PARIKH
Practicing in the Geosciences

MEMORANDUM

To:	**CSW | ST2** **CSW/Stube-Stroeh Engineering Group, Inc.**	August 1st, 2021 Job No. 2019-147-GEO
Attn:	Mr. Robert Stevens, P.E.	
From:	Y. David Wang Ph.D., P.E. C52911	
Subject:	Geotechnical Design Recommendations Mirada Road Pedestrian Bridge Replacement and Bluff Stabilization Project, San Mateo County, California	

INTRODUCTION

The existing Mirada Road pedestrian bridge was installed by the County in 2004. The existing bridge is a single span structure supported on 24-inch diameter Cast-In-Drilled-Hole (CIDH) piles with a service load of 30 Tons per pile. Due to marine environment, the bridge has severe corrosion issue. The County performed study and the preferred approach is to replace the existing bridge with a clear span prefabricated aluminum truss bridge. Based on Parikh's previous involvement (the original bridge design in 2004 and evaluation performed in early 2018), it is our understanding that the existing 24-inch diameter CIDH piles could be reused for foundation support.

The structural designer is to design the project to conform to applicable current Caltrans seismic design criteria and AASHTO LRFD specifications. In addition to the pedestrian bridge, the coastal bluff of the general area is also of design considerations. The bridge replacement must address the threat of coastal erosion and the impact of Sea-Level Rise. A 2015 study completed by the US Army Corps of Engineers indicated that the bluff north of the Mirada Road revetment retreated at a rate of 1.64 feet per year from 1993 to 2012. The erosion occurring north and south of the existing bridge is threatening collapse of the original/old concrete arch structure.

The current project requires a comprehensive design that addresses a long-term solution which protects coastal access. For the bluff stabilization, the current design concept of bluff stabilization is to use soil nail walls at north and south sides of the bridge with rock riprap and engineering fabric at bottom to provide confinement of the material and to account for future Sea-Level Rise.

SUBSURFACE CONDITIONS

Parikh performed the original investigation for bridge and prepared a report in July 2001. In addition, WRECO performed borings and investigation on Mirada Road for retaining wall evaluation in May 2017. The project utilizes the existing soil boring data (Parikh 2001 and WRECO 2017) for the current design. The log sheet of WRECO (2017) was provided by the County. The Log of Test Boring sheets are attached in Appendix A.

Based on the soil boring data, the subsoils consist of about 20 to 25 feet of interbedded very stiff sandy lean clay and medium dense clayey to poorly grade sand. Below that, the borings encountered generally medium dense to dense silty sand/clayey sand through Elev. -25 feet (~50 feet depth below existing Mirada Road).

Groundwater was encountered at about 25 feet and 31 feet depth below Mirada Road during Parikh's 2001 investigation. The existing Mirada Road grade appears to be at approximately Elev. 32 feet. Groundwater levels may change with passage of time due to groundwater/tidal fluctuations from season to season, surface run-off, weather condition, and other factors which may not be present at the time of the investigation.

SEISMIC DESIGN CRITERIA

The recommended response spectrum was determined based on the Caltrans ARS Online tool (Ver. 2.3.09, 2012). The development of the design ARS curve is based on several input parameters, including site location (longitude/latitude), average shear wave velocity for the top 30 m (100 feet) (VS30m), and other site parameters, such as fault characteristics, and site-to-fault distances. The design methods incorporate both deterministic and probabilistic seismic hazards to produce the design response spectrum.

The average shear wave velocity (Vs) for the top 30m (100 feet) at the site was estimated by using established correlations and guidelines provided in Caltrans "Methodology for Developing Design Response Spectrum for Use in Seismic Design Recommendation," dated November 2012. The site condition may be classified as Site Class "D" per NEHRP. Based on the subsurface data, we recommend that a Vs value of 290 m/s be used for design.

The site location and the relevant parameters are summarized as follows, and the recommended ARS Design Curve is attached in Appendix B. The soil strength and calculation of the shear wave velocity (Vs_{30m}) are attached in Appendix C.

1. Site Location: 37.4934ºN/ 122.4598ºW
2. Recommended Vs_{30m} for design = 290 m/sec (Site Class D per NEHRP)

3. The recommended ARS curve is the envelope of the Deterministic and Probabilistic approaches per Caltrans ARS Online. For the site, the curve is governed by the Probabilistic approach.
4. To account for Near Fault effect, a factor of 1.2 is applied to Sa for structural periods over 1 second per Caltrans design guidelines.
5. Peak Ground Acceleration (PGA) = 0.712 g

LIQUEFACTION POTENTIAL

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

Based on the boring data, the underlying sands are generally dense to very dense. The liquefaction potential at the site is considered low.

BLUFF STABILIZATION WITH SOIL NAIL WALLS

Based on the latest discussion with the design and agency, soil nail walls are planned to stabilize the bluff on the north and south sides of the bridge. From a geotechnical standpoint, the retreat of the bluff at the area is mainly due to wave erosion. The planned soil nail walls with rock riprap and engineering fabric at bottom is intended to stabilize the bluff, to provide confinement of the toe material and to reduce the wave impact.

Existing Bluff Stability and Soil Strength Parameters. The existing bluff is relatively steep, and the retreat of the bluff has been mainly due to erosion, surficial sloughing and wave action at toe. To verify the existing bluff stability and determination of native soil strength parameters, slope stability analyses were performed, and parametric studies were evaluated for selection of proper strength parameters for design of the planned soil nail walls. A general site map and typical existing bluff sections provided by the designer are attached in Appendix D.

Slope stability analyses were performed on a typical existing steep slope. The existing steep slope has been standing in the place so the current minimum FS should be over 1.0. A typical stability analysis plot is attached in Appendix C-1. For steep slopes of this configuration, soil cohesion plays a significant role in the stability. Based on the soil data and analyses, we recommend that the cohesion value be limited to 350 psf. For soil nail wall design, the recommended soil strength parameters consist of c = 350 psf and ϕ = 34 to 36 deg.

Typical Governing Section and SNAIL Analysis. The design of soil nail walls will be performed using Caltrans SNAIL Program (Version 2.2.2) with collaboration with geotechnical engineer.

We provided analysis of a typical section based on information provided by the designer. The typica section is presented in Appendix C-2 with relevant design information.

The typical governing section is of a 29-foot-high wall from Elev. 32 feet (existing Mirada roadway grade) to Elev. 3 feet (toe) with a typical wall batter of 1H:12V. The toe then extends 2 feet out and drops to about Elev. -1 foot to accommodate the rip rap construction. The typical soil nail spacing is 5 feet (V & H), and the first row is typically 2 to 2.5 feet below top. There are 6 rows of nails in this section, and the nail lengths vary from 35 feet to 25 feet. The selection of soil-grout ultimate bond strength and typical F.S. input per FHWA Soil Nail manual (GEC No. 7, 2015) are excerpted and attached in Appendix C-2. The soil properties (unit weight, cohesion and friction angle) and bond strength shown in the section are recommended for soil nail wall design by the designer. Groundwater was considered at the toe and getting higher in the slope. It is our understanding that the design includes a small 12-inch-tall parapet wall on the wall top, but that does not affect the overall stability.

Also attached in Appendix C-2 are the SNAIL analysis output for permanent and seismic conditions of the section. The min. F.S. required for overall stability is 1.5 for static and 1.1 for seismic loads. The analysis results and detail output are included.

Seismic Analysis. For seismic/pseudo-static design, the selection of Kh has discussed a lot in recent years. The latest Caltrans guidelines and AASHTO LRFD Specifications suggest using 50% of the Peak Ground Acceleration (PGA). For Mirada project, the recommended Kh is 0.356g for seismic. Based on our evaluation, the overall design is governed by the seismic case (to achieve min. F.S. of 1.1).

Wall Deflection and Basal Stability. The potential wall deflection is evaluated based on FHWA Soil Nail manual (GEC No. 7, 2015). For the sandy soil conditions at site and the anticipated wall configuration, we estimate that the wall deflection may be on the order of 0.7 inches. The site does not have geologic scale overall stability issue. The bluff is mainly subject to erosion and tidal action (which is part of natural geologic process). There is no soft clay or liquefiable material below the toe. Therefore, basal heave and sliding are not considered design concerns.

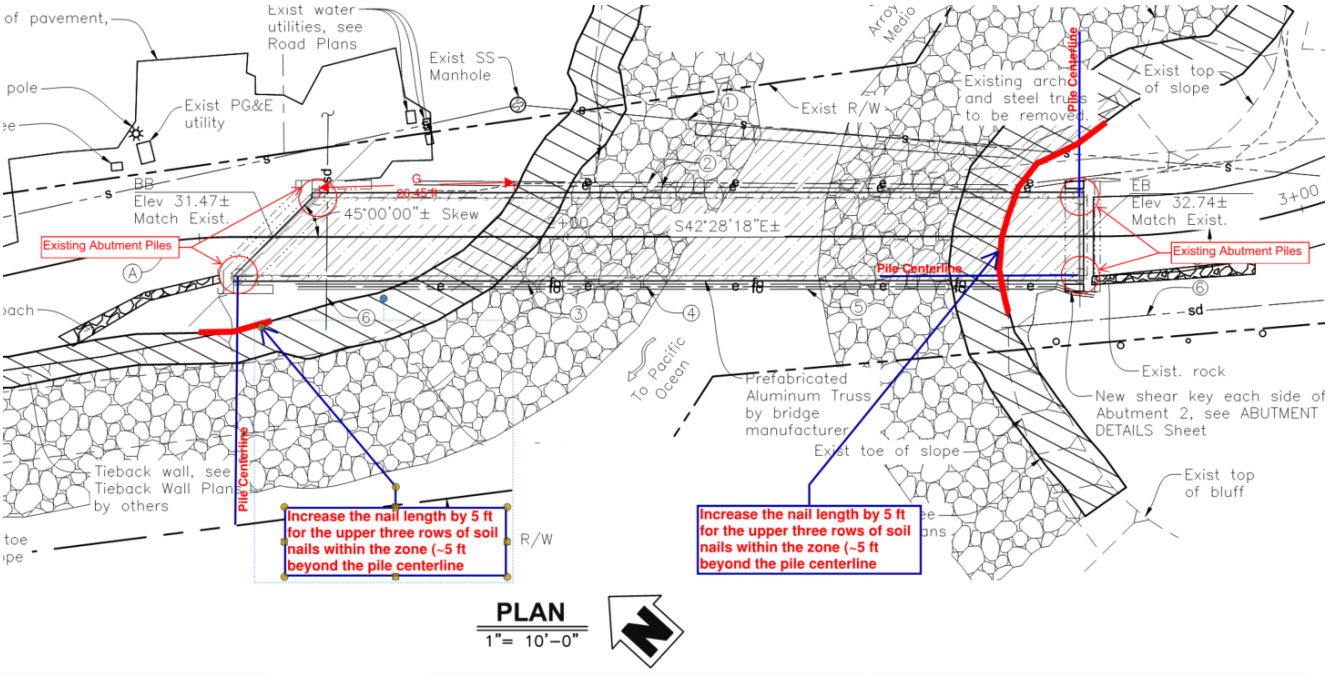
ADDITIONAL CONSTRUCTION CONSIDERATIONS

The current information indicates that the planned bluff stabilization wall bottom is at Elev. 3 feet. The rip rap rock and filter layer extend to Elev. 0. The rip rap consists of 2-Ton rock conforming to Caltrans standard specifications Section 72. Due to tidal fluctuation, construction activities near the toe could be affected by the ocean and time of day. It may require temporary groundwater control such as the use of cofferdam to provide workable environment.

POTENTIAL IMPACT OF ABUTMENT PILES ON SOIL NAILS

Based on the general plan provided, the proposed soil nail walls will be in proximity (less than 10 feet) to the existing bridge abutment piles. Under seismic condition, the piles could be under lateral load and pose some impact on the soil nail walls. It is our opinion that the western pile at north abutment and both piles at south abutment could be impacting the soil nail walls during seismic conditions.

Per communication with the bridge designer, each 24-inch diameter abutment pile could carry 20 kips of shear load under seismic condition. For the piles under seismic lateral load, majority of the reactions are in the upper 10 to 15 feet of the embedment. It is recommended that the upper three rows of soil nails for the zones indicated below be increased by 5 feet, in addition to meeting overall slope stability requirements of the walls.



BRIDGE FOUNDATION DESIGN

It is our understanding that the existing CIDH piles will remain and will be re-used for foundation support. The superstructure will be replaced, and the required demand does not exceed the existing pile capacity. Due to update of design standards and seismic design criteria, the structural engineer needs to re-evaluate the lateral design. For analyses using LPILE program, the geotechnical parameters are provided below:

Geotechnical Parameters for LPILE Analysis

North Abutment (Boring B-2, Parikh 2001)

Approx. Depth (ft.)	Generalized Soil Profile	LPILE Soil Type	Soil Strength	Effect. Unit Wt. (pcf)
0 to 4	Clayey Sand, medium dense	Sand (Reese)	ϕ= 34º	125
4 to 9	Lean Clay, stiff	Stiff Clay w/o free water	C = 1600 psf	125
9 to 25	Clayey Sand & Silty Sand, medium dense to dense	Sand (Reese)	ϕ= 38º	125
25 to 30	Clayey Sand, dense	Sand (Reese)	ϕ= 38º	63

South Abutment (Boring B-1, Parikh 2001)

Approx. Depth (ft.)	Generalized Soil Profile	LPILE Soil Type	Soil Strength	Effect. Unit Wt. (pcf)
0 to 4	Clayey Sand, medium dense	Sand (Reese)	ϕ= 34º	125
4 to 14	Lean Clay, stiff	Stiff Clay w/o free water	C = 2000 psf	125
14 to 25	Clayey Sand & Silty Sand, medium dense to dense	Sand (Reese)	ϕ= 38º	125
25 to 30	Clayey Sand, dense	Sand (Reese)	ϕ= 38º	63

Use default values for ε_{50} and k in LPILE program
Depth "0" is at existing grade of Mirada Road

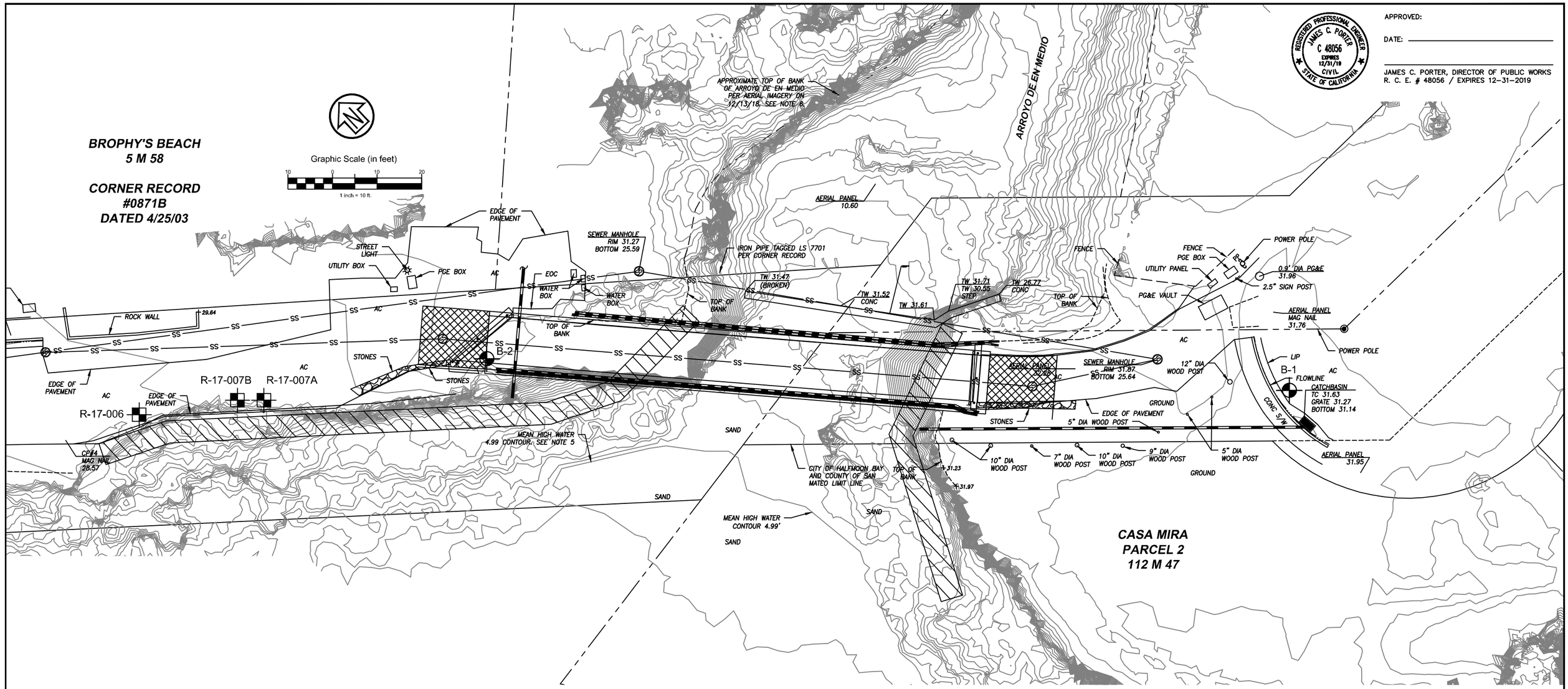
At each abutment, the two piles are at about 15 feet apart. There is no group reduction, and p-multiplier = 1.0.

Please be advised that we are performing a professional service and that our conclusions are professional opinions only. All work done and all recommendations made are in accordance with generally accepted geotechnical engineering principles and practices. No warranty expressed or implied, of merchantability or fitness, is made or intended in connection with our work.

ATTACHMENTS:

- Appendix A: Log of Test Borings
- Appendix B: ARS Design Curves
- Appendix C:
  - Appendix C-1 -- Existing Bluff Stability (typical section), Bond Strength & Min. FS
  - Appendix C-2 -- Representative Section for Soil Nail Wall Design & Analysis Results with SNAIL program output
  - Appendix C-3 – Soil Strength and V_{s30} Calculation
- Appendix D: Bluff Stabilization Plans Provided by Designer

APPENDIX A
Log of Test Borings



APPROVED:

DATE: _____

JAMES C. PORTER, DIRECTOR OF PUBLIC WORKS
R. C. E. # 48056 / EXPIRES 12-31-2019

REGISTERED PROFESSIONAL ENGINEER
JAMES C. PORTER
C 48056
EXPIRES 12/31/19
CIVIL
STATE OF CALIFORNIA

LEGEND

B-1 — Location of Boring drilled by Parikh (2001)

R-17-007A — Location of Boring drilled in by WRECO (2017)

APPROVED DATE:	
NAME NAME, CITY ENGINEER	
HALF MOON BAY	
R.C.E. # 00000 / EXPIRES 00-00-0000	

APPROVED DATE:	
PARIKH Practicing in the Geosciences	REGISTERED PROFESSIONAL ENGINEER GARY PARIKH G.E. 666 No. 12/31/19 GEOTECHNICAL STATE OF CALIFORNIA
GARY PARIKH, P.E.	
PARIKH CONSULTANTS, INC.	
R.C.E. # G.E. 666 / EXPIRES 12-31-2019	

COUNTY OF SAN MATEO PUBLIC WORKS

REVISION	DATE		
		DESIGNED BY: RCS	LOG OF TEST BORINGS 1 OF 5 MIRADA ROAD
		CHECKED BY: RCS	
		DRAWN BY: MJV	
		JAMES C. PORTER, DIRECTOR OF PUBLIC WORKS SAN MATEO COUNTY	555 COUNTY CENTER, 5th FLOOR REDWOOD CITY, CALIFORNIA 94063

SCALE: AS SHOWN
DATE: 10/30/2019
FILE NO.: 4122700

FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES 0 1 2 3 4

LOTB-1
SHEET 1 OF 5

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APPROVED:

DATE: _____

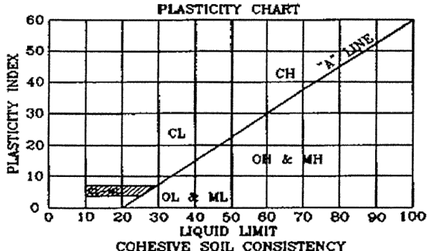
JAMES C. PORTER, DIRECTOR OF PUBLIC WORKS
R. C. E. # 48056 / EXPIRES 12-31-2019

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP SYMBOLS	ILLUSTRATIVE GROUP NAMES
COARSE-GRAINED SOILS More than 50% retained on No. 200 sieve	GRAVELS More than 50% of coarse fraction retained on No. 4 sieve	CLEAN GRAVELS Less than 5% fines	GW	Well graded gravel, Well graded gravel with sand
			GP	Poorly graded gravel, Poorly graded gravel with sand
		GRAVELS WITH FINES More than 12% fines	GM	Silty gravel, Silty gravel with sand
			GC	Clayey gravel, Clayey gravel with sand
	SANDS 50% or more of coarse fraction passing No. 4 sieve	CLEAN SANDS Less than 5% fines	SW	Well graded sand, Well graded sand with gravel
			SP	Poorly graded sand, Poorly graded sand with gravel
		SANDS WITH FINES More than 12% fines	SM	Silty sand, Silty sand with gravel
			SC	Clayey sand, Clayey sand with gravel
FINE-GRAINED SOILS 50% or more passing No. 200 sieve	SILTS AND CLAYS Liquid Limit less than 50%		ML	Silt, Sandy silt with gravel
			CL	Lean clay, Sandy lean clay with gravel
			OL	Organic clay, Sandy organic clay with gravel
	SILTS AND CLAYS Liquid Limit more than 50%		MH	Elastic silt, Sandy elastic silt with gravel
			CH	Fat clay, Sandy fat clay with gravel
			OH	Organic clay, Sandy organic clay with gravel
HIGHLY ORGANIC			PT	Peat, Highly organic silts

NOTE: 1. Coarse-grained soils receive dual symbols if: (a) their fines are CL-ML (e.g. SC-SM or GC-GM) or (b) they contain 5-12% fines (e.g. SW-SM, GP-GC, etc.). Fine-grained soils receive dual symbols if their limits plot in the hatched zone of the Plasticity Chart (CL-ML).
2. The table lists 30 out of a possible 110 Group Names, all of which are assigned to unique proportions of the constituent soils. Flow charts in ASTM D 2487-93 aid assignment of the Group Names.

PLASTICITY CHART



GRAIN SIZE CLASSIFICATION

CLASSIFICATION	US STANDARD SIEVE SIZE
BOULDERS	Above 12"
COBBLES	12" to 3"
GRAVEL	
Coarse	3" to 3/4"
Fine	3/4" to No. 4
SAND	
Coarse	No. 4 to No. 10
Medium	No. 10 to No. 40
Fine	No. 40 to No.200
SILT & CLAY	Below No. 200

COHESIVE SOIL CONSISTENCY

CLASSIFICATION	UNCONFINED COMP. STRENGTH (psf)
Very Soft	< 500
Soft	500 - 1000
Medium(Firm)	1000 - 2000
Stiff	2000 - 4000
Very Stiff	4000 - 8000
Hard	> 8000

COHESIONLESS SOIL RELATIVE DENSITY

CLASSIFICATION	SPT BLOW COUNTS (Blows/ft)
Very Loose	< 4
Loose	5 to 10
Medium Dense	11 to 30
Dense	31 to 50
Very Dense	> 50

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

MIRADA ROAD PEDESTRIAN BRIDGE
SAN MATEO COUNTY, CALIFORNIA

JOB NO.: 201131.10 | PLATE NO.: A-1A

Boring Location, Elevation & Date Drilled:

Drilling Method:

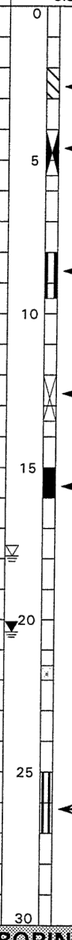
Sampling Method:

BORING NUMBER LEGEND

Sheet 1 of 1

Sample Type & No.	Dry Density (pcf)	Water Content (%)	Blows Per Foot	Compress. Strength (tsf)
1			22	
2	110	12	23	1.2
3	98	28	100 psi	0.8
4	-	10	35	-
5	95	20		0.7
6	-	12		
7	-	-		12.0

Depth (ft) Soil Graph & U.S.C.S.



