Orange County
17782 Georgetown Lane
Huntington Beach, California 92647
Tele: (714) 375-3830
Fax: (714) 375-3831

GEOTECHNICAL REPORT
SLOPE REPAIR RECOMMENDATIONS
HUNTINGTON BEACH DOG BEACH
19341 PACIFIC COAST HWY
HUNTINGTON BEACH, CALIFORNIA 92648
AESCO PROJECT NO. 20240155-H3925

Prepared for:

City of Huntington Beach
2000 Main Street
Huntington Beach, CA 92648

Attention: Mr. David Fait

Prepared By:

AESCO
17782 Georgetown Lane
Huntington Beach, California 92647
Adam Chamaa, PE GE
Geotechnical Project Manager

June 4, 2024

AESCO

Orange County
17782 Georgetown Lane
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June 4, 2024

Mr. David Fait
Construction Manager
City of Huntington Beach
Construction Management Division
2000 Main Street
Huntington Beach, CA 92648

Subject: GEOTECHNICAL REPORT
SLOPE REPAIR RECOMMENDATIONS
HUNTINGTON BEACH DOG BEACH
19341 PACIFIC COAST HIGHWAY
HUNTINGTON BEACH, CALIFORNIA 92648
AESCO PROJECT NO. 20240155-H3925

Dear Mr. Fait:

AESCO is pleased to provide you with the geotechnical report for the slope repair recommendations at the subject site.

AESCO is pleased to extend our services to provide any necessary Construction Materials Testing and Inspection Services, construction oversight, or construction management services required during the construction phase of this project. As a comprehensive engineering service company, AESCO has a robust background in environmental engineering services, positioning us as a valuable partner to support your project from start to finish. We look forward to the opportunity to collaborate with you on this project.

Please do not hesitate to contact us if you have any questions or if we may be of any additional assistance. We look forward to assisting you during the construction of the proposed facility.

Sincerely,

AESCO, Inc.

Omar Chamaa, PE
Project Manager

Nadra Matar
Geology Division

Adam Chamaa, P.E, G.E.

Adam Chamaa, PE, GE
Engineering Manager

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Geotechnical Report
Slope Repair Recommendations
City of Huntington Beach
Huntington Beach Dog Beach
19341 Pacific Coast Hwy
Huntington Beach, CA 92648

This report (authorized by Mr. David Fait from the City of Huntington Beach as defined in our proposal dated April 8, 2024), presents the results of a geotechnical investigation performed by AESCO, Incorporated (AESCO) to perform geotechnical engineering services for the evaluation and repair mitigation of the slope failure located at the Dog Beach in Huntington Beach. Recently, the slope along the bike path experienced slope failure. The slope failure is approximately 20 feet wide at the top of the slope, extending southwest to the bottom of the slope, which is approximately 10 feet wide. The slope's height, based on the topographical data provided by the City of Huntington Beach, is approximately 16 feet. The site layout, including boring locations, is shown on the Site Plan, Figure 2.

The purpose of this study was to provide repair mitigation alternatives for the current slope failure and perform geotechnical engineering services for the evaluation and repair of the slope failure located at Huntington Beach Dog Beach. The scope of our services included the following:

- Coordinating site access for the field investigation;
- Obtaining utility clearances for the field investigation;
- Performing geotechnical drilling and sampling at the site;
- Performing laboratory testing of representative samples;
- Conducting a seismic hazard screening;
- Conducting slope stability analysis;
- Reviewing alternative repair mitigations to rebuild slope;
- Engineering analyses; and
- Preparing this report.

This report summarizes our findings and presents geotechnical recommendations for repair of the slope.

2.1 FIELD INVESTIGATION

A field investigation was conducted at the site on May 21, 2024, to obtain information on the subsurface conditions. The investigation involved drilling two borings to a maximum depth of 10 feet below the existing ground surface. Boring B-1 was located at the top of the slope, and Boring B-2 was located at the toe of the slope. The locations of these boring are shown on the Site Plan, Figure 2. AESCO personnel logged the borings, visually classified, and collected samples of the subsurface materials encountered. The borings were then backfilled with cuttings. The Logs of Borings B-1 and B-2 are presented in the attached Appendix.

2.2 LABORATORY TESTING

All testing was performed in accordance with ASTM Standards and California Test Methods. Laboratory testing performed in our Huntington Beach, California geotechnical laboratory consisted of water content (ASTM D4959), pocket penetrometer test (ASTM WK27337), direct shear (ASTM D3080), Atterberg Limits (ASTM D4318), and washed sieve analysis (ASTM D1140). Results of the laboratory tests are summarized on the Boring Logs and are included in the attached Appendix.

3.1 REGIONAL GEOLOGIC SETTING

The project site is in Huntington Beach, California, within the southern portion of the Los Angeles basin, in the transition between the northern portion of the Peninsular Ranges physiographic province and the southern portion of the Transverse Ranges physiographic province. The project area is within the Transverse Ranges physiographic province by Norris and Webb (1990) and within the Peninsular Ranges physiographic province by Yerkes et al. (1965). These two physiographic provinces have contrasting tectonic characteristics that overlap within the Los Angeles basin resulting in a complex tectonic environment marked by active faulting and historic seismicity. Geologic materials at the ground surface in the vicinity of the site consist of Quaternary alluvial sediments deposited by the Santa Ana River or its tributaries.

3.2 SITE AND SUBSURFACE CONDITIONS

The existing slope is located on the southwest side of the Huntington Beach Bike Trail that runs parallel to Pacific Coast Highway. The existing slope shows signs of sloughing and minor surficial slope failure. The slope failure extends approximately 2 feet under the bike trail pavement to the northeast. Exposed utilities were observed including irrigation lines at the top of the slope failure. The site is covered with landscaping. Existing underground utilities may be present within the site boundary.

The material encountered in boring B-1 consisted of dense to medium dense clayey sands to a depth of 6 feet, and brown sandy clays to the total depth drilled of 10 feet. The material encountered in boring B-2 consisted of stiff to hard sandy clay to a depth of 7 feet, loose clayey sand to a depth of 8 feet, and stiff sandy clay to the total depth drilled of 10 feet.

Groundwater was not encountered within borings B-1 and B-2. Based on regional data, the historical highest groundwater level in the project vicinity is approximately 10 feet below the ground surface (CGS, 1998). The depth to groundwater may fluctuate, depending on rainfall and possible groundwater recharge or pumping activity in the site vicinity.

4.1 SEISMIC DESIGN

A seismic hazards screening was performed for this site to evaluate potential seismic hazards. The seismic hazards screening consisted of reviewing available data published by the California Geological Survey (CGS), the 2022 California Building Code (CBC), the ASCE/SEI 7-16, the ATC Council, and the 2022 International Building Code (IBC). The site is in the United States Geological Survey Seal Beach Quadrangle. Data reviewed yielded the following Seismic Parameters:

Site Class	D
Spectral Response 'Ss'	1.403g
Spectral Response 'SMs'	1.683g
Spectral Response 'S1'	0.509g
Spectral Response 'SM1'	N/A

Data published by the USGS was reviewed. Results of the fault search are presented in the Appendix. A listing of faults within 100 miles of the site is also included. The search indicates that the Newport Inglewood Connected alt 1 fault is 1.11 miles from the site.

The CGS (CDMG, 2000-003) does not delineate this site as being within an Alquist-Priolo Earthquake Fault Zone. With the active faults in the region, the site could be subjected to future strong ground shaking that may result from earthquakes on local to distant source.

4.2 LIQUEFACTION POTENTIAL

Liquefaction is a mode of ground failure that results from the generation of high pore water pressures during earthquake ground shaking, causing loss of shear strength. Liquefaction is typically a hazard where loose sandy soils exist below groundwater. The CGS has designated certain areas within southern California as potential liquefaction hazard zones. These are areas considered at risk of liquefaction-related ground failure during a seismic event, based upon mapped surficial deposits and the presence of a relatively shallow water table. The project site is not located within a potential liquefaction hazard zone as designated by the CGS (1998). Based on this, we conclude that the potential for liquefaction at the site is low. Other geologic hazards related to liquefaction, such as lateral spreading, are therefore also low.

4.3 SLOPE STABILITY ANALYSIS

A cross-section of the representative slope (Figure 3) was prepared for analysis purposes, depicting the existing slope prior to failure. We conducted a slope stability analysis, including both static and seismic loading, on Section A-A' using the provided cross-section from the city. The analysis was performed using GEO5 software, which utilizes a two-dimensional limit equilibrium method.

Our analysis utilized shear strength parameters based on field observations, laboratory test data, and our experience with similar materials. The results indicate a minimum safety factor of 1.94 for static loading and 1.36 for seismic loading. In comparison, general geotechnical engineering practice in Southern California recommends minimum acceptable safety factors of 1.5 and 1.1 for static and seismic load cases, respectively. Therefore, the test results indicated that the existing slope safety factors for both seismic load and static conditions are acceptable.

The results of the slope stability analysis are included in the Appendix

4.4 REASONS FOR SLOPE DISTRESS

Our slope stability analyses suggest that the observed slope failure is likely surficial in nature, with no evidence of gross slope failure observed at the site. We believe that the following factors contributed to the surficial slope failure:

1) The absence of adequate drainage structures to manage surface runoff from rainfall and/or irrigation, which may have exacerbated the failure. Heavy rainfall in the past may have also played a role.

2) Exposed broken irrigation lines, previously buried in the slope, were observed in the failure areas. Laboratory tests revealed an increase in moisture content in soil samples from the failed slope, suggesting that leaking irrigation lines may have saturated the subsurface soils, increasing the driving force that led to the failure.

