not include directional weathering along shears or faults and their associated features. For example, a shear zone that carried weathering to great depths into a fresh rock mass would not require the rock mass to be classified as weathered.

§ These are generalizations and should not be used as diagnostic features for weathering or excavation classification. These characteristics vary to a large extent based on naturally weak materials or cementation and type of excavation.

FRACTURE DENSITY

Modified from United States Bureau of Reclamation, Engineering Geology Field Manual.

FRACTURE DENSITY- Based on the spacing of all natural fractures in an exposure or core recovery lengths in boreholes; excludes mechanical breaks, shears, and shear zones; however, shear-disturbed zones (fracturing outside the shear) are included. Descriptors for fracture density apply to all rock exposures such as tunnel walls, dozer trenches, outcrops, or foundation cut slopes and inverts, as well as boreholes. Descriptive criteria presented below are based on borehole cores where lengths are measured along the core axis, for other exposures the criteria is distance measured between fractures (size of blocks).

UNFRACTURED (FD0): No fractures.

VERY SLIGHTLY FRACTURED (FD1): Core recovered mostly in lengths greater than 1 m.

SLIGHTLY TO VERY SLIGHTLY FRACTURED (FD2)*

SLIGHTLY FRACTURED (FD3): Core recovered mostly in lengths from 300 to 1000 mm, with few scattered lengths less than 300 mm or greater than 1000 mm.

MODERATELY TO SLIGHTLY FRACTURED (FD4)*

MODERATELY FRACTURED (FD5): Core recovered mostly in 100 to 300 mm lengths with most lengths about 200 mm.

INTENSELY TO MODERATELY FRACTURED (FD6)*

INTENSELY FRACTURED (FD7): Lengths average from 30 to 100 mm with scattered fragmented intervals. Core recovered mostly in lengths less than 100 mm.

VERY INTENSELY TO INTENSELY FRACTURED (FD8)*

VERY INTENSELY FRACTURED (FD9): Core recovered mostly as chips and fragments with a few scattered short core lengths.

* Combinations of fracture densities (e.g. very intensely to intensely fractured, or moderately to slightly fractured) are used where equal distribution of both fracture density characteristics are present over a significant interval or exposure, or where characteristics are "in between" the descriptor definitions.

ROCK HARDNESS DESCRIPTORS

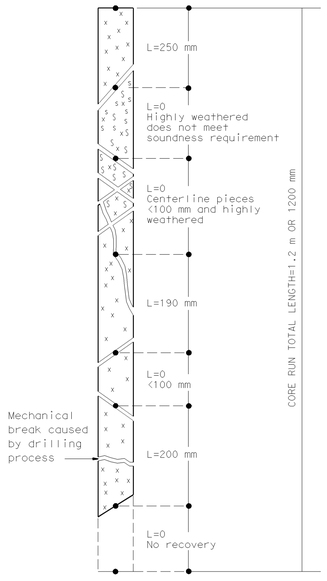
Alphanumeric Descriptor	Descriptor	Criteria
H1	Extremely hard	Core, fragment, or exposure cannot be scratched with knife or sharp pick; can only be chipped with repeated heavy hammer blows.
H2	Very hard	Cannot be scratched with knife of sharp pick. Core or fragment breaks with repeated heavy hammer blows.
H3	Hard	Can be scratched with knife or sharp pick with difficulty (heavy pressure). Heavy hammer blow required to break specimen.
H4	Moderately hard	Can be scratched with knife or sharp pick with light or moderate pressure. Core or fragment breaks with moderate hammer blow.
H5	Moderately soft	Can be grooved 2 mm deep by knife or sharp pick with moderate or heavy pressure. Core or fragment breaks with light hammer blow or heavy manual pressure.
H6	Soft	Can be grooved or gouged easily by knife or sharp pick with light pressure, can be scratched with fingernail. Breaks with light to moderate manual pressure.
H7	Very soft	Can be readily indented, grooved or gouged with fingernail, or carved with a knife. Breaks with light manual pressure.

Any bedrock unit softer than H7, very soft, is to be described using ASTM D-2488 consistency descriptors.

Note: Although "sharp pick" is included in these definitions, descriptions of ability to be scratched, grooved or gouged by a knife is the preferred criteria.

Modified from United States Bureau of Reclamation, Engineering Geology Field Manual.

ROCK QUALITY DESIGNATION (RQD) & PERCENT RECOVERY (REC) LOGGING



RQD (ROCK QUALITY DESIGNATION)	DESCRIPTION OF ROCK QUALITY
0 - 25%	VERY POOR
25 - 50%	POOR
50 - 75%	FAIR
75 - 90%	GOOD
90 - 100%	EXCELLENT

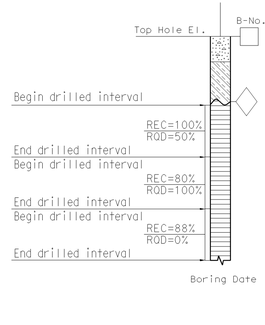
REC = Percent Core Recovery

$$REC = \frac{\sum \text{Length of all core pieces}}{\text{Total core run length}}$$

$$RQD = \frac{\sum \text{Length of sound core pieces} \geq 100\text{ mm}}{\text{Total core run length}}$$

$$RQD = \frac{250+190+200}{1200} \times 100\%$$

RQD = 53% (fair)



(No Scale)
After Deere & Deere, 1989

BEDDING, FOLIATION, OR FLOW TEXTURE DESCRIPTORS

Descriptors	Thickness / Spacing
Massive	Greater than 3 m
Very thickly (bedded, foliated, or banded)	1 to 3 m
Thickly	300 mm to 1 m
Moderately	100 to 300 mm
Thinly	30 to 100 mm
Very thinly	10 to 30 mm
Laminated (intensely foliated or banded)	Less than 10 mm

Modified from United States Bureau of Reclamation, Engineering Geology Field Manual.

JUDD J. KING
No. 2903
GEOTECHNICAL
REGISTERED PROFESSIONAL ENGINEER
STATE OF CALIFORNIA

GEOTECHNICAL SERVICES - DIVISION OF ENGINEERING SERVICES

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DIST.	COUNTY	ROUTE	POST MILES - TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
05	SLO	101	20.9/21.3	X	X

REGISTERED ENGINEER - CIVIL — 3-2-22 DATE

AVILA BEACH DRIVE AT US 101 INTERCHANGE

RETAINING WALL NO. 1 ("N1")/RETAINING WALL NO. 2 ("W1")

As-Built Vertical Datum: | Datum Conversion:

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

CU: 05 EA: 05-1G4801 | BRIDGE NO. 49-E0027/49E-0028

Caltrans Metric

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
05	SLO	101	R31.5/R35.4	104	105

Michael S. Finegan 4-25-05
REGISTERED CIVIL ENGINEER

8-21-06
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER Michael S. Finegan No. C50138 Exp. 6-30-05 CIVIL STATE OF CALIFORNIA

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ENGINEERING SERVICE CENTER	GEOTECHNICAL SERVICES
PREPARED BY	F. Nguyen 03/04
CHECKED BY	M. Finegan

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

DIVISION OF STRUCTURES
STRUCTURE DESIGN 7

BRIDGE NO. 49-0191L
KILOMETER POST 33.9

AVILA RD UC - LEFT BRIDGE (WIDEN)
LOG OF TEST BORINGS 2 OF 3

OSF GEOLOGIST LOG OF TEST BORINGS SHEET (METRIC) (REV. 5/2003)

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

CU 05
EA 485611

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY): 4-15-05, 2-27-06

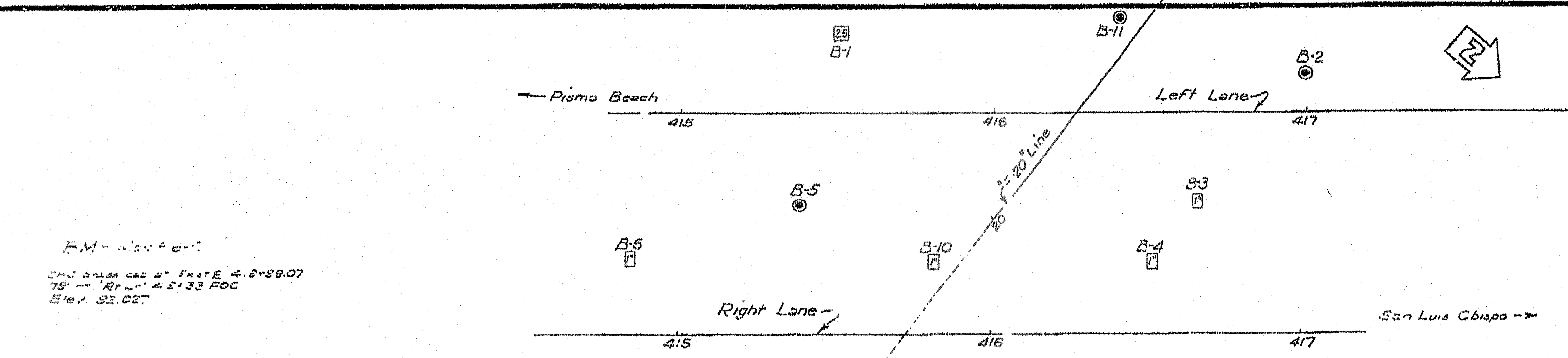
SHEET 17 OF 18

FILE => 49-0191-z-lotb2.dgn

USERNAME => avolde2 DATE PLOTTED => 10-NOV-2009 TIME PLOTTED => 12:20

Plate 1 - As Built LOTB

FED. ROAD DIV. No.	STATE	PROJ. No.	FISCAL YEAR	SHEET No.	TOTAL SHEETS
7	CAL.			162	177



DIST.	COUNTY	ROUTE	SECTION	SHEET No.	TOTAL SHEETS
V	SLO				

DATE APPROVED April 1, 1963

GEOTECHNICAL SERVICES - DIVISION OF ENGINEERING SERVICES

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DIST.	COUNTY	ROUTE	POST MILES - TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
05	SLO	101	20.9/21.3	X	X

REGISTERED ENGINEER - CIVIL   DATE 3-2-22

AVILA BEACH DRIVE AT US 101 INTERCHANGE

RETAINING WALL NO. 1 ("N1")/RETAINING WALL NO. 2 ("W1")

As-Built Vertical Datum: Datum Conversion:

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

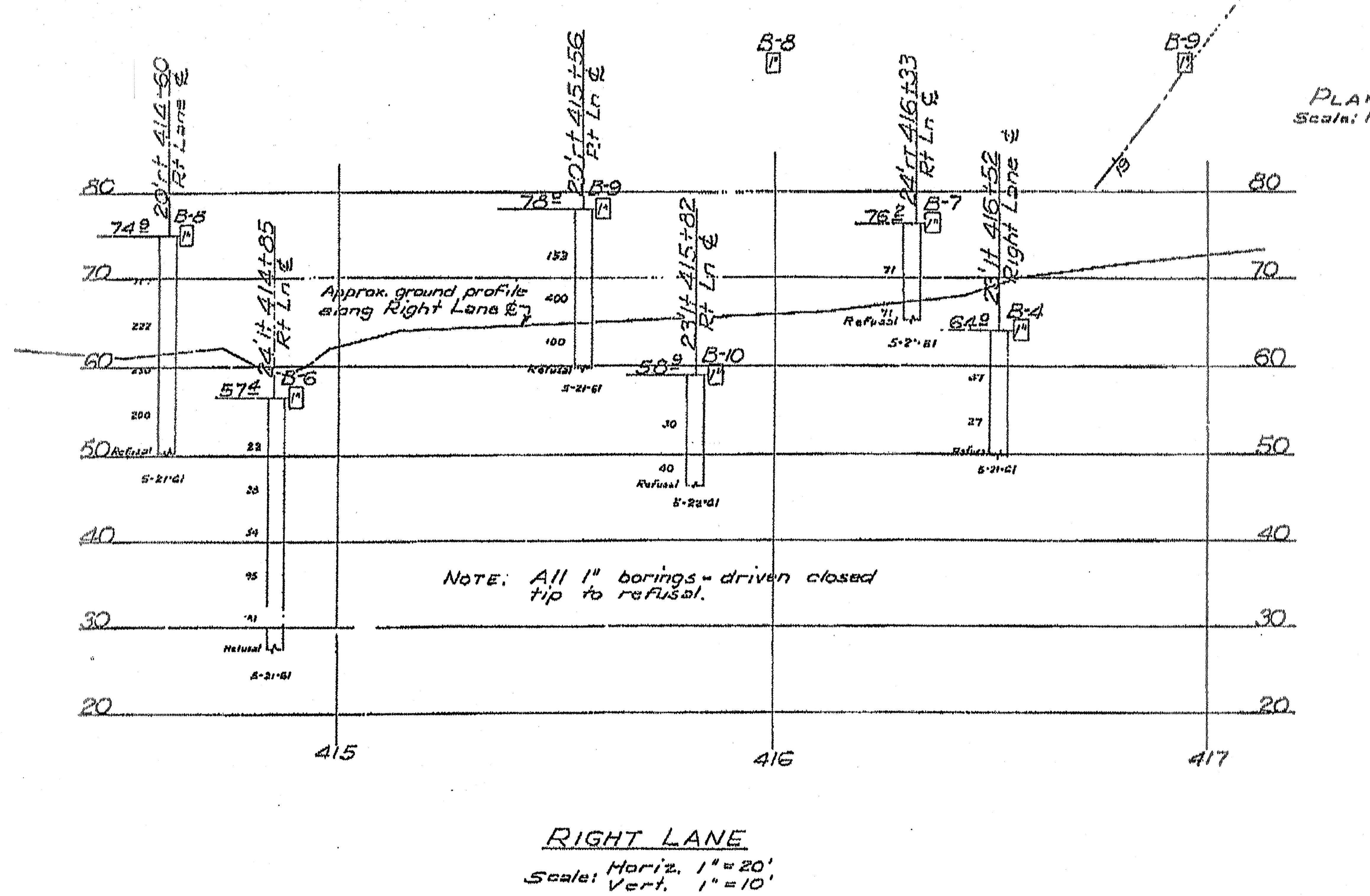
CU: 05
EA: 05-1G4801

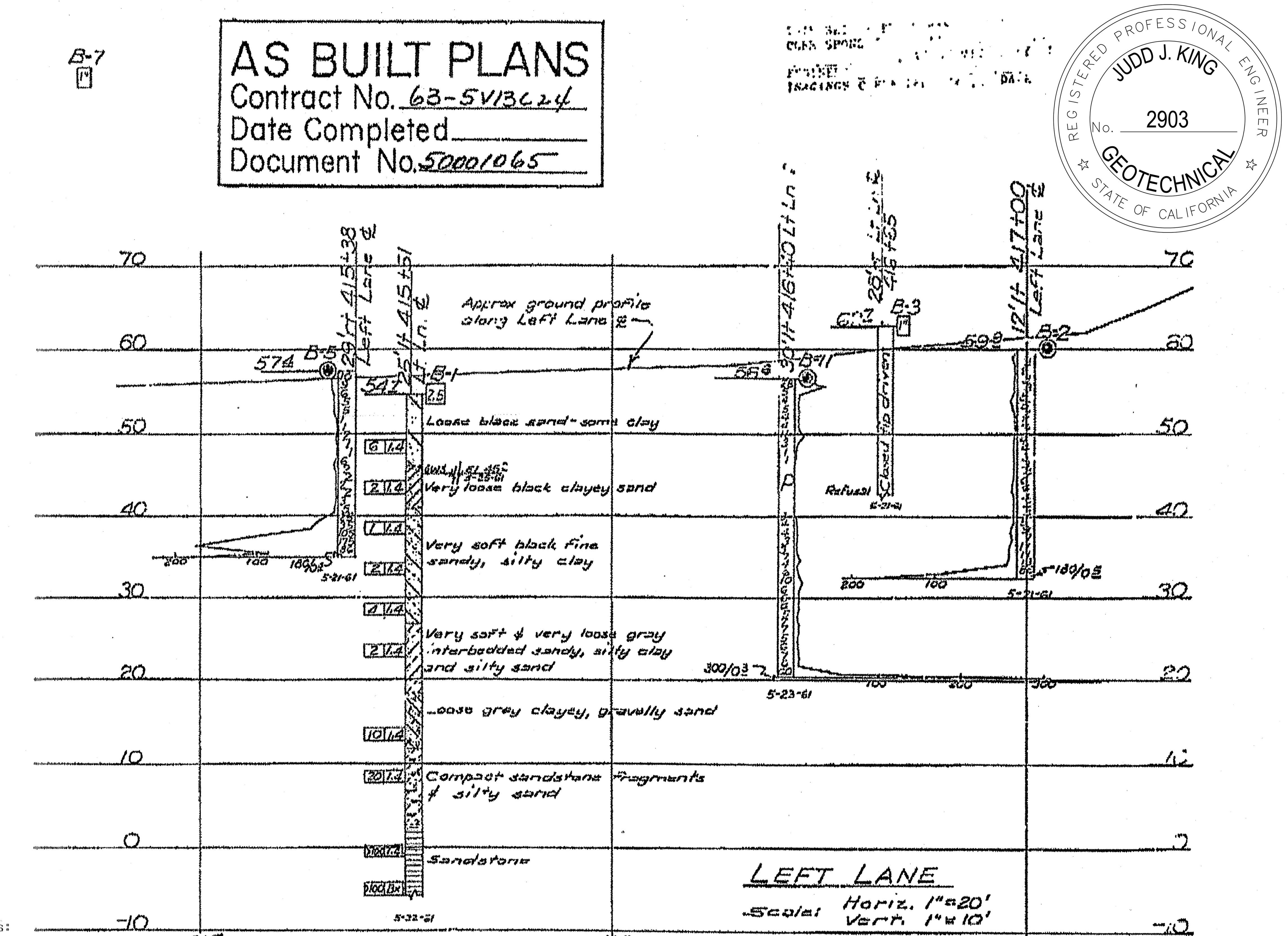
BRIDGE NO. 49-E0027/49E-0028

AS BUILT PLANS
Contract No. 63-5V13C24
Date Completed
Document No. 50001065

REGISTERED PROFESSIONAL ENGINEER — JUDD J. KING — No. 2903 — GEOTECHNICAL — STATE OF CALIFORNIA

BRIDGE DEPARTMENT





FIELD STUDY	B. Shoulor	5-61
DRAWN	B. Darr	7-61
CHECKED	W. Shoulor	10-61

Revisions made to this Log of Test Borings from the original 1961 Log of Test Borings are the addition of the following table and notes:

BORING	STATION	OFFSET FROM "CL2" LINE
B-1	33+68.099	11.378 m LT
B-2	34+11.466	7.835 m LT
B-3	34+06.777	4.402 m RT
B-4	33+96.727	10.485 m RT
B-5	33+63.881	5.055 m RT
B-6	33+47.794	10.579 m RT
B-7	33+91.045	24.832 m RT
B-8	33+40.131	23.966 m RT
B-9	33+69.535	23.809 m RT
B-10	33+77.428	10.644 m RT
B-11	33+92.211	13.076 m LT

Notes:

1. See the General Plan and/or Foundation Plan for Metric Stationing.
2. Structure Design produced the data presented in the table above. The data are the metric locations for the As-Built Test Borings referenced to the proposed new 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.

CLASSIFICATION OF MATERIAL BASED ON STANDARD GRADE SIZE LIMITS

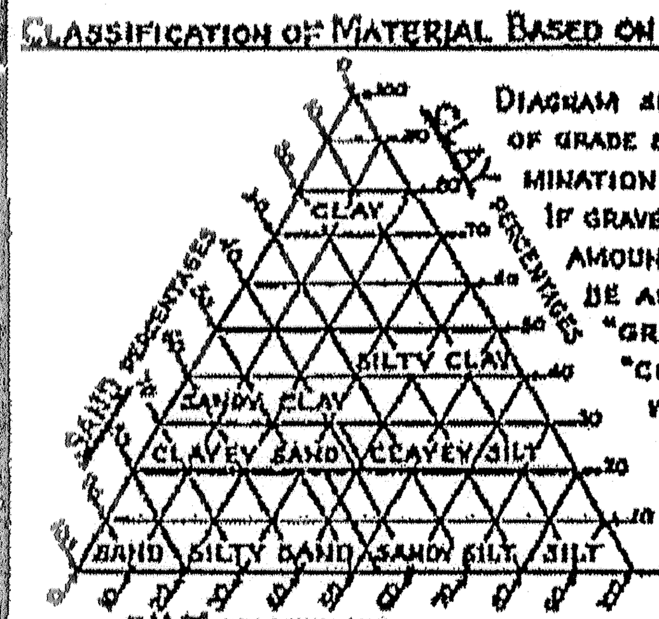


DIAGRAM SHOWING THE BASIS FOR ESTIMATES OF GRADE SIZE DISTRIBUTION USED IN DETERMINATION OF CLASS NAMES. IF GRAVEL IS PRESENT IN APPRECIABLE AMOUNTS THE TERM "GRAVELLY" MAY BE ADDED TO THE CLASS NAME, VIZ. "GRAVELLY SAND." THE TERMS "COARSE", "MEDIUM" AND "FINE" WHEN USED TO DESCRIBE SAND, SILT AND GRAVEL REFER TO STANDARD GRADE SIZE LIMITS.

LEGEND OF EARTH MATERIALS

- GRAVEL
- SAND
- SILT
- CLAY
- SANDY CLAY OR CLAYEY SAND
- SANDY SILT OR SILTY SAND
- SILTY CLAY OR CLAYEY SILT
- PEAT AND/OR ORGANIC MATTER
- FILL MATERIAL
- IGNEOUS ROCK
- SEDIMENTARY ROCK
- METAMORPHIC ROCK

To accompany plans dated 8-21-06

DIVISION OF ENGINEERING SERVICES - GEOTECHNICAL SERVICES

As-Built Log of Test Borings sheet is considered an informational 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. 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
05	SLO	101	R31.5/R35.4	105	105

REGISTERED CIVIL ENGINEER   DATE 4/25/05

AVILA RD UC - LEFT BRIDGE (WIDEN)

LOG OF TEST BORINGS 3 OF 3

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

CU: 05
EA: 485611

BRIDGE No. 49-0191L

Sheet 18 of 18

To get to the Caltrans web site, go to: http://www.dot.ca.gov

REGISTERED PROFESSIONAL ENGINEER — Michael S. Finegan — No. C50138 — Exp. 6-30-05 — CIVIL — STATE OF CALIFORNIA

NOTE

Classification of earth material as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis.

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

AVILA ROAD UNDERCROSSING

LOG OF TEST BORINGS

SCALE As shown | BRIDGE 49-191 R/L | FILE | DRAWING C-49191-11

PR-49191-5   295

162

I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY DIRECTION AND CONTROL ON THIS DATE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF PUBLIC WORKS.

49-0191-z-lotb3.tif

APPENDIX A - BORING LOGS

GROUP SYMBOLS AND NAMES

Graphic / Symbol	Group Names
GW	Well-graded GRAVEL Well-graded GRAVEL with SAND
GP	Poorly graded GRAVEL Poorly graded GRAVEL with SAND
GW-GM	Well-graded GRAVEL with SILT Well-graded GRAVEL with SILT and SAND
GW-GC	Well-graded GRAVEL with CLAY (or SILTY CLAY) Well-graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)
GP-GM	Poorly graded GRAVEL with SILT Poorly graded GRAVEL with SILT and SAND
GP-GC	Poorly graded GRAVEL with CLAY (or SILTY CLAY) Poorly graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)
GM	SILTY GRAVEL SILTY GRAVEL with SAND
GC	CLAYEY GRAVEL CLAYEY GRAVEL with SAND
GC-GM	SILTY, CLAYEY GRAVEL SILTY, CLAYEY GRAVEL with SAND
SW	Well-graded SAND Well-graded SAND with GRAVEL
SP	Poorly graded SAND Poorly graded SAND with GRAVEL
SW-SM	Well-graded SAND with SILT Well-graded SAND with SILT and GRAVEL
SW-SC	Well-graded SAND with CLAY (or SILTY CLAY) Well-graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)
SP-SM	Poorly graded SAND with SILT Poorly graded SAND with SILT and GRAVEL
SP-SC	Poorly graded SAND with CLAY (or SILTY CLAY) Poorly graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)
SM	SILTY SAND SILTY SAND with GRAVEL
SC	CLAYEY SAND CLAYEY SAND with GRAVEL
SC-SM	SILTY, CLAYEY SAND SILTY, CLAYEY SAND with GRAVEL
PT	PEAT
	COBBLES COBBLES and BOULDERS BOULDERS

Graphic / Symbol	Group Names
CL	Lean CLAY Lean CLAY with SAND Lean CLAY with GRAVEL SANDY lean CLAY SANDY lean CLAY with GRAVEL GRAVELLY lean CLAY GRAVELLY lean CLAY with SAND
CL-ML	SILTY CLAY SILTY CLAY with SAND SILTY CLAY with GRAVEL SANDY SILTY CLAY SANDY SILTY CLAY with GRAVEL GRAVELLY SILTY CLAY GRAVELLY SILTY CLAY with SAND
ML	SILT SILT with SAND SILT with GRAVEL SANDY SILT SANDY SILT with GRAVEL GRAVELLY SILT GRAVELLY SILT with SAND
OL	ORGANIC lean CLAY ORGANIC lean CLAY with SAND ORGANIC lean CLAY with GRAVEL SANDY ORGANIC lean CLAY SANDY ORGANIC lean CLAY with GRAVEL GRAVELLY ORGANIC lean CLAY GRAVELLY ORGANIC lean CLAY with SAND
OL	ORGANIC SILT ORGANIC SILT with SAND ORGANIC SILT with GRAVEL SANDY ORGANIC SILT SANDY ORGANIC SILT with GRAVEL GRAVELLY ORGANIC SILT GRAVELLY ORGANIC SILT with SAND
CH	Fat CLAY Fat CLAY with SAND Fat CLAY with GRAVEL SANDY fat CLAY SANDY fat CLAY with GRAVEL GRAVELLY fat CLAY GRAVELLY fat CLAY with SAND
MH	Elastic SILT Elastic SILT with SAND Elastic SILT with GRAVEL SANDY elastic SILT SANDY elastic SILT with GRAVEL GRAVELLY elastic SILT GRAVELLY elastic SILT with SAND
OH	ORGANIC fat CLAY ORGANIC fat CLAY with SAND ORGANIC fat CLAY with GRAVEL SANDY ORGANIC fat CLAY SANDY ORGANIC fat CLAY with GRAVEL GRAVELLY ORGANIC fat CLAY GRAVELLY ORGANIC fat CLAY with SAND
OH	ORGANIC elastic SILT ORGANIC elastic SILT with SAND ORGANIC elastic SILT with GRAVEL SANDY elastic ELASTIC SILT SANDY ORGANIC elastic SILT with GRAVEL GRAVELLY ORGANIC elastic SILT GRAVELLY ORGANIC elastic SILT with SAND
OL/OH	ORGANIC SOIL ORGANIC SOIL with SAND ORGANIC SOIL with GRAVEL SANDY ORGANIC SOIL SANDY ORGANIC SOIL with GRAVEL GRAVELLY ORGANIC SOIL GRAVELLY ORGANIC SOIL with SAND

FIELD AND LABORATORY TESTS

C	Consolidation (ASTM D2435)
CL	Collapse Potential (ASTM D5333)
CP	Compaction Curve (ASTM D1557)
CR	Corrosion, Sulfates, Chlorides (CTM 643; ASTM D4972, ASTM G187, ASTM D4327)
CU	Consolidated Undrained Triaxial (ASTM D4767)
DS	Direct Shear (ASTM D3080)
EI	Expansion Index (ASTM D4829)
M	Moisture Content (ASTM D2216)
OC	Organic Content (ASTM D2974)
P	Permeability (ASTM 5084)
PA	Particle Size Analysis (ASTM D422-63 [2007])
PI	Liquid Limit, Plastic Limit, Plasticity Index (ASTM D4318)
PL	Point Load Index (ASTM D5731)
PM	Pressure Meter
PP	Pocket Penetrometer
R	R-Value (CTM 301)
SE	Sand Equivalent (CTM 217)
SG	Specific Gravity (AASHTO T 100)
SL	Shrinkage Limit (ASTM D427)
SW	Swell Potential (ASTM D4546)
TV	Pocket Torvane
UC	Unconfined Compression - Soil (ASTM D2166) Unconfined Compression - Rock (ASTM D7012)
UU	Unconsolidated Undrained Triaxial (ASTM D2850)
UW	Unit Weight (ASTM D4767, ASTM D7263)
VS	Vane Shear (AASHTO T 223-96 [2004])
-200	200 Wash (ASTM D1140)

SAMPLER GRAPHIC SYMBOLS

- Standard Penetration Test (SPT) (2" O.D.)
- Standard California Sampler (2.5" O.D.)
- Modified California Sampler (3" O.D.)
- Shelby Tube
- Piston Sampler
- Rock Core
- Grab Sample
- Bulk Sample
- Other (see remarks)

DRILLING METHOD SYMBOLS

- Auger Drilling
- Rotary Drilling
- Dynamic Cone or Hand Driven
- Diamond Core

WATER LEVEL SYMBOLS

- First Water Level Reading (during drilling)
- Static Water Level Reading (short-term)
- Static Water Level Reading (long-term)

Yeh and Associates, Inc.
Geotechnical • Geological • Construction Services

REPORT TITLE
LEGEND FOR SOIL CLASSIFICATION

PROJECT NAME
Avila Beach Drive at US 101 Interchange Improvements

DATE
6/18/2021

SHEET
1 of 1

LOGGED BY	BEGIN DATE	COMPLETION DATE	HAMMER TYPE	BORING NUMBER
J. Cravens	**9-18-19**	**9-18-19**	**140-lb Automatic Trip**	**19W-01**
FINAL BY			BOREHOLE LOCATION (Lat/Long or North/East and Datum)	SURFACE ELEVATION
J. King			**--/--**	**113.0 ft**
DRILLING METHOD			BOREHOLE LOCATION (Offset, Station, Line)	WEATHER NOTES
8" Hollow Stem Auger			**119' Lt. Sta. 119+92, "AV1" Line**	**Sunny, cool, breezy**
DRILLER			LOCATION DESCRIPTION	BACKFILLED WITH
S/G Drilling Co.			**62.8' N of conrete barrier for undercrossing, 6.4' W of guardrail**	**Portland cement grout**
DRILL RIG			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
CME-85			**Not Encountered**	**35.1 ft**

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (ksf)	Drilling Method	Casing Depth	Remarks
	0		CLAYEY SAND with GRAVEL (SC); loose; brown; dry; trace fine GRAVEL; fine SAND; slightly hydrophobic; (FILL).		K										
111	2				36	10 6 4	10	11		8					-200 (19% G, 55% S, 26% F)
109	4		Very loose; brown; dry; medium to coarse, subangular GRAVEL; fine SAND; slightly hydrophobic.												
	5				37	3 2 2	4	44							
107	6														
	7														
105	8														
	9				38	6 25 50/4"	75/10"100								
103	10		Very dense; fine to medium, subangular GRAVEL; fine to coarse SAND; slightly hydrophobic; hard, dark gray SANDSTONE COBBLE in shoe.												
	11														
101	12														
	13														Minor rig chatter at ~13'
99	14				--	50/5"	Ref/5"	0							
	15														
97	16														Ittermittent rig chatter from ~16' to ~19.5'
	17		SANDY fat CLAY with GRAVEL (CH); hard; dark brown; dry; fine, subangular GRAVEL; fine to medium SAND.												
95	18														
	19				39	13 15 26	41	67		8		>4.5PP			-200 (1% G, 76% S, 22% F) CR (pH = 6.88, r = 656 ohm-cm, SO_4^{2-} = 4,885 mg/kg, Cl^- = 14 mg/kg)
93	20		CLAYEY SAND (SC); medium dense; light yellowish brown; dry; fine SAND; few rust stains and trace caliche; dark brown sandy fat CLAY (CH) in shoe.												
	21														
91	22		SANDY lean CLAY with GRAVEL (CL); hard; dark brown; dry; fine to coarse, subangular GRAVEL; fine to coarse SAND; trace rust stains.												
	23														
89	24				40	28 50/6"	50/6"	75		15	99	>4.5PP			CU
	25														

(continued)

5 BR - STANDARD 216-423 BORING LOGS.GPJ CALIFORNIA YEH LIBRARY (YEH V2 APRIL 2019)_7.GLB 12/6/19

Yeh and Associates, Inc.
Geotechnical • Geological • Construction Services

PROJECT NAME	**Avila Beach Drive at US 101 Interchange Improvements**
PROJECT NUMBER	**216-423**
BORING NUMBER	**19W-01**
REVISION DATE	**6/18/2021**
SHEET	**1 of 2**

