FOR CONTRACT NO.: 05-0P650**4**

INFORMATION HANDOUT

MATERIALS INFORMATION

FINAL FOUNDATION REPORT

FOUNDATION REVIEW

ROUTE: 05-SCr-9-1.8

State of California
DEPARTMENT OF TRANSPORTATION

Business, Transportation and Housing Agency

Memorandum

Flex your power!
Be energy efficient!

To: MS. SHANNON POST
Chief Office of Bridge Design - Central

Date: July 2, 2007

Attention: Michael Downs

File: 05-SCr-9 PM 1.8
05-0P6501
Storm Damage

From: EDUARDO ORTEGA
Associate Materials and Research Engineer
Office of Geotechnical Design – West
Geotechnical Services
Division of Engineering Services

WAJAHAT NYAZ
Chief, Branch C
Office of Geotechnical Design – West
Geotechnical Services
Division of Engineering Services

Subject: Final Foundation Report for Storm Damage Site at 5-SCr-9 PM 1.8

This memorandum presents our geotechnical recommendations for the referenced storm damage site. The project is located about 3.2 km (2 miles) north of the City of Santa Cruz in Santa Cruz County, California (see attached Vicinity Map). The recommendations contained in this memorandum are based on the results of our subsurface explorations performed at the site, our site observations, and our engineering judgment.

BACKGROUND AND SITE DESCRIPTION

During January/February 2006 rainstorms, a landslide occurred on a steeply sloping ground along Route 9. The subject landslide is about 30 m (100 ft) in length when measured along the roadway, and extends about 6 m (20 ft) on the downhill slope below the roadway. The headscarp of the landslide is located on the roadway pavement of Route 9, which is a two-lane highway. The approximate limits of the landslide and the headscarp location are shown in the attached Layout Map.

SCOPE OF WORK

Work performed for this investigation included:

- Subsurface investigation consisting of two power borings (B-1-06 and B-2-06) in the vicinity of the subject landslide to determine the subsurface conditions at the site.

These borings were drilled by the Office of Geotechnical Design - North in January 2006.

- Installation of a slope inclinometer (SI) in boring B-1-06 to monitor the landslide movement.

- Review of available information on the site geology and seismicity.

- Engineering analysis and formulation of the repair recommendations.

REGIONAL AND SITE GEOLOGY

The project lies within the Coast Range geomorphic province and is on the western edge of the Santa Cruz Mountains, a chain of steep ridges and valleys that traverse roughly WNW toward the coast. The Santa Cruz Mountains are bounded on the east by the San Andreas Fault and the west by the Pacific Ocean. Basement rocks west of the San Andreas Fault are composed of Paleozoic to Mesozoic metasedimentary rocks that are part of the Salinian Block. These are overlain by Mesozoic sedimentary and volcanic rocks.

SITE GEOLOGY AND SEISMICITY

Bedrock within the project area consists of Cretaceous quartz diorite. Borings drilled in 2006 in the vicinity of the site, indicate the underlying material to be granitic, hard to very hard, intensely fractured and moderately weathered. Locally, the rock is decomposed to silty sand or sandy silt with gravel that is dense and often contains large cobbles of granite. Decomposed granite thicknesses were measured up to 7 m (23 ft) thick, but were typically 0.9 to 2.1 m (3 to 7 ft) thick.

The project is located within the seismically active San Andreas Fault system and may be prone to moderate to large earthquakes over time. This fault system is composed of northwest trending, generally right-lateral, strike-slip faults. Several faults within the San Andreas Fault system are capable of affecting the project site. Table 1 below presents the list of faults and their predicted ground accelerations (reported as a percentage of the force of gravity) based upon a likely maximum credible event (earthquake, given in moment magnitude, Mw) as calculated by Mualchin (1996).

Table 1 - Predicted Maximum Credible Earthquake and Acceleration

Fault	Distance from Project Site (km)	Maximum Credible Event (Mw)	Peak Bedrock Acceleration
San Andreas	17.5	8.0	0.42 g
San Gregorio	16.0	7.5	0.35 g
Zayante	12.5	7.25	0.35 g

Mualchin, L, 1996, California Seismic Hazard Map, California Department of Transportation.

LANDSLIDE MONOTORING

A Slope Inclinometer (SI) was installed in boring B-1-06 to determine the landslide slip-plane depth and to determine the rate of movement of the landslide. Three reading taken over a one-year period (end of March 2006 to mid April 2007) show that the inclinometer is exhibiting erratic behavior. Such behavior is typically seen when the SI is backfilled with improper/insufficient backfill material. It is possible this inclinometer might settle down and provide reliable information in the future.

Although the SI readings are not conclusive, our review of the SI results indicates that the landslide slip-plane is most likely located about 5.5 m below the roadway elevation (at the SI location). The rate of movement of the landslide cannot be determined at this time. The plot of the SI readings showing the recorded movements is attached.

Based on our experience, it is our opinion that if repair measures are not performed, there is a possibility that the landslide movement will accelerate significantly during the rainy season(s) compromising the roadway.

SLOPE STABILITY ANALYSIS

Back-analysis

Soil/rock strength parameters of the sliding mass were determined using back-analysis of the landslide. This is necessary because it is very difficult to estimate the residual shear

strength of the soil/rock at the slip-plane by conventional means. The size of the sliding mass was estimated using slip-plane location (estimated from SI data), headscarp location, and other geologic features. Since the landslide is likely creeping at a very slow rate, we believe that the landslide currently has a Safety Factor (SF) of slightly less than 1.0. Our back-analysis show that an effective friction angle of 28° and cohesion of 0 kPa (along the slip-plane) will result in a SF of slightly less than 1.0. To simulate the faster landslide movement during the winter months, we included some pore water pressure in the sliding mass to reduce the SF to 0.95. The soil strength and pore water pressure parameters determined by back-analysis are summarized in Table 2.

The back analysis was performed using computer program "SLOPE/W" and "XSTABL". The graphical outputs (generated by the computer program) are attached.

Table 2 - Back Calculated Soil/Rock Strength and Pore Water Pressure Parameters

Soil/Rock Type	Unit Weight, KN/m^3	Internal Friction Angle ϕ, (Degrees)	Cohesion c, KPa	Pore Water Pressure Parameter, r_u	Safety Factor (SF)
Fill/ Clayey Sand	20.4	28	0	0	~1.0
Fill/ Clayey Sand	20.4	28	0	0.08	~0.95

Slope Stability Analysis of the Proposed Repair

Since the slip-plane of the landslide is significantly different from the assumed slip-plane used in a conventional retaining wall analysis/design, we performed a slope stability analysis of the proposed repair strategy using the estimated slip-plane and the back calculated soil/rock strength parameters (including the water pressure). Our analysis shows that a retaining system that extends to the bottom of the slip-plane will require an anchor load of 132.7 KN/m (9.1 Kips/ft) for a SF of 1.3. The results of the slope stability analysis are attached.

EXPLORATION AND SUBSURFACE CONDITIONS

Two borings (B-1-06 and B-2-06) drilled in the vicinity of the subject landslide in February 2006 utilizing the rotatory wash drilling method to the maximum depth of 15.3 m. The borings locations are shown in the attached Layout Map. Standard Penetration Tests (SPT) were performed, in the borings, at locations where fill/colluvium was encountered. The subsurface conditions encountered in these borings are briefly described below:

The borings show that the subsurface conditions at the site consists of 0.3 m (maximum) of Asphalt Concrete (AC) underlain by 3.0 to 4.8 m of fill/colluvium consisting of loose to very dense clayey sand and silty sand with gravel. The SPT blow count in the fill/colluvium ranges from 7 to greater than 50 blows per 0.3 m. However, 20 to 30 blows are typical, with refusal occurring at 3 to 4.6 m (10' to 15'). The fill/colluvium is underlain by gray to yellowish brown, hard to very hard, intensely fractured and moderately weathered Granite (rock). See attached boring logs for details.

Due to the drilling method used (wet rotatory), groundwater was not measured in the borings during drilling. However, we anticipate that a perched groundwater condition develops at the site during the rainy season.

Log of Test Boring (LOTB) sheet should be included with the contract plans. The LOTB sheet(s) will be forwarded to you upon completion.

RECOMMENDATIONS

The most viable repair strategy for this location is to construct a soldier pile tieback retaining system. However, since the slip-plane is located about 5.5 m below the roadway elevation (at the proposed retaining wall location), a conventional soldier pile tieback wall with a retained height of 6.1 m will require a large excavation in sloping ground. Large excavation is not desirable at the project site because of environmental concerns as well as constructability issues such as material stocking piling and disposal. Therefore, we recommend a closely spaced soldier pile retaining system with one row of tiebacks as shown on the attached Typical Section. The piles should be spaced at a maximum spacing of 2.5 times the pile diameter to develop full arching between the piles. This will eliminate the need for the lagging between the piles and consequently the need for the large excavation. Lagging will be needed in the upper portion of the wall above the

whaler. The minimum bench in front of the lagging portion of the wall must be 1.5 m wide as shown on the Typical Section.

It is our understanding that the proposed wall will be located at the existing guardrail location and it will conform to the existing retaining wall located at the southern end of the landslide. The approximate beginning and end of the proposed retaining wall are shown in the attached Layout Map. The wall should taper at 1:2 (vertical to horizontal) at the north end.