3) The geotechnical investigation revealed dense to medium-dense clayey sands and brown sandy clays to a depth of 10 feet from the top of the slope. The clayey sand has potential to lose its shear value when saturated, which may be caused by water intrusion near the top of the slope.

These factors suggest that the surficial slope failure was likely caused by a combination of inadequate drainage and saturated subsurface soils, rather than a fundamental instability in the slope's underlying geology.

4.5 RECOMMENDATIONS FOR SLOPE REPAIR

AESCO reviewed and evaluated multiple types of retaining walls to repair the slope failure area. The options evaluated were Gravity Retaining Walls, Crib Wall, and Gabion Walls. Based on our economical and constructability evaluation, we recommend that the most economical repair is to reconstruct the slope with additional reinforcement. The additional reinforcement is an option to enhance the stability of the slope in case a minor water intrusion in the slope. We hereby recommend the following remedial measures to construct a stable slope section at the subject site:

- Prior to grading, the subject slope area should be cleared of surface and subsurface obstructions, tree stumps, roots, debris and other unsuitable materials. The slope repair area should extend 5-foot on both sides of the existing failure area and should begin 7 feet behind the top of the slope. Based on our visual observation the width of the slope failure is approximately 20 feet. Therefore, the total width of the repair should be a minimum of 30 feet. A repair section is presented in Figure 4 to provide the details of the reconstruction. Therefore, slope surface should be overexcavated and replaced with compacted soil placed at optimum moisture content and at a minimum of 95 percent relative compaction per ASTM D1557. The compacted soil could be from on-site material or from imported soils. Fill soil, import or onsite, should be free of roots, organic materials, and should not contain particles greater than 3 inches in the largest dimension. Any import soils should contain a sufficient amount of plastic fine material (percent finer than No. 200 sieve between 15 and 30, liquid limit between 30 and 40, and plasticity index between 10 and 20.
- A drainage system consisting of a V-ditch along the top of the subject slope section should be constructed which is connected to downward ditches along the slope, spaced at intervals not exceeding 20 feet horizontally. These downslope ditches should be connected to drain away from the slope. This option may not be feasible due to the pedestrian and bike pavement at the top of the slope.
- Since a V-ditch may not be feasible due to the bike and pedestrian trail, we recommend that the slope should be reinforced with Geogrid such as BX1200 or equivalent as shown in Figure 4 to provide additional protection of the slope. The Geogrid should be embedded into

the repaired section of the slope and placed 2 feet from the top of the slope and every two feet thereafter.

Immediately after construction of the graded slope, as recommended above, should be covered with jute layer and then the slope surface deep rooted vegetation should be planted that require little irrigation water. This design will provide additional protection to the slope and minimize further localized failure due to minor soil saturation.

4.6 SITE PREPARATION AND EARTHWORK

All grading and site preparation should be observed by experienced personnel reporting to the project Soil Engineer. Our field monitoring services are an essential continuation of our prior studies, to confirm and correlate the findings and recommendations with the actual subsurface conditions exposed during construction. This oversight confirms that suitable fill soils are placed and properly compacted.

4.7 CONSTRUCTION OBSERVATIONS AND FIELD TESTING

As geotechnical engineer of record, construction observation and field-testing services are an essential continuation of this geotechnical study to confirm and correlate our findings and recommendations with the actual subsurface conditions exposed during construction. As such, to maintain the status of geotechnical engineer of record, AESCO should be present to observe and provide testing during the following construction activities:

- Soil Benching
- Key Construction
- Soil reinforcement installation.
- Placement of all fill and backfill.
- The Pedestrian and Bike Path
- Asphalt placement and testing
- Jute placement
- Approval of Imported Fill

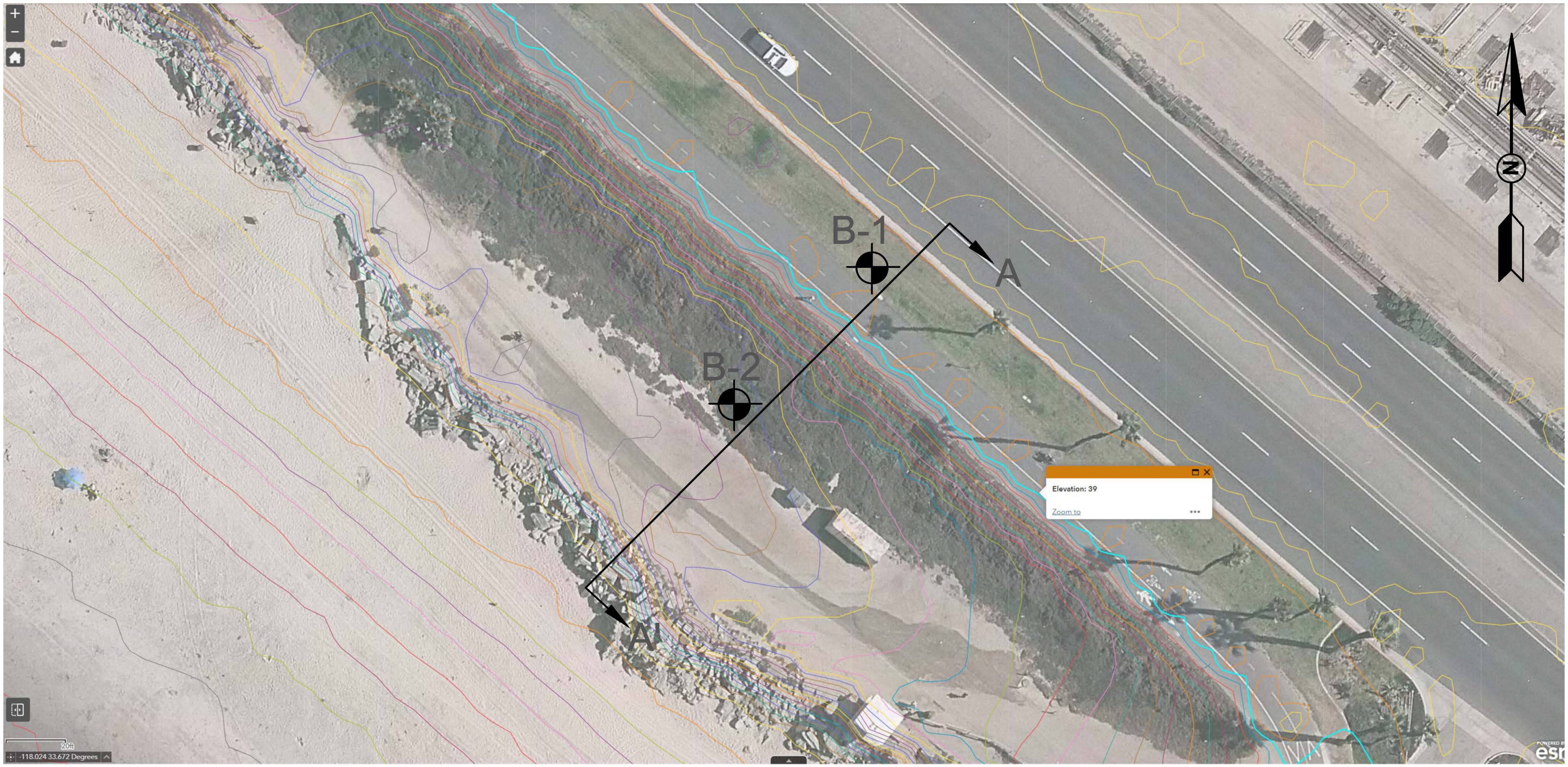
5.1 LIMITATIONS

It must be recognized that the conclusions reached in this report are based on conditions which exist at the boring location and are assumed to exist over the entire site. In any subsoil investigation, it is necessary to assume that the subsoil conditions between boring(s) do not change significantly. The number of the borings, locations, and spacing are chosen in such a manner as to decrease the possibility of undiscovered anomalies, while considering the nature of loading, size, existing structures, and the cost of the project. Note that the boring(s) was placed as close to the location of the proposed structure(s) as possible. Consequently, careful observations must be made during construction to detect significant deviations of actual conditions throughout the construction area from those inferred from the exploratory borings.

Should any unusual conditions be encountered during construction, this office should be notified immediately so that further investigations and supplemental recommendations can be made. Geotechnical observations and testing should be provided on a continuous basis during grading, excavation, and reconstruction of the slope. If parties other than AESCO are engaged to provide geotechnical services during construction, they will be required to assume full responsibility for the geotechnical phase of the project by adhering to the recommendations of this report.