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (ksf)	Drilling Method	Casing Depth	Remarks
	25		Poorly graded SAND with CLAY and GRAVEL (SP-SC); very dense; light yellowish brown; dry; fine to medium, subangular GRAVEL; fine SAND; trace rust stains.												
87	26														Rig chatter at ~26'
	27		Poorly graded SAND with CLAY (SP-SC); very dense; light yellowish brown; moist; fine SAND; trace rust stains.												
85	28														
	29				41	50/5"	Ref/5"	40							
83	30														
	31		SANDY lean CLAY with GRAVEL (CL); hard; light brown; moist; medium, subangular GRAVEL; fine to medium SAND.												Rig chatter at ~31'
81	32														
	33														
79	34				42	50/2"	Ref/2"	25		7					
	35														Rig chatter at ~35'. Auger refusal at ~35.1'
77	36		Bottom of borehole at 35.1 ft bgs												
	37		This Boring Record was developed in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (2010) except as noted on the Soil or Rock Legend or below.												
75	38														
	39														
73	40														
	41														
71	42														
	43														
69	44														
	45														
67	46														
	47														
65	48														
	49														
63	50														
	51														
61	52														
	53														
59	54														
	55														

Yeh and Associates, Inc.
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PROJECT NAME	**Avila Beach Drive at US 101 Interchange Improvements**
PROJECT NUMBER	**216-423**
BORING NUMBER	**19W-01**
REVISION DATE	**6/18/2021**
SHEET	**2 of 2**

5 BR - STANDARD 216-423 BORING LOGS.GPJ CALIFORNIA YEH LIBRARY (YEH V2 APRIL 2019)_7.GLB 12/6/19

LOGGED BY	BEGIN DATE	COMPLETION DATE	HAMMER TYPE	BORING NUMBER
J. King/J. Cravens	9-17-19	9-17-19	140-lb Automatic Trip	19W-02
FINAL BY			BOREHOLE LOCATION (Lat/Long or North/East and Datum)	SURFACE ELEVATION
J. King			--/--	124.0 ft
DRILLING METHOD			BOREHOLE LOCATION (Offset, Station, Line)	WEATHER NOTES
8" Hollow Stem Auger			63' Rt. Sta. 611+78, "R-22a" Line	Clear, warm
DRILLER			LOCATION DESCRIPTION	BACKFILLED WITH
S/G Drilling Co.			Shoulder of SB Hwy 101 10' W of EP, 40' S of abutment	6-sack cement slurry
DRILL RIG			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
CME-85			Not Encountered	40.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (ksf)	Drilling Method	Casing Depth	Remarks
	0		Well-graded GRAVEL with CLAY and SAND (GW-GC); dense; brown; dry; fine to coarse, angular GRAVEL; (FILL).		F										
122	2				19	8 20 29	49	78		17					PA (70% G, 24% S, 6% F) CR (pH = 5.49, r = 1,169 ohm-cm)
120	4		Moist.		20	17 18 13	31	89		18	82				CU
118	6														
116	8				21	50/6"	Ref/6"	100							CR (pH = 5.51, r = 1,842 ohm-cm)
114	10														
112	12														
110	14		Well-graded SAND with CLAY and GRAVEL (SW-SC); very dense; brown; dry; caliche deposits, oxidized stains.		22	46 39 50	89	89		17	85				PA (44% G, 44% S, 12% F)
108	16														
106	18				23	31 50/4"	50/4"	100							CR (pH = 6.08, r = 1,968 ohm-cm)
104	20														
102	22		SANDY fat CLAY with GRAVEL (CH); hard; dark brown; dry; fine to medium, subrounded to subangular GRAVEL; fine to medium SAND; few rust stains.												
100	24				24	31 29 50/4"	79/10"	69		12	95	>4.5PP			CU
	25														

(continued)

5 BR - STANDARD 216-423 BORING LOGS.GPJ CALIFORNIA YEH LIBRARY (YEH V2 APRIL 2019)_7.GLB 12/6/19

Yeh and Associates, Inc.
Geotechnical • Geological • Construction Services

PROJECT NAME	
Avila Beach Drive at US 101 Interchange Improvements	
PROJECT NUMBER	
216-423	
BORING NUMBER	
19W-02	
REVISION DATE	SHEET
6/18/2021	1 of 2

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (ksf)	Drilling Method	Casing Depth	Remarks
	25		SANDY fat CLAY with GRAVEL (CH) *(continued)*.												
98	26														
	27														Rig chatter at ~27'
96	28														
	29		Very stiff; moist.		25	10 12 14	26	97				2.75PP			
94	30														
	31														
92	32		SANDY lean CLAY with GRAVEL (CL); very stiff; light grayish brown mtottled with gray and red; moist; fine to medium, subangular to angular GRAVEL; fine to medium SAND; few rust stains; coarse GRAVEL clast at 34.5'.												Rig chatter at ~31.5'
	33														
90	34				26	11 18 26	44	50		26	91	2.5PP			
	35														
88	36														
	37		CLAYEY SAND with GRAVEL (SC); medium dense; grayish brown; moist; fine to medium, subrounded to subangular GRAVEL; fine to coarse SAND; trace rust stains; 1" layer of poorly graded SAND (SP) at 38.5', light yellowish brown, moist, fine SAND.												
86	38														
	39				27	12 12 17	29	100				2.0PP			
84	40		Bottom of borehole at 40.0 ft bgs												
	41														
82	42		This Boring Record was developed in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (2010) except as noted on the Soil or Rock Legend or below.												
	43														
80	44														
	45														
78	46														
	47														
76	48														
	49														
74	50														
	51														
72	52														
	53														
70	54														
	55														

5 BR - STANDARD 216-423 BORING LOGS.GPJ CALIFORNIA YEH LIBRARY (YEH V2 APRIL 2019)_7.GLB 12/6/19

Yeh and Associates, Inc.
Geotechnical • Geological • Construction Services

PROJECT NAME
Avila Beach Drive at US 101 Interchange Improvements

PROJECT NUMBER
216-423

BORING NUMBER
19W-02

REVISION DATE
6/18/2021

SHEET
2 of 2

LOGGED BY	BEGIN DATE	COMPLETION DATE	HAMMER TYPE	BORING NUMBER
J. Cravens	**9-16-19**	**9-16-19**	**140-lb Automatic Trip**	**19W-03**
FINAL BY			BOREHOLE LOCATION (Lat/Long or North/East and Datum)	SURFACE ELEVATION
J. King			**--/--**	**116.0 ft**
DRILLING METHOD			BOREHOLE LOCATION (Offset, Station, Line)	WEATHER NOTES
8" Hollow Stem Auger			**1' Lt. Sta. 609+60 "R-22a" Line**	**Sunny, cool**
DRILLER			LOCATION DESCRIPTION	BACKFILLED WITH
S/G Drilling Co.			**SB on-ramp of Hwy 101 384' S of Hwy 101 SB entrance sign, 4.5' W of EP**	**6-sack cement slurry**
DRILL RIG			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
CME-85			**Not Encountered**	**40.6 ft**

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (ksf)	Drilling Method	Casing Depth	Remarks
	0		4.5" ASPHALT CONCRETE.		A					7					PA (9% G, 33% S, 57% F)
	1		6" AGGREGATE BASE.												CR (pH = 6.58, r = 3,087 ohm-cm)
			SANDY fat CLAY with GRAVEL (CH); hard; dark brown; dry; fine to coarse, subangular, light brown,												R (R-Value = 46)
114	2		SANDSTONE GRAVEL; fine to medium SAND; few to some rust stains; (FILL).		1	15 31 35	66	89		21	95	>4.5PP			CU
	3														
112	4														
	5		CLAYEY SAND with GRAVEL (SC); very dense; brown; dry; fine to coarse, subangular, dark gray SILTSTONE GRAVEL; fine to medium SAND; micaceous; trace rust stains.		2	19 21 50/5"	71/11"	89		17	91				
110	6														
	7														
108	8														Rig chatter at ~8
			SANDY fat CLAY (CH); hard; dark brown; dry; trace fine to medium, subangular GRAVEL; fine, light brown SAND; trace rust stains.												
106	10				3	12 32 30	62	83				>4.5PP			
	11														
104	12														
	13														Rig chatter at ~13'
102	14		CLAYEY SAND with GRAVEL (SC); medium dense; dark brown; dry; medium to coarse, subangular to angular, light brown to grayish brown GRAVEL; light brown SAND; few rust stains.												
	15				4	15 17 28	45	86		17	94	>4.5PP			-200 (36% G, 50% S, 15% F)
100	16														
	17														
98	18														
	19		Dense; light brown; dry; subrounded to subangular GRAVEL; fine SAND; trace rust stians; 2" layer of sandy fat CLAY (CH) at 21' , very stiff (3.0pp), dark brown.												
96	20				5	3 8 29	37	78		15					-200 (26% G, 61% S, 12% F)
	21														
94	22														
	23														Rig chatter at ~23'
92	24		SANDY lean CLAY (CL); stiff; dark brown; moist; fine to medium SAND; trace rust stains; coarse, angular to subangular, light brown SANDSTONE GRAVEL in												
	25														

(continued)

5 BR - STANDARD 216-423 BORING LOGS.GPJ CALIFORNIA YEH LIBRARY (YEH V2 APRIL 2019)_7.GLB 12/6/19

Yeh and Associates, Inc.
Geotechnical • Geological • Construction Services

PROJECT NAME	**Avila Beach Drive at US 101 Interchange Improvements**
PROJECT NUMBER	**216-423**
BORING NUMBER	**19W-03**
REVISION DATE	**6/18/2021**
SHEET	**1 of 2**

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (ksf)	Drilling Method	Casing Depth	Remarks
	25		shoe.												
90	26		SANDY lean CLAY (CL) *(continued)*.		6	5 8 12	20	56		25	92	1.25PP			
	27														
88	28														
	29		Poorly graded SAND with CLAY and GRAVEL (SP-SC); very dense; light brown; dry; medium to coarse, subangular to angular, light brown SANDSTONE GRAVEL; fine SAND; rust stains on fracture surfaces of GRAVEL.												
86	30				7	13 25 33	58	78							
	31														
84	32														
	33														
82	34		CLAYEY GRAVEL with SAND (GC); medium dense; light brown; dry; subangular to angular GRAVEL; fine SAND; few rust stains; some structure in shoe.												
	35				8	11 17 21	38	67		27	86				
80	36														
	37														
78	38														
	39		SANDY fat CLAY with GRAVEL (CH); very stiff; dark brown; dry; fine to coarse, subangular to angular GRAVEL; fine SAND.												
76	40				9	16 50/1"	50/1"	100				3.0PP			
	41		Bottom of borehole at 40.6 ft bgs												
74	42														
	43		This Boring Record was developed in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (2010) except as noted on the Soil or Rock Legend or below.												
72	44														
	45														
70	46														
	47														
68	48														
	49														
66	50														
	51														
64	52														
	53														
62	54														
	55														

5 BR - STANDARD 216-423 BORING LOGS.GPJ CALIFORNIA YEH LIBRARY (YEH V2 APRIL 2019)_7.GLB 12/6/19

Yeh and Associates, Inc.
Geotechnical • Geological • Construction Services

PROJECT NAME
Avila Beach Drive at US 101 Interchange Improvements

PROJECT NUMBER
216-423

BORING NUMBER
19W-03

REVISION DATE
6/18/2021

SHEET
2 of 2

COUNTY OF SAN LUIS OBISPO HEALTH AGENCY
ENVIRONMENTAL HEALTH SERVICES DIVISION
2156 Sierra Way STE. B, San Luis Obispo, CA 93401
PO Box 1489, San Luis Obispo, CA 93406
Phone: (805) 781-5544 Fax: (805) 781-4211
Email: ehs@co.slo.ca.us

19W-01

OFFICE USE
Permit No. 2019-055
Submittal Complete ☐
Date 9/3/19
WP No. WP1026524
Invoice No. IN0121035
Scanned ____/____/____

MONITORING WELL PERMIT APPLICATION

NUMBER OF WELLS 1

SITE INFORMATION

Proposed Well Site Address: NW embankment of 101 Interchange at Avila Beach Drive City or Area: San Luis Obispo County

Assessor's Parcel Number: N/A Site served by a water company, agency or district? ☑ No ☐ Yes

GPS 35.180025° N -120.699979° W Coastal Zone? Y Water Co. Name: N/A

WELL OWNER INFORMATION

Well Owner: San Luis Obispo County: Genaro Diaz Telephone Number: (805) 781-5252

PROPERTY OWNER INFORMATION

Property Owner Name: California Department of Transportation: Paul Valadao

Mailing Address: 50 Higuera Street City: San Luis Obispo Zip: 93401

Telephone Number: (805) 549-3016 Email: paul.valadao@dot.ca.gov

WELL CONSULTANT INFORMATION

Consultant Company: Yeh and Associates, Inc. Telephone Number: 805-801-6416

Consultant Name: Judd King Email: jking@yeh-eng.com

WELL TYPE

- ☑ Construction
- ☐ Repair/Modify

PURPOSE OF WELL

- ☑ Monitoring
- ☐ Test Well
- ☐ Vapor Extraction
- ☐ Electric ≥ 50'
- ☐ Cathodic Protection ≥ 50'
- ☑ Soil Testing ≥ 25'
- ☐ Sparging ≥ 25'

(Permit required for listed depth or encountering groundwater)

DRILLING METHOD

- ☑ Rotary
- ☐ Reverse Rotary
- ☐ Air Rotary
- ☐ Cable Tool
- ☐ Other

Proposed Depth 40 ft Casing Diameter 8 in Annular Seal Depth 40 ft Seal Material: Bentonite grout Proposed Length of Work 1 day

Agency requiring monitoring well implementation, and/or reason for monitoring well: Geotechnical soil sampling for interchange improvement project

WELL DRILLER INFORMATION

Drilling Contractor Name: S/G Drilling Company c/o Randall and Julie Glaze C-57 License No. 611934

Drilling Company Name: S/G Drilling Company Telephone Number: (805) 735-3454

Mailing Address: 308 N 1st Street, Lompoc, CA 93436

Fax: (805) 736-3456 Email Address: sgdrillingcompany@verizon.net

I hereby agree to comply with all applicable laws and regulations of the County of San Luis Obispo and the State of California pertaining to well construction, destruction, repair or modification. Within sixty days after completion of the well, I will furnish Environmental Health Services with a well completion report. This application becomes a valid permit following sign off by Environmental Health Services.

DRILLING SHALL NOT COMMENCE UNTIL THIS APPLICATION IS APPROVED (EHS requires 48 hour notice before completion of work)

Contractor Signature: Julie A Glaze Contractor Printed Name: Julie Glaze Date: 8/28/2019

FOR OFFICE USE ONLY

RECEIVED BY CA DATE 9/3/19 FEE PAID $ 253 CK/CC 29756

WELL SITE APPROVED: YES ☑ NO ☐ BY [signature] DATE 9/3/19

WELL SITE APPROVAL GPS COORDINATES ____ N ____ W

PERMIT EXPIRATION DATE 3/3/2020

SPECIAL REQUIREMENTS FOR DRILLING CONTRACTOR ____

WELL SEAL WITNESSED YES ☐ NO ☐ BY ____ DATE ____ DEPTH ____

WELL SEAL GPS COORDINATES ____ N ____ W

WELL COMPLETION REPORT RECEIVED DATE ____

COUNTY OF SAN LUIS OBISPO HEALTH AGENCY
ENVIRONMENTAL HEALTH SERVICES DIVISION
2156 Sierra Way STE. B, San Luis Obispo, CA 93401
PO Box 1489, San Luis Obispo, CA 93406
Phone: (805) 781-5544 Fax: (805) 781-4211
Email: ehs@co.slo.ca.us

19W-02

OFFICE USE
Permit No. 2019-056
Submittal Complete ☐
Date 9/3/19
WP No. WP1026525
Invoice No. FN012035
Scanned ____/____/____

MONITORING WELL PERMIT APPLICATION

NUMBER OF WELLS 1

SITE INFORMATION

Proposed Well Site Address: SW embankment of 101 Interchange at Avila Beach Drive City or Area: San Luis Obispo County

Assessor's Parcel Number: N/A Site served by a water company, agency or district? ☑ No ☐ Yes

GPS 35.179520° N -120.699504° W Coastal Zone? Y Water Co. Name N/A

WELL OWNER INFORMATION

Well Owner: San Luis Obispo County: Genaro Diaz Telephone Number: (805) 781-5252

PROPERTY OWNER INFORMATION

Property Owner Name: California Department of Transportation: Paul Valadao

Mailing Address: 50 Higuera Street City: San Luis Obispo Zip: 93401

Telephone Number: (805) 549-3016 Email: paul.valadao@dot.ca.gov

WELL CONSULTANT INFORMATION

Consultant Company: Yeh and Associates, Inc. Telephone Number: 805-801-6416

Consultant Name: Judd King Email: jking@yeh-eng.com

WELL TYPE	PURPOSE OF WELL		DRILLING METHOD	
☑ Construction	☑ Monitoring	☐ Electric ≥ 50' ☐ Cathodic Protection ≥ 50'	☑ Rotary	☐ Cable Tool
☐ Repair/Modify	☐ Test Well	☑ Soil Testing ≥ 25' ☐ Sparging ≥ 25'	☐ Reverse Rotary	☐ Other
	☐ Vapor Extraction	(Permit required for listed depth or encountering groundwater)	☐ Air Rotary	

Proposed Depth 40 ft Casing Diameter 8 in Annular Seal Depth 40 ft Seal Material 6-sack slurry Proposed Length of Work 1 day

Agency requiring monitoring well implementation, and/or reason for monitoring well: Geotechnical soil sampling for interchange improvement project

WELL DRILLER INFORMATION

Drilling Contractor Name: S/G Drilling Company c/o Randall and Julie Glaze C-57 License No. 611934

Drilling Company Name: S/G Drilling Company Telephone Number: (805) 735-3454

Mailing Address: 308 N 1st Street, Lompoc, CA 93436

Fax: (805) 736-3456 Email Address: sgdrillingcompany@verizon.net

I hereby agree to comply with all applicable laws and regulations of the County of San Luis Obispo and the State of California pertaining to well construction, destruction, repair or modification. Within sixty days after completion of the well, I will furnish Environmental Health Services with a well completion report. This application becomes a valid permit following sign off by Environmental Health Services.

DRILLING SHALL NOT COMMENCE UNTIL THIS APPLICATION IS APPROVED (EHS requires 48 hour notice before completion of work)

Contractor Signature: Julie A Glaze Contractor Printed Name: Julie Glaze Date: 8/28/2019

FOR OFFICE USE ONLY

RECEIVED BY CR DATE 9/3/19 FEE PAID $ 253-00 CK/CC 29756

WELL SITE APPROVED: YES ☐ NO ☐ BY _____ DATE 9/3/19

WELL SITE APPROVAL GPS COORDINATES _____ N _____ W

PERMIT EXPIRATION DATE 3/3/2020

SPECIAL REQUIREMENTS FOR DRILLING CONTRACTOR _____

WELL SEAL WITNESSED YES ☐ NO ☐ BY _____ DATE _____ DEPTH _____

WELL SEAL GPS COORDINATES _____ N _____ W

WELL COMPLETION REPORT RECEIVED DATE _____

COUNTY OF SAN LUIS OBISPO HEALTH AGENCY
ENVIRONMENTAL HEALTH SERVICES DIVISION
2156 Sierra Way STE. B, San Luis Obispo, CA 93401
PO Box 1489, San Luis Obispo, CA 93406
Phone: (805) 781-5544 Fax: (805) 781-4211
Email: ehs@co.slo.ca.us

19W-03

OFFICE USE
Permit No. 2019-057
Submittal Complete ☐
Date 9/3/19
WP No. WP1026526
Invoice No. INV021035
Scanned ____/____/____

MONITORING WELL PERMIT APPLICATION

NUMBER OF WELLS 1

SITE INFORMATION

Proposed Well Site Address: Southbound on-ramp of 101 Interchange at Avila Beach Drive City or Area: San Luis Obispo County

Assessor's Parcel Number: N/A Site served by a water company, agency or district? ☑ No ☐ Yes

GPS 35.179020° N -120.699284° W Coastal Zone? Y Water Co. Name: N/A

WELL OWNER INFORMATION

Well Owner: San Luis Obispo County: Genaro Diaz Telephone Number: (805) 781-5252

PROPERTY OWNER INFORMATION

Property Owner Name: California Department of Transportation: Paul Valadao

Mailing Address: 50 Higuera Street City: San Luis Obispo Zip: 93401

Telephone Number: (805) 549-3016 Email: paul.valadao@dot.ca.gov

WELL CONSULTANT INFORMATION

Consultant Company: Yeh and Associates, Inc. Telephone Number: 805-801-6416

Consultant Name: Judd King Email: jking@yeh-eng.com

WELL TYPE	PURPOSE OF WELL		DRILLING METHOD	
☑ Construction	☑ Monitoring	☐ Electric ≥ 50' ☐ Cathodic Protection ≥ 50'	☑ Rotary	☐ Cable Tool
☐ Repair/Modify	☐ Test Well	☑ Soil Testing ≥ 25' ☐ Sparging ≥ 25'	☐ Reverse Rotary	☐ Other
	☐ Vapor Extraction	(Permit required for listed depth or encountering groundwater)	☐ Air Rotary	

Proposed Depth 40 ft Casing Diameter 8 in Annular Seal Depth 40 ft Seal Material 6-sack slurry, rapid set concrete patch for AC Proposed Length of Work 1 day

Agency requiring monitoring well implementation, and/or reason for monitoring well: Geotechnical soil sampling for interchange improvement project.

WELL DRILLER INFORMATION

Drilling Contractor Name: S/G Drilling Company c/o Randall and Julie Glaze C-57 License No. 611934

Drilling Company Name: S/G Drilling Company Telephone Number: (805) 735-3454

Mailing Address: 308 N 1st Street, Lompoc, CA 93436

Fax: (805) 736-3456 Email Address: sgdrillingcompany@verizon.net

I hereby agree to comply with all applicable laws and regulations of the County of San Luis Obispo and the State of California pertaining to well construction, destruction, repair or modification. Within sixty days after completion of the well, I will furnish Environmental Health Services with a well completion report. This application becomes a valid permit following sign off by Environmental Health Services.

DRILLING SHALL NOT COMMENCE UNTIL THIS APPLICATION IS APPROVED (EHS requires 48 hour notice before completion of work)

Contractor Signature: Julie A Glaze Contractor Printed Name: Julie Glaze Date: 8/28/2019

FOR OFFICE USE ONLY

RECEIVED BY CP DATE 9/3/19 FEE PAID $ 253- CK/CC 29750

WELL SITE APPROVED: YES ☑ NO ☐ BY [signature] DATE 9/3/19

WELL SITE APPROVAL GPS COORDINATES ____ N ____ W

PERMIT EXPIRATION DATE 3/3/2020

SPECIAL REQUIREMENTS FOR DRILLING CONTRACTOR ____

WELL SEAL WITNESSED YES ☐ NO ☐ BY ____ DATE ____ DEPTH ____

WELL SEAL GPS COORDINATES ____ N ____ W

WELL COMPLETION REPORT RECEIVED DATE ____

State of California

Well Completion Report

Form DWR 188 Complete 4/29/2020

WCR2020-004976

Owner's Well Number 19W-01 Date Work Began 09/18/2019 Date Work Ended 09/18/2019

Local Permit Agency San Luis Obispo County Environmental Health Services

Secondary Permit Agency Permit Number 2019-055 Permit Date 09/03/2019

Well Owner (must remain confidential pursuant to Water Code 13752)

Name CALIFORNIA DEPARTMENT OF TRANSPORTATION, Paul Valadao

Mailing Address 50 Higuera Street

City San Luis Obispo State CA Zip 93401

Planned Use and Activity

Activity Drill and Destroy

Planned Use Destruction

Well Location

Address

City Zip County San Luis Obispo

Latitude 35 10 48.09 N Longitude -120 41 59.9243 W

Deg. Min. Sec. Deg. Min. Sec.

Dec. Lat. 35.180025 Dec. Long. -120.699979

Vertical Datum Horizontal Datum WGS84

Location Accuracy Location Determination Method

APN N/A

Township 31 S

Range 12 E

Section 33

Baseline Meridian Mount Diablo

Ground Surface Elevation

Elevation Accuracy

Elevation Determination Method

Borehole Information

Orientation Vertical Specify

Drilling Method Auger Drilling Fluid None

Total Depth of Boring 35.1 Feet

Total Depth of Completed Well Feet

Water Level and Yield of Completed Well

Depth to first water (Feet below surface)

Depth to Static Water Level (Feet) Date Measured

Estimated Yield* (GPM) Test Type

Test Length (Hours) Total Drawdown (feet)

*May not be representative of a well's long term yield.

Geologic Log - USCS/ASTM D2488

Depth from Surface Feet to Feet		Soil Class	Soil Color	Soil Description
0	16.5	(SC) Clayey sand with gravel	brown	
16.5	19	(CH) Sandy fat clay with gravel	dark brown	
19	22	(SC) Clayey sand	light yellowish brown	
22	24.8	(CL) Sandy lean clay with gravel	dark brown	
24.8	27	(SP-SC) Poorly graded sand with clay and gravel	light yellowish brown	
27	31	(SP-SC) Poorly graded sand with clay	light yellowish brown	
31	35.1	(CL) Sandy lean clay with gravel	light brown	

Casings

Casing #	Depth from Surface Feet to Feet		Casing Type	Material	Casings Specificatons	Wall Thickness (inches)	Outside Diameter (inches)	Screen Type	Slot Size if any (inches)	Description

Annular Material

Depth from Surface Feet to Feet		Fill	Fill Type Details	Filter Pack Size	Description

Destruction Details:
Backfilled with Portland Cement Grout

Other Observations:

Borehole Specifications

Depth from Surface Feet to Feet		Borehole Diameter (inches)
0	35.1	8

Certification Statement

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief

Name: S/G TESTING LABORATORIES INC
Person, Firm or Corporation

308 NORTH 1ST STREET (Address) | LOMPOC (City) | CA (State) | 93436 (Zip)

Signed: *electronic signature received* (C-57 Licensed Water Well Contractor) | 04/15/2020 (Date Signed) | 611394 (C-57 License Number)

Attachments

WCR 19W-01.pdf - Location Map

19W-01.jpg - Geologic Log

DWR Use Only

CSG #	State Well Number	Site Code	Local Well Number

N — Latitude Deg/Min/Sec

W — Longitude Deg/Min/Sec

TRS:

APN:

State of California

Well Completion Report

Form DWR 188 Complete 4/29/2020

WCR2020-004979

Owner's Well Number 19W-02 Date Work Began 09/17/2019 Date Work Ended 09/17/2019

Local Permit Agency San Luis Obispo County Environmental Health Services

Secondary Permit Agency Permit Number 2019-056 Permit Date 09/03/2019

Well Owner (must remain confidential pursuant to Water Code 13752)

Name CALIFORNIA DEPARTMENT OF TRANSPORTATION, Paul Valadao

Mailing Address 50 Higuera Street

City San Luis Obispo State CA Zip 93401

Planned Use and Activity

Activity Drill and Destroy

Planned Use Destruction

Well Location

Address

City Zip County San Luis Obispo

Latitude 35 Deg. 10 Min. 46.2719 Sec. N Longitude -120 Deg. 41 Min. 58.2144 Sec. W

Dec. Lat. 35.17952 Dec. Long. -120.699504

Vertical Datum Horizontal Datum WGS84

Location Accuracy Location Determination Method

APN N/A

Township 31 S

Range 12 E

Section 33

Baseline Meridian Mount Diablo

Ground Surface Elevation

Elevation Accuracy

Elevation Determination Method

Borehole Information

Orientation Vertical Specify

Drilling Method Auger Drilling Fluid None

Total Depth of Boring 40 Feet

Total Depth of Completed Well Feet

Water Level and Yield of Completed Well

Depth to first water (Feet below surface)

Depth to Static Water Level (Feet) Date Measured

Estimated Yield* (GPM) Test Type

Test Length (Hours) Total Drawdown (feet)

*May not be representative of a well's long term yield.

Geologic Log - USCS/ASTM D2488

Depth from Surface Feet to Feet		Soil Class	Soil Color	Soil Description
0	13	(GW-GC) Well-graded gravel with clay and sand	brown	
13	21.5	(SW-SC) Well-graded sand with clay and gravel	brown	
21.5	31.5	(CH) Sandy fat clay with gravel	dark brown	
31.5	36.5	(CL) Sandy lean clay with gravel		
36.5	40	(SC) Clayey sand with gravel	grayish brown	

Casings

Casing #	Depth from Surface Feet to Feet		Casing Type	Material	Casings Specificatons	Wall Thickness (inches)	Outside Diameter (inches)	Screen Type	Slot Size if any (inches)	Description

Annular Material

Depth from Surface Feet to Feet		Fill	Fill Type Details	Filter Pack Size	Description

Destruction Details:
Backfilled with 6-sack cement slurry

Other Observations:

Borehole Specifications

Depth from Surface Feet to Feet		Borehole Diameter (inches)
0	40	8

Certification Statement

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief

Name: S/G TESTING LABORATORIES INC (Person, Firm or Corporation)

308 NORTH 1ST STREET (Address) | LOMPOC (City) | CA (State) | 93436 (Zip)

Signed: *electronic signature received* (C-57 Licensed Water Well Contractor) | 04/15/2020 (Date Signed) | 611394 (C-57 License Number)

Attachments

WCR 19W-02.pdf - Location Map

19W-02.jpg - Geologic Log

DWR Use Only

CSG #	State Well Number	Site Code	Local Well Number

N — Latitude Deg/Min/Sec

W — Longitude Deg/Min/Sec

TRS:

APN:

State of California

Well Completion Report

Form DWR 188 Complete 4/29/2020

WCR2020-004985

Owner's Well Number 19W-03 Date Work Began 09/16/2019 Date Work Ended 09/16/2019

Local Permit Agency San Luis Obispo County Environmental Health Services

Secondary Permit Agency Permit Number 2019-057 Permit Date 09/03/2019

Well Owner (must remain confidential pursuant to Water Code 13752)

Name CALIFORNIA DEPARTMENT OF TRANSPORTATION, Paul Valadao

Mailing Address 50 Higuera Street

City San Luis Obispo State CA Zip 93401

Planned Use and Activity

Activity Drill and Destroy

Planned Use Destruction

Well Location

Address

City Zip County San Luis Obispo

Latitude 35 10 44.4719 N Longitude -120 41 57.4224 W

Deg. Min. Sec. Deg. Min. Sec.

Dec. Lat. 35.17902 Dec. Long. -120.699284

Vertical Datum Horizontal Datum WGS84

Location Accuracy Location Determination Method

APN N/A

Township 31 S

Range 12 E

Section 33

Baseline Meridian Mount Diablo

Ground Surface Elevation

Elevation Accuracy

Elevation Determination Method

Borehole Information

Orientation Vertical Specify

Drilling Method Auger Drilling Fluid None

Total Depth of Boring 40.6 Feet

Total Depth of Completed Well Feet

Water Level and Yield of Completed Well

Depth to first water (Feet below surface)

Depth to Static Water Level (Feet) Date Measured

Estimated Yield* (GPM) Test Type

Test Length (Hours) Total Drawdown (feet)

*May not be representative of a well's long term yield.