Compressive strength as measured by Pocket Penetrometer, in tsf. → pp = 1.0tsf

2 inch I.D. California Sampler (C).

2-1/2 inch I.D. Modified California Sampler (MC).

3.5-inch I.D. Pitcher Tube Sampler (Cored).

1-3/8 inch I.D. Standard Splitspoon Sampler (SPT).

1.9 inch I.D. Hand Sampler driven with a slide hammer.

Groundwater level first encountered during drilling

Groundwater level at completion of boring

Bulk sample stored in plastic bag.

Liquid Limit (LL), in percent → LL = 30
Plasticity Index (PI), in percent → PI = 10

NX Core.

Percent gravel and coarser in sample,(+#4) → +#4 = 20%
Percent fines (silt/clay) in sample, (-#200) → -#200 = 50%

Triaxial Test → TX

LEGEND FOR LOG OF BORING

PARIKH CONSULTANTS, INC.
Geotechnical & Materials Engineering

MIRADA ROAD PEDESTRIAN BRIDGE
SAN MATEO COUNTY, CALIFORNIA

Date: 7/2001 | Job No.: 201131.10

This log is part of the report prepared by Parikh Consultants, Inc. for the named project and should be read together with that report for complete interpretation. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.

Plate: A-1B

LEGEND LEGEN 2-20-01

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APPROVED DATE:	
NAME NAME, CITY ENGINEER	
HALF MOON BAY	
R.C.E. # 00000 / EXPIRES 00-00-0000	

APPROVED DATE:	
PARIKH Practicing in the Geosciences	
GARY PARIKH, P.E.	
PARIKH CONSULTANTS, INC.	
R.C.E. # G.E. 666 / EXPIRES 12-31-2019	

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — 12/31/19 — EXP. GEOTECHNICAL — STATE OF CALIFORNIA

COUNTY OF SAN MATEO PUBLIC WORKS

REVISION	DATE	DESIGNED BY: RCS	LOG OF TEST BORINGS 2 OF 5 MIRADA ROAD	SCALE: AS SHOWN
		CHECKED BY: RCS		DATE: 10/30/2019
		DRAWN BY: MJV		FILE NO.: 4122700
		JAMES C. PORTER, DIRECTOR OF PUBLIC WORKS SAN MATEO COUNTY	555 COUNTY CENTER, 5th FLOOR REDWOOD CITY, CALIFORNIA 94063	

FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES 0 1 2 3 4

LOTB-2
SHEET 2 OF 5

REGISTERED PROFESSIONAL ENGINEER
JAMES C. PORTER
C 48056
EXPIRES 12/31/19
CIVIL
STATE OF CALIFORNIA

APPROVED:

DATE: _____

JAMES C. PORTER, DIRECTOR OF PUBLIC WORKS
R. C. E. # 48056 / EXPIRES 12–31–2019

Boring Location, Elevation & Date Drilled:
SEE ATTACHED SITE PLAN; Elev. approx. 31.0 ft.; drilled on 4-17-01

Drilling Method:
8-inch dia. Hollow stem auger
MOBILE B-53

BORING NUMBER B-1

Sheet 1 of 2

Sampling Method:
2 1/2" I.D. Mod. Cal. (MC)/2" I.D. Cal. (C)/1 3/8" I.D. Std. Pen., 140 lbs hammer, 30 inch drop.

Sample Type & No.	Dry Density (pcf)	Water Content (%)	Blows Per Foot	Compress. Strength (tsf)	Depth (ft) Soil Graph & U.S.C.S.	
					0	2 inches of ASPHALT CONCRETE over 15 inches of AGGREGATE BASE
MC-1	108	16	27		SC	CLAYEY SAND (SC), medium dense, dark gray, moist, trace lean clay, fine to medium grained, trace coarse grained
MC-2	106	21	45		5 CL	SANDY LEAN CLAY (CL), very stiff, mottled gray/brown, moist, trace friable white shale
MC-3	106	21	37	2.1	10	--very stiff, trace coarse grained sand
MC-4	113	16	48		15 SC	CLAYEY SAND (SC), medium dense, mottled gray/brown, moist, fine to medium grained, trace coarse grained, trace friable white shale
MC-5	102	12	45		20 SP SM	POORLY-GRADED SAND WITH SILT (SP-SM), medium dense, yellowish brown, moist, fine to medium grained, trace coarse grained
MC-6	117	16	75		▼25 SC	CLAYEY SAND (SC), dense, olive gray, wet, fine grained, trace coarse grained, trace clay
					30 SM	

LOG OF BORING

PARIKH CONSULTANTS, INC.
Geotechnical & Materials Engineering

MIRADA ROAD PEDESTRIAN BRIDGE
SAN MATEO COUNTY, CALIFORNIA

Date: JULY 2001 | Job No.: 201131.10

This log is part of the report prepared by Parikh Consultants, Inc. for the named project and should be read together with that report for complete interpretation. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.

Plate: A-2A

LB 21131 7-13-01

Boring Location, Elevation & Date Drilled:
SEE ATTACHED SITE PLAN; Elev. approx. 31.0 ft.; drilled on 4-17-01

Drilling Method:
8-inch dia. Hollow stem auger
MOBILE B-53

BORING NUMBER B-1

Sheet 2 of 2

Sampling Method:
2 1/2" I.D. Mod. Cal. (MC)/2" I.D. Cal. (C)/1 3/8" I.D. Std. Pen., 140 lbs hammer, 30 inch drop.

Sample Type & No.	Dry Density (pcf)	Water Content (%)	Blows Per Foot	Compress. Strength (tsf)	Depth (ft) Soil Graph & U.S.C.S.	
SPT-7	-	22	58		30	SILTY SAND (SM), very dense, gray/brown, wet, fine to medium grained, trace coarse grained
SPT-8	-	17	65		35 SC	CLAYEY SAND (SC), very dense, grayish brown, wet, fine grained, trace lean clay
MC-9	113	19	37		40	--medium dense, gray/brown, wet, fine grained, trace medium to coarse grained
SPT-10	-	19	64		45 SM	SILTY SAND (SM), very dense, grayish brown, wet, fine grained, trace medium grained
						Bottom of boring at 46.5 feet
					50	
					55	
					60	

LOG OF BORING

PARIKH CONSULTANTS, INC.
Geotechnical & Materials Engineering

MIRADA ROAD PEDESTRIAN BRIDGE
SAN MATEO COUNTY, CALIFORNIA

Date: JULY 2001 | Job No.: 201131.10

This log is part of the report prepared by Parikh Consultants, Inc. for the named project and should be read together with that report for complete interpretation. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.

Plate: A-2B

LB 21131 7-13-01

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APPROVED DATE:	
NAME NAME, CITY ENGINEER	
HALF MOON BAY	
R.C.E. # 00000 / EXPIRES 00–00–0000	

APPROVED DATE:	
PARIKH Practicing in the Geosciences	REGISTERED PROFESSIONAL ENGINEER GARY PARIKH No. G.E. 666 EXP. 12/31/19 GEOTECHNICAL STATE OF CALIFORNIA
GARY PARIKH, P.E.	
PARIKH CONSULTANTS, INC.	
R.C.E. # G.E. 666 / EXPIRES 12–31–2019	

COUNTY OF SAN MATEO PUBLIC WORKS

REVISION	DATE	DESIGNED BY: RCS	CHECKED BY: RCS	DRAWN BY: MJV	LOG OF TEST BORINGS 3 OF 5 MIRADA ROAD	SCALE: AS SHOWN	DATE: 10/30/2019	FILE NO.: 4122700
		JAMES C. PORTER, DIRECTOR OF PUBLIC WORKS SAN MATEO COUNTY				555 COUNTY CENTER, 5th FLOOR REDWOOD CITY, CALIFORNIA 94063		
		FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES 0 1 2 3 4				LOTB-3 SHEET 3 OF 5		

REGISTERED PROFESSIONAL ENGINEER JAMES C. PORTER C 48056 EXPIRES 12/31/19 CIVIL STATE OF CALIFORNIA

APPROVED:

DATE: _____

JAMES C. PORTER, DIRECTOR OF PUBLIC WORKS
R. C. E. # 48056 / EXPIRES 12-31-2019

Boring Location, Elevation & Date Drilled:
SEE ATTACHED SITE PLAN; Elev. approx. 31.0 ft.; drilled on 4-17-01

Drilling Method:
8-inch dia. Hollow stem auger
MOBILE B-53

BORING NUMBER B-2

Sampling Method:
2 1/2" I.D. Mod. Cal. (MC)/2" I.D. Cal. (C)/1 3/8" I.D. Std. Pen., 140 lbs hammer, 30 inch drop.

Sheet 1 of 2

Sample Type & No.	Dry Density (pcf)	Water Content (%)	Blows Per Foot	Compress. Strength (tsf)	Depth (ft) Soil Graph & U.S.C.S.	
					0	1 inches of ASPHALT CONCRETE over 8 inches of AGGREGATE BASE
						SC
MC-1	105	12	40			CLAYEY SAND (SC), medium dense, dark gray/black, moist, trace lean clay, fine grained, trace medium to coarse grained
						CL
MC-2	111	18	38	1.65	5	SANDY LEAN CLAY (CL), very stiff, gray/brown, moist, trace friable white shale
						SC
MC-3	110	18	37		10	CLAYEY SAND (SC), medium dense, gray/brown, moist, fine to coarse grained, trace fine gravel, trace friable white shale
MC-4	118	15	64	1.95	15	--dense, gray/brown, moist, fine to coarse grained
						SM
MC-5	114	17	56		20	SILTY SAND (SM), dense, yellowish brown, moist, fine grained, trace medium to coarse grained
						SC
MC-6	111	17	75/10"		25	CLAYEY SAND (SC), dense, olive gray, moist, fine grained, trace medium to coarse grained
						SM
					30	

LOG OF BORING

PARIKH CONSULTANTS, INC.
Geotechnical & Materials Engineering

MIRADA ROAD PEDESTRIAN BRIDGE
SAN MATEO COUNTY, CALIFORNIA

Date: JULY 2001 | Job No.: 201131.10

This log is part of the report prepared by Parikh Consultants, Inc. for the named project and should be read together with that report for complete interpretation. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.

Plate: A-3A

LB 21131 7-13-01

Boring Location, Elevation & Date Drilled:
SEE ATTACHED SITE PLAN; Elev. approx. 31.0 ft.; drilled on 4-17-01

Drilling Method:
8-inch dia. Hollow stem auger
MOBILE B-53

BORING NUMBER B-2

Sampling Method:
2 1/2" I.D. Mod. Cal. (MC)/2" I.D. Cal. (C)/1 3/8" I.D. Std. Pen., 140 lbs hammer, 30 inch drop.

Sheet 2 of 2

Sample Type & No.	Dry Density (pcf)	Water Content (%)	Blows Per Foot	Compress. Strength (tsf)	Depth (ft) Soil Graph & U.S.C.S.		
MC-7	118	15	79		30		SILTY SAND (SM), dense, gray, moist to wet, fine to medium grained, trace coarse grained
						SC	
SPT-8	-	16	31		35		CLAYEY SAND (SC), dense, grayish brown, wet, fine grained, trace medium grained, trace lean clay
						SW SM	
SPT-9	-	22	47		40		WELL-GRADED SAND WITH SILT (SW-SM), dense, yellowish brown, wet
						SM	
SPT-10	-	19	55		45		SILTY SAND (SM), very dense, gray, wet, fine to medium grained, trace coarse grained
					50		Bottom of boring at 46.5 feet
					55		
					60		

+#4=0.2%
-#200=11.4%

LOG OF BORING

PARIKH CONSULTANTS, INC.
Geotechnical & Materials Engineering

MIRADA ROAD PEDESTRIAN BRIDGE
SAN MATEO COUNTY, CALIFORNIA

Date: JULY 2001 | Job No.: 201131.10

This log is part of the report prepared by Parikh Consultants, Inc. for the named project and should be read together with that report for complete interpretation. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.

Plate: A-3B

LB 21131 7-13-01

S:\ACAD\2019-147-GEOLOTB4.dwg 10/30/2019 - 03:51 PM cgoulfner 1:3.5602

APPROVED DATE:	
NAME NAME, CITY ENGINEER	
HALF MOON BAY	
R.C.E. # 00000 / EXPIRES 00-00-0000	

APPROVED DATE:	
PARIKH Practicing in the Geosciences	REGISTERED PROFESSIONAL ENGINEER GARY PARIKH No. G.E. 666 12/31/19 EXP. GEOTECHNICAL STATE OF CALIFORNIA
GARY PARIKH, P.E.	
PARIKH CONSULTANTS, INC.	
R.C.E. # G.E. 666 / EXPIRES 12-31-2019	

COUNTY OF SAN MATEO PUBLIC WORKS

REVISION	DATE	DESIGNED BY: RCS	CHECKED BY: RCS	DRAWN BY: MJV

LOG OF TEST BORINGS
4 OF 5
MIRADA ROAD

JAMES C. PORTER, DIRECTOR OF PUBLIC WORKS
SAN MATEO COUNTY

555 COUNTY CENTER, 5th FLOOR
REDWOOD CITY, CALIFORNIA 94063

SCALE: AS SHOWN
DATE: 10/30/2019
FILE NO.: 4122700

FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES 0 1 2 3 4

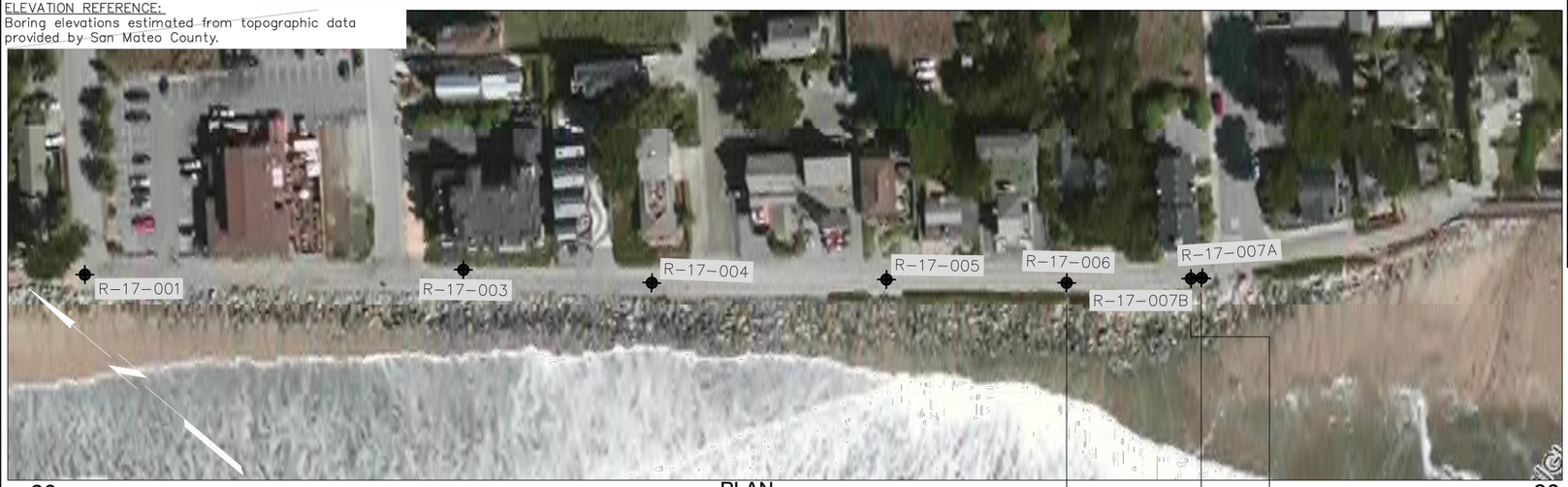
LOTB-4
SHEET 4 OF 5

APPROVED:

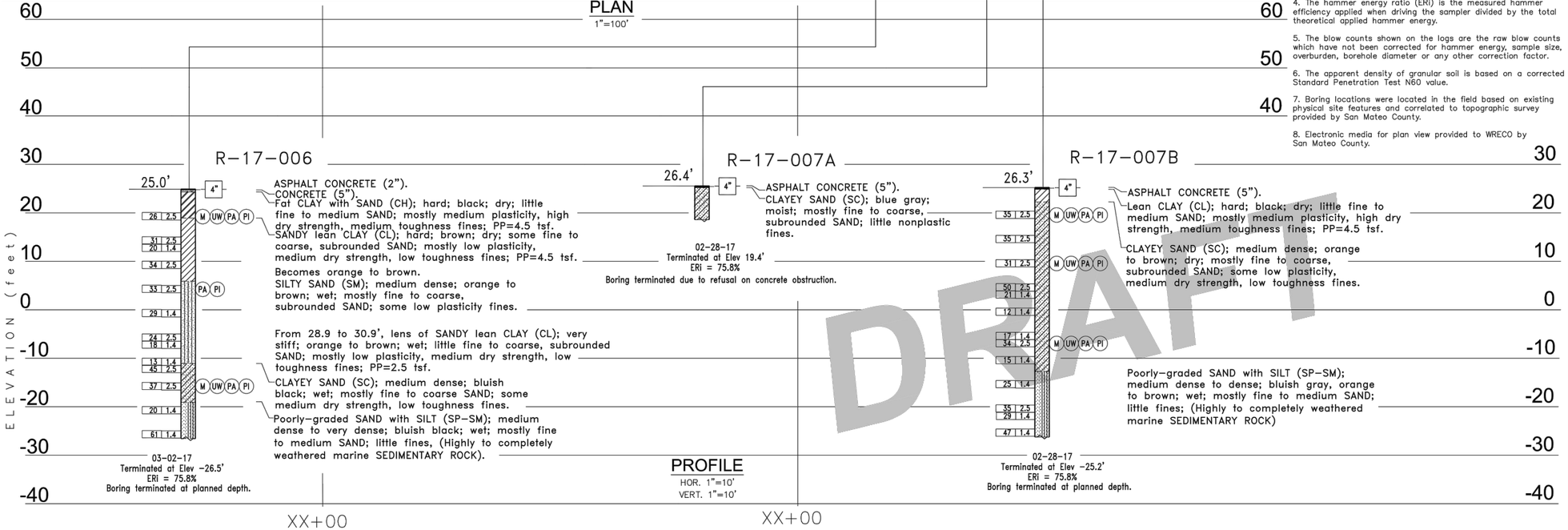
DATE: _____

JAMES C. PORTER, DIRECTOR OF PUBLIC WORKS
R. C. E. # 48056 / EXPIRES 12-31-2019

ELEVATION REFERENCE:
Boring elevations estimated from topographic data provided by San Mateo County.



PLAN
1"=100'



PROFILE
HOR. 1"=10'
VERT. 1"=10'

XX+00 XX+00

DRAFT

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	SM	XX			

REGISTERED GEOTECHNICAL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER ROBERT LAWRENCE No. 2785 Exp. 06-30-18 GEOTECHNICAL STATE OF CALIFORNIA

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

WRECO
8331 SIERRA COLLEGE BLVD SE 208
ROSEVILLE, CALIFORNIA 95661 WRECO JOB NO: P15102 TO-03

County Of San Mateo Department of Public Works
555 County Center, 5th Floor
Redwood City, CA 94063-1665

Notes:

1. Field classification of soils was performed in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (2010 Edition).

2. The 1.4 and 2.5 inch ID split barrel drive samplers were driven using a 140 pound auto-trip hammer free falling 30 inches in general conformance for performing the Standard Penetration Test (ASTM D1586) and the Modified California Split Barrel Tests (ASTM D3550). The 1.4 inch ID split barrel sampler was driven without any liner or sand catcher installed while the 2.5 inch ID split barrel sampler was fitted with three, six inch stainless steel liners installed.

3. The number of blows to drive a split barrel drive sampler the last 12 inches of an 18 inch drive was recorded as the blow count (N).

4. The hammer energy ratio (ERi) is the measured hammer efficiency applied when driving the sampler divided by the total theoretical applied hammer energy.

5. The blow counts shown on the logs are the raw blow counts which have not been corrected for hammer energy, sample size, overburden, borehole diameter or any other correction factor.

6. The apparent density of granular soil is based on a corrected Standard Penetration Test N60 value.

7. Boring locations were located in the field based on existing physical site features and correlated to topographic survey provided by San Mateo County.