APPENDIX
SITE PLAN

City of Huntington Beach		
Project No. : 20240155-H3925		
Site Name: Huntington Beach Dog Beach		
Site Address: 33.672221, -118.0232, Huntington Beach, CA 92648		
SITE VICINITY MAP	Date: 6-4-24	Figure 1



LEGEND

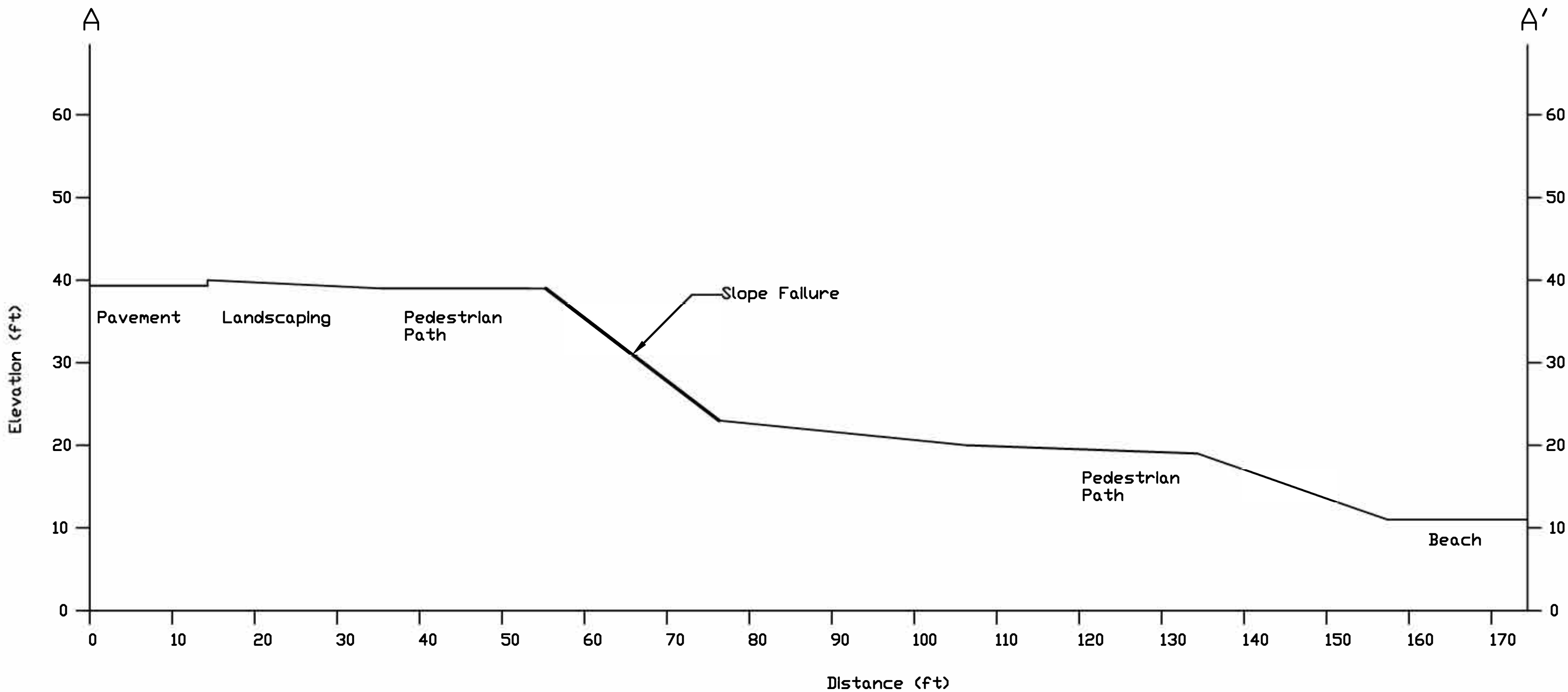
Approximate Location of Borings

A
A' Approximate Location of Cross-Section A-A'

Note: Topo Provided by the City of Huntington Beach

AESCO			
	City of Huntington Beach		
	Project No. : 20240155-H3925	Scale: *1 inch ≅ 20 feet*	
	Site Name: Huntington Beach Dog Beach		
	Site Address: 33.672221, -118.0232, Huntington Beach, CA 92648		
	SITE PLAN	Date: 6-4-24	Figure 2

APPENDIX
CROSS-SECTION A-A’



Note: Topo Provided by the City of Huntington Beach

AESCO

City of Huntington Beach

Project No. : 20240155-H3925	Scale: *1 inch ≅ 20 feet*
Site Name: Huntington Beach Dog Beach	
Site Address: 33.672221, -118.0232, Huntington Beach, CA 92648	

CROSS-SECTION A-A'

Date: 6-4-24

Figure 3

APPENDIX

LOG OF BORINGS B-1 through B-2

MAJOR DIVISION			GRAPHIC SYMBOL	LETTER SYMBOL	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS MORE THAN 50% BY WEIGHT OF MATERIAL IS LARGER THAN 200 SIEVE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVEL (LITTLE OR NO FINES)		GW	WELL GRADED GRAVELS, GRAVEL SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY GRADED GRAVELS, GRAVEL SAND MIXTURES, LITTLE OR NO FINES
		GRAVEL WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL SAND SILT MIXTURE
				GC	CLAYEY GRAVELS, GRAVEL SAND CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING NO. 4 SIEVE	CLEAN SAND (LITTLE OR NO FINES)		SW	WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
		SANDS WITH FINE (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND-SILT MIXTURES
				SC	CLAYEY SANDS, SAND-CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% BY WEIGHT OF MATERIAL IS SMALLER THAN 200 SIEVE	SILTS AND CLAYS	LIQUID LIMIT <50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT >50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLATICITY, FAT CLAYS
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

AESCO

UNIFIED SOIL CLASSIFICATION SYSTEM

KEY

- ☒ Split Spoon Sample (SPT)
- C California Modified Sample
- ◫ Hand Auger Sample
- ▼ Ground Water Level
- **N** SPT Blows/ft
- **P** Penetrometer TSF

LOG OF BORING NO. B - 1

AESCO

Project: HB Dog Beach Slope Repair Site
Location: Top of Failed Slope (33.672221, -118.0232), Huntington Beach, CA
WATER: Not Encountered

Client: City of Huntington Beach
Logger: Aziz Trabolci
Date: 05/23/24
Project No. 20240155-H3925
DRILLING: Hand Auger

FIELD DATA		TESTS	LABORATORY DATA												DESCRIPTION OF STRATUM
SOIL SYMBOL	DEPTH (FT)	N= T= P=	MOISTURE CONTENT %	DRY DENSITY PCF	PASSING 200 SIEVE %	LIQUID LIMITS %	PLASTIC LIMITS %	PLASTICITY INDEX %	DIRECT SHEAR Cohesion TSF	DIRECT SHEAR Φ	CHEMICAL ANALYSIS PH	CHEMICAL ANALYSIS Chlorides (ppm)	CHEMICAL ANALYSIS Sulfates (ppm)	EXPANSION INDEX	
SC		P=4.0	4.1	106.2		37	23	14	111	29	7.20	84	30		**Brown clayey SAND (SC), dense**
	2	P=2.0	3.6	89.6	28.5										
		P=4.0	3.7	107.9	24.5										
	4	P=2.0	6.5	102.4	31.7	20	11	9							
		P=3.0	7.7	100.4	36.1										**- Increase in clay content**
	6		11.3		48.9										
CL			9.6		67.4				390	16					**Brown sandy CLAY (CL), firm**
	8		11.5		70.4										
			10.8		61.6										
	10		12.9		69.3	31	14	17							

Boring Terminated at 10 Feet

TUBE SAMPLE
AUGER SAMPLE
C CALIFORNIA MODIFIED SAMPLER
SPLIT SPOON
NO RECOVERY

Ground Water Level
Hydrostatic Ground Water Level

N= SPT, BLOWS/FT
T= THD,BLOWS/FT
P= HAND PEN.,TSF

SC
CL

REMARKS:
NP: Non Plastic Materials
* Remolded Samples

LOG OF BORING NO. B - 2

AESCO

Project:	**HB Dog Beach Slope Repair Site**	**Location:**	**Bottom of Failed Slope (33.67208, -118.02327), Huntington Beach, CA**
Client:	**City of Huntington Beach**	**Logger:**	**Aziz Trabolci**
Date:	**05/23/24**	**Project No.**	**20240155-H3925**

WATER: Not Encountered

DRILLING:
Hand Auger

FIELD DATA		TESTS	LABORATORY DATA												DESCRIPTION OF STRATUM
SOIL SYMBOL	DEPTH (FT)	N= T= P=	MOISTURE CONTENT %	DRY DENSITY PCF	PASSING 200 SIEVE %	LIQUID LIMITS %	PLASTIC LIMITS %	PLASTICITY INDEX %	DIRECT SHEAR Cohesion TSF	DIRECT SHEAR Φ	CHEMICAL ANALYSIS PH	Chlorides (ppm)	Sulfates (ppm)	EXPANSION INDEX	
CL		P=4.5	14.6	107.9	67.5	22	13	9							**Brown sandy CLAY (CL), hard**
	2	P=3.0	13.7	93.4	60.2				365	15					**- Very stiff at 1 foot**
		P=3.0	14.4	94.4	68.2										
	4	P=2.0	15.8	95.5	66.7	25	13	12							**- Stiff at 4 foot**
		P=1.5	15.2	95.5	60.2										
	6		18.1		67.2										
			18.3		66.8										
SC	**8**		13.9		29.6				0	27					**Brown clayey SAND (SC), loose**
CL			16.9		64.2	29	13	6	391	17					**Brown sandy CLAY (CL), stiff**
	10		18.3		73.6										