We recommend the following requirements/criteria for the anchored soldier pile retaining system design:

Earth Pressures

For active earth pressure *against the wall/piles, use the following:*

- From top of the wall to the full design height, use active earth pressure coefficient (Ka) of 0.32. This Ka was computed using the back calculated strength properties of the sliding mass (internal friction angle, $\phi = 28^{\circ}$, cohesion, c = 0 kPa, and total unit weight of soil, $\gamma = 20.4$ KN/m^3). Below the full design height, use Ka of 0.27. This Ka was computed using engineering properties of fill (internal friction angle, $\phi = 35^{\circ}$, cohesion, c = 0 kPa, and total unit weight of soil, $\gamma = 20.4$ KN/m^3).

For passive earth pressure *against the soldier piles, use the following:*

- Use passive earth pressure coefficient (Kp) of 3.7. This Kp was computed using engineering properties of fill (internal friction angle, $\phi = 35^{\circ}$, cohesion, c = 0 kPa, and total unit weight of soil, $\gamma = 21.2$ KN/m^3).

- Friction Factor $\delta = 17^{\circ}$.

For seismic *earth pressure* against the wall/piles, use a constant pressure of 3H kPa (rectangular pressure diagram), where H is the full wall design height.

For traffic loading, use a constant pressure of 3.35 kPa (rectangular pressure diagram) to a maximum depth of 3.0 m below the top of the wall. This pressure is equivalent to a 0.6 m of surcharge immediately behind the wall.

Vertical Capacity of Soldier Piles

Soldier piles should be embedded a minimum of 5.0 m below design height as shown on the attached Typical Section and the pile spacing should be limited to not more than 3 times the pile diameter.

The ultimate vertical compression and tension capacities of the piles are summarized in Table 3.

TABLE 3 - Pile Friction and Tip Compression Capacities

	Ultimate (KPa)	Allowable (KPa)
Unit pile shaft friction per unit surface area of the pile length below the full design wall height	81.7	40.85 (SF=2)
Pile tip compression bearing pressure per unit tip area of the CIDH piles	5156.8	1718.9 (SF=3)

Use 60% of the compression shaft resistance values to calculate the ultimate tension (uplift) resistance of the pile.

Tieback Anchors

The minimum tieback anchor load should be 132.7 KN/m (9.1 Kips/ft). This anchor load was determined by slope stability analysis. The minimum unbonded length of the tieback anchor should be 10 m.

CORROSION

The corrosion testing has not been completed. We recommend that the site be considered corrosive until testing is completed. We will provide the corrosion tests result as soon as they become available.

CONSTRUCTION CONSIDERATIONS AND REQUIREMENTS

The following construction considerations and requirements should be included in the design and construction specifications for the proposed wall:

- The Contractor may encounter difficult drilling for the CIDH piles. This is likely due to the presence of loose material in the top 3.0 m and hard to very hard rock below the depth of 3.0 m. Groundwater may be encountered depending on the season. Casing of drilled hole may be required where loose material is encountered.

- Installation of the CIDH piles should be performed in accordance with Section 49-4 of the Standard Specifications.

- The drilling and concrete placement for CIDH pile construction shall be staggered. No open holes shall be adjacent.

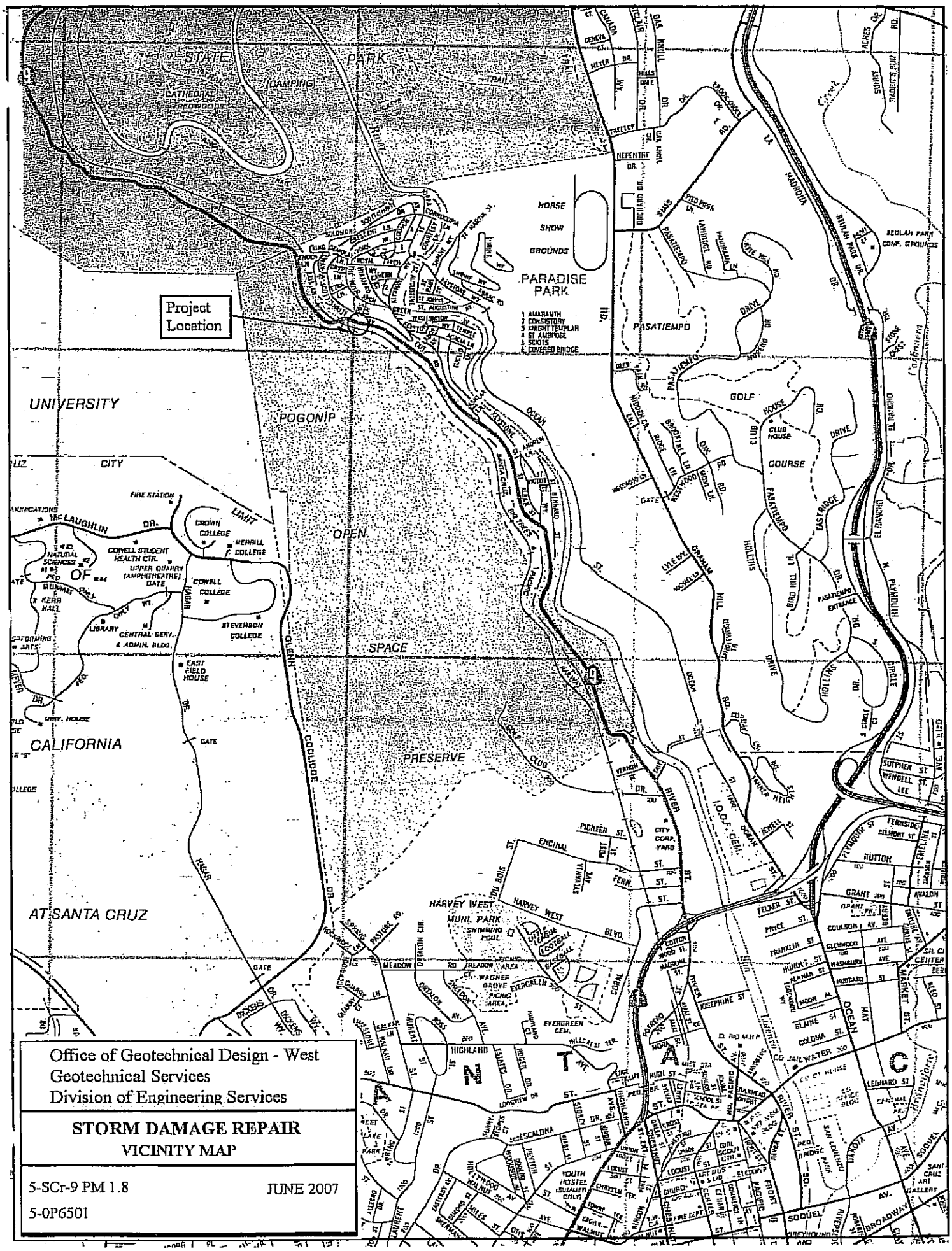
* * * * *

If you have any questions, please call Eduardo Ortega at (510) 286-4821 or Wajahat Nyaz at (510) 622-1777.

Attachments: Vicinity Map, Layout Map, Borings Log, Typical Section

c: TPokrywka, WNyaz, E☺rtega, Daily File, Route File

Eduardo ☺rtega/mm/0P6501 Foundations.doc



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Geotechnical Services
Division of Engineering Services

