INFORMATION HANDOUT COVER sheet: Use for IH cover. Delete, replace, or add text to match the titles of the Information Handout contents. Use if supplemental project information includes an IH. Include cover if changes are made to IH due to addendum.

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INSERT: contract number ending in phase number 4. Road includes District–County–Route–Post Mile. Project ID phase number 1.

For Contract No. 12-0N5404

At 12-Ora-405-8.4

Identified by

Project ID 1214000057

Geotechnical Design Report

DEPARTMENT OF TRANSPORTATION
DIVISION OF ENGINEERING SERVICES
Geotechnical Services
Office of Geotechnical Design – South 1

AERIALLY DEPOSIT LEAD Report

AERIALLY DEPOSITED LEAD INVESTIGATION RESULTS
RED HILL AVENUE BETWEEN I-405 AND AIRPORT LOOP DRIVE
COSTA MESA, CALIFORNIA
CONTRACT 12A1535; EA 0N5401; TO 12-0N5401-02

MATERIALS Report

FINAL MATERIALS LETTER REPORT FOR RE-CONSTRUCTION OF SOUTHERN EMBANKMENT OF RED HILL AVENUE OVERCROSSING BRIDGE IN CITY OF COSTA MESA, CALIFORNIA.

State of California **Business, Transportation and Housing Agency**

M e m o r a n d u m

Flex your power!
Be energy efficient!

To: HOWARD NG
Branch Chief
Bridge Design Branch 20

Date: 2/10/2015

File: 12-ORA-405-PM 8.4
12-0N540
Red Hill Avenue MSE Wall

Attention: Dawit Worku

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
Geotechnical Services
Office of Geotechnical Design – South 1

Subject: Geotechnical Design Report

INTRODUCTION

In response to the request from the Office of Structure Design dated June 12, 2014, the Office of Geotechnical Design South-1 provides the following foundation recommendation for the proposed retaining walls. This report also presents the results of a geotechnical investigation performed on the movement of Mechanically Stabilized Earth (MSE) Walls (Wall Nos. 28 and 29) and underlying embankment; the movement of these walls and underlying embankment triggered progressive pavement cracks on the roadway above the wall and cause 5 inches horizontal separation between the approach slab and bridge abutment.

Figure 1: Site Vicinity Map

The subject MSE walls are located on Red Hill Avenue to the south of the I-405 in the City of Costa Mesa. The approach ramp is supported by the two MSE walls along both sound bound and

north bound Red Hill Avenue. The general location of the Site is shown on the Vicinity Map in Figure 1.

SCOPE OF WORK

The work is to investigate the backfill materials behind the walls and in the embankment, and observed movement to provide recommendations for their repairs. The scope of work includes:

1. Review background documents including existing subsurface information and as built plans;
2. Perform subsurface exploration;
3. Review groundwater monitoring data;
4. Perform geotechnical analysis on proposed retaining walls and embankment; and
5. Provide recommendations.

BACKGROUND INFORMATION

Red Hill Avenue Overcrossing (OC) was originally constructed in 1965 with five bents. The bridge was supported on driven piles, with approach embankments constructed at a slope of 1.5:1 (H:V), with approximate heights of 29 feet and 31 feet at the south and north abutments, respectively. Both the north and south approach embankments experienced about 9 inches of settlement within 60 days of the completion of construction in 1966.

In late 1980, there appeared to be work done to Abutment 7. The lower section of the existing slope fronting 405 was removed and replaced with a cast in place concrete wall with tie backs, likely making room for 405 northbound ramps.

In 2004, the bridge was replaced with a three-span bridge with CIP/PS concrete box girder, and the bents were supported by driven pile (Class 625C). The approach ramps were raised by 15 feet and 18 feet at abutment 1 and 4 respectively, and supported by MSE walls constructed on the existing embankment. The embankment slopes were flatten to 2:1 (H:V) by placing sliver fill over existing embankment slope.

In September 2006, roadway pavement cracks were observed along the entire length of the MSE wall No. 29, about 16 feet to 20 feet behind the face of the wall. The cracks had both horizontal and vertical separations (refer to “Geotechnical Forensic Study Report” dated May 2008).

In 2009, soil nail reinforcements were installed on embankment slope to stabilize the MSE walls and embankment slope. Roadway pavement was reconstructed as part of the repair project.

In May 2013, new cracks on the pavement were observed in the areas behind MSE wall reinforcements and along the entire length of the MSE walls (Wall Nos. 28 and 29). The cracks begin at about 100 feet south of the beginning of the MSE wall in the City of Costa Mesa (Figure 2), and the location and pattern of the cracks are similar to that observed in 2006. At abutment 1,

the top of MSE wall (Wall No. 29) registered cumulative (since completion of the wall) horizontal movement of about 6 inches (Figure 3). Badly mis-aligned MSE wall panels at this location tilted in every other direction.

At the toe of the wall No. 29 a gap of 3 inch wide and 2 to 3 feet deep between embankment backfill and the face of the wall (Figure 5) was also observed.

The tilting and mis-alignment of the MSE wall panels at Abutment 1, and the gap between embankment backfill and the MSE wall reported in "Geotechnical Forensic Study Report" dated May 2008, were not addressed in the 2009 repair.

Figure 2: Pavement Cracks

Figure 3: Separation at Abutment 1 (Wall No. 29)

Figure 4: Tilting and mis-alignment of MSE wall panels near Abutment 1 (Wall No. 29)

Figure 5: Gap between embankment backfill and MSE wall at the toe of the MSE wall (Wall No. 29): (Figure from "Geotechnical Forensic Study Report" dated May 2008)

In October 2013, our office recommended the closure of Lane No. 2 of sound bound Red Hill Avenue, sealing of the pavement cracks and grouting of the gaps between the embankment and the wall No. 29.

SITE EXPLORATION

Subsurface Exploration

Six boreholes (R-14-101 to R-14-106) were drilled at the site from January to March, 2013 to log and sample the subsurface soils. Most of boreholes were drilled near the pavement cracks, except for R-14-103, which was drilled at the medium of the roadway. The depths of the boreholes range from 65 to 100 feet. The boreholes were drilled with the rotary wash method using a 4.5" OD wire-line punch core. Soil samples were obtained using a 140-pound safety hammer dropping 30 inches on a Standard Penetration Test (SPT) split spoon sampler for a total penetration of 18 inches. SPT-N values were noted on the boring logs. In addition, Shelby tube samples were obtained at various depths to obtain relatively undisturbed samples. Pocket penetrometer tests were also performed on disturbed cohesive materials sampled by SPT split spoon sampler to estimate the unconfined compressive strength of the soil. However, the pocket penetrometer tests on disturbed samples can only be used as a reference.

Ten Cone Penetration Tests (CPTs) were also performed from January 7 to 10, 2013 along the entire length of the MSE wall at both sound bound and north bound of Red Hill Avenue. The depths of penetration varied from 40 feet to 60 feet depending on strength of materials (refusal) encountered.

The locations of the boreholes are shown in the following figure (Figure 6). The locations shown are approximate, and the final surveyed locations including CPT sounding will be included in the Log of Test Boring Sheets.

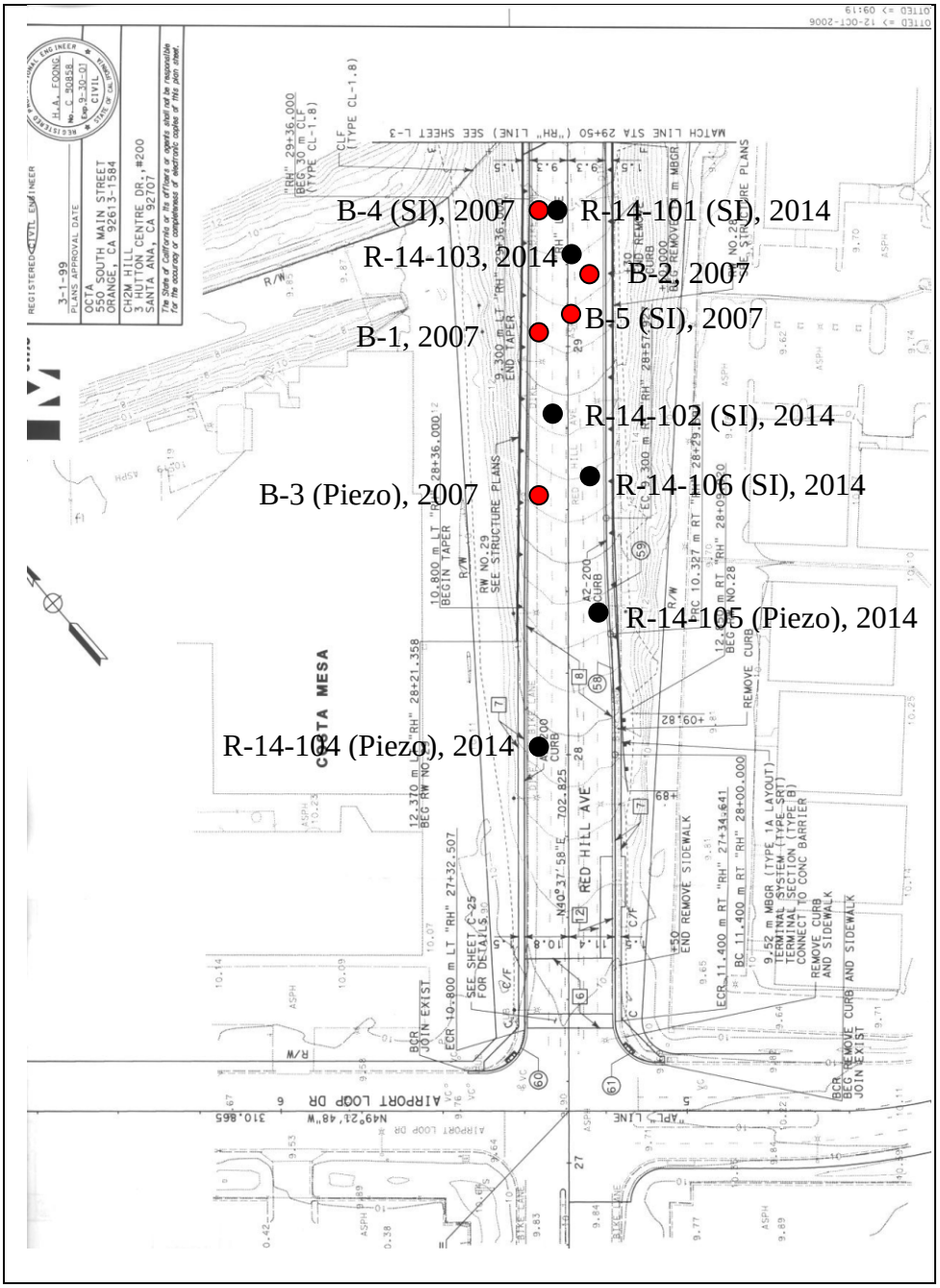


Figure 6: Borehole Locations

Laboratory Test

Soil samples from SPT Split Sampler and Shelby Tube, collected during subsurface exploration has been assigned to test for engineering properties, soil classification, consolidation/swelling test and direction shear tests.

The results are to be included in the Appendix.

SITE CONDITONS

The project site is located in the southern end of the Los Angeles physiographic, near the border between the city of Irvine and Costa Mesa, and at the southwest edge of the flat basin floor (Tustin Plain). The Los Angeles physiographic basin is a low-elevation coastal plain surrounded by mountains; the Santa Monica Mountains to the north, the Repetto Hills-Puente Hills- Santa Ana Mountains to the east, and the San Joaquin Hills to the south. The basin floor is relatively flat, gently sloping southwesterly from the surrounding hills to the coastline.

Subsurface Conditions

Based on review of available as built LOTBs, subsurface investigation conducted in January to March, 2014, the material at the site consisted of MSE Wall structural backfill, newly constructed embankment backfill behind the MSE wall, embankment backfill under the MSE walls, and native soils. The MSE wall structural backfill generally consisted of medium dense to dense silty sand and well graded sand. The embankment backfill behind the reinforced zone consisted of loose to medium dense sandy materials(SM/SW), high and low plastic clay (CH/CL), and silt (ML). Most sandy materials were encountered in the upper 7 feet. The embankment backfill under the MSE wall, which was placed during the original approach ramp construction in 1965, consisted of mostly soft to firm high plastic clay (CH) with various layers of low plastic clay (CL). The native soil underneath the ramp embankment backfill consisted of soft to medium stiff silt and clay and medium dense sand. For a more detailed description of the encountered subsurface condition, please refer to the Log of Test Boring Sheets (LOTB), which will be provided upon completion.

New slope indicator (SI) casings were installed at boreholes R-14-101, R-14-102 and R-14-106 after completion of drilling; and two new piezometers were also installed at boreholes R-14-104, and R-14-105.

Groundwater Monitoring

According to groundwater readings from three piezometers (Boreholes No. B-3, R-14-104, and R-14-105), the groundwater varies between 23 feet and 21 feet (MSL) in elevation.

Faulting and Seismicity

Both deterministic and probabilistic seismic analyses were performed using ARS online, based on average shear wave velocity of 270 m/sec, estimated from the subsurface exploration. According to the analysis, the seismic design at the project site is governed by deterministic analysis. Controlling fault parameters considered for the analysis were summarized in Table 1.

Table 1: Summary of Faults

Fault Name	Type	Magnitude (M_w)	Distance (miles)	PGA (g)
San Joaquin Hills (ID 376)	R	7.0	0.0	0.62
NewPort Inglewood – Fault Zone (ID 366)	SS	7.2	4.2	0.36

Estimated design PGA value is 0.62g based on the design ARS curve.

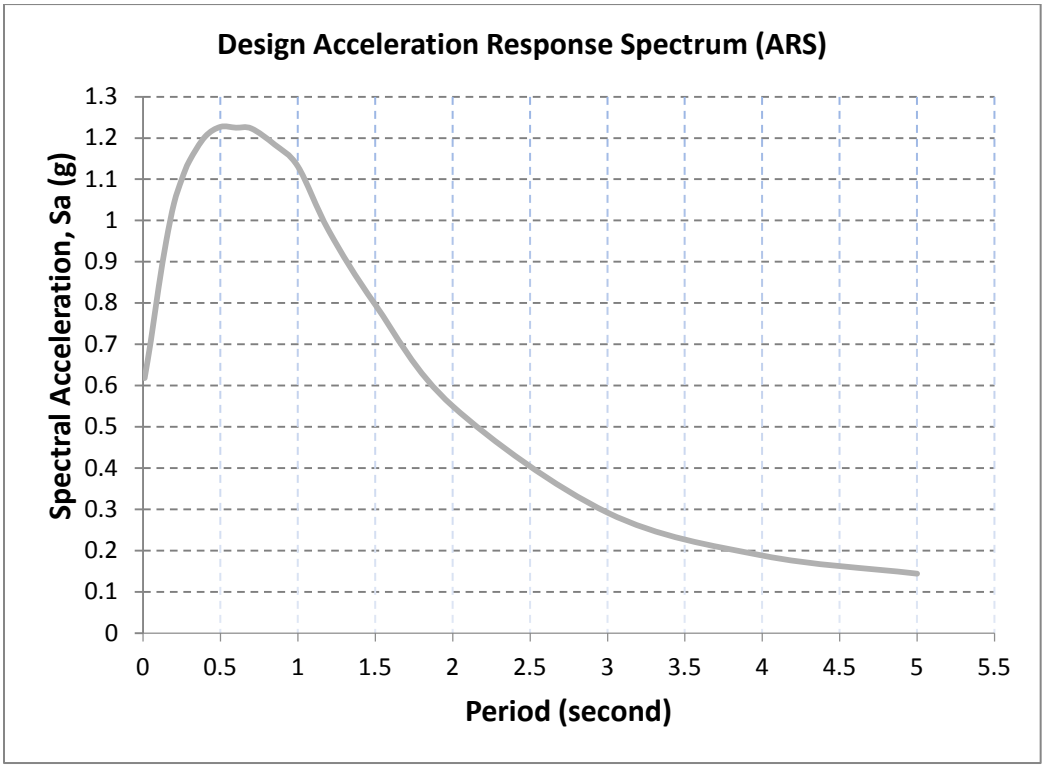


Figure 7. Design ARS Curve

Liquefaction

Liquefaction is a phenomenon in which loose, saturated, fine grained granular soils behave like a fluid when subjected to high intensity ground shaking. Liquefaction occurs when three general conditions exist: (1) shallow ground water (2) low-density, fine, sandy soils and (3) high-intensity ground motion. Based on subsurface information, there is a medium dense to dense sandy layer with fine grained material (> 11%), and the liquefaction potential of this layer is expected to be low.

REMEDIAL OPTIONS EVALUATED

Based on the observed distress in the roadway, and the recorded movement in the slope indicator (SI), the MSE walls are continuously tilting outward. The vertical extent of the movement reaches about 7 to 10 feet below the wall. The SI reading did not register apparent shear failure surface - distinct change and break of displacement profile.

The movement of the MSE walls is considered to be due to poor soil condition below the wall and at the slope surface. Based on information retrieved from subsurface exploration, the underlying embankment was built with high-plastic clay, which generally has high swelling and shrinkage potential and is highly sensitive to moisture change, causing softening and creeping of soils.

To stabilize the embankment and the wall, the problematic high-plastic clay need to be removed, reinforced or buttressed to support the embankment and the wall. Due to the presence of underground utilities, soil nail reinforcements, and characteristic of high-plastic clay, ground improvement methods using soil mixing and grouting were not considered for this project.

The following are feasible options to stabilize or rebuild the walls. Most of these options have been evaluated jointly by the project development team (PDT). The sketches of the options were shown in the appendix.

- Option 1a: Complete replacement of the embankment and walls

- Option 1b: Complete removal of the existing embankment and walls. Construct retaining walls and place embankment above the walls.

- Option 1c: Construct new embankment and new walls; with complete removal of existing MSE walls. The new embankment will be constructed over the existing embankment.

- Option 2a: Construct pile supported embankment and new retaining walls; with complete removal of existing MSE walls and partial removal of existing embankment.

- Option 2b: Construct new pile supported retaining walls; with complete removal of existing MSE walls.

Options 1a, 1b and 2a were ruled out due to high construction cost, requirement of full lane closures, and relocations of underground and overhead utilities. Option 2b was also ruled out due to the construction difficulty to be caused by pile installations through previously installed soil nails.