Boring Terminated at 10 Feet

TUBE SAMPLE
AUGER SAMPLE
CALIFORNIA MODIFIED SAMPLER
SPLIT SPOON
NO RECOVERY

Ground Water Level
Hydrostatic Ground Water Level

N= SPT, BLOWS/FT
T= THD,BLOWS/FT
P= HAND PEN.,TSF

CL
SC

REMARKS:
NP: Non Plastic Materials
* Remolded Samples

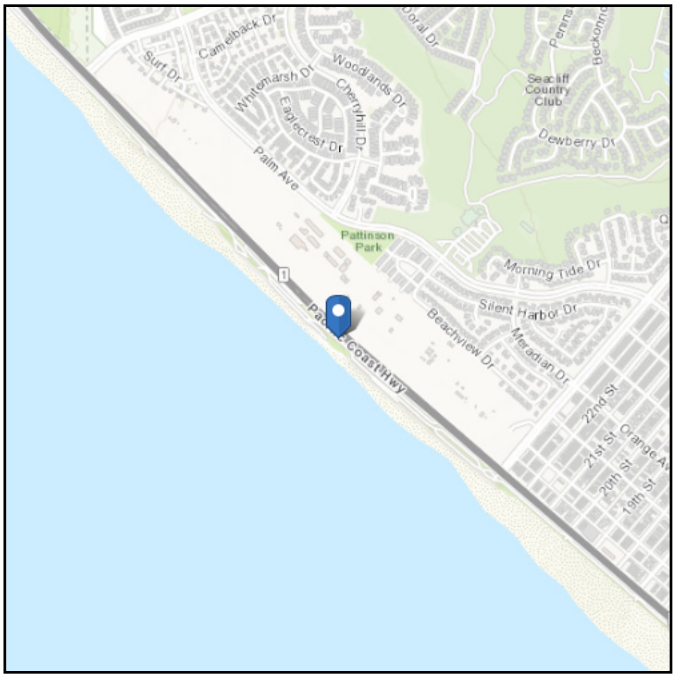
APPENDIX
SEISMIC DESIGN DATA

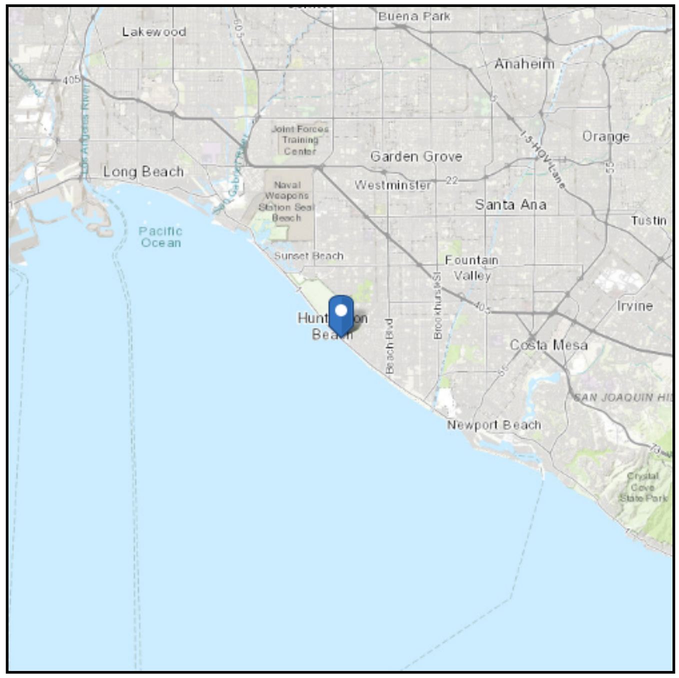
ASCE Hazards Report

Address:
Y:33.672221 X:-118.023200
,

Standard: ASCE/SEI 7-16
Risk Category: I
Soil Class: D - Default (see Section 11.4.3)

Latitude: 33.672221
Longitude: -118.0232
Elevation: 36.023621697375276 ft (NAVD 88)





ASCE
AMERICAN SOCIETY OF CIVIL ENGINEERS

Seismic

Site Soil Class: D - Default (see Section 11.4.3)

Results:

S_S :	1.403	S_{D1} :	N/A
S_1 :	0.509	T_L :	8
F_a :	1.2	PGA :	0.613
F_v :	N/A	PGA_M :	0.736
S_{MS} :	1.683	F_{PGA} :	1.2
S_{M1} :	N/A	I_e :	1
S_{DS} :	1.122	C_v :	1.381

Ground motion hazard analysis may be required. See ASCE/SEI 7-16 Section 11.4.8.

Data Accessed: Thu May 30 2024

Date Source: USGS Seismic Design Maps

The ASCE Hazard Tool is provided for your convenience, for informational purposes only, and is provided "as is" and without warranties of any kind. The location data included herein has been obtained from information developed, produced, and maintained by third party providers; or has been extrapolated from maps incorporated in the ASCE standard. While ASCE has made every effort to use data obtained from reliable sources or methodologies, ASCE does not make any representations or warranties as to the accuracy, completeness, reliability, currency, or quality of any data provided herein. Any third-party links provided by this Tool should not be construed as an endorsement, affiliation, relationship, or sponsorship of such third-party content by or from ASCE.

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In using this Tool, you expressly assume all risks associated with your use. Under no circumstances shall ASCE or its officers, directors, employees, members, affiliates, or agents be liable to you or any other person for any direct, indirect, special, incidental, or consequential damages arising from or related to your use of, or reliance on, the Tool or any information obtained therein. To the fullest extent permitted by law, you agree to release and hold harmless ASCE from any and all liability of any nature arising out of or resulting from any use of data provided by the ASCE Hazard Tool.

U.S. Geological Survey - Earthquake Hazards Program

2008 National Seismic Hazard Maps - Source Parameters

New Search

Distance in Miles	Name	State	Pref Slip Rate (mm/yr)	Dip (degrees)	Dip Dir	Slip Sense	Rupture Top (km)	Rupture Bottom (km)	Length (km)
1.11	Newport Inglewood Connected alt 1	CA	1.3	89		strike slip	0	11	208
1.11	Newport-Inglewood, alt 1	CA	1	88		strike slip	0	15	65
1.12	Newport Inglewood Connected alt 2	CA	1.3	90	V	strike slip	0	11	208
5.38	San Joaquin Hills	CA	0.5	23	SW	thrust	2	13	27
8.36	Newport-Inglewood (Offshore)	CA	1.5	90	V	strike slip	0	10	66
9.33	Palos Verdes	CA	3	90	V	strike slip	0	14	99
9.33	Palos Verdes Connected	CA	3	90	V	strike slip	0	10	285
14.28	Puente Hills (Coyote Hills)	CA	0.7	26	N	thrust	2.8	15	17
17.10	Puente Hills (Santa Fe Springs)	CA	0.7	29	N	thrust	2.8	15	11
20.01	Elsinore;W+GI+T+J+CM	CA	n/a	84	NE	strike slip	0	16	241
20.01	Elsinore;W+GI+T+J	CA	n/a	84	NE	strike slip	0	16	199
20.01	Elsinore;W+GI+T	CA	n/a	84	NE	strike slip	0	14	124
20.01	Elsinore;W+GI	CA	n/a	81	NE	strike slip	0	14	83
20.01	Elsinore;W	CA	2.5	75	NE	strike slip	0	14	46
21.30	Puente Hills (LA)	CA	0.7	27	N	thrust	2.1	15	22
26.61	San Jose	CA	0.5	74	NW	strike slip	0	15	20
26.89	Chino, alt 1	CA	1	50	SW	strike slip	0	9	24

26.91	Chino, alt 2	CA	1	65	SW	strike slip	0	14	29
27.13	Elsinore;GI+T	CA	5	90	V	strike slip	0	14	78
27.13	Elsinore;GI+T+J	CA	n/a	86	NE	strike slip	0	17	153
27.13	Elsinore;GI+T+J+CM	CA	n/a	86	NE	strike slip	0	16	195
27.13	Elsinore;GI	CA	5	90	V	strike slip	0	13	37
27.53	Elysian Park (Upper)	CA	1.3	50	NE	reverse	3	15	20
27.71	Coronado Bank	CA	3	90	V	strike slip	0	9	186
31.35	Raymond	CA	1.5	79	N	strike slip	0	16	22
32.53	Verdugo	CA	0.5	55	NE	reverse	0	15	29
33.05	Hollywood	CA	1	70	N	strike slip	0	17	17
33.27	Sierra Madre Connected	CA	2	51		reverse	0	14	76
33.27	Sierra Madre	CA	2	53	N	reverse	0	14	57
33.67	Santa Monica Connected alt 2	CA	2.4	44		strike slip	0.8	11	93
34.86	Clamshell-Sawpit	CA	0.5	50	NW	reverse	0	14	16
35.35	Santa Monica Connected alt 1	CA	2.6	51		strike slip	0	16	79
35.35	Santa Monica, alt 1	CA	1	75	N	strike slip	0	18	14
35.49	Cucamonga	CA	5	45	N	thrust	0	8	28
36.50	Elsinore;T	CA	5	90	V	strike slip	0	14	52
36.50	Elsinore;T+J+CM	CA	n/a	85	NE	strike slip	0	16	169
36.50	Elsinore;T+J	CA	n/a	86	NE	strike slip	0	17	127
37.94	Malibu Coast, alt 2	CA	0.3	74	N	strike slip	0	16	38
37.94	Malibu Coast, alt 1	CA	0.3	75	N	strike slip	0	8	38