STORM DAMAGE REPAIR
VICINITY MAP

5-SCr-9 PM 1.8 JUNE 2007
5-0P6501

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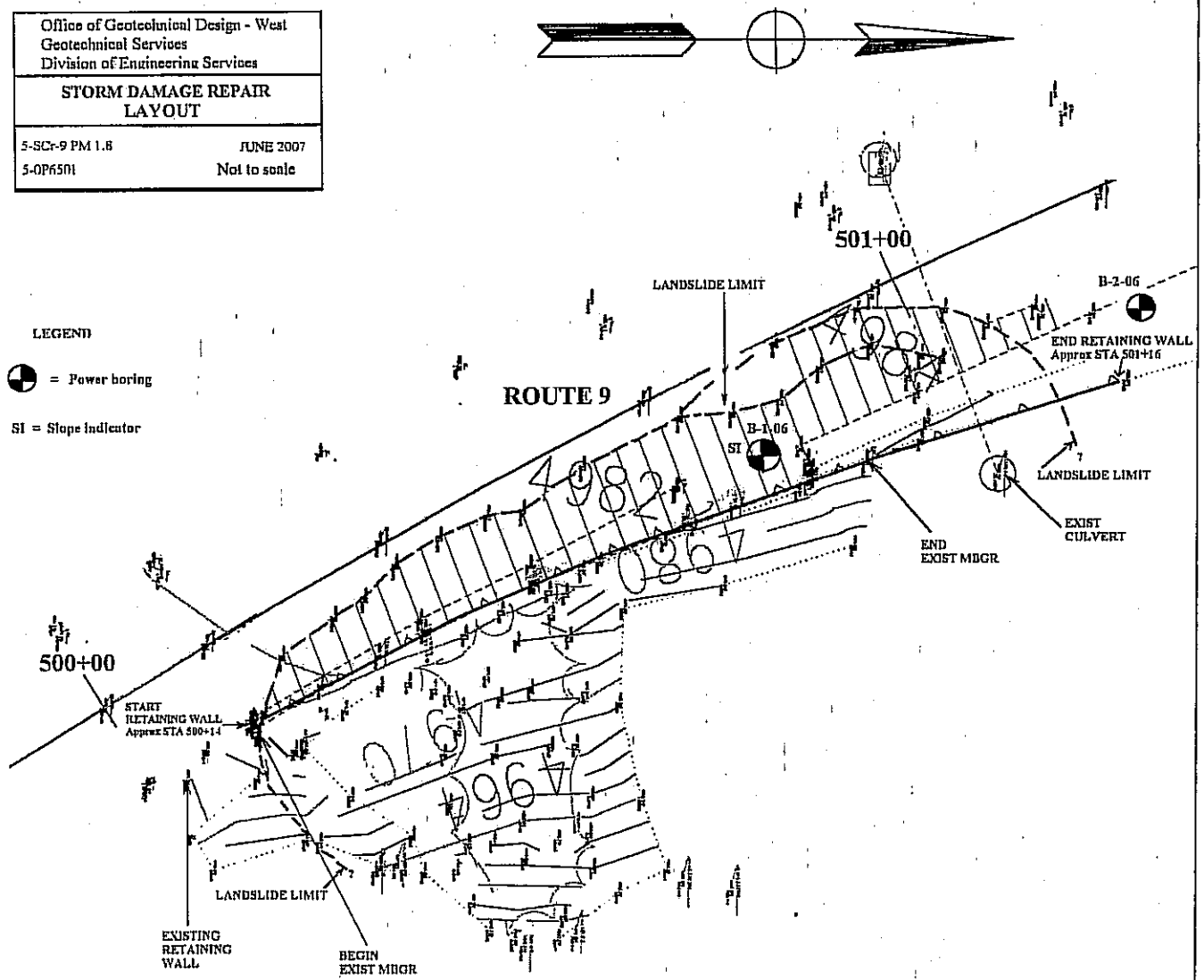
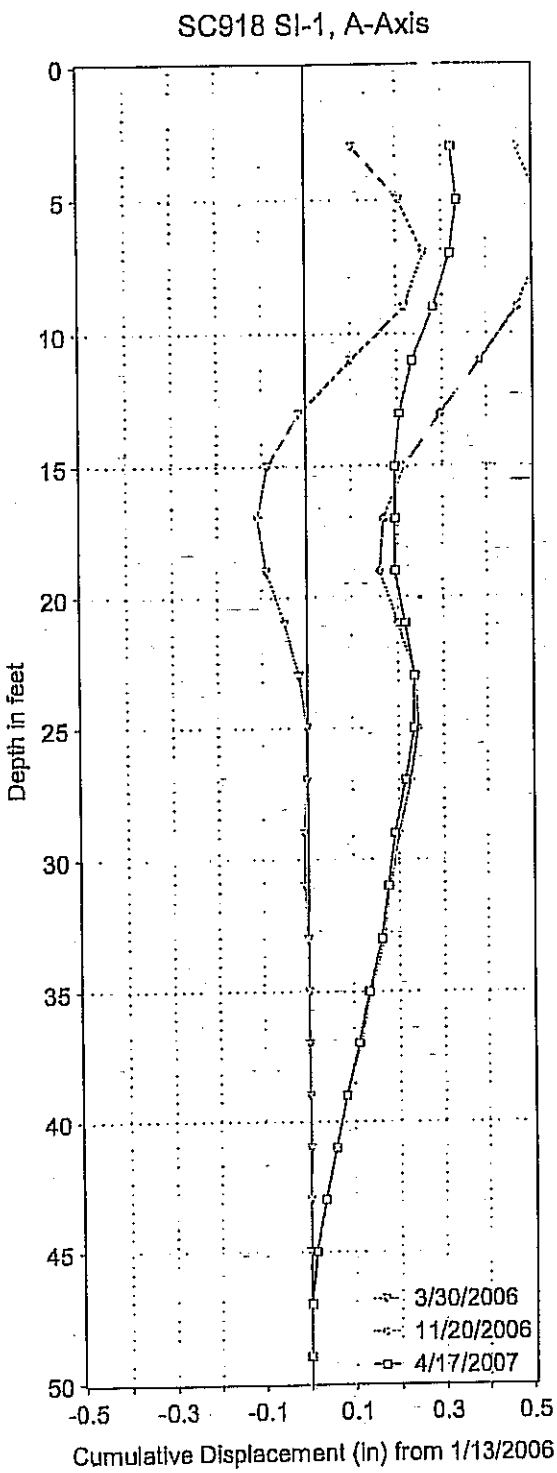
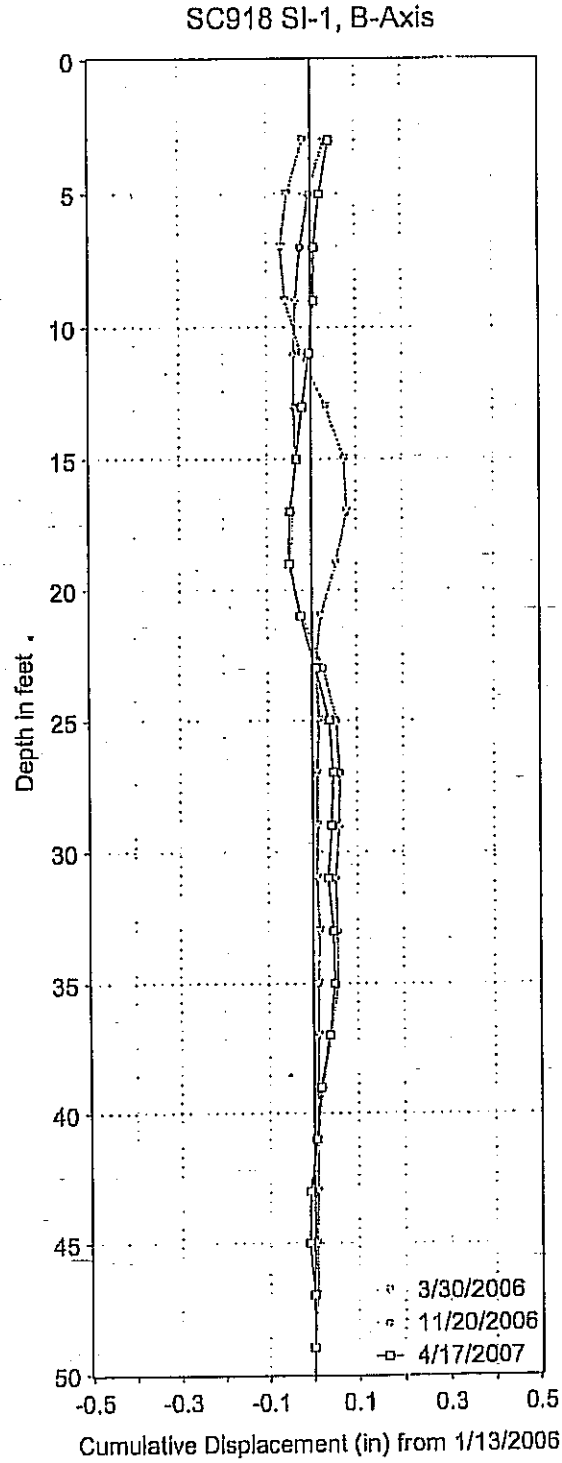
Geotechnical Services
Division of Engineering Services