RECOMMENDATIONS

Based on all the constraints discussed above, option 1c was considered to be the most suitable and feasible solution for this project. Since the option 1c will induce a long-term settlement caused by consolidation of native compressive clay soils due to additional surcharge load, the settlement will be monitored during and after the placement of sliver fills and wall construction. The associated downdrag forces on the piles are considered in the design. The settlement of retaining wall should be less than permissible values provided by Structure Design since the piles will transfer all the loads from the wall to competent soil layers. Due to close proximity of business buildings to the project site and to minimize construction noise building during pile installation, CIDH piles are recommended.

According to the information provided by Structure Design and District Design, the design wall height varies from 8 feet to 24 feet. The maximum sliver fill is about 20 feet near existing bridge abutment with average sliver fill of about 12 feet.

Due to high demand on lateral capacity of the piles, two rows of 30 inches CIDH piles are used for wall height up to 16 feet and three rows of 30 inches CIDH piles for greater than 16 feet. The pile spacing is 2.5 times pile diameter.

Engineering Design Parameters

The retaining walls will support the embankment consisting of newly placed structural backfill and existing high plastic clay materials with 2(H):1(V) embankment slope at the top of the wall.

Considering soil nails installed in the exiting embankment, a typical friction angle (34 degree) of structure backfill material over 2(H):1(V) existing embankment slope, an average friction angle of 30 degree can be used for service and strength condition. Note that soil nails installed through the existing embankment will also reduce lateral earth pressure from existing embankment.

For the extreme condition, an average friction angle of 30 degree, cohesion of 200 pound per square feet (psf), and horizontal seismic acceleration coefficient of about 0.2 can be used for the design. The horizontal seismic acceleration coefficient is estimated based on estimated peak ground acceleration of 0.62 g and Caltrans practice, which is to use one third of peak ground acceleration as horizontal seismic acceleration for the wall design.

Design groundwater elevation is assumed to be 25 feet considering seasonal fluctuation.

Table 2: Engineering Parameters (LPile and Shaft Analysis):

Elevation (ft)	Soil Type	Effective Unit Weight (γ'), lb/in^3 (lb/ft^3)	Friction Angle, (ϕ), degree	Undrained Shear Strength (Su), lb/in^2 (lb/ft^2)	Soil Strain Parameter (ε_{50})	Soil Modulus (k), lb/in^3
70 to 55	Sand/Silty Sand	0.069 (115)	34			90
55 to 35	Clay	0.066 (115)		7 (1000)	0.01	100
35 to 25	Clay	0.066 (115)		2.76 (400)	0.02	30
25 to 18	Clay/Silt	0.03 (52.6)		4.86 (700)	0.01	100
18 to 5	Sand	0.034 (57.6)	34			60
5 to -15	Silt/Clay	0.03 (52.6)		10.4 (1500)	0.007	500
Below -15	Sand/Silty sand/ Silt	0.034 (57.6)	37			125

Note: ε_{50}: strain corresponding to a stress of 50 percent of the ultimate stress

Lateral Capacity Analysis

According to the information provided by Structure Design, the 30-inch CIDH piles are to be staggered at 2.5 times pile diameter center to center (CTC) space, and cracked inertial moment of the pile is 11100 in^4. The structural nominal capacities of the pile are provided as follows:

Table 3: 30 inches CIDH Pile Structural Capacity

	M_p (Kips-ft)	M_n (Kips-ft)	V_n (Kips)	Max Lateral Movement (in)
Service Limit				½
Strength Limit		552	113	
Extreme Limit	618		113	

For the lateral capacity analysis of the pile, Structure Design recommended using the cracked inertial moment for strength limit state and extreme limit state, and the gross inertial moment for service limit state. In addition, for P-Delta effect in the analysis, an axial load of 200 kips was recommended to be used for service limit state and extreme limit state and 300 kips for strength limit state. Downdrag effect associated with the consolidation of compressive clay layers was also included in these axial loads.

Considering the pile spacing, and staggered pile arrangement, average P_multiplier of 0.55 was used to account for group effect of the piles on lateral capacity. The p-y curve is reduced by multiplying p value (lbs/in.) with an average P_multiplier while the y value (in.) remains the same.

The lateral capacity analysis was performed using LPILE V2012, and engineering parameters shown on the table 2. The analysis results are summarized in following table.

Table 4: Pile Lateral Capacity

	Capacity for	Pile Capacity (Kips)	Pile Length (ft)
Service Limit	Max Lateral Movement: ½ inches	22	30
Strength Limit	M_n: 552 Kips-ft	49	30
Extreme Limit	M_p: 618 Kips-ft	54	30

Axial Capacity Analysis

Axial capacity analysis of the pile was performed using Shaft V6.0, and engineering parameters shown on Table 2. Considering the pile spacing, and staggered pile arrangement, average reduction factor of 0.65 was used to account for group effect of the piles on axial capacity. Downdrag effect was considered only for service limit, assuming the negative side resistance will diminish, or even become positive for strength limit state and extreme limit state, in which the pile movement is greater or equal to surrounding soil movement. Based on the finite element analysis (FEA), the negative side resistance is assumed to be developed down to elevation 18 feet, which is at the top of sand layer.

The engineering analyses of the walls are summarized in the following tables.

Table 5: Wall No. 1

Wall Location		Pile Type	Bottom of Footing Elevation (ft)	Service-I Limit State Load per Pile (kips)	Total Permissible Settlement (inches)	Required Factored Nominal Resistance (kips)				Design Tip Elevation (ft)	Specified Tip Elevation (ft)	Required Nominal Driving Resistance (kips)
Station						Strength/Construction		Extreme Event				
Beg	End					Comp. (φ= 0.7)	Tension (φ= 0.7)	Comp. (φ= 1.0)	Tension (φ= 1.0)			
0.00	168.00	30" CIDH	34.70	105	2	225	N/A	150	N/A	-25 (a) 5 (d)	-25	N/A
168.00	320.00	30" CIDH	34.54	130	2	250	N/A	215	N/A	-25 (a) 5 (d)	-25	N/A
320.00	361.00	30" CIDH	34.54	130	2	280	N/A	215	N/A	-25 (a) 5 (d)	-25	N/A
361.00	400.00	30" CIDH	38.20	130	2	280	N/A	215	N/A	-25 (a) 5 (d)	-25	N/A
400.00	435.00	30" CIDH	38.54	130	2	280	N/A	215	N/A	-25 (a) 5 (d)	-25	N/A
435.00	493.39	30" CIDH	33.95	130	2	250	N/A	240	N/A	-25 (a) 5 (d)	-25	N/A
493.39	503.39	30" CIDH	37.95	120	2	215	N/A	185	N/A	-25 (a) 5 (d)	-25	N/A
503.39	513.39	30" CIDH	41.95	120	2	215	N/A	185	N/A	-25 (a) 5 (d)	-25	N/A
513.39	523.39	30" CIDH	45.95	120	2	215	N/A	185	N/A	-20 (a) 10 (d)	-20	N/A
523.39	533.93	30" CIDH	49.95	120	2	215	N/A	185	N/A	-20 (a) 10 (d)	-20	N/A

Table 6: Wall No. 2

Wall Location		Pile Type	Bottom of Footing Elevation (ft)	Service-I Limit State Load per Pile (kips)	Total Permissible Settlement (inches)	Required Factored Nominal Resistance (kips)				Design Tip Elevation (ft)	Specified Tip Elevation (ft)	Required Nominal Driving Resistance (kips)
Station						Strength/Construction		Extreme Event				
Beg	End					Comp. (φ= 0.7)	Tension (φ= 0.7)	Comp. (φ= 1.0)	Tension (φ= 1.0)			
0.00	20.23	30" CIDH	34.70	85	2	165	N/A	100	N/A	-20 (a) 5 (d)	-20	N/A
20.23	38.23	30" CIDH	36.70	85	2	165	N/A	100	N/A	-20 (a) 5 (d)	-20	N/A
36.23	67.22	30" CIDH	39.20	85	2	165	N/A	100	N/A	-20 (a) 5 (d)	-20	N/A

Table 7: Wall No. 3

Wall Location		Pile Type	Bottom of Footing Elevation (ft)	Service-I Limit State Load per Pile (kips)	Total Permissible Settlement (inches)	Required Factored Nominal Resistance (kips)				Design Tip Elevation (ft)	Specified Tip Elevation (ft)	Required Nominal Driving Resistance (kips)
Station						Strength/Construction		Extreme Event				
Beg	End					Comp. (φ= 0.7)	Tension (φ= 0.7)	Comp. (φ= 1.0)	Tension (φ= 1.0)			
0.00	239.62	30" CIDH	32.60	105	2	225	N/A	150	N/A	-25 (a) 5 (d)	-25	N/A
239.62	335.62	30" CIDH	32.44	130	2	250	N/A	215	N/A	-25 (a) 5 (d)	-25	N/A
335.62	407.62	30" CIDH	32.44	130	2	280	N/A	215	N/A	-25 (a) 5 (d)	-25	N/A
407.62	445.62	30" CIDH	34.44	130	2	280	N/A	215	N/A	-25 (a) 0 (d)	-25	N/A
445.62	471.62	30" CIDH	34.44	120	2	260	N/A	225	N/A	-25 (a) 0 (d)	-25	N/A
471.62	510.12	30" CIDH	38.10	130	2	280	N/A	215	N/A	-25 (a) 0 (d)	-25	N/A
510.12	527.62	30" CIDH	34.35	130	2	280	N/A	270	N/A	-25 (a) 0 (d)	-25	N/A

527.62	579.98	30" CIDH	33.85	135	2	250	N/A	250	N/A	-25 (a) 0 (d)	-25	N/A
579.98	589.98	30" CIDH	37.85	120	2	215	N/A	185	N/A	-25 (a) 5 (d)	-25	N/A
589.98	599.98	30" CIDH	41.85	120	2	215	N/A	185	N/A	-20 (a) 10(d)	-20	N/A
599.98	615.50	30" CIDH	45.85	120	2	215	N/A	185	N/A	-20 (a) 10 (d)	-20	N/A

Table 8: Wall No. 4

Wall Location		Pile Type	Bottom of Footing Elevation (ft)	Service-I Limit State Load per Pile (kips)	Total Permissible Settlement (inches)	Required Factored Nominal Resistance (kips)				Design Tip Elevation (ft)	Specified Tip Elevation (ft)	Required Nominal Driving Resistance (kips)
Station						Strength/Construction		Extreme Event				
Beg	End					Comp. (φ= 0.7)	Tension (φ= 0.7)	Comp. (φ= 1.0)	Tension (φ= 1.0)			
0.00	58.38	30" CIDH	33.85	85	2	165	N/A	100	N/A	-20 (a) 5 (d)	-20	N/A

Notes:

1) Design tip elevations are controlled by: (a) Compression and (d) Lateral Load.
2) The specified tip elevation shall not be raised.
3) Downdrag effect on design tip elevation was considered only for service limit, assuming the negative side resistance will diminish, or even become positive for strength limit state and extreme limit state, in which the pile movement is greater or equal to surrounding soil movement.

Long-Term Settlement Analysis

According to an obtained chronology of Redhill OC (Bridge No. 55-439), the bridge was originally constructed in 1966 with maximum embankment height of 30 feet. There was 0.75 feet to 1 ft of settlement occurred within 60 days of the construction of the approach embankment. The ground water was 7 to 10 feet below original grade then.

According to EMI Structure Foundation Report for Proposed Mechanically Stabilized Embankment (MSE) Wall dated September 25, 1997, a waiting period of 10 months was estimated for the MSE wall construction, and it was decreased to 5 months with the surcharge load of a 3-meter thick blanket of soil. Based on actual settlement monitoring data, the settlements were done within about 90 days after the completion of the surcharge.

Based on available settlement data collected in 1966, and 2000, available LOTBs, and typical ranges of engineering parameters for cohesive soils and granular soils, FEA using Plaxis 2D was performed for sliver fill heights of 10 feet and 16 feet. The purpose of the FEA is to better understand the behavior of the wall and embankment considering construction sequence; estimating a short-term and long-term settlement, stresses on the wall and embankment, and limit of downdrag effect for the pile design.

Based on the FEA results, the estimated maximum settlement is about 1 inch at retaining wall locations, 2 inches under roadway section, and 4 to 5 inches in sliver fill section between the wall and the crest of roadway embankment. The consolidation settlements (95% consolidation) will take place within 90 days after completion of the backfill placement. The waiting period of 90 days is based on previous settlement monitoring data.

Actual settlements will be monitored during and after construction to verify and determine the completion of consolidation.

CONSTRUCTION CONSIDERATIONS

Drilled Shaft Foundation

Cave-in potential during construction of the pile should be anticipated since the recommended shaft tip elevations are lower than the groundwater table elevation, and there are sandy granular layers between clay layers.

Section 49-3.02C(1):

Sequence of drilled shaft construction can affect the performance and integrity of the piles while center-to-center spacing of the drilled shaft is less than three times pile diameter. Construction of adjacent drilled shafts should not be started before sufficient strength of the Portland cement concrete of the previously installed adjacent drilled shafts has developed.

Before excavation for wall footing and pile installation, existing soil nail reinforcement locations should be verified in the field by stripping surfacial material of the existing embankment. If the wall footing will be conflict with the soil nail reinforcements, the nails should be cut one foot beyond the footing. If the piles will be conflict with the soil nail reinforcements, the piles can be rearranged to avoid the nails and have clearance of 6 inches between piles and nails.

Section 19-6: Embankment Construction

Structure backfill must be used for embankment construction. The structure backfill must have a sand equivalent value of at least 10 and comply with grading requirements shown in the following table.

Table 9: Grading requirement for roadway structure backfill

Sieve size	Percentage passing
3"	100
No. 4	35–100
No. 30	20–100

Section 19-6.03D: Settlement Periods and Surcharge

Due to the presence of compressive clay layers below the groundwater, there will be consolidation settlement. In order to prevent the distress of approach slab and the pavement section caused by consolidation settlement, the settlement period of 90 days are recommended. The settlement periods should be verified through settlement monitoring program.

Settlement Monitoring and Instrumentation

Consolidation settlement should be monitored to verify the completion of consolidation process and determine if increase or decrease of settlement periods is necessary.

Table 10: Location of Temporary Monuments

Retaining Walls and Embankment	From Stations to Stations	Locations of temporary monuments
Wall No. 1	0+00 to 4+50	Equally spaced at 50 feet along the face of the retaining wall. One at top of the wall and one at middle of the wall
Southbound Embankment	0+00 to 4+50	Equally spaced at 50 feet along the embankment. One at the crest of embankment.
Wall No. 3	0+00 to 5+50	Equally spaced at 50 feet along the face of the retaining wall. One at top of the wall and one at middle of the wall
Northbound Embankment	0+00 to 5+50	Equally spaced at 50 feet along the embankment. One at the crest of embankment.

Settlement monitoring must comply with the following schedule:

- Every 3 days in the first 2 months after completion of the embankment
- Every week after 2 months after completion of the embankment

Pre-construction meeting should be held before construction, and geotechnical engineer should be invited for the meeting.

If you have any questions regarding this report, please contact Seugnwoon Han.

Seungwoon Han Ph.D, P.E.
Transportation Engineer
OGDS-1

APPENDIX

Table 1A. Pros and Cons of Options

Option No.	Pros	Cons	Comments
1a	• Complete removal of problematic high plastic clay used to construct the embankment.	• Structural stability of existing piles during construction need to be addressed. • Temporary shoring with additional support is required. • Removal or reroute of existing utilities. • Complete closure of roadway.	• After removal of existing MSE walls and embankment, new embankment will first be constructed and then new retaining walls (pile supported walls) will be built on the top of the new embankment. • Embankment must be constructed using structural back fill materials.
1b	• Complete removal of problematic high plastic clay.	• Structural stability of existing piles during construction need to be addressed. • Temporary shoring with additional support is required. • Require removal or reroute of existing utilities. • Complete closure of roadway.	• After removal of existing MSE walls and embankment, new retaining walls (pile supported walls) will first be built, and then embankment will be constructed on the top of the walls. • Embankment must be constructed using structural back fill materials.
1c	• No effect on existing piles at Abutment 1. • Existing soil nail reinforcements remain in place. • No effect on existing buried utilities.	• Maintenance effort is expected due to the potential of the embankment movement caused by remaining high plastic clay. • Grouting of existing gaps/failure surface within the remaining embankment may be required. • Additional settlement may occur due to additional embankment fill over existing embankment.	• Existing MSE wall will be removed. • New embankment must be constructed using structural back fill materials. • Settlement monitoring must be performed during construction.
2a	• No effect on existing piles at Abutment 1. • existing soil nail reinforcements remain in place	• Require removal or reroute of existing utilities.	• Existing MSE wall and material behind the wall will be removed. • CIDH piles with load transfer platform will be constructed on remaining existing embankment.
2b	• No effect on existing piles at Abutment 1. • Existing soil nail reinforcements remain in place. • No effect on existing buried utilities.	• Maintenance effort is expected due to the potential of the embankment movement caused by remaining high plastic clay. • Grouting of existing gaps/failure surface within the remaining embankment is required.	• Existing MSE wall will be removed.

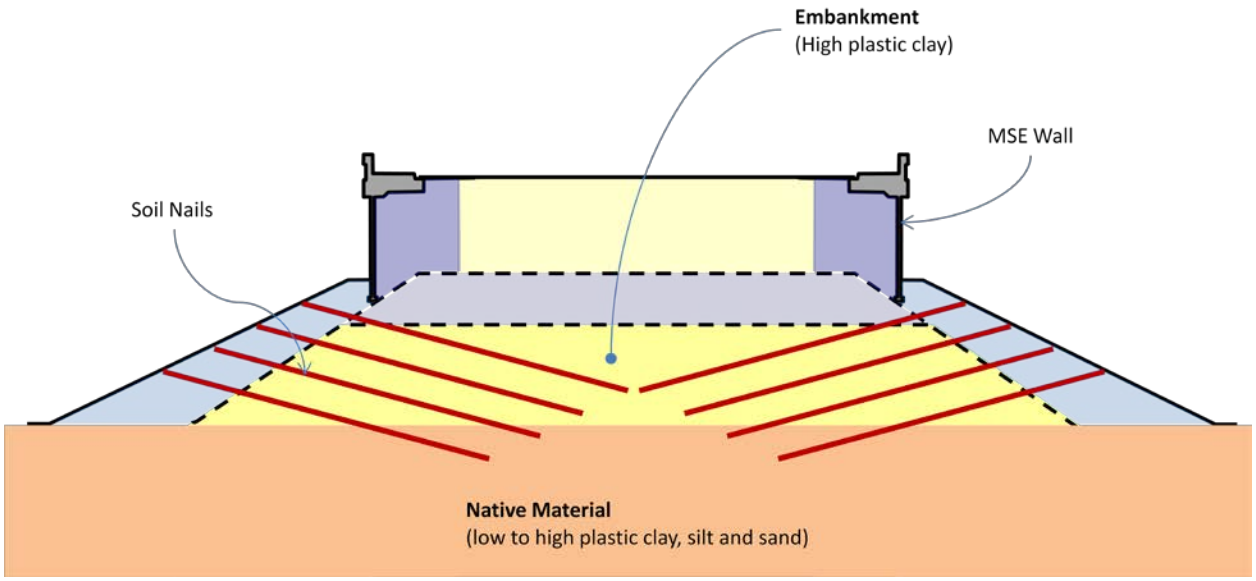


Figure 1A: Existing Embankment and Walls.