38.78	Anacapa-Dume, alt 2	CA	3	41	N	thrust	1.2	12	65
44.24	Anacapa-Dume, alt 1	CA	3	45	N	thrust	0	16	51
44.62	Sierra Madre (San Fernando)	CA	2	45	N	thrust	0	13	18
46.90	San Gabriel	CA	1	61	N	strike slip	0	15	71
48.45	Northridge	CA	1.5	35	S	thrust	7.4	17	33
49.76	San Jacinto;SBV+SJV+A+C	CA	n/a	90	V	strike slip	0	17	181
49.76	San Jacinto;SBV+SJV+A	CA	n/a	90	V	strike slip	0	16	134
49.76	San Jacinto;SBV+SJV	CA	n/a	90	V	strike slip	0	16	88
49.76	San Jacinto;SBV	CA	6	90	V	strike slip	0	16	45
49.76	San Jacinto;SBV+SJV+A+CC+B+SM	CA	n/a	90	V	strike slip	0.1	15	241
49.76	San Jacinto;SBV+SJV+A+CC+B	CA	n/a	90	V	strike slip	0.1	15	215
49.76	San Jacinto;SBV+SJV+A+CC	CA	n/a	90	V	strike slip	0	16	181
51.04	San Jacinto;SJV+A+CC	CA	n/a	90	V	strike slip	0	16	136
51.04	San Jacinto;SJV	CA	18	90	V	strike slip	0	16	43
51.04	San Jacinto;SJV+A+CC+B	CA	n/a	90	V	strike slip	0.1	15	170
51.04	San Jacinto;SJV+A+CC+B+SM	CA	n/a	90	V	strike slip	0.1	15	196
51.04	San Jacinto;SJV+A+C	CA	n/a	90	V	strike slip	0	17	136
51.04	San Jacinto;SJV+A	CA	n/a	90	V	strike slip	0	17	89
51.31	Rose Canyon	CA	1.5	90	V	strike slip	0	8	70
51.89	S. San Andreas;NM+SM+NSB+SSB+BG	CA	n/a	83		strike slip	0	14	271
51.89	S. San Andreas;CH+CC+BB+NM+SM	CA	n/a	90	V	strike slip	0	14	306

51.89	S. San Andreas;CH+CC+BB+NM+SM+NSB+SSB+BG+CO	CA	n/a	86		strike slip	0.1	13	512
51.89	S. San Andreas;SM	CA	29	90	V	strike slip	0	13	98
51.89	S. San Andreas;CC+BB+NM+SM	CA	n/a	90	V	strike slip	0	14	243
51.89	S. San Andreas;CC+BB+NM+SM+NSB	CA	n/a	90	V	strike slip	0	14	279
51.89	S. San Andreas;CC+BB+NM+SM+NSB+SSB	CA	n/a	90	V	strike slip	0	14	322
51.89	S. San Andreas;CC+BB+NM+SM+NSB+SSB+BG	CA	n/a	85		strike slip	0	14	380
51.89	S. San Andreas;CC+BB+NM+SM+NSB+SSB+BG+CO	CA	n/a	86		strike slip	0.1	13	449
51.89	S. San Andreas;CH+CC+BB+NM+SM+NSB	CA	n/a	90	V	strike slip	0	14	341
51.89	S. San Andreas;CH+CC+BB+NM+SM+NSB+SSB	CA	n/a	90	V	strike slip	0	14	384
51.89	S. San Andreas;CH+CC+BB+NM+SM+NSB+SSB+BG	CA	n/a	86		strike slip	0	14	442
51.89	S. San Andreas;NM+SM	CA	n/a	90	V	strike slip	0	14	134
51.89	S. San Andreas;NM+SM+NSB	CA	n/a	90	V	strike slip	0	13	170
51.89	S. San Andreas;NM+SM+NSB+SSB	CA	n/a	90	V	strike slip	0	13	213
51.89	S. San Andreas;NM+SM+NSB+SSB+BG+CO	CA	n/a	84		strike slip	0.1	13	340
51.89	S. San Andreas;BB+NM+SM	CA	n/a	90	V	strike slip	0	14	184
51.89	S. San Andreas;PK+CH+CC+BB+NM+SM	CA	n/a	90	V	strike slip	0.1	13	342
51.89	S. San Andreas;PK+CH+CC+BB+NM+SM+NSB	CA	n/a	90	V	strike slip	0.1	13	377
51.89	S. San Andreas;PK+CH+CC+BB+NM+SM+NSB+SSB	CA	n/a	90	V	strike slip	0.1	13	421
51.89	S. San Andreas;PK+CH+CC+BB+NM+SM+NSB+SSB+BG	CA	n/a	86		strike slip	0.1	13	479
51.89	S. San Andreas;PK+CH+CC+BB+NM+SM+NSB+SSB+BG+CO	CA	n/a	86		strike slip	0.1	13	548

51.89	S. San Andreas;BB+NM+SM+NSB	CA	n/a	90	V	strike slip	0	14	220
51.89	S. San Andreas;SM+NSB	CA	n/a	90	V	strike slip	0	13	133
51.89	S. San Andreas;SM+NSB+SSB	CA	n/a	90	V	strike slip	0	13	176
51.89	S. San Andreas;SM+NSB+SSB+BG	CA	n/a	81		strike slip	0	13	234
51.89	S. San Andreas;SM+NSB+SSB+BG+CO	CA	n/a	83		strike slip	0.1	13	303
51.89	S. San Andreas;BB+NM+SM+NSB+SSB	CA	n/a	90	V	strike slip	0	14	263
51.89	S. San Andreas;BB+NM+SM+NSB+SSB+BG	CA	n/a	84		strike slip	0	14	321
51.89	S. San Andreas;BB+NM+SM+NSB+SSB+BG+CO	CA	n/a	85		strike slip	0.1	13	390
52.05	S. San Andreas;NSB+SSB+BG+CO	CA	n/a	79		strike slip	0.2	12	206
52.05	S. San Andreas;NSB+SSB	CA	n/a	90	V	strike slip	0	13	79
52.05	S. San Andreas;NSB+SSB+BG	CA	n/a	75		strike slip	0	14	136
52.05	S. San Andreas;NSB	CA	22	90	V	strike slip	0	13	35
52.26	Santa Susana, alt 1	CA	5	55	N	reverse	0	16	27
54.46	Cleghorn	CA	3	90	V	strike slip	0	16	25
54.72	San Jacinto;A+C	CA	n/a	90	V	strike slip	0	17	118
54.72	San Jacinto;A+CC+B	CA	n/a	90	V	strike slip	0.1	15	152
54.72	San Jacinto;A+CC+B+SM	CA	n/a	90	V	strike slip	0.1	15	178
54.72	San Jacinto;A+CC	CA	n/a	90	V	strike slip	0	16	118
54.72	San Jacinto;A	CA	9	90	V	strike slip	0	17	71
56.57	S. San Andreas;SSB+BG	CA	n/a	71		strike slip	0	13	101

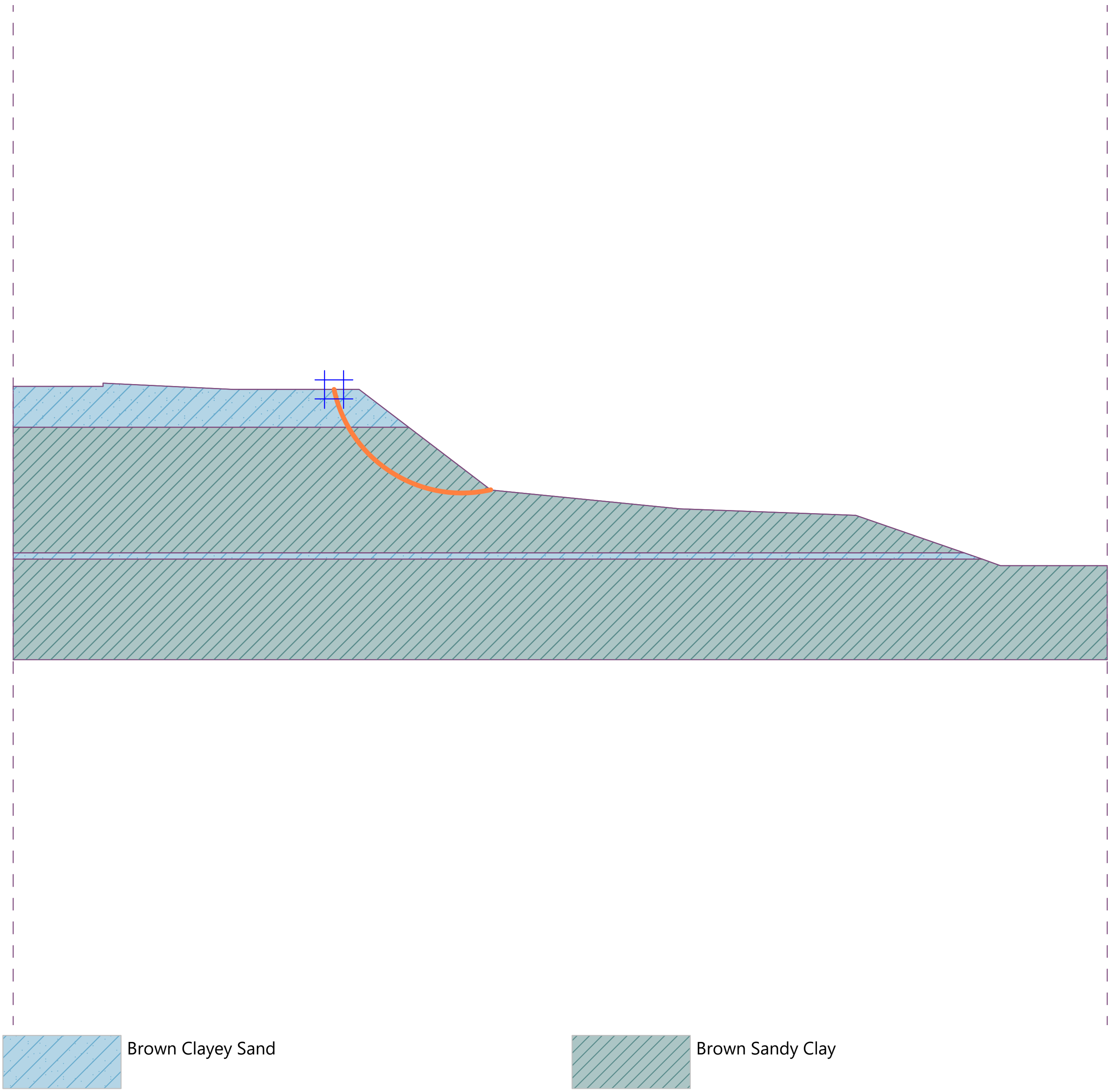
56.57	S. San Andreas;SSB	CA	16	90	V	strike slip	0	13	43
56.57	S. San Andreas;SSB+BG+CO	CA	n/a	77		strike slip	0.2	12	170
58.24	Simi-Santa Rosa	CA	1	60		strike slip	1	12	39
59.57	Holser, alt 1	CA	0.4	58	S	reverse	0	19	20
62.02	North Frontal (West)	CA	1	49	S	reverse	0	16	50
62.85	Elsinore;J	CA	3	84	NE	strike slip	0	19	75
62.85	Elsinore;J+CM	CA	3	84	NE	strike slip	0	17	118
64.16	Oak Ridge (Onshore)	CA	4	65	S	reverse	1	19	49
64.16	Oak Ridge Connected	CA	3.6	53		reverse	0.6	15	94
67.62	San Cayetano	CA	6	42	N	thrust	0	16	42
72.87	S. San Andreas;BG	CA	n/a	58		strike slip	0	13	56
72.87	S. San Andreas;BG+CO	CA	n/a	72		strike slip	0.3	12	125
74.35	Santa Cruz Island	CA	1	90	V	strike slip	0	13	69
75.40	Channel Islands Thrust	CA	1.5	20	N	thrust	5	12	59
76.03	S. San Andreas;NM	CA	27	90	V	strike slip	0	15	37
76.03	S. San Andreas;CC+BB+NM	CA	n/a	90	V	strike slip	0	15	146
76.03	S. San Andreas;CH+CC+BB+NM	CA	n/a	90	V	strike slip	0	14	208
76.03	S. San Andreas;PK+CH+CC+BB+NM	CA	n/a	90	V	strike slip	0.1	12	245
76.03	S. San Andreas;BB+NM	CA	n/a	90	V	strike slip	0	15	87
79.15	Ventura-Pitas Point	CA	1	64	N	reverse	1	15	44
79.15	Pitas Point Connected	CA	1	55		reverse	1.2	13	78
79.37	Pinto Mtn	CA	2.5	90	V	strike slip	0	16	74
80.64	Santa Ynez Connected	CA	2	70		strike slip	0	11	132