STORM DAMAGE REPAIR LAYOUT

5-SCr-9 PM 1.8 JUNE 2007
5-0P6501 Not to scale







SCr-009-1.8
SI1-06

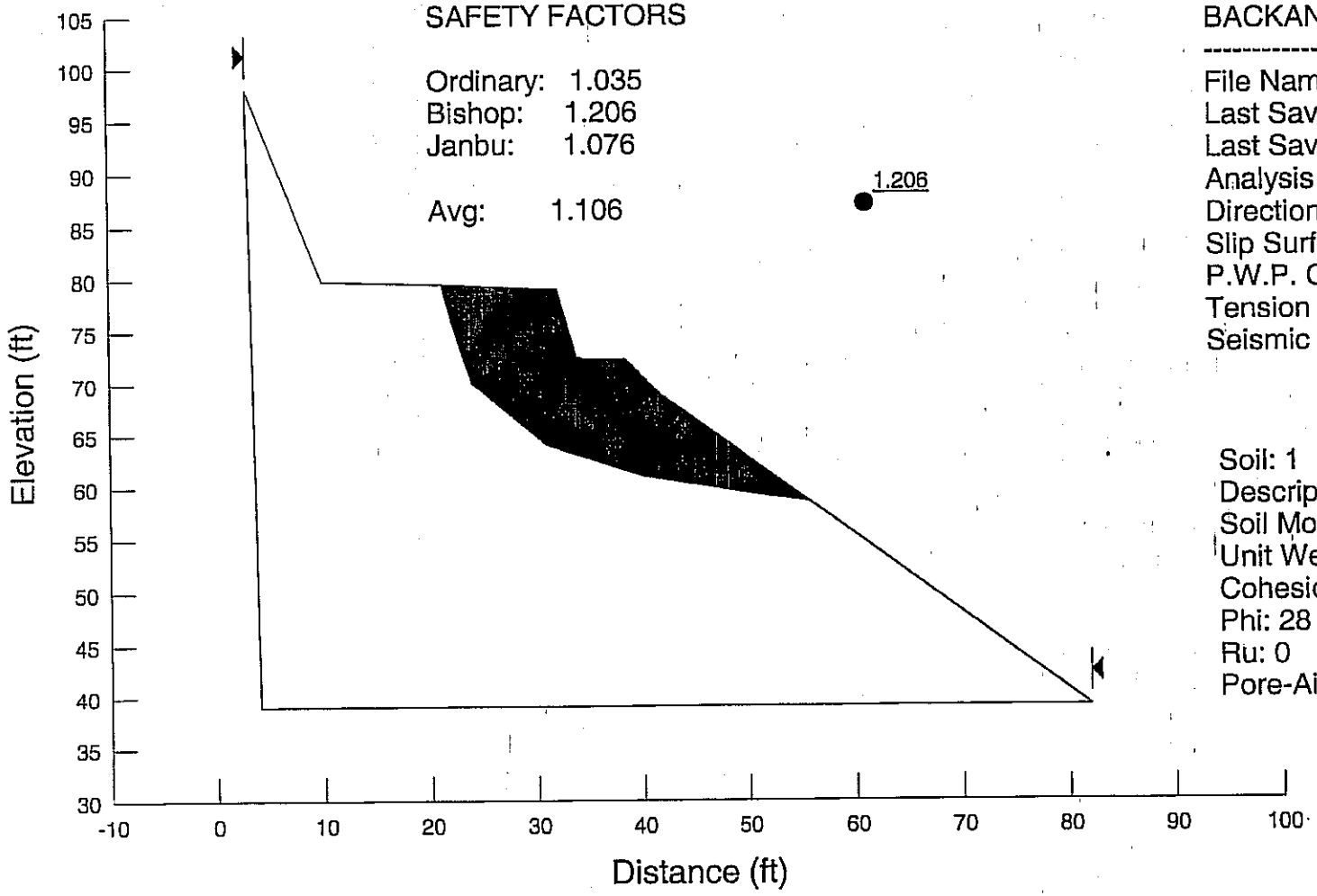
CUMULATIVE DISPLACEMENT

05-SCr-9 PM 1.8

SAFETY FACTORS

Ordinary: 1.035
Bishop: 1.206
Janbu: 1.076

Avg: 1.106



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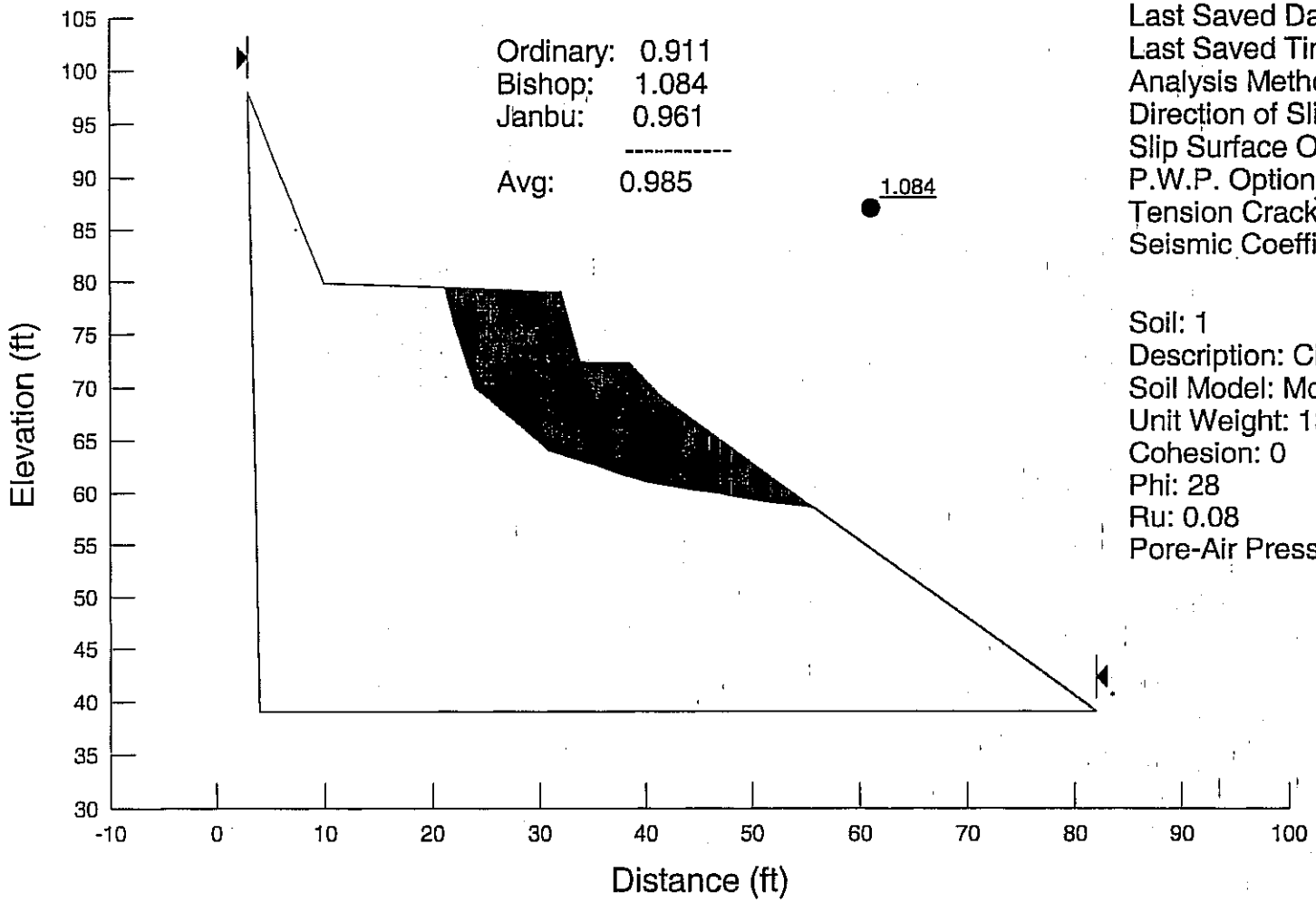
Slip Surface Option: Fully Specified
P.W.P. Option: Ru Coefficients
Tension Crack Option: (none)
Seismic Coefficient: (none)

Soil: 1
Description: Clayey Sand
Soil Model: Mohr-Coulomb
Unit Weight: 130
Cohesion: 0
Phi: 28
Ru: 0
Pore-Air Pressure: 0



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Tension Crack Option: (none)
Seismic Coefficient: (none)

Soil: 1
Description: Clayey Sand
Soil Model: Mohr-Coulomb
Unit Weight: 130
Cohesion: 0
Phi: 28
Ru: 0.08
Pore-Air Pressure: 0

XSTABL File: SCR9PM_1 5-18-** 10:22

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*        Slope Stability Analysis       *
*               using the               *
*            Method of Slices           *
*                                       *
*         Copyright (C) 1992 Ä 96       *
*   Interactive Software Designs, Inc.  *
*        Moscow, ID 83843, U.S.A.       *
*                                       *
*          All Rights Reserved          *
*                                       *
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Problem Description :

BACKANALYSIS CHECK FOR SLIDE AT 05-SCr 9 PM 1.8

SEGMENT BOUNDARY COORDINATES
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10 SURFACE boundary segments

Segment No.	x-left (ft)	y-left (ft)	x-right (ft)	y-right (ft)	Soil Unit Below Segment
1	18.0	39.0	44.0	59.0	1
2	44.0	59.0	55.0	66.5	1
3	55.0	66.5	58.4	69.0	1
4	58.4	69.0	61.6	72.3	1
5	61.6	72.3	65.6	72.3	1
6	65.6	72.3	66.2	72.5	1
7	66.2	72.5	68.0	79.0	1
8	68.0	79.0	78.0	79.4	1
9	78.0	79.4	90.0	79.8	1
10	90.0	79.8	97.0	98.0	1

ISOTROPIC Soil Parameters
---

1 Soil unit(s) specified

Soil Unit No.	Unit Weight Moist (pcf)	Unit Weight Sat. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Parameter Ru	Pore Pressure Constant (psf)	Water Surface No.
1	130.0	130.0	.0	28.00	.080	.0	0

A SINGLE FAILURE SURFACE HAS BEEN SPECIFIED FOR ANALYSIS

Trial failure surface specified by
the following 7 coordinate points :

Point No.	x-surf (ft)	y-surf (ft)
1	44.00	59.00
2	48.00	59.00
3	60.00	61.00
4	69.00	64.00
5	76.00	70.00
6	78.00	76.00
7	79.00	79.43

****
SELECTED METHOD OF ANALYSIS: Spencer (1973)
****

****
SUMMARY OF INDIVIDUAL SLICE INFORMATION
****

Slice	x-base (ft)	y-base (ft)	height (ft)	width (ft)	alpha	beta	weight (lb)
1	46.00	59.00	1.36	4.00	.00	34.29	709.
2	51.50	59.58	4.53	7.00	9.46	34.29	4123.
3	56.70	60.45	7.30	3.40	9.46	36.33	3227.
4	59.20	60.87	8.96	1.60	9.46	45.88	1863.
5	60.80	61.27	10.21	1.60	18.43	45.88	2123.
6	63.60	62.20	10.10	4.00	18.43	.00	5252.
7	65.90	62.97	9.43	.60	18.43	18.43	736.
8	67.10	63.37	12.38	1.80	18.43	74.52	2898.
9	68.50	63.83	15.19	1.00	18.43	2.29	1974.
10	72.50	67.00	12.18	7.00	40.60	2.29	11084.
11	77.00	73.00	6.36	2.00	71.57	2.29	1654.
12	78.50	77.72	1.70	1.00	73.76	1.91	221.