8. Electronic media for plan view provided to WRECO by San Mateo County.

ENGINEERING SERVICES		GEOTECHNICAL SERVICES		PREPARED FOR		BRIDGE NO.	MIRADA ROAD REVETMENT PROJECT
FUNCTIONAL SUPERVISOR	DRAWN BY: D. Lukashov	FIELD INVESTIGATION BY:	DATE:	SAN MATEO COUNTY	XX PROJECT ENGINEER	XXX-XXXX	**LOG OF TEST BORINGS 3 of 3**
XX	CHECKED BY: A. Kahn	K. Patrick	02-28-17 & 03-02-17			POST MILE XX.XX	
OGS CIVIL LOG OF TEST BORINGS SHEET		ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3		CU XXXXXX EA XXXXX		DISREGARD PRINTS BEARING EARLIER REVISION DATES →	REVISION DATES (PRELIMINARY STAGE ONLY) SHEET XX OF XX

MIRADA LOTS.dwg 3/29/201/

S:\AC402019-147-GEOLOTB\5 of 5.dwg 10/02/2019 - 03:52 PM cgauthier 1:3.5602

APPROVED DATE:

NAME NAME, CITY ENGINEER
HALF MOON BAY
R.C.E. # 00000 / EXPIRES 00-00-0000

APPROVED DATE:

PARIKH Practicing in the Geosciences

GARY PARIKH, P.E.
PARIKH CONSULTANTS, INC.
R.C.E. # G.E. 666 / EXPIRES 12-31-2019

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

COUNTY OF SAN MATEO PUBLIC WORKS

REVISION	DATE	DESIGNED BY: RCS	CHECKED BY: RCS	DRAWN BY: MJV	LOG OF TEST BORINGS 5 OF 5 MIRADA ROAD	SCALE: AS SHOWN	DATE: 10/30/2019	FILE NO.: 4122700
					JAMES C. PORTER, DIRECTOR OF PUBLIC WORKS SAN MATEO COUNTY	555 COUNTY CENTER, 5th FLOOR REDWOOD CITY, CALIFORNIA 94063		

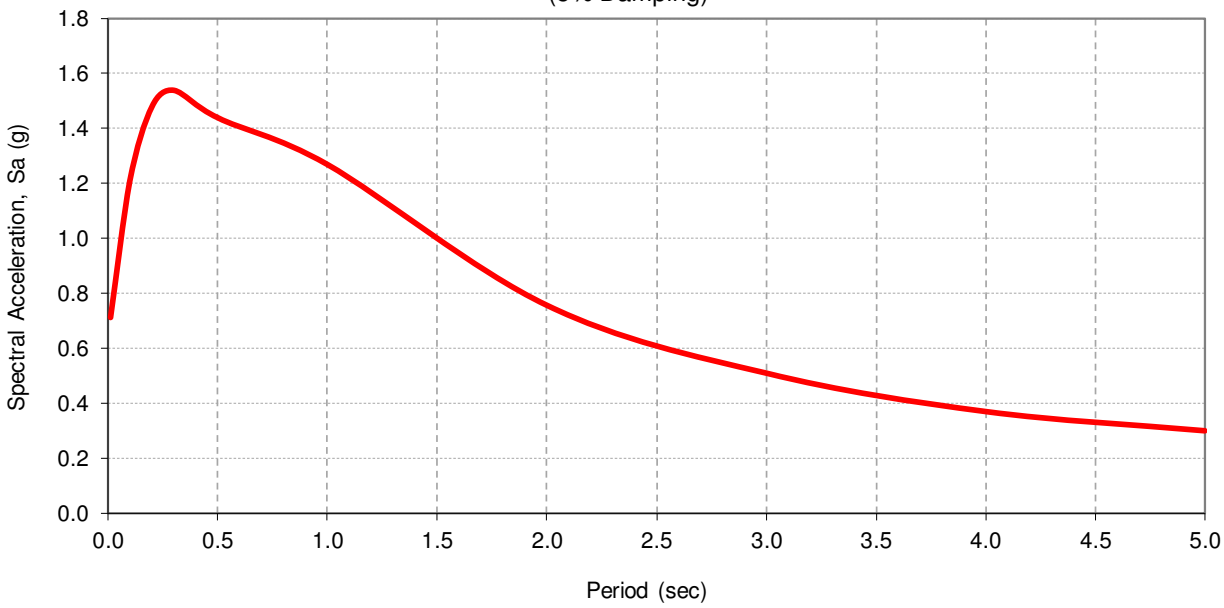
FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES 0 1 2 3 4

LOTB-5
SHEET 5 OF 5

APPENDIX B
ARS Design Curves

RECOMMENDED ACCELERATION RESPONSE SPECTRUM

(5% Damping)



Site Information

Latitude:	37.4934
Longitude	-122.4598
V_{S30} (m/s) =	290
$Z_{1.0}$ (m) =	N/A
$Z_{2.5}$ (km) =	N/A
Near Fault Factor, Derived from Caltrans ARS. Dist (km) =	5.65

Governing Curve:

Caltrans Online Probabilistic ARS

Recommended Response Spectrum				
Period (sec)	Caltrans Online Probabilistic Spectral Acceleration (g)	Adjusted for Near Fault Effect	Adjusted For Basin Effect	Final Adjusted Spectral Acceleration (g)
0.0	0.712	1	1	0.712
0.1	1.208	1	1	1.208
0.2	1.481	1	1	1.481
0.3	1.538	1	1	1.538
0.5	1.438	1	1	1.438
1.0	1.058	1.2	1	1.270
2.0	0.63	1.2	1	0.756
3.0	0.425	1.2	1	0.510
4.0	0.309	1.2	1	0.371
5.0	0.25	1.2	1	0.300

Source:

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

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

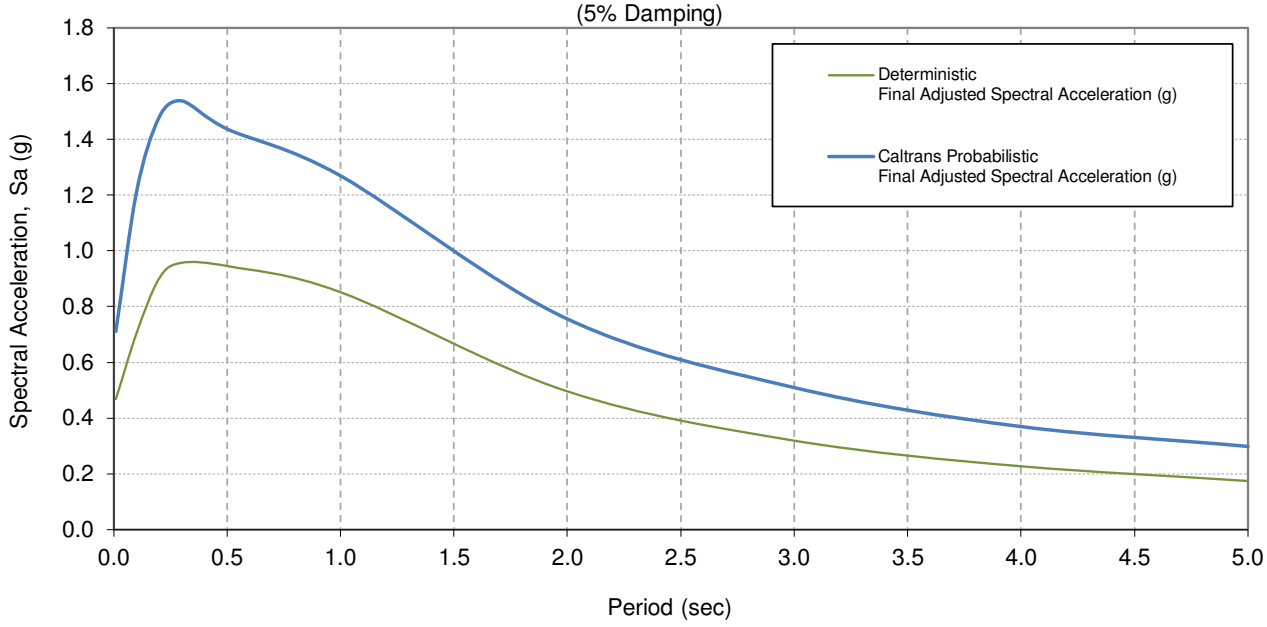
PARIKH
Practicing in the Geosciences

MIRADA ROAD PEDESTRIAN BRIDGE
HALF MOON BAY, CALIFORNIA

Project No.: 2019-147-GEO | **Plate No.: IV-A**

ACCELERATION RESPONSE SPECTRUM COMPARISON

(Deterministic & Probablistic Curves)
(5% Damping)



Site Information

Latitude:	37.4934
Longitude	-122.4598
V_{S30} (m/s) =	290
$Z_{1.0}$ (m) =	N/A
$Z_{2.5}$ (km) =	N/A
Near Fault Factor, Derived from USGS Deagg. Dist (km) =	5.65

Period (sec)	Deterministic Final Adjusted Spectral Acceleration (g)	Caltrans Probabilistic Final Adjusted Spectral Acceleration (g)
0.0	0.470	0.712
0.1	0.703	1.208
0.2	0.902	1.481
0.3	0.958	1.538
0.5	0.946	1.438
1.0	0.853	1.270
2.0	0.496	0.756
3.0	0.320	0.510
4.0	0.228	0.371
5.0	0.176	0.300

Source:

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

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

PARIKH
Practicing in the Geosciences

MIRADA ROAD PEDESTRIAN BRIDGE
HALF MOON BAY, CALIFORNIA

Project No.: 2019-147-GEO | **Plate No.: IV-B**

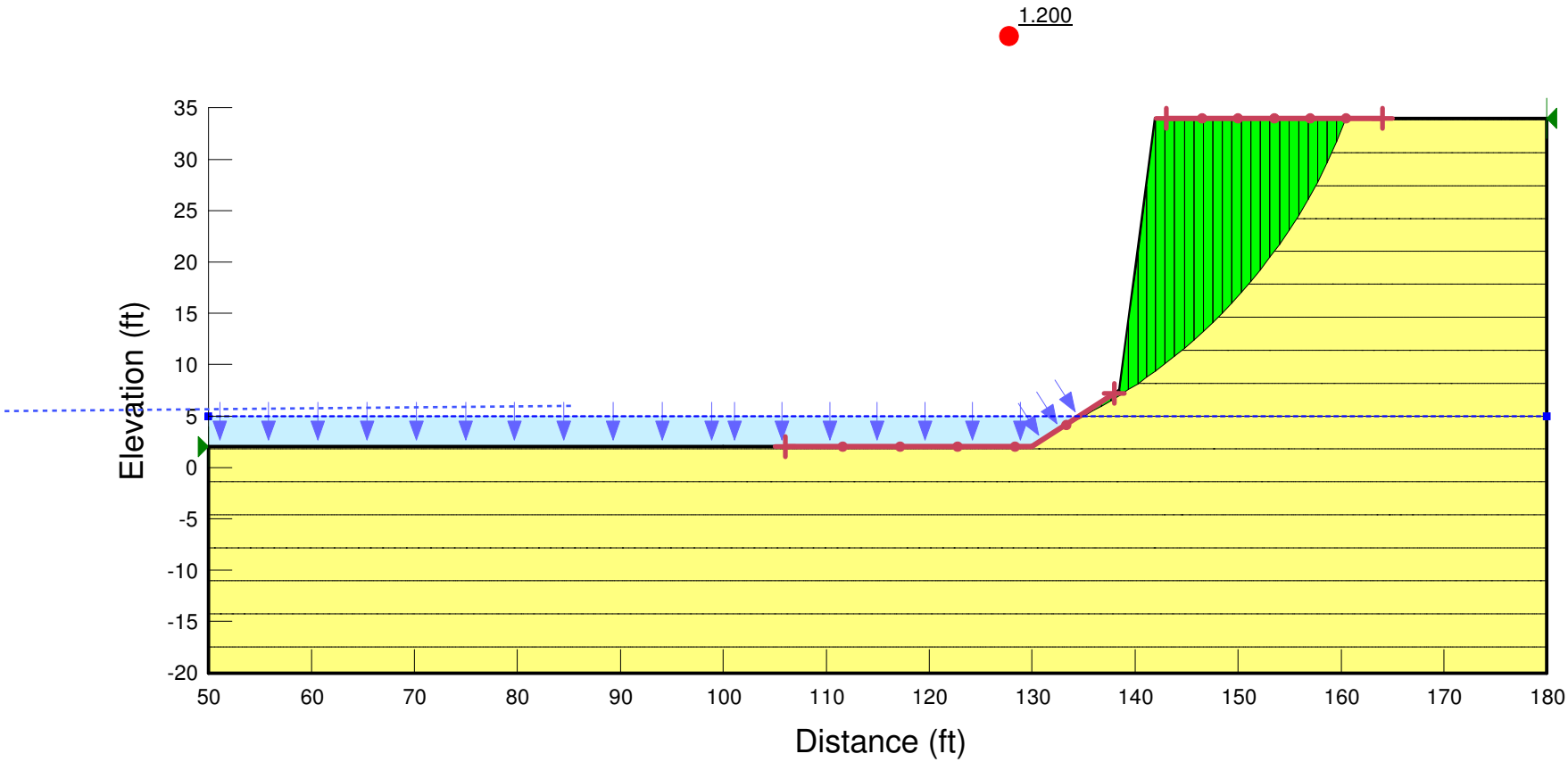
APPENDIX C

Appendix C-1

Static Slope Stability

Project No. 2019-147-GEO

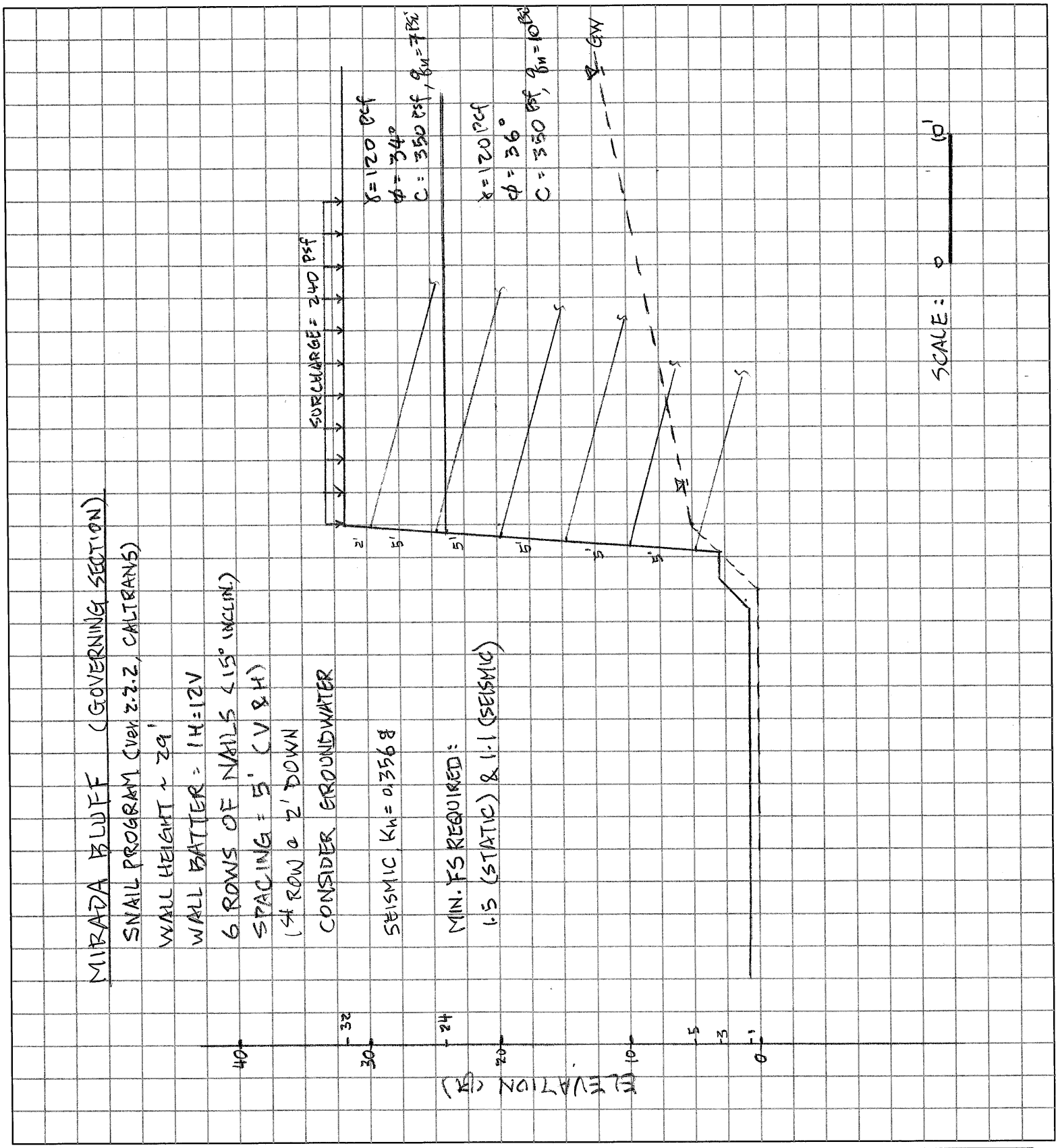
Name: Soil Unit Weight: 125 pcf Cohesion': 350 psf Phi': 34 °



PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

PROJECT NO. 2019-147-GEO
PROJECT NAME MIRADA RD
CALCULATED BY Y. DAVID WANG DATE 6/2/21
CHECKED BY _____ DATE _____
VERIFIED BY _____ DATE _____
BACK CHECKED BY _____ DATE _____

SUBJECT SOIL NAIL WALL



Refrence: FHWA GEC No. 7, Feb 2015 (Soil Nail Walls)

Typical ultimate bond strength of the soil-to-grout interface

Table 4.4a: Estimated Bond Strength for Soil Nails in Coarse-Grained Soils (Modified after Elias and Juran 1991)

Drill-Hole Drilling Method	Soil Type	Bond Strength, q_u (psi)
Rotary Drilled	Sand/gravel	15 - 26
Rotary Drilled	Silty sand	15 - 22
Rotary Drilled	Silt	9 - 11
Rotary Drilled	Piedmont residual	6 - 17
Rotary Drilled	Fine Colluvium	11 - 22
Driven Casing	Sand/gravel w/low overburden (1)	28 - 35
Driven Casing	Sand/gravel w/high overburden (1)	41 - 62
Driven Casing	Dense Moraine	55 - 70
Driven Casing	Colluvium	15 - 26
Augered	Silty sand fill	3 - 6
Augered	Silty fine sand	8 - 13
Augered	Silty clayey sand	9 - 20

Note: (1) Low and high overburden are defined as effective overburden pressure being, respectively, less than and greater than 1.5 tsf.

Coarse-grained soils, check Tables 4.4a & 4.6.

Table 4.4b: Estimated Bond Strength for Soil Nails in Fine-Grained Soils (Modified after Elias and Juran 1991)

Drill-Hole Drilling Method	Soil Type	Bond Strength, q_u (psi)
Rotary Drilled	Silty clay	5 - 7
Driven Casing	Clayey silt	13 - 20
Augered	Loess	4 - 11
Augered	Soft clay	3 - 4
Augered	Stiff clay	6 - 9
Augered	Stiff clayey silt	6 - 15
Augered	Calcareous sandy clay	13 - 20

Estimated values of bond strength in weathered rock and rock are presented in Table 4.5 as a reference. The Post-Tensioning Institute (PTI 2005) also presents presumptive values of the nominal bond strength of ground anchors grouted under gravity.

Fine-grained soils, check Table 4.4b with CIDH capacity calc (c=.55Su).

Table 4.5: Estimated Bond Strength for Soil Nails in Rock – Drilling Method: Rotary Drilled (Modified after Elias and Juran 1991)

Rock Type	Bond Strength, q_u (psi)
Marl/limestone	44 - 58
Phyllite	15 - 44
Chalk	73 - 87
Soft dolomite	58 - 87
Fissured dolomite	87 - 145
Weathered sandstone	29 - 44
Weathered shale	15 - 22
Weathered schist	15 - 25
Basalt	73 - 87
Slate/Hard shale	44 - 58

Table 4.6: Presumptive Ultimate Values of Soil Nail Pullout Resistance per Unit Length (1) (Modified after Sabatini et al. 1999)

Soil Type	Relative Density/ Consistency	SPT $(N_1)_{60}$ Range	Ultimate Pullout Resistance per Unit Length, r_{PO} (kip/ft)
Sand and Gravel	Loose	4-10	10
Sand and Gravel	Medium dense	11-30	15
Sand and Gravel	Dense	31-50	20
Sand	Loose	4-10	7
Sand	Medium dense	11-30	10
Sand	Dense	31-50	13
Sand and Silt	Loose	4-10	5
Sand and Silt	Medium dense	11-30	7
Sand and Silt	Dense	31-50	9
Silt-clay mixture of low plasticity or fine micaceous sand or silt mixtures	Stiff	10-20	2
Silt-clay mixture of low plasticity or fine micaceous sand or silt mixtures	Hard	21-40	4

Notes: (1) Values are for small-diameter (4 and 6 in.), straight-shaft, gravity-grouted ground anchors installed in soil.

Table 5.1: Minimum Recommended Factors of Safety for the Design of Soil Nail Walls Using the ASD Method [1]

Limit State	Condition	Symbol	Minimum Recomm. Factors of Safety, Static Loads	Minimum Recomm. Factors of Safety, Seismic Loads
Overall	Overall Stability	FS_{OS}	1.5[2]	1.1[6]
Overall	Short Term Condition, Excavation	FS_{OS}	1.25-1.33[3]	NA
Overall	Basal Heave	FS_{BH}	2.0[4], 2.5[5]	2.3[5]
Strength – Geotechnical	Pullout Resistance	FS_{PO}	2.0	1.5
Strength – Geotechnical	Lateral Sliding	FS_{LS}	1.5	1.1
Strength – Structural	Tendon Tensile Strength (Grades 60 and 75)	FS_{T}	1.8	1.35
Strength – Structural	Tendon Tensile Strength (Grades 95 and 150)	FS_{T}	2.0	1.50
Strength – Structural	Facing Flexural	FS_{FF}	1.5	1.1
Strength – Structural	Facing Punching Shear	FS_{FP}	1.5	1.1
Strength – Structural	Headed Stud Tensile (A307 Bolt)	FS_{FH}	2.0	1.5
Strength – Structural	Headed Stud Tensile (A325 Bolt)	FS_{FH}	1.7	1.3

The maximum long-term horizontal and vertical displacements at the top of the wall, δ_h and δ_v (Figure 5.20), can be estimated as follows (Clouterre 1991):

$$\delta_v \approx \delta_h = \left(\frac{\delta_h}{H}\right)_i \times H$$

Equation 5.30: Maximum long-term horizontal and vertical displacement at the top of wall.

Where $(\delta_h/H)_i$ is a ratio that depends on soil conditions, as indicated in Table 5.12.

This equation is valid as long as: (i) the ratio $L/H \geq 0.7$, where L = soil nail length, H = wal height; (ii) the surcharge is negligible; and (iii) $FS_{OS} \geq 1.5$ for overall stability.

Table 5.12: Values of $(\delta_h/H)_i$ and C as Functions of Soil Conditions

Variable	Weathered Rock and Stiff Soil	Sandy Soil	Fine-Grained Soil
$(\delta_h/H)_i$	1/1000	1/500	1/333
C	0.8	1.25	1.5

Note: Modified from Clouterre (1993) and Byrne et al. (1998).

Ground deformation can be significant up to a distance (D_{DEF}) behind the wall (Figure 5.16 which can be estimated as:

$$D_{DEF} = C\,(1 - \tan\alpha)\,H$$

Equation 5.31: Distance of significant soil deformation behind the wall.