80.64	Santa Ynez (East)	CA	2	70	S	strike slip	0	13	68
81.14	Helendale-So Lockhart	CA	0.6	90	V	strike slip	0	13	114
82.18	Oak Ridge (Offshore)	CA	3	32	S	thrust	0	8	38
83.81	North Frontal (East)	CA	0.5	41	S	thrust	0	16	27
85.59	Mission Ridge-Arroyo Parida-Santa Ana	CA	0.4	70	S	reverse	0	8	69
86.49	San Jacinto;CC+B	CA	n/a	90	V	strike slip	0.2	14	77
86.49	San Jacinto;CC+B+SM	CA	n/a	90	V	strike slip	0.2	14	103
86.49	San Jacinto;CC	CA	4	90	V	strike slip	0	16	43
86.74	Red Mountain	CA	2	56	N	reverse	0	14	101
87.95	San Jacinto;C	CA	14	90	V	strike slip	0	17	47
89.66	Earthquake Valley	CA	2	90	V	strike slip	0	19	20
90.42	Pitas Point (Lower)-Montalvo	CA	2.5	16	N	thrust	0.4	13	30
91.92	Lenwood-Lockhart-Old Woman Springs	CA	0.9	90	V	strike slip	0	13	145
92.05	North Channel	CA	1	26	N	thrust	1.1	5	51
92.70	S. San Andreas;PK+CH+CC+BB	CA	n/a	90	V	strike slip	0.1	12	208
92.70	S. San Andreas;CH+CC+BB	CA	n/a	90	V	strike slip	0	14	171
92.70	S. San Andreas;BB	CA	34	90	V	strike slip	0	15	50
92.70	S. San Andreas;CC+BB	CA	n/a	90	V	strike slip	0	15	109
93.17	Garlock;GW	CA	6	90	V	strike slip	0.7	14	98
93.17	Garlock;GC+GW	CA	n/a	90	V	strike slip	0.4	12	210
93.17	Garlock;GE+GC+GW	CA	n/a	90	V	strike slip	0.3	12	256
95.62	Burnt Mtn	CA	0.6	67	W	strike slip	0	16	21

96.71	Johnson Valley (No)	CA	0.6	90	V	strike slip	0	16	35
97.99	Landers	CA	0.6	90	V	strike slip	0	15	95
98.57	Eureka Peak	CA	0.6	90	V	strike slip	0	15	19
99.61	Pitas Point (Upper)	CA	1	42	N	thrust	1.4	10	35
99.89	Pleito	CA	2	46	S	reverse	0	14	44

APPENDIX
SLOPE STABILITY ANALYSIS

Name : **Stage - analysis : 1 - 1**



The slip surface after optimization.

Slope stability verification (Bishop)

Sum of active forces : F_a = 8525.8 lbf/ft
Sum of passive forces : F_p = 16500.0 lbf/ft

Sliding moment : M_a = 177506.2 lbfft/ft
Resisting moment : M_p = 343529.8 lbfft/ft
Factor of safety = 1.94 > 1.50
Slope stability ACCEPTABLE

Slope stability analysis

Input data

Project

Task : 20240155-H4677
Description : Slope Stability Analysis of Slope Prior to Failure
Customer : City of Huntington Beach
Author : Omar Chamaa, PE
Date : 5/30/2024
Project ID : H4667
Project number : 20240155

Settings

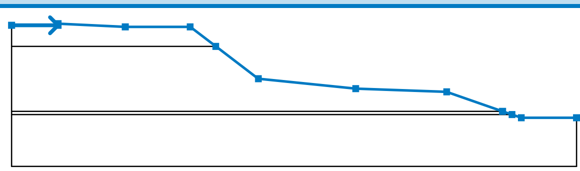
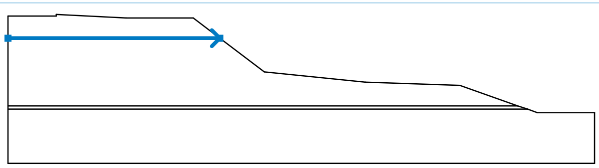
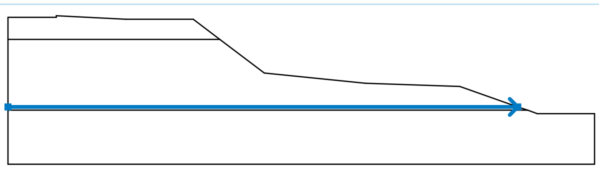
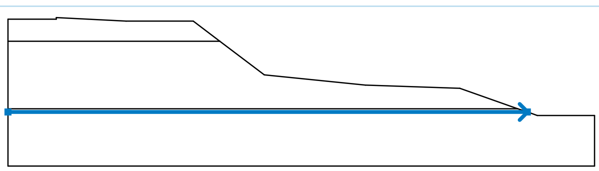
(input for current task)

Stability analysis

Earthquake analysis : Standard
Verification methodology : Safety factors (ASD)

Safety factors			
Permanent design situation			
Safety factor :	SF_s =	1.50	[–]

Interface

No.	Interface location	Coordinates of interface points [ft] x	z	x	z	x	z
1		0.00	39.50	14.30	39.50	14.30	40.00
		35.00	39.00	55.00	39.00	62.88	33.00
		76.00	23.00	106.00	20.00	134.00	19.00
		151.25	13.00	154.12	12.00	157.00	11.00
		174.00	11.00				
2		0.00	33.00	62.88	33.00		
3		0.00	13.00	151.25	13.00		
4		0.00	12.00	154.12	12.00		

Soil parameters - effective stress state

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]
1	Brown Clayey Sand		29.00	111.0	106.5

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]
2	Brown Sandy Clay		16.00	390.0	127.5

Soil parameters - uplift

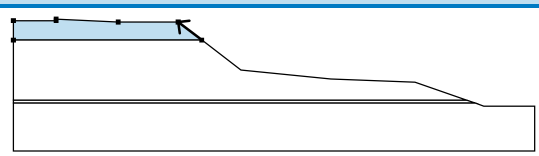
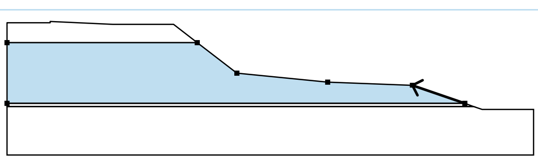
No.	Name	Pattern	γ_{sat} [pcf]	γ_s [pcf]	n [–]
1	Brown Clayey Sand		106.5		
2	Brown Sandy Clay		127.5		

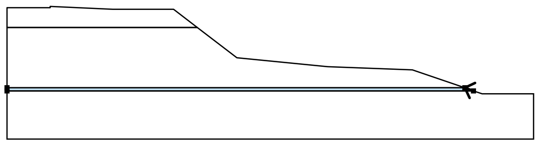
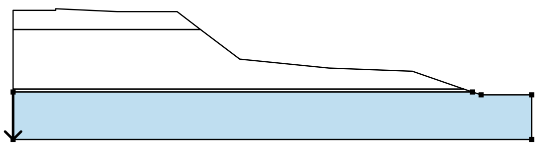
Soil parameters

Brown Clayey Sand
Unit weight : γ = 106.5 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 29.00 °
Cohesion of soil : c_{ef} = 111.0 psf
Saturated unit weight : γ_{sat} = 106.5 pcf

Brown Sandy Clay
Unit weight : γ = 127.5 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 16.00 °
Cohesion of soil : c_{ef} = 390.0 psf
Saturated unit weight : γ_{sat} = 127.5 pcf

Assigning and surfaces

No.	Surface position	Coordinates of surface points [ft] x	z	x	z	Assigned soil
1		62.88	33.00	55.00	39.00	Brown Clayey Sand
		35.00	39.00	14.30	40.00	
		14.30	39.50	0.00	39.50	
		0.00	33.00			
2		151.25	13.00	134.00	19.00	Brown Sandy Clay
		106.00	20.00	76.00	23.00	
		62.88	33.00	0.00	33.00	
		0.00	13.00			

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
3		154.12	12.00	151.25	13.00	Brown Clayey Sand
		0.00	13.00	0.00	12.00	
4		0.00	12.00	0.00	-4.00	Brown Sandy Clay
		174.00	-4.00	174.00	11.00	
		157.00	11.00	154.12	12.00	

Water

Water type : No water

Tensile crack

Tensile crack not input.