Geologic Log - USCS/ASTM D2488

Depth from Surface Feet to Feet		Soil Class	Soil Color	Soil Description
0	4	(CH) Sandy fat clay with gravel	dark brown	4.5" AC over 6" AB
4	8.5	(SC) Clayey sand with gravel	brown	
8.5	13.5	(CH) Sandy fat clay	dark brown	
13.5	23.5	(SC) Clayey sand with gravel	dark brown	
23.5	28.5	(CL) Sandy lean clay	dark brown	
28.5	33.5	(GP-GC) Poorly graded gravel with clay and sand	light brown	
33.5	38.5	(GC) Clayey gravel with sand	light brown	
38.5	40.6	(CH) Sandy fat clay with gravel	dark brown	

Casings

Casing #	Depth from Surface Feet to Feet		Casing Type	Material	Casings Specificatons	Wall Thickness (inches)	Outside Diameter (inches)	Screen Type	Slot Size if any (inches)	Description

Annular Material

Depth from Surface Feet to Feet		Fill	Fill Type Details	Filter Pack Size	Description

Destruction Details:
6-sack cement slurry

Other Observations:

Borehole Specifications

Depth from Surface Feet to Feet		Borehole Diameter (inches)
0	40.6	8

Certification Statement

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief

Name: S/G TESTING LABORATORIES INC
Person, Firm or Corporation

308 NORTH 1ST STREET	LOMPOC	CA	93436
Address	City	State	Zip

Signed: *electronic signature received* | 04/15/2020 | 611394
C-57 Licensed Water Well Contractor | Date Signed | C-57 License Number

Attachments

19W-03.jpg - Location Map

WCR 19W-03.pdf - Geologic Log

DWR Use Only

CSG #	State Well Number	Site Code	Local Well Number

					N						W
Latitude Deg/Min/Sec						**Longitude Deg/Min/Sec**					

TRS:

APN:

APPENDIX B - LABORATORY TEST RESULTS

SUMMARY OF LABORATORY TEST RESULTS

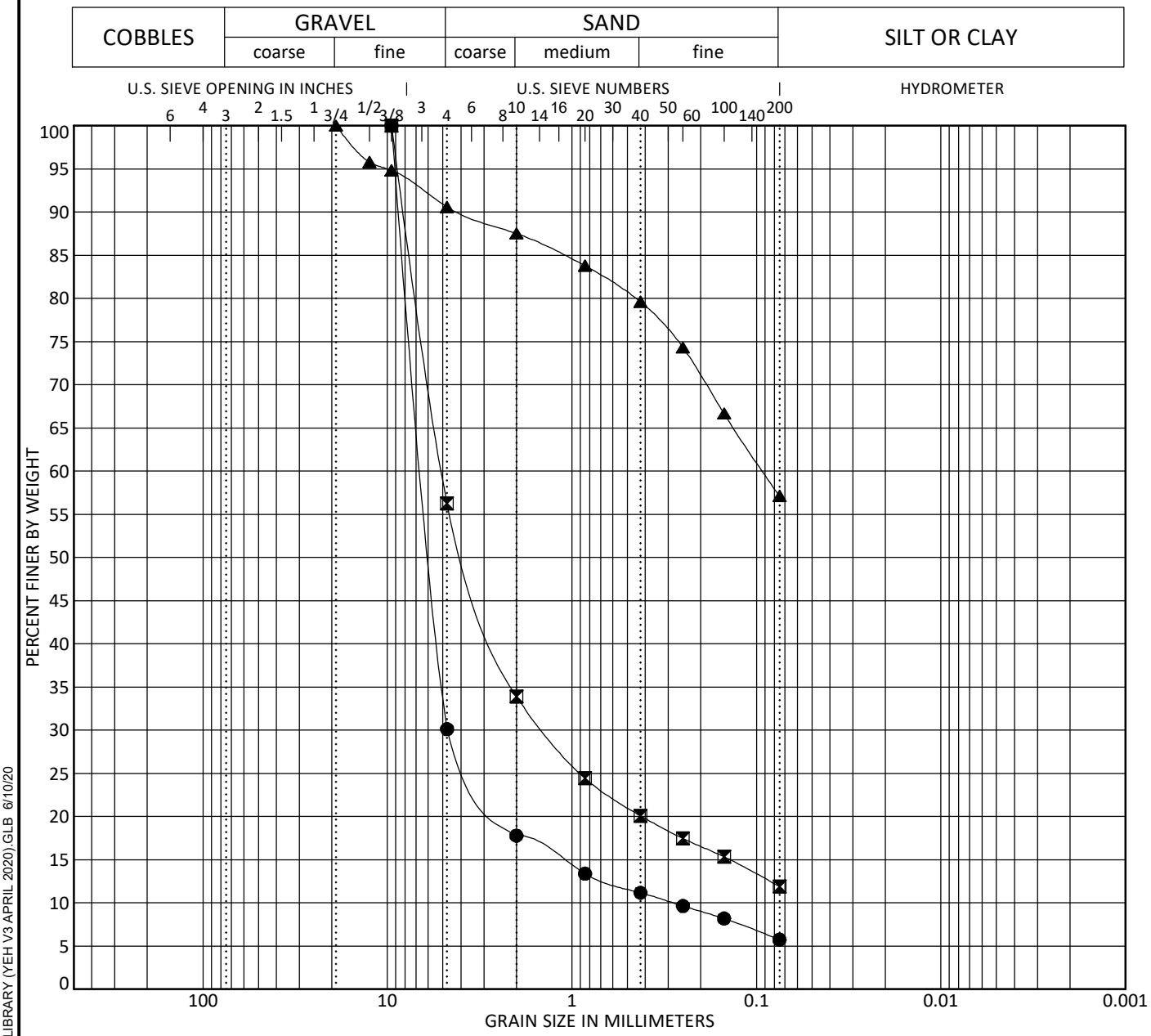
Sample Information							Gradation			Atterberg		Corrosion				Compaction					
Boring No.	Sample No.	Depth (ft)	Sample Type	Total Unit Weight, γ_t (pcf)	Dry Unit Weight, γ_d (pcf)	Moisture Content (%)	Gravel (%)	Sand (%)	Fines (%)	Plasticity Index (PI)	Liquid Limit (LL)	pH	Resistivity (Ω - cm)	SO_4^{2-} (mg/kg)	Cl^- (mg/kg)	Max. Dry Unit Weight, $\gamma_{d,MAX}$ (pcf)	Optimum Moisture Content (%)	R-Value	Expansion Index	Additional Testing	USCS Classification
19W-01	36	2.0	GRAB	--	--	8	19	55	26	--	--	--	--	--	--	--	--	--	--	--	CLAYEY SAND with GRAVEL (SC)
19W-01	39	18.5	SPT	--	--	8	1	76	22	--	--	6.88	656	4,885	14	--	--	--	--	--	CLAYEY SAND (SC)
19W-01	40	23.5	MCAL	114	99	15	--	--	--	--	--	--	--	--	--	--	--	--	--	CU	SANDY lean CLAY with GRAVEL (CL)
19W-01	42	33.5	MCAL	--	--	7	--	--	--	--	--	--	--	--	--	--	--	--	--	--	SANDY lean CLAY with GRAVEL (CL)
19W-02	19	2.0	MCAL	--	--	17	70	24	6	--	--	5.49	1,169	--	--	--	--	--	--	--	Well-graded GRAVEL with CLAY and SAND (GW-GC)
19W-02	20	3.5	MCAL	97	82	18	--	--	--	--	--	--	--	--	--	--	--	--	--	CU	Well-graded GRAVEL with CLAY and SAND (GW-GC)
19W-02	21	8.5	SPT	--	--	--	--	--	--	--	--	5.51	1,842	--	--	--	--	--	--	--	Well-graded GRAVEL with CLAY and SAND (GW-GC)
19W-02	22	13.5	MCAL	100	85	17	44	44	12	--	--	--	--	--	--	--	--	--	--	--	Well-graded SAND with CLAY and GRAVEL (SW-SC)
19W-02	23	18.5	SPT	--	--	--	--	--	--	--	--	6.08	1,968	--	--	--	--	--	--	--	Well-graded SAND with CLAY and GRAVEL (SW-SC)
19W-02	24	23.5	MCAL	106	95	12	--	--	--	--	--	--	--	--	--	--	--	--	--	CU	SANDY fat CLAY with GRAVEL (CH)
19W-02	26	33.5	MCAL	114	91	26	--	--	--	--	--	--	--	--	--	--	--	--	--	--	SANDY lean CLAY with GRAVEL (CL)
19W-03	A	0.0	BULK	--	--	7	9	33	57	--	--	6.58	3,087	--	--	--	--	46	--	--	SANDY fat CLAY (CH)
19W-03	1	2.0	MCAL	115	95	21	--	--	--	--	--	--	--	--	--	--	--	--	--	CU	SANDY fat CLAY (CH)
19W-03	2	5.0	MCAL	107	91	17	--	--	--	--	--	--	--	--	--	--	--	--	--	--	CLAYEY SAND (SC)
19W-03	4	15.0	MCAL	110	94	17	36	50	15	--	--	--	--	--	--	--	--	--	--	--	CLAYEY SAND with GRAVEL (SC)
19W-03	5	20.0	SPT	--	--	15	26	61	12	--	--	--	--	--	--	--	--	--	--	--	CLAYEY SAND with GRAVEL (SC)
19W-03	6	25.0	MCAL	115	92	25	--	--	--	--	--	--	--	--	--	--	--	--	--	--	SANDY lean CLAY (CL)
19W-03	8	35.0	MCAL	109	86	27	--	--	--	--	--	--	--	--	--	--	--	--	--	--	CLAYEY GRAVEL (GC)
19W-03	9	40.0	SPT	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	SANDY fat CLAY with GRAVEL (CH)

Yeh and Associates, Inc.
Geotechnical • Geological • Construction Services

PROJECT NAME
Avila Beach Drive at US 101 Interchange Improvements

PROJECT NO. **216-423**	REVISION DATE **11-7-19**
PROJECT MANAGER **J. King**	PREPARED BY **R. Hooke**
CHECKED BY **J. Cravens**	SHEET **1 of 1**

YEH SUMMARY OF TEST RESULTS 216-423 BORING LOGS - WALL BORINGS ONLY.GPJ CALIFORNIA YEH LIBRARY (YEH V3 APRIL 2020).GLB 6/10/20



Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	19W-02	2.0 ft	Well-graded GRAVEL with CLAY and SAND (GW-GC)	--	--	--	--	22.43
⊠	19W-02	13.5 ft	Well-graded SAND with CLAY and GRAVEL (SW-SC)	--	--	--	--	97.60
▲	19W-03	0.0 ft	SANDY fat CLAY (CH)	--	--	--	--	--

Specimen Identification			D100	D60	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	19W-02	2.0 ft	9.5	6.389	5.786	4.715	0.285	69.9	24.4	5.7	
⊠	19W-02	13.5 ft	9.5	5.043	3.734	1.408	--	43.8	44.4	11.9	
▲	19W-03	0.0 ft	19	0.092	--	--	--	9.4	33.4	57.1	

Yeh and Associates, Inc.
Geotechnical • Geological • Construction Services

GRAIN SIZE DISTRIBUTION

PROJECT NAME	PROJECT NO.
Avila Beach Drive at US 101 Interchange Improvements	216-423
REVISION DATE: 11-7-19	PROJECT MANAGER: J. King
PREPARED BY: R. Hooke	CHECKED BY: J. Cravens
SHEET: 1 of 1	

YEH SIEVE 216-423 BORING LOGS - WALL BORINGS ONLY.GPJ CALIFORNIA YEH LIBRARY (YEH V3 APRIL 2020).GLB 6/10/20

Corrosivity Tests Summary

CTL # 687-083 **Date:** 11/22/2019 **Tested By:** PJ **Checked:** PJ
Client: Yeh and Associates **Project:** Avila Beach Road Interchange **Proj. No:** 216-423
Remarks:

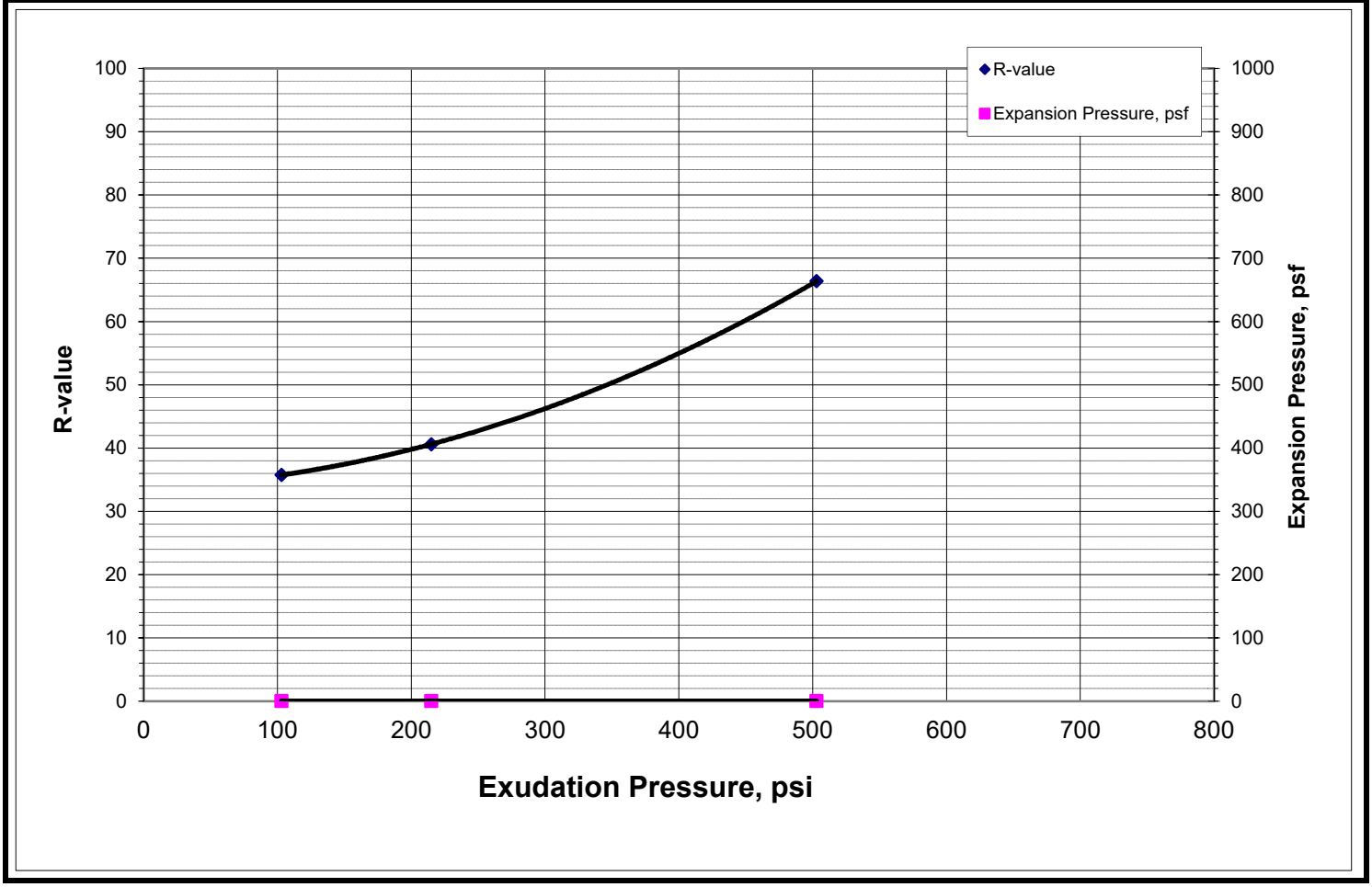
Sample Location or ID			Resistivity @ 15.5 °C (Ohm-cm)			Chloride	Sulfate		pH	ORP (Redox)		Sulfide	Moisture	Soil Visual Description
			As Rec.	Min	Sat.	mg/kg	mg/kg	%				Qualitative	At Test	
						Dry Wt.	Dry Wt.	Dry Wt.		E_H (mv)	At Test	by Lead	%	
Boring	Sample, No.	Depth, ft.	ASTM G57	Cal 643	ASTM G57	ASTM D4327	ASTM D4327	ASTM D4327	ASTM G51	ASTM G200	Temp °C	Acetate Paper	ASTM D2216	
19W-01	39	18.5	-	-	-	14	4,885	0.4885	-	-	-	-	6.2	Light Yellowish Brown Clayey SAND (SC)

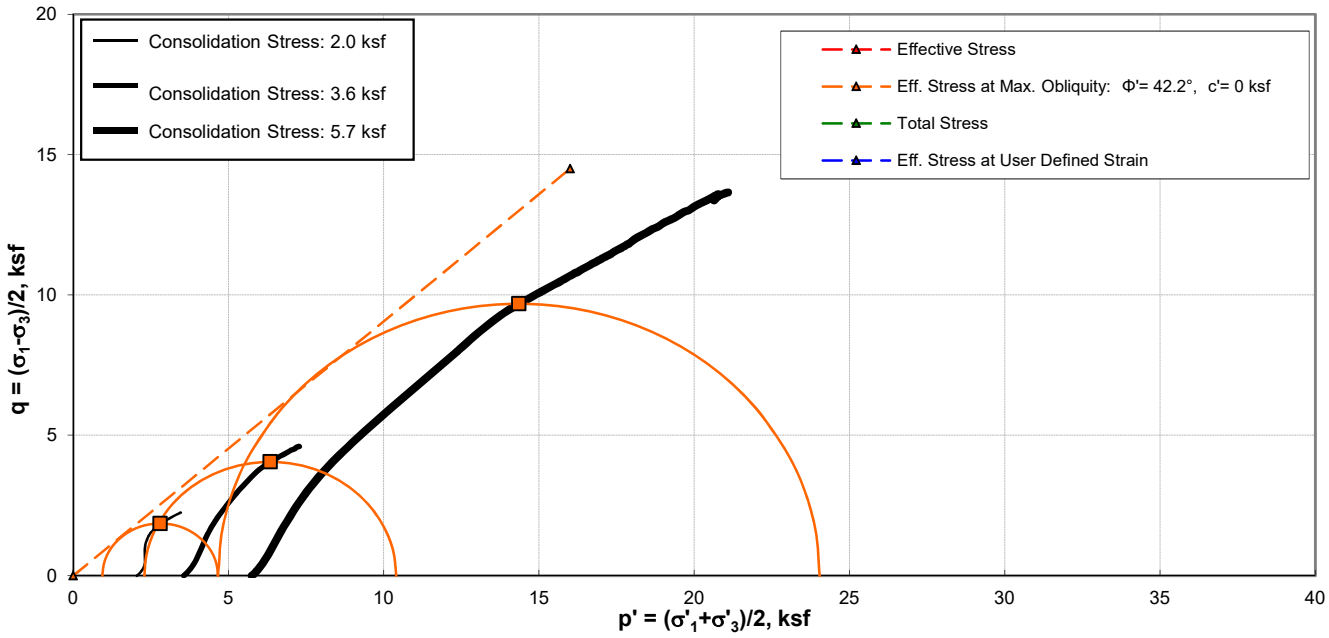
R-value Test Report (Caltrans 301)

Job No.:	687-082	**Date:**	10/08/19	**Initial Moisture,**	11.1
Client:	Yeh & Associates	**Tested**	PJ	**R-value**	**46**
Project:	216-423	**Reduced**	RU		
Sample	19W-03 A @ 0-5'	**Checked**	DC	**Expansion Pressure**	**0** psf
Soil Type:	Brown sandy fat CLAY				

Specimen Number	A	B	C	D
Exudation Pressure, psi	215	103	503	
Prepaired Weight, grams	1200	1200	1200	
Final Water Added, grams/cc	50	60	40	
Weight of Soil & Mold, grams	3197	3220	3183	
Weight of Mold, grams	2082	2097	2097	
Height After Compaction, in.	2.61	2.68	2.52	
Moisture Content, %	15.7	16.6	14.8	
Dry Density, pcf	111.9	108.9	113.8	
Expansion Pressure, psf	0	0	0	
Stabilometer @ 1000				
Stabilometer @ 2000	82	90	40	
Turns Displacement	3.88	4.14	3.80	
R-value	41	36	66	

Remarks:





SAMPLE ID

Boring Number	19W-01
Sample Number	40
Specimen Depth	23.5 ft
USCS Classification	Sandy lean CLAY with GRAVEL (CL), brown

INITIAL

Trial ID	A	B	C
Water Content, %	14.9%	21.6%	21.0%
Dry Unit Weight, pcf	99.3	106.4	107.4
Saturation, %	58%	100%	100%
Void Ratio	0.70	0.58	0.57
Diameter, in	2.42	2.37	2.38
Height, in	5.00	4.87	4.77

PRE-SHEAR

Water Content, %	21.6%	21.0%	20.6%
Dry Unit Weight, pcf	106.4	107.4	108.3
Saturation, %	100%	100%	100%
Void Ratio	0.58	0.57	0.56

REMARKS

Test Method: ASTM 4767 (modified for staged testing)
Project: Avila Beach Road Interchange
Tested by: N. Derbidge GEOE Lab
Checked by: J. King Yeh and Associates

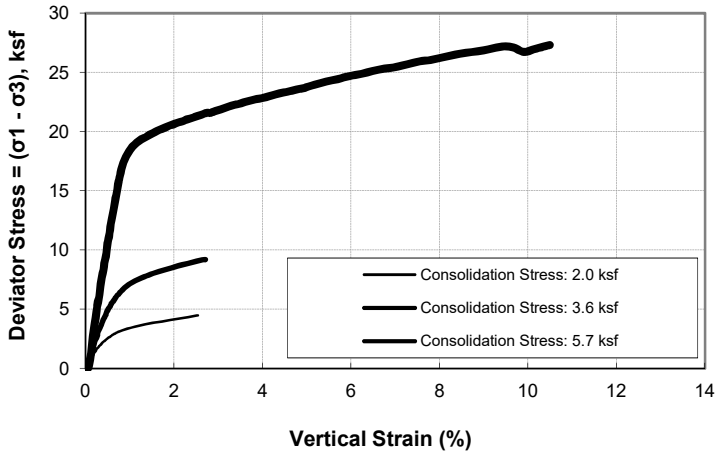
CLASSIFICATION

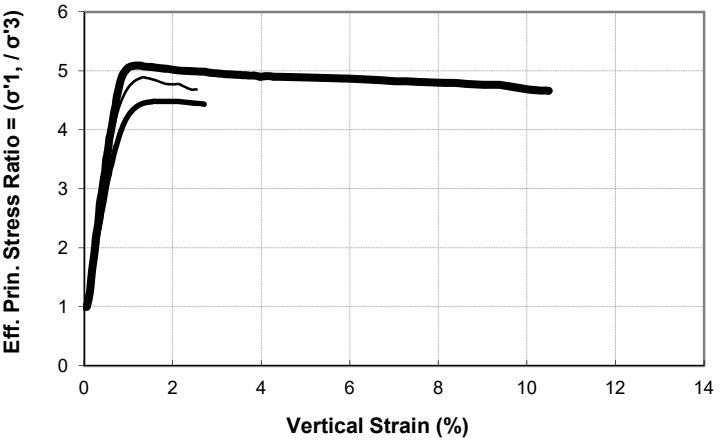
Trial ID	A	B	C
Liquid Limit	---	---	---
Plastic Limit	---	---	---
Plastic Index	---	---	---
Passing #4 (4.75 mm)	---	---	---
Passing #200 (0.075 mm)	---	---	---
Estimated Gs	2.70	2.70	2.70

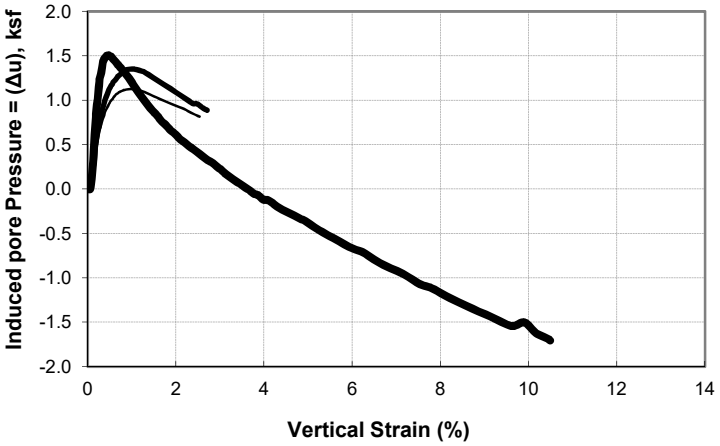
TEST SUMMARY

Trial ID	A	B	C
B-Parameter	0.98	0.98	0.98
t_{50}, minutes	N/A	N/A	N/A
Strain Rate, %/min	0.02	0.02	0.02
Cell Pressure, ksf	10.7	12.3	14.4
Back Pressure, ksf	8.7	8.7	8.7
Consolidation Stress, ksf	2.0	3.6	5.7
Deviator Stress @ Failure, ksf	3.7	8.0	19.1
Axial Strain @ Failure, %	1.3	1.6	1.3
σ'_{1F}, ksf	4.6	10.3	23.8
σ'_{3F}, ksf	0.9	2.3	4.7
Tested By:	ND	ND	ND
Date Tested:	10/3/19	10/4/19	10/10/19

CONSOLIDATED UNDRAINED TRIAXIAL TEST

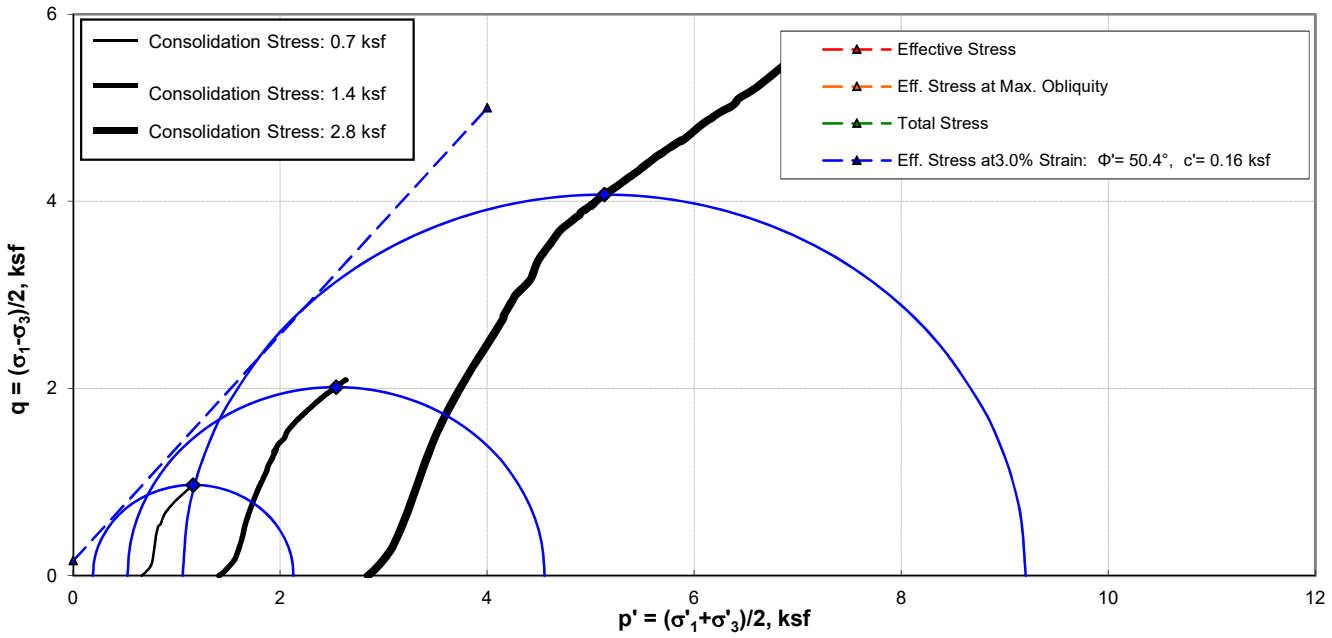






A	19W-01	#40	23.5 ft	Sandy lean CLAY with GRAVEL (CL), brown
B	19W-01	#40	23.5 ft	
C	19W-01	#40	23.5 ft	

CONSOLIDATED UNDRAINED TRIAXIAL TEST



SAMPLE ID

Boring Number	19W-02
Sample Number	20
Specimen Depth	3.5 ft
USCS Classification	Well-graded GRAVEL with CLAY and SAND (GW-GC), dark brown

INITIAL

Trial ID	A	B	C
Water Content, %	17.7%	30.4%	28.9%
Dry Unit Weight, pcf	82.4	92.6	94.6
Saturation, %	46%	100%	100%
Void Ratio	1.05	0.82	0.78
Diameter, in	2.42	2.32	2.33
Height, in	5.00	4.86	4.72

PRE-SHEAR

Water Content, %	30.4%	28.9%	27.8%
Dry Unit Weight, pcf	92.6	94.6	96.3
Saturation, %	100%	100%	100%
Void Ratio	0.82	0.78	0.75

REMARKS

Test Method: ASTM 4767 (modified for staged testing)
Project: Avila Beach Road Interchange
Tested by: N. Derbidge Cal Poly GEOE Lab
Checked by: J. King, Yeh and Associates

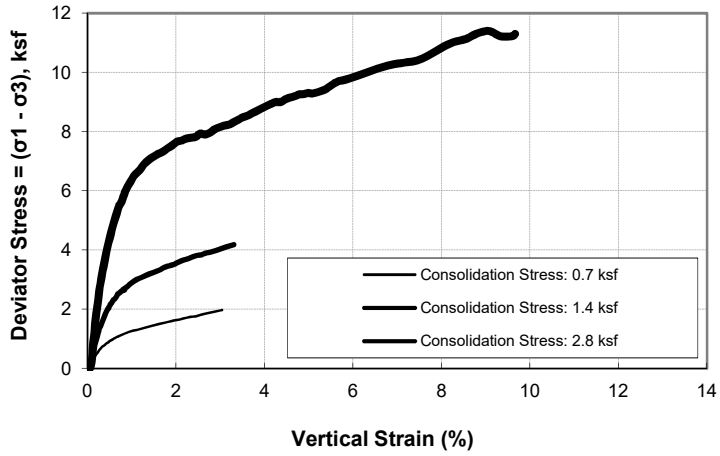
CLASSIFICATION

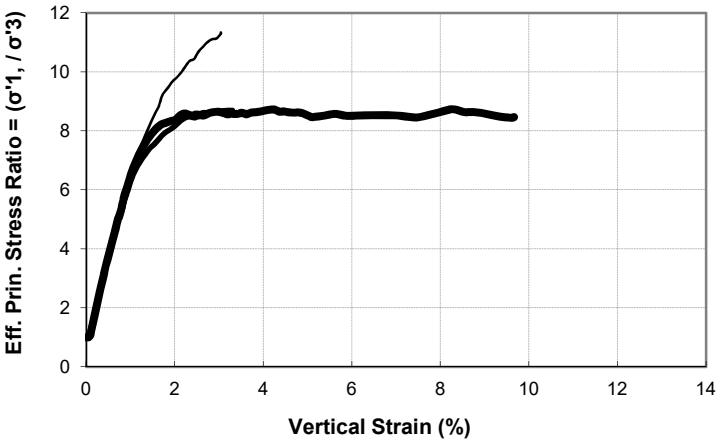
Trial ID	A	B	C
Liquid Limit	---	---	---
Plastic Limit	---	---	---
Plastic Index	---	---	---
Passing #4 (4.75 mm)	---	---	---
Passing #200 (0.075 mm)	---	---	---
Estimated Gs	2.70	2.70	2.70

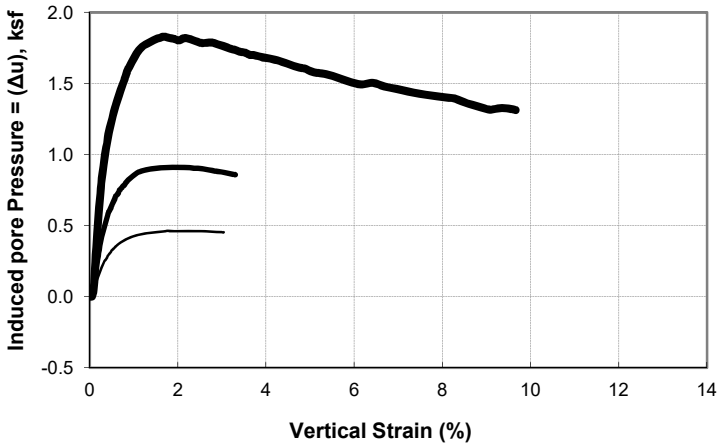
TEST SUMMARY

Trial ID	A	B	C
B-Parameter	0.98	0.98	0.98
t_{50}, minutes	N/A	N/A	N/A
Strain Rate, %/min	0.02	0.02	0.02
Cell Pressure, ksf	9.3	10.1	11.6
Back Pressure, ksf	8.7	8.7	8.7
Consolidation Stress, ksf	0.7	1.4	2.8
Deviator Stress @ Failure, ksf	1.9	4.0	8.0
Axial Strain @ Failure, %	2.9	3.0	3.0
σ'_{1F}, ksf	2.1	4.5	9.1
σ'_{3F}, ksf	0.2	0.5	1.1
Tested By:	ND	ND	ND
Date Tested:	10/2/19	10/7/19	10/9/19