Where:

α = wall batter angle

C = soil-dependent coefficient included in Table 5.12

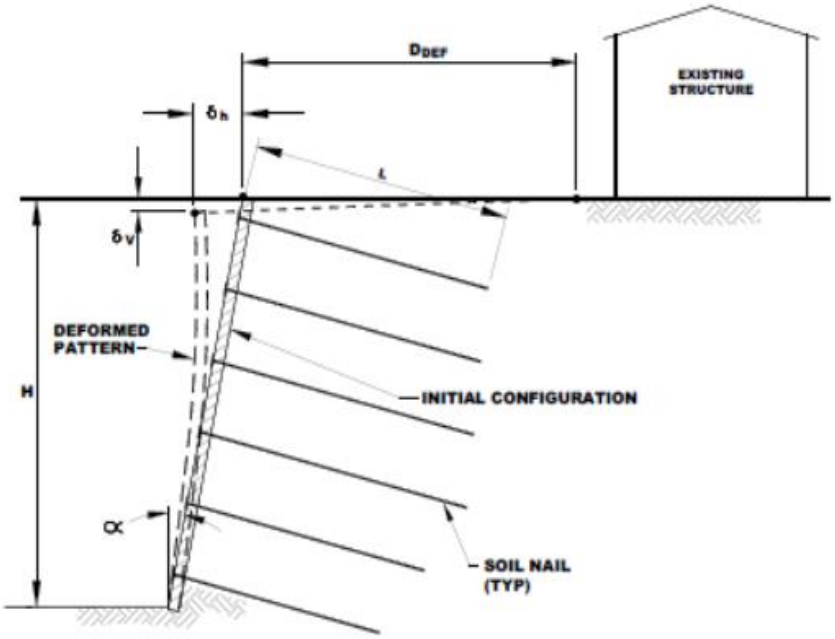
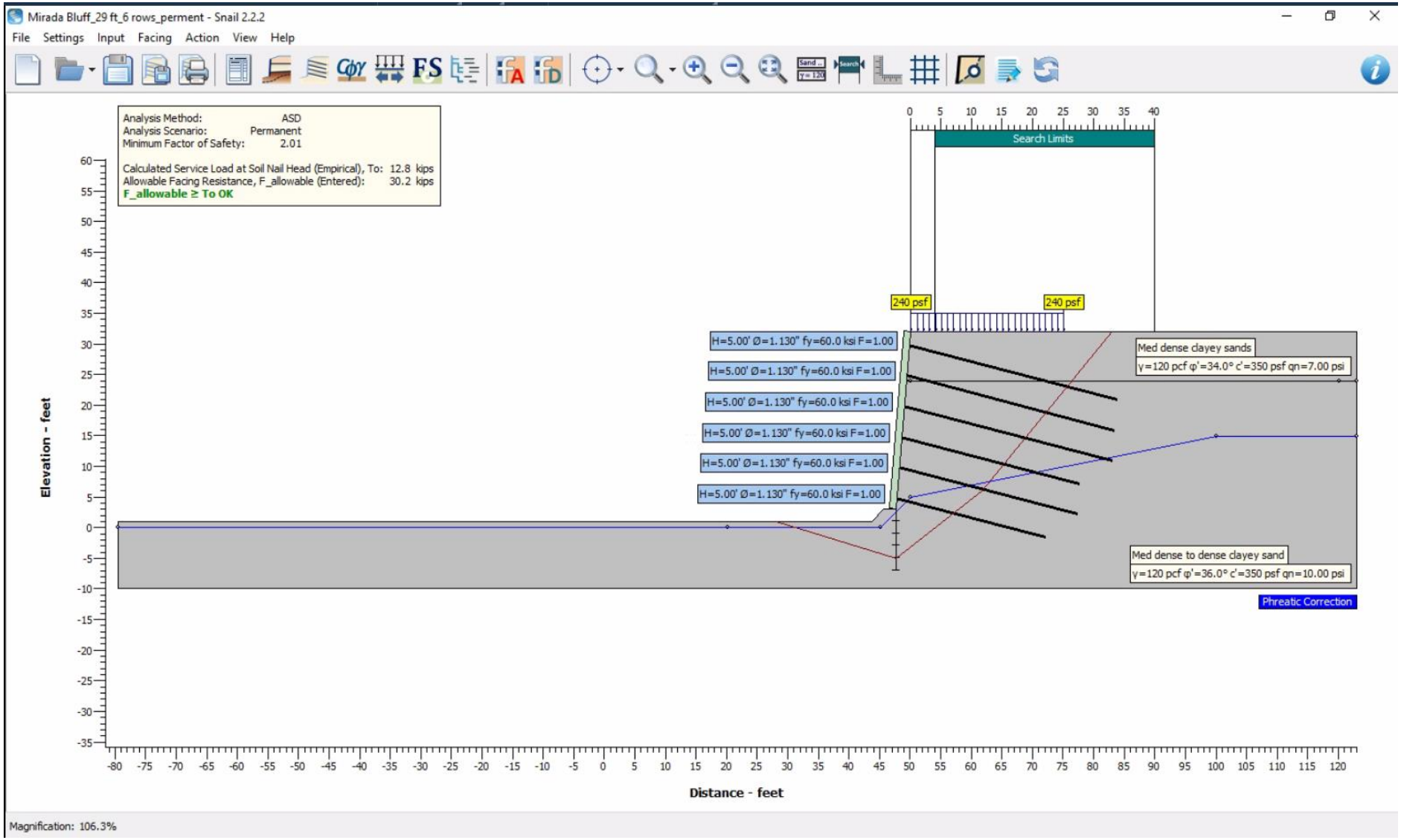


Figure 5.16: Illustration. Deformation of soil nail walls. Modified after Clouterre (1991) and Byrne et al. (1998).

Appendix C-2


Mirada Bluff_29 ft_6 rows_perment - Snail 2.2.2
File Settings Input Facing Action View Help
Analysis Method: ASD
Analysis Scenario: Permanent
Minimum Factor of Safety: 2.01
Calculated Service Load at Soil Nail Head (Empirical), To: 12.8 kips
Allowable Facing Resistance, F_allowable (Entered): 30.2 kips
F_allowable ≥ To OK
Search Limits
240 psf
240 psf
H=5.00' Ø=1.130" fy=60.0 ksi F=1.00
H=5.00' Ø=1.130" fy=60.0 ksi F=1.00
H=5.00' Ø=1.130" fy=60.0 ksi F=1.00
H=5.00' Ø=1.130" fy=60.0 ksi F=1.00
H=5.00' Ø=1.130" fy=60.0 ksi F=1.00
H=5.00' Ø=1.130" fy=60.0 ksi F=1.00
Med dense clayey sands
γ=120 pcf φ'=34.0° c'=350 psf qn=7.00 psi
Med dense to dense clayey sand
γ=120 pcf φ'=36.0° c'=350 psf qn=10.00 psi
Phreatic Correction
Elevation - feet
Distance - feet
Magnification: 106.3%

Snail

Version: 2.2.2

File Information

File Name: Mirada Bluff 29 ft 6 rows perment.snz
Run Date: 06/02/21
Run Time: 21:17:32

Project Information

Description: Bluff Stabilization
Location: Mirada Rd, San Mateo
EA:
Project ID: 2019-147-GEO
Wall No.: Soil Nail Wall
Structure No.:
Station: N of Mirado Rd Br
Engineer: DW
Designer

Comments:

Wall height ~ 29'. Use 6 rows of nails. Medium dense to dense Clayey Sands.

Geometry

Layout:

Reference Point:

At: Top of Wall
Distance From Origin: 50.00 feet
Elevation Above Origin: 32.00 feet

Wall Dimensions:

Wall Height: 29.00 feet
Facing Angle: 85.24 degrees
Facing Batter: 0.999 :12 H:V

Ground Surface:

Number of lines that define the ground surface above the wall: 2

No.	Angle degrees	Distance feet
1	0	60.00
2	0	

Number of lines that define the ground surface in front of the toe: 3

No.	Angle degrees	Distance feet
1	0	2.00
2	-45	2.80
3	0	

Soil Layers:

Number of Layers: 2

Layers Below the Top Layer:

Coordinates of the Top of the Layer: feet

Layer	Point 1 Distance	Point 1 Elevation	Point 2 Distance	Point 2 Elevation
2	50.00	24.00	120.00	24.00

Ground Water:

Include Ground Water: Yes
Phreatic Correction: Yes
Number of Points: 4

No.	Distance feet	Elevation feet
1	20.00	0.00
2	45.00	0.00
3	50.00	5.00
4	100.00	15.00

Soil Nails

Dimensions and Properties:

Maximum Vertical Spacing: 5.00 feet
Number of Soil Nail Rows: 6
Soil Nail Design Parameters: Varying

No.	Soil Nail Length feet	Inclination From Horizontal degrees	Vertical Spacing feet	Horizontal Spacing H feet	Nail Bar Diameter Ø inches	Nail Bar Yield Strength fy ksi	Bond Strength Factor F
1	35.00	15	2.00	5.00	1.130	60.0	1.00
2	35.00	15	5.00	5.00	1.130	60.0	1.00
3	35.00	15	5.00	5.00	1.130	60.0	1.00
4	30.00	15	5.00	5.00	1.130	60.0	1.00
5	30.00	15	5.00	5.00	1.130	60.0	1.00
6	25.00	15	5.00	5.00	1.130	60.0	1.00

Facing Resistance:

	Temporary	Permanent	Seismic
ASD Allowable Facing Resistance:	24.3	30.2	41.2 kips

Soil Properties

Layer	Description	Unit Weight γ pcf	Friction Angle φ' degrees	Cohesion c' psf
1	Med dense clayey sands	120	34.0	350
2	Med dense to dense clayey sand	120	36.0	350

Loads

Applied Loads:

Seismic:

Horizontal Seismic Coefficient Kh0.36:

External Load:

Apply external load: No

Surcharges:

Apply surcharges: Yes

No.	Distance from Top of Wall Begin feet	End feet	Load Begin psf	Load End psf
1	0.00	25.00	240	240

Factors of Safety

	Temporary	Permanent	Seismic
Pullout (Distal):	2.00	2.00	1.50
Pullout (Proximal):	2.00	2.00	1.50
Nail Bar Yield:	1.80	1.80	1.35

Search Options

Search Limits:

Begin: 4.00 feet
End: 40.00 feet

Below Toe Searches (BTS):

Perform below Toe Search: Yes
Number of BTS Points: 5
BTS Depth: 10.00 feet
Interface Friction
Reduction Factor: 0.33

Advanced Search Options:

Use Advanced Search Options: No

Results

Analysis:

Method: ASD
Scenario: Permanent

Factor of Safety:

Minimum: 2.01
Found at Search Point: 9
Found at Grid Point: 27
Found at Search Level: 8.00 feet below the toe of the wall

Load at Soil Nail Head:

Calculated Service Load at Soil Nail Head (Empirical), To: 12.8 kips
Allowable Facing Resistance, F allowable (Entered): 30.2 kips
F_allowable ≥ To OK

Nominal Pullout Resistance:

Layer	Description	Nominal Pullout Resistance klf
1	Med dense clayey sands	1.583
2	Med dense to dense clayey sand	2.262

Results by Search Level: Detail search results

** Indicates Minimum Factor of Safety

Search Level: At the toe of the wall Facing Design Force = 19.0 kips (Clouterre)

Search Point	Minimum Factor of Safety	Distance From Toe of Wall feet	Failure Planes: Lower Angle degrees	Lower Length feet	Upper Angle degrees	Upper Length feet	Reinforcement: Level	Stress ksi	Controlling Resistance Failure Mode
1	3.32	6.41	68.29	15.61	87.47	14.51	1	28.3	Pullout
							2	33.3	Bar Yield
							3	33.3	Bar Yield
							4	29.8	Pullout
							5	31.5	Pullout
							6	27.5	Pullout
2	2.94	10.01	58.14	17.07	86.05	14.53	1	25.5	Pullout
							2	30.6	Pullout
							3	30.6	Pullout
							4	27.4	Pullout
							5	30.1	Pullout
							6	27.1	Pullout
3	2.76	13.61	56.69	17.35	74.27	15.06	1	23.4	Pullout
							2	28.8	Pullout
							3	29.9	Pullout
							4	27.0	Pullout
							5	29.8	Pullout
							6	27.1	Pullout

4	2.66	17.21	54.54	17.80	64.60	16.05	1	21.5	Pullout
							2	27.0	Pullout
							3	29.0	Pullout
							4	26.4	Pullout
							5	29.5	Pullout
							6	27.0	Pullout
5	2.57	20.81	46.26	12.04	58.40	23.83	1	19.5	Pullout
							2	24.8	Pullout
							3	27.4	Pullout
							4	24.5	Pullout
							5	28.1	Pullout
							6	26.6	Pullout
6	2.50	24.41	41.70	13.08	54.19	25.03	1	17.4	Pullout
							2	22.3	Pullout
							3	25.4	Pullout
							4	22.9	Pullout
							5	27.3	Pullout
							6	26.3	Pullout
7	2.49	28.01	37.83	14.19	50.38	26.36	1	15.5	Pullout
							2	20.0	Pullout
							3	23.5	Pullout
							4	21.5	Pullout
							5	26.5	Pullout
							6	26.1	Pullout
8	2.54	31.61	34.53	15.35	46.94	27.78	1	13.7	Pullout
							2	17.8	Pullout
							3	21.7	Pullout
							4	20.1	Pullout
							5	25.8	Pullout
							6	25.9	Pullout
9	2.61	35.21	33.38	21.09	44.66	24.75	1	11.1	Pullout
							2	15.3	Pullout
							3	19.6	Pullout
							4	19.5	Pullout
							5	25.5	Pullout
							6	25.8	Pullout
10	2.66	38.81	30.87	22.61	41.88	26.07	1	8.6	Pullout
							2	13.2	Pullout
							3	17.9	Pullout
							4	18.5	Pullout
							5	24.9	Pullout
							6	25.6	Pullout
11	2.72	42.41	28.68	24.17	39.37	27.43	1	6.3	Pullout
							2	11.3	Pullout
							3	16.3	Pullout
							4	17.4	Pullout
							5	24.3	Pullout
							6	25.5	Pullout

Search Level: 2.00 feet below the toe of the wall Facing Design Force = 17.3 kips (Clouterre)

			Failure Planes				Reinforcement		
			Lower		Upper				
Search Point	Minimum Factor of Safety	Distance From Toe of Wall feet	Angle degrees	Length feet	Angle degrees	Length feet	Level	Stress ksi	Controlling Resistance Failure Mode
1	3.09	6.41	65.03	13.68	88.03	18.61	1	28.3	Pullout
							2	33.3	Bar Yield
							3	33.3	Bar Yield
							4	28.2	Pullout
							5	30.1	Pullout
							6	26.4	Pullout
2	2.77	10.01	59.82	17.93	86.30	15.53	1	25.5	Pullout
							2	30.6	Pullout
							3	30.5	Pullout
							4	26.6	Pullout
							5	29.1	Pullout
							6	26.0	Pullout
3	2.52	13.61	54.91	18.94	80.04	15.74	1	23.0	Pullout
							2	27.7	Pullout
							3	28.2	Pullout
							4	25.1	Pullout

							5	28.2	Pullout
							6	25.6	Pullout
4	2.35	17.21	52.14	19.63	71.57	16.34	1	20.9	Pullout
							2	25.5	Pullout
							3	26.8	Pullout
							4	24.3	Pullout
							5	27.6	Pullout
							6	25.3	Pullout
5	2.28	20.81	51.14	19.91	61.76	17.59	1	19.1	Pullout
							2	23.9	Pullout
							3	26.3	Pullout
							4	24.0	Pullout
							5	27.4	Pullout
							6	25.3	Pullout
6	2.22	24.41	40.25	9.60	55.43	30.12	1	17.3	Pullout
							2	22.0	Pullout
							3	25.0	Pullout
							4	22.3	Pullout
							5	25.3	Pullout
							6	24.2	Pullout
7	2.20	28.01	36.42	10.44	51.67	31.62	1	15.3	Pullout
							2	19.6	Pullout
							3	23.0	Pullout
							4	20.8	Pullout
							5	24.2	Pullout
							6	23.7	Pullout
8	2.23	31.61	33.17	11.33	48.26	33.24	1	13.4	Pullout
							2	17.3	Pullout
							3	21.1	Pullout
							4	19.3	Pullout
							5	23.1	Pullout
							6	23.3	Pullout
9	2.26	35.21	30.41	12.25	45.17	34.97	1	10.9	Pullout
							2	15.1	Pullout
							3	19.3	Pullout
							4	17.9	Pullout
							5	22.1	Pullout
							6	22.9	Pullout
10	2.31	38.81	30.92	18.10	42.98	31.83	1	8.3	Pullout
							2	12.7	Pullout
							3	17.2	Pullout
							4	16.1	Pullout
							5	22.2	Pullout
							6	22.9	Pullout
11	2.35	42.41	28.73	19.35	40.45	33.44	1	5.9	Pullout
							2	10.7	Pullout
							3	15.6	Pullout
							4	14.8	Pullout
							5	21.4	Pullout
							6	22.6	Pullout

Search Level: 4.00 feet below the toe of the wall Facing Design Force = 17.2 kips (Clouterre)

			Failure Planes				Reinforcement		
			Lower		Upper				
Search Point	Minimum Factor of Safety	Distance From Toe of Wall feet	Angle degrees	Length feet	Angle degrees	Length feet	Level	Stress ksi	Controlling Resistance Failure Mode
1	3.13	6.41	65.60	10.87	85.24	23.18	1	28.4	Pullout
							2	33.3	Bar Yield
							3	33.3	Bar Yield
							4	29.3	Pullout
							5	29.3	Pullout
							6	25.5	Pullout
2	2.72	10.01	58.74	15.44	84.22	19.90	1	25.6	Pullout
							2	31.0	Pullout
							3	31.1	Pullout
							4	25.5	Pullout
							5	27.7	Pullout
							6	24.7	Pullout
3	2.45	13.61	54.17	16.28	78.35	20.22	1	23.1	Pullout
							2	28.0	Pullout

							3	28.7	Pullout
							4	23.8	Pullout
							5	26.6	Pullout
							6	24.1	Pullout
4	2.27	17.21	51.96	16.76	70.82	20.96	1	21.0	Pullout
							2	25.6	Pullout
							3	27.1	Pullout
							4	22.8	Pullout
							5	26.1	Pullout
							6	23.8	Pullout
5	2.17	20.81	48.55	22.01	69.27	17.64	1	18.4	Pullout
							2	22.2	Pullout
							3	23.7	Pullout
							4	21.4	Pullout
							5	25.2	Pullout
							6	23.3	Pullout
6	2.10	24.41	43.99	23.76	66.06	18.05	1	16.1	Pullout
							2	19.1	Pullout
							3	21.0	Pullout
							4	19.6	Pullout
							5	24.0	Pullout
							6	22.7	Pullout
7	2.07	28.01	44.47	23.55	55.82	19.95	1	14.8	Pullout
							2	18.3	Pullout
							3	21.2	Pullout
							4	19.8	Pullout
							5	24.1	Pullout
							6	22.7	Pullout
8	2.09	31.61	34.83	11.55	50.03	34.45	1	13.1	Pullout
							2	16.7	Pullout
							3	20.3	Pullout
							4	18.2	Pullout
							5	21.8	Pullout
							6	21.1	Pullout
9	2.10	35.21	31.99	12.46	46.96	36.12	1	10.4	Pullout
							2	14.4	Pullout
							3	18.4	Pullout
							4	16.7	Pullout
							5	20.7	Pullout
							6	20.5	Pullout
10	2.13	38.81	29.54	13.38	44.18	37.88	1	7.9	Pullout
							2	12.2	Pullout
							3	16.5	Pullout
							4	15.2	Pullout
							5	19.6	Pullout
							6	19.9	Pullout
11	2.15	42.41	27.42	14.33	41.64	39.73	1	5.5	Pullout
							2	10.1	Pullout
							3	14.8	Pullout
							4	13.8	Pullout
							5	18.5	Pullout
							6	19.4	Pullout

Search Level: 6.00 feet below the toe of the wall Facing Design Force = 15.2 kips (Clouterre)

			Failure Planes				Reinforcement		
			Lower		Upper				
Search Point	Minimum Factor of Safety	Distance From Toe of Wall feet	Angle degrees	Length feet	Angle degrees	Length feet	Level	Stress ksi	Controlling Resistance Failure Mode
1	3.23	6.41	63.95	11.69	87.00	24.53	1	28.4	Pullout
							2	33.3	Bar Yield
							3	33.3	Bar Yield
							4	28.6	Pullout
							5	28.4	Pullout
							6	24.3	Pullout
2	2.78	10.01	56.27	12.63	83.01	24.68	1	25.7	Pullout
							2	31.2	Pullout
							3	31.4	Pullout
							4	26.0	Pullout
							5	26.2	Pullout
							6	23.1	Pullout

3	2.48	13.61	52.12	13.30	77.47	25.10	1	23.2	Pullout
							2	28.2	Pullout
							3	29.0	Pullout
							4	24.1	Pullout
							5	24.9	Pullout
							6	22.3	Pullout
4	2.29	17.21	50.66	13.58	70.64	25.97	1	21.0	Pullout
							2	25.7	Pullout
							3	27.1	Pullout
							4	22.9	Pullout
							5	24.3	Pullout
							6	22.1	Pullout
5	2.16	20.81	48.27	18.76	68.37	22.59	1	18.5	Pullout
							2	22.4	Pullout
							3	24.0	Pullout
							4	20.0	Pullout
							5	23.5	Pullout
							6	21.6	Pullout
6	2.08	24.41	47.08	14.34	59.13	28.55	1	16.9	Pullout
							2	21.0	Pullout
							3	23.5	Pullout
							4	20.5	Pullout
							5	23.1	Pullout
							6	21.4	Pullout
7	2.04	28.01	44.99	19.80	56.30	25.24	1	14.7	Pullout
							2	18.2	Pullout
							3	21.1	Pullout
							4	18.3	Pullout
							5	22.4	Pullout
							6	21.0	Pullout
8	2.03	31.61	41.53	21.12	53.03	26.28	1	12.4	Pullout
							2	15.7	Pullout
							3	18.9	Pullout
							4	16.5	Pullout
							5	21.2	Pullout
							6	20.2	Pullout
9	2.04	35.21	39.63	27.44	51.17	22.46	1	9.4	Pullout
							2	12.8	Pullout
							3	16.3	Pullout
							4	15.5	Pullout
							5	20.5	Pullout
							6	19.8	Pullout
10	2.05	38.81	31.01	13.59	45.86	39.02	1	7.4	Pullout
							2	11.5	Pullout
							3	15.6	Pullout
							4	14.1	Pullout
							5	18.2	Pullout
							6	17.6	Pullout
11	2.07	42.41	28.82	14.52	43.32	40.81	1	4.9	Pullout
							2	9.3	Pullout
							3	13.8	Pullout
							4	12.6	Pullout
							5	17.0	Pullout
							6	16.9	Pullout

Search Level: 8.00 feet below the toe of the wall Facing Design Force = 12.8 kips (Clouterre)

			Failure Planes				Reinforcement		
			Lower		Upper				
Search Point	Minimum Factor of Safety	Distance From Toe of Wall feet	Angle degrees	Length feet	Angle degrees	Length feet	Level	Stress ksi	Controlling Resistance Failure Mode
1	3.29	6.41	72.67	19.38	88.02	18.51	1	28.3	Pullout
							2	33.3	Bar Yield
							3	33.3	Bar Yield
							4	28.2	Pullout
							5	29.4	Pullout
							6	25.0	Pullout
2	2.82	10.01	67.90	23.96	86.13	14.83	1	25.5	Pullout
							2	30.6	Pullout
							3	30.5	Pullout
							4	26.3	Pullout
							5	28.0	Pullout