Earthquake

Earthquake not included.

Settings of the stage of construction

Design situation : permanent

Results (Stage of construction 1)

Analysis 1

Circular slip surface

Slip surface parameters							
Center :	x =	71.39	[ft]	Angles :	α_1 =	-77.97	[°]
	z =	43.34	[ft]		α_2 =	12.69	[°]
Radius :	R =	20.82	[ft]				
The slip surface after optimization.							

The restrictions of points of circular slip surface

Keep the left end point of the slip surface

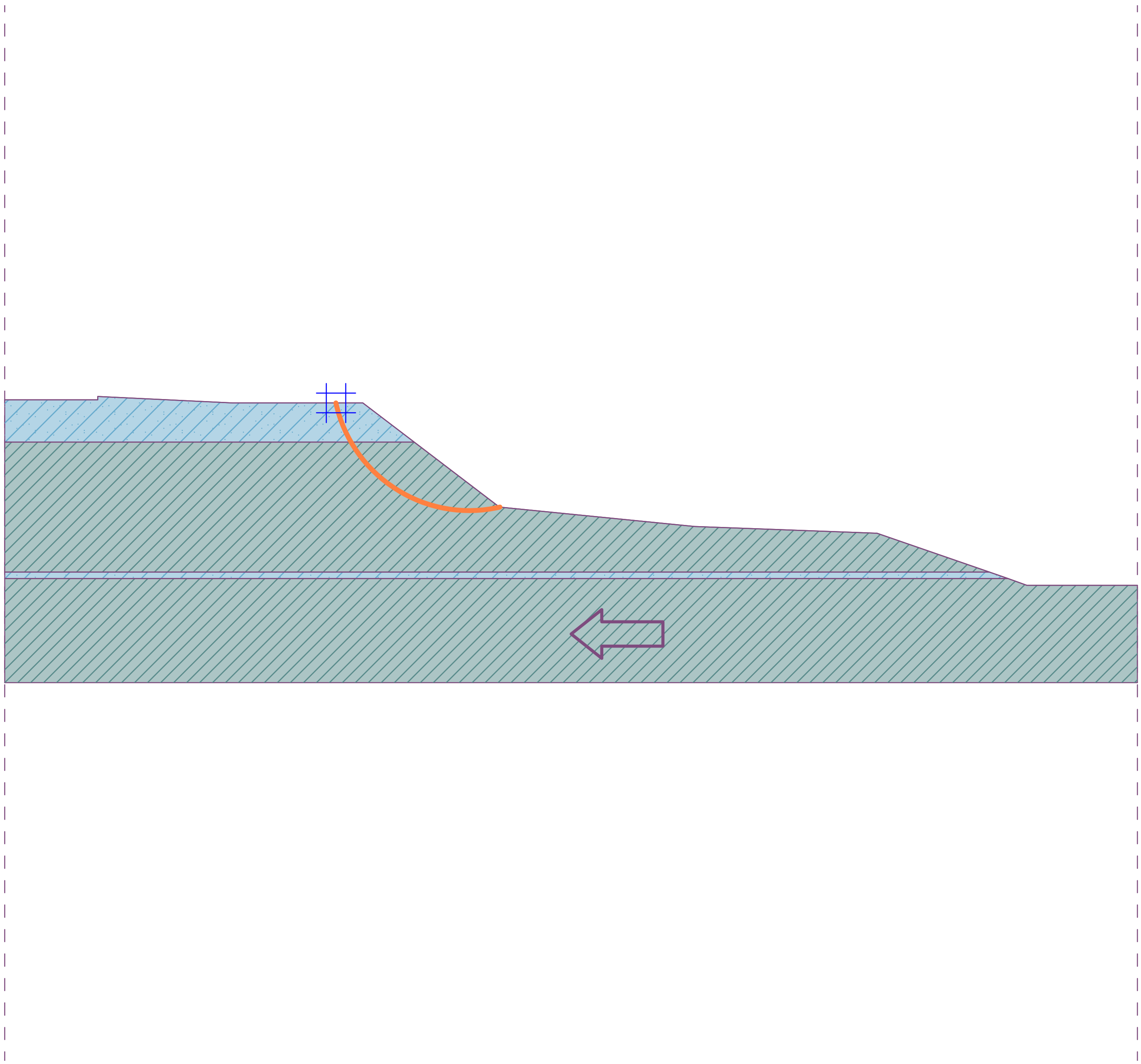
Slope stability verification (Bishop)

Sum of active forces : F_a = 8525.8 lbf/ft
Sum of passive forces : F_p = 16500.0 lbf/ft

Sliding moment : M_a = 177506.2 lbfft/ft
Resisting moment : M_p = 343529.8 lbfft/ft
Factor of safety = 1.94 > 1.50

Slope stability ACCEPTABLE

Name : **Stage - analysis : 1 - 1**



Brown Clayey Sand

Brown Sandy Clay

The slip surface after optimization.

Slope stability verification (Bishop)

Sum of active forces : F_a = 11872.6 lbf/ft

Sum of passive forces : F_p = 16093.0 lbf/ft

Sliding moment : M_a = 248850.3 lbfft/ft

Resisting moment : M_p = 337310.3 lbfft/ft

Factor of safety = 1.36 > 1.10

Slope stability ACCEPTABLE

Slope stability analysis

Input data

Project

Task : 20240155-H4677
Description : Slope Stability Analysis of Slope Prior to Failure
Customer : City of Huntington Beach
Author : Omar Chamaa, PE
Date : 5/30/2024
Project ID : H4667
Project number : 20240155

Settings

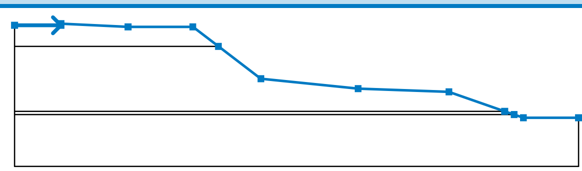
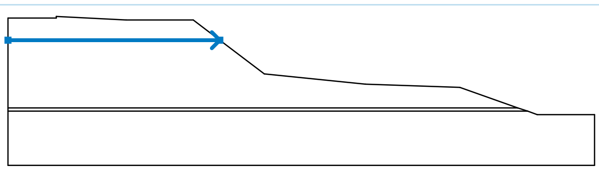
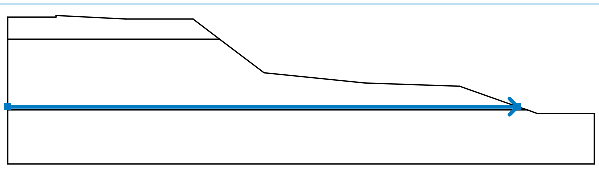
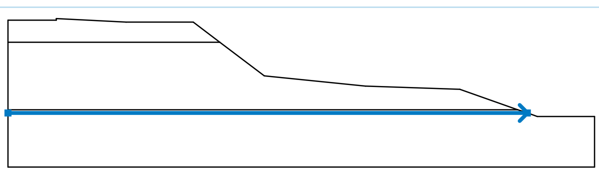
(input for current task)

Stability analysis

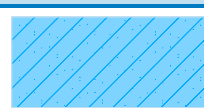
Earthquake analysis : Standard
Verification methodology : Safety factors (ASD)

Safety factors			
Seismic design situation			
Safety factor :	SF_s =	1.10	[–]

Interface

No.	Interface location	Coordinates of interface points [ft] x	z	x	z	x	z
1		0.00	39.50	14.30	39.50	14.30	40.00
		35.00	39.00	55.00	39.00	62.88	33.00
		76.00	23.00	106.00	20.00	134.00	19.00
		151.25	13.00	154.12	12.00	157.00	11.00
		174.00	11.00				
2		0.00	33.00	62.88	33.00		
3		0.00	13.00	151.25	13.00		
4		0.00	12.00	154.12	12.00		

Soil parameters - effective stress state

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]
1	Brown Clayey Sand		29.00	111.0	106.5

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]
2	Brown Sandy Clay		16.00	390.0	127.5