ITERATIONS FOR SPENCER'S METHOD

Iter #	Theta	FOS_force	FOS_moment
2	25.9159	1.0916	1.1144
3	26.2063	1.0931	1.0916
4	26.1968	1.0930	1.0931

SLICE INFORMATION ... continued :

Slice	Sigma (psf)	c-value (psf)	phi	U-base (lb)	U-top (lb)	P-top (lb)	Delta
1	214.4	.0	28.00	57.	0.	0.	.00
2	582.4	.0	28.00	334.	0.	0.	.00
3	938.4	.0	28.00	262.	0.	0.	.00
4	1151.6	.0	28.00	151.	0.	0.	.00
5	1107.4	.0	28.00	179.	0.	0.	.00
6	1095.6	.0	28.00	443.	0.	0.	.00
7	1023.3	.0	28.00	62.	0.	0.	.00
8	1343.3	.0	28.00	244.	0.	0.	.00
9	1647.4	.0	28.00	166.	0.	0.	.00
10	877.4	.0	28.00	1168.	0.	0.	.00
11	179.4	.0	28.00	418.	0.	0.	.00
12	42.1	.0	28.00	63.	0.	0.	.00

SPENCER'S (1973) - TOTAL Stresses at center of slice base

Slice #	Base x-coord (ft)	Normal Stress (psf)	Vertical Stress (psf)	Pore Water Pressure (psf)	Shear Stress (psf)
1	46.00	228.6	177.3	14.2	104.3
2	51.50	629.5	588.9	47.1	283.3
3	56.70	1014.3	949.0	75.9	456.5
4	59.20	1244.8	1164.6	93.2	560.2
5	60.80	1213.5	1327.1	106.2	538.7
6	63.60	1200.7	1313.0	105.0	533.0
7	65.90	1121.4	1226.3	98.1	497.8
8	67.10	1472.1	1609.8	128.8	653.5
9	68.50	1805.3	1974.3	157.9	801.4
10	72.50	1004.1	1583.4	126.7	426.8
11	77.00	245.5	826.8	66.1	87.3
12	78.50	59.8	221.0	17.7	20.5

SPENCER'S (1973) - Magnitude & Location of Interslice Forces

Slice #	Right x-coord (ft)	Force Angle (degrees)	Interslice Force (lb)	Force Height (ft)	Boundary Height (ft)	Height Ratio
1	48.00	26.20	465.	.98	2.73	.361
2	55.00	26.20	1857.	1.67	6.33	.264
3	58.40	26.20	2946.	1.95	8.27	.236
4	60.00	26.20	3575.	2.08	9.65	.216
5	61.60	26.20	3814.	2.20	10.77	.204
6	65.60	26.20	4406.	2.49	9.43	.264
7	66.20	26.20	4489.	2.54	9.43	.270

8	68.00	26.20	4815.	2.65	15.33	.173
9	69.00	26.20	5038.	2.68	15.04	.178
10	76.00	26.20	1653.	3.00	9.32	.322
11	78.00	26.20	206.	1.47	3.40	.433
12	79.00	.00	0.	.08	.00	.000

AVERAGE VALUES ALONG FAILURE SURFACE

Total Normal Stress = 848.37 (psf)
Pore Water Pressure = 79.25 (psf)
Shear Stress = 374.14 (psf)

Total Length of failure surface = 44.77 feet

For the single specified surface and the assumed angle of the interslice forces, the SPENCER'S (1973) procedure gives a

FACTOR OF SAFETY = 1.093

Total shear strength available along specified failure surface = 164.23E+02 lb

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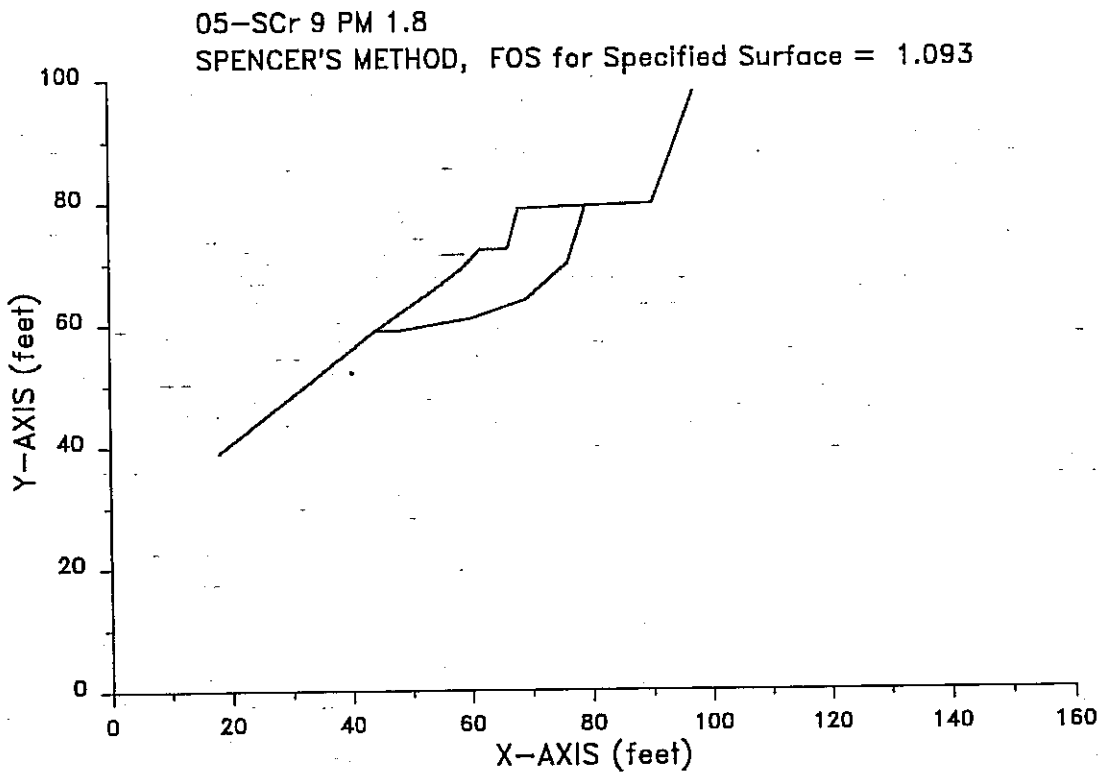
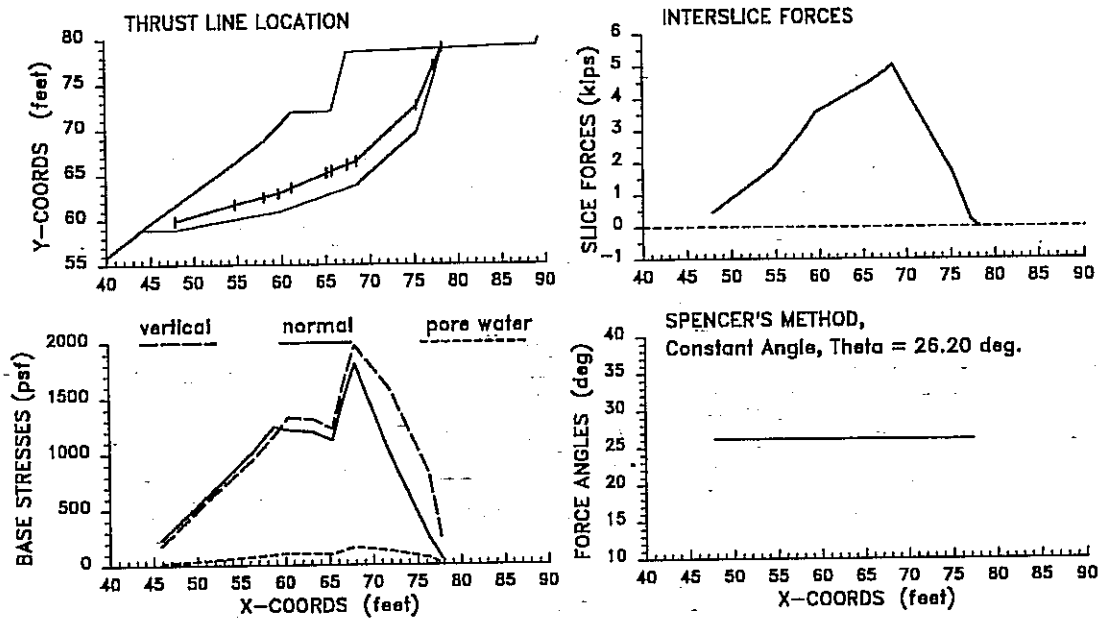