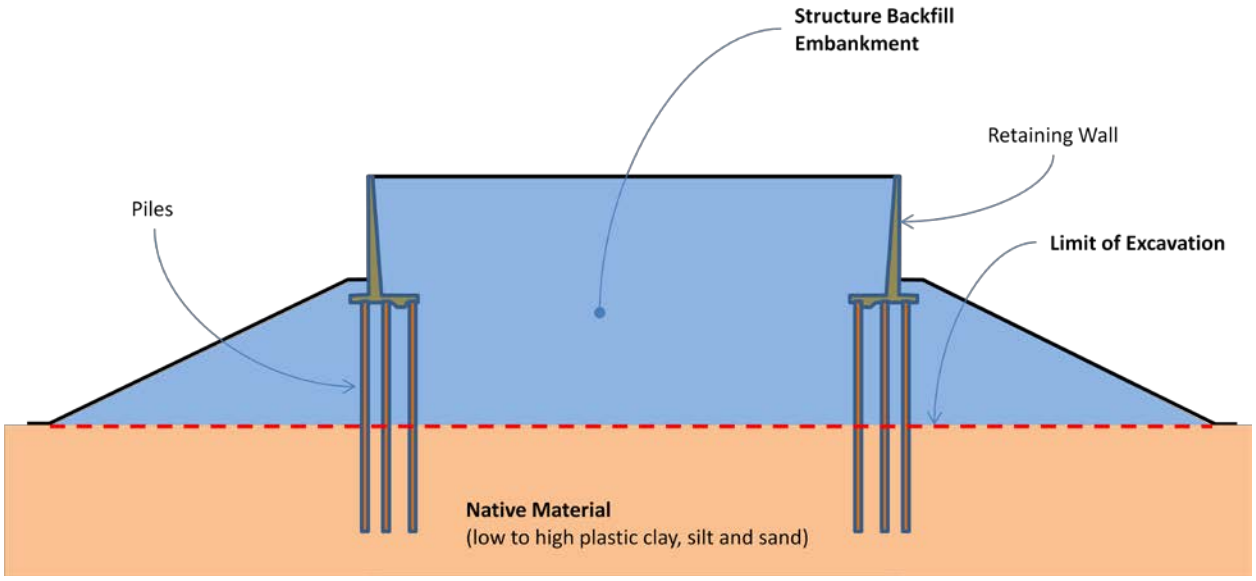


Figure 2A: Option 1a.

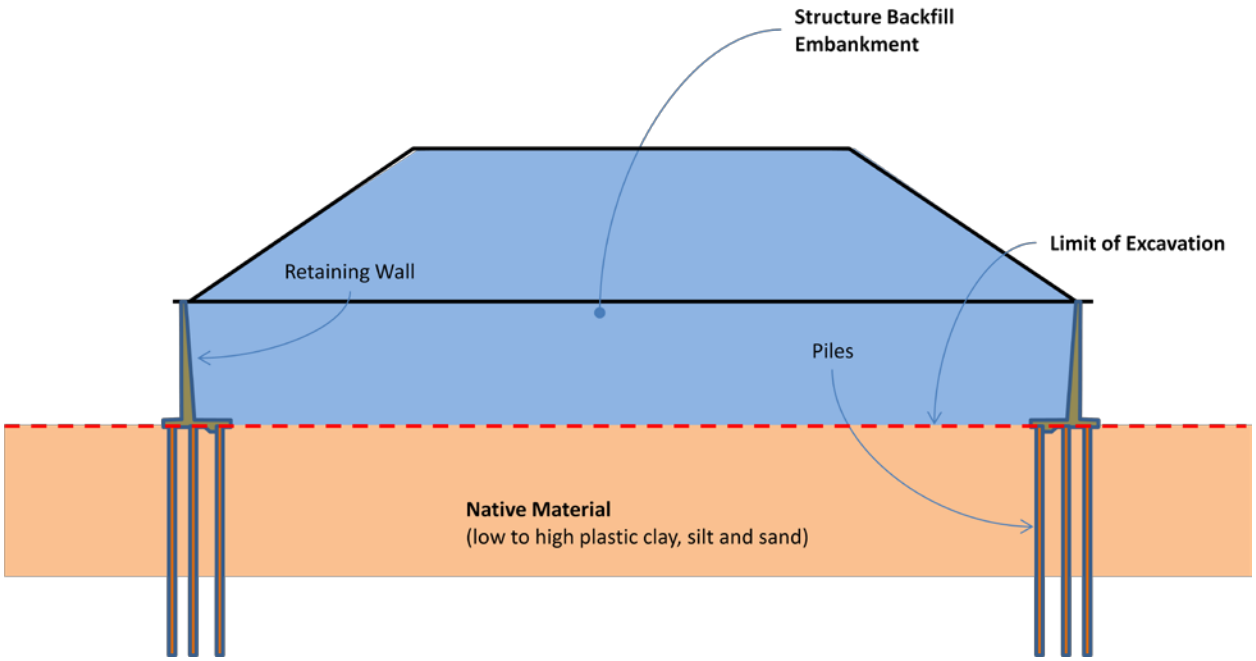


Figure 3A: Option 1b.

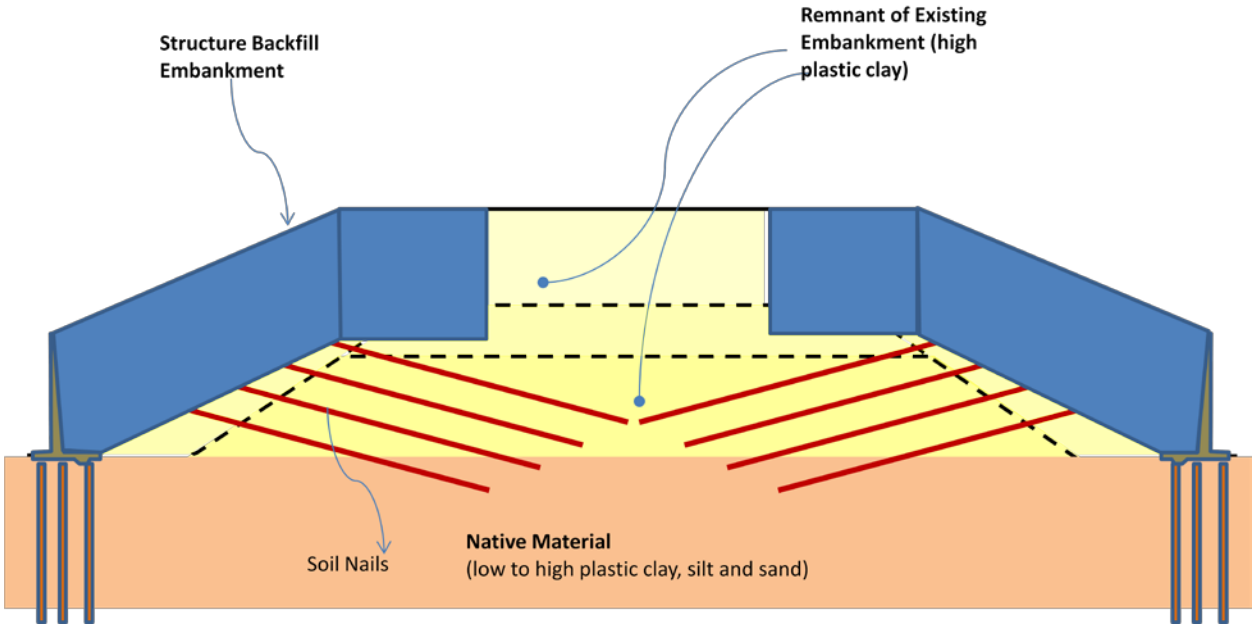


Figure 4A: Option 1c.

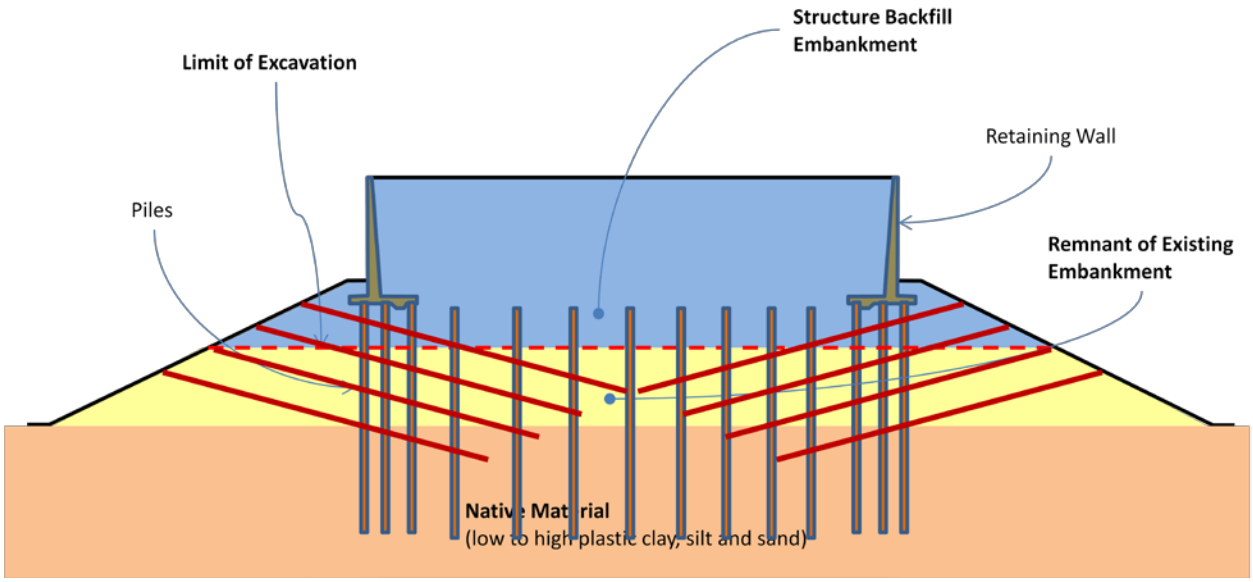


Figure 5A: Option 2a.

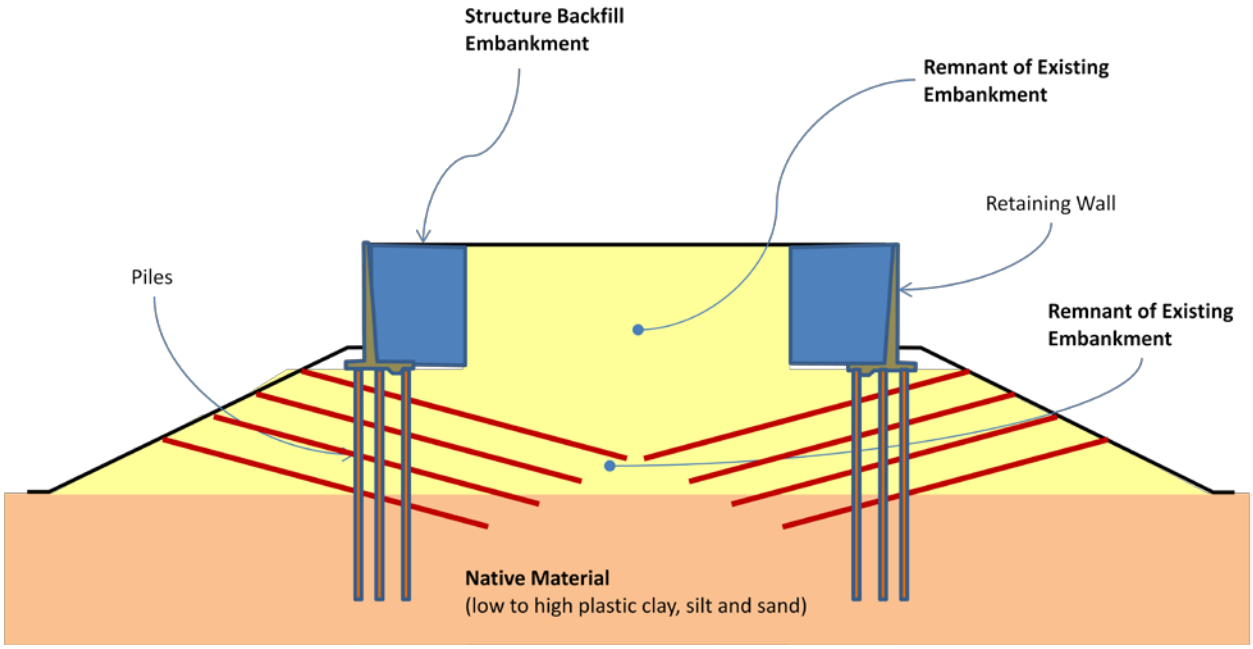


Figure 6A: Option 2b.

CALIFORNIA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL LABORATORY

GL TRACKING NO : 14-006
Dist - EA: 12-0N5400
Report Date: February 25, 2014

CLASSIFICATION TEST SUMMARY

SAMPLE ID	% FINER THAN																	ATTERBERG LIMITS		AS RECEIVED		Gs
	3"	2 1/2"	2"	1 1/2"	1"	3/4"	1/2"	3/8"	No. 4	No. 8	No. 16	No. 30	No. 50	No. 100	No. 200	5μ	1μ	LL	PI	γd (pcf)	%m	
R-14-101_01					100	87	86	85	61	60	58	55	52	48	45	28	19	48	29		19.1	
R-14-101_02						100	99	91	55	53	52	50	50	48	45	27	16	46	25		24.6	
R-14-101_03									100	98	96	92	87	81	75	40	25	48	32		20.1	
R-14-101_04									100	99	96	94	90	85	77	41	20	54	36		27.2	
R-14-101_05								100	99	99	98	95	91	85	76	40	19	49	30		24.6	
R-14-101_06											100	99	99	97	95	75	5	62	38		29.4	
R-14-101_07								100	99	98	96	94	90	85	81	58	40	50	33		35.1	
R-14-101_08										100	97	91	76	58	47	25	14	29	16		23.1	
R-14-101_09										100	99	98	96	93	87	35	16	41	24		25.1	
R-14-101_10												100	99	98	96	60	31	42	21		28.7	
R-14-102_01							100	97	87	82	78	71	62	53	45	29	19	34	17		21.0	
R-14-102_02								100	85	83	81	78	74	69	65	47	31	57	33		27.1	
R-14-102_03								100	99	96	91	81	67	55	44	20	12	31	17		15.9	
R-14-102_04							100	97	85	84	83	81	78	74	67	39	2	54	33		29.5	
R-14-102_05						100	98	89	66	60	55	51	47	41	35	16	7	49	12		40.0	
R-14-102_06										100	99	98	98	97	96	78	67	91	59		43.5	
R-14-102_07									100	99	97	94	87	74	63	25	17	39	22		24.6	
R-14-102_08								100	97	92	89	85	77	66	52	21	8	28	9		16.4	
R-14-102_09										100	99	99	98	96	93	54	21	42	21		32.4	
R-14-102_10									100	99	99	98	97	95	89	56	27	46	25		26.6	