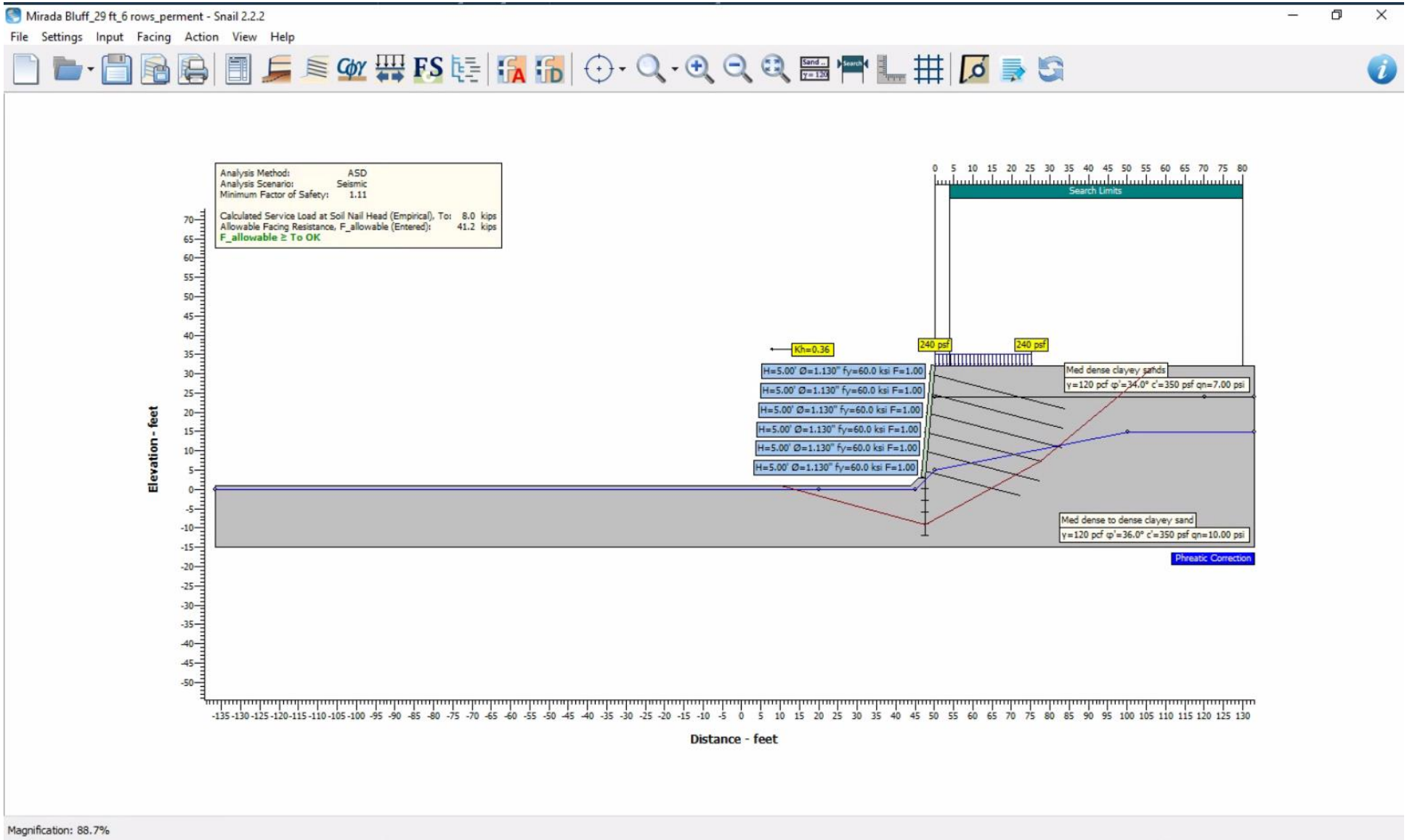
							6	24.1	Pullout
3	2.55	13.61	63.87	24.73	79.58	15.05	1	23.1	Pullout
							2	27.8	Pullout
							3	28.4	Pullout
							4	24.7	Pullout
							5	26.8	Pullout
							6	23.3	Pullout
4	2.34	17.21	59.11	30.18	81.19	11.23	1	20.1	Pullout
							2	23.4	Pullout
							3	25.8	Pullout
							4	22.8	Pullout
							5	25.4	Pullout
							6	22.3	Pullout
5	2.20	20.81	49.84	19.37	69.44	23.71	1	18.4	Pullout
							2	22.1	Pullout
							3	23.7	Pullout
							4	19.6	Pullout
							5	22.3	Pullout
							6	20.3	Pullout
6	2.11	24.41	45.29	10.41	60.00	34.18	1	16.8	Pullout
							2	20.7	Pullout
							3	23.2	Pullout
							4	20.1	Pullout
							5	22.6	Pullout
							6	19.4	Pullout
7	2.04	28.01	41.36	11.20	56.48	35.51	1	14.7	Pullout
							2	18.1	Pullout
							3	21.0	Pullout
							4	18.2	Pullout
							5	21.1	Pullout
							6	18.3	Pullout
8	2.02	31.61	37.96	12.03	53.22	36.96	1	12.4	Pullout
							2	15.6	Pullout
							3	18.8	Pullout
							4	16.4	Pullout
							5	19.6	Pullout
							6	17.2	Pullout
** 9	2.01	35.21	38.24	17.93	50.79	33.43	1	9.4	Pullout
							2	13.0	Pullout
							3	16.5	Pullout
							4	14.3	Pullout
							5	17.8	Pullout
							6	17.3	Pullout
10	2.02	38.81	37.33	24.41	48.84	29.49	1	6.5	Pullout
							2	10.3	Pullout
							3	14.0	Pullout
							4	12.1	Pullout
							5	17.3	Pullout
							6	17.0	Pullout
11	2.03	42.41	33.20	20.27	45.50	36.31	1	4.2	Pullout
							2	8.3	Pullout
							3	12.5	Pullout
							4	11.0	Pullout
							5	15.3	Pullout
							6	15.7	Pullout

Search Level: 10.00 feet below the toe of the wall Facing Design Force = 10.0 kips (Clouterre)

			Failure Planes				Reinforcement		
			Lower		Upper				
Search Point	Minimum Factor of Safety	Distance From Toe of Wall feet	Angle degrees	Length feet	Angle degrees	Length feet	Level	Stress ksi	Controlling Resistance Failure Mode
1	3.43	6.41	71.79	16.42	86.86	23.44	1	28.4	Pullout
							2	33.3	Bar Yield
							3	33.3	Bar Yield
							4	28.7	Pullout
							5	28.5	Pullout
							6	24.1	Pullout
2	2.87	10.01	65.19	21.48	87.06	19.53	1	25.4	Pullout
							2	30.5	Pullout
							3	30.3	Pullout

							4	24.5	Pullout
							5	26.3	Pullout
							6	22.6	Pullout
3	2.59	13.61	62.36	26.41	85.01	15.66	1	22.7	Pullout
							2	26.7	Pullout
							3	26.7	Pullout
							4	23.1	Pullout
							5	25.3	Pullout
							6	21.9	Pullout
4	2.39	17.21	59.52	27.15	77.56	15.98	1	20.4	Pullout
							2	24.2	Pullout
							3	25.0	Pullout
							4	21.8	Pullout
							5	24.3	Pullout
							6	21.2	Pullout
5	2.26	20.81	55.54	33.11	79.91	11.88	1	17.4	Pullout
							2	19.7	Pullout
							3	22.6	Pullout
							4	19.9	Pullout
							5	22.9	Pullout
							6	20.2	Pullout
6	2.16	24.41	46.80	21.40	67.35	25.36	1	15.9	Pullout
							2	18.8	Pullout
							3	20.6	Pullout
							4	16.7	Pullout
							5	19.5	Pullout
							6	17.8	Pullout
7	2.09	28.01	46.24	16.20	58.38	32.06	1	14.4	Pullout
							2	17.6	Pullout
							3	20.2	Pullout
							4	17.2	Pullout
							5	19.9	Pullout
							6	17.7	Pullout
8	2.05	31.61	42.78	17.23	55.21	33.24	1	11.9	Pullout
							2	14.9	Pullout
							3	18.0	Pullout
							4	15.3	Pullout
							5	18.3	Pullout
							6	16.6	Pullout
9	2.03	35.21	39.71	18.31	52.26	34.52	1	9.1	Pullout
							2	12.4	Pullout
							3	15.8	Pullout
							4	13.5	Pullout
							5	16.8	Pullout
							6	15.6	Pullout
10	2.02	38.81	37.00	19.44	49.53	35.88	1	6.3	Pullout
							2	10.0	Pullout
							3	13.7	Pullout
							4	11.7	Pullout
							5	15.3	Pullout
							6	14.6	Pullout
11	2.01	42.41	34.59	20.61	47.01	37.32	1	3.7	Pullout
							2	7.7	Pullout
							3	11.6	Pullout
							4	9.9	Pullout
							5	13.9	Pullout
							6	13.7	Pullout

END OF REPORT


Mirada Bluff_29 ft_6 rows_perment - Snail 2.2.2
File Settings Input Facing Action View Help
Analysis Method: ASD
Analysis Scenario: Seismic
Minimum Factor of Safety: 1.11
Calculated Service Load at Soil Nail Head (Empirical), To: 8.0 kips
Allowable Facing Resistance, F_allowable (Entered): 41.2 kips
F_allowable ≥ To OK
Search Limits
Kh=0.36
240 psf
240 psf
H=5.00' Ø=1.130" fy=60.0 ksi F=1.00
H=5.00' Ø=1.130" fy=60.0 ksi F=1.00
H=5.00' Ø=1.130" fy=60.0 ksi F=1.00
H=5.00' Ø=1.130" fy=60.0 ksi F=1.00
H=5.00' Ø=1.130" fy=60.0 ksi F=1.00
H=5.00' Ø=1.130" fy=60.0 ksi F=1.00
Med dense clayey sands
γ=120 pcf φ'=34.0° c'=350 psf qn=7.00 psi
Med dense to dense clayey sand
γ=120 pcf φ'=36.0° c'=350 psf qn=10.00 psi
Phreatic Correction
Elevation - feet
Distance - feet
Magnification: 88.7%

==========
File Information
==========

File Name: Mirada Bluff 29 ft 6 rows perment.snz
Run Date: 06/02/21
Run Time: 21:51:09

==========
Project Information
==========

Description: Bluff Stabilization
Location: Mirada Rd, San Mateo
EA:
Project ID: 2019-147-GEO
Wall No.: Soil Nail Wall
Structure No.:
Station: N of Mirado Rd Br
Engineer: DW
Designer

Comments:

Wall height ~ 29'. Use 6 rows of nails. Medium dense to dense Clayey Sands.

==========
Geometry
==========

Layout:

Reference Point:

At: Top of Wall
Distance From Origin: 50.00 feet
Elevation Above Origin: 32.00 feet

Wall Dimensions:

Wall Height: 29.00 feet
Facing Angle: 85.24 degrees
Facing Batter: 0.999 :12 H:V

Ground Surface:

Number of lines that define the ground surface above the wall: 2

No.	Angle degrees	Distance feet
1	0	60.00
2	0	

Number of lines that define the ground surface in front of the toe: 3

No.	Angle degrees	Distance feet
1	0	2.00
2	-45	2.80
3	0	

Soil Layers:

Number of Layers: 2

Layers Below the Top Layer:

Coordinates of the Top of the Layer: feet

Layer	Point 1 Distance	Point 1 Elevation	Point 2 Distance	Point 2 Elevation
2	50.00	24.00	120.00	24.00

Ground Water:

Include Ground Water: Yes
Phreatic Correction: Yes
Number of Points: 4

No.	Distance feet	Elevation feet
1	20.00	0.00
2	45.00	0.00
3	50.00	5.00
4	100.00	15.00

Soil Nails

Dimensions and Properties:

Maximum Vertical Spacing: 5.00 feet
Number of Soil Nail Rows: 6
Soil Nail Design Parameters: Varying

No.	Soil Nail Length feet	Inclination From Horizontal degrees	Vertical Spacing feet	Horizontal Spacing H feet	Nail Bar Diameter Ø inches	Nail Bar Yield Strength fy ksi	Bond Strength Factor F
1	35.00	15	2.00	5.00	1.130	60.0	1.00
2	35.00	15	5.00	5.00	1.130	60.0	1.00
3	35.00	15	5.00	5.00	1.130	60.0	1.00
4	30.00	15	5.00	5.00	1.130	60.0	1.00
5	30.00	15	5.00	5.00	1.130	60.0	1.00
6	25.00	15	5.00	5.00	1.130	60.0	1.00

Facing Resistance:

	Temporary	Permanent	Seismic	
ASD Allowable Facing Resistance:	24.3	30.2	41.2	kips

Soil Properties

Layer	Description	Unit Weight γ pcf	Friction Angle φ' degrees	Cohesion c' psf
1	Med dense clayey sands	120	34.0	350
2	Med dense to dense clayey sand	120	36.0	350

Loads

Applied Loads:

Seismic:

Horizontal Seismic Coefficient Kh0.36:

External Load:

Apply external load: No

Surcharges:

Apply surcharges: Yes

No.	Distance from Top of Wall Begin feet	End feet	Load Begin psf	Load End psf
1	0.00	25.00	240	240

Factors of Safety

	Temporary	Permanent	Seismic
Pullout (Distal):	2.00	2.00	1.50
Pullout (Proximal):	2.00	2.00	1.50
Nail Bar Yield:	1.80	1.80	1.35

Search Options

Search Limits:

Begin: 4.00 feet
End: 80.00 feet

Below Toe Searches (BTS):

Perform below Toe Search: Yes
Number of BTS Points: 5
BTS Depth: 15.00 feet
Interface Friction
Reduction Factor: 0.33

Advanced Search Options:

Use Advanced Search Options: No

Results

Analysis:

Method: ASD
Scenario: Seismic

Factor of Safety:

Minimum: 1.11
Found at Search Point: 8
Found at Grid Point: 34
Found at Search Level: 12.00 feet below the toe of the wall

Load at Soil Nail Head:

Calculated Service Load at Soil Nail Head (Empirical), To: 8.0 kips
Allowable Facing Resistance, F allowable (Entered): 41.2 kips
F_allowable ≥ To OK

Nominal Pullout Resistance:

Layer	Description	Nominal Pullout Resistance klf
1	Med dense clayey sands	1.583
2	Med dense to dense clayey sand	2.262

Results by Search Level:

** Indicates Minimum Factor of Safety

Search Level: At the toe of the wall Facing Design Force = 23.9 kips (Clouterre)

Search Point	Minimum Factor of Safety	Distance From Toe of Wall feet	Failure Planes: Lower Angle degrees	Lower Length feet	Upper Angle degrees	Upper Length feet	Reinforcement: Level	Stress ksi	Controlling Resistance Failure Mode
1	3.20	6.41	52.25	7.34	85.26	23.28	1	37.9	Pullout
							2	44.4	Bar Yield
							3	44.4	Bar Yield
							4	39.0	Pullout
							5	39.0	Pullout
							6	35.8	Pullout
2	2.41	14.01	41.57	13.11	78.30	20.73	1	30.5	Pullout
							2	36.8	Pullout
							3	37.7	Pullout
							4	31.1	Pullout
							5	36.4	Pullout
							6	35.1	Pullout
3	1.87	21.61	33.86	15.62	66.93	22.06	1	24.1	Pullout
							2	29.2	Pullout
							3	31.5	Pullout
							4	26.4	Pullout
							5	34.2	Pullout
							6	34.5	Pullout

4	1.63	29.21	34.79	35.58	90.00	8.70	1	11.5	Pullout
							2	19.1	Pullout
							3	26.7	Pullout
							4	26.8	Pullout
							5	34.4	Pullout
							6	34.5	Pullout
5	1.50	36.81	25.30	40.72	90.00	11.60	1	0.0	Pullout
							2	8.2	Pullout
							3	18.3	Pullout
							4	20.9	Pullout
							5	31.0	Pullout
							6	33.6	Pullout
6	1.46	44.41	24.56	48.83	90.00	8.70	1	0.0	Pullout
							2	7.2	Pullout
							3	17.5	Pullout
							4	20.3	Pullout
							5	30.7	Pullout
							6	33.5	Pullout
7	1.46	52.01	24.04	56.95	90.00	5.80	1	0.0	Pullout
							2	6.4	Pullout
							3	16.9	Pullout
							4	19.9	Pullout
							5	30.4	Pullout
							6	33.4	Pullout
8	1.46	59.61	20.04	25.38	29.58	41.13	1	0.0	Pullout
							2	4.6	Pullout
							3	13.4	Pullout
							4	16.5	Pullout
							5	28.4	Pullout
							6	32.8	Pullout
9	1.47	67.21	17.93	28.26	26.72	45.15	1	0.0	Pullout
							2	0.3	Pullout
							3	10.0	Pullout
							4	14.4	Pullout
							5	27.2	Pullout
							6	32.5	Pullout
10	1.49	74.81	10.97	15.24	23.56	65.30	1	0.0	Pullout
							2	0.0	Pullout
							3	8.4	Pullout
							4	11.5	Pullout
							5	22.2	Pullout
							6	31.0	Pullout
11	1.53	82.41	13.20	25.40	21.91	62.18	1	0.0	Pullout
							2	0.0	Pullout
							3	4.8	Pullout
							4	8.7	Pullout
							5	23.8	Pullout
							6	31.5	Pullout

Search Level: 3.00 feet below the toe of the wall Facing Design Force = 19.4 kips (Clouterre)

			Failure Planes				Reinforcement		
			Lower		Upper				
Search Point	Minimum Factor of Safety	Distance From Toe of Wall feet	Angle degrees	Length feet	Angle degrees	Length feet	Level	Stress ksi	Controlling Resistance Failure Mode
1	2.85	6.41	65.72	14.04	88.09	19.21	1	37.7	Pullout
							2	44.4	Bar Yield
							3	44.4	Bar Yield
							4	37.6	Pullout
							5	39.7	Pullout
							6	34.7	Pullout
2	1.98	14.01	51.75	20.37	85.00	16.06	1	29.8	Pullout
							2	35.0	Pullout
							3	35.1	Pullout
							4	31.2	Pullout
							5	35.7	Pullout
							6	32.7	Pullout
3	1.60	21.61	46.60	22.02	67.94	17.26	1	23.9	Pullout
							2	28.8	Pullout
							3	31.1	Pullout
							4	28.7	Pullout

							5	34.1	Pullout
							6	31.9	Pullout
4	1.36	29.21	37.48	36.81	90.00	9.60	1	10.6	Pullout
							2	17.1	Pullout
							3	24.2	Pullout
							4	23.7	Pullout
							5	30.7	Pullout
							6	30.3	Pullout
5	1.26	36.81	31.32	43.09	90.00	9.60	1	1.8	Pullout
							2	10.2	Pullout
							3	18.6	Pullout
							4	19.5	Pullout
							5	28.0	Pullout
							6	28.9	Pullout
6	1.25	44.41	29.96	51.26	90.00	6.40	1	0.0	Pullout
							2	8.5	Pullout
							3	17.3	Pullout
							4	18.5	Pullout
							5	27.3	Pullout
							6	28.5	Pullout
7	1.24	52.01	24.77	22.91	35.67	38.42	1	0.0	Pullout
							2	6.8	Pullout
							3	14.2	Pullout
							4	14.1	Pullout
							5	24.3	Pullout
							6	27.1	Pullout
8	1.26	59.61	19.69	19.00	31.53	48.96	1	0.0	Pullout
							2	2.4	Pullout
							3	10.8	Pullout
							4	11.6	Pullout
							5	20.8	Pullout
							6	25.3	Pullout
9	1.27	67.21	19.65	28.55	29.05	46.13	1	0.0	Pullout
							2	0.0	Pullout
							3	6.2	Pullout
							4	8.6	Pullout
							5	20.7	Pullout
							6	25.3	Pullout
10	1.30	74.81	15.92	23.34	26.05	58.29	1	0.0	Pullout
							2	0.0	Pullout
							3	3.5	Pullout
							4	5.9	Pullout
							5	17.4	Pullout
							6	23.7	Pullout
11	1.32	82.41	14.51	25.54	23.93	63.12	1	0.0	Pullout
							2	0.0	Pullout
							3	0.3	Pullout
							4	3.3	Pullout
							5	16.0	Pullout
							6	22.9	Pullout

Search Level: 6.00 feet below the toe of the wall Facing Design Force = 13.5 kips (Clouterre)

			Failure Planes				Reinforcement		
			Lower		Upper				
Search Point	Minimum Factor of Safety	Distance From Toe of Wall feet	Angle degrees	Length feet	Angle degrees	Length feet	Level	Stress ksi	Controlling Resistance Failure Mode
1	2.80	6.41	61.20	11.98	88.50	24.51	1	37.7	Pullout
							2	44.4	Bar Yield
							3	44.4	Bar Yield
							4	37.4	Pullout
							5	37.0	Pullout
							6	31.8	Pullout
2	1.93	14.01	47.98	18.84	86.18	21.05	1	29.7	Pullout
							2	34.7	Pullout
							3	34.6	Pullout
							4	26.9	Pullout
							5	31.2	Pullout
							6	28.8	Pullout
3	1.52	21.61	42.78	20.61	72.84	21.98	1	23.3	Pullout
							2	27.3	Pullout

							3	28.9	Pullout
							4	23.0	Pullout
							5	28.9	Pullout
							6	27.4	Pullout
4	1.30	29.21	35.71	35.98	90.00	14.00	1	10.6	Pullout
							2	10.5	Pullout
							3	17.9	Pullout
							4	17.8	Pullout
							5	25.3	Pullout
							6	25.2	Pullout
5	1.19	36.81	33.64	44.22	90.00	10.50	1	0.1	Pullout
							2	8.0	Pullout
							3	15.8	Pullout
							4	16.2	Pullout
							5	24.1	Pullout
							6	24.4	Pullout
6	1.17	44.41	28.88	50.72	90.00	10.50	1	0.0	Pullout
							2	1.4	Pullout
							3	10.4	Pullout
							4	12.0	Pullout
							5	21.0	Pullout
							6	22.6	Pullout
7	1.17	52.01	26.78	23.31	38.13	39.68	1	0.0	Pullout
							2	4.7	Pullout
							3	11.6	Pullout
							4	11.0	Pullout
							5	19.5	Pullout
							6	21.6	Pullout
8	1.17	59.61	21.38	19.21	33.86	50.25	1	0.0	Pullout
							2	0.0	Pullout
							3	7.8	Pullout
							4	8.1	Pullout
							5	15.9	Pullout
							6	18.9	Pullout
9	1.18	67.21	19.14	21.34	30.76	54.75	1	0.0	Pullout
							2	0.0	Pullout
							3	3.6	Pullout
							4	4.7	Pullout
							5	13.3	Pullout
							6	17.5	Pullout
10	1.20	74.81	17.32	23.51	28.13	59.39	1	0.0	Pullout
							2	0.0	Pullout
							3	0.0	Pullout
							4	1.5	Pullout
							5	10.8	Pullout
							6	16.3	Pullout
11	1.23	82.41	17.67	34.60	26.36	55.19	1	0.0	Pullout
							2	0.0	Pullout
							3	0.0	Pullout
							4	0.0	Pullout
							5	11.1	Pullout
							6	16.5	Pullout

Search Level: 9.00 feet below the toe of the wall Facing Design Force = 10.6 kips (Clouterre)

			Failure Planes				Reinforcement		
			Lower		Upper				
Search Point	Minimum Factor of Safety	Distance From Toe of Wall feet	Angle degrees	Length feet	Angle degrees	Length feet	Level	Stress ksi	Controlling Resistance Failure Mode
1	2.95	6.41	55.97	9.17	87.58	30.43	1	37.8	Pullout
							2	44.4	Bar Yield
							3	44.4	Bar Yield
							4	37.9	Pullout
							5	37.6	Pullout
							6	29.7	Pullout
2	1.98	14.01	50.31	19.75	86.48	22.84	1	29.7	Pullout
							2	34.6	Pullout
							3	34.5	Pullout
							4	26.8	Pullout
							5	28.9	Pullout
							6	26.2	Pullout

3	1.54	21.61	41.32	23.02	79.27	23.21	1	22.5	Pullout
							2	25.3	Pullout
							3	26.1	Pullout
							4	19.3	Pullout
							5	24.1	Pullout
							6	22.9	Pullout
4	1.28	29.21	37.97	37.06	90.00	15.20	1	10.6	Pullout
							2	10.0	Pullout
							3	15.7	Pullout
							4	15.1	Pullout
							5	22.0	Pullout
							6	21.5	Pullout
5	1.16	36.81	31.77	43.30	90.00	15.20	1	0.0	Pullout
							2	0.2	Pullout
							3	8.5	Pullout
							4	9.4	Pullout
							5	17.7	Pullout
							6	18.5	Pullout
6	1.14	44.41	30.92	51.77	90.00	11.40	1	0.0	Pullout
							2	0.0	Pullout
							3	7.5	Pullout
							4	8.5	Pullout
							5	17.0	Pullout
							6	18.0	Pullout
7	1.13	52.01	30.30	60.25	90.00	7.60	1	0.0	Pullout
							2	0.0	Pullout
							3	6.7	Pullout
							4	7.8	Pullout
							5	16.5	Pullout
							6	17.7	Pullout
8	1.13	59.61	25.55	26.43	36.64	44.58	1	0.0	Pullout
							2	0.0	Pullout
							3	4.5	Pullout
							4	4.2	Pullout
							5	12.3	Pullout
							6	14.8	Pullout
9	1.13	67.21	22.98	29.20	33.41	48.31	1	0.0	Pullout
							2	0.0	Pullout
							3	0.0	Pullout
							4	0.3	Pullout
							5	9.7	Pullout
							6	13.0	Pullout
10	1.16	74.81	20.85	32.02	30.65	52.18	1	0.0	Pullout
							2	0.0	Pullout
							3	0.0	Pullout
							4	0.0	Pullout
							5	7.3	Pullout
							6	11.4	Pullout
11	1.18	82.41	19.08	34.88	28.28	56.15	1	0.0	Pullout
							2	0.0	Pullout
							3	0.0	Pullout
							4	0.0	Pullout
							5	5.0	Pullout
							6	9.8	Pullout