BACKANALYSIS CHECK



05-SCr 9 PM 1.8
SPENCER'S METHOD, FOS for Specified Surface = 1.093

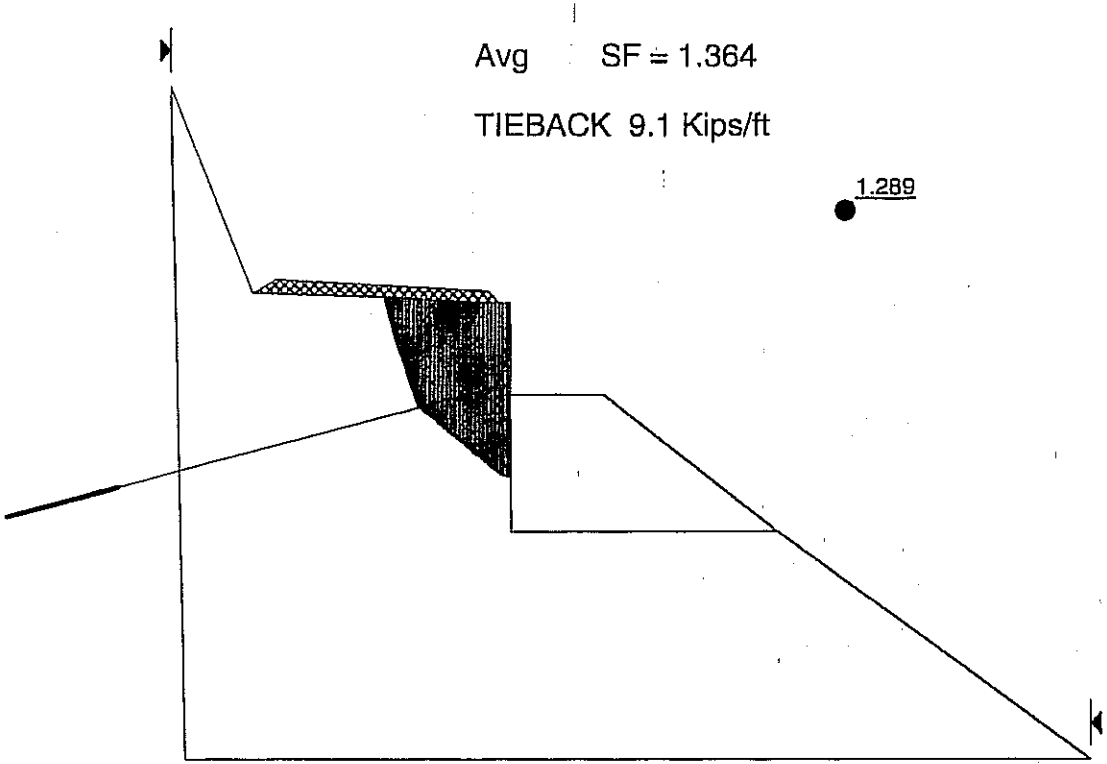
BACKANALYSIS CHECK

SAFETY FACTORS

Ordinary = 1.491
Bishop = 1.289
Janbu = 1.311

Avg SF = 1.364

TIEBACK 9.1 Kips/ft



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Analysis Method: Bishop
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P.W.P. Option: Ru Coefficients
Tension Crack Option: (none)
Seismic Coefficient: (none)

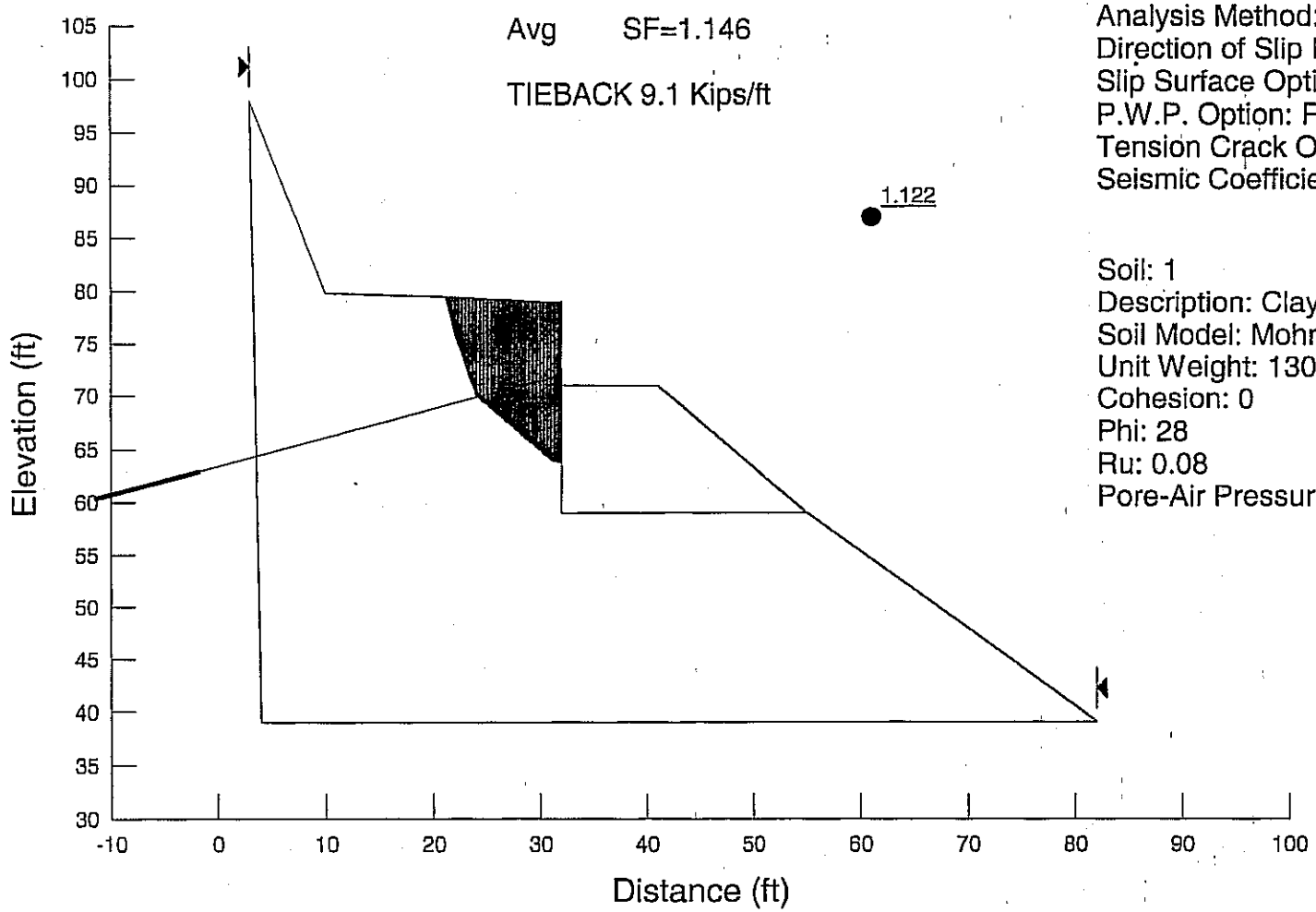
Soil: 1
Description: Clayey Sand
Soil Model: Mohr-Coulomb
Unit Weight: 130
Cohesion: 0
Phi: 28
Ru: 0.08
Pore-Air Pressure: 0

SAFETY FACTO

Ordinary SF=1.239
Bishop SF=1.122
Janbu SF=1.077

Avg SF=1.146

TIEBACK 9.1 Kips/ft



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Comments:
File Name: Final_Seism Wall SCR-9 PM 1.8_Ru.slp
Last Saved Date: 5/31/2007
Last Saved Time: 5:25:54 PM
Analysis Method: Bishop
Direction of Slip Movement: Left to Right
Slip Surface Option: Fully Specified
P.W.P. Option: Ru Coefficients
Tension Crack Option: (none)
Seismic Coefficient: Horizontal and Vertical

Soil: 1
Description: Clayey Sand
Soil Model: Mohr-Coulomb
Unit Weight: 130
Cohesion: 0
Phi: 28
Ru: 0.08
Pore-Air Pressure: 0

Equipment: Mobile B47	Station/KP:	Boring ID.: B-1-06
Hammer: Safety semi-automatic drop (140#/ 30")	Offset Distance/Line:	Date Completed: 1-10-06
Drilling Method: Rotary wash	North/East: 1828360.9ft / 6111161.9ft	Hole Diameter: 3.7in
Sampling Method: SPT, Rock Core	Ground Surface Elevation: 4982.2ft	Total Depth: 50.2ft
Notes:	Depth to GW/date measured:	Logged By: DL Appelbaum