CALIFORNIA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL LABORATORY

GL TRACKING NO : 14-019
Dist - EA: 12-0N5401
Report Date: June 26, 2014

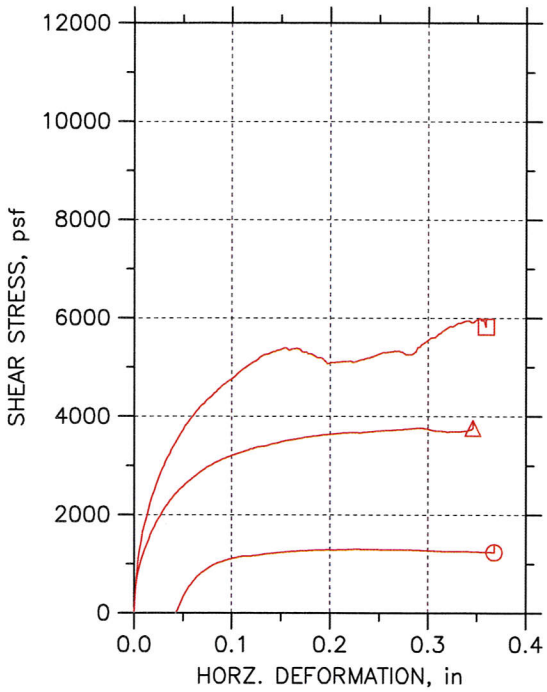
CLASSIFICATION TEST SUMMARY

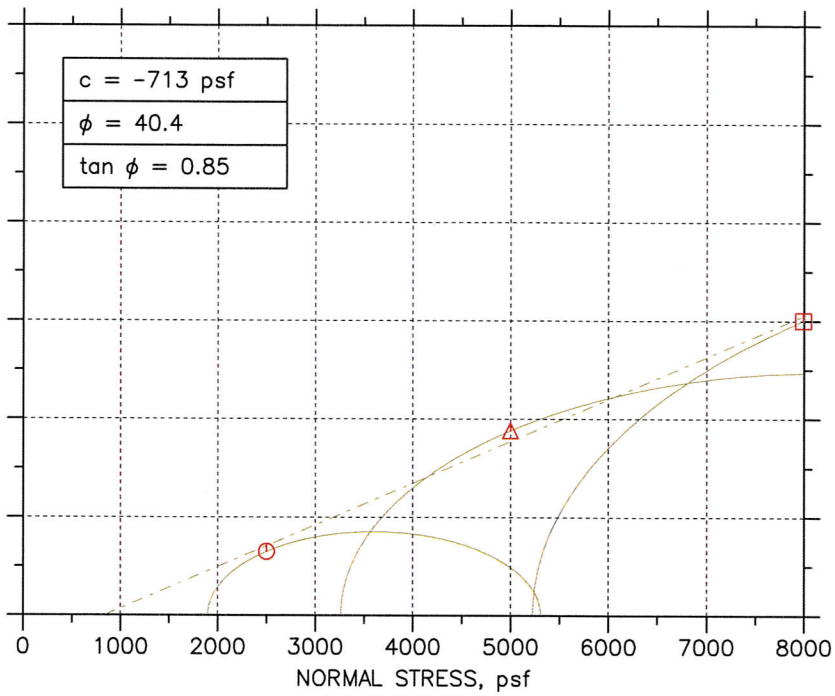
SAMPLE ID	% FINER THAN																	ATTERBERG LIMITS		AS RECEIVED		Gs
	3"	2 1/2"	2"	1 1/2"	1"	3/4"	1/2"	3/8"	No. 4	No. 8	No. 16	No. 30	No. 50	No. 100	No. 200	5μ	1μ	LL	PI	γd (pcf)	%m	
R-14-103_01						100	99	96	90	85	80	74	67	61	56	37	25	46	25		20.6	
R-14-103_02						100	98	96	92	87	84	79	74	68	62	43	33	45	25		21.7	
R-14-103_03									100	99	96	89	77	65	53	34	23	32	16		22.1	
R-14-103_04								100	99	97	96	95	91	86	80	46	29	41	22		22.1	
R-14-103_05										100	99	97	89	61	42	17	11		NP		16.8	
R-14-103_06						100	98	98	95	92	88	84	78	69	59	29	17	39	16		25.4	
R-14-103_07								100	98	97	96	94	90	86	80	57	6	50	28		27.5	
R-14-103_08								100	99	97	95	93	88	81	75	52	34	39	22		24.6	
R-14-103_09								100	98	96	95	90	77	57	44	21	13		NP		21.9	
R-14-103_10									100	98	91	68	37	20	12	4	2		NP		19.5	
R-14-103_11									100	97	86	54	34	22	16	6	2		NP		17.7	
R-14-104_01							100	98	91	88	85	79	71	64	56	37	26	41	24		25.4	
R-14-104_02									100	99	98	96	93	88	81	53	32	51	28		28.7	
R-14-104_03								100	99	98	97	95	91	85	79	53	34	37	22		30.8	
R-14-104_04								100	99	99	98	97	93	83	66	32	18	27	9		22.7	
R-14-104_05										100	96	87	68	37	20	6	2		NP		20.3	
R-14-104_06									100	99	99	99	96	74	59	19	8		NP		26.2	
R-14-104_07								100	97	96	95	94	93	92	91	49	23	40	16		31.1	
R-14-104_08													100	80	40	10	5		NP		25.2	
R-14-104_09											100	99	98	96	94	65	35	56	31		30.3	
R-14-104_10								100	99	97	97	96	95	90	83	64	34	53	29		31.5	
R-14-104_11								100	99	95	84	66	50	37	29	22	13	31	17		18.2	
R-14-104_12											100	98	93	69	42	18	10		NP		16.9	
R-14-104_13									100	99	98	98	96	93	85	31	14	32	8		26.0	
R-14-104_14										100	99	87	60	33	30	10	5		NP		19.8	
R-14-104_15									100	99	95	85	56	25	13	5	1		NP		22.0	
R-14-104_16											100	98	69	25	13	4	0		NP		24.6	
R-14-105_01								100	99	97	94	90	84	78	72	55	21	51	29		27.5	

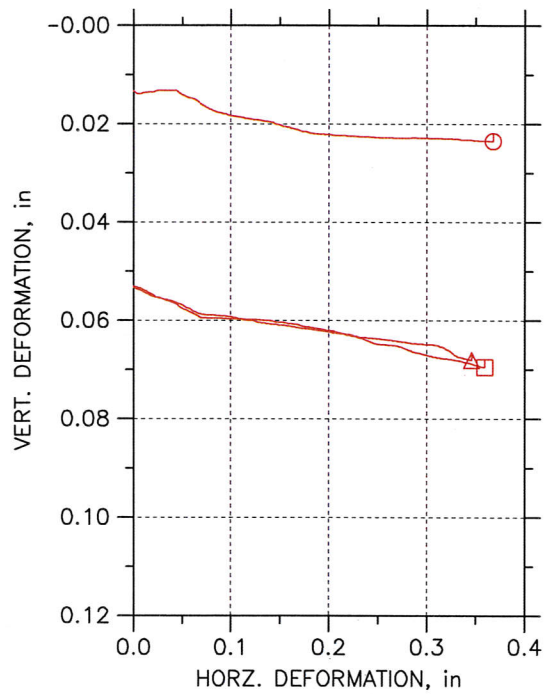
CLASSIFICATION TEST SUMMARY

SAMPLE ID	% FINER THAN																	ATTERBERG LIMITS		AS RECEIVED		Gs
	3"	2 1/2"	2"	1 1/2"	1"	3/4"	1/2"	3/8"	No. 4	No. 8	No. 16	No. 30	No. 50	No. 100	No. 200	5μ	1μ	LL	PI	γd (pcf)	%m	
R-14-105_02								100	99	97	96	93	89	83	76	51	44	51	28		20.5	
R-14-105_03									100	99	98	96	93	90	84	54	34	50	26		28.6	
R-14-105_04									100	99	98	97	95	91	88	66	31	62	36		27.3	
R-14-105_05										100	99	97	91	76	63	27	16	33	18		21.1	
R-14-105_06											100	99	94	64	32	6	2		NP		22.1	
R-14-105_07									100	95	88	70	44	19	10	2	0		NP		18.5	
R-14-105_08									100	95	79	51	28	16	11	1	0		NP		19.2	
R-14-105_09									100	96	88	71	42	22	12	0	0		NP		20.6	
R-14-105_10									100	96	94	93	92	86	68	22	9	28	6			
R-14-105_11									100	98	97	97	94	83	67	32	14	34	17		26.7	
R-14-105_12											100	99	98	78	35	11	5		NP		24.2	
R-14-105_13									100	97	94	86	73	59	43	13	6		NP		19.5	
R-14-105_14								100	99	96	84	59	33	16	11	3	0		NP			
R-14-106_01																					15.7	
R-14-106_02																					15.1	
R-14-106_03									100	99	97	94	89	82	72	42	26	44	24		27.7	
R-14-106_04									100	98	95	91	83	74	63	33	22	40	25		22.5	
R-14-106_05											100	99	98	95	90	71	4	53	30		32.2	
R-14-106_06												100	99	98	95	82	4	73	42		41.5	
R-14-106_07									100	99	97	95	87	75	64	34	22	34	19		23.2	
R-14-106_08										100	99	97	89	70	50	19	9		NP		19.9	
R-14-106_09									100	99	95	80	57	33	23	2	0		NP		20.7	
R-14-106_10									100	96	89	80	65	47	38	8	4		NP		20.8	
R-14-106_11											100	99	96	85	74	29	7	32	11		29.8	
R-14-106_12									100	98	96	94	90	85	72	33	14	29	10		25.3	
R-14-106_13									100	99	99	99	99	78	39	5	1		NP		30.1	
R-14-106_14												100	98	84	63	39	19	27	8		19.5	
R-14-106_15									100	96	96	95	92	86	78	41	17	34	16		29.1	

DIRECT SHEAR TEST REPORT

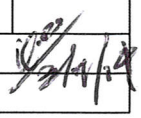






Symbol		⏲	△	⏍	
Test No.		DS1400A	DS1400B	DS1400C	
Sample No.		1-B	1-B	1-B	
Shape		Circular	Circular	Circular	
Initial	Dimension, in	2.375	2.375	2.375	
	Area, in^2	4.4301	4.4301	4.4301	
	Height, in	1	1	1	
	Water Content, %	27.35	23.42	21.70	
	Dry Density, pcf	96.828	103.19	106.2	
	Saturation, %	99.70	99.81	99.79	
	Void Ratio	0.74078	0.63343	0.58714	
Consol. Height, in		0.98719	0.94926	0.94934	
Consol. Void Ratio		0.71848	0.55054	0.50673	
Final	Water Content, %	25.84	19.25	17.65	
	Dry Density, pcf	99.16	110.73	114.13	
	Saturation, %	99.71	99.51	99.95	
	Void Ratio	0.69984	0.52229	0.47686	
Normal Stress, psf		2498.9	4999.6	7998.3	
Max. Shear Stress, psf		1298.3	3763.6	6004	
Ult. Shear Stress, psf		1236.2	3762.8	5821.9	
Time to Failure, min		68.504	77.5	89.501	
Disp. Rate, in/min		0.004	0.004	0.004	
Implied Specific Gravity		2.70	2.70	2.70	
Liquid Limit		---	---	---	
Plastic Limit		---	---	---	
Plasticity Index		---	---	---	

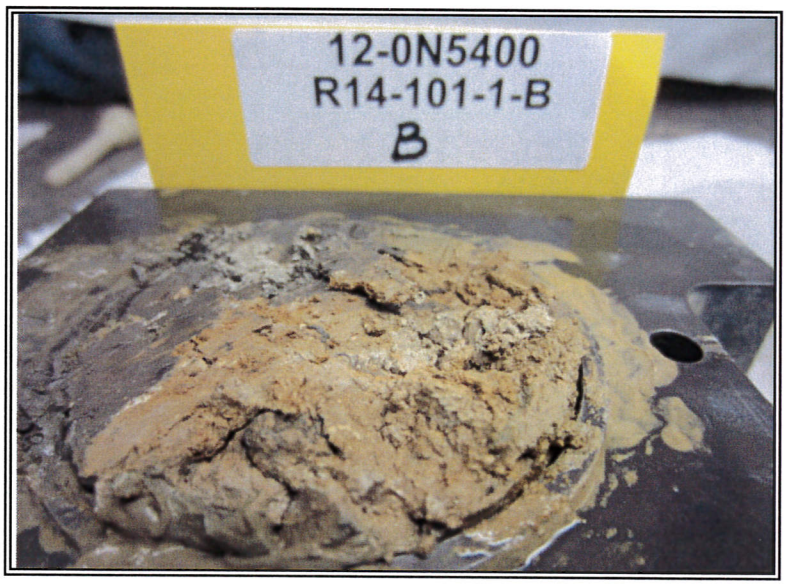
Project: Redhill Slope Repair
Location: 12-ORA-405-8.4
Project No.: 12-0N5400
Boring No.: R14-101
Sample Type: TUBE
Description: Moist, dark brown- tan, clay, w/silt and gravel
Remarks: ASTM D 3080. Sample description is not a soil classification.



Wed, 05-MAR-2014 15:12:50

DIRECT SHEAR
JOB : 12-0N5400
SAMPLE :R14-101-1-B
Test Specimen A

DIRECT SHEAR
JOB : 12-0N5400
SAMPLE :R14-101-1-B
Test Specimen B

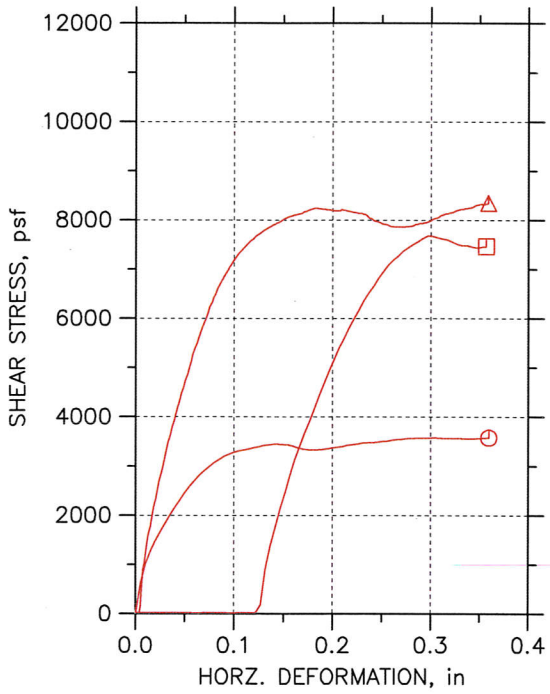


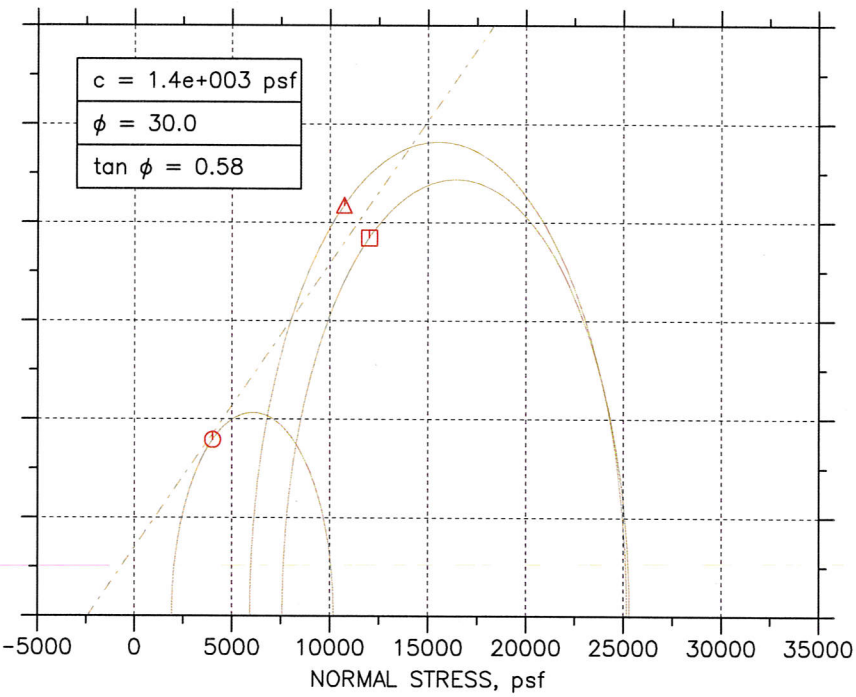
DIRECT SHEAR
JOB : 12-0N5400
SAMPLE :R14-101-1-B
Test Specimen C

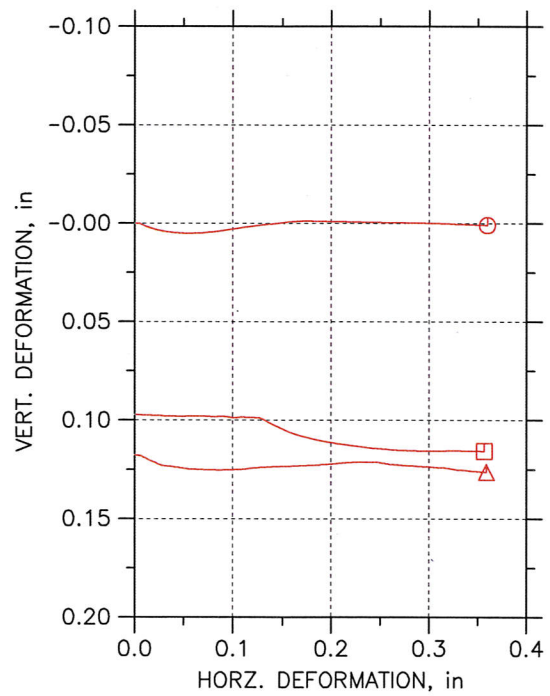
DIRECT SHEAR
JOB : 12-0N5401
SAMPLE : R-14-104-1-C
Test Specimen A

NO TEST

DIRECT SHEAR TEST REPORT







Symbol		⏲	△	⊡	
Test No.		DS1408A	DS1408B	DS1408C	
Sample No.		2-B	2-B	2-B	
Shape		Circular	Circular	Circular	
Initial	Dimension, in	2.375	2.375	2.375	
	Area, in^2	4.4301	4.4301	4.4301	
	Height, in	1	1	1	
	Water Content, %	17.61	16.94	15.25	
	Dry Density, pcf	113.77	110.67	104.91	
	Saturation, %	98.74	87.44	67.85	
	Void Ratio	0.48157	0.52301	0.60665	
Consol. Height, in		1	0.8828	0.90325	
Consol. Void Ratio		0.48157	0.34451	0.45121	
Final	Water Content, %	17.76	12.20	15.57	
	Dry Density, pcf	113.88	126.67	118.64	
	Saturation, %	99.88	99.62	99.93	
	Void Ratio	0.48015	0.33062	0.42077	
Normal Stress, psf		3989.4	10723	12000	
Max. Shear Stress, psf		3579.3	8347.6	7685.2	
Ult. Shear Stress, psf		3579.3	8347.6	7465	
Time to Failure, min		36.256	91.437	30.003	
Disp. Rate, in/min		0.004	0.004	0.004	
Implied Specific Gravity		2.70	2.70	2.70	
Liquid Limit		---	---	---	
Plastic Limit		---	---	---	
Plasticity Index		---	---	---	

Project: Redhill Slope Repair
Location: 12-ORA-405-8.4
Project No.: 12-0N5401
Boring No.: R14-104
Sample Type: TUBE
Description: Damp, brown silt w/sand
Remarks: ASTM D 3080. Sample description is not a soil classification.