CONSOLIDATED UNDRAINED TRIAXIAL TEST

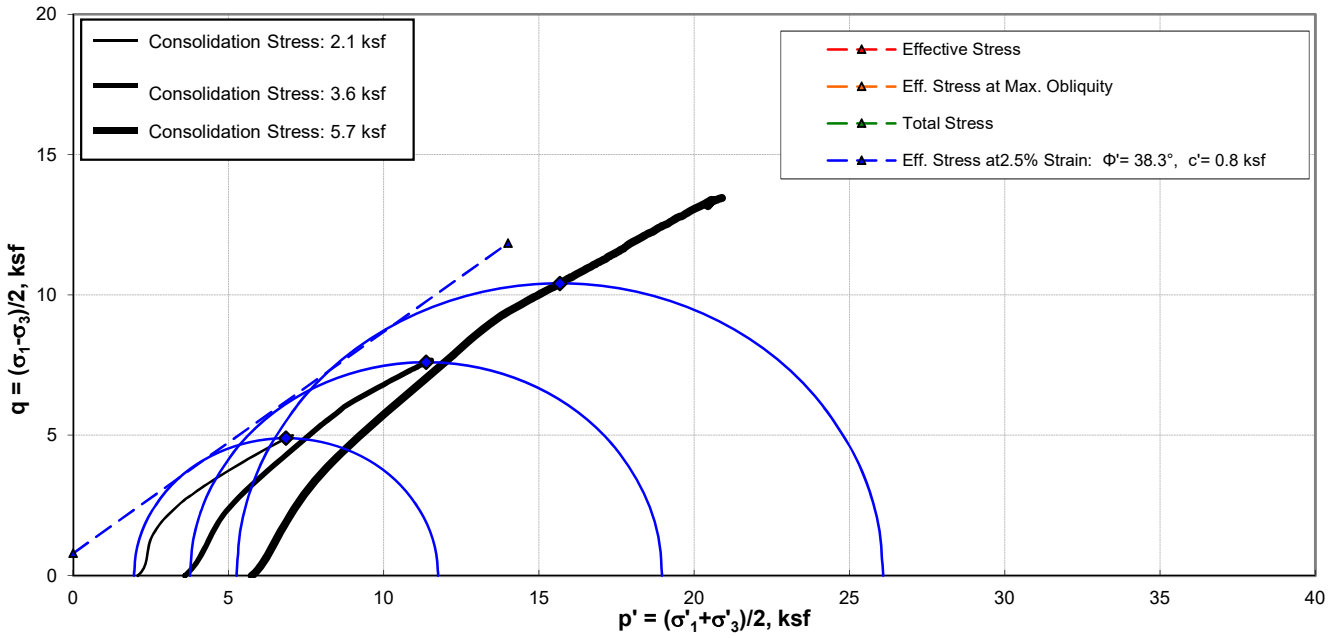






A	19W-02	#20	3.5 ft	Well-graded GRAVEL with CLAY and SAND (GW-GC), dark brown
B	19W-02	#20	3.5 ft	
C	19W-02	#20	3.5 ft	

CONSOLIDATED UNDRAINED TRIAXIAL TEST



SAMPLE ID

Boring Number	19W-02
Sample Number	24
Specimen Depth	23.5 ft
USCS Classification	Sandy fat CLAY with GRAVEL (CH), dark brown

INITIAL

Trial ID	A	B	C
Water Content, %	11.7%	25.3%	25.0%
Dry Unit Weight, pcf	94.9	100.1	100.6
Saturation, %	41%	100%	100%
Void Ratio	0.78	0.68	0.68
Diameter, in	2.42	2.38	2.40
Height, in	5.00	4.89	4.79

PRE-SHEAR

Water Content, %	25.3%	25.0%	24.7%
Dry Unit Weight, pcf	100.1	100.6	101.0
Saturation, %	100%	100%	100%
Void Ratio	0.68	0.68	0.67

REMARKS

Test Method: ASTM 4767 (modified for staged testing)
Project: Avila Beach Road Interchange
Tested by: N. Derbidge, Cal Poly GEOE Lab
Checked by: J. King, Yeh and Associates

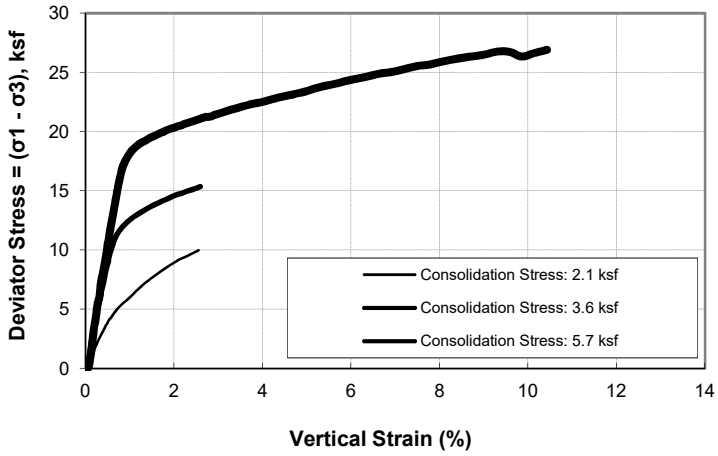
CLASSIFICATION

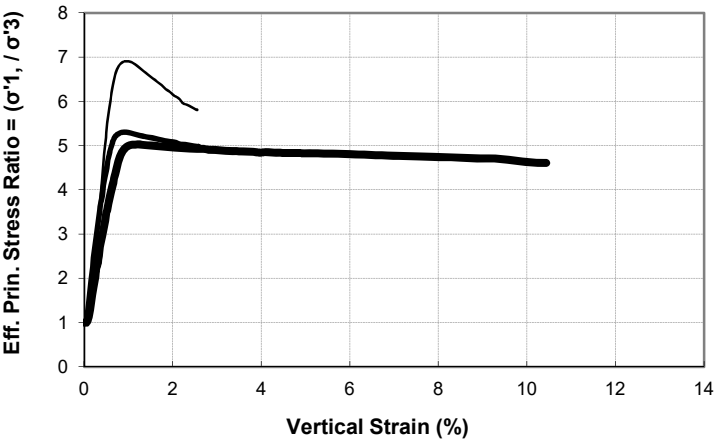
Trial ID	A	B	C
Liquid Limit	---	---	---
Plastic Limit	---	---	---
Plastic Index	---	---	---
Passing #4 (4.75 mm)	---	---	---
Passing #200 (0.075 mm)	---	---	---
Estimated Gs	2.70	2.70	2.70

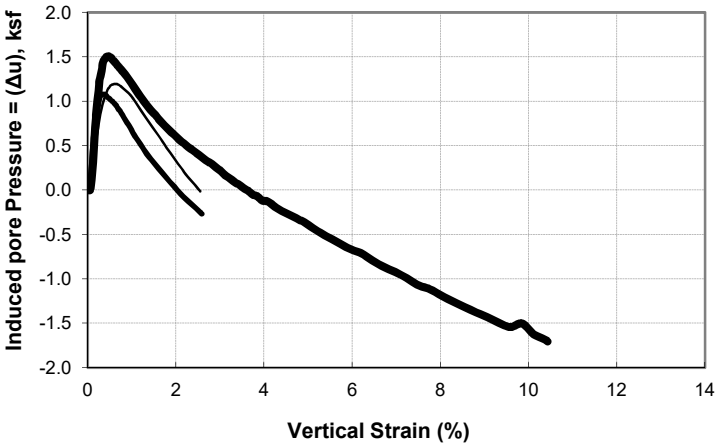
TEST SUMMARY

Trial ID	A	B	C
B-Parameter	0.98	0.98	0.98
t_{50}, minutes	N/A	N/A	N/A
Strain Rate, %/min	0.02	0.02	0.02
Cell Pressure, ksf	10.7	12.2	14.4
Back Pressure, ksf	8.7	8.7	8.7
Consolidation Stress, ksf	2.1	3.6	5.7
Deviator Stress @ Failure, ksf	9.7	15.0	20.6
Axial Strain @ Failure, %	2.5	2.5	2.4
σ'_{1F}, ksf	11.6	18.8	25.8
σ'_{3F}, ksf	2.0	3.8	5.3
Tested By:	ND	ND	ND
Date Tested:	10/3/19	10/7/19	10/9/19

CONSOLIDATED UNDRAINED TRIAXIAL TEST

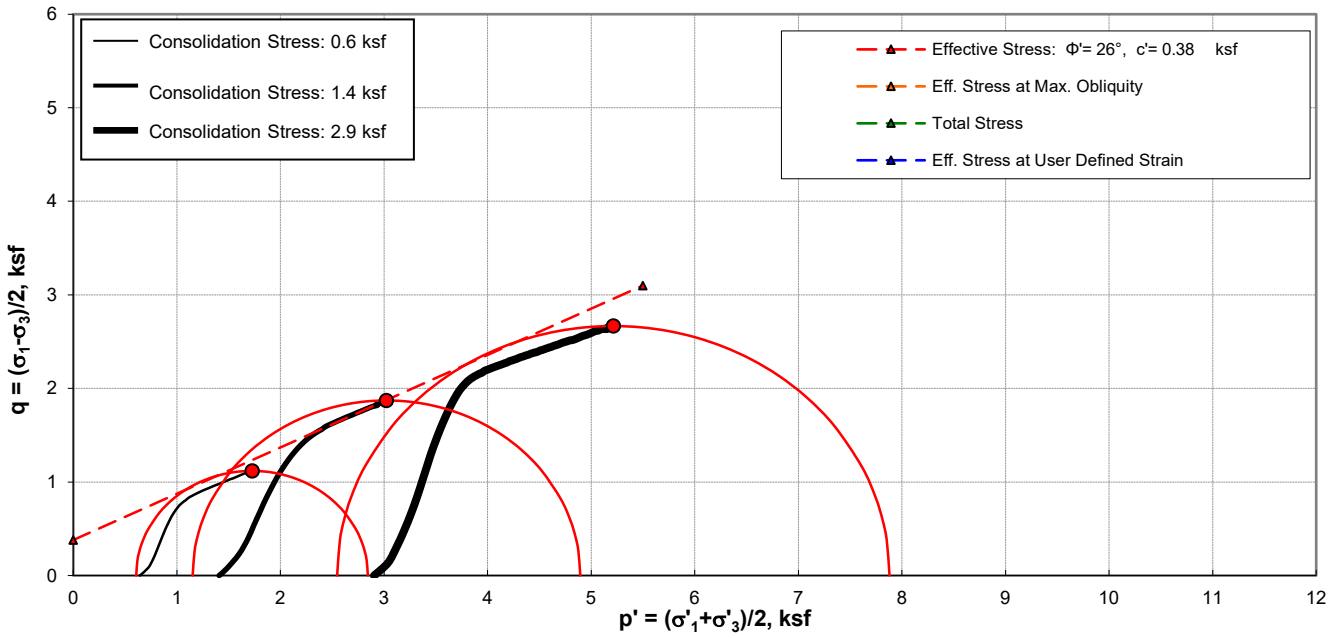






A	19W-02	#24	23.5 ft	Sandy fat CLAY with GRAVEL (CH), dark brown
B	19W-02	#24	23.5 ft	
C	19W-02	#24	23.5 ft	

CONSOLIDATED UNDRAINED TRIAXIAL TEST



SAMPLE ID

Boring Number	19W-03
Sample Number	1
Specimen Depth	2.0 ft
USCS Classification	Sandy fat CLAY (CH), dark brown

INITIAL

Trial ID	A	B	C
Water Content, %	21.2%	29.6%	29.2%
Dry Unit Weight, pcf	94.6	93.6	94.2
Saturation, %	73%	100%	100%
Void Ratio	0.78	0.80	0.79
Diameter, in	2.42	2.46	2.49
Height, in	5.00	4.87	4.74

PRE-SHEAR

Water Content, %	29.6%	29.2%	28.8%
Dry Unit Weight, pcf	93.6	94.2	94.8
Saturation, %	100%	100%	100%
Void Ratio	0.80	0.79	0.78

REMARKS

Test Method: ASTM 4767 (modified for staged testing)
Project: Avila Beach Road Interchange

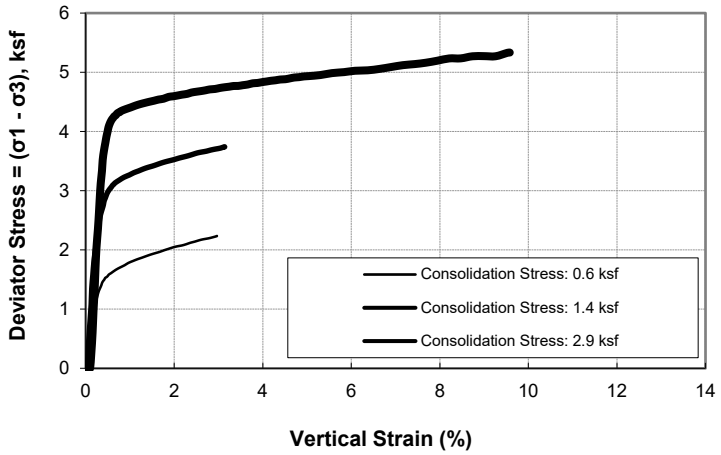
CLASSIFICATION

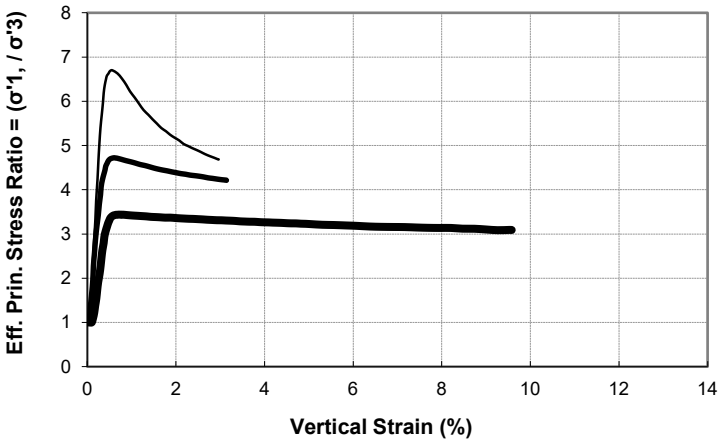
Trial ID	A	B	C
Liquid Limit	---	---	---
Plastic Limit	---	---	---
Plastic Index	---	---	---
Passing #4 (4.75 mm)	---	---	---
Passing #200 (0.075 mm)	---	---	---
Estimated Gs	2.70	2.70	2.70

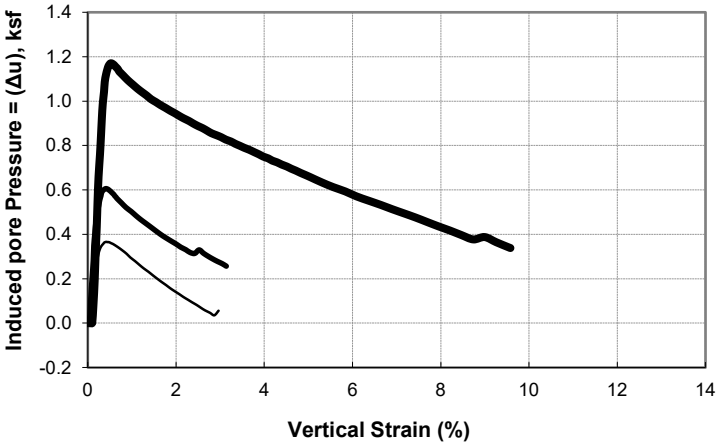
TEST SUMMARY

Trial ID	A	B	C
B-Parameter	0.98	0.98	0.98
t_{50}, minutes	N/A	N/A	N/A
Strain Rate, %/min	0.02	0.02	0.02
Cell Pressure, ksf	9.3	10.1	11.6
Back Pressure, ksf	8.7	8.7	8.7
Consolidation Stress, ksf	0.6	1.4	2.9
Deviator Stress @ Failure, ksf	2.2	3.7	5.3
Axial Strain @ Failure, %	3.0	3.1	9.6
σ'_{1F}, ksf	2.8	4.8	7.8
σ'_{3F}, ksf	0.6	1.2	2.5
Tested By:	ND	ND	ND
Date Tested:	10/3/19	10/4/19	10/10/19

CONSOLIDATED UNDRAINED TRIAXIAL TEST







A	19W-03	#1	2.0 ft	Sandy fat CLAY (CH), dark brown
B	19W-03	#1	2.0 ft	
C	19W-03	#1	2.0 ft	

CONSOLIDATED UNDRAINED TRIAXIAL TEST

APPENDIX C - CALCULATIONS

Yeh and Associates, Inc.
Geotechnical • Geological • Construction Services

Project No. **216-423**
Project: **Avila Beach Drive Interchange Improvements**
Comments: **Caltrans Borings**
Performed by: **J. Cravens**
Reference: Youd et al (2001), "Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER/NSF Workshops on Evaluation of Liquefaction Resistance of Soils".

Enter Data in **RED** Bold Spaces

γ_w	Magnitude (Mw)	MSF	a_{max} (g)	Hammer Efficiency	Atmospheric Pressure (100 =metric, 2000=English)
62.4	6.7	1.34	0.39	75	2000

Drill Hole	Top Depth (ft)	Depth to GWT (ft)	Surface Water Depth (ft)	Sample Depth (ft)	Unit Wt. (pcf)	Lined ? (1=Yes, 2= No)	Sample OD (in)	Nfield	Field SPT N_{60}	Nspt (for Cetin)	(12) (N'60)cs	N'60	σ ' (psf)	fines	CSR	Liquefied Residual Strength	Friction Angle (degrees)	F.S.	Soil Type
B-1-03	5.6	27.6	0	6.6	110	2	2	41	51	41	80	77	726	10	0.50	--	46	Non-Liq	SW
	10.5	27.6	0	11.5	110	2	2	10	13	10	15	14	1265	10	0.17	--	--	Non-Liq	CL
	15.5	27.6	0	16.5	110	2	2	19	24	19	28	25	1815	15	0.34	--	33	Non-Liq	SM
	20.4	27.6	0	21.4	110	2	2	21	26	21	30	28	2354	15	0.43	--	--	Non-Liq	CL
	25.3	27.6	0	26.3	110	2	2	31	39	31	40	37	2893	15	0.50	--	36	Non-Liq	SM
	30.2	27.6	0	31.2	110	2	2	51	64	51	62	57	3207	15	0.50	64608	41	4.40	GC
	35.1	27.6	0	36.1	110	2	2	30	38	30	37	34	3441	15	0.50	5431	36	2.65	SM
	40.1	27.6	0	41.1	110	2	2	14	18	14	17	15	3679	15	0.19	725	31	1.14	ML
	45.0	27.6	0	46	110	2	2	9	11	9	11	10	3912	15	0.11	398	29	0.73	ML
	49.9	27.6	0	50.9	110	2	2	7	9	7	8	7	4145	15	0.09	318	29	0.53	ML
B-2-03	5.0	44.5	0	6	110	2	2	3	4	3	6	6	660	5	0.08	--	28	Non-Liq	GP
	10.0	44.5	0	11	110	2	2	12	15	12	18	17	1210	5	0.19	--	31	Non-Liq	SW
	15.0	44.5	0	16	110	2	2	21	26	21	29	29	1760	5	0.43	--	34	Non-Liq	GP
	20.0	44.5	0	21	110	2	2	35	44	35	50	46	2310	15	0.50	--	39	Non-Liq	SM
	25.0	44.5	0	26	110	2	2	40	50	40	50	48	2860	10	0.50	--	39	Non-Liq	GP-GM
	30.0	44.5	0	31	110	2	2	13	16	13	16	14	3410	15	0.17	--	31	Non-Liq	SM
	35.0	44.5	0	36	110	2	2	50	63	50	63	53	3960	80	0.50	--	40	Non-Liq	SPg
	40.0	44.5	0	41	110	2	2	10	13	10	11	10	4510	15	0.12	--	29	Non-Liq	SM
	45.0	44.5	0	46	110	2	2	17	21	17	18	16	4966	15	0.19	930	31	1.63	SM
	50.0	44.5	0	51	110	2	2	8	10	8	9	7	5204	15	0.09	369	29	0.72	ML

Note: No correction for gravel because interbeds of sand are noted.

Clean sands: 1% Fines
Borderline clean/dirty sands: 8% Fines
Dirty sands: 15% fines
Unless measured in laboratory

Yeh and Associates, Inc.
Geotechnical • Geological • Construction Services

Project No. **216-423**
Project: **Avila Beach Drive Interchange Improvements**
Comments: **Yeh Borings**
Performed by: **J. Cravens**
Reference: Youd et al (2001), "Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER/NSF Workshops on Evaluation of Liquefaction Resistance of Soils".

Enter Data in **RED** Bold Spaces

γ_w	Magnitude (Mw)	MSF	a_{max} (g)	Hammer Efficiency	Atmospheric Pressure (100 =metric, 2000=English)
62.4	6.7	1.34	0.39	75	2000

Drill Hole	Top Depth (ft)	Depth to GWT (ft)	Surface Water Depth (ft)	Sample Depth (ft)	Unit Wt. (pcf)	Lined ? (1=Yes, 2= No)	Sample OD (in)	Nfield	Field SPT N_{60}	Nspt (for Cetin)	(12) (N'60)cs	N'60	σ ' (psf)	fines	CSR	Liquefied Residual Strength	Friction Angle (degrees)	F.S.	Soil Type
19W-01	2	43	0	3	110	1	3	10	8	7	15	13	330	26	0.17	--	30	Non-Liq	SC
	5	43	0	6	110	1	3	4	3	3	6	4	660	26	0.08	--	28	Non-Liq	SC
	8.5	43	0	9.5	110	2	2	100	125	100	173	156	1045	26	0.50	--	66	Non-Liq	SC
	13.5	43	0	14.5	110	1	3	100	83	67	89	79	1595	26	0.50	--	47	Non-Liq	SC
	18.5	43	0	19.5	110	2	2	41	51	41	56	50	2145	22	0.50	--	40	Non-Liq	SC
	23.5	43	0	24.5	110	1	3	100	83	67	79	68	2695	50	0.50	--	--	Non-Liq	CL
	28.5	43	0	29.5	110	2	2	100	125	100	116	112	3245	8	0.50	--	55	Non-Liq	SP-SC
	33.5	43	0	34.5	110	1	3	100	83	67	71	60	3795	50	0.50	--	--	Non-Liq	CL
19W-02	2	54	0	3	97	1	3	49	41	33	63	61	290	6	0.50	--	42	Non-Liq	GW-GC
	3.5	54	0	4.5	97	1	3	31	26	21	40	39	435	6	0.50	--	37	Non-Liq	GW-GC
	8.5	54	0	9.5	97	2	2	100	125	100	170	166	919	6	0.50	--	68	Non-Liq	GW-GC
	13.5	54	0	14.5	99	1	3	89	74	59	78	74	1442	12	0.50	--	46	Non-Liq	SW-SC
	18.5	54	0	19.5	99	2	2	100	125	100	136	129	1939	12	0.50	--	59	Non-Liq	SW-SC
	23.5	54	0	24.5	106	1	3	100	83	67	81	69	2607	50	0.50	--	--	Non-Liq	CH
	28.5	54	0	29.5	106	2	2	26	33	26	36	30	3127	50	0.50	--	--	Non-Liq	CH
	33.5	54	0	34.5	115	1	3	44	37	29	31	26	3956	50	0.50	--	--	Non-Liq	CL
	38.5	54	0	39.5	110	2	2	29	36	29	32	30	4345	15	0.50	--	34	Non-Liq	SC
19W-03	2	46	0	3	115	1	3	66	55	44	96	83	345	57	0.50	--	--	Non-Liq	CH
	4.5	46	0	5.5	106	1	3	100	83	67	123	116	586	15	0.50	--	56	Non-Liq	SC
	8.5	46	0	9.5	110	2	2	62	78	62	112	96	1045	50	0.50	--	--	Non-Liq	CH
	13.5	46	0	14.5	110	1	3	45	38	30	39	36	1595	15	0.50	--	36	Non-Liq	SC
	18.5	46	0	19.5	110	2	2	37	46	37	48	46	2145	12	0.50	--	38	Non-Liq	SC
	23.5	46	0	24.5	115	1	3	20	17	13	17	13	2818	50	0.18	--	--	Non-Liq	CL
	28.5	46	0	29.5	110	2	2	58	73	58	67	65	3245	8	0.50	--	43	Non-Liq	SP-SC
	33.5	46	0	34.5	109	1	3	38	32	25	25	23	3768	15	0.29	--	33	Non-Liq	GC
	38.5	46	0	39.5	110	2	2	100	125	100	118	102	4345	50	0.50	--	--	Non-Liq	CH

Note: No correction for gravel because interbeds of sand are noted.

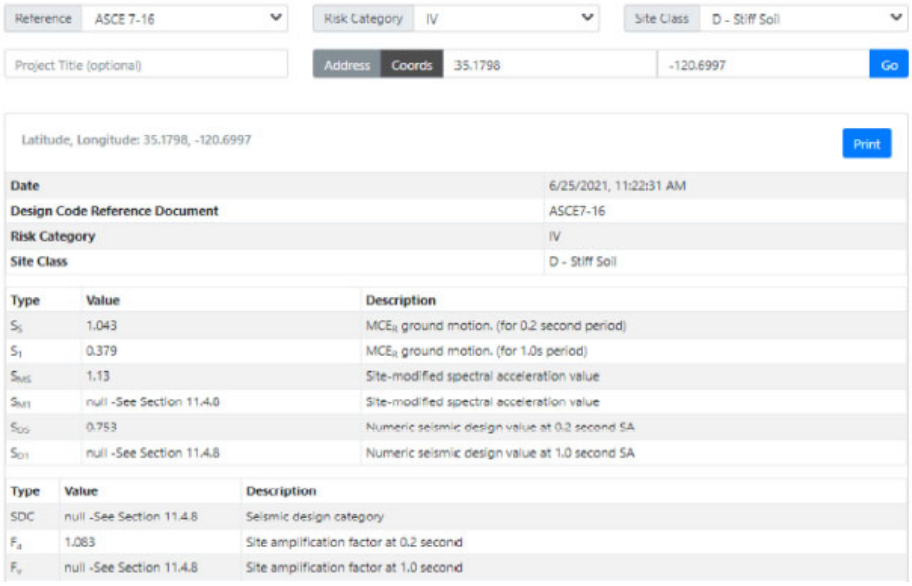
Clean sands: 1% Fines
Borderline clean/dirty sands: 8% Fines
Dirty sands: 15% fines
Unless measured in laboratory

kh Estimation Based on FHWA (2011) GEC No.3 and AASHTO (2020) BDS

Project: 216-423 Avila Beach Drive Interchange Improvements
Engineer: J. Cravens
Date: 8/12/2021

Location	Wall W1	Wall W1B	Notes:
H (ft)	33	14	*H = vertical distance between ground surface and wall base at the back of the wall heel*
F_v	1.921	1.921	*F_v = Site Class adjustment factor from SEAOC Web Tool**
S_1	0.379	0.379	*S_1 = Spectral acceleration coefficient at 1 sec from SEAOC Web Tool**
PGA	0.39	0.39	*PGA = Peak Ground Acceleration from CT ARS Online (see plot in report)*
F_{PGA}	1.11	1.11	*F_{PGA} = AASHTO peak ground acceleration site factor from FHWA (2011) Table 3-6*
k_{max}	0.433	0.433	*k_{max} = site adjusted PGA from FHWA (2011) Eq. 6-1 = F_{PGA} x PGA*
β	1.682	1.682	*β from FHWA (2011) Eq. 6-4 and AASHTO (2020) Section A11.5.2 = F_v x S_1/k_{max}*
α	0.947	0.978	*α from FHWA (2011) Eq. 6-3 and AASHTO (2020) Section A11.5.2 = 1 + 0.01 x H x (0.5 x β - 1)*
k_{av}	0.410	0.423	*k_{av} = avg peak acceleration of potential failure mass from FHWA (2011) Eq. 6-2*
k_h	0.205	0.212	*k_h = seismic coefficient for 1-2 in of displacement and FS=1.1 = FHWA (2011) Eq. 6-5 = 0.5 x k_{av}*

** Data from SEAOC Web Tool (accessed 06/25/2021):*



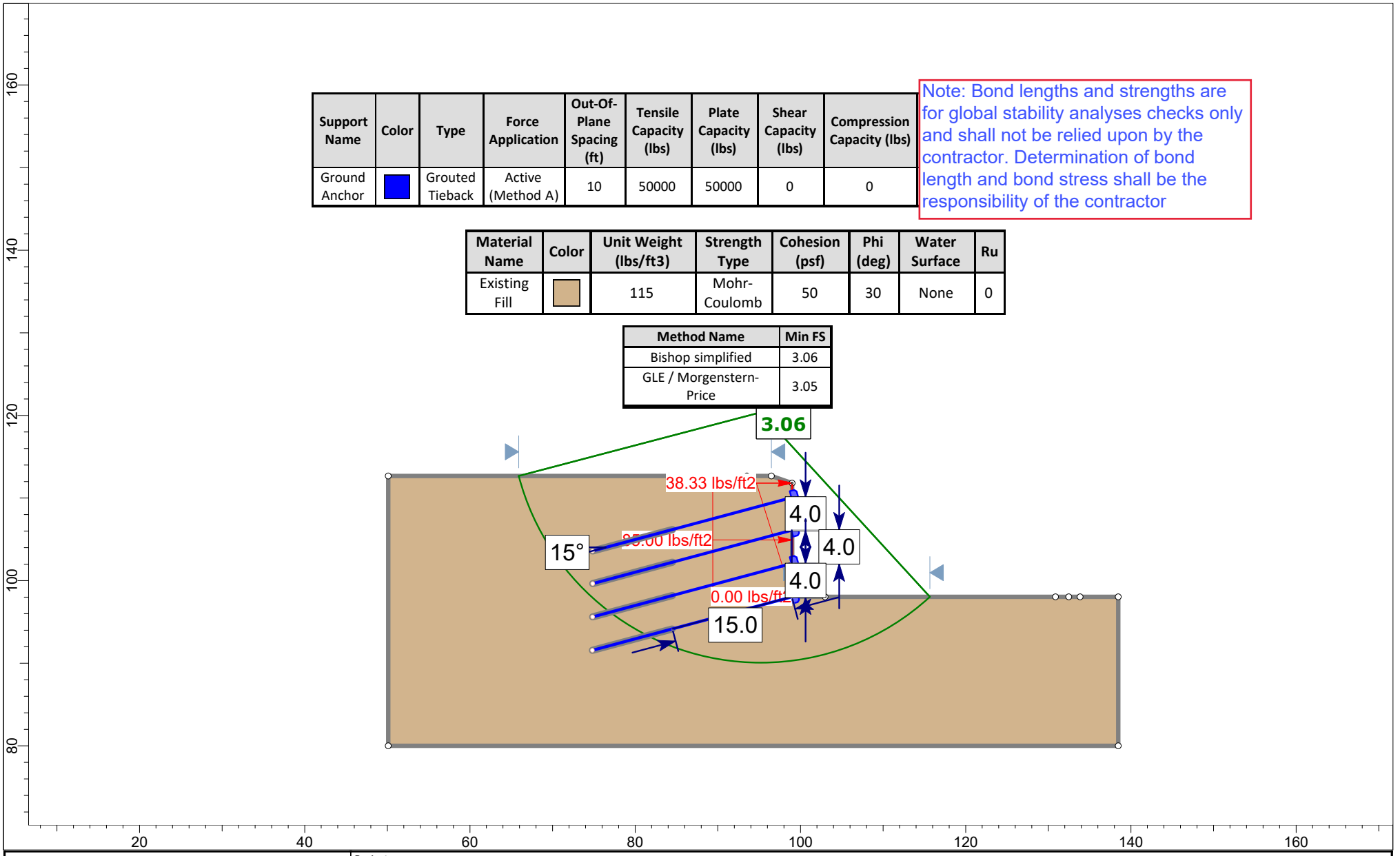
Note: Fv calculated from Table 11.4-2 of ASCE 7-16 using linear interpolation.