ELEVATION (m)	DEPTH (m)	DEPTH (ft)	Graphic Log	Description	Sample Type	Sample Number	Sample Blows	Blows per Foot	Recovery (%)	RQD (%)	w/c (%)	Dry Density (pcf)	Shear Strength (tsf)	Drilling Method/ Casing	Remarks
				hot mix and cold mix.		1			56						
1518.27	0.30	1													
1517.96	0.61	2		CLAYEY SAND (SC): loose, brown, moist, subangular, fine to coarse sand, low plasticity, trace angular fine GRAVEL.											
1517.66	0.91	3													
1517.35	1.22	4													
1517.05	1.52	5													
1516.74	1.83	6				2	2 23 60	83	41						SPT pushed rock. Use N=4 (2XN for first 6").
1516.44	2.13	7		GRANITE: gray, moderately weathered, very hard, intensely to moderately fractured, iron oxide stained fracture surfaces.		3			40						
1516.13	2.44	8		CLAYEY SAND (SC): loose, brown, moist, subangular, fine to coarse sand, low plasticity, trace angular fine GRAVEL.											
1515.83	2.74	9													
1515.53	3.05	10													
1515.22	3.35	11				4	4 16 15	31	53						SPT pushed rock. Use N=8 (2XN for first 6").
1514.92	3.66	12		GRANITE: gray, moderately weathered, very hard, intensely to moderately fractured, iron oxide stained fracture surfaces.		5			43						
1514.61	3.96	13		DECOMPOSED GRANITE Well-graded SAND with SILT (SW): very dense, reddish brown, moist, angular, fine to coarse sand, nonplastic, trace subangular fine to coarse GRAVEL and small COBBLES.											
1514.31	4.27	14													
1514.00	4.57	15													
1513.70	4.88	16				6			80						
1513.39	5.18	17													
1513.09	5.49	18				7			100						
1512.78	5.79	19													
1512.48	6.10	20													

(continued)

ELEVATION (m)	DEPTH (m)	DEPTH (ft)	Graphic Log	Description	Sample Type	Sample Number	Sample Blows	Blows per Foot	Recovery (%)	RQD (%)	w/c (%)	Dry Density (pcf)	Shear Strength (tsf)	Drilling Method/ Casing	Remarks
				DECOMPOSED GRANITE Well-graded SAND with SILT (SW): very dense, reddish brown, moist, angular, fine to coarse sand, nonplastic, trace subangular fine to coarse GRAVEL and small COBBLES. *(continued)*		8			96						
1512.17	6.40	21													
1511.87	6.71	22													
1511.56	7.01	23													
1511.26	7.32	24													
1510.95	7.62	25													
						9			68						
1510.65	7.92	26													
1510.34	8.23	27		GRANITE: gray, intensely to moderately weathered, very hard, very intensely to intensely fractured, iron oxide stained fracture surfaces.											
1510.04	8.53	28													
1509.73	8.84	29													
1509.43	9.14	30													
				DECOMPOSED GRANITE SANDY SILT with GRAVEL (ML): very dense, yellowish brown, moist, subangular, fine sand/fine gravel, low plasticity.		10			96	8					
1509.12	9.45	31													
1508.82	9.75	32		GRANITE: gray, intensely to moderately weathered, very hard, very intensely to intensely fractured, iron oxide stained fracture surfaces.											
1508.51	10.06	33													
1508.21	10.36	34													
1507.91	10.67	35													
				DECOMPOSED GRANITE SANDY SILT with GRAVEL (ML): very dense, yellowish brown, moist, subangular, fine to coarse sand/fine gravel, low plasticity.		11			95	0					
1507.60	10.97	36		GRANITE: gray, intensely weathered, hard, very intensely fractured, pockets of decomposed granite: SANDY CLAY (CL), very dense, yellowish brown, moist, fine sand, medium plasticity.											
1507.30	11.28	37													
1506.99	11.58	38													
1506.69	11.89	39		GRANITE: gray, intensely to moderately weathered, hard to very hard, intensely to moderately fractured, iron oxide stained fracture surfaces.		12			86	10					
1506.38	12.19	40													
1506.08	12.50	41													
1505.77	12.80	42													
1505.47	13.11	43													
1505.16	13.41	44													

(continued)

ELEVATION (m)	DEPTH (m)	DEPTH (ft)	Graphic Log	Description	Sample Type	Sample Number	Sample Blows	Blows per Foot	Recovery (%)	RQD (%)	w/c (%)	Dry Density (pcf)	Shear Strength (tsf)	Drilling Method/ Casing	Remarks
1504.86	13.72	45		GRANITE: gray, intensely to moderately weathered, hard to very hard, intensely to moderately fractured, iron oxide stained fracture surfaces. *(continued)*		13			88	11					
1504.55	14.02	46													
1504.25	14.33	47													
1503.94	14.63	48													
1503.64	14.94	49													
1503.33	15.24	50													
				Bottom of Hole at 15.30 m (50.2 ft) on 1-10-06											Installed slope inclinometer casing. Backfilled anulus with #8 sand. Installed 6" Monitoring Well cover.
1503.03	15.54	51													
1502.72	15.85	52													
1502.42	16.15	53													
1502.11	16.46	54													
1501.81	16.76	55													
1501.50	17.07	56													
1501.20	17.37	57													
1500.89	17.68	58													
1500.59	17.98	59													
1500.29	18.29	60													
1499.98	18.59	61													
1499.68	18.90	62													
1499.37	19.20	63													
1499.07	19.51	64													
1498.76	19.81	65													
1498.46	20.12	66													
1498.15	20.42	67													
1497.85	20.73	68													
1497.54	21.03	69													

Equipment: Mobile B47	Station/KP:	Boring ID.: B-2-06
Hammer: Safety semi-automatic drop (140#/ 30")	Offset Distance/Line:	Date Completed: 1-11-06
Drilling Method: Rotary wash	North/East: 1828321.0ft / 6111179.2ft	Hole Diameter: 3.7in
Sampling Method: SPT, Rock Core	Ground Surface Elevation: 4980.2ft	Total Depth: 44.0ft
Notes:	Depth to GW/date measured:	Logged By: DL Appelbaum

ELEVATION (m)	DEPTH (m)	DEPTH (ft)	Graphic Log	Description	Sample Type	Sample Number	Sample Blows	Blows per Foot	Recovery (%)	RQD (%)	w/c (%)	Dry Density (pcf)	Shear Strength (tsf)	Drilling Method/ Casing	Remarks
				hot mix and cold mix.		1			30						
1517.67	0.30	1													
				DECOMPOSED GRANITE SILTY SAND (SM): loose, brown, moist, angular, fine to coarse sand, nonplastic, trace angular fine GRAVEL.											
1517.36	0.61	2													
1517.06	0.91	3													
1516.75	1.22	4													
1516.45	1.52	5													
						2	3 3 4	7	60						
1516.14	1.83	6													
1515.84	2.13	7		GRANITE: gray, moderately weathered, very hard, intensely fractured, iron oxide stained fracture surfaces, lenses of decomposed granite: SILTY SAND with GRAVEL, dense, reddish brown, moist, angular, fine to coarse SAND, fine to coarse GRAVEL, nonplastic.		3			71						
1515.53	2.44	8													
1515.23	2.74	9													
1514.92	3.05	10													
						4			66						
1514.62	3.35	11													
				Well-graded SAND with SILT and GRAVEL (SW): very dense, reddish brown, moist, angular, fine to coarse sand, fine to coarse gravel, nonplastic											
1514.31	3.66	12													
1514.01	3.96	13													
1513.71	4.27	14													
1513.40	4.57	15				5	44 60 60	120	60						
1513.10	4.88	16													
						6			100	11					
1512.79	5.18	17		GRANITE: gray, moderately weathered, very hard, intensely to moderately fractured, iron oxide stained fracture surfaces, lenses of decomposed granite: SILTY SAND with GRAVEL, dense, reddish brown, moist, angular, fine to coarse SAND, fine to coarse GRAVEL, nonplastic.											
1512.49	5.49	18													
1512.18	5.79	19													
1511.88	6.10	20													

(continued)

ELEVATION (m)	DEPTH (m)	DEPTH (ft)	Graphic Log	Description	Sample Type	Sample Number	Sample Blows	Blows per Foot	Recovery (%)	RQD (%)	w/c (%)	Dry Density (pcf)	Shear Strength (tsf)	Drilling Method/ Casing	Remarks
				no lenses of decomposed granite.		7			90	10					
1511.57	6.40	21													
1511.27	6.71	22													
1510.96	7.01	23													
1510.66	7.32	24													
1510.35	7.62	25				8			56	0					
1510.05	7.92	26		very intensely to moderately fractured, lenses of decomposed granite; SILTY SAND with GRAVEL, dense, reddish brown, moist, angular, fine to coarse SAND, fine to coarse GRAVEL, nonplastic.											
1509.74	8.23	27													
1509.44	8.53	28													
1509.13	8.84	29													
1508.83	9.14	30													
				intensely to moderately fractured.		9			74	0					
1508.52	9.45	31													
1508.22	9.75	32													
1507.91	10.06	33													
1507.61	10.36	34													
1507.30	10.67	35													
						10			40	8					
1507.00	10.97	36													
				SILTY SAND with GRAVEL (SM): very dense, reddish brown, moist, subangular, fine to coarse sand, fine gravel, nonplastic.											
1506.69	11.28	37													
1506.39	11.58	38													
1506.09	11.89	39													
1505.78	12.19	40													
						11			63	0					
1505.48	12.50	41													
1505.17	12.80	42													
1504.87	13.11	43		GRANITE: gray, moderately weathered, very hard, very intensely to intensely fractured, iron oxide stained fracture surfaces.											
1504.56	13.41	44													
				Bottom of Hole at 13.41 m (44.0 ft) on 1-11-06											Backfilled with bentonite chips and

(continued)

Department of Transportation
Division of Engineering Services
Geotechnical Services
Office of Geotechnical Design - North