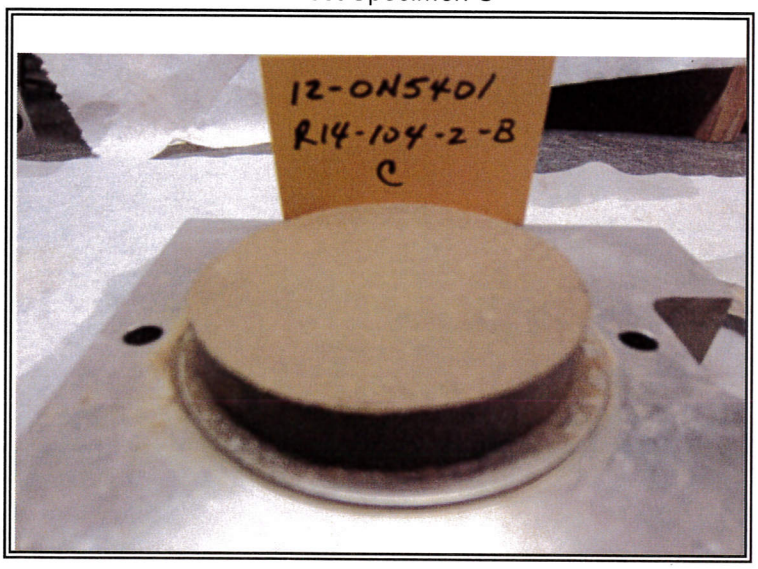
5/28/14

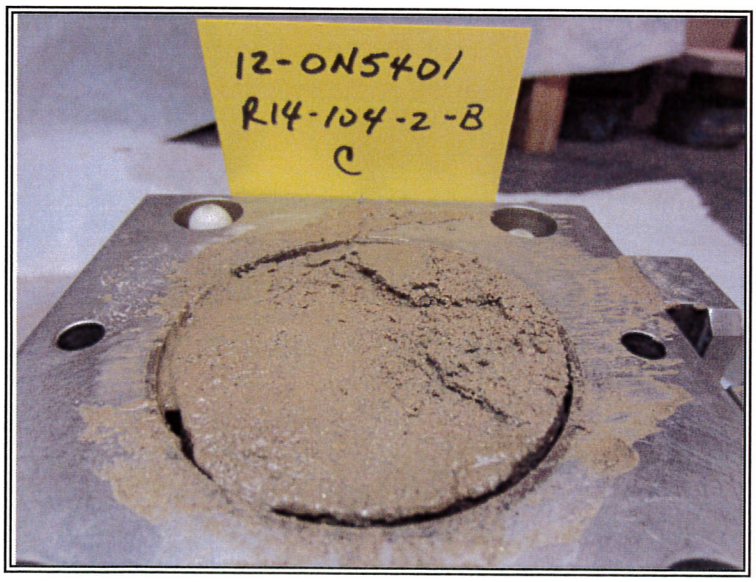
Tue, 27-MAY-2014 15:51:20

DIRECT SHEAR
JOB : 12-0N5401
SAMPLE : R14-104-2B
Test Specimen A

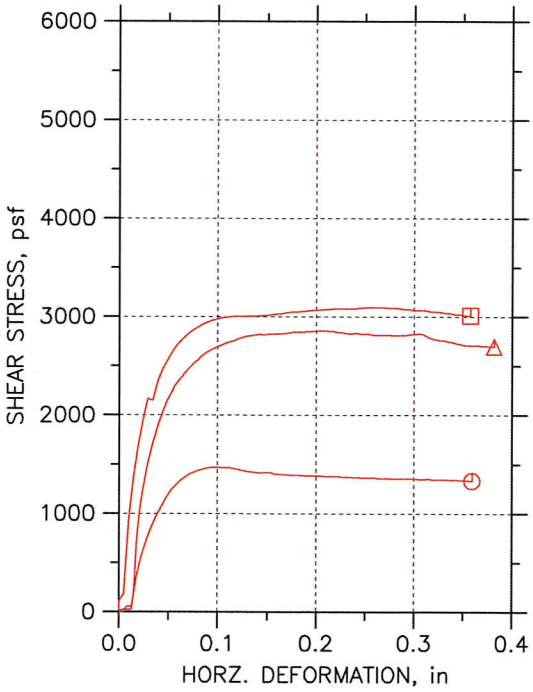
DIRECT SHEAR
JOB : 12-0N5401
SAMPLE : R14-104-2B
Test Specimen B

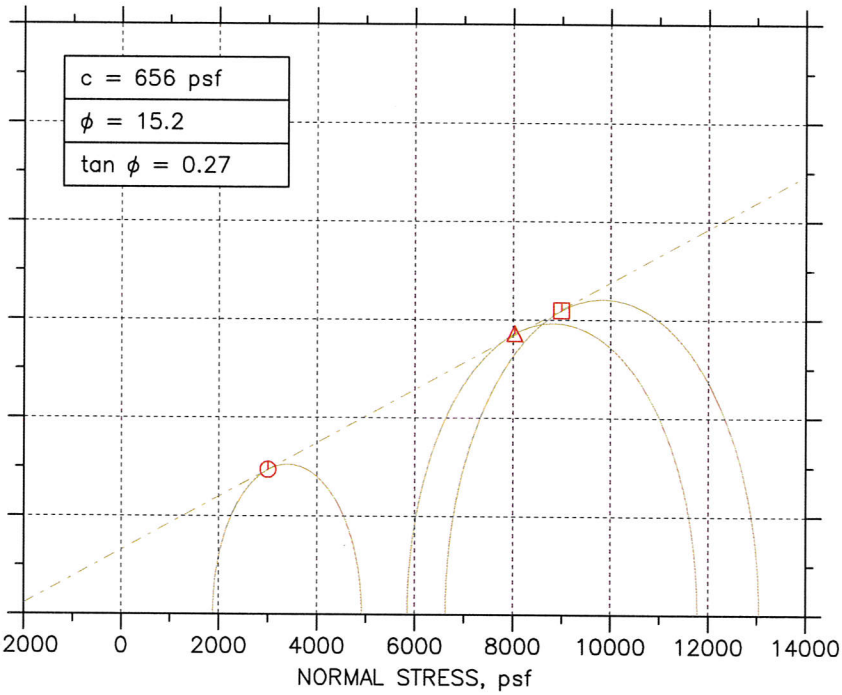
DIRECT SHEAR
JOB : 12-0N5401
SAMPLE : R14-104-2B
Test Specimen C

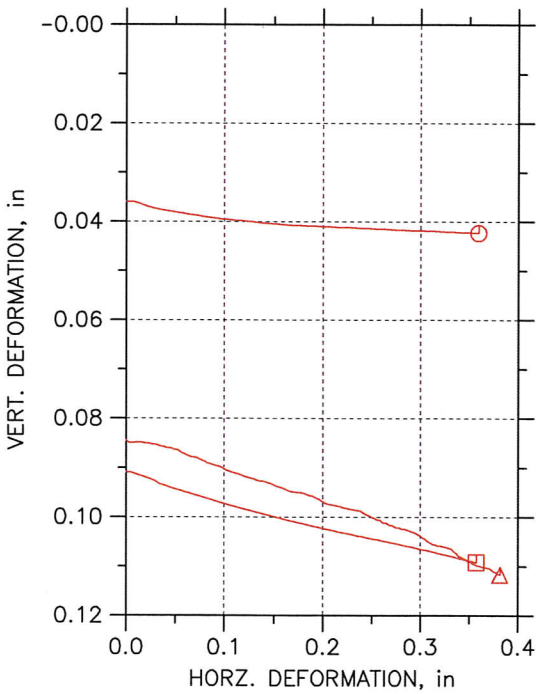




DIRECT SHEAR TEST REPORT







Symbol		⏲	△	⏍	
Test No.		DS1409A	DS1409B	DS1409C	
Sample No.		1-C	1-C	1-C	
Shape		Circular	Circular	Circular	
Initial	Dimension, in	2.375	2.375	2.375	
	Area, in^2	4.4301	4.4301	4.4301	
	Height, in	1	1	1	
	Water Content, %	35.67	36.51	37.04	
	Dry Density, pcf	85.821	84.789	83.585	
	Saturation, %	99.90	99.78	98.37	
	Void Ratio	0.96405	0.98795	1.0166	
Consol. Height, in		0.9669	0.92747	0.91005	
Consol. Void Ratio		0.89904	0.84375	0.83519	
Final	Water Content, %	32.57	28.30	29.42	
	Dry Density, pcf	89.613	95.447	93.832	
	Saturation, %	99.81	99.74	99.76	
	Void Ratio	0.88093	0.76595	0.79635	
Normal Stress, psf		2998.9	8041.2	8997.9	
Max. Shear Stress, psf		1470.4	2860.2	3095.5	
Ult. Shear Stress, psf		1332.9	2697.3	3010.4	
Time to Failure, min		10.003	56.503	27.501	
Disp. Rate, in/min		0.004	0.004	0.004	
Implied Specific Gravity		2.70	2.70	2.70	
Liquid Limit		---	---	---	
Plastic Limit		---	---	---	
Plasticity Index		---	---	---	

Project: Redhill Slope Repair
Location: 12-ORA-405-8.4
Project No.: 12-0N5401
Boring No.: R14-105
Sample Type: TUBE
Description: Damp, grey silt w/clay
Remarks: ASTM D 3080. Sample description is not a soil classification.

5/29/14

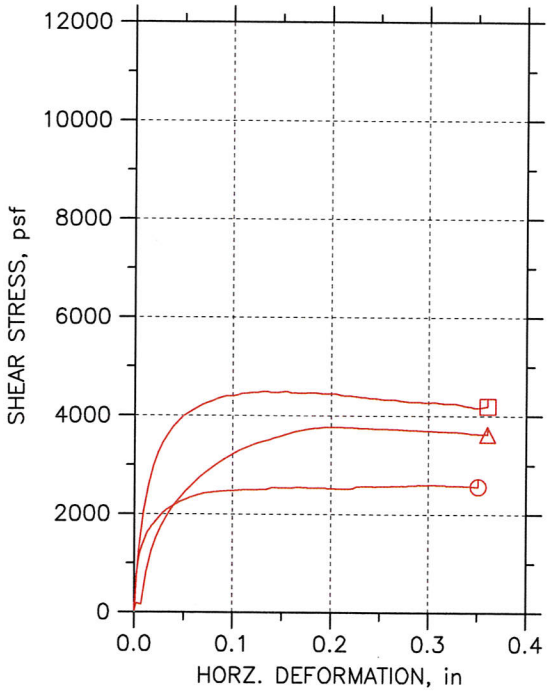
Tue, 27-MAY-2014 15:09:51

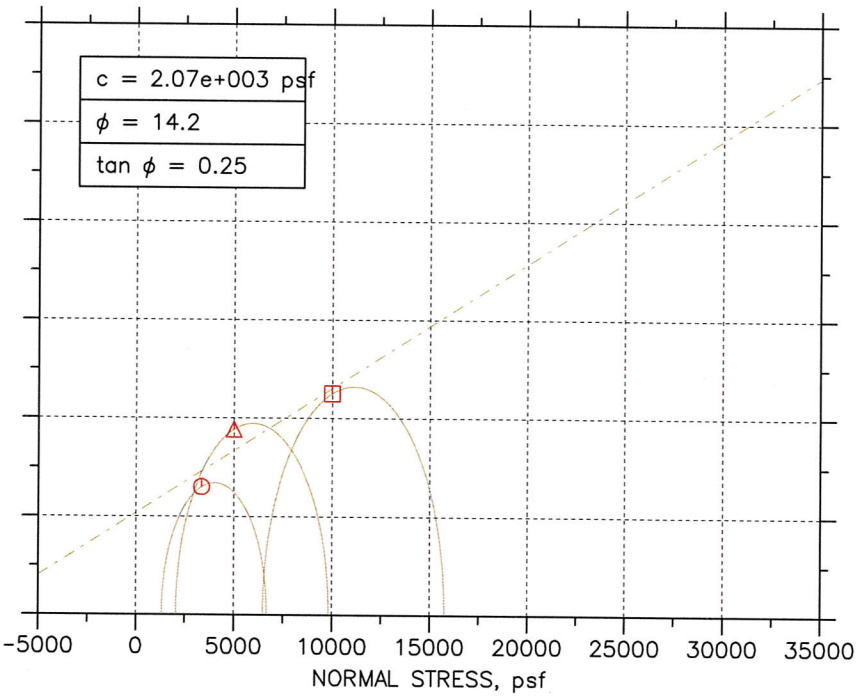
DIRECT SHEAR
JOB : 12-0N5401
SAMPLE : R14-105-1-C
Test Specimen A

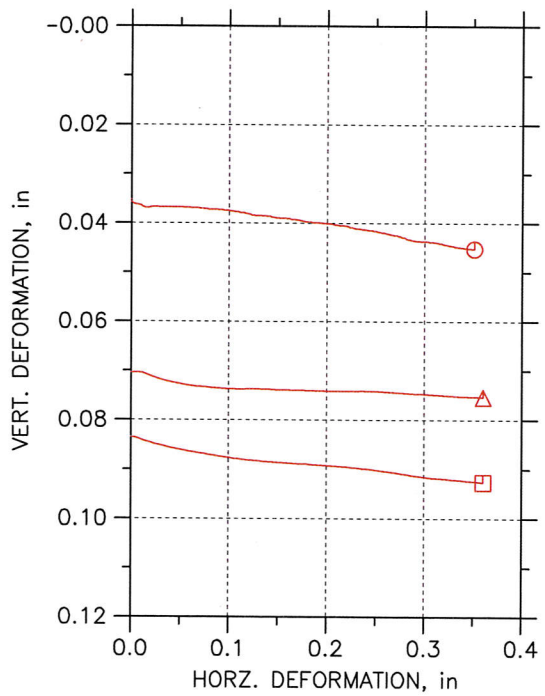
DIRECT SHEAR
JOB : 12-0N5401
SAMPLE : R14-105-1-C
Test Specimen B

DIRECT SHEAR
JOB : 12-0N5401
SAMPLE : R14-105-1-C
Test Specimen C

DIRECT SHEAR TEST REPORT







Symbol		⏲	△	⊡	
Test No.		DS1410A	DS1410B	DS1410C	
Sample No.		1-C	1-C	1-C	
Shape		Circular	Circular	Circular	
Initial	Dimension, in	2.375	2.375	2.375	
	Area, in^2	4.4301	4.4301	4.4301	
	Height, in	1	1	1	
	Water Content, %	21.07	18.65	22.24	
	Dry Density, pcf	106.54	112.05	105.17	
	Saturation, %	97.72	99.85	99.63	
	Void Ratio	0.58202	0.50431	0.60271	
Consol. Height, in		0.96966	0.92993	0.92091	
Consol. Void Ratio		0.53401	0.39891	0.47595	
Final	Water Content, %	18.89	14.43	16.76	
	Dry Density, pcf	111.59	121.18	115.91	
	Saturation, %	99.90	99.64	99.64	
	Void Ratio	0.51044	0.39097	0.45422	
Normal Stress, psf		3350.6	4999.8	9998.4	
Max. Shear Stress, psf		2598.4	3772.7	4501.6	
Ult. Shear Stress, psf		2563.4	3625.1	4195.2	
Time to Failure, min		77.503	20.503	13.504	
Disp. Rate, in/min		0.004	0.004	0.004	
Implied Specific Gravity		2.70	2.70	2.70	
Liquid Limit		---	---	---	
Plastic Limit		---	---	---	
Plasticity Index		---	---	---	

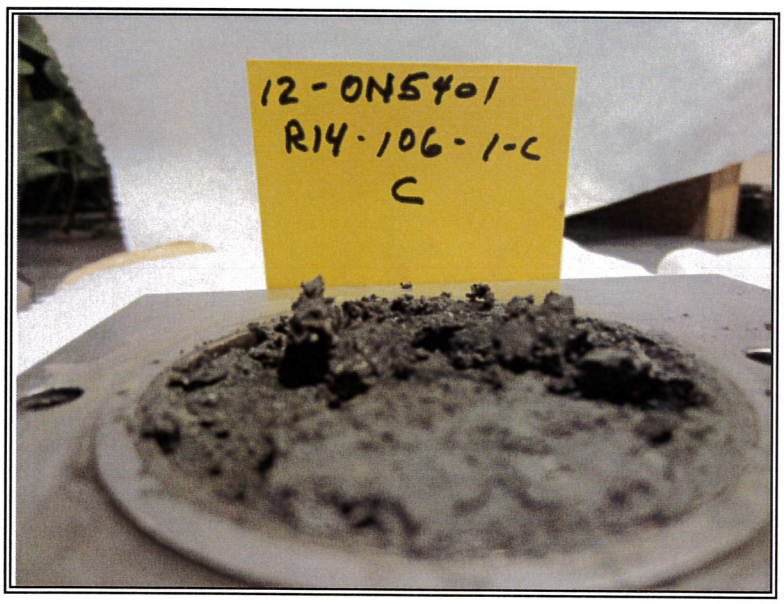
Project: REDHILL SLOPE REPAIR
Location: 12-ORA-405-8.4
Project No.: 12-0N5401
Boring No.: R-14-106
Sample Type: TUBE
Description: Damp, black slit w/organic
Remarks: ASTM D 3080. Sample description is not a soil classification.

5/29/14

DIRECT SHEAR
JOB : 12-0N5401
SAMPLE : R14-106-1-C
Test Specimen A

DIRECT SHEAR
JOB : 12-0N5401
SAMPLE : R14-106-1-C
Test Specimen B

DIRECT SHEAR
JOB : 12-0N5401
SAMPLE : R14-106-1-C
Test Specimen C



One-Dimensional Consolidation by ASTM D 2435 - Method B

Project: Redhill Slope Repair
Boring No.: R-14-104
Sample No.: 1-A
Test No.: 14-014-G1

Location: 12-ORA-405-8.4
Tested By: jg
Test Date: 04/25/14
Sample Type: tube

Project No.: 12-0N5401
Checked By: MP 5/16
Depth: 13-15
Elevation: GL 14-020

Soil Description: Moist; Black; Clay with gravel, silt
Remarks: Swell @ 0.3 tsf

Measured Specific Gravity: 2.71
Initial Void Ratio: 0.940
Final Void Ratio: 0.618

Liquid Limit: ---
Plastic Limit: ---
Plasticity Index: ---

Initial Height: 1.00 in
Specimen Diameter: 2.38 in

	Before Consolidation		After Consolidation	
	Trimmings	Specimen+Ring	Specimen+Ring	Trimmings
Container ID		RING		
Wt. Container + Wet Soil, gm	224.00	224.00	212.20	212.20
Wt. Container + Dry Soil, gm	189.10	189.10	189.10	189.10
Wt. Container, gm	87.900	87.900	87.900	87.900
Wt. Dry Soil, gm	101.20	101.20	101.20	101.20
Water Content, %	34.49	34.49	22.83	22.83
Void Ratio	---	0.940	0.618	---
Degree of Saturation, %	---	99.19	99.98	---
Dry Unit Weight, pcf	---	87.024	104.40	---

One-Dimensional Consolidation by ASTM D 2435 - Method B

Project: Redhill Slope Repair
Boring No.: R-14-104
Sample No.: 1-A
Test No.: 14-014-G1