Soil parameters - uplift

No.	Name	Pattern	γ_{sat} [pcf]	γ_s [pcf]	n [–]
1	Brown Clayey Sand		106.5		
2	Brown Sandy Clay		127.5		

Soil parameters

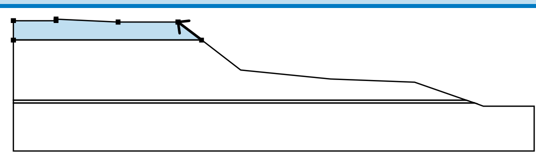
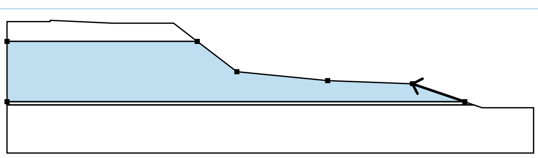
Brown Clayey Sand

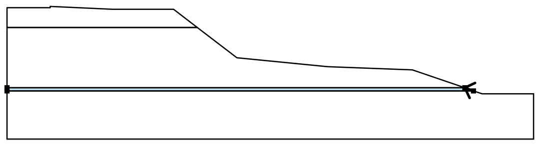
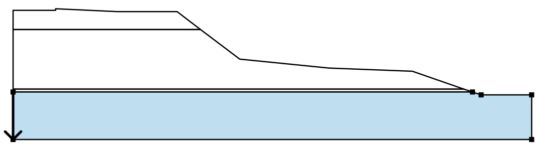
Unit weight : γ = 106.5 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 29.00 °
Cohesion of soil : c_{ef} = 111.0 psf
Saturated unit weight : γ_{sat} = 106.5 pcf

Brown Sandy Clay

Unit weight : γ = 127.5 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 16.00 °
Cohesion of soil : c_{ef} = 390.0 psf
Saturated unit weight : γ_{sat} = 127.5 pcf

Assigning and surfaces

No.	Surface position	Coordinates of surface points [ft] x	z	x	z	Assigned soil
1		62.88	33.00	55.00	39.00	Brown Clayey Sand
		35.00	39.00	14.30	40.00	
		14.30	39.50	0.00	39.50	
		0.00	33.00			
2		151.25	13.00	134.00	19.00	Brown Sandy Clay
		106.00	20.00	76.00	23.00	
		62.88	33.00	0.00	33.00	
		0.00	13.00			

No.	Surface position	Coordinates of surface points [ft] x	z	x	z	Assigned soil
3		154.12	12.00	151.25	13.00	Brown Clayey Sand
		0.00	13.00	0.00	12.00	
4		0.00	12.00	0.00	-4.00	Brown Sandy Clay
		174.00	-4.00	174.00	11.00	
		157.00	11.00	154.12	12.00	

Water

Water type : No water

Tensile crack

Tensile crack not input.

Earthquake

Horizontal seismic coefficient : K_h = 0.25
Vertical seismic coefficient : K_v = 0.00

Settings of the stage of construction

Design situation : seismic

Results (Stage of construction 1)

Analysis 1

Circular slip surface

Slip surface parameters								
Center :	x =	71.38	[ft]	Angles :	α_1 =	-77.83	[°]
	z =	43.42	[ft]		α_2 =	12.94	[°]
Radius :	R =	20.96	[ft]				
The slip surface after optimization.							

The restrictions of points of circular slip surface

Keep the left end point of the slip surface

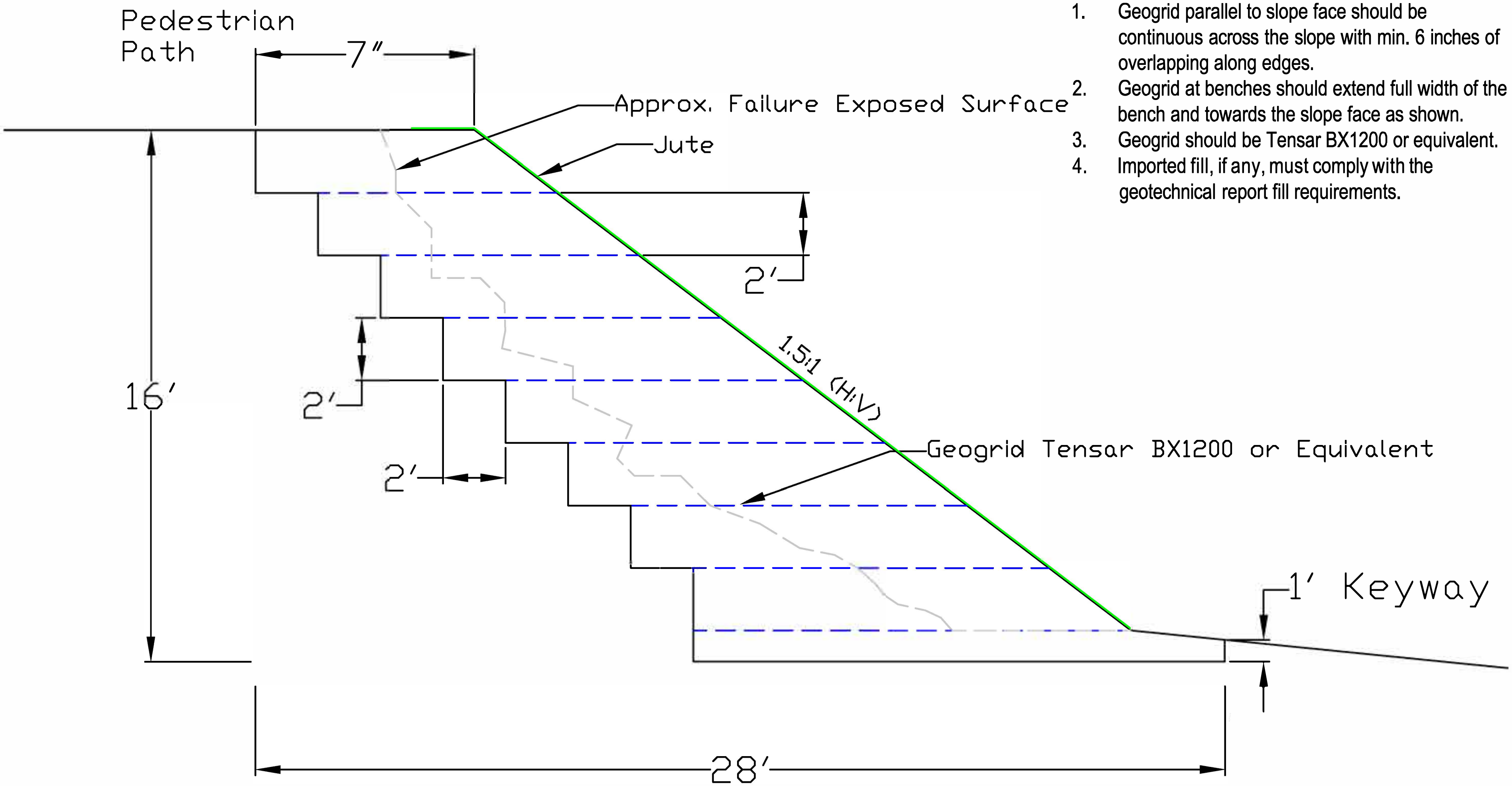
Slope stability verification (Bishop)

Sum of active forces : F_a = 11872.6 lbf/ft
Sum of passive forces : F_p = 16093.0 lbf/ft

Sliding moment : M_a = 248850.3 lbfft/ft
Resisting moment : M_p = 337310.3 lbfft/ft
Factor of safety = 1.36 > 1.10

Slope stability ACCEPTABLE

APPENDIX
SCHEMATIC FOR STABILITY FILL



GENERAL NOTES:

1. Geogrid parallel to slope face should be continuous across the slope with min. 6 inches of overlapping along edges.
2. Geogrid at benches should extend full width of the bench and towards the slope face as shown.
3. Geogrid should be Tensar BX1200 or equivalent.
4. Imported fill, if any, must comply with the geotechnical report fill requirements.

Note: Topo Provided by the City of Huntington Beach

AESCO

City of Huntington Beach	
Project No. : 20240155-H3925	Scale: *1 inch ≅ 5 feet*
Site Name: Huntington Beach Dog Beach	
Site Address: 33.672221, -118.0232, Huntington Beach, CA 92648	
SCHEMATIC FOR STABILITY FILL (WITH NATIVE SOIL AND GEOGRID)	Date: 6-4-24 — Figure 4

APPENDIX

Construction Procedures

CONSTRUCTION PROCEDURES

The upper soils at the site are composed of a significant amount of fine materials. These soils are subject to extreme changes in shear strength with varying moisture conditions and, if construction is initiated during wetter seasons of the year, it may be very difficult to move equipment about the site. Also, once the soil becomes saturated, compaction operations can be seriously hampered by a tendency of the fine material to "pump". Consequently, it is recommended that adequate site drainage be established prior to and continued during and following construction operations to prevent ponding of water on or adjacent to the construction area and subsequent saturation of the soil. Compaction operations may be expedited by using light compaction equipment and thin lifts of soil. Rolling only as necessary to obtain compaction is advisable because further repetitive loading may cause the subgrade to "pump". Once the soil begins to "pump", it generally becomes necessary to undercut the poor soil, waste it and replace it with controlled fill.

Compaction operations and installation of the foundations should be supervised by the Geotechnical Engineer. All foundation excavations should be inspected to verify cleaning and bearing stratum. Concrete should be placed in foundation excavations as soon as practical after forming and final clean-up have been approved to avoid prolonged exposure of the bearing stratum and possible disturbance due to standing water, desiccation or construction operations.