Search Level: 12.00 feet below the toe of the wall Facing Design Force = 8.0 kips (Clouterre)

			Failure Planes				Reinforcement		
			Lower		Upper				
Search Point	Minimum Factor of Safety	Distance From Toe of Wall feet	Angle degrees	Length feet	Angle degrees	Length feet	Level	Stress ksi	Controlling Resistance Failure Mode
1	2.95	6.41	67.35	13.33	87.44	28.73	1	37.8	Pullout
							2	44.4	Bar Yield
							3	44.4	Bar Yield
							4	37.9	Pullout
							5	37.7	Pullout
							6	29.8	Pullout
2	1.98	14.01	58.40	24.07	86.09	20.55	1	29.7	Pullout
							2	34.7	Pullout
							3	34.6	Pullout
							4	27.0	Pullout
							5	30.3	Pullout

							6	26.3	Pullout
3	1.58	21.61	46.50	28.26	83.98	20.61	1	21.9	Pullout
							2	23.8	Pullout
							3	24.0	Pullout
							4	18.1	Pullout
							5	23.5	Pullout
							6	21.3	Pullout
4	1.30	29.21	40.10	38.19	90.00	16.40	1	10.6	Pullout
							2	10.0	Pullout
							3	13.6	Pullout
							4	12.6	Pullout
							5	19.2	Pullout
							6	18.2	Pullout
5	1.16	36.81	33.75	44.28	90.00	16.40	1	0.0	Pullout
							2	0.0	Pullout
							3	6.0	Pullout
							4	6.3	Pullout
							5	14.2	Pullout
							6	14.5	Pullout
6	1.13	44.41	32.87	52.88	90.00	12.30	1	0.0	Pullout
							2	0.0	Pullout
							3	4.8	Pullout
							4	5.3	Pullout
							5	13.4	Pullout
							6	13.9	Pullout
7	1.12	52.01	28.89	59.41	90.00	12.30	1	0.0	Pullout
							2	0.0	Pullout
							3	0.0	Pullout
							4	0.6	Pullout
							5	9.6	Pullout
							6	11.2	Pullout
** 8	1.11	59.61	28.82	34.02	39.53	38.65	1	0.0	Pullout
							2	0.0	Pullout
							3	1.3	Pullout
							4	0.5	Pullout
							5	9.6	Pullout
							6	11.1	Pullout
9	1.12	67.21	26.01	37.40	36.20	41.65	1	0.0	Pullout
							2	0.0	Pullout
							3	0.0	Pullout
							4	0.0	Pullout
							5	6.6	Pullout
							6	8.9	Pullout
10	1.13	74.81	23.67	40.84	33.33	44.77	1	0.0	Pullout
							2	0.0	Pullout
							3	0.0	Pullout
							4	0.0	Pullout
							5	3.8	Pullout
							6	6.9	Pullout
11	1.15	82.41	21.70	44.35	30.84	47.99	1	0.0	Pullout
							2	0.0	Pullout
							3	0.0	Pullout
							4	0.0	Pullout
							5	1.2	Pullout
							6	5.0	Pullout

Search Level: 15.00 feet below the toe of the wall Facing Design Force = 3.1 kips (Clouterre)

			Failure Planes				Reinforcement		
			Lower		Upper				
Search Point	Minimum Factor of Safety	Distance From Toe of Wall feet	Angle degrees	Length feet	Angle degrees	Length feet	Level	Stress ksi	Controlling Resistance Failure Mode
1	3.21	6.41	71.21	13.94	86.43	30.86	1	37.8	Pullout
							2	44.4	Bar Yield
							3	44.4	Bar Yield
							4	38.4	Pullout
							5	38.3	Pullout
							6	30.6	Pullout
2	1.87	14.01	54.37	21.65	86.96	26.44	1	29.6	Pullout
							2	34.5	Pullout
							3	34.3	Pullout

							4	26.5	Pullout
							5	26.3	Pullout
							6	21.9	Pullout
3	1.60	21.61	48.52	29.37	84.39	22.11	1	21.8	Pullout
							2	23.7	Pullout
							3	23.8	Pullout
							4	16.4	Pullout
							5	21.4	Pullout
							6	18.9	Pullout
4	1.40	29.21	39.92	34.28	82.44	22.19	1	12.5	Pullout
							2	12.9	Pullout
							3	13.2	Pullout
							4	8.2	Pullout
							5	14.8	Pullout
							6	13.8	Pullout
5	1.24	36.81	25.55	40.81	90.00	26.40	1	0.0	Pullout
							2	0.0	Pullout
							3	0.0	Pullout
							4	0.0	Pullout
							5	0.0	Pullout
							6	2.3	Pullout
6	1.14	44.41	34.74	54.05	90.00	13.20	1	0.0	Pullout
							2	0.0	Pullout
							3	2.4	Pullout
							4	2.5	Pullout
							5	10.1	Pullout
							6	10.3	Pullout
7	1.13	52.01	34.09	62.81	90.00	8.80	1	0.0	Pullout
							2	0.0	Pullout
							3	1.5	Pullout
							4	1.7	Pullout
							5	9.5	Pullout
							6	9.8	Pullout
8	1.12	59.61	31.59	41.99	42.69	32.44	1	0.0	Pullout
							2	0.0	Pullout
							3	0.0	Pullout
							4	0.0	Pullout
							5	7.0	Pullout
							6	7.8	Pullout
9	1.12	67.21	27.64	37.94	38.15	42.74	1	0.0	Pullout
							2	0.0	Pullout
							3	0.0	Pullout
							4	0.0	Pullout
							5	2.4	Pullout
							6	4.3	Pullout
10	1.13	74.81	25.20	41.34	35.21	45.79	1	0.0	Pullout
							2	0.0	Pullout
							3	0.0	Pullout
							4	0.0	Pullout
							5	0.0	Pullout
							6	1.9	Pullout
11	1.14	82.41	23.98	54.12	33.72	39.63	1	0.0	Pullout
							2	0.0	Pullout
							3	0.0	Pullout
							4	0.0	Pullout
							5	0.0	Pullout
							6	0.6	Pullout

END OF REPORT

Soil Strength & V_{s30m} Calculation

Appendix C-3

SOIL STRENGTH PARAMETERS & V_{s30}

Calc By: J. Zhang
Date: 12/16/19

PROJECT NAME: ***Mirada Road Bridge***
PROJECT NO.: ***2019-147-GEO***
STRUCTURE:
BORING NO.: ***B-1 (As-built, 2001)***

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

BOREHOLE DIA (in)= 8
GW DEPTH (ft)= 25
HAMMER ENERGY = 60%
DRILLING RODS (Y/N)= Y

Nd 32
N_{30} 40
V_{sd} (m/s) *236*
V_{s30} (m/s) *292*
Correlation 1) Caltrans

Sample No	Layer Thickness from	to	Sample Depth (ft)	Soil Type	Field Blow Count	Sampler Type	Unit Weight (pcf)	σ_v (psf)	σ_v' (psf)	SPT-$N_{eq.}$	N_{60} CE Corr.	N_{60} CR,CB,CS Corr.	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60, CS}$	Correlated Strength Parameters ϕ (°)	c (psf)	S_r (psf)	Lab Test Results c (psf)	Vs (m/s)
1	0.0	4.0	2.5	1	27	MC	125	312.5	313	18	17.6	15.1	1.70	25.7		25.7	40				142
2	4.0	9.0	6	2	45	MC	125	750	750	29	29.3	26.9	1.63	43.9				3656			213
3	9.0	14	11	2	37	MC	125	1375	1375	24	24.1	23.5	1.21	28.4				3006		2100	208
4	14.0	20	16	1	48	MC	125	2000	2000	31	31.2	34.1	1.00	34.1		34.1	39				233
5	20.0	23	21	1	45	MC	125	2625	2625	29	29.3	32.0	0.87	27.9		27.9	38				247
6	23.0	29	26	1	75	MC	125	3250	3188	49	48.8	56.1	0.79	44.4		44.4	39				272
7	29.0	33	31	1	58	SPT	125	3875	3501	58	58.0	86.7	0.76	65.5		65.5	41				282
8	33.0	38	36	1	65	SPT	125	4500	3814	65	65.0	97.2	0.72	70.4		70.4	42				291
9	38.0	43	41	1	37	MC	125	5125	4127	24	24.1	27.7	0.70	19.3		19.3	35				270
10	43.0	46.5	46	1	64	SPT	125	5750	4440	64	64.0	95.7	0.67	64.2		64.2	40				302

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

SOIL STRENGTH PARAMETERS & V_{s30}

Calc By: J. Zhang
Date: 12/16/19

PROJECT NAME: ***Mirada Road Bridge***
PROJECT NO.: ***2019-147-GEO***
STRUCTURE:
BORING NO.: ***B-2 (As-built, 2001)***

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

BOREHOLE DIA (in)= 8
GW DEPTH (ft)= 31
HAMMER ENERGY = 60%
DRILLING RODS (Y/N)= Y

Nd 35 V_{sd} (m/s) *236*
N_{30} 43 V_{s30} (m/s) *292*
Correlation 1) Caltrans

Sample No	Layer Thickness from	to	Sample Depth (ft)	Soil Type	Field Blow Count	Sampler Type	Unit Weight (pcf)	σ_v (psf)	σ_v' (psf)	SPT-$N_{eq.}$	N_{60} CE Corr.	N_{60} CR,CB,CS Corr.	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60,CS}$	Correlated Strength Parameters ϕ (°)	c (psf)	S_r (psf)	Lab Test Results c (psf)	Vs (m/s)
1	0.0	4.0	2.5	1	40	MC	125	312.5	313	26	26.0	22.4	1.70	38.1		38.1	42				148
2	4.0	8.5	6	2	38	MC	125	750	750	25	24.7	22.7	1.63	37.1				3088		1650	185
3	8.5	13.5	11	1	37	MC	125	1375	1375	24	24.1	23.5	1.21	28.4		28.4	39				208
4	13.5	19	16	1	64	MC	125	2000	2000	42	41.6	45.4	1.00	45.4		45.4	41				240
5	19.0	23	21	1	56	MC	125	2625	2625	36	36.4	39.8	0.87	34.7		34.7	39				252
6	23.0	28.5	26	1	75	MC	125	3250	3250	49	48.8	56.1	0.78	44.0		44.0	39				273
7	28.5	33	31	1	79	MC	125	3875	3875	51	51.4	59.1	0.72	42.4		42.4	39				286
8	33.0	39	36	1	31	SPT	125	4500	4188	31	31.0	46.3	0.69	32.0		32.0	37				277
9	39.0	44	41	1	47	SPT	125	5125	4501	47	47.0	70.3	0.67	46.8	11%	49.5	39				294
10	44.0	46.5	46	1	55	SPT	125	5750	4814	55	55.0	82.2	0.64	53.0		53.0	39				303

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

SOIL STRENGTH PARAMETERS & V_{s30}

Calc By: J. Zhang
Date: 12/16/19

PROJECT NAME: ***Mirada Road Bridge***
PROJECT NO.: ***2019-147-GEO***
STRUCTURE:
BORING NO.: ***R-17-006 (WRECO 2017)***

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

BOREHOLE DIA (in)= 4
GW DEPTH (ft)= 20
HAMMER ENERGY = 76%
DRILLING RODS (Y/N)= Y

Nd 27 V_{sd} (m/s) *245*
N_{30} 33 V_{s30} (m/s) *298*
Correlation 1) Caltrans

Sample No	Layer Thickness from	to	Sample Depth (ft)	Soil Type	Field Blow Count	Sampler Type	Unit Weight (pcf)	σ_v (psf)	σ_v' (psf)	SPT-$N_{eq.}$	N_{60} CE Corr.	N_{60} CR,CB,CS Corr.	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60, CS}$	Correlated Strength Parameters ϕ (°)	c (psf)	S_r (psf)	Lab Test Results c (psf)	Vs (m/s)
1	0.0	6.5	5	2	26	MC	125	625	625	17	21.4	16.0	1.70	27.2				2669			192
2	6.5	11.5	11	2	31	MC	125	1375	1375	20	25.5	21.6	1.21	26.1				3182			228
3	11.5	15	12.5	2	20	SPT	125	1562.5	1563	20	25.3	27.9	1.13	31.6				3158			232
4	15.0	19	16	2	34	MC	125	2000	2000	22	27.9	26.5	1.00	26.5				3490			247
5	19.0	23	21	1	33	MC	125	2625	2563	21	27.1	25.7	0.88	22.7		22.7	37				244
6	23.0	28	26	1	29	SPT	125	3250	2876	29	36.6	47.6	0.83	39.7		39.7	39				258
7	28.0	31.5	31	1	24	MC	125	3875	3189	16	19.7	19.7	0.79	15.6		15.6	35				249
8	31.5	35	32.5	1	18	SPT	125	4062.5	3283	18	22.7	27.6	0.78	21.6		21.6	36				254
9	35.0	36.5	36	1	13	SPT	125	4500	3502	13	16.4	18.8	0.76	14.2		14.2	34				250
10	36.5	38.0	37.5	1	45	MC	125	4687.5	3596	29	37.0	37.0	0.75	27.6		27.6	37				272
11	38.0	44.0	41	1	37	MC	125	5125	3815	24	30.4	30.4	0.72	22.0		22.0	36				271
12	44.0	47.0	46	1	20	SPT	125	5750	4128	20	25.3	30.7	0.70	21.3		21.3	35				271
13	47.0	51.0	51	1	61	SPT	125	6375	4441	61	77.1	100.2	0.67	67.2		67.2	41				307

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

SOIL STRENGTH PARAMETERS & V_{s30}

Calc By: J. Zhang
Date: 12/16/19

PROJECT NAME: ***Mirada Road Bridge***
PROJECT NO.: ***2019-147-GEO***
STRUCTURE:
BORING NO.: ***R-17-007B (WRECO 2017)***

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

BOREHOLE DIA (in)= 4
GW DEPTH (ft)= 20
HAMMER ENERGY = 76%
DRILLING RODS (Y/N)= Y

Nd 26
N_{30} 31
V_{sd} (m/s) *234*
V_{s30} (m/s) *285*
Correlation 1) Caltrans

Sample No	Layer Thickness from	to	Sample Depth (ft)	Soil Type	Field Blow Count	Sampler Type	Unit Weight (pcf)	σ_v (psf)	σ_v' (psf)	SPT-$N_{eq.}$	N_{60} CE Corr.	N_{60} CR,CB,CS Corr.	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60,CS}$	Correlated Strength Parameters ϕ (°)	c (psf)	S_r (psf)	Lab Test Results c (psf)	Vs (m/s)
1	0.0	8.0	5	1	26	MC	125	625	625	17	21.4	16.0	1.70	27.2		27.2	40				171
2	8.0	13.0	11	1	31	MC	125	1375	1375	20	25.5	21.6	1.21	26.1		26.1	39				209
3	13.0	18	16	1	20	MC	125	2000	2000	13	16.4	15.6	1.00	15.6		15.6	36				219
4	18.0	21.5	21	1	34	MC	125	2625	2563	22	27.9	26.5	0.88	23.4		23.4	37				245
5	21.5	23	22.5	1	33	SPT	125	2812.5	2657	33	41.7	51.5	0.87	44.7		44.7	40				256
6	23.0	28	26	1	29	SPT	125	3250	2876	29	36.6	47.6	0.83	39.7		39.7	39				258
7	28.0	31.5	31	1	24	SPT	125	3875	3189	24	30.3	39.4	0.79	31.2		31.2	38				260
8	31.5	34	32.5	1	18	MC	125	4062.5	3283	12	14.8	14.8	0.78	11.5		11.5	34				244
9	34.0	38	36	1	13	SPT	125	4500	3502	13	16.4	18.8	0.76	14.2		14.2	34				250
10	38.0	43.0	41	1	45	SPT	125	5125	3815	45	56.9	73.9	0.72	53.5		53.5	40				288
11	43.0	46.5	46	1	37	MC	125	5750	4128	24	30.4	30.4	0.70	21.1		21.1	35				276
12	46.5	48.0	47.5	1	20	SPT	125	5937.5	4222	20	25.3	30.6	0.69	21.1		21.1	35				273
13	48.0	51.5	51	1	61	SPT	125	6375	4441	61	77.1	100.2	0.67	67.2		67.2	41				307

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

APPENDIX D
Bluff Stabilization Plans
Provided by Designer

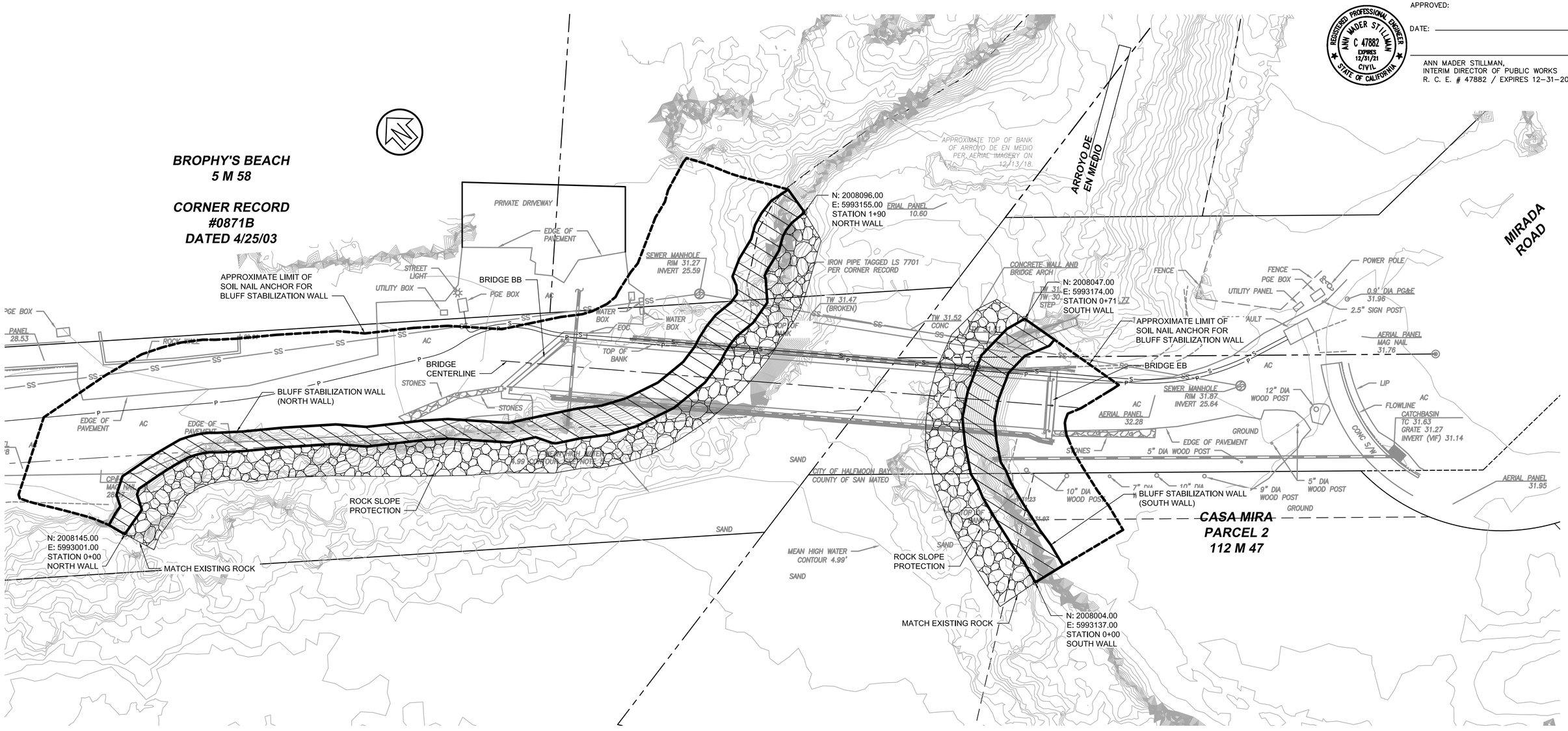
APPROVED:

DATE: _____

_____

ANN MADER STILLMAN,
INTERIM DIRECTOR OF PUBLIC WORKS
R. C. E. # 47882 / EXPIRES 12-31-2021

REGISTERED PROFESSIONAL ENGINEER
ANN MADER STILLMAN
C 47882
EXPIRES 12/31/21
CIVIL
STATE OF CALIFORNIA



BLUFF STABILIZATION PLAN

SCALE: 1" = 10'

NOTES:

1. THE LIMITS, LENGTH AND ALIGNMENT FOR THE BLUFF STABILIZATION SHOWN ON THIS DRAWINGS IS APPROXIMATE. CONTRACTOR SHALL FOLLOW THE SURFACE OF THE EXISTING BLUFF AND USE THAT FOR THE ALIGNMENT OF THE BLUFF STABILIZATION WALL.
2. ROCK SLOPE PROTECTION ALIGNMENT SHALL ALSO FOLLOW THE ALIGNMENT OF THE BLUFF STABILIZATION WALL.
3. SEE SHEET C006 FOR TYPICAL SECTION OF BLUFF STABILIZATION WALL. ROCK SLOPE PROTECTION AND SOIL NAIL ANCHORS.

Graphic Scale (in feet)

10 0 10 20

1 inch = 10 ft.