Location: 12-ORA-405-8.4
Tested By: jg
Test Date: 04/25/14
Sample Type: tube

Project No.: 12-0N5401
Checked By:
Depth: 13-15
Elevation: GL 14-020

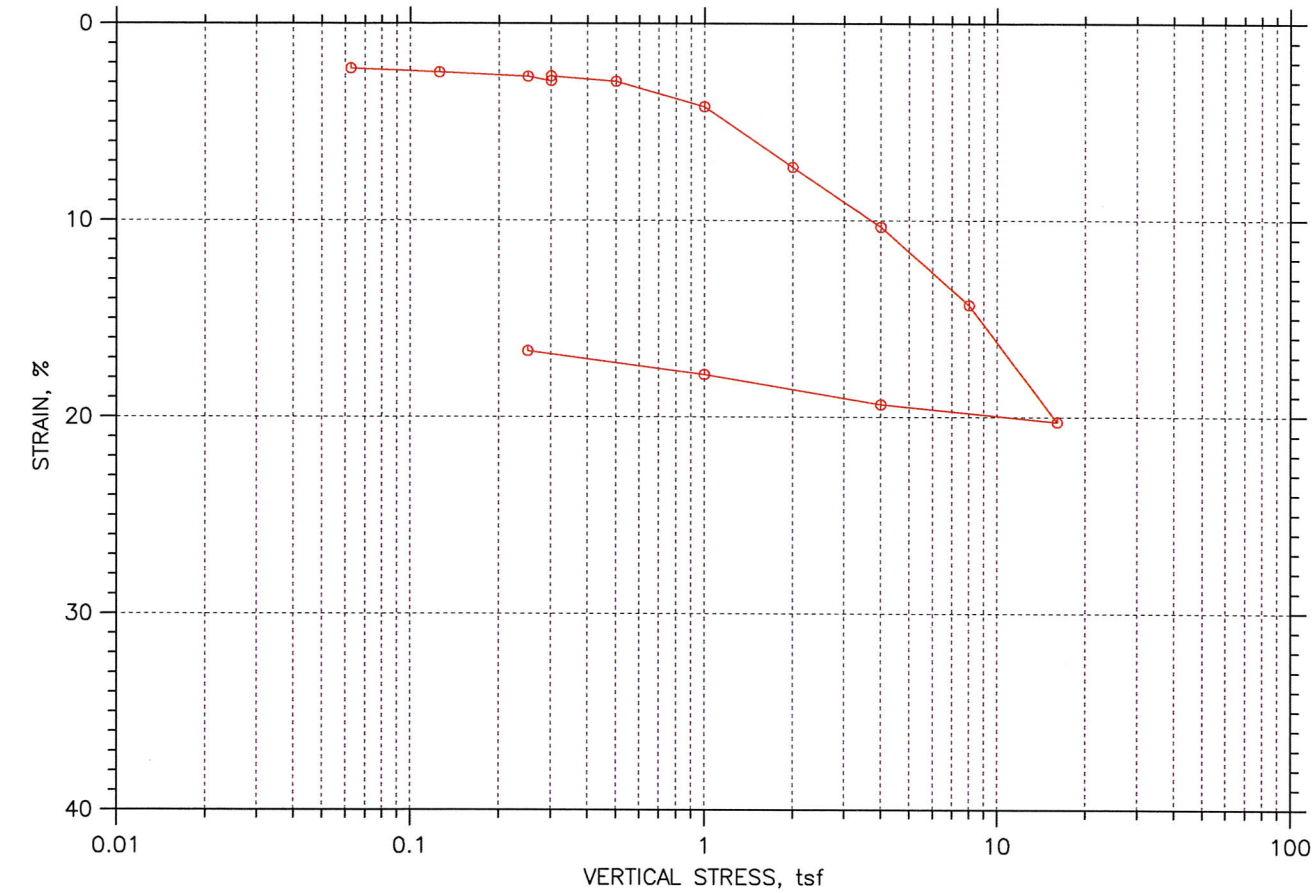
Soil Description: Moist; Black; Clay with gravel, silt
Remarks: Swell @ 0.3 tsf
Displacement at End of Increment

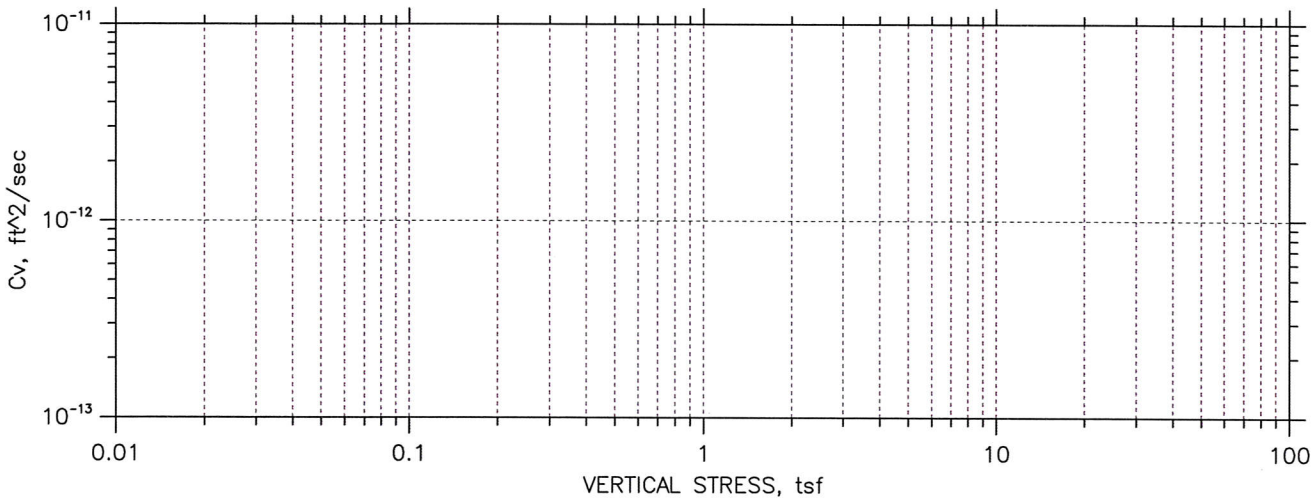
	Applied Stress tsf	Final Displacement in	Void Ratio	Strain at End %	Sq.Rt T90 min	Cv ft^2/sec	Mv 1/tsf	k ft/day
1	0.0625	0.02275	0.896	2.27	1.153	2.08e-005	3.64e-001	2.04e-002
2	0.125	0.02482	0.892	2.48	0.264	8.87e-005	3.32e-002	7.95e-003
3	0.250	0.02685	0.888	2.69	0.256	9.11e-005	1.62e-002	3.99e-003
4	0.300	0.02909	0.884	2.91	4.064	5.71e-006	4.47e-002	6.87e-004
5	0.300	0.02666	0.889	2.67	0.000	0.00e+000	-1.#Je+000	-1.#Je+000
6	0.500	0.02934	0.884	2.93	66.625	3.48e-007	1.34e-002	1.25e-005
7	1.00	0.04215	0.859	4.21	8.126	2.81e-006	2.56e-002	1.94e-004
8	2.00	0.07289	0.799	7.29	43.410	5.02e-007	3.07e-002	4.16e-005
9	4.00	0.1033	0.740	10.3	115.199	1.77e-007	1.52e-002	7.27e-006
10	8.00	0.1431	0.663	14.3	139.037	1.36e-007	9.95e-003	3.64e-006
11	16.0	0.2025	0.548	20.3	143.402	1.17e-007	7.42e-003	2.34e-006
12	4.00	0.1936	0.565	19.4	47.094	3.35e-007	7.42e-004	6.70e-007
13	1.00	0.1783	0.594	17.8	172.050	9.45e-008	5.08e-003	1.30e-006
14	0.250	0.1664	0.618	16.6	0.000	0.00e+000	1.59e-002	0.00e+000

	Applied Stress tsf	Final Displacement in	Void Ratio	Strain at End %	Log T50 min	Cv ft^2/sec	Mv 1/tsf	k ft/day	Ca %
1	0.0625	0.02275	0.896	2.27	0.390	1.43e-005	3.64e-001	1.40e-002	0.00e+000
2	0.125	0.02482	0.892	2.48	0.122	4.46e-005	3.32e-002	4.00e-003	0.00e+000
3	0.250	0.02685	0.888	2.69	0.119	4.54e-005	1.62e-002	1.99e-003	0.00e+000
4	0.300	0.02909	0.884	2.91	0.000	0.00e+000	4.47e-002	0.00e+000	0.00e+000
5	0.300	0.02666	0.889	2.67	0.000	0.00e+000	-1.#Je+000	-1.#Je+000	0.00e+000
6	0.500	0.02934	0.884	2.93	19.889	2.71e-007	1.34e-002	9.76e-006	0.00e+000
7	1.00	0.04215	0.859	4.21	0.000	0.00e+000	2.56e-002	0.00e+000	0.00e+000
8	2.00	0.07289	0.799	7.29	8.916	5.68e-007	3.07e-002	4.71e-005	0.00e+000
9	4.00	0.1033	0.740	10.3	0.000	0.00e+000	1.52e-002	0.00e+000	0.00e+000
10	8.00	0.1431	0.663	14.3	0.000	0.00e+000	9.95e-003	0.00e+000	0.00e+000
11	16.0	0.2025	0.548	20.3	0.000	0.00e+000	7.42e-003	0.00e+000	0.00e+000
12	4.00	0.1936	0.565	19.4	0.000	0.00e+000	7.42e-004	0.00e+000	0.00e+000
13	1.00	0.1783	0.594	17.8	0.000	0.00e+000	5.08e-003	0.00e+000	0.00e+000
14	0.250	0.1664	0.618	16.6	0.000	0.00e+000	1.59e-002	0.00e+000	0.00e+000

One-Dimensional Consolidation by ASTM D 2435 ↔ Method B

SUMMARY REPORT



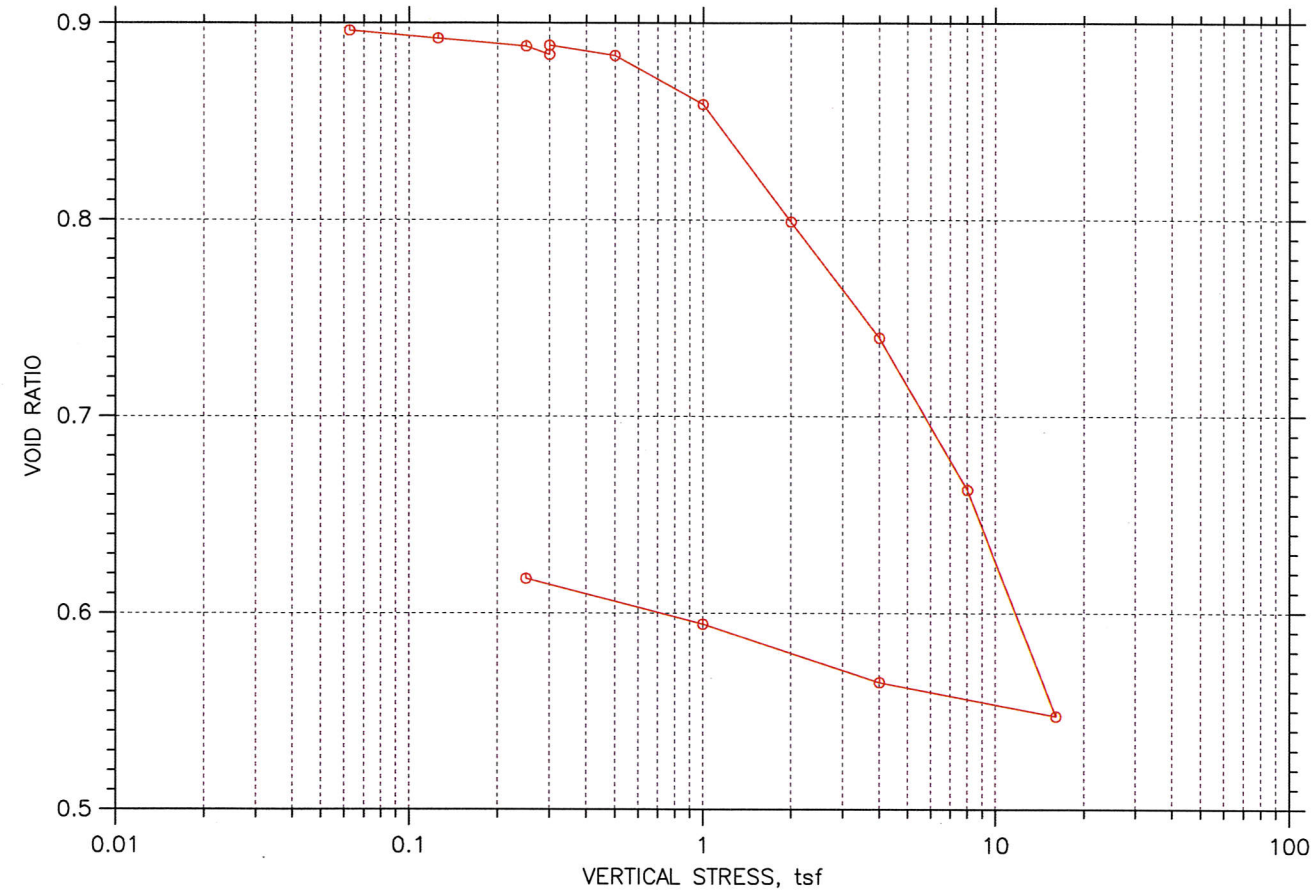


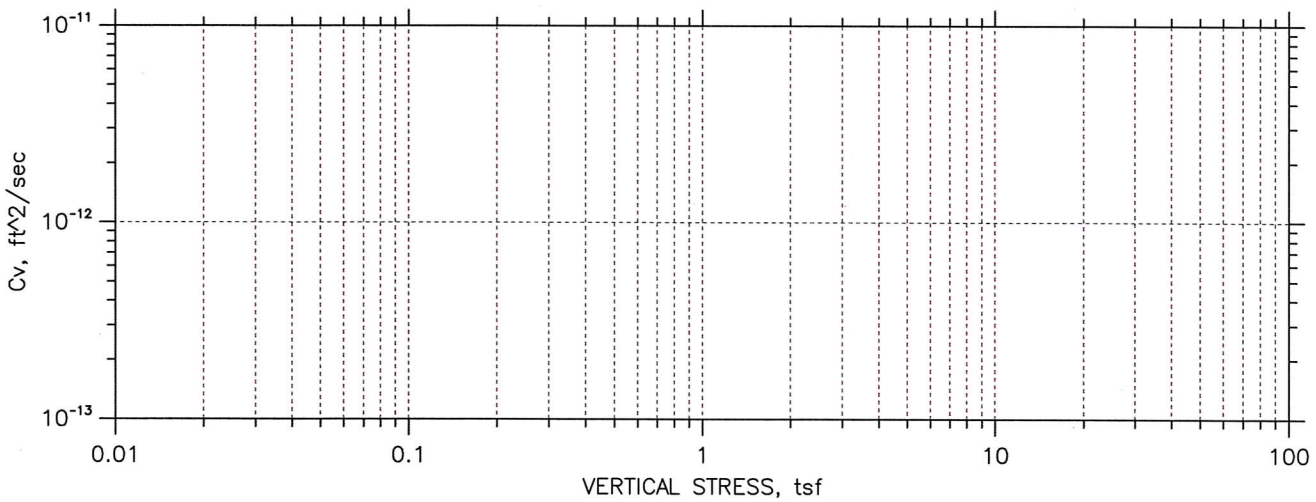
	Project: Redhill Slope Repair	Location: 12-ORA-405-8.4	Project No.: 12-0N5401
	Boring No.: R-14-104	Tested By: jg	Checked By:
	Sample No.: 1-A	Test Date: 04/25/14	Test No.: 14-014-G1
	Depth: 13-15	Sample Type: tube	Elevation: GL 14-020
	Description: Moist; Black; Clay with gravel, silt		
	Remarks: Swell @ 0.3 tsf		
	Displacement at End of Increment		

Fri, 09-MAY-2014 09:28:59

One-Dimensional Consolidation by ASTM D 2435 ↔ Method B

SUMMARY REPORT





	Project: Redhill Slope Repair	Location: 12-ORA-405-8.4	Project No.: 12-0N5401
	Boring No.: R-14-104	Tested By: jg	Checked By:
	Sample No.: 1-A	Test Date: 04/25/14	Test No.: 14-014-G1
	Depth: 13-15	Sample Type: tube	Elevation: GL 14-020
	Description: Moist; Black; Clay with gravel, silt		
	Remarks: Swell @ 0.3 tsf		
	Displacement at End of Increment		

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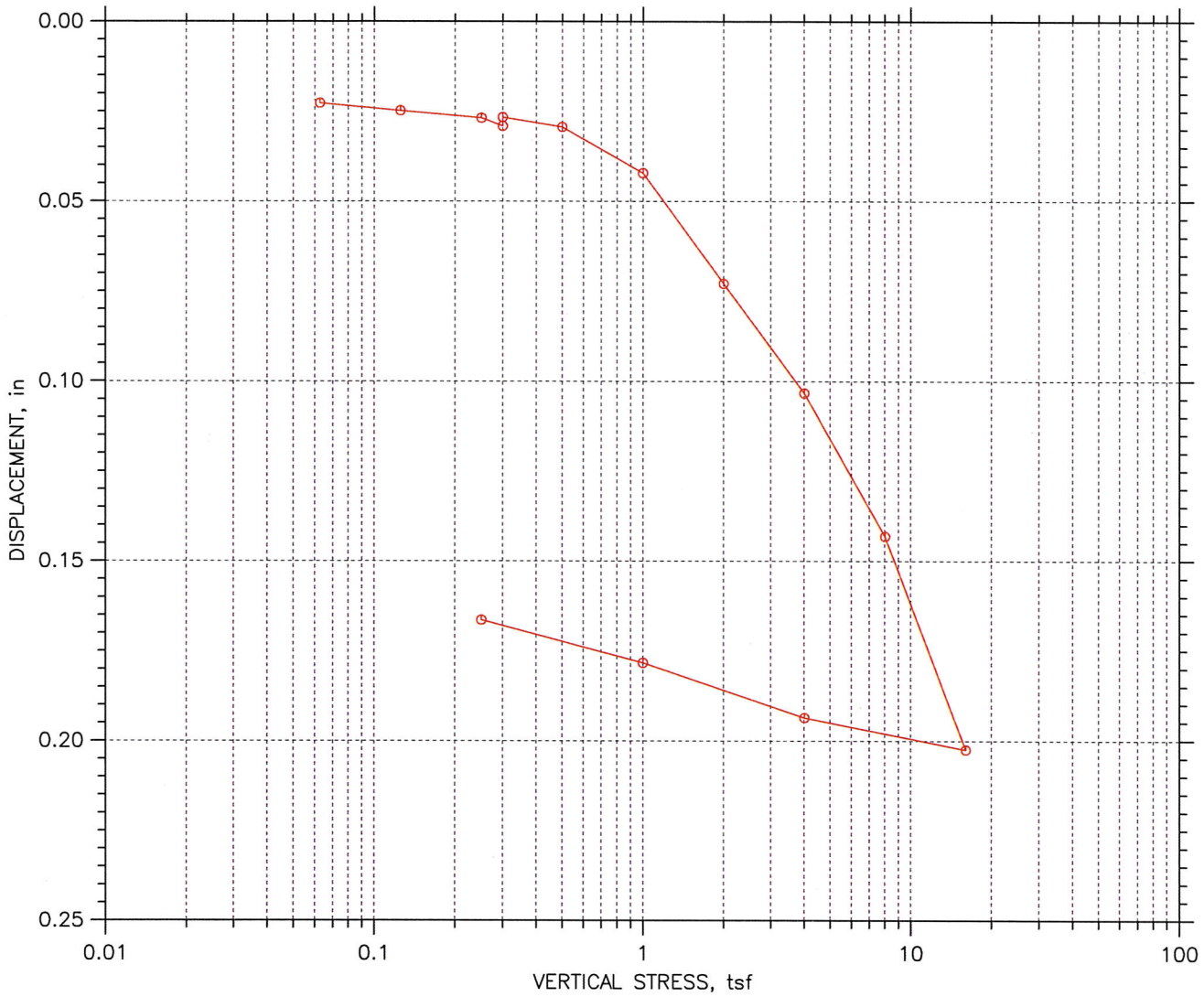
One-Dimensional Consolidation by ASTM D 2435 ⇔ Method B