Support Name	Color	Type	Force Application	Out-Of-Plane Spacing (ft)	Tensile Capacity (lbs)	Plate Capacity (lbs)	Shear Capacity (lbs)	Compression Capacity (lbs)
Ground Anchor		Grouted Tieback	Active (Method A)	10	50000	50000	0	0

Note: Bond lengths and strengths are for global stability analyses checks only and shall not be relied upon by the contractor. Determination of bond length and bond stress shall be the responsibility of the contractor

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Existing Fill		115	Mohr-Coulomb	50	30	None	0

Method Name	Min FS
Bishop simplified	3.06
GLE / Morgenstern-Price	3.05



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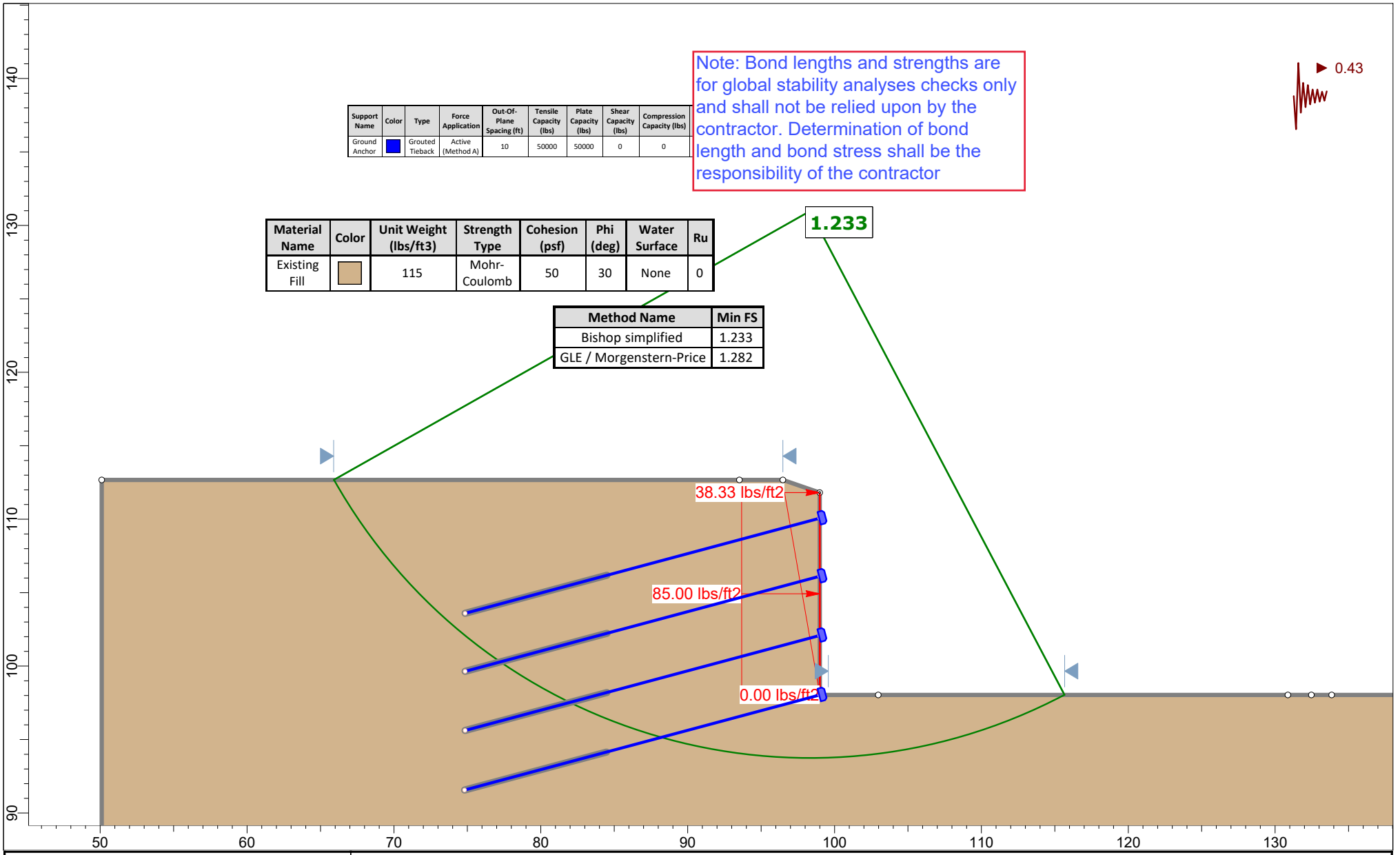
SLIDEINTERPRET 9.027

Project	216-423 Avila Beach Drive Interchange Improvements		
Analysis Description	Retaining Wall N1 (Sta. 121+50.4 "N1" Line)		
Drawn By	J. Cravens/J. King	Scale 1:192	Company Yeh and Associates, Inc.
Date	5/22/23		File Name 216-423 Wall N1.slmd



Support Name	Color	Type	Force Application	Out-Of-Plane Spacing (ft)	Tensile Capacity (lbs)	Plate Capacity (lbs)	Shear Capacity (lbs)	Compression Capacity (lbs)
Ground Anchor		Grouted Tieback	Active (Method A)	10	50000	50000	0	0

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Existing Fill		115	Mohr-Coulomb	50	30	None	0

Method Name	Min FS
Bishop simplified	1.233
GLE / Morgenstern-Price	1.282

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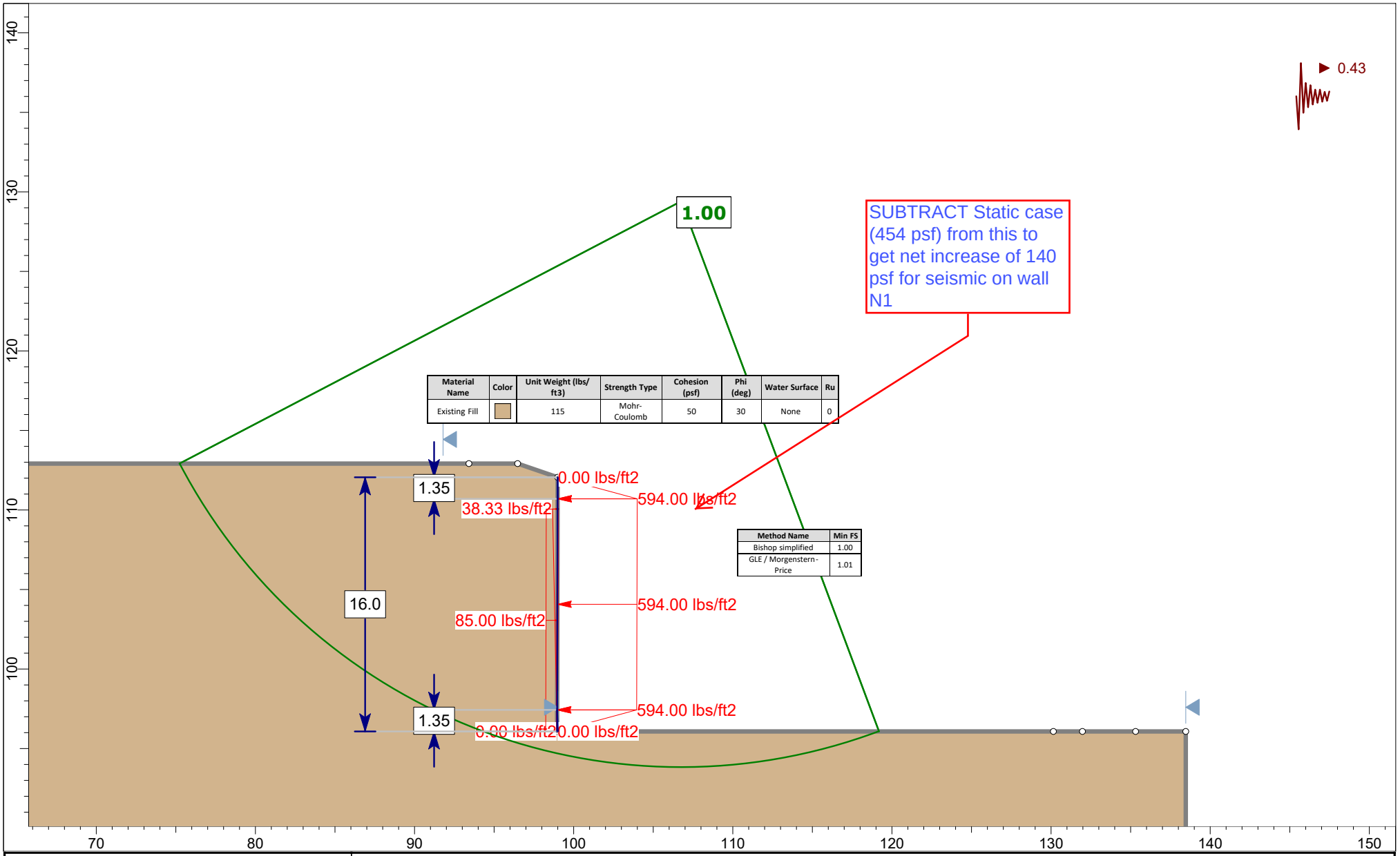
SLIDEINTERPRET 9.027

Project	216-423 Avila Beach Drive Interchange Improvements		
Analysis Description	Retaining Wall N1 (Sta. 121+50.4 "N1" Line)		
Drawn By	J. Cravens/J. King	Scale 1:108	Company Yeh and Associates, Inc.
Date	5/22/23		File Name 216-423 Wall N1.slmd



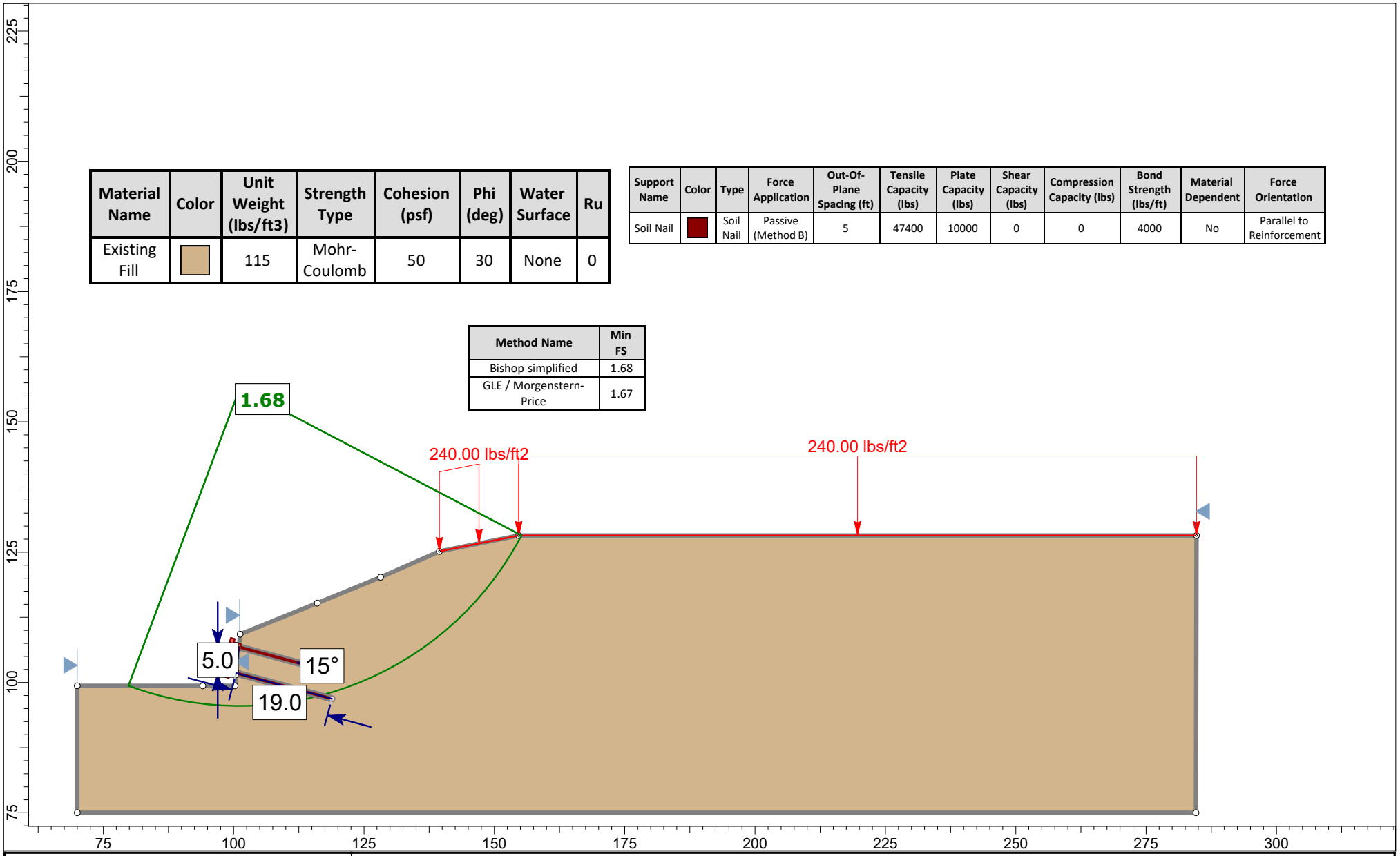
Yeh and Associates, Inc. Geotechnical • Geological • Construction Services	Project: 216-423 Avila Beach Drive Interchange Improvements		
	Analysis Description: Retaining Wall N1 (Sta. 121+50.4 "N1" Line)		
	Drawn By: J. Cravens	Scale: 1:100	Company: Yeh and Associates, Inc.
	Date: 1/6/2022		File Name: 216-423 Wall N1.slmd

SLIDEINTERPRET 9.020

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Existing Fill		115	Mohr-Coulomb	50	30	None	0

Support Name	Color	Type	Force Application	Out-Of-Plane Spacing (ft)	Tensile Capacity (lbs)	Plate Capacity (lbs)	Shear Capacity (lbs)	Compression Capacity (lbs)	Bond Strength (lbs/ft)	Material Dependent	Force Orientation
Soil Nail		Soil Nail	Passive (Method B)	5	47400	10000	0	0	4000	No	Parallel to Reinforcement

Method Name	Min FS
Bishop simplified	1.68
GLE / Morgenstern-Price	1.67



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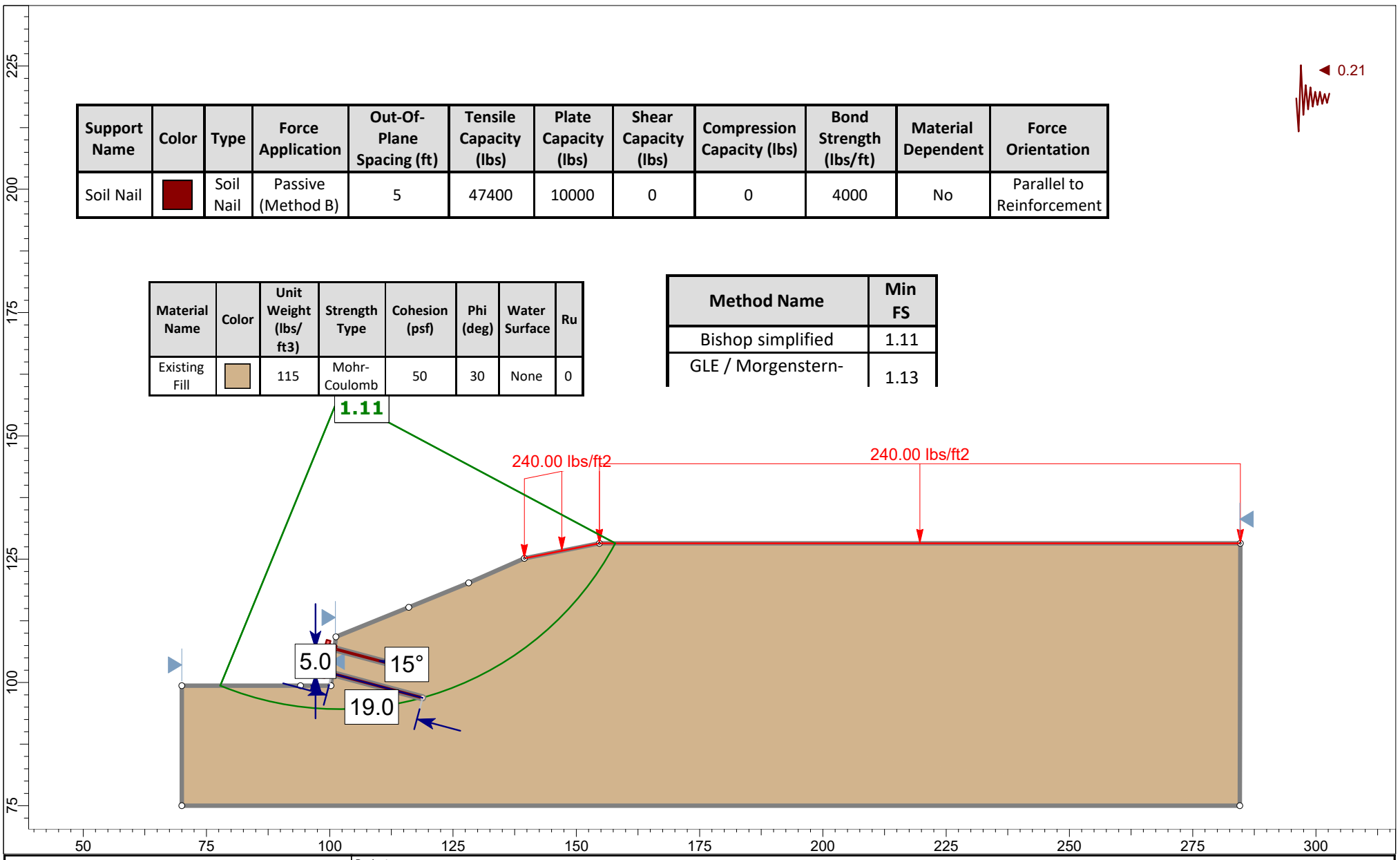
SLIDEINTERPRET 9.027

Project	216-423 Avila Beach Drive Interchange Improvements		
Analysis Description	Retaining Wall W1 (Sta. 611+67 "W1-A" Line)		
Drawn By	J. Cravens/J. King	Scale 1:305	Company Yeh and Associates, Inc.
Date	5/22/23		File Name 216-423 Wall W1A Sta 611+67.slmd

Support Name	Color	Type	Force Application	Out-Of-Plane Spacing (ft)	Tensile Capacity (lbs)	Plate Capacity (lbs)	Shear Capacity (lbs)	Compression Capacity (lbs)	Bond Strength (lbs/ft)	Material Dependent	Force Orientation
Soil Nail		Soil Nail	Passive (Method B)	5	47400	10000	0	0	4000	No	Parallel to Reinforcement

Material Name	Color	Unit Weight (lbs/ ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Existing Fill		115	Mohr-Coulomb	50	30	None	0

Method Name	Min FS
Bishop simplified	1.11
GLE / Morgenstern-	1.13



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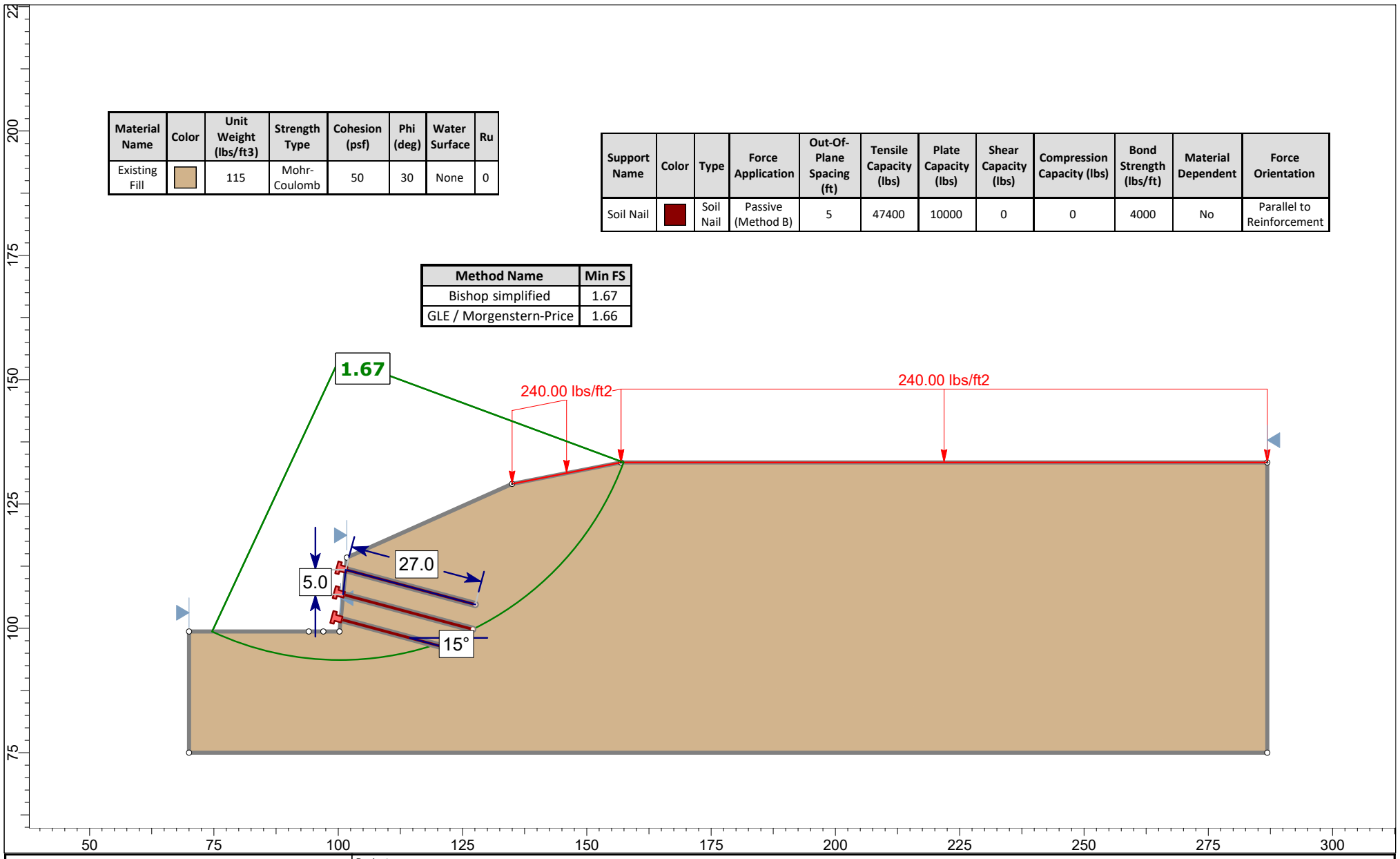
SLIDEINTERPRET 9.027

Project	216-423 Avila Beach Drive Interchange Improvements		
Analysis Description	Retaining Wall W1 (Sta. 611+67 "W1-A" Line)		
Drawn By	J. Cravens/J. King	Scale 1:323	Company Yeh and Associates, Inc.
Date	5/22/23		File Name 216-423 Wall W1A Sta 611+67.slmd

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Existing Fill		115	Mohr-Coulomb	50	30	None	0

Support Name	Color	Type	Force Application	Out-Of-Plane Spacing (ft)	Tensile Capacity (lbs)	Plate Capacity (lbs)	Shear Capacity (lbs)	Compression Capacity (lbs)	Bond Strength (lbs/ft)	Material Dependent	Force Orientation
Soil Nail		Soil Nail	Passive (Method B)	5	47400	10000	0	0	4000	No	Parallel to Reinforcement

Method Name	Min FS
Bishop simplified	1.67
GLE / Morgenstern-Price	1.66



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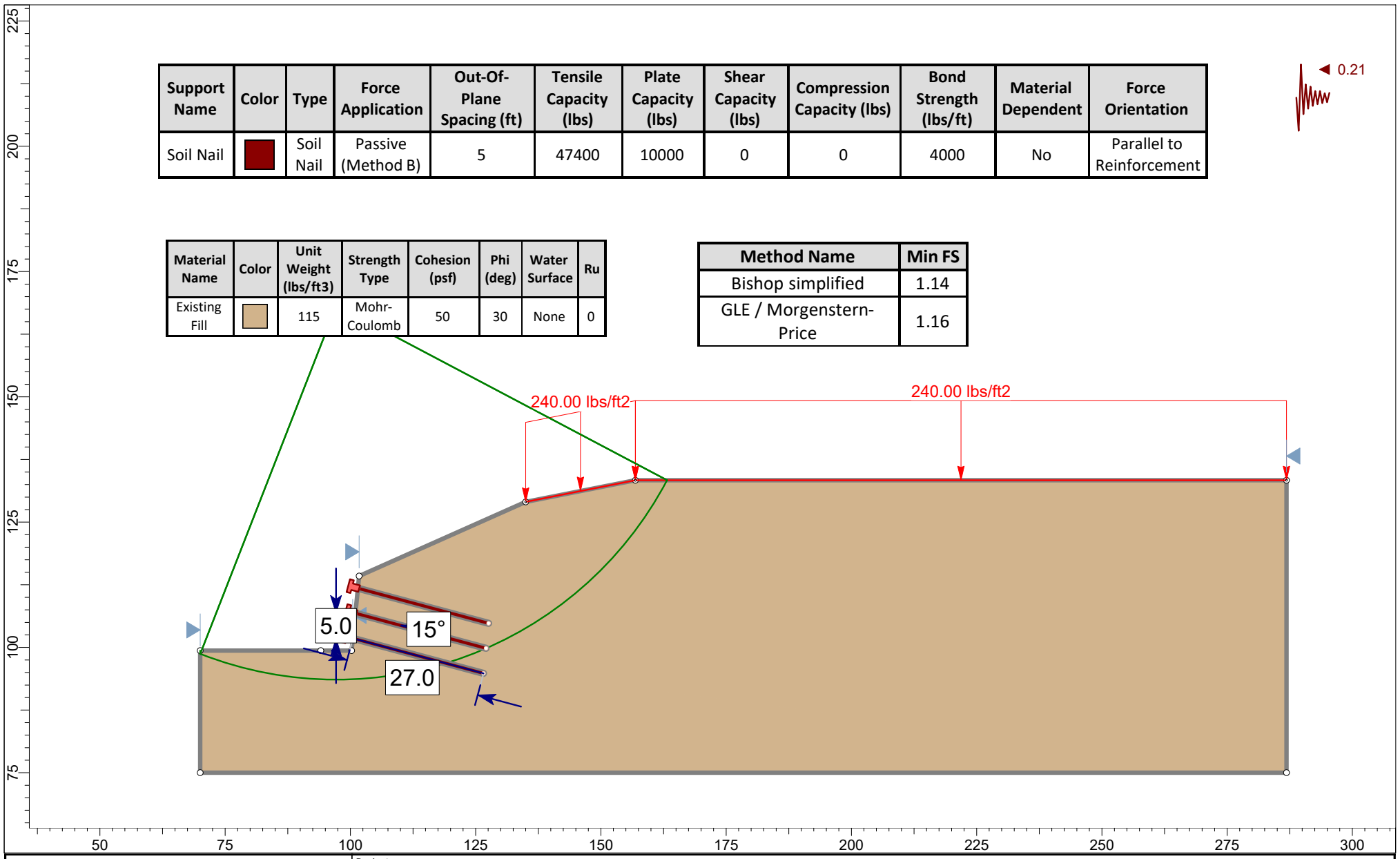
Project	216-423 Avila Beach Drive Interchange Improvements		
Analysis Description	Retaining Wall W1 (Sta. 612+12 "W1-A" Line)		
Drawn By	J. Cravens/J. King	Scale 1:320	Company Yeh and Associates, Inc.
Date	5/22/23		File Name 216-423 Wall W1A Sta 612+12.slmd

Support Name	Color	Type	Force Application	Out-Of-Plane Spacing (ft)	Tensile Capacity (lbs)	Plate Capacity (lbs)	Shear Capacity (lbs)	Compression Capacity (lbs)	Bond Strength (lbs/ft)	Material Dependent	Force Orientation
Soil Nail		Soil Nail	Passive (Method B)	5	47400	10000	0	0	4000	No	Parallel to Reinforcement

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Existing Fill		115	Mohr-Coulomb	50	30	None	0

Method Name	Min FS
Bishop simplified	1.14
GLE / Morgenstern-Price	1.16



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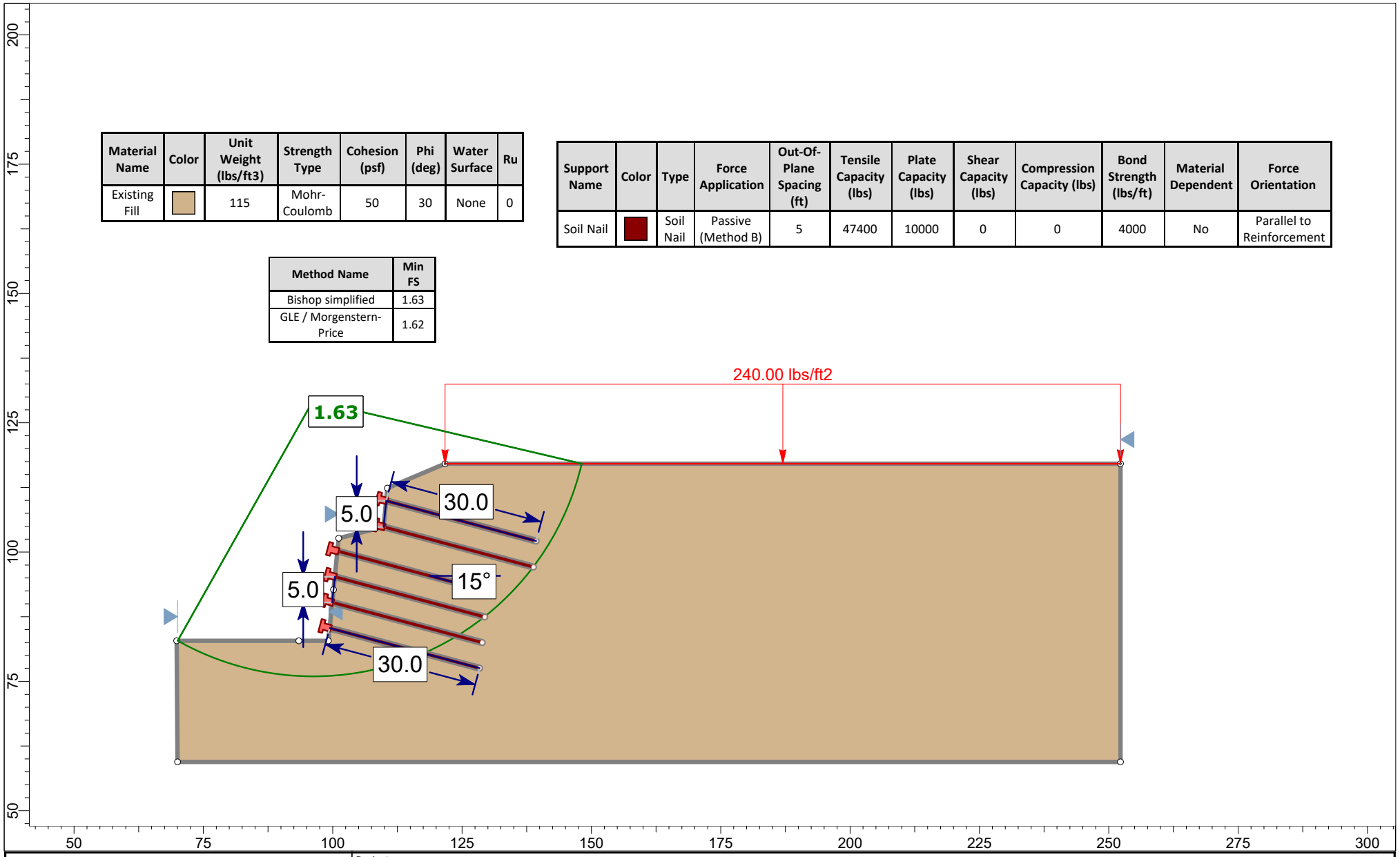
Project	216-423 Avila Beach Drive Interchange Improvements		
Analysis Description	Retaining Wall W1 (Sta. 612+12 "W1-A" Line)		
Drawn By	J. Cravens/J. King	Scale 1:317	Company Yeh and Associates, Inc.
Date	5/22/23		File Name 216-423 Wall W1A Sta 612+12.slmd

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Existing Fill		115	Mohr-Coulomb	50	30	None	0

Support Name	Color	Type	Force Application	Out-Of-Plane Spacing (ft)	Tensile Capacity (lbs)	Plate Capacity (lbs)	Shear Capacity (lbs)	Compression Capacity (lbs)	Bond Strength (lbs/ft)	Material Dependent	Force Orientation
Soil Nail		Soil Nail	Passive (Method B)	5	47400	10000	0	0	4000	No	Parallel to Reinforcement