100% SUBMITTAL
JULY 23, 2021
NOT FOR CONSTRUCTION

APPROVED DATE:	
NAME NAME, CITY ENGINEER	
HALF MOON BAY	
R.C.E. # 00000 / EXPIRES 00-00-0000	

APPROVED DATE:	
moffatt & nichol 2185 N. CALIFORNIA BLVD, SUITE 500 WALNUT CREEK, CA 94596 925-944-5411	
DILIP R. TRIVEDI	
MOFFATT & NICHOL	
R.C.E. # XXXXXX / EXPIRES XX-XX-XXXX	

COUNTY OF SAN MATEO PUBLIC WORKS

REVISION	DATE		
		DESIGNED BY: DAJ	BLUFF STABILIZATION PLAN
		CHECKED BY: JFJ	MIRADA ROAD PEDESTRIAN BRIDGE REPLACEMENT AND BANK STABILIZATION PROJECT
		DRAWN BY: PH	ANN MADER STILLMAN, INTERIM DIRECTOR OF PUBLIC WORKS COUNTY SAN MATEO
			555 COUNTY CENTER, 5th FLOOR REDWOOD CITY, CALIFORNIA 94063

SCALE: AS SHOWN
DATE: 07/16/2021
FILE NO.: 1/4983

FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES 0 1 2 3 4

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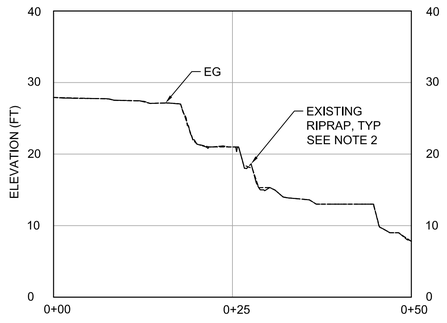
SHEET OF



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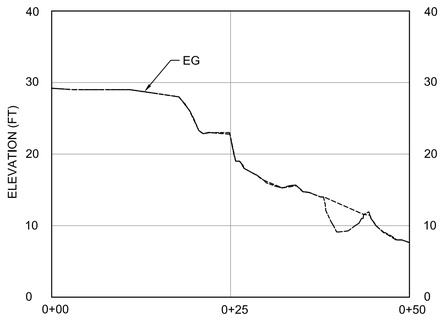

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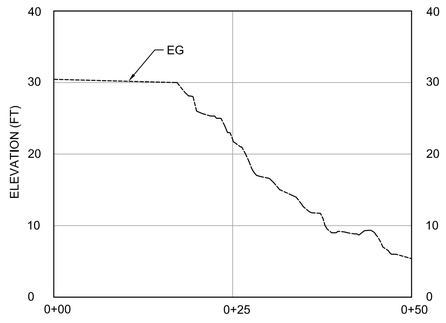

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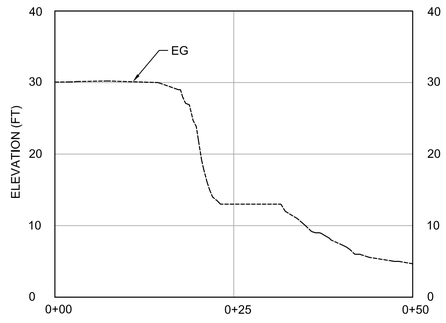

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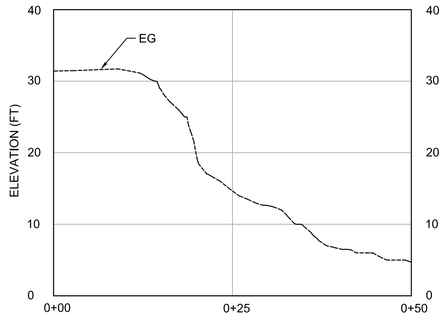

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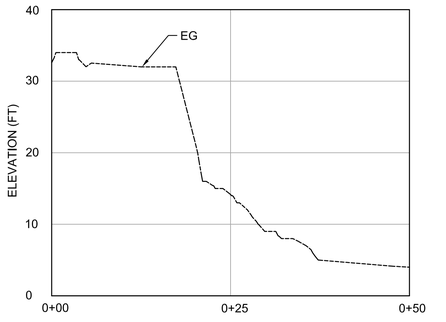

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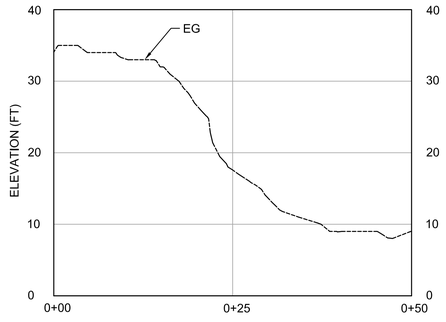

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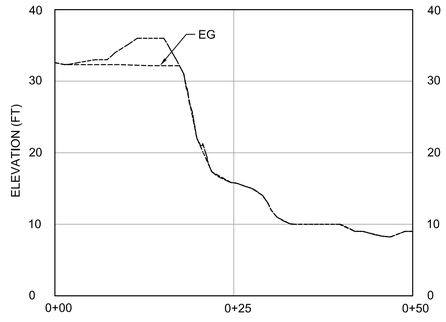
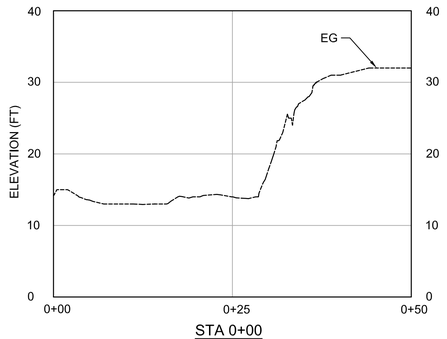


STA 1+90

NORTH WALL EXISTING BLUFF SECTIONS

SCALE: 1" = 10'

SEE NOTE 1



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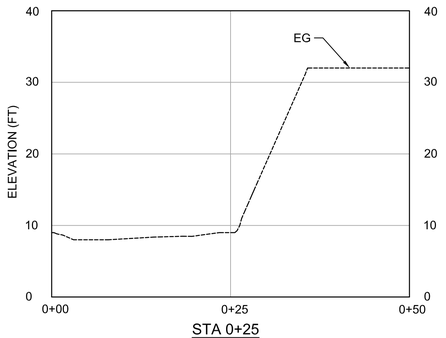

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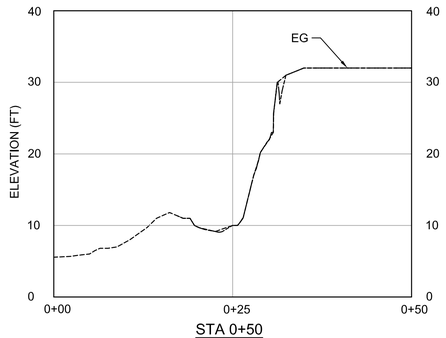

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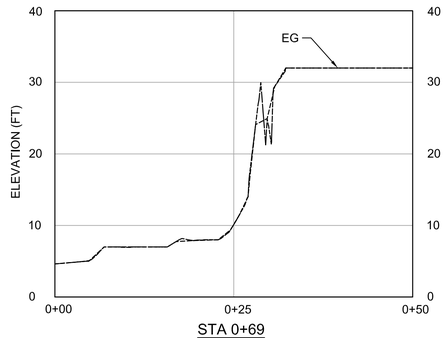

STA 0+69

SOUTH WALL EXISTING BLUFF SECTIONS

SCALE: 1" = 10'

SEE NOTE 1

NOTES:

1. STATIONS SHOWN ARE APPROXIMATE ALONG THE ALIGNMENT OF THE EXISTING BLUFF. FOR NORTH WALL IT STARTS ON THE NORTHWEST END. FOR SOUTH WALL, IT STARTS ON THE SOUTHWEST END.
2. EXISTING ROCK RIPRAP SHALL BE REMOVED TO EXPOSE THE EXISTING NATURAL BLUFF FACE AND FOR CONSTRUCTION OF THE BLUFF STABILIZATION WALL. SEE DEMOLITION PLAN.

10' 0' 10' 20'

SCALE: 1"=10'

100% SUBMITTAL
JULY 23, 2021
NOT FOR CONSTRUCTION

APPROVED:

DATE: _____

_____
ANN MADER STILLMAN,
INTERIM DIRECTOR OF PUBLIC WORKS
R. C. E. # 47882 / EXPIRES 12-31-2021

REGISTERED PROFESSIONAL ENGINEER
ANN MADER STILLMAN
C 47882
EXPIRES 12/31/21
CIVIL
STATE OF CALIFORNIA

APPROVED DATE:	
NAME NAME, CITY ENGINEER	
HALF MOON BAY	
R.C.E. # 00000 / EXPIRES 00-00-0000	

APPROVED DATE:	
moffatt & nichol 2185 N. CALIFORNIA BLVD, SUITE 500 WALNUT CREEK, CA 94596 925-944-5411	
DILIP R. TRIVEDI	
MOFFATT & NICHOL	
R.C.E. # XXXXXX / EXPIRES XX-XX-XXXX	

COUNTY OF SAN MATEO PUBLIC WORKS

REVISION	DATE		
		DESIGNED BY: DAJ	EXISTING BLUFF SECTIONS
		CHECKED BY: JFJ	MIRADA ROAD PEDESTRIAN BRIDGE REPLACEMENT AND BANK STABILIZATION PROJECT
		DRAWN BY: PH	ANN MADER STILLMAN, INTERIM DIRECTOR OF PUBLIC WORKS COUNTY SAN MATEO
			555 COUNTY CENTER, 5th FLOOR REDWOOD CITY, CALIFORNIA 94063

SCALE: AS SHOWN
DATE: 07/16/2021
FILE NO.: 1/4983

FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES 0 1 2 3 4

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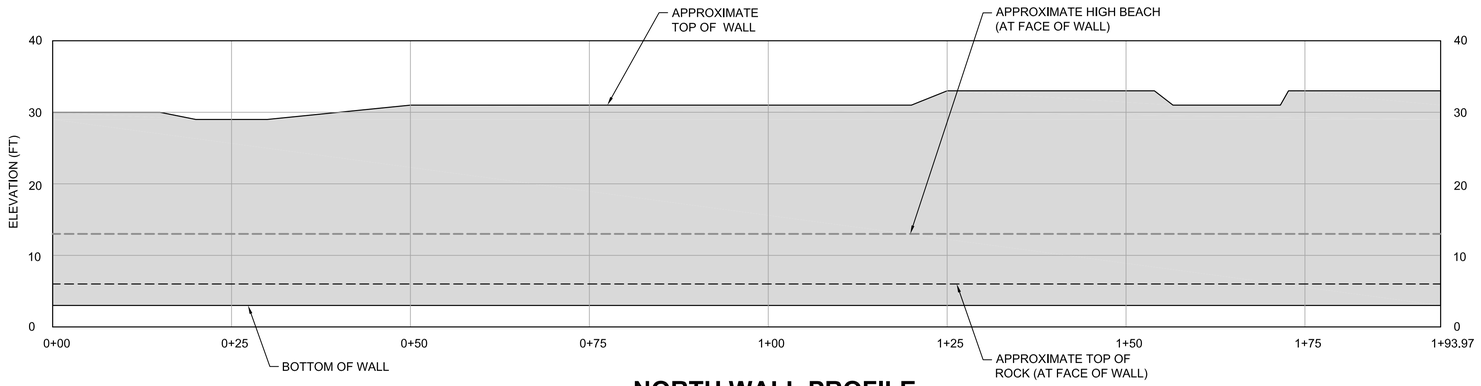
APPROVED:

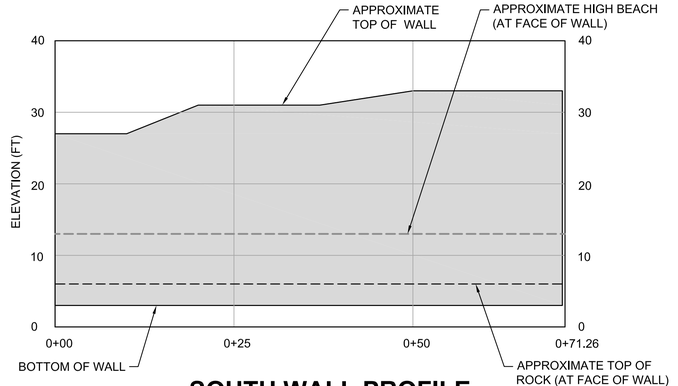
DATE: _____

ANN MADER STILLMAN,
INTERIM DIRECTOR OF PUBLIC WORKS
R. C. E. # 47882 / EXPIRES 12-31-2021



NORTH WALL PROFILE

SCALE: 1" = 10'



SOUTH WALL PROFILE

SCALE: 1" = 10'

NOTE:

SEE NOTES ON SHEET C004.

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10' 0' 10' 20'

SCALE: 1"=10'

APPROVED DATE:	
NAME NAME, CITY ENGINEER	
HALF MOON BAY	
R.C.E. # 00000 / EXPIRES 00-00-0000	

APPROVED DATE:	
moffatt & nichol — 2185 N. CALIFORNIA BLVD, SUITE 500 WALNUT CREEK, CA 94596 925-944-5411	
DILIP R. TRIVEDI	
MOFFATT & NICHOL	
R.C.E. # XXXXXX / EXPIRES XX-XX-XXXX	

COUNTY OF SAN MATEO · PUBLIC WORKS

REVISION	DATE		
		DESIGNED BY: DAJ	BLUFF STABILIZATION WALL - PROFILES
		CHECKED BY: JFJ	MIRADA ROAD PEDESTRIAN BRIDGE REPLACEMENT AND BANK STABILIZATION PROJECT
		DRAWN BY: PH	
		ANN MADER STILLMAN, INTERIM DIRECTOR OF PUBLIC WORKS COUNTY SAN MATEO	555 COUNTY CENTER, 5th FLOOR REDWOOD CITY, CALIFORNIA 94063

SCALE: AS SHOWN
DATE: 07/16/2021
FILE NO.: 1/4983

FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES 0 1 2 3 4

C005
SHEET OF

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DATE: _____

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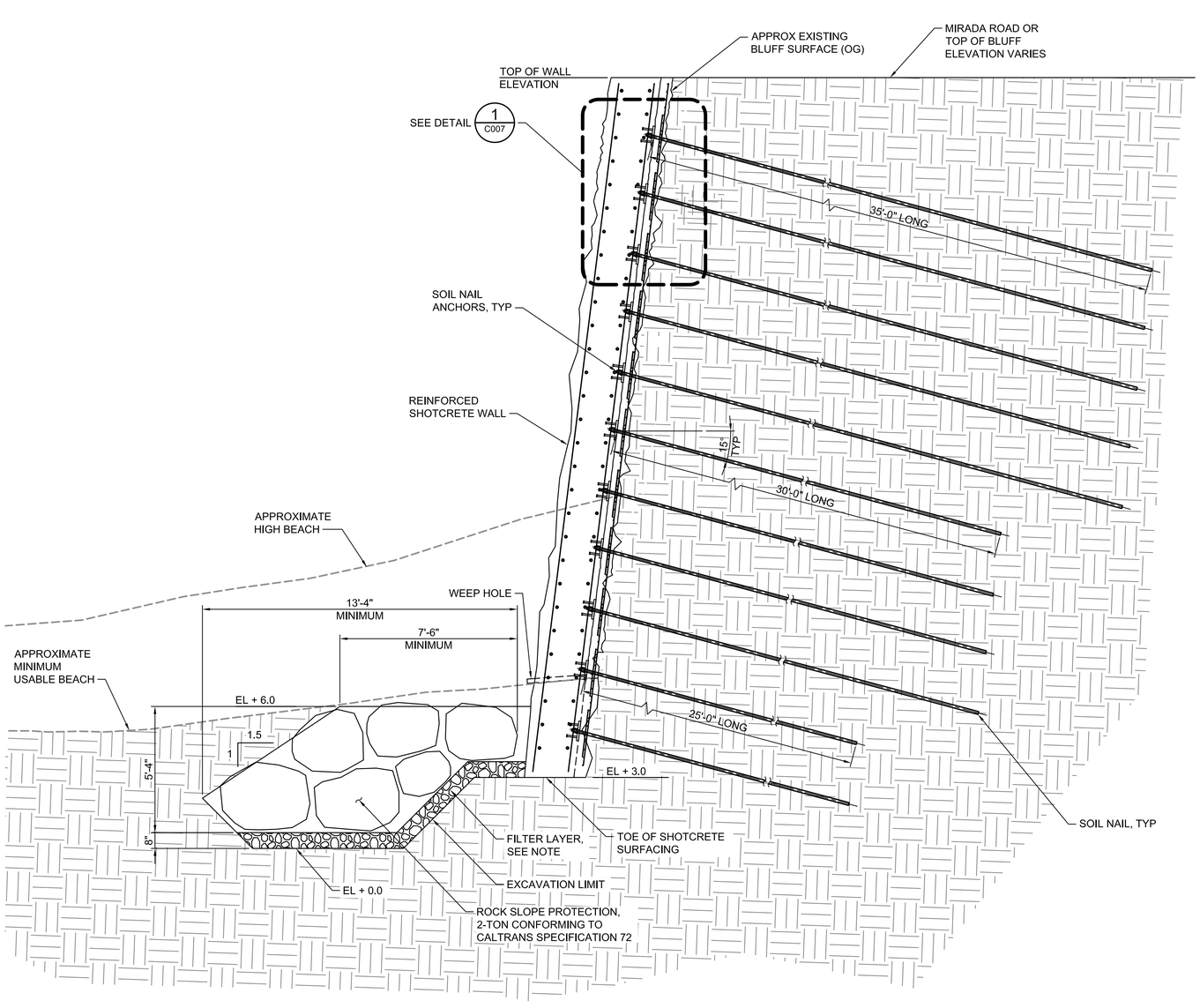
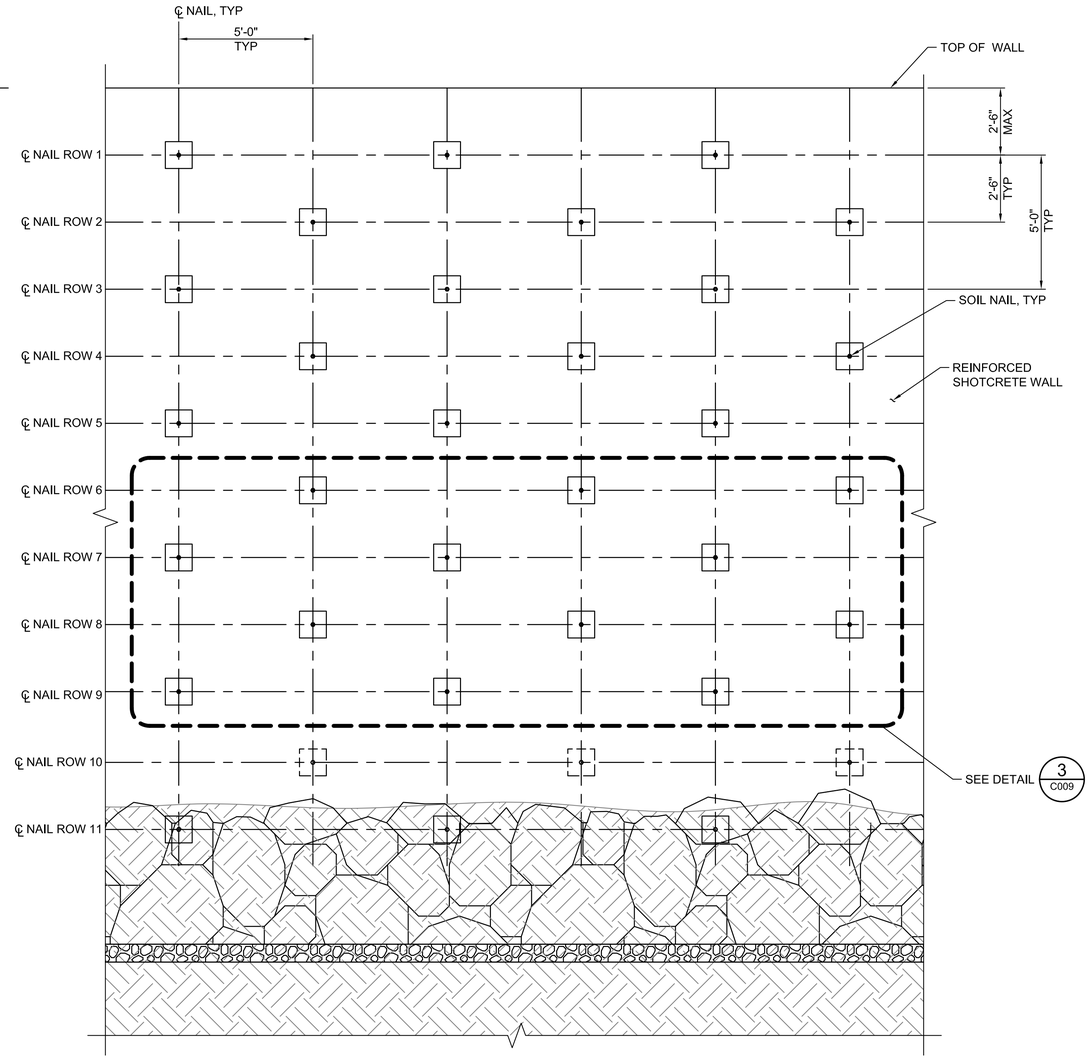
INTERIM DIRECTOR OF PUBLIC WORKS
R. C. E. # 47882 / EXPIRES 12-31-2021



A - **SECTION**
SCALE: 3/8" = 1'-0"

NOTE: ROCK FOR FILTER LAYER SHALL CONFORM TO CALTRANS SPECIFICATION 72 AND THE FOLLOWING GRADATION: 8-INCH,100% PASSING, 4 INCH 0% TO 5% PASSING.



B - **ELEVATION**
SCALE: 3/8" = 1'-0"

NOTES:

1. REINFORCEMENT NOT SHOWN FOR CLARITY.
2. SEE SOIL NAIL WALL SCHEDULE ON SHEET C009.

4'-0" 0'-0" 2'-0" 4'-0"
SCALE: 3/8"=1'-0"

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APPROVED DATE:	
NAME NAME, CITY ENGINEER	
HALF MOON BAY	
R.C.E. # 00000 / EXPIRES 00-00-0000	

APPROVED DATE:	
moffatt & nichol — 2185 N. CALIFORNIA BLVD, SUITE 500 WALNUT CREEK, CA 94596 925-944-5411	
DILIP R. TRIVEDI	
MOFFATT & NICHOL	
R.C.E. # XXXXXX / EXPIRES XX-XX-XXXX	

COUNTY OF SAN MATEO · PUBLIC WORKS

REVISION	DATE		
		DESIGNED BY: DAJ	BLUFF STABILIZATION WALL SECTION AND ELEVATION MIRADA ROAD PEDESTRIAN BRIDGE REPLACEMENT AND BANK STABILIZATION PROJECT
		CHECKED BY: JFJ	
		DRAWN BY: PH	
		ANN MADER STILLMAN, INTERIM DIRECTOR OF PUBLIC WORKS COUNTY SAN MATEO	555 COUNTY CENTER, 5th FLOOR REDWOOD CITY, CALIFORNIA 94063

SCALE: AS SHOWN
DATE: 07/16/2021
FILE NO.: 1/4983

FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES 0 1 2 3 4

C006
SHEET OF

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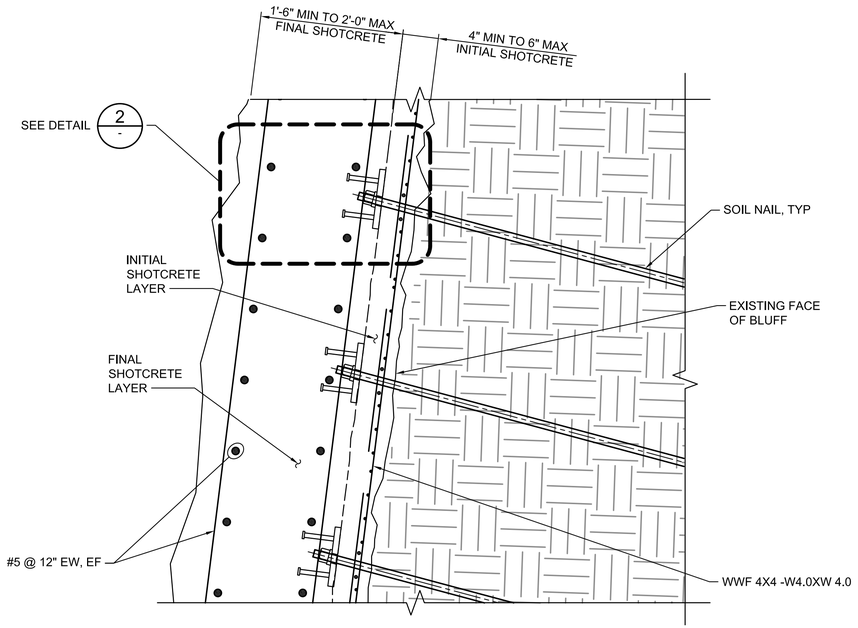
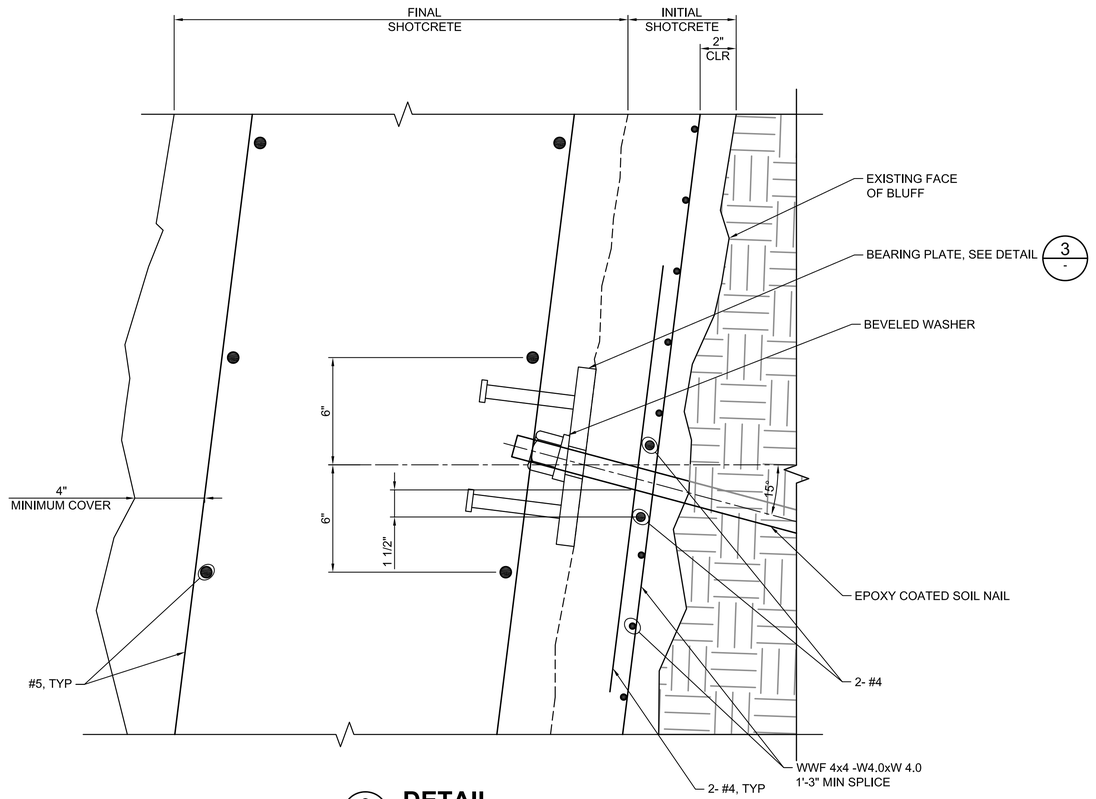
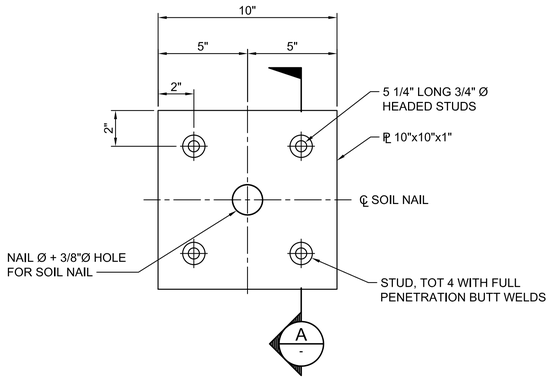