SUMMARY REPORT

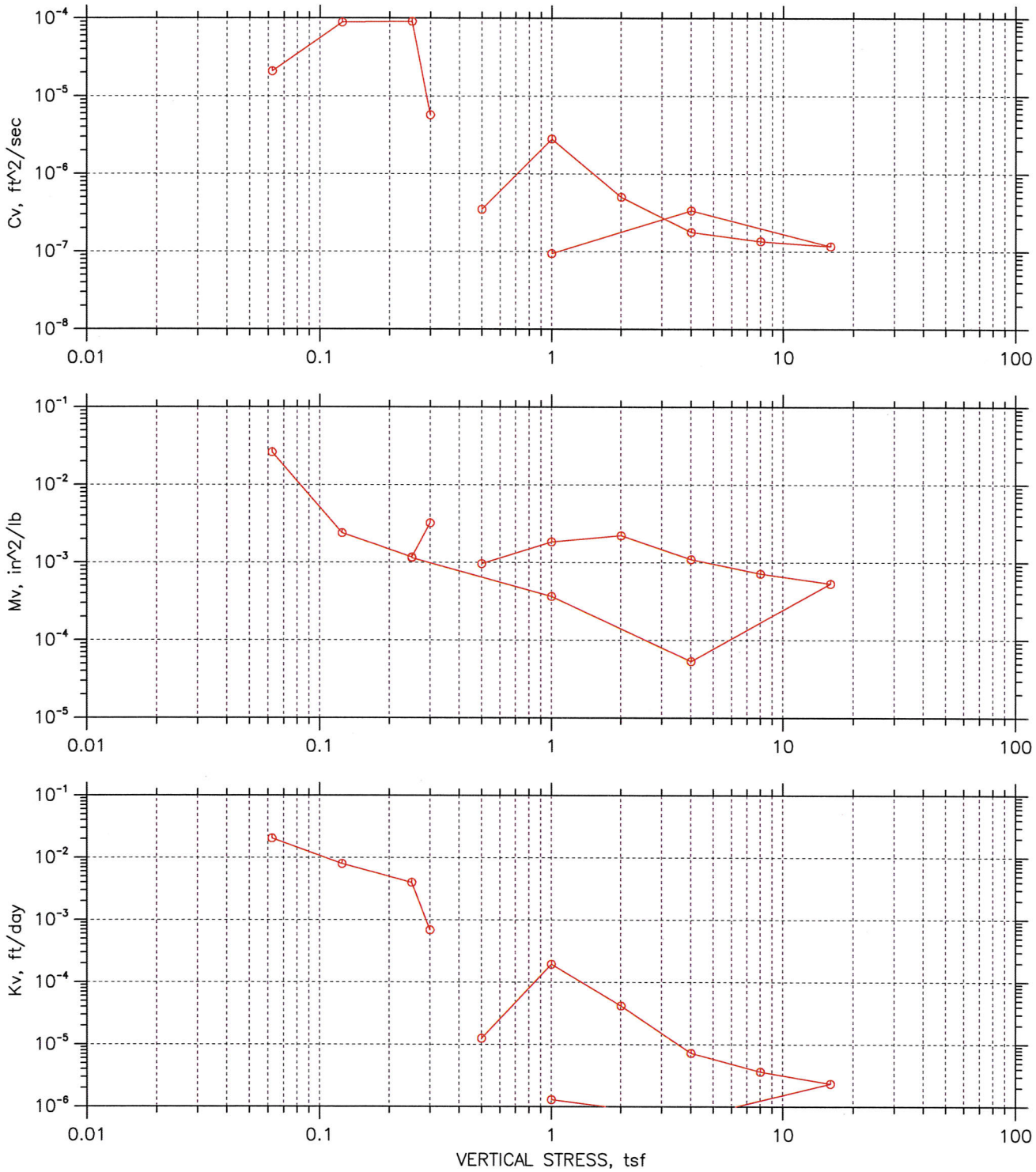


				Before Test	After Test
Overburden Pressure: 0 tsf				Water Content, %	34.49	22.83
Preconsolidation Pressure: 0 tsf				Dry Unit Weight, pcf	87.024	104.4
Compression Index: 0				Saturation, %	99.19	99.98
Diameter: 2.375 in		Height: 1 in		Void Ratio	0.94	0.62
LL: ---	PL: ---	PI: ---	GS: 2.71			

	Project: Redhill Slope Repair	Location: 12-ORA-405-8.4	Project No.: 12-0N5401
	Boring No.: R-14-104	Tested By: jg	Checked By:
	Sample No.: 1-A	Test Date: 04/25/14	Test No.: 14-014-G1
	Depth: 13-15	Sample Type: tube	Elevation: GL 14-020
	Description: Moist; Black; Clay with gravel, silt		
	Remarks: Swell @ 0.3 tsf		
	Displacement at End of Increment		

One-Dimensional Consolidation by ASTM D 2435 ⇔ Method B

ROOT of TIME COEFFICIENTS



	Project: Redhill Slope Repair	Location: 12-ORA-405-8.4	Project No.: 12-0N5401
	Boring No.: R-14-104	Tested By: jg	Checked By:
	Sample No.: 1-A	Test Date: 04/25/14	Test No.: 14-014-G1
	Depth: 13-15	Sample Type: tube	Elevation: GL 14-020
	Description: Moist; Black; Clay with gravel, silt		
	Remarks: Swell @ 0.3 tsf		
	Displacement at End of Increment		

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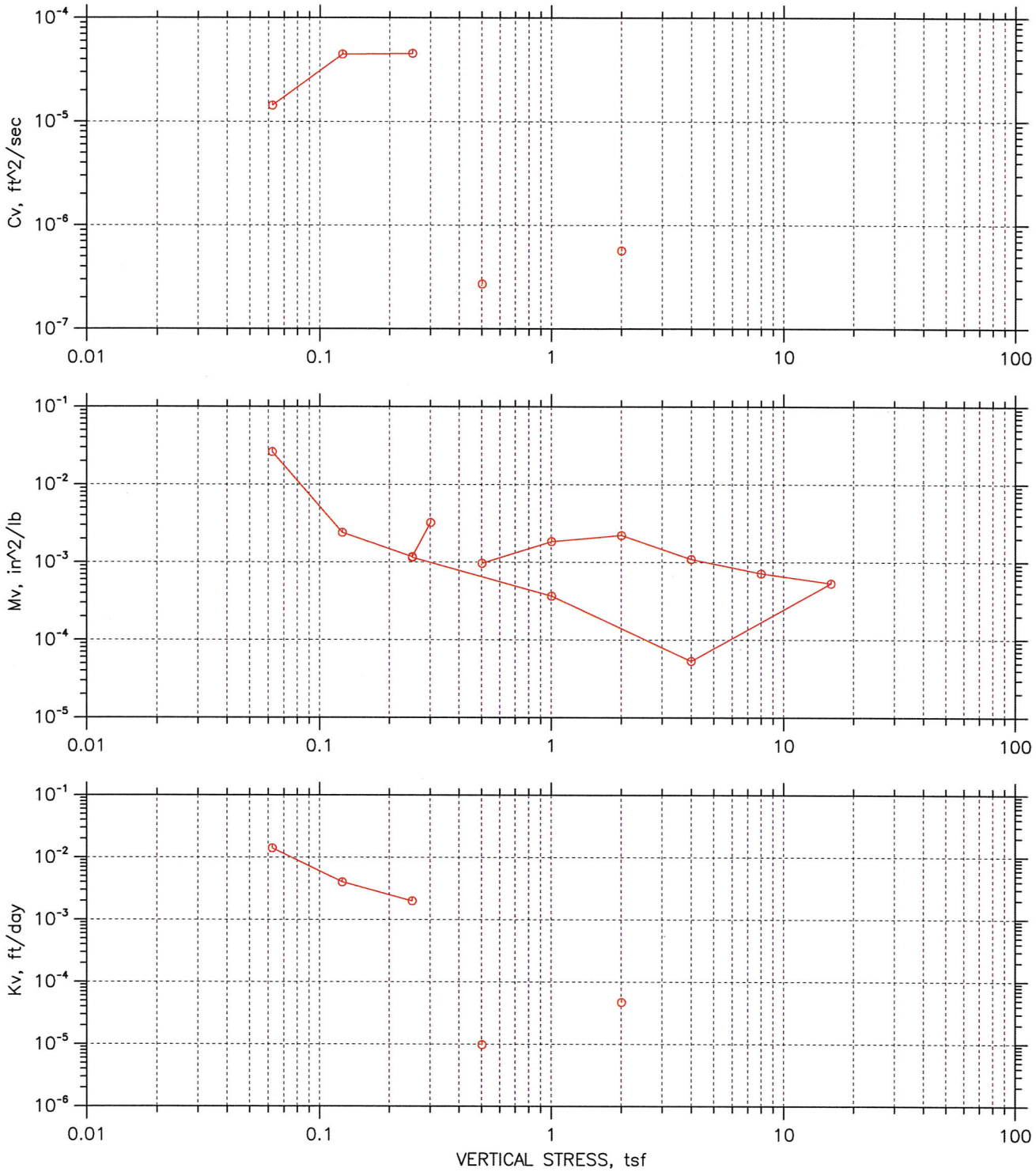
One-Dimensional Consolidation by ASTM D 2435 ↔ Method B

LOG of TIME COEFFICIENTS



	Project: Redhill Slope Repair	Location: 12-ORA-405-8.4	Project No.: 12-0N5401
	Boring No.: R-14-104	Tested By: jg	Checked By:
	Sample No.: 1-A	Test Date: 04/25/14	Test No.: 14-014-G1
	Depth: 13-15	Sample Type: tube	Elevation: GL 14-020
	Description: Moist; Black; Clay with gravel, silt		
	Remarks: Swell @ 0.3 tsf		
	Displacement at End of Increment		

Fri, 09-MAY-2014 09:28:03

CONSOLIDATION TEST DATA

Project: Redhill Slope Repair
Boring No.: R-14-104
Sample No.: 1-B
Test No.: 14-015-G3

Location: 12-ORA-405-8.4
Tested By: jg
Test Date: 04/25/14
Sample Type: tube

Project No.: 12-0N5401
Checked By: WP 5/16
Depth: 13-15
Elevation: GL 14-020

Soil Description: Moist; Black; Clay with gravel, silt
Remarks: Swell @ 0.8 tsf

Measured Specific Gravity: 2.74
Initial Void Ratio: 1.01
Final Void Ratio: 0.71

Liquid Limit: ---
Plastic Limit: ---
Plasticity Index: ---

Initial Height: 1.00 in
Specimen Diameter: 2.38 in

	Before Consolidation		After Consolidation	
	Trimmings	Specimen+Ring	Specimen+Ring	Trimmings
Container ID		RING		
Wt. Container + Wet Soil, gm	224	224	213.9	213.9
Wt. Container + Dry Soil, gm	188.4	188.4	188.4	188.4
Wt. Container, gm	89.3	89.3	89.3	89.3
Wt. Dry Soil, gm	99.1	99.1	99.1	99.1
Water Content, %	35.92	35.92	25.73	25.73
Void Ratio	---	1.01	0.71	---
Degree of Saturation, %	---	97.69	99.66	---
Dry Unit Weight, pcf	---	85.219	100.2	---

CONSOLIDATION TEST DATA

Project: Redhill Slope Repair
Boring No.: R-14-104
Sample No.: 1-B
Test No.: 14-015-G3

Location: 12-ORA-405-8.4
Tested By: jg
Test Date: 04/25/14
Sample Type: tube

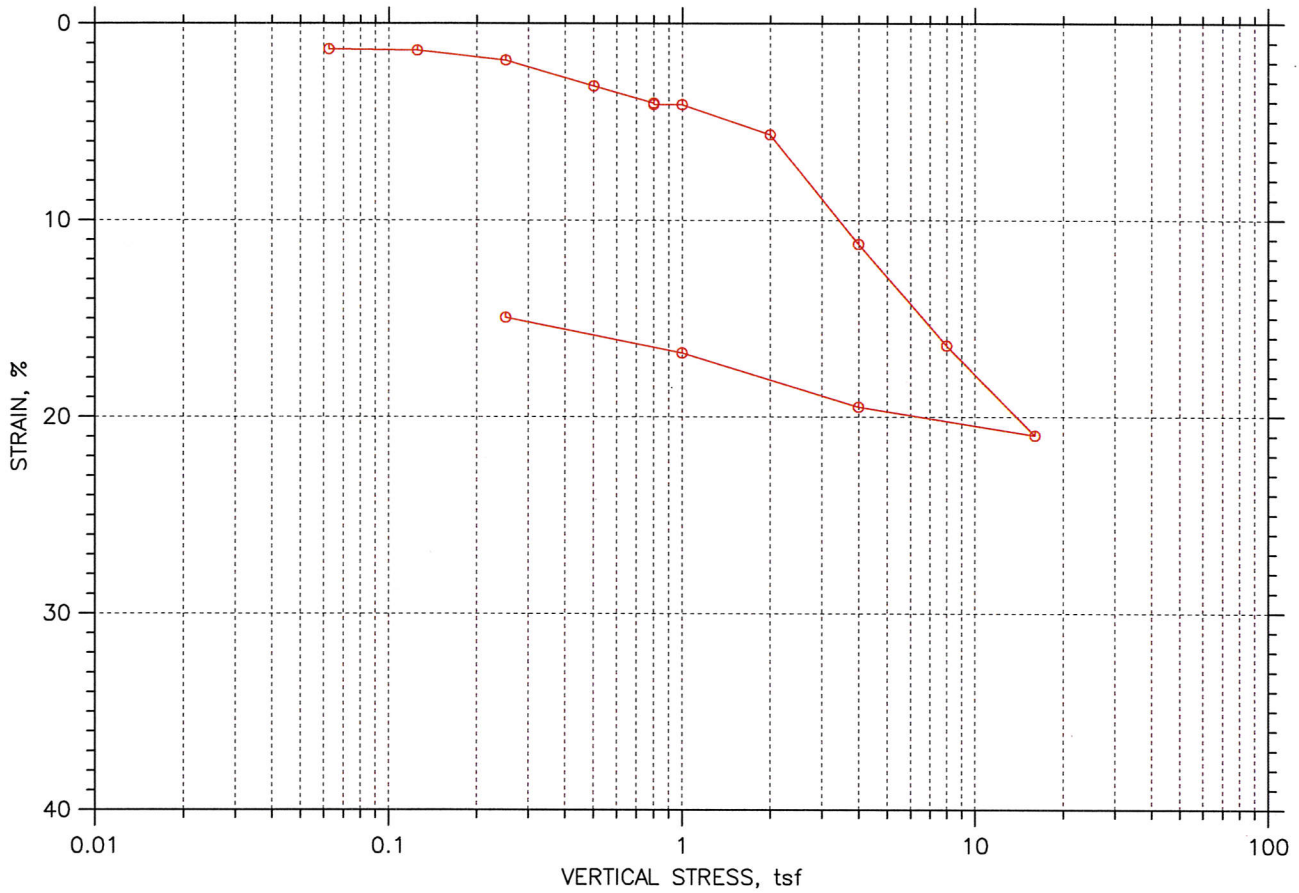
Project No.: 12-0N5401
Checked By:
Depth: 13-15
Elevation: GL 14-020

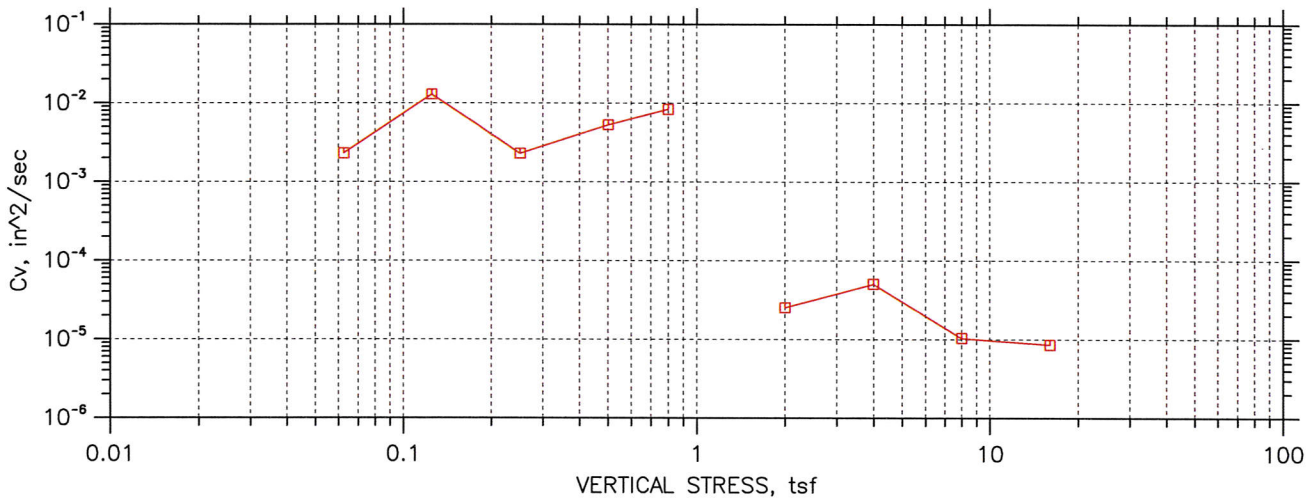
Soil Description: Moist; Black; Clay with gravel, silt
Remarks: Swell @ 0.8 tsf