EA:	05-0N9703
Date:	2-1-06
Drafted By:	DL Appelbaum

B-2-06

05-SCR-9 / KP 2.93 (PM 1.8)

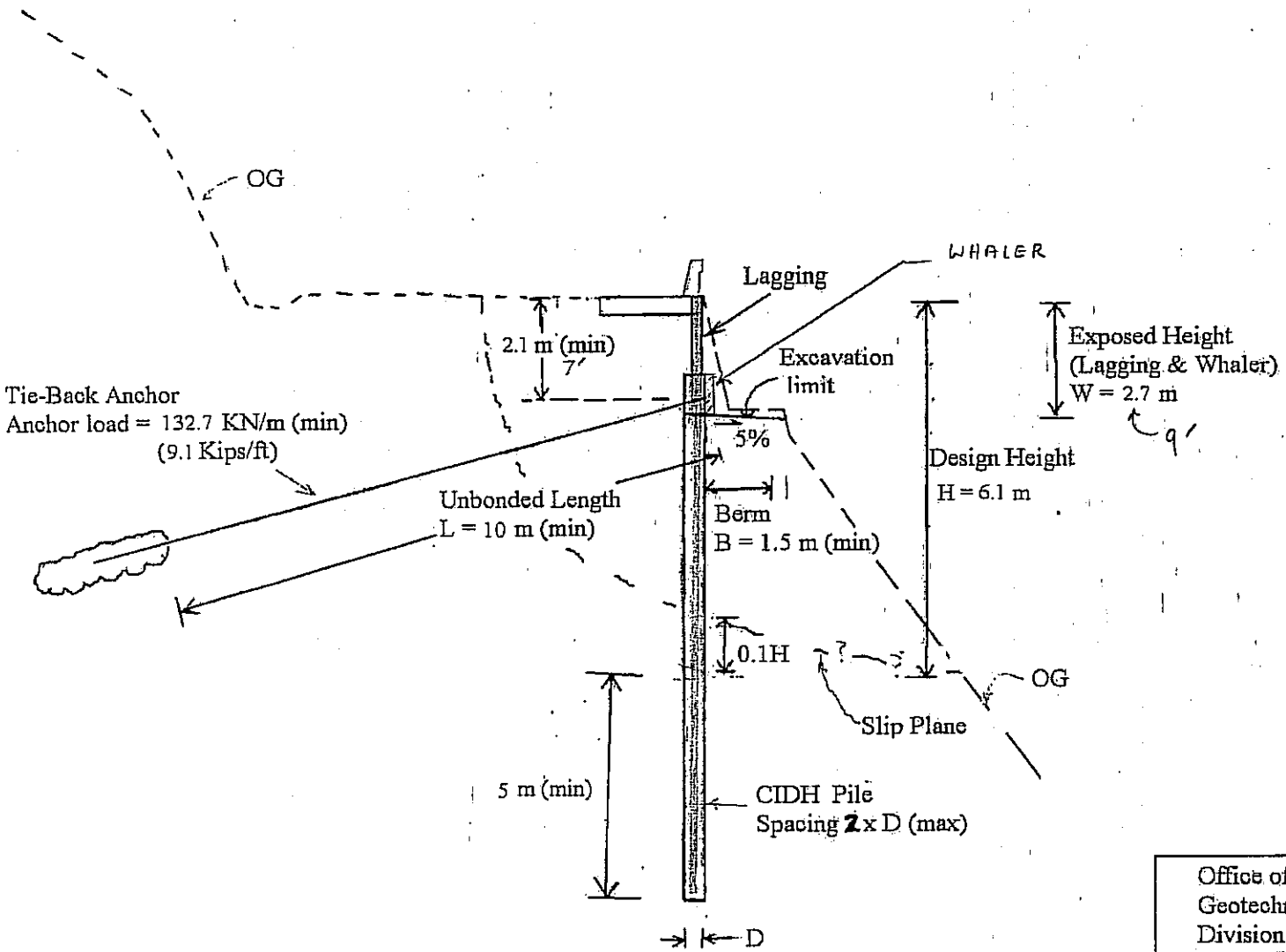
Structure Foundation Report

Equipment: Mobile B47	Station/KP:	Boring ID.: B-3-06
Hammer: Safety semi-automatic drop (140#/ 30")	Offset Distance/Line:	Date Completed: 1-12-06
Drilling Method: Rotary wash	North/East: 1828415.6ft / 6111141.4ft	Hole Diameter: 3.7in
Sampling Method: SPT, Rock Core	Ground Surface Elevation: 4985.6ft	Total Depth: 40.0ft
Notes:	Depth to GW/date measured:	Logged By: DL Appelbaum

ELEVATION (m)	DEPTH (m)	DEPTH (ft)	Graphic Log	Description	Sample Type	Sample Number	Sample Blows	Blows per Foot	Recovery (%)	RQD (%)	w/c (%)	Dry Density (pcf)	Shear Strength (tsf)	Drilling Method/ Casing	Remarks
				SANDY lean CLAY (CL): hard, brown, moist, fine to medium sand, low plasticity.		1			4						
1519.29	0.30	1													
1518.99	0.61	2													
1518.68	0.91	3													
1518.38	1.22	4													
1518.07	1.52	5													
				DECOMPOSED GRANITE SILTY SAND (SM): dense, reddish brown/gray, moist, fine to medium sand, low plasticity.		2	10 12 15	27	80						
1517.77	1.83	6													
1517.46	2.13	7				3			94						
				DECOMPOSED GRANITE SILTY SAND with GRAVEL (SM): dense, reddish brown/gray, moist, angular, fine to medium sand, fine to coarse gravel, nonplastic.											
1517.16	2.44	8													
1516.85	2.74	9													
1516.55	3.05	10				4	8 14 18	32	87						
1516.24	3.35	11													
1515.94	3.66	12		GRANITE: dark gray, moderately weathered, hard, intensely to moderately fractured, iron oxide staining on fracture surfaces.		5			89						
1515.63	3.96	13													
1515.33	4.27	14		very intensely fractured.											
1515.02	4.57	15				6			75	10					
1514.72	4.88	16		DECOMPOSED GRANITE SILTY SAND with GRAVEL (SM): very dense, reddish brown/gray, moist, angular, fine to coarse sand, fine gravel, nonplastic.											
1514.41	5.18	17		GRANITE: dark gray, moderately weathered, very hard, intensely fractured, iron oxide staining on fracture surfaces.											
1514.11	5.49	18		intensely to moderately fractured.											
1513.81	5.79	19													

(continued)

ELEVATION (m)	DEPTH (m)	DEPTH (ft)	Graphic Log	Description	Sample Type	Sample Number	Sample Blows	Blows per Foot	Recovery (%)	RQD (%)	w/c (%)	Dry Density (pcf)	Shear Strength (tsf)	Drilling Method/ Casing	Remarks
1504.26	13.72	45													capped with Quickset PCC.
1503.95	14.02	46													
1503.65	14.33	47													
1503.34	14.63	48													
1503.04	14.94	49													
1502.73	15.24	50													
1502.43	15.54	51													
1502.12	15.85	52													
1501.82	16.15	53													
1501.51	16.46	54													
1501.21	16.76	55													
1500.90	17.07	56													
1500.60	17.37	57													
1500.29	17.68	58													
1499.99	17.98	59													
1499.68	18.29	60													
1499.38	18.59	61													
1499.07	18.90	62													
1498.77	19.20	63													
1498.47	19.51	64													
1498.16	19.81	65													
1497.86	20.12	66													
1497.55	20.42	67													
1497.25	20.73	68													
1496.94	21.03	69													



Office of Geotechnical Design - West
Geotechnical Services
Division of Engineering Services

STORM DAMAGE REPAIR
TYPICAL X- SECTION

5-SCr-9 PM 1.8 JUNE 2007
5-0P6501

FOUNDATION REVIEW

DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES

To: **Structure Design**
1. Preliminary Report
2. R.E. Pending File
3. Specifications & Estimates
4. File

Geotechnical Services
1. GS (Sacramento)
2. GS

District Project Development
District Project Engineer

Date: 10/14/08

Slope Repair Wall
Structure Name

05 - SCr - 009 - 1.8
District County Route Post ~~Km~~ Mi

05 - 0P6501 36E0018
E.A. Number Structure Number

Foundation Report By: E. Ortega Dated: 7/2/07

Reviewed By: M. Friedheim (OSD) R. Price (GS)

General Plan Dated: 10/9/08 Foundation Plan Dated: 10/9/08

☒ No changes. ☐ The following changes are necessary.

FOUNDATION CHECKLIST

- ✓ Pile Types and Design Loads
- ✓ Pile Lengths
- — Predrilling
- — Pile Load Test
- — Substitution of H Piles For Concrete Piles ☐ Yes ☐ No
- — Footing Elevations, Design Loads, and Locations
- ✓ Seismic Data
- — Location of Adjacent Structures and Utilities
- — Stability of Cuts or Fills
- — Fill Time Delay
- ✓ Effect of Fills on Abutments and Bents
- ✓ LOTB's
- — Fill Surcharge
- ✓ Approach Paving Slabs
- ✓ Scour
- ✓ Ground Water
- — Tremie Seals/Type D Excavation

Office of Structure Design — Branch No. 17 — Geotechnical Services

Rev. 10/02