Method Name	Min FS
Bishop simplified	1.63
GLE / Morgenstern-Price	1.62



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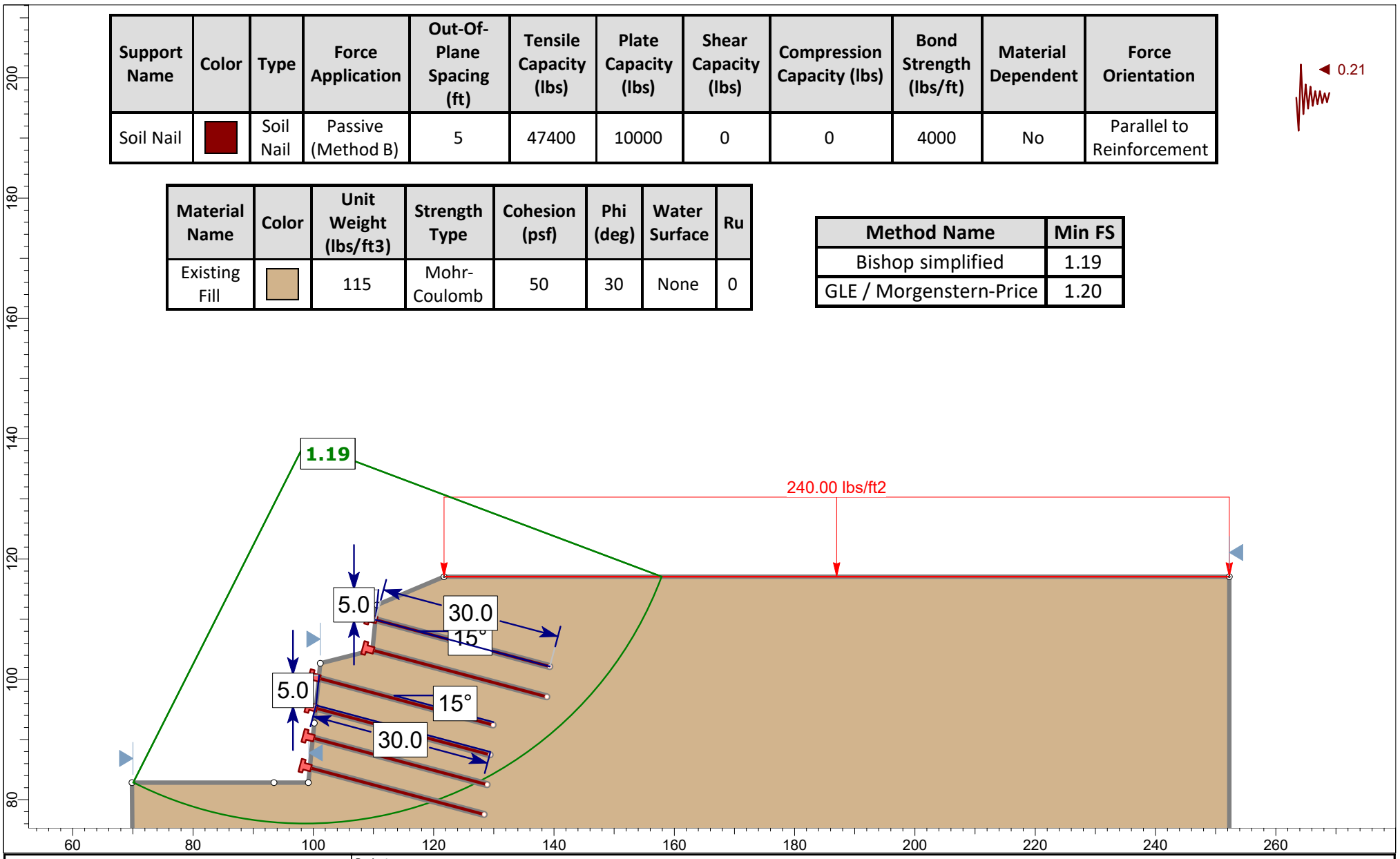
Project	216-423 Avila Beach Drive Interchange Improvements		
Analysis Description	Retaining Wall W1 (Sta. 612+68 "W1-A" Line)		
Drawn By	J. Cravens/J. King	Scale 1:307	Company Yeh and Associates, Inc.
Date	5/22/23		File Name 216-423 Wall W1 Sta 612+68.slmd

Support Name	Color	Type	Force Application	Out-Of-Plane Spacing (ft)	Tensile Capacity (lbs)	Plate Capacity (lbs)	Shear Capacity (lbs)	Compression Capacity (lbs)	Bond Strength (lbs/ft)	Material Dependent	Force Orientation
Soil Nail		Soil Nail	Passive (Method B)	5	47400	10000	0	0	4000	No	Parallel to Reinforcement

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Existing Fill		115	Mohr-Coulomb	50	30	None	0

Method Name	Min FS
Bishop simplified	1.19
GLE / Morgenstern-Price	1.20



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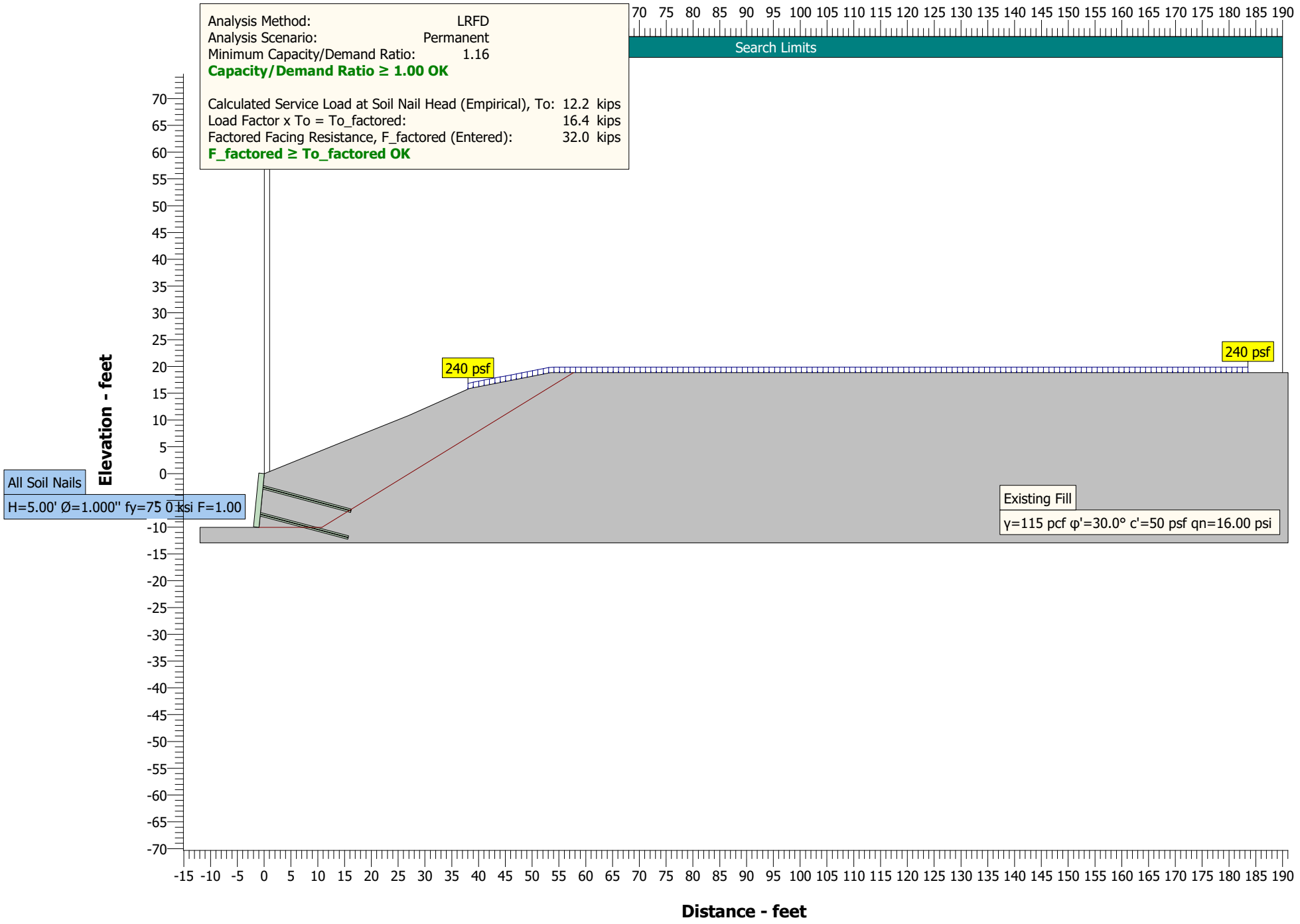
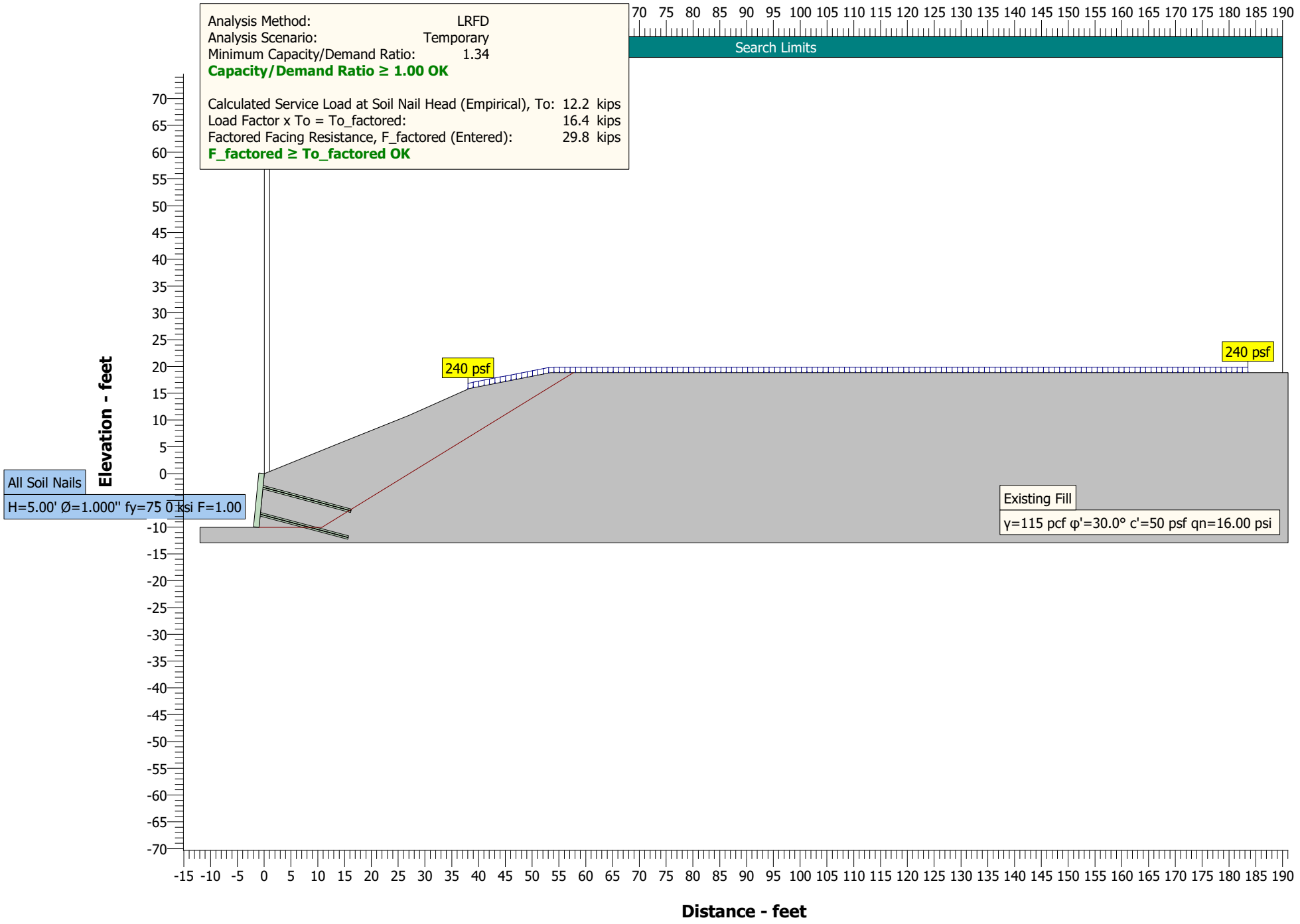
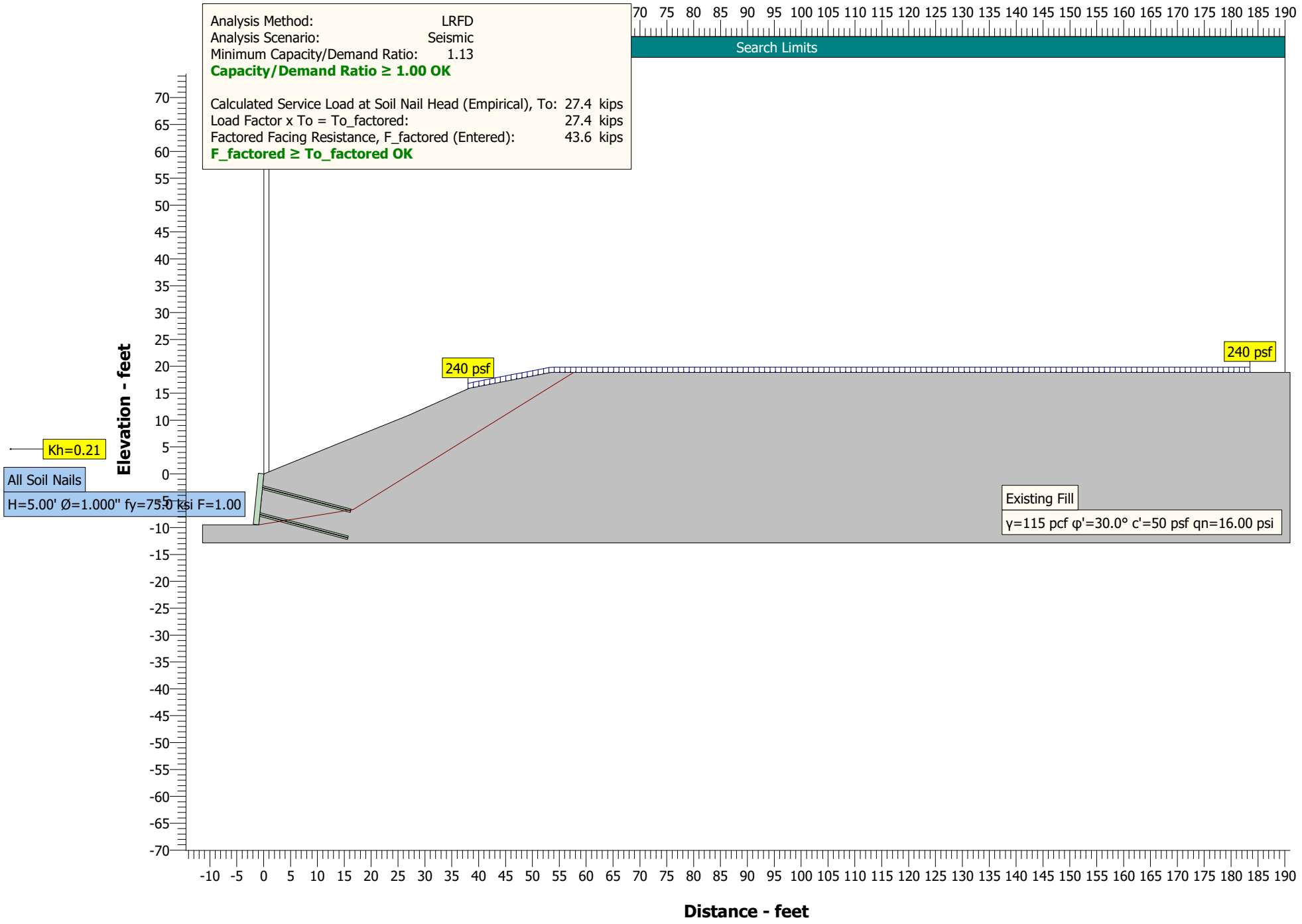
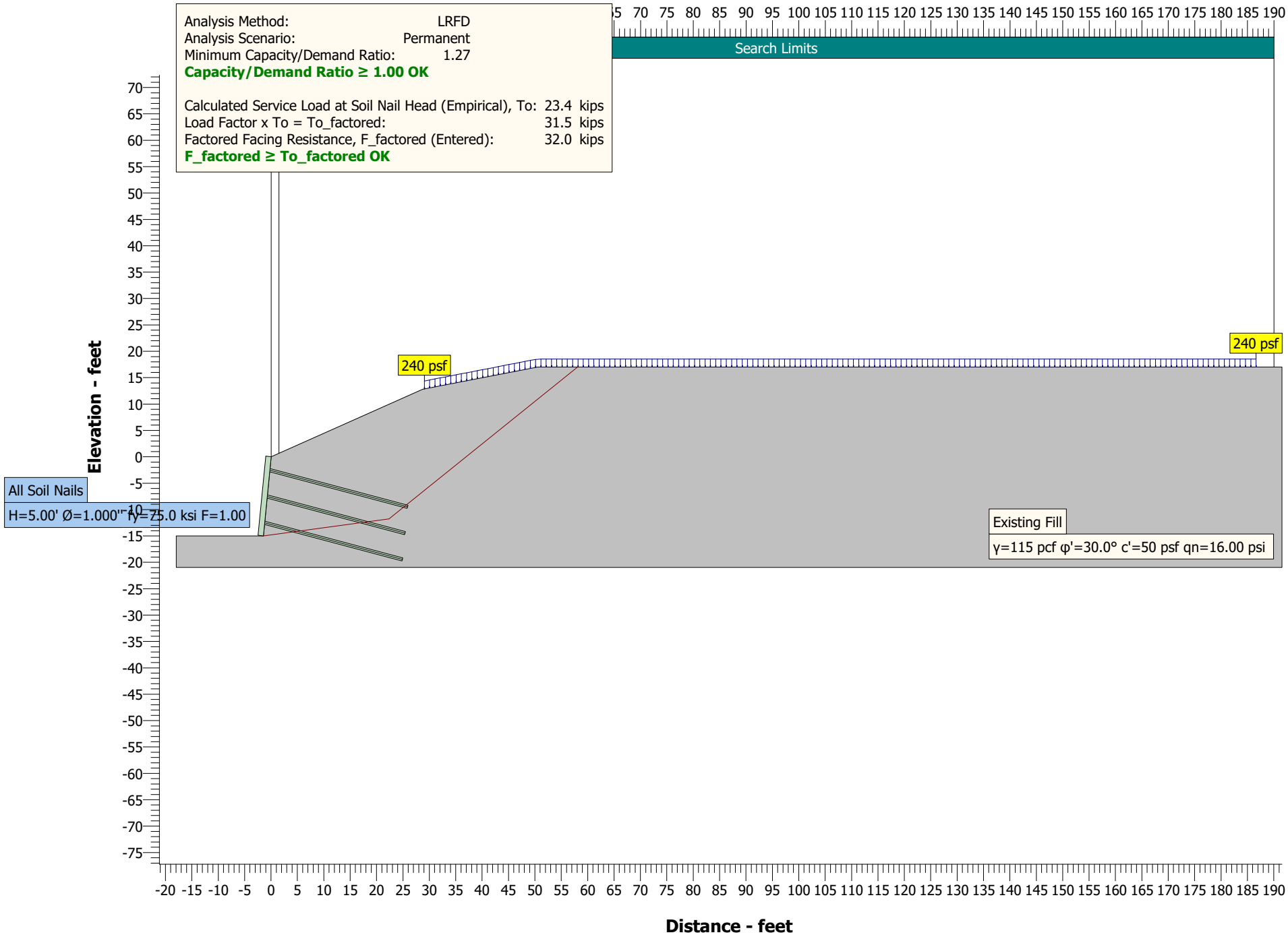
SLIDEINTERPRET 9.027

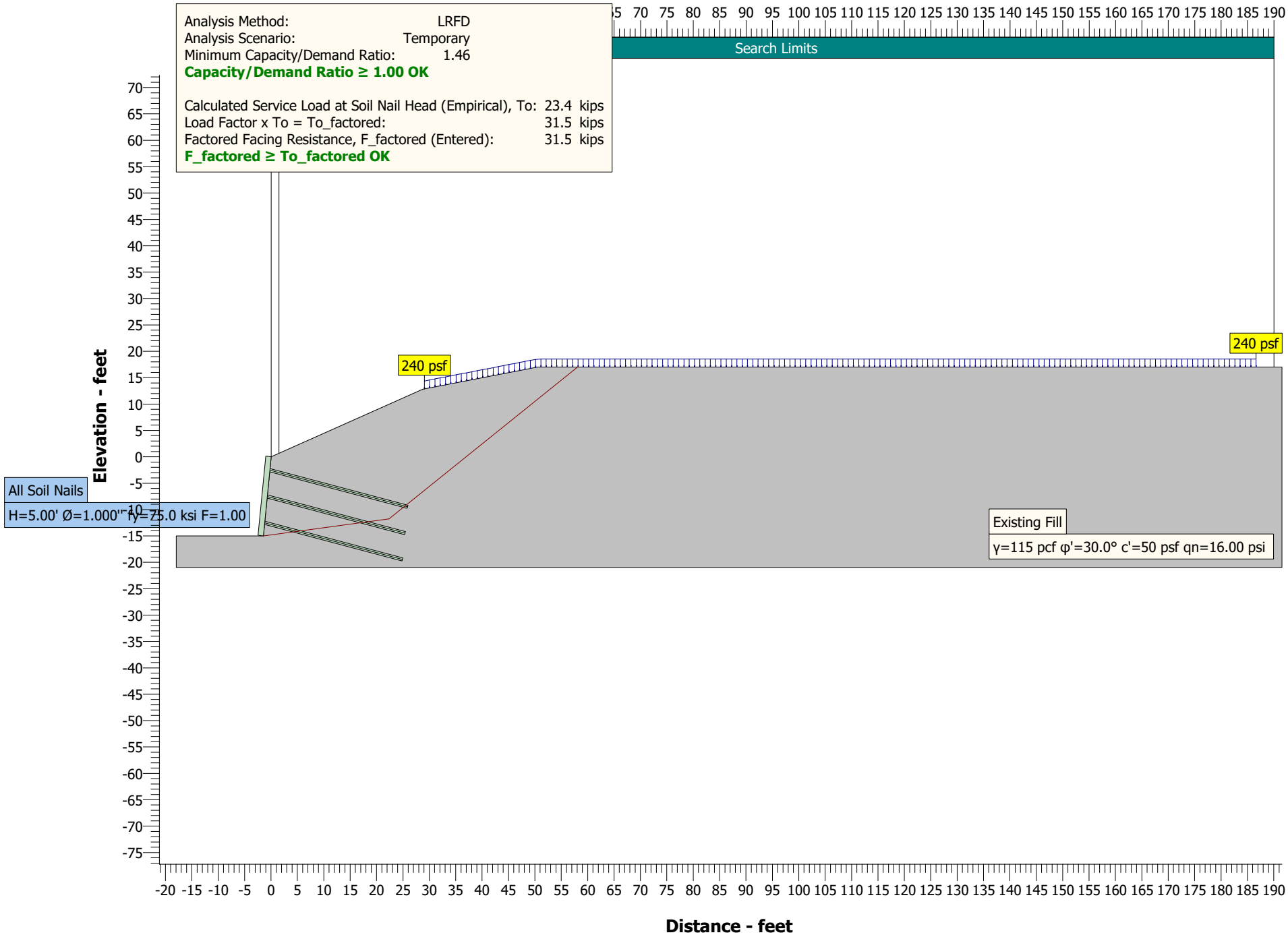
Project	216-423 Avila Beach Drive Interchange Improvements		
Analysis Description	Retaining Wall W1 (Sta. 612+68 "W1-A" Line)		
Drawn By	J. Cravens/J. King	Scale 1:265	Company Yeh and Associates, Inc.
Date	5/22/23		File Name 216-423 Wall W1 Sta 612+68.slmd

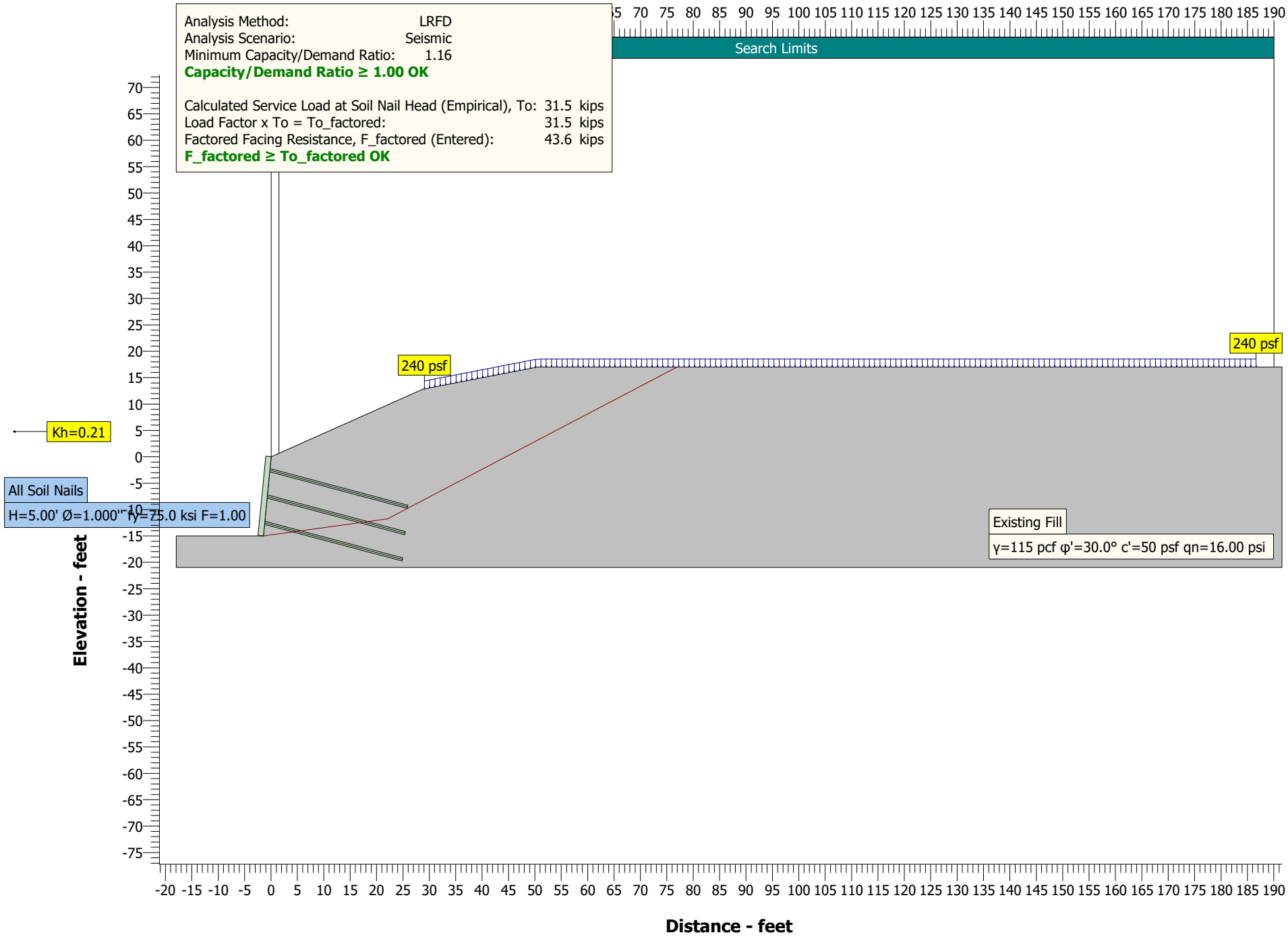

Analysis Method: LRFD
Analysis Scenario: Permanent
Minimum Capacity/Demand Ratio: 1.16
Capacity/Demand Ratio ≥ 1.00 OK
Calculated Service Load at Soil Nail Head (Empirical), To: 12.2 kips
Load Factor x To = To_factored: 16.4 kips
Factored Facing Resistance, F_factored (Entered): 32.0 kips
F_factored ≥ To_factored OK
Search Limits
240 psf
240 psf
All Soil Nails
H=5.00' Ø=1.000'' fy=75.0 ksi F=1.00
Existing Fill
γ=115 pcf φ'=30.0° c'=50 psf qn=16.00 psi
Elevation - feet
Distance - feet

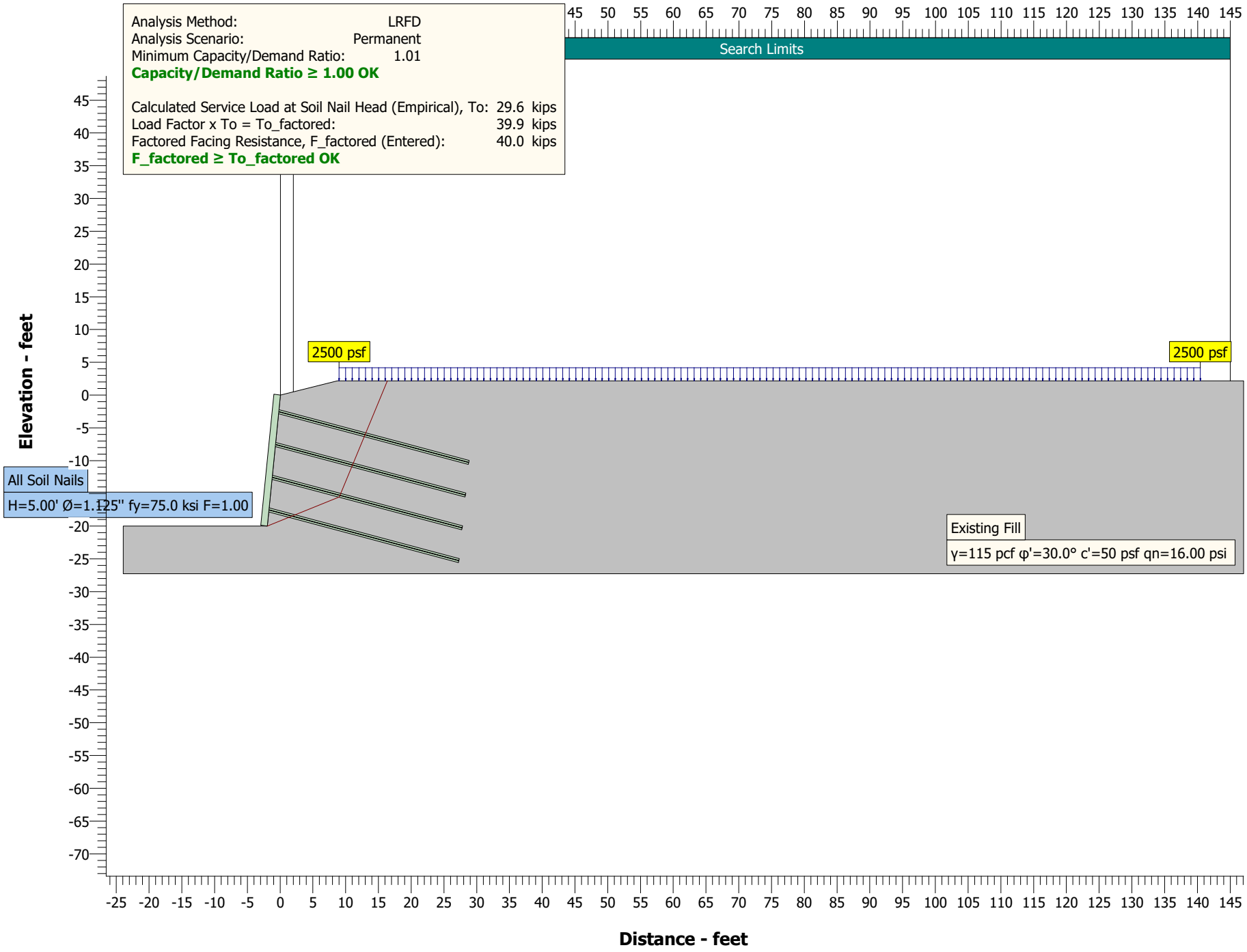

Analysis Method: LRFD
Analysis Scenario: Temporary
Minimum Capacity/Demand Ratio: 1.34
Capacity/Demand Ratio ≥ 1.00 OK
Calculated Service Load at Soil Nail Head (Empirical), To: 12.2 kips
Load Factor x To = To_factored: 16.4 kips
Factored Facing Resistance, F_factored (Entered): 29.8 kips
F_factored ≥ To_factored OK
Search Limits
240 psf
240 psf
All Soil Nails
H=5.00' Ø=1.000'' fy=75.0 ksi F=1.00
Existing Fill
γ=115 pcf φ'=30.0° c'=50 psf qn=16.00 psi
Elevation - feet
Distance - feet