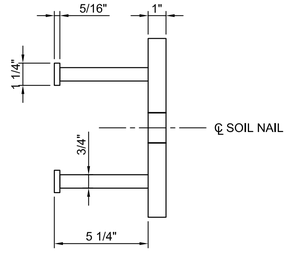
1 C006 **STEEL- REINFORCEMENT DETAIL**
SCALE: 1" = 1'-0"



2 - **DETAIL**
SCALE: 3" = 1'-0"



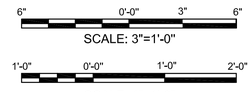
3 - **BEARING PLATE DETAIL**
SCALE: 3" = 1'-0"



A - **SECTION**
SCALE: 3" = 1'-0"

NOTES:

1. THE VERTICAL AND HORIZONTAL CONSTRUCTION JOINTS IN THE INITIAL SHOTCRETE LAYER SHALL BE LOCATED A MINIMUM OF 1'-6" FROM ADJACENT SOIL NAILS.
2. LAP SPLICE LENGTH FOR REBAR SHALL BE EQUAL TO 48 BAR DIAMETERS.
3. LAP SPLICE LENGTH GEOCOMPOSITE DRAIN SHALL BE 12".
4. REINFORCED CONCRETE / SHOTCRETE: F'c= 5,000 PSI @ 28 DAYS.
5. REINFORCING STEEL: ASTM A615 GRADE 60, Fy = 60,000 PSI.



APPROVED:

DATE: _____

ANN MADER STILLMAN,
INTERIM DIRECTOR OF PUBLIC WORKS
R. C. E. # 47882 / EXPIRES 12-31-2021

REGISTERED PROFESSIONAL ENGINEER · ANN MADER STILLMAN · C 47882 · EXPIRES 12/31/21 · CIVIL · STATE OF CALIFORNIA

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JULY 23, 2021
NOT FOR CONSTRUCTION

APPROVED DATE:	
NAME NAME, CITY ENGINEER	
HALF MOON BAY	
R.C.E. # 00000 / EXPIRES 00-00-0000	

APPROVED DATE:	
moffatt & nichol — 2185 N. CALIFORNIA BLVD, SUITE 500 WALNUT CREEK, CA 94596 925-944-5411	
DILIP R. TRIVEDI	
MOFFATT & NICHOL	
R.C.E. # XXXXXX / EXPIRES XX-XX-XXXX	

COUNTY OF SAN MATEO · PUBLIC WORKS

REVISION	DATE		
		DESIGNED BY: DAJ	BLUFF STABILIZATION WALL DETAILS SHEET 1 OF 3 MIRADA ROAD PEDESTRIAN BRIDGE REPLACEMENT AND BANK STABILIZATION PROJECT
		CHECKED BY: JFJ	
		DRAWN BY: PH	
		ANN MADER STILLMAN, INTERIM DIRECTOR OF PUBLIC WORKS COUNTY SAN MATEO	555 COUNTY CENTER, 5th FLOOR REDWOOD CITY, CALIFORNIA 94063

SCALE: AS SHOWN
DATE: 07/16/2021
FILE NO.: 1/4983

FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES 0 1 2 3 4

C007
SHEET OF

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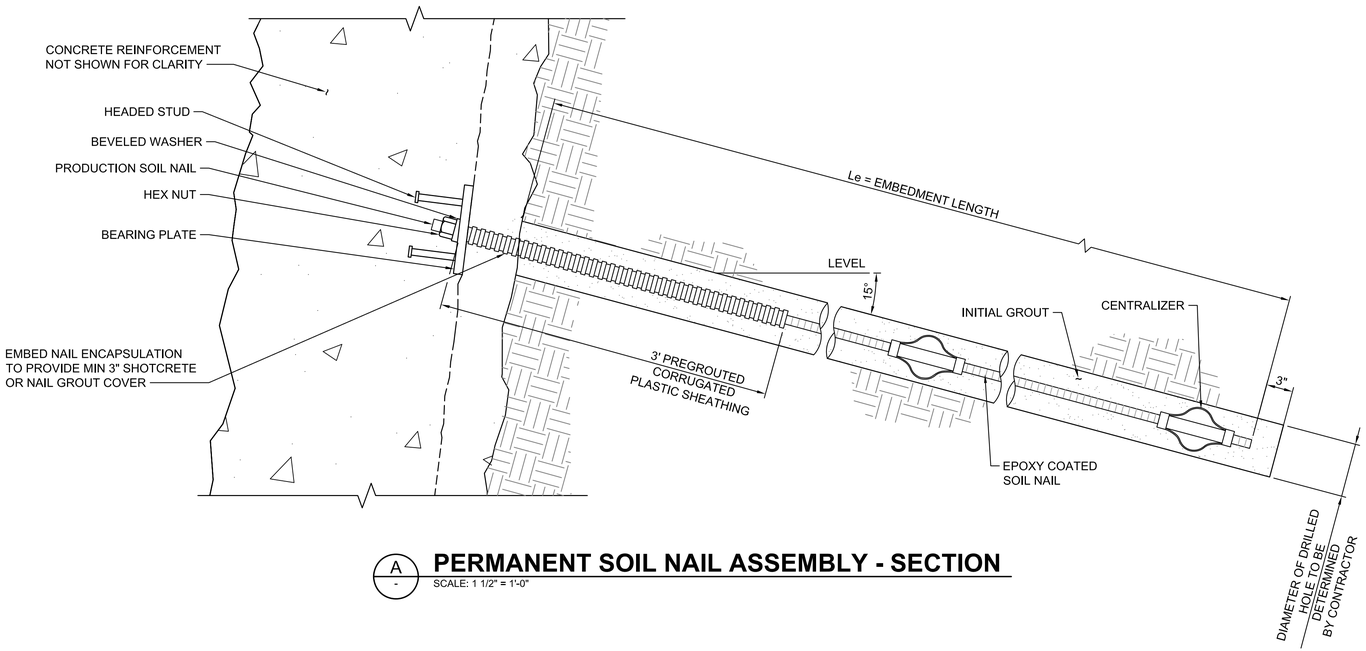
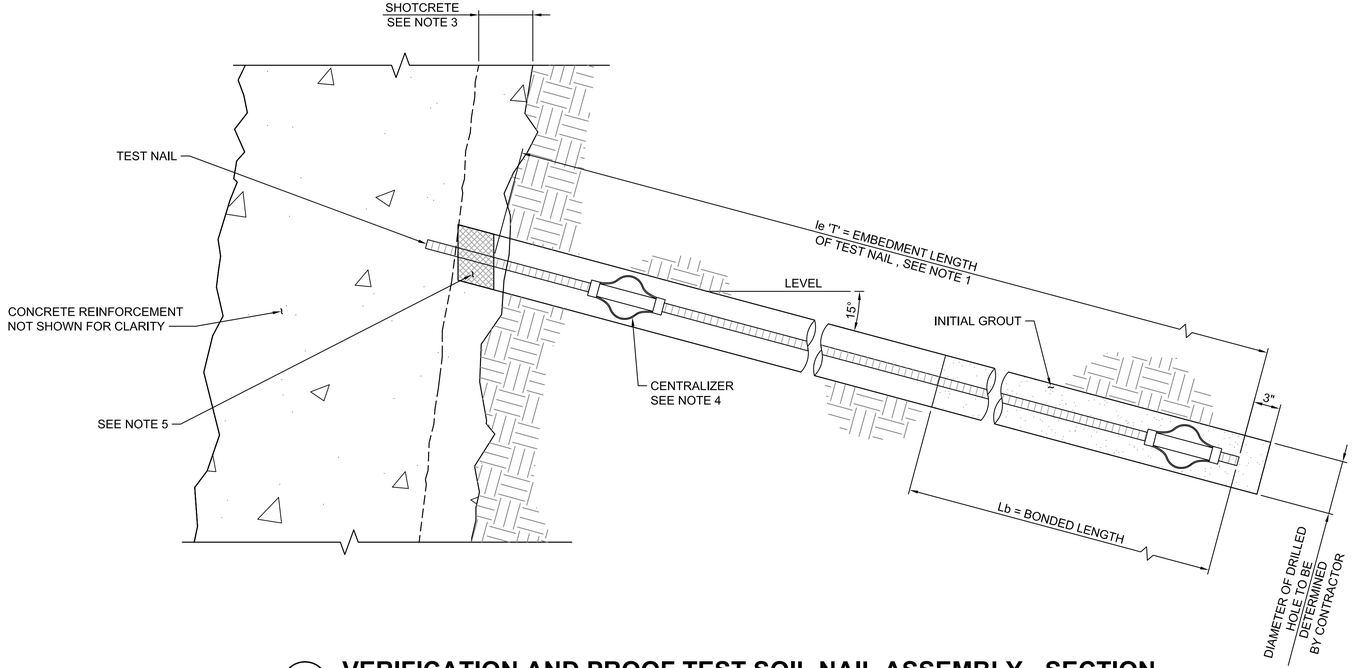


A - **PERMANENT SOIL NAIL ASSEMBLY - SECTION**

SCALE: 1 1/2" = 1'-0"



B - **VERIFICATION AND PROOF TEST SOIL NAIL ASSEMBLY - SECTION**

SCALE: 1 1/2" = 1'-0"

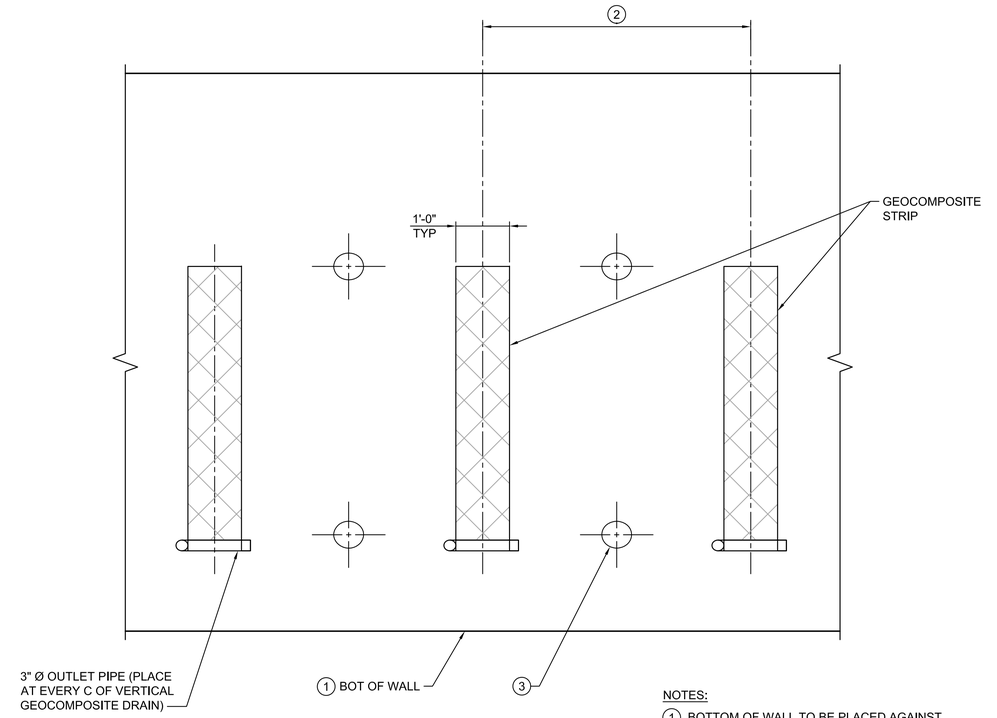
APPROVED:

DATE: _____

ANN MADER STILLMAN,
INTERIM DIRECTOR OF PUBLIC WORKS
R. C. E. # 47882 / EXPIRES 12-31-2021

NOTES:

1. THE Le 'T', EMBEDMENT LENGTH OF TEST NAIL, SHALL BE EQUAL TO TWO THIRDS OF THE EMBEDMENT LENGTH, Le OF ADJACENT SOIL NAIL ASSEMBLIES, BUT NOT LESS THAN 20 FEET.
2. CONTRACTOR IS RESPONSIBLE FOR SELECTING TEST NAIL BAR DIAMETER, AND THE TOTAL LENGTH TO ACCOMMODATE THE JACKING EQUIPMENT FOR THE TEST SOIL NAIL.
3. REINFORCEMENT REQUIRED FOR PROOF TESTING.
4. THE CENTRALIZER SHALL BE MADE FROM A PLASTIC MATERIAL AND ATTACHED TO THE NAIL IN A WAY THAT WILL NOT IMPEDE THE FREE FLOW OF GROUT.
5. MINIMUM 2" DIAMETER BLOCKOUT IS REQUIRED FOR PULLOUT TESTING. VERIFICATION, PROOF TEST, AND DESIGN PULLOUT RESISTANCE.



C - **WALL PART - ELEVATION**

NTS

NOTES:

① BOTTOM OF WALL TO BE PLACED AGAINST UNDISTURBED MATERIAL.

② CENTER OF GEOCOMPOSITE STRIPS SHALL BE CENTERED VERTICAL BETWEEN SOIL NAIL ASSEMBLIES.

③ INDICATE SOIL NAIL LOCATIONS.

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moffatt & nichol — 2185 N. CALIFORNIA BLVD, SUITE 500 WALNUT CREEK, CA 94596 925-944-5411	
DILIP R. TRIVEDI	
MOFFATT & NICHOL	
R.C.E. # XXXXXX / EXPIRES XX-XX-XXXX	

COUNTY OF SAN MATEO PUBLIC WORKS

		DESIGNED BY: DAJ	BLUFF STABILIZATION WALL DETAILS SHEET 2 OF 3 MIRADA ROAD PEDESTRIAN BRIDGE REPLACEMENT AND BANK STABILIZATION PROJECT
		CHECKED BY: JFJ	
		DRAWN BY: PH	
REVISION	DATE	ANN MADER STILLMAN, INTERIM DIRECTOR OF PUBLIC WORKS COUNTY SAN MATEO	555 COUNTY CENTER, 5th FLOOR REDWOOD CITY, CALIFORNIA 94063

SCALE: AS SHOWN
DATE: 07/16/2021
FILE NO.: 1/4983

FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES 0 1 2 3 4

C008
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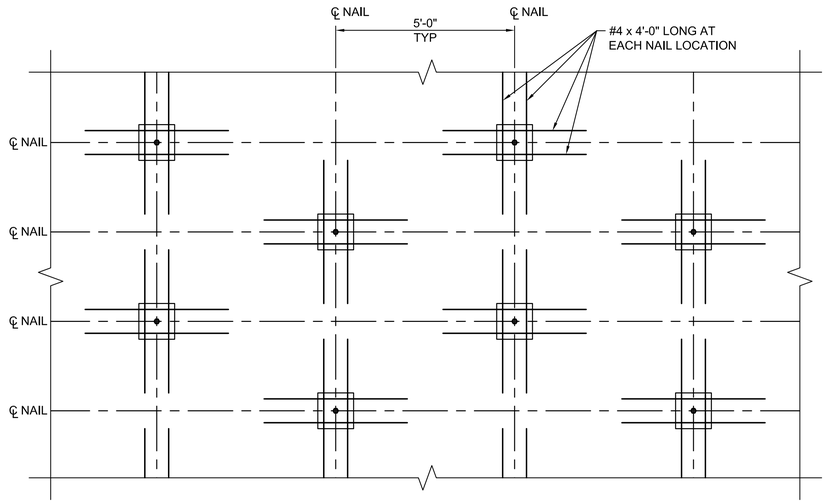
DATE: _____

ANN MADER STILLMAN,
INTERIM DIRECTOR OF PUBLIC WORKS
R. C. E. # 47882 / EXPIRES 12–31–2021



NOTE: ADDITIONAL WALL REINFORCEMENT SHALL BE PLACED AT THE WWF LAYER OF INITIAL SHOTCRETE. WWF AT INITIAL SHOTCRETE AND REINFORCING AT FINAL SHOTCRETE LAYER NOT SHOWN FOR CLARITY.

SOIL NAIL SCHEDULE

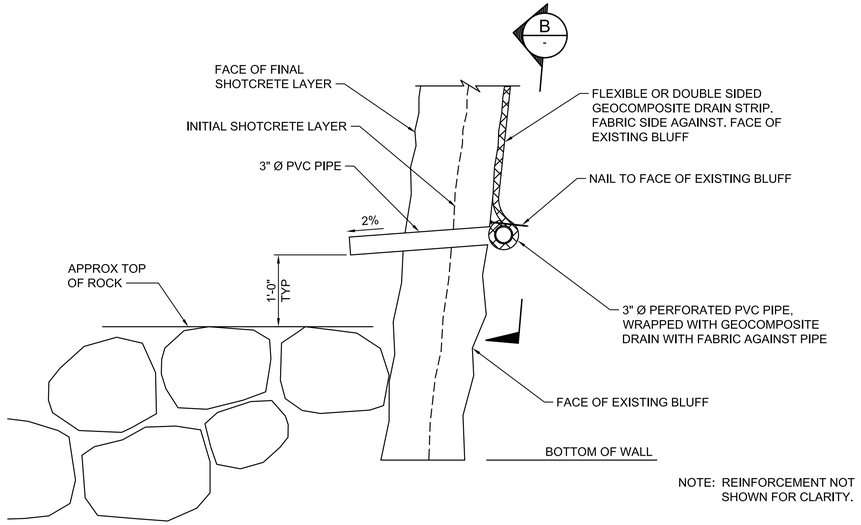
ROW	Le, FT	BAR SIZE	Pn	SOIL DESCRIPTION
1-2	35	#9	1.58	MEDIUM DENSE CLAYEY SAND
3-5	35	#9	2.26	MEDIUM DENSE TO DENSE CLAYEY SAND
6-7	30	#9	2.26	MEDIUM DENSE TO DENSE CLAYEY SAND
8-9	30	#9	2.26	MEDIUM DENSE TO DENSE CLAYEY SAND
10-11	25	#9	2.26	MEDIUM DENSE TO DENSE CLAYEY SAND

Le: EMBEDMENT LENGTH, FT.

Pn: NOMINAL PULLOUT RESISTANCE, KLF (KIP PER LINEAR FOOT).

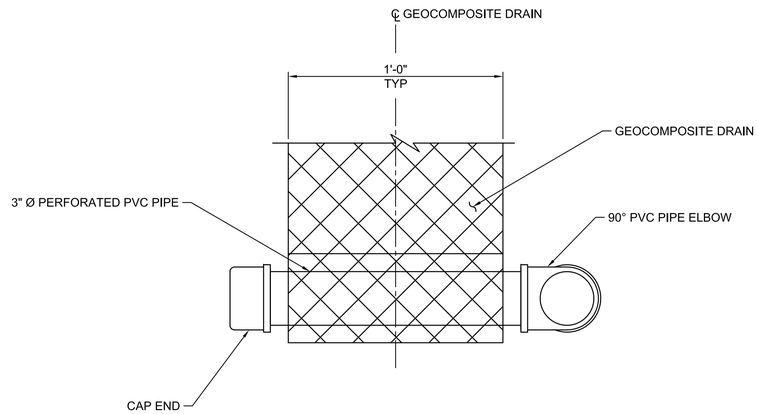
1. THE EMBEDMENT LENGTH Le FOR ROWS 1, 2, AND 3 SHALL BE 40 FT IN THE NORTH WALL AT STATION 0+90 TO 1+10.
2. THE EMBEDMENT LENGTH Le FOR ROWS 1, 2, AND 3 SHALL BE 40 FT IN THE SOUTH WALL AT STATION 0+35 TO 0+71.

3 / C006 **ADDITIONAL WALL REINFORCEMENT**
SCALE: 1/2" = 1'-0"



NOTE: REINFORCEMENT NOT SHOWN FOR CLARITY.

4 / - **WALL DRAIN DETAIL AT WEEPHOLE OPTION**
SCALE: 1" = 1'-0"



NOTES:

1. GEOCOMPOSITE DRAIN STRIP PER SECTION 88 GEOSYNTHETICS OF THE CALTRANS STANDARD SPECIFICATIONS.

B / - **SECTION**
SCALE: 3" = 1'-0"

6" 0'-0" 3" 6"
SCALE: 3"=1'-0"

1'-0" 0'-0" 1'-0" 2'-0"
SCALE: 1"=1'-0"

4'-0" 0'-0" 2'-0" 4'-0"
SCALE: 3/8"=1'-0"

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DILIP R. TRIVEDI	
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COUNTY OF SAN MATEO · PUBLIC WORKS

REVISION	DATE		
		DESIGNED BY: DAJ	BLUFF STABILIZATION WALL DETAILS SHEET 3 OF 3 MIRADA ROAD PEDESTRIAN BRIDGE REPLACEMENT AND BANK STABILIZATION PROJECT
		CHECKED BY: JFJ	
		DRAWN BY: PH	
		ANN MADER STILLMAN, INTERIM DIRECTOR OF PUBLIC WORKS COUNTY SAN MATEO	555 COUNTY CENTER, 5th FLOOR REDWOOD CITY, CALIFORNIA 94063

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C009
SHEET OF

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