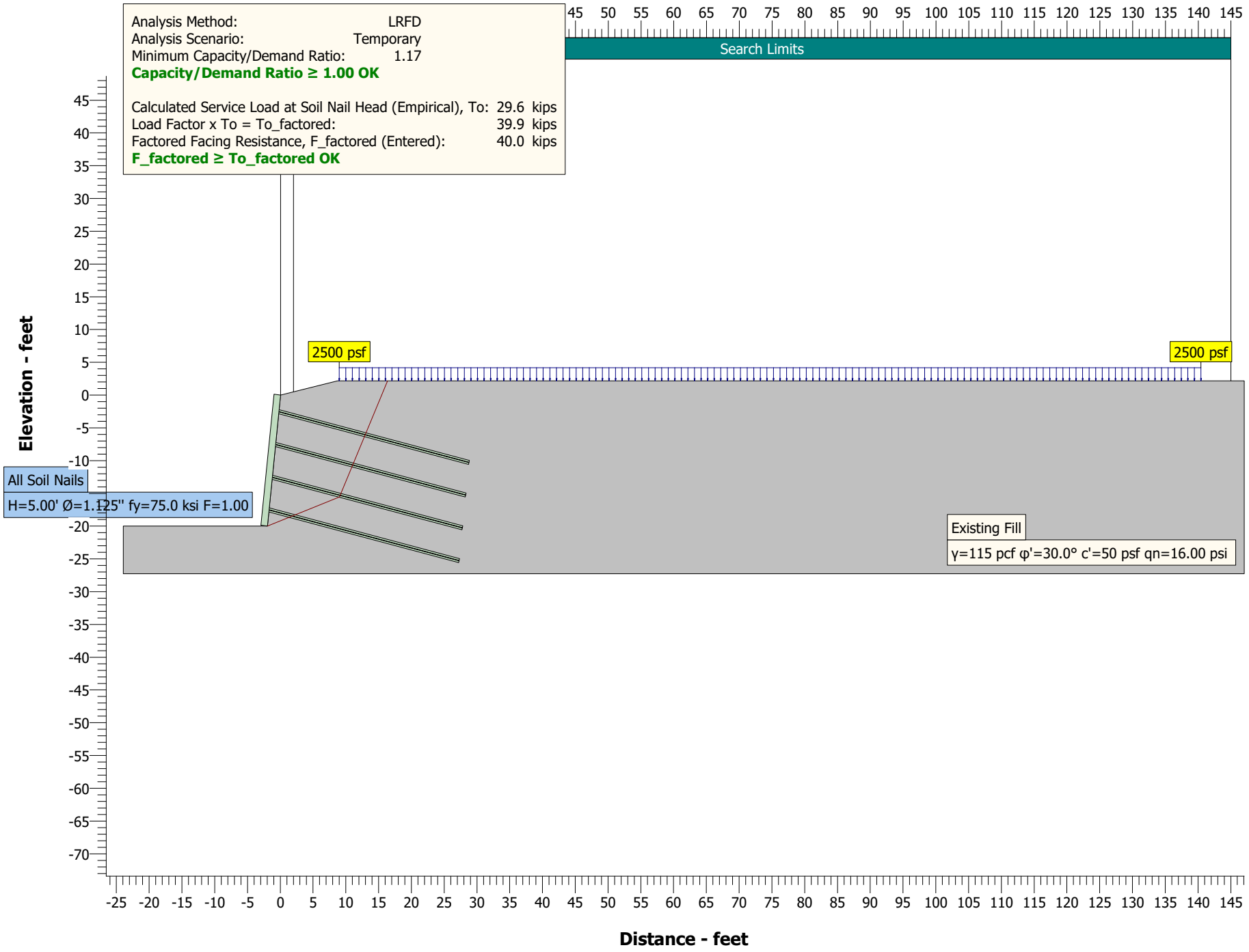

Analysis Method: LRFD
Analysis Scenario: Seismic
Minimum Capacity/Demand Ratio: 1.13
Capacity/Demand Ratio ≥ 1.00 OK
Calculated Service Load at Soil Nail Head (Empirical), To: 27.4 kips
Load Factor x To = To_factored: 27.4 kips
Factored Facing Resistance, F_factored (Entered): 43.6 kips
F_factored ≥ To_factored OK
Search Limits
240 psf
240 psf
Kh=0.21
All Soil Nails
H=5.00' Ø=1.000" fy=75.0 ksi F=1.00
Existing Fill
γ=115 pcf φ'=30.0° c'=50 psf qn=16.00 psi
Elevation - feet
Distance - feet

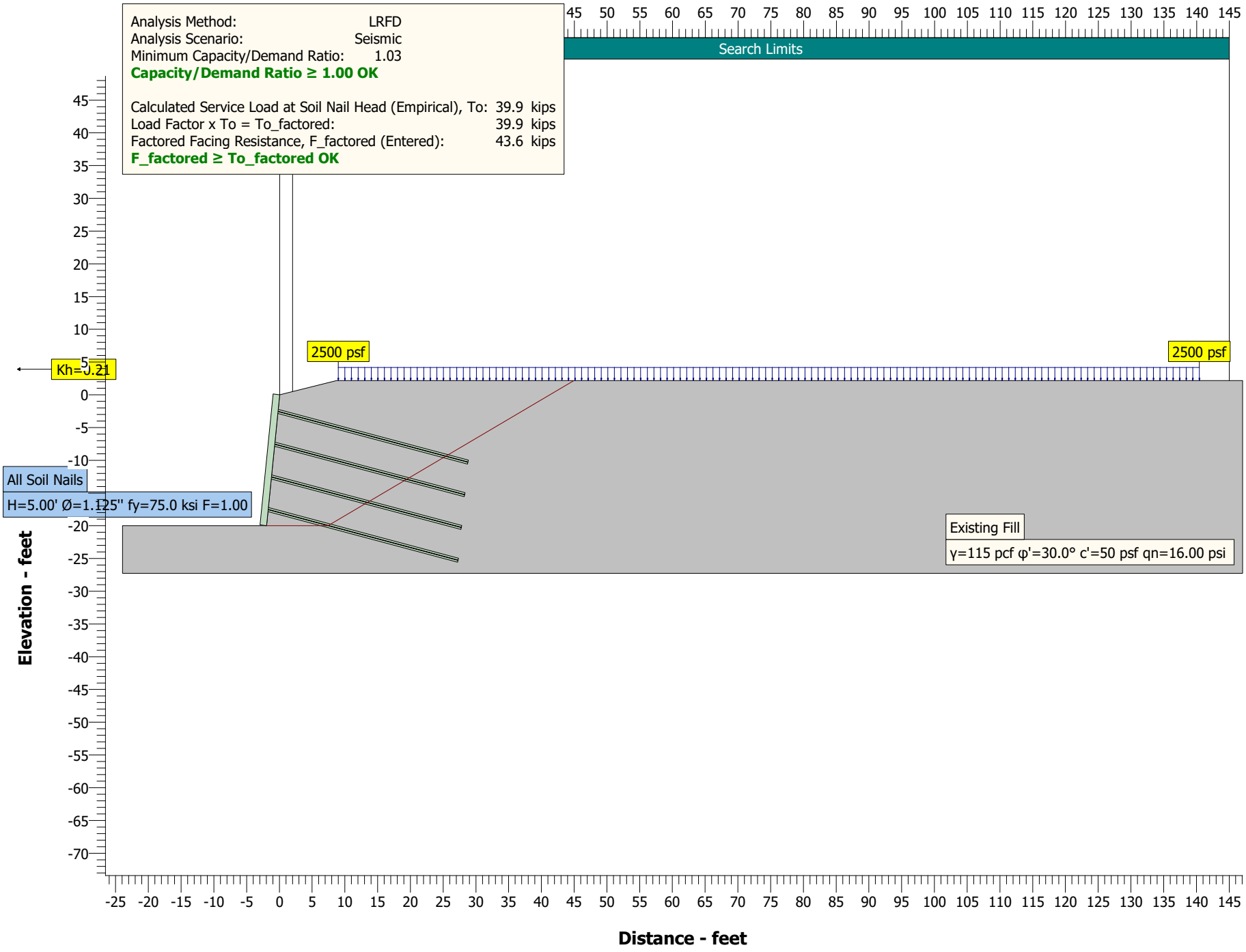

Analysis Method: LRFD
Analysis Scenario: Permanent
Minimum Capacity/Demand Ratio: 1.27
Capacity/Demand Ratio ≥ 1.00 OK
Calculated Service Load at Soil Nail Head (Empirical), To: 23.4 kips
Load Factor x To = To_factored: 31.5 kips
Factored Facing Resistance, F_factored (Entered): 32.0 kips
F_factored ≥ To_factored OK
Search Limits
240 psf
240 psf
All Soil Nails
H=5.00' Ø=1.000" fy=75.0 ksi F=1.00
Existing Fill
γ=115 pcf φ'=30.0° c'=50 psf qn=16.00 psi
Elevation - feet
Distance - feet

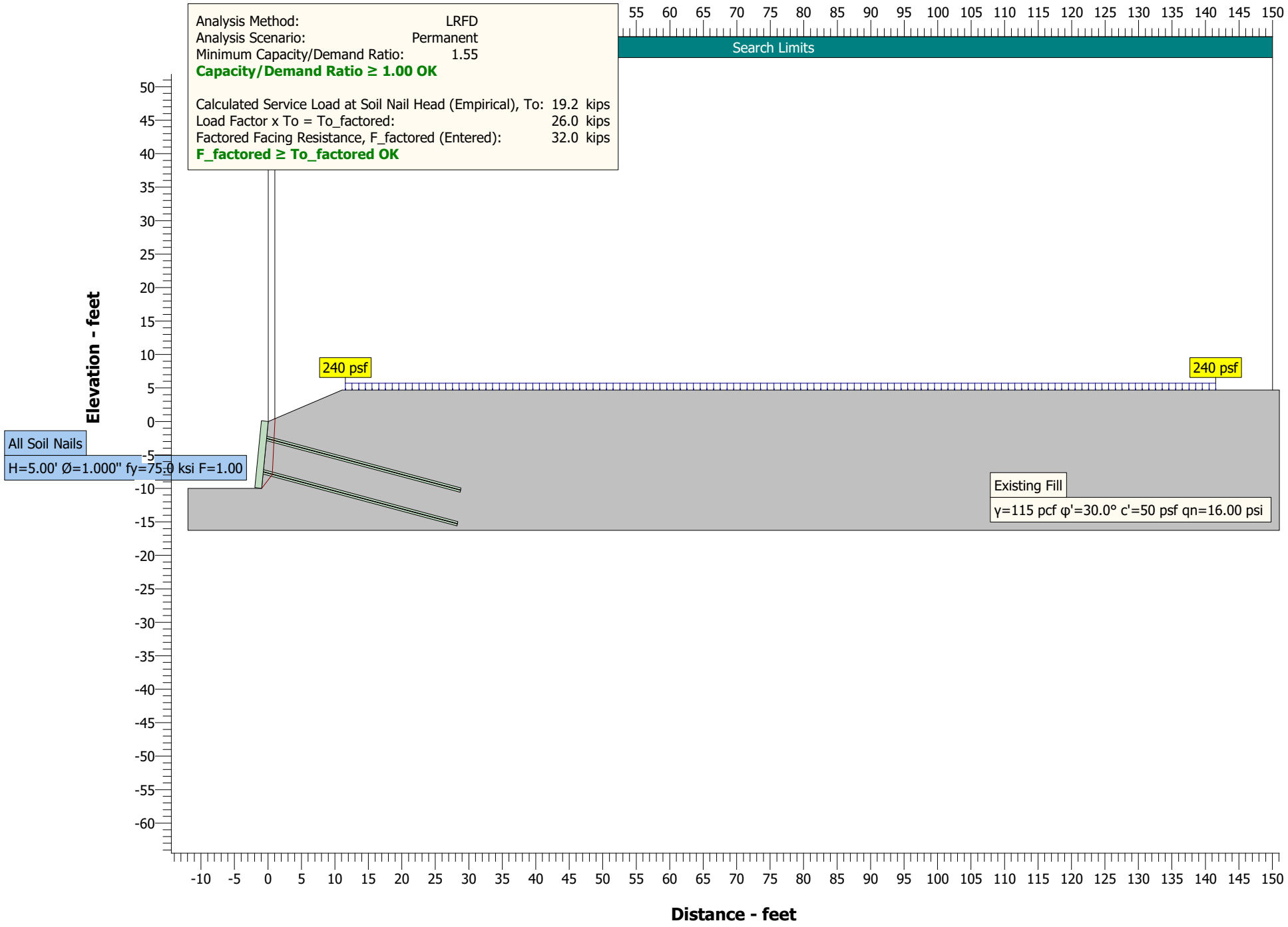

Analysis Method: LRFD
Analysis Scenario: Temporary
Minimum Capacity/Demand Ratio: 1.46
Capacity/Demand Ratio ≥ 1.00 OK
Calculated Service Load at Soil Nail Head (Empirical), To: 23.4 kips
Load Factor x To = To_factored: 31.5 kips
Factored Facing Resistance, F_factored (Entered): 31.5 kips
F_factored ≥ To_factored OK
Search Limits
240 psf
240 psf
All Soil Nails
H=5.00' Ø=1.000" fy=75.0 ksi F=1.00
Existing Fill
γ=115 pcf φ'=30.0° c'=50 psf qn=16.00 psi
Elevation - feet
Distance - feet

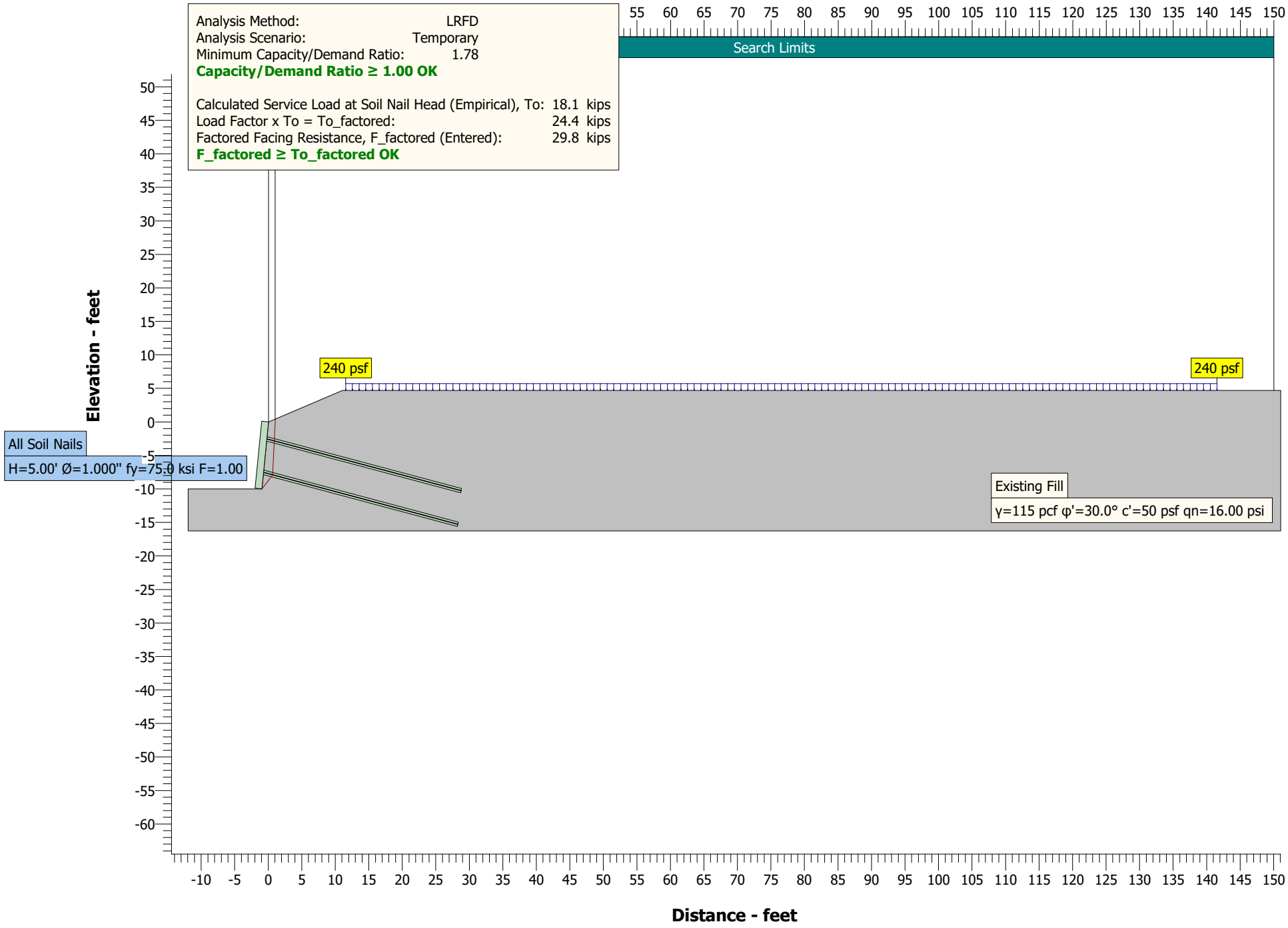

Analysis Method: LRFD
Analysis Scenario: Seismic
Minimum Capacity/Demand Ratio: 1.16
Capacity/Demand Ratio ≥ 1.00 OK
Calculated Service Load at Soil Nail Head (Empirical), To: 31.5 kips
Load Factor x To = To_factored: 31.5 kips
Factored Facing Resistance, F_factored (Entered): 43.6 kips
F_factored ≥ To_factored OK
Search Limits
240 psf
240 psf
Kh=0.21
All Soil Nails
H=5.00' Ø=1.000" fy=75.0 ksi F=1.00
Existing Fill
γ=115 pcf φ'=30.0° c'=50 psf qn=16.00 psi
Elevation - feet
Distance - feet

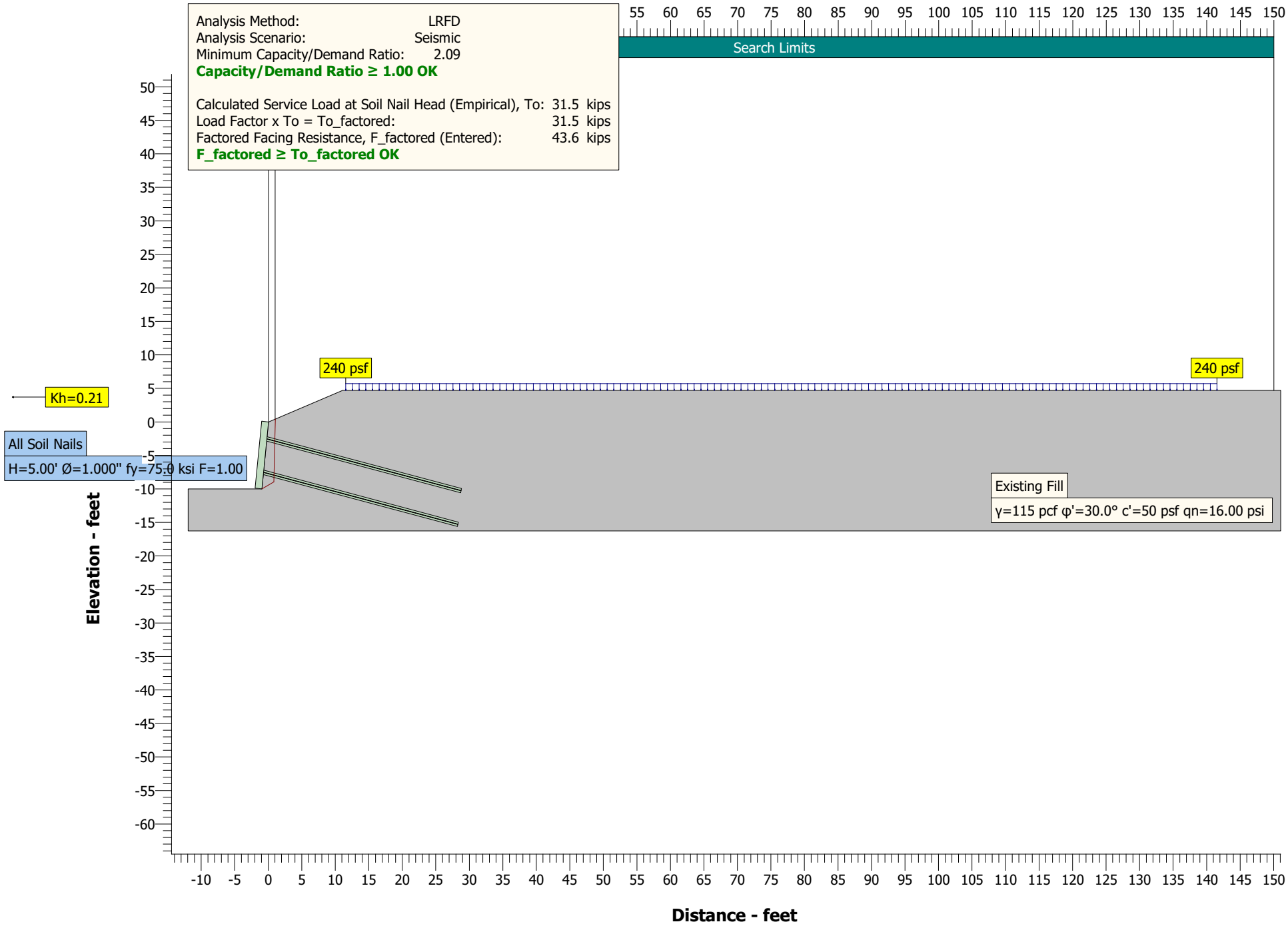

Analysis Method: LRFD
Analysis Scenario: Permanent
Minimum Capacity/Demand Ratio: 1.01
Capacity/Demand Ratio ≥ 1.00 OK
Calculated Service Load at Soil Nail Head (Empirical), To: 29.6 kips
Load Factor x To = To_factored: 39.9 kips
Factored Facing Resistance, F_factored (Entered): 40.0 kips
F_factored ≥ To_factored OK
Search Limits
2500 psf
2500 psf
All Soil Nails
H=5.00' Ø=1.125" fy=75.0 ksi F=1.00
Existing Fill
γ=115 pcf φ'=30.0° c'=50 psf qn=16.00 psi
Elevation - feet
Distance - feet


Analysis Method: LRFD
Analysis Scenario: Temporary
Minimum Capacity/Demand Ratio: 1.17
Capacity/Demand Ratio ≥ 1.00 OK
Calculated Service Load at Soil Nail Head (Empirical), To: 29.6 kips
Load Factor x To = To_factored: 39.9 kips
Factored Facing Resistance, F_factored (Entered): 40.0 kips
F_factored ≥ To_factored OK
Search Limits
2500 psf
2500 psf
All Soil Nails
H=5.00' Ø=1.125" fy=75.0 ksi F=1.00
Existing Fill
γ=115 pcf φ'=30.0° c'=50 psf qn=16.00 psi
Elevation - feet
Distance - feet


Analysis Method: LRFD
Analysis Scenario: Seismic
Minimum Capacity/Demand Ratio: 1.03
Capacity/Demand Ratio ≥ 1.00 OK
Calculated Service Load at Soil Nail Head (Empirical), To: 39.9 kips
Load Factor x To = To_factored: 39.9 kips
Factored Facing Resistance, F_factored (Entered): 43.6 kips
F_factored ≥ To_factored OK
Search Limits
2500 psf
2500 psf
Kh=0.21
All Soil Nails
H=5.00' Ø=1.125" fy=75.0 ksi F=1.00
Existing Fill
γ=115 pcf φ'=30.0° c'=50 psf qn=16.00 psi
Elevation - feet
Distance - feet


Analysis Method: LRFD
Analysis Scenario: Permanent
Minimum Capacity/Demand Ratio: 1.55
Capacity/Demand Ratio ≥ 1.00 OK
Calculated Service Load at Soil Nail Head (Empirical), To: 19.2 kips
Load Factor x To = To_factored: 26.0 kips
Factored Facing Resistance, F_factored (Entered): 32.0 kips
F_factored ≥ To_factored OK
Search Limits
240 psf
240 psf
All Soil Nails
H=5.00' Ø=1.000" fy=75.0 ksi F=1.00
Existing Fill
γ=115 pcf φ'=30.0° c'=50 psf qn=16.00 psi
Elevation - feet
Distance - feet


Analysis Method: LRFD
Analysis Scenario: Temporary
Minimum Capacity/Demand Ratio: 1.78
Capacity/Demand Ratio ≥ 1.00 OK
Calculated Service Load at Soil Nail Head (Empirical), To: 18.1 kips
Load Factor x To = To_factored: 24.4 kips
Factored Facing Resistance, F_factored (Entered): 29.8 kips
F_factored ≥ To_factored OK
Search Limits
240 psf
240 psf
All Soil Nails
H=5.00' Ø=1.000" fy=75.0 ksi F=1.00
Existing Fill
γ=115 pcf φ'=30.0° c'=50 psf qn=16.00 psi
Elevation - feet
Distance - feet


Analysis Method: LRFD
Analysis Scenario: Seismic
Minimum Capacity/Demand Ratio: 2.09
Capacity/Demand Ratio ≥ 1.00 OK
Calculated Service Load at Soil Nail Head (Empirical), To: 31.5 kips
Load Factor x To = To_factored: 31.5 kips
Factored Facing Resistance, F_factored (Entered): 43.6 kips
F_factored ≥ To_factored OK
Search Limits
240 psf
240 psf
Kh=0.21
All Soil Nails
H=5.00' Ø=1.000" fy=75.0 ksi F=1.00
Existing Fill
γ=115 pcf φ'=30.0° c'=50 psf qn=16.00 psi
Elevation - feet
Distance - feet

APPENDIX D – RESPONSE TO CALTRANS COMMENTS

Draft Type Selection Report, Field Infiltration Testing Memo, and Foundation Review Comment Sheet

May 18, 2021

EA: **05-1G480_**
CO-Rte-KP (PM): **SLO-101-PM 17.9/21.5** *Proj. NAME*: **Avila Ramps Roundabouts**
PROJECT MANAGER: **Paul Valadao (916) 763-9123**

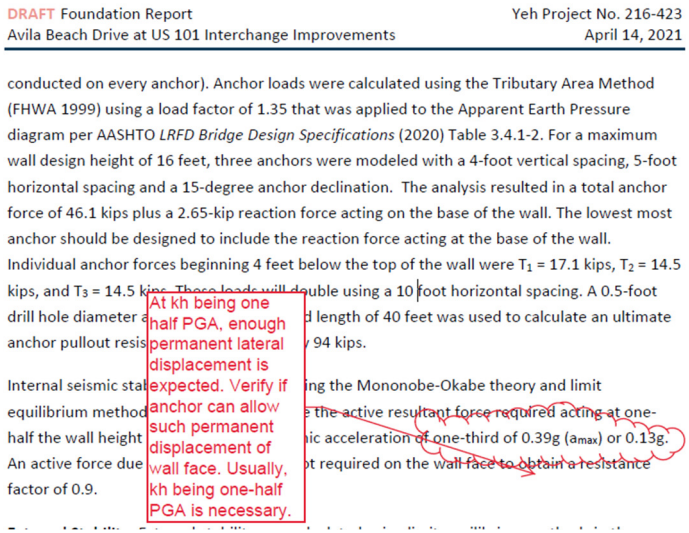
REVIEWED BY: **K.D. Cook/ R. Atilano**
FUNCTIONAL UNIT: **Headquarters Geotechnical Design**

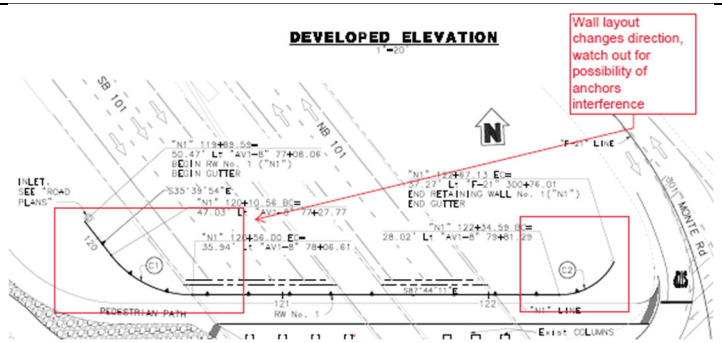
Page/Sheet No. ↓	**Section**	**Paragraph** ↓	**Comment**	**Response (Yeh and Associates, J. King, J. Cravens)**
i	Cover letter		The report is dated April 14, 2021; therefore, it falls under the criteria of the Foundation Reports of Earth Retaining Systems (ERS) January 2021 and not the 2017 edition of the same. Please revise the report accordingly.	Yeh updated the report for the January 2021 ERS Report Guidelines.
1	Introduction	1	Please provide a copy for review of the DRAFT Geotechnical Design Report (Yeh, 2020) "provided under separate" as referred to in the report.	Yeh revised the DRAFT Geotechnical Design Report on July 8, 2021 per 65% design plans and provided a copy to Wallace Group.
1	References	1	This may be omitted, references are listed later in the report.	Yeh omitted this section
2	Proposed Improvements	2	Type selection report notes that the maximum wall height is 15 feet for retaining wall N1 and a combined maximum height of 26 feet for retaining wall W1. FR mentions different heights. Revise if needed.	Yeh revised this section
3	Exceptions	1	If no exceptions, omit this section.	Yeh omitted this section
4	Exploration Drilling		Please identify and reference the Caltrans Encroachment Permit under which the work was	Yeh included the Caltrans Encroachment Permit number in this section.

			conducted.	
4	Exploration Drilling		Please identify, reference, and provide a copy of the County of San Luis Obispo Health Agency, Well Permit which the borings were drilled and abandoned (grouted) under.	Yeh included the Well Permit numbers in this section and will provide copies of the approved Well Permits in an appendix to the Foundation Report.
5	Laboratory Testing	1	Revise the 4th sentence as needed.	Yeh revised sentence 4.
11	Groundwater Conditions	1	What is the design groundwater elevation? A groundwater elevation was assumed for liquefaction calculations and should be included in the report.	Yeh added the design groundwater elevation to the liquefaction section.
12	Ground Rupture	1	Please include a statement that the site is not within 1000 feet of a Holocene age fault in accordance with the Caltrans Fault Rupture element (2017) of the Geotechnical Manual.	Yeh added a statement in this section.
13	Liquefaction	1	Suggest revising the first sentence, it is not clear where the silt and loose sands are located in relation to the groundwater table and dense soils.	Yeh revised the first sentence.
13	Liquefaction	1	What are the vertical limits (depth or elevation) of the liquefiable layer?	Yeh added limits of liquefiable layer.
13	Liquefaction	1	Suggest including a clear statement at the beginning of this section stating if liquefaction potential exists or not.	Comment noted. Statement included at end of section.
13	Liquefaction	2	Suggest removing mention of non-liquefiable soils from this section.	Added note that soil is not considered vulnerable to liquefaction "based on Yeh's analyses".
15	Geotechnical Recommendations		Replace "Finished Grade" with the elevation at finished grade.	Replaced "finished grade" with "finished grade elevation"
15	Geotechnical Recommendations		The 2003 LOTBs and 2019 borings show blow counts, and current lab data, that suggest a higher friction angle. What is the basis of the 30-degree friction angle?	Artificial fill material within the active zone of the proposed earth retaining structures was found to be variable in consistency. An effective friction angle of 30 degrees was estimated based on the variable conditions of the materials.
15	Geotechnical Recommendations	4	What is the seismic displacement associated with the horizontal ground acceleration?	The horizontal ground acceleration is associated with 2 inches of lateral displacement. Yeh clarified this in the report.
	Appendix A – Boring Logs		Please provide the Borehole Locations, either Latitude – Longitude, or Line Station and offset.	Yeh added borehole Line/Station/Offset to the boring logs.
			Please provide all calculations along with the revised	Yeh provided geotechnical calculations

			report for review.	associated with the recommendations provided in the Foundation Report. Structural design recommendations and calculations for the Earth Retaining Structures will be provided by Mark Thomas.
			Updated report guidelines may be found here: https://dot.ca.gov/programs/engineering-services/manuals/geotechnical-manual	

REVIEWED BY: **Reza Erfanian**
FUNCTIONAL UNIT: **Headquarters Structures Design (DES OSFP)**

Page/Sheet No. ↓	Section	Paragraph ↓	Comment	Response
16	Foundation Report		 See attached '216-423 DRAFT Avila Beach Dr Interchange Foundation Report 04-14-2021, GW Comnts.pdf'	Mark Thomas is providing structural design recommendations and calculations for the wall design.

General Plan	Type Selection Report		 See attached 'Draft Type Selection Report - Avila Beach Dr_Ret Walls 4-16-21, GW Comnts.pdf'	N/A to the Foundation Report

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:		☐ PSR/PDS (Review No.)	Reviewer Name:	**Sungro Cho**
Proj ID (Phase):		☐ APS/PSR (Review No.)	Functional Unit:	**OGDW**
Project Name:	**Avila Beach Drive IC Improvements**	☐ APS/PR (Review No.)	Cost Center:	**59-3660**
OSFP Liaison:		☐ Type Selection	Phone Number:	**(805) 549-3194**
Phone:		☐ 65% PS&E Unchecked Details	e-mail:	**sungro.cho@dot.ca.gov**
E-mail:		PS&E (Review No. 1)	Date of Review:	**8/20/2021**
		☐ Construction	Structure Name*:	
		☐ Other:	Br No*:	
			(*Use if necessary to when comment sheets are by individual structure)	

Consultant Information (to be filled in by Consultant)

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)

Submittal Data (Reviewer to complete)

Project ID: Reviewer: Str Name*:

Date of Review: Functional Unit: Br No*. *=if applicable

#	Doc. (See Note 1)	Page, Section, or SSP	Review Comments	Consultant Responses	✓

Consultant Structure Lead (First and Last Name)	Structure Consultant Firm	Phone Number	E-mail	Response Date
Judd King	**Yeh and Associates**	**805-801-6416**	**jking@yeh-eng.com**	**9-9-2021**

#	Doc. (See Note 1)	Page, Section, or SSP	Review Comments	Consultant Responses	✓
1	FR	general	Please update the report with 2021ERS report Guidelines (See table of contents) For example, Physical setting in the draft foundation report is no longer used in the 2021 guidelines.	Yeh will update the Foundation Report to match the heading organization from the 2021 ERS Report Guidelines. Additional pertinent information not specified in the guidelines is provided as input to the geotechnical design and analyses.	
2	FR	Page 11	Groundwater condition. Please describe the design groundwater table that is used to your engineering analysis. e.g. "*The design groundwater table elevation for engineering analysis is 70 feet.*"	Groundwater Conditions are described in the report (on the referenced Page 11). Elevation 70 feet is the highest groundwater elevation recorded at the site based on previous boring data from Caltrans. The design groundwater elevation used in the liquefaction analyses is stated in the liquefaction section of the report.	
3	FR	Page 12	We don't require active and potentially active faults information since probabilistic analysis is used to determine the seismic parameters. Recommend removing the "Table 2: Active and potentially active faults"	Yeh will remove the Fault ID table.	
4	FR	Page 12	7.3 Dynamic Analysis and Seismic Data Please describe how to estimate the Vs30. e.g. "*Based on available subsurface information and Standard Penetration Test (SPT) correlations for determining shear wave velocity, the time-average shear wave velocity (VS30) for the upper 100 feet of soil at the site is estimated to be 972 ft/sec.*"	Yeh will include pertinent references used in Yeh's shear wave velocity estimation. Appendix A of *Caltrans Methodology for Developing Design Response Spectrum for use in Seismic Design Recommendations,* issued November 2012 is the specific document we used in estimating Vs30 based on subsurface data and SPT correlations.	

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RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓= Comment Resolved
(for Reviewer's use)

OSFP Rev Form 12/2010

Submittal Data (Reviewer to complete)

Project ID: Reviewer: Str Name*:

Date of Review: Functional Unit: Br No*. *=if applicable

#	Doc. (See Note 1)	Page, Section, or SSP	Review Comments	Consultant Responses	✓
5	FR	Page 13	ARS curve is not required for retaining wall design. Recommend removing the Figure 5.	Comment noted. The ARS curve is provided as a basis for the seismic design. It is provided as additional pertinent design information.	
6	FR	Page 17	Table 6, Geotech is not recommending the ground anchor vertical and horizontal spacing, and foundation soil factored nominal bearing resistance for facing. Instead, need to provide the apparent earth pressures (AEP) for wall (active, and passive). Please estimate the AEP or since soil properties are provided, let structure estimate them. e.g. *"To determine lateral pressures for the soldier pile wall, Figure 3.11.5.7-1 (b) of section 3.11.5.7 – Apparent Earth Pressures (AEP) for Anchored Walls (active and passive) from AASHTO LRFD Bridge Design Specifications, Eighth Edition, shall be used."*	Tables for Ground Anchor and Soil Nail Walls do include columns with recommendations for "maximum Ground Anchor Vertical Spacing", "Maximum Ground Anchor Horizontal Spacing", and "Foundation Soil Factored Nominal Bearing Resistance for Facing". Updated values will be provided in the final version of the FR. Geotechnical design properties were provided in the Foundation Report for the structure designer for use with estimating the AEP. Yeh will clarify the AASHTO LRFD Bridge Design AEP figure 3.11.5.7-1(b) should be used in the design.	
7	65% plans	Sheet No, 119	"Soil Design Parameters" Kh in the plan is 0.13. Please make sure that the soil parameters in the plan are the ones provided in the Foundation Report.	Plans will be updated	
8	65% plans	Sheet No, 132	Please add approximate location of proof test nail in the plan. FR, page 19 , 10.2 Retaining wall w1 described that "wall layout plan and elevation view should show locations of proof test nails in locations provided by geotechnical	Plans will be updated	

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Submittal Data (Reviewer to complete)

Project ID: Reviewer: Str Name*:

Date of Review: Functional Unit: Br No*. *=if applicable

#	Doc. (See Note 1)	Page, Section, or SSP	Review Comments	Consultant Responses	✓
			engineer. Plans should show at least 0.08N proof test nails where N is the number of production nails in each wall zone".		
9	Geotech Design Report	general	Same comments as # 1. Please update the report with 2021Geotechnical Design report Guidelines (See table of contents) https://des.onramp.dot.ca.gov/downloads/des/files/gs/Geotechnical%20Manual/202102-GM-GeotechnicalDesignReports-a11y.pdf For example, Physical setting in the draft GDR is no longer used in the 2021 guidelines.	Yeh will update the Geotechnical Design Report to match the heading organization from the 2021 GDR Guidelines. Additional pertinent information not specified in the guidelines is provided as input to the geotechnical design and analyses.	
10	Geotech Design Report	Page 16	"Dynamic Analysis and Seismic Data" Same comments as # 4 and 5	Yeh will include pertinent references used in Yeh's shear wave velocity estimation. The ARS curve is provided as a basis for the seismic design. It is provided as additional pertinent design information.	

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
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✓= Comment Resolved
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OSFP Rev Form 12/2010

Draft Geotechnical Design Report & Updated Draft Foundation Report Review Comment-Response Sheet

May 18, 2022

EA: **05-1G480_**
CO-Rte-KP (PM): **SLO-101-PM 17.9/21.5** *Proj. NAME:* **Avila Ramps Roundabouts**
PROJECT MANAGER: **Paul Valadao (916) 763-9123**

REVIEWED BY: **Md Zahangir Alam**
FUNCTIONAL UNIT: **Office of Geotechnical Design-West, Branch E**

Page/Sheet No. ↓	**Section**	**Paragraph** ↓	**Comment**	**Response**
	FR/Cover Sheet, Cover Letter and Header		1. From cover sheet, it is not possible to identify whether this foundation report is for bridge, retaining wall or other Structure. As per the Foundation Reports for ERS module, cover of the report must include structure name and number. If you do not have this info, please include "Retaining Walls (N1 and W1). For example, Foundation Report for Retaining Walls (N1 and W1). This is also applicable to subject in cover letter and header on all pages. 2. Please use total project PM xx/xx to match with the plans.	Yeh will add "Retaining Walls N1 and W1" to title sheet and include PM 20.9/21.3 to the Cover Sheet – *Completed 9-23-22*
P-1	FR/Section 1		Please revise the section name to just "Introduction". Please indicate the latest plans/layouts that were used to prepare this report.	Section will be renamed "Introduction". Plans are referenced in Section 2 – *Completed 9-23-22*
P-2	FR/Section 2.1		Please provide the vertical datum reference for the "elevation 97 feet".	Yeh will provide datum to NAVD88 – *Completed 9-23-22*
P-2	FR/Section 2.2		1. Figure 2 indicates WG 2021b and 2021c; however, 3rd line indicates WG 2021a and	1. No change needed

			2021c. Please check and correct, if needed. 2. Please provide project vertical datum reference. For example, "All elevations referenced within this report are based on the North American Vertical Datum of 1988 (NAVD 88), unless otherwise noted." 3. What does MT stand for?	2. Yeh will provide datum – *Completed 9-23-22* 3. "(MT 2022)" is a reference citation, Mark Thomas (MT) will be defined in the Section and is included in the references section – *Completed 9-23-22*
P-3	FR/Table 1		Based on the station no., the length of wall W1-A and W1-B is approximately 183.81 feet and 126.26 feet respectively. Please check and update. Also, as per the module, begin and end should include northing/easting or latitude/longitude not Sta. number, offset and reference line.	Yeh will check wall lengths. Refer to project plans for wall locations and with respect these data will not be included in the report. – *Completed 9-23-22*
P-4	FR/Section 3		Section 3 and Section 8 has same name but contains different information. This is misleading. Please move all information of Section 3 to Section 15 Reference.	Comment Noted – with respect no change will be made to the format and layout
P-4	FR/Section 4		Please revise the section name to "Geotechnical Investigation".	Comment noted. The use of the word "investigation" in reports is against Yeh company policy for liability reasons. With respect, no change considered necessary.
P-4	FR/Section 4.2		1. Borings' name does not follow the Caltrans Logging manual. For example, the boring name should be A-19-001 through A-19-003. Please update the borings' name all over the report. 2. Please indicate that as-built LOTBs were also reviewed as part of geotechnical investigation.	1. Comment noted. Boring numbering will not be changed. 2. Yeh will note the review of the as-built LOTBs in this section. – Completed 9-23-22
P-5	FR/Section 4.2/Figure 3		It seems like boring 19W-01 and 19W-03 were drilled away from retaining wall line. Please provide clarification/justification in the write up.	Walls are located on an area with existing steep slopes which made locating borings along the exact alignment impractical. Walls will be in artificial fill and we judged the boring locations selected by Yeh in

				combination with existing subsurface information provided by Caltrans borings sufficient to characterize the subsurface conditions.
P-6	FR/Table 2		1. Please indicate which boring is associated with retaining wall N1 and W1. 2. Please indicate in the write up that borings' information is presented in Table 2. 3. Please attach hammer efficiency data in an Appendix. 4. Please include sta. no., offset, reference line or northing/easting or latitude/longitude info for each boring.	1. Comment noted 2. Comment noted 3. A hammer efficiency of 75% was used for the rig. The hammer efficiency documentation is not available as the drilling company is no longer in business and the drill rig has been sold out of state. A hammer efficiency of 75% for an automatic hammer is considered reasonable. 4. Comment noted. Refer to LOTB for locations of borings.
P-6	FR/Section 5		Please revise the section name to "Laboratory Testing Program".	Comment noted. Section will be renamed to "Laboratory Testing Program" – *Completed 9-23-22*
P-8	FR/Section 6.1.1		As per ERS module, this section is not needed. For consistency with the latest guideline, we recommend deleting this section.	Commend noted. Yeh clarified this information in our September 9, 2021 response to a previous Caltrans review. Yeh included this information as pertinent input to the geotechnical design and analyses. Faulting and seismicity are important contextual information for seismic data and design. With respect, this section will not be changed.
P-9	FR/Section 6.3	2nd	Please include corresponding elevations of fill.	Yeh will add elevations to the "Artificial Fill" section. – *Completed 9-23-22*
P-10	FR/Section 6.3	1st	There is a typo in 4th sentence "Sand (ML). Please check and revise.	With respect, the sentence does not contain a typo. The full description says "silt with varying amounts of sand (ML)" The description was from the 2003 Caltrans borings.
P-10	FR/Section 7		Please rename the section to only "Groundwater". If possible, please include a	Section will be renamed to "Groundwater" Yeh will include table for groundwater data

			table for groundwater measurements as per the ERS module. Is there any historical groundwater data based on Geotracker, DWR etc.? If so, we suggest including that information. Though it is in liquefaction section, please add a statement of design groundwater elevation and depth here as well.	based on borings drilled. There was no pertinent data from Geotracker or DWR for this location. – *Completed 9-23-22* This section is for presentation of data similar to the Subsurface Conditions section. Design information is including in subsequent sections of the report. Yeh's policy is to reduce redundancy of presentation of data in reports to avoid errors and discrepancies of data. With respect, the design groundwater elevation will not be included in this section.
P-11	FR/Section 8, last 3 bullet items		These are good information; however, these do not belong to As-Built Data. Please move these bullet items to "Notes for Construction".	Comment noted – with respect this section will remain.
P-11	FR/Section 9		1. Please rename the section to just "Corrosion". 2. Please update corrosion guideline to 2021, and minimum resistivity from 1,100 to 1,500 ohm-cm.	1. Section 9 is named "Corrosion". 2. Yeh will update to the 2021 Corrosion Guidelines *Completed 9-23-22*
P-12	FR/Section 9	Last para	1. Please update sulfate concentration from 2,000 ppm to 1,500 ppm. 2. Not only 2003 but also 2019 test results indicate soil are corrosive. Please revise the statement. 3. Since minimum resistivity at elevation of 122 in 19W-02 is less than 1,500 ohm-cm, you may consider performing chloride and sulfate at this depth. 4. In Table 3, please add a column of Corrosive (Yes or No). 5. In table 3, please include test method (ASTM or CTM) for each test. Based on the corrosion test summary (under Appendix), it seems like tests are performed as per ASTM. Caltrans corrosion guideline is based on CTM. So, corrosion tests should be performed as per CTM method not	1. Yeh will revise 2. Yeh will revise 3. Comment noted. 4. Yeh will add column 5. Comment noted. The soil is considered corrosive. Additional testing is not considered necessary or that it would change the conclusion and subsequent recommendations.

			ASTM.	
P-12	FR/Section 10		Please rename the section to "Seismic Information."	Comment noted. Section will be renamed to "Seismic Information". *Completed 9-23-22*
P-12 and 13	FR/Section 10.1		1. Please rename the section to "Ground Motion Hazard." 2. Please attach Vs30 calculations in the appendix. 3. Please update Design Response Spectrum 2012 to 2021 and please check Vs30 calculation as per this new guideline. 4. Please attach ARS online output in an Appendix. Mean magnitude and site to source distance is not matching. Please check. 5. Please add a sentence of kh value.	1. Section will be renamed to "Ground Motion Hazard". 2. Comment Noted 3. Comment Noted 4. Plot on Figure 5 of report is a direct output of ARS online data and including the output data is redundant and not considered necessary. Mean magnitude and site to source distance match our output data from ARS online. 5. Design kh and associated discussions for each wall are provided in Section 11.3. Yeh will reference Section 11.3 in Section 10.1
P-13	FR/Section 10.2		• Please rename this section to "Surface Fault Rupture".	Section will be renamed to "Surface Fault Rupture" – *Completed 9-23-22*
P-13 and 14	FR/Section 10.3		1. Please indicate that the calculation is attached is Appendix. 2. Please do not use "considered to be low". As per liquefaction module, use the liquefaction potential does not exist.	1. Yeh will include reference to calculations – *Completed 9-23-22* 2. Comment noted. With respect, we will leave this statement as-is. Use of absolute or certainty such as "liquefaction potential does not exist" is against Yeh internal risk management policy.
P-14	FR		Please include *10.3 Seismic Slope Stability* and *10.4 Tsunami Risk* as pre the ERS module.	Seismic slope stability for the proposed retaining walls is included in the external stability recommendations in Section 11.2. Tsunami Risk is noted in the FR for ERS

				guidelines as to be included "if applicable". Tsunami risk is not applicable at this project site. No section for Tsunami will be included
P-15	FR/Section 11.1		1. CA amendment to AASHTO does not have 3.11 Section. So, please refer only AASHTO 8th Edition for 3.11.5.7.1-1(b). 2. How are the soil parameters calculated? Please provide calculation. We recommend Caltrans' Soil Correlations module for calculating soil parameters. Also, it is not recommended cohesion value for cohesionless soils. Either do not use cohesion or provide justification for using cohesion value in the analysis.	1. Yeh will update and reference AASHTO only in this sentence. *Completed 9-23-22* 2. Parameters are based on boring logs and laboratory test data. The material tested (Clayey Sand with Gravel) has cohesion per our test results and soil classifications. Selected soil parameters are considered applicable for this project site.
P-15	FR/Section 11.2.1		1. Please indicate what is the pressure distribution used for 85 psf and 38.33 psf. 2. Please indicate what is the kh value used for seismic stability and how it is selected. Based on the results in Appendix C, it seems like kh = 0.43 is used. Based on the ARS, PGA is 0.39g. As per the Geotechnical manual for Ground anchor walls, Kh is either ½ of PGA or 1/3 of PGA depending on the acceptable displacement.	1. Yeh will clarify. These data were provided by the structure designer (MTCO) – *Completed 9-23-22* 2. Kh and selection process is described in Section 11.3. Yeh will clarify and include the equation for Kh0=Kh (see paragraph 1 of Section 11.3.1) in this section for Wall N1 which is designed for zero displacement per the project's structural designer. We used a generalized limit equilibrium method to determine kh based on preferred wall displacement. Section 11.3 describes this methodology that is provided in AASHTO. With respect, this section will remain as-is.
P-16	FR/Table 5		1. Determination of minimum unbonded length is not clear. As per the Geotechnical manual for ground anchors, "*The minimum anchor unbonded length is the distance from wall face to the failure surface plus a minimum distance between potential*	1. The minimum unbonded length was determined per the geotechnical manual and consideration of a potential failure plane. 15 feet is sufficient. 2. Comment noted. With respect these

			failure surface and frontal anchor bond zone, 5 feet or H/5, whichever is greater." Is the 5 feet added in the minimum unbonded length? Please confirm. 2. Please provide the bearing resistance calculation in the Appendix.	calculations are considered excessive – a bearing capacity for the footing of the concrete facing of 3ksf is considered adequate.
P-16	FR/11.2.2		Please indicate the value of kh used for the analysis.	Kh and selection process is described in Section 11.3.
P-17	FR/Table 6		Please provide the calculation of nominal pull resistance in the appendix.	Input assumptions included in Table 6. – *Completed 9-28-22*
P-18	FR/11.3.1		1. Please provide the kh calculation. See comment no. on P-15. 2. Please provide SLIDE last output for the seismic earth pressure calculation and please present the calculation on how 140 psf is estimated as well. AASHTO has specific guidelines (Appendix A11). 3. Seismic earth pressure distribution should be selected as per the above (A11) procedure. Please check and confirm.	1. Kh calculation is provided in appendix C page C-3. 2. SLIDE Output is provided in Appendix C page C-10. GLE method is referenced in AASHTO Appendix A11, see A11.3.3. 3. See comment 2. *Completed 9-28-22*
P-19	FR/Section 12		Please follow the Caltrans "Notes of Specifications" module.	Comment noted. Yeh has already provided input to the project specifications. See SSP's for the project.
P-20	FR/Section 13.1		Please check whether soil Type is B or C. Based on GDR, Type is C which is more accurate.	Yeh will update. Type C is considered appropriate.
	FR/Legend for Soil Classification		As per Caltrans logging manual, it is missing some info (e.g., apparent density, consistency etc.). Please include this information. A 2nd sheet can be used for legend.	Comment noted.
	FR/Boring Logs		i. Please follow Caltrans Logging Manual. For example, ii. lat/long or north/east is missing for borehole location, iii. Some apparent densities are not matching. Fyi, apparent density is based on N60 not field SPT.	i. Comment noted ii. Comment noted iii. Comment noted. With respect, the boring logs represent the recorded field conditions. Consistency is based upon blow counts (coarse grained material) and pocket

			iv. Even with the presence moisture, same layers are called dry. This should be moist not dry. v. Sandy Fat Clay/Sandy Lean Clay layer is called dry. Typically, clay layer has in-situ moisture, so these clay layers may be moist. vi. Same layers have gravel, but gravel description is missing. vii. Where there are Fat clay, it is suggested to perform at least few Atterberg Limits test to confirm. viii. Hammer energy efficiency is missing on the logs. ix. We can only use "with gravel" if the gravel percentage is greater than 15%. In 19W-03@1' depth, gravel percentage is 9% but the layer is called Sandy Fat Clay with Gravel?	penetrometer (fine grained soil). This is consistent with standards of practice. iv. Comment noted. v. Comment noted. vi. Comment noted vii. Comment noted. viii. Comment noted. ix. Comment noted.
	FR/LOTB		As per the ERS module, LOTBs should be attached with the report. As-Built LOTBS and Boring records are attached; however, no current LOTBs are found in the report. Please include LOTBs.	Yeh will include LOTBs in appendix for the final report. LOTB's are developed with the plans and are not included in earlier versions of the report as the layout may change or adjust based upon design.
	FR/Summary of Laboratory Test Results		No test results are presented at depth of 40' in 19W-03. If there are no tests conducted, then delete this row.	Comment noted.
	FR/Corrosivity Tests Summary		Please complete the table and see comments P-12, FR/Section 9 regarding ASTM and CTM.	Comment noted.
	FR/R-value Test		Is there any reason for R-value test result that is attached in FR?	Comment noted. The test result was a part of the overall project.
	FR/General/Wall N1		1. Please include that "Determination of anchor pullout resistance and corresponding anchor bond length are the Contractor's responsibility. 2. Since bond length is contractor's	1. Yeh provided comment. *Completed 9-28-22* 2. Note was provided on outputs in Appendix C.

			responsibility, please remove the column of bond length in the stability analysis results (Appendix C).	
	FR/General/Wall W1		As per the Caltrans soil nail walls module, please remove the column of bond strength in the stability analysis results (Appendix C).	We did not see this requirement in the soil nail walls module. Bond strength is included in the tables required per the manual. Comment noted.
	FR/General		As per the Foundation Reports for ERS module, "Prepare a separate foundation report for each ERS". Please add a statement in the cover letter why (i.e., Caltrans approval etc.) multiple ERS are placed in one report. Was it approved by Caltrans?	One report will be submitted.
	FR/General		What is the appropriate project name?	See front cover of project plans. We will include pertinent information on the cover of the FR as noted. – *Completed 9-23-22*
	FR/General		Please change all AASHTO (2020) reference to AASHTO (2017). Caltrans still use AASHTO 8th Edition (2017).	Yeh will revise. – *Completed 9-28-22*
	FR/General		What is the lateral displacement for ground anchor wall?	Zero displacement. See Section 11.3.1
	GDR/Cover Sheet and Cover Letter		Please use total project PM xx/xx.	Cover sheet will be revised.
P-ii	GDR		Please check mean magnitude and site to source distance and correct accordingly.	Comment noted. Mean magnitude and site to source distance values in report match our output data from ARS online
P-2	GDR/Section 2		1. As per latest Caltrans GDR guideline (2021), project description is a part of Introduction. If possible, consider revising the format. 2. Please include the project datum reference.	1. Comment noted. 2. Yeh will include datum – *Completed 9-28-22*
P-3	GDR/Table 1		Since no recommendations for ERS will be provided in the GDR and a separate report has been prepared for ERS, we recommend deleting ESR info from Table 1. Instead of ERS info, if	Yeh will delete Table 1 – *Completed 9-28-22*

			possible, please include other improvements info (e.g., slopes) in Table 1.	
P-3	GDR/Section 2.3		This section is from old GDR guideline. The least guideline does not have this section. We suggest deleting this section. This information can be provided under reference.	Comment noted. No change will be implemented at this final report.
P-4	GDR/Section 3		Please rename to "Geotechnical Investigation".	Comment noted. The use of the word "investigation" in reports is against Yeh company policy for liability reasons. With respect, no change considered necessary.
P-4	GDR/Section 3.1 and Table 2		For borehole name, please follow the Caltrans logging manual. For example, 19W-01 should be A-19-001. Please update the borings' name all over the report. If possible, please rename the table name to "Borehole Summary List".	Comment noted. Boring names will not be updated. Yeh will update Table 2 caption to "Borehole Summary List"
P-5	GDR/Section 3.1		Please indicate the hammer efficiency and also attach hammer calibration data in the appendix.	A hammer efficiency of 75% was used for the rig. The hammer efficiency documentation is not available as the drilling company is no longer in business and the drill rig has been sold out of state. A hammer efficiency of 75% for an automatic hammer is considered reasonable.
P-6	GDR/Section 3.4		As per Caltrans Stormwater manual (2022), "California Test Method (CTM) 749 and CTM 750 were previously used, however, those standards are no longer maintained by Caltrans and are not recommended to be performed by Caltrans personnel. Use of CTM 749 and 750 requires an exception to policy." So, either remove the CTM 749 and 750 reference from the section or include an exception to policy, if obtained.	Yeh will revise and reference the test methodology in the San Luis Obispo County Post Construction Stormwater Low Impact Design Manual Appendix D-1. – *Completed 9-28-22.* https://www.slocounty.ca.gov/Departments/Planning-Building/Forms-Documents/Stormwater-Forms-and-Documents/Post-Construction-Stormwater-Management/Stormwater-Post-Construction-Documents/San-Luis-Obispo-County-Low-Impact-Development-Hand.pdf
P-11	GDR/Section 4.3	2nd	Please include corresponding elevations of fill.	Comment noted

P-12	GDR/Section 4.4		If possible, please include a table for groundwater measurements as per the ERS module. Is there any historical groundwater data based on Geotracker, DWR etc.? If so, we suggest including those data. Please add a stamen of design groundwater depth and elevation.	Comment noted.
P-12 and 13	GDR/Section 4.5 and table 4		1. Please update corrosion guideline to 2021, and minimum resistivity from 1,100 to 1,500 ohm-cm. 2. Please update sulfate concentration from 2,000 ppm to 1,500 ppm. 3. Not only 2003 but also 2019 test results indicate soil are corrosive. Please revise the statement. 4. Since minimum resistivity at elevation of 122 in 19W-02 is less than 1,500 ohm-cm, you may consider performing chloride and sulfate at this depth. 5. In Table 4, please add a column of Corrosive (Yes or No). 6. In table 4, please include test method (ASTM or CTM) for each test. Based on the corrosion test summary (under appendix), it seems like tests are performed as per ASTM. Caltrans corrosion guideline is based on CTM. So, corrosion tests should be performed as per CTM method not ASTM.	1. Yeh will update to current corrosion guidelines 2. Yeh will update 3. Yeh states that 2019 data is also corrosive. No revision needed 4. Comment noted 5. Yeh will add column 6. Comment noted The soil is considered corrosive. Additional testing is not considered necessary or that it would change the conclusion and subsequent recommendations. *Completed 9-28-22*
P-13	GDR/Section 4.6		• Please rename to "Seismic Hazards"	Comment noted. Section name will be updated.
P-13	GDR/Section 4.6.1		1. Please refer to Table 5. 2. Please attach Vs30 calculations in the appendix. 3. Please update Design Response Spectrum 2012 to 2021 and please check Vs30 calculation as per this new guideline.	1. Yeh will update reference to Table 5 not Table 4 – *Completed 9-28-22* 2. Comment noted. – Calculations are represented in the curve in Figure 3 3. Yeh will check and update to 2021 – *Completed 9-28-22*

			Please attach ARS online output in an Appendix. Mean magnitude and site to source distance is not matching. Please check. • Please add a sentence of kh value.	4. Plot on Figure 3 of report is a direct output of ARS online data. Including output data is redundant. Mean magnitude and site to source distance match our output data from ARS online 5. Kh value not applicable to the improvements in this report. Design kh and associated discussions for each wall are provided in Section 11.3 of the Foundation Report
P-15	GDR/Section 4.6.2		Please also include not within 1,000 feet of an unzoned fault that is Holocene or younger in age.	Yeh will revise. – *Completed 9-28-22*
P-15	GDR/Section 4.6.3		1. Please indicate that the calculation is attached is Appendix and include the calculation in an appendix. 2. Please do not use "considered to be low". As per liquefaction module, use the liquefaction potential does not exist.	1. Calculations provided in Appendix D 2. Comment noted. With respect, we will leave this statement as-is. Use of absolute or certainty such as "liquefaction potential does not exist" is against Yeh internal risk management policy.
P-15	GDR		As per the GDR module, *Analysis and Design* Section is missing. This section mainly includes design information provided by other design team members, Soil Engineering properties, geotechnical model and analyses etc. We suggest to incorporate these information.	Comment Noted. With respect, this section is not applicable to the improvements in this report. Some analysis discussion provided in recommendations section
P-16	GDR/Section 5.1.4		Please address embankment stability and settlement. If needed, please perform slope stability analysis using and present FOS under static and seismic conditions. Please provide settlement calculations and Stability analysis in an appendix.	Comment noted. With respect, this report is for the proposed improvements not the existing structure/embankments. There are no proposed embankments greater than 5 feet, and our experience has shown this typical detail is sufficient for minor embankment grading. Slope stability analyses for the proposed retaining walls and associated embankments are provided in the Foundation Report.

P-17	GDR/Section 5.1.5		Please indicate that 1.5:1 cut slope will be stable. If needed, perform slope stability analysis.	See sheets X-5 to X-7. Cut slopes have been designed to 2:1 and are considered stable. Our experience has shown that cut slopes in similar material are stable when cut at 1.5:1 or flatter.
P-19	GDR/Section 5.3		Please refer to Table 6. Also, refer previous comment about CTM 749.	Yeh will refer to Table 6 instead of Table 5. Comment noted. – *Completed 9-28-22*
P-22/23	GDR/Section 5.4.3		1. Please refer to Table 7. 2. Please update to Caltrans Highway Design manual to 2020. 3. Please attach pavement section calculations in an appendix and indicate in the body of the report. 4. Binder selection should be based on Table 632.1 of HDM, 2020. Please check and update, if necessary.	1. Yeh will refer to Table 7 instead of Table 6 2. Note HDM in 2020 uses a different calculation approach that does not apply to this project. Methods for calculation of flexible pavement sections were performed per the HDM 2018 3. Yeh will attach pavement calculations 4. Yeh will check binder vs 2020 HDM. PG64-10 is typical in this region.
P-24	GDR/Section 6		Please follow Caltrans "Notes for Specifications" guideline.	Comment noted. Review and comments were provided during project specification preparation.
P-24	GDR/Section		Caltrans GDR module does not have "Notes for Constructions". Please rename this section as Construction Recommendations or Construction Considerations etc.	Comment noted. Section will be renamed if appropriate.
	GDR/Plate 2		Cross-Section material type (SM, CL etc.) is not matching with boring logs. Please check and update accordingly.	Comment noted. Cross-section is not intended to replace the boring logs. A subsurface cross-section is intended to generalize the profile of materials encountered for visual interpretation. Hence the note "See text and logs of exploration for description of subsurface conditions. All boundaries and locations are approximate."
	GDR/Boring Logs and legend		Please follow Caltrans logging manual. Refer FR comments on boring logs and legend. Please	Comment noted. Yeh will update if appropriate.

			check and correct accordingly, if there is any inconsistency. Just as an example, boring log 19IN-05 classify as Silty Gravel with Sand (GW); however, Atterberg Limits test indicates Sandy Lean Clay with Gravel (CL) which is not accurate etc.	
	GDR/Moisture-Density Test		Moisture-Density test was performed as per ASTM 1557B. However, Caltrans do not use ASTM for moisture-density test. Test should be performed as per CTM.	Comment noted. With respect, ASTM D1557B is used extensively throughout the United States, and it is a test to determine the maximum dry density. CTM 216 is used for density control of fills and was not considered appropriate for our analyses.
	GDR/General		Based on the 95% plans (sheet nos. 97-108). However, no discussion/recommendations were provided in the GDR. Please clarify. If needed, please include discussion and recommendations on sign foundations.	Comment noted. Signs will use Caltrans Standard Plans. Sign foundations that would require geotechnical input such as those included in S sheets in the 2018 Standard Plans are not being used on this project. No comment in report considered necessary as the lack of comment should have indicated that no sign foundations are needing geotechnical input.
	95% Plans – Sheet 139		LOTB does not match with the Errata (2022) sheet. For LOTB, please follow Caltrans logging manual (2010) and Errata (2022) and update accordingly.	Comment noted. LOTB sheets will remain as prepared.
	95% Plans – Sheet 144		Sheet indicates $\Delta kae = 0.44$. However, we did not find this value in the FR. This value should come from FR.	This will be removed from the plans as that value was not used in the structure design.
	95% Plans – Sheet 149		LOTB does not match with the Errata (2022) sheet. For LOTB, please follow Caltrans logging manual (2010) and Errata (2022) and update accordingly.	Comment noted. LOTB sheets will remain as prepared.
	95% Plans – Sheet 143 to 148		We did not find location of proof test nail. If it is added, please inform the sheet #. Otherwise, please include.	See sheet 146. Proof test nails are identified in both the legend and on the Developed Mirror Elevation.
	95% Plans		Please include total project PM xx/xx.	