	Applied Stress tsf	Final Displacement in	Void Ratio	Strain at End %	T50 Fitting Sq.Rt. min	T50 Fitting Log min	Coefficient of Consolidation Sq.Rt. in^2/sec	Coefficient of Consolidation Log in^2/sec	Coefficient of Consolidation Ave. in^2/sec
1	0.0625	0.01304	0.982	1.30	0.4	0.3	2.11e-003	2.52e-003	2.30e-003
2	0.125	0.01367	0.981	1.37	0.1	0.0	1.29e-002	0.00e+000	1.29e-002
3	0.25	0.01864	0.971	1.86	0.3	0.0	2.29e-003	0.00e+000	2.29e-003
4	0.5	0.03181	0.944	3.18	0.2	0.1	5.07e-003	5.50e-003	5.27e-003
5	0.8	0.04046	0.927	4.05	0.1	0.1	7.94e-003	8.75e-003	8.33e-003
6	0.8	0.04114	0.925	4.11	0.0	0.0	0.00e+000	0.00e+000	0.00e+000
7	1	0.04117	0.925	4.12	0.0	0.0	0.00e+000	0.00e+000	0.00e+000
8	2	0.05642	0.895	5.64	29.4	0.0	2.53e-005	0.00e+000	2.53e-005
9	4	0.1121	0.783	11.21	13.7	0.0	5.04e-005	0.00e+000	5.04e-005
10	8	0.1637	0.679	16.37	50.1	67.3	1.22e-005	9.09e-006	1.04e-005
11	16	0.2094	0.587	20.94	56.6	70.4	9.61e-006	7.72e-006	8.56e-006
12	4	0.1949	0.617	19.49	11.8	0.0	4.45e-005	0.00e+000	4.45e-005
13	1	0.1674	0.672	16.74	88.0	88.0	6.26e-006	6.26e-006	6.26e-006
14	0.25	0.1495	0.708	14.95	164.5	122.0	3.54e-006	4.77e-006	4.06e-006

CONSOLIDATION TEST DATA

SUMMARY REPORT



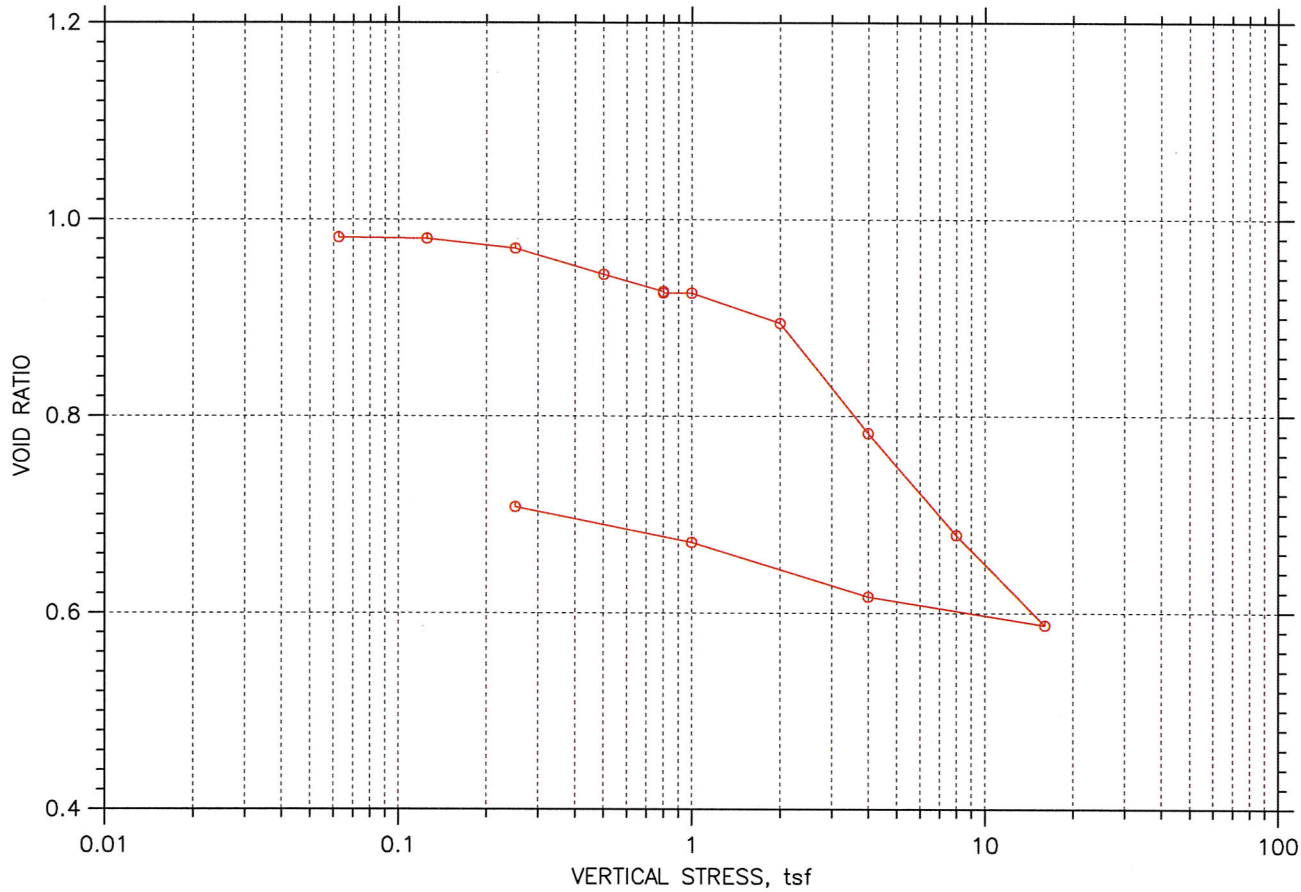


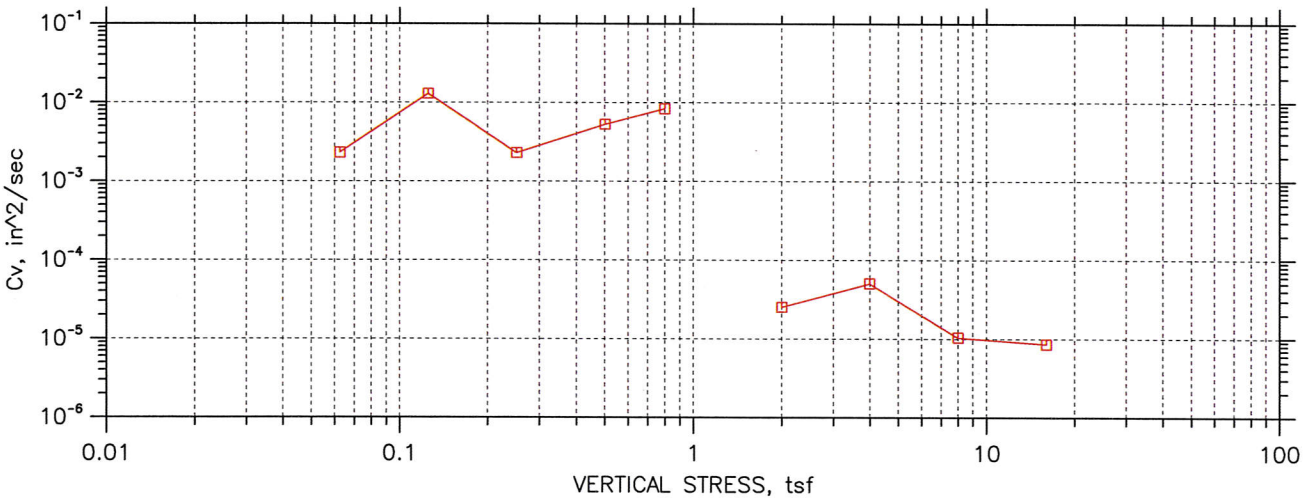
	Project: Redhill Slope Repair	Location: 12-ORA-405-8.4	Project No.: 12-0N5401
	Boring No.: R-14-104	Tested By: jg	Checked By:
	Sample No.: 1-B	Test Date: 04/25/14	Depth: 13-15
	Test No.: 14-015-G3	Sample Type: tube	Elevation: GL 14-020
	Description: Moist; Black; Clay with gravel, silt		
	Remarks: Swell @ 0.8 tsf		

Fri, 09-MAY-2014 10:08:05

CONSOLIDATION TEST DATA

SUMMARY REPORT



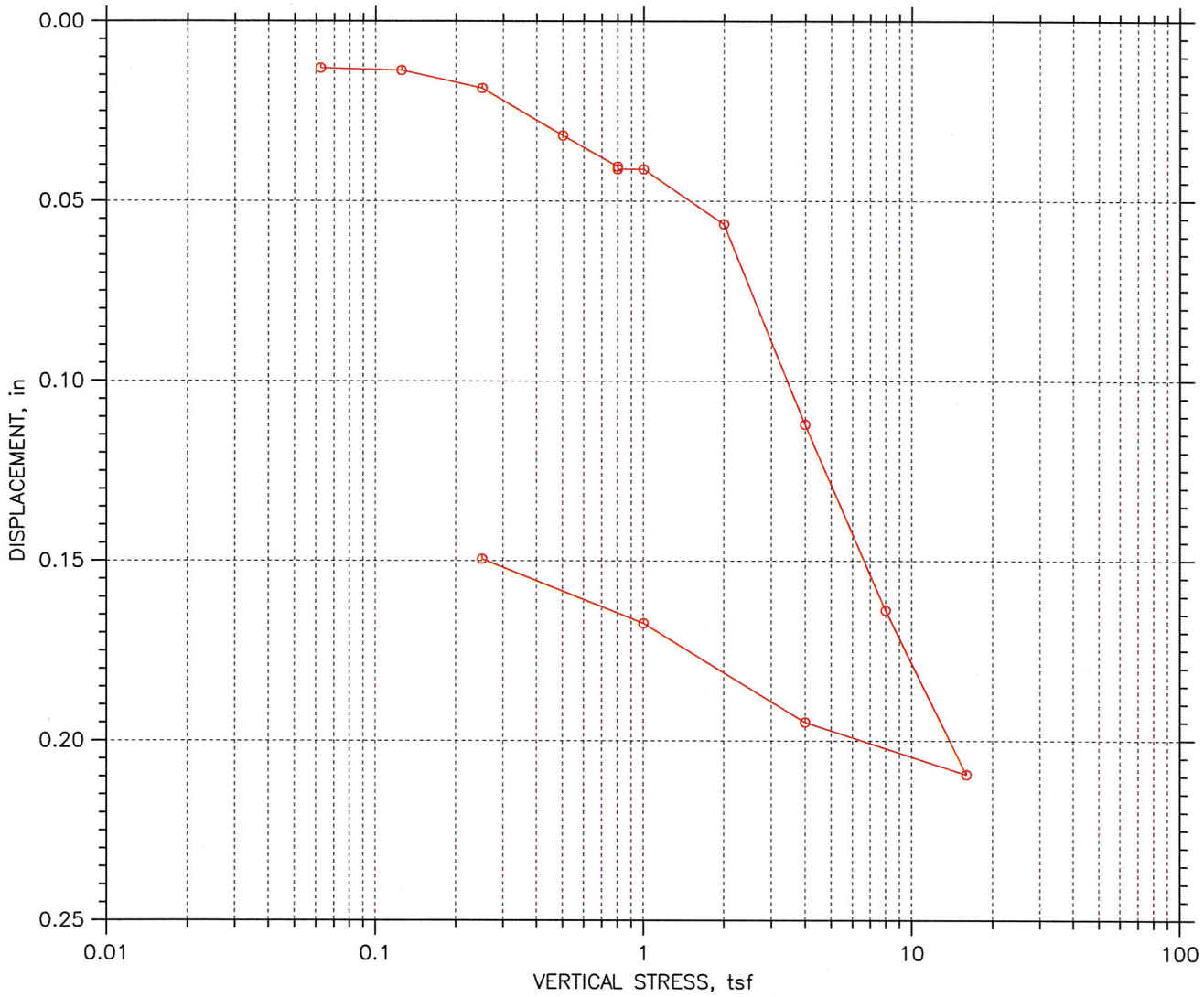


	Project: Redhill Slope Repair	Location: 12-ORA-405-8.4	Project No.: 12-0N5401
	Boring No.: R-14-104	Tested By: jg	Checked By:
	Sample No.: 1-B	Test Date: 04/25/14	Depth: 13-15
	Test No.: 14-015-G3	Sample Type: tube	Elevation: GL 14-020
	Description: Moist; Black; Clay with gravel, silt		
	Remarks: Swell @ 0.8 tsf		

Fri, 09-MAY-2014 10:08:37

CONSOLIDATION TEST DATA

SUMMARY REPORT



				Before Test	After Test
Overburden Pressure: 0 tsf				Water Content, %	35.92	25.73
Preconsolidation Pressure: 0 tsf				Dry Unit Weight, pcf	85.22	100.2
Compression Index: 0				Saturation, %	97.69	99.66
Diameter: 2.375 in		Height: 1 in		Void Ratio	1.01	0.71
LL: ---	PL: ---	PI: ---	GS: 2.74			

	Project: Redhill Slope Repair	Location: 12-ORA-405-8.4	Project No.: 12-0N5401
	Boring No.: R-14-104	Tested By: jg	Checked By:
	Sample No.: 1-B	Test Date: 04/25/14	Depth: 13-15
	Test No.: 14-015-G3	Sample Type: tube	Elevation: GL 14-020
	Description: Moist; Black; Clay with gravel, silt		
	Remarks: Swell @ 0.8 tsf		

Fri, 09-MAY-2014 10:09:03

CONSOLIDATION TEST DATA

Project: Redhill Slope Repair
Boring No.: R-14-105
Sample No.: 1-A
Test No.: 14-016-G4

Location: 12-ORA-405-8.4
Tested By: jg
Test Date: 04/25/14
Sample Type: tube

Project No.: 12-0N5401
Checked By: VP 6/16
Depth: 25-29
Elevation: GL 14-020

Soil Description: Moist; Black; Clay with silt
Remarks: Swell @ 0.3 tsf

Measured Specific Gravity: 2.76
Initial Void Ratio: 1.55
Final Void Ratio: 1.03

Liquid Limit: ---
Plastic Limit: ---
Plasticity Index: ---

Initial Height: 1.00 in
Specimen Diameter: 2.38 in

	Before Consolidation		After Consolidation	
	Trimmings	Specimen+Ring	Specimen+Ring	Trimmings
Container ID		RING		
Wt. Container + Wet Soil, gm	205.9	205.9	194.4	194.4
Wt. Container + Dry Soil, gm	165.1	165.1	165.1	165.1
Wt. Container, gm	86.6	86.6	86.6	86.6
Wt. Dry Soil, gm	78.5	78.5	78.5	78.5
Water Content, %	51.97	51.97	37.32	37.32
Void Ratio	---	1.55	1.03	---
Degree of Saturation, %	---	92.42	99.84	---
Dry Unit Weight, pcf	---	67.504	84.787	---

CONSOLIDATION TEST DATA

Project: Redhill Slope Repair
Boring No.: R-14-105
Sample No.: 1-A
Test No.: 14-016-G4

Location: 12-ORA-405-8.4
Tested By: jg
Test Date: 04/25/14
Sample Type: tube

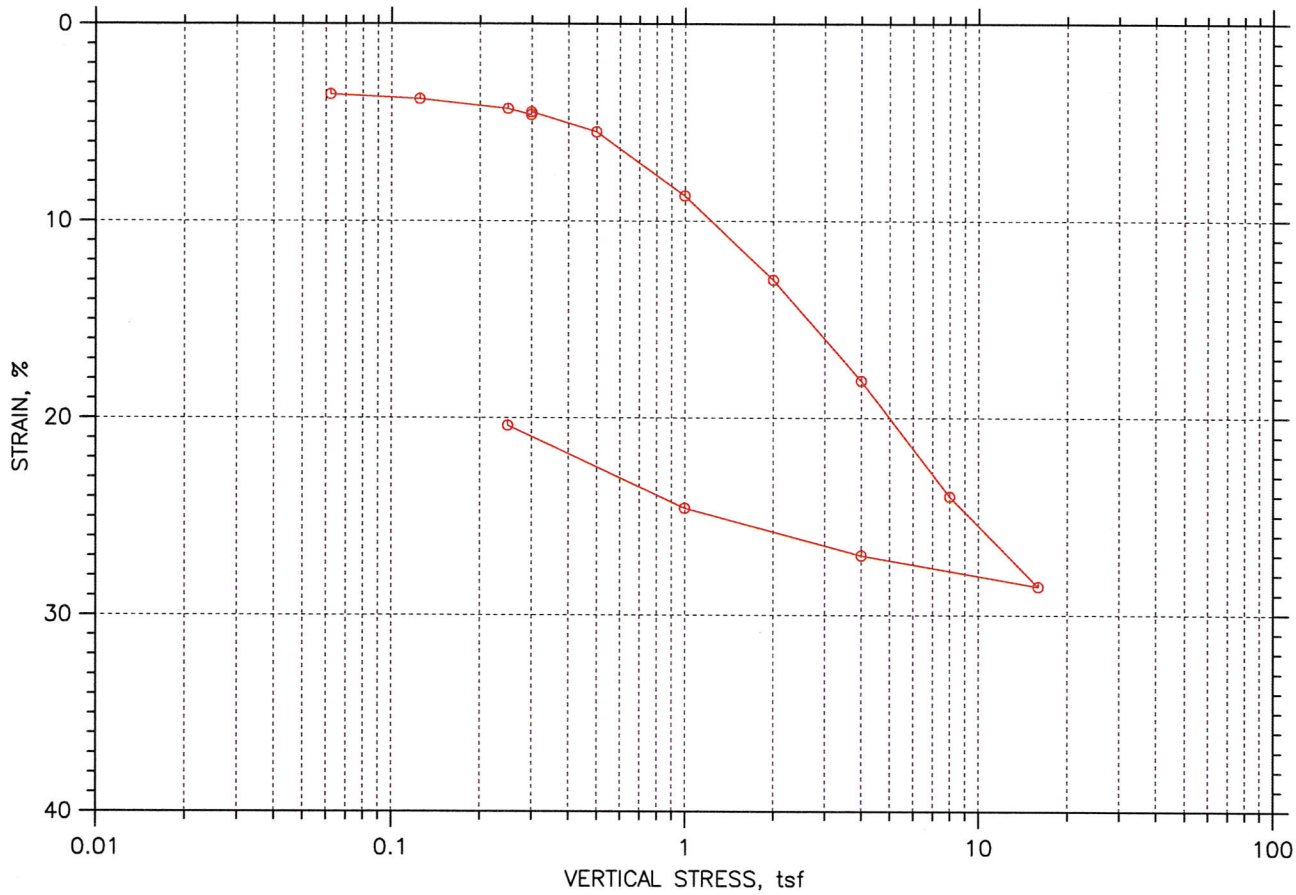
Project No.: 12-0N5401
Checked By:
Depth: 25-29
Elevation: GL 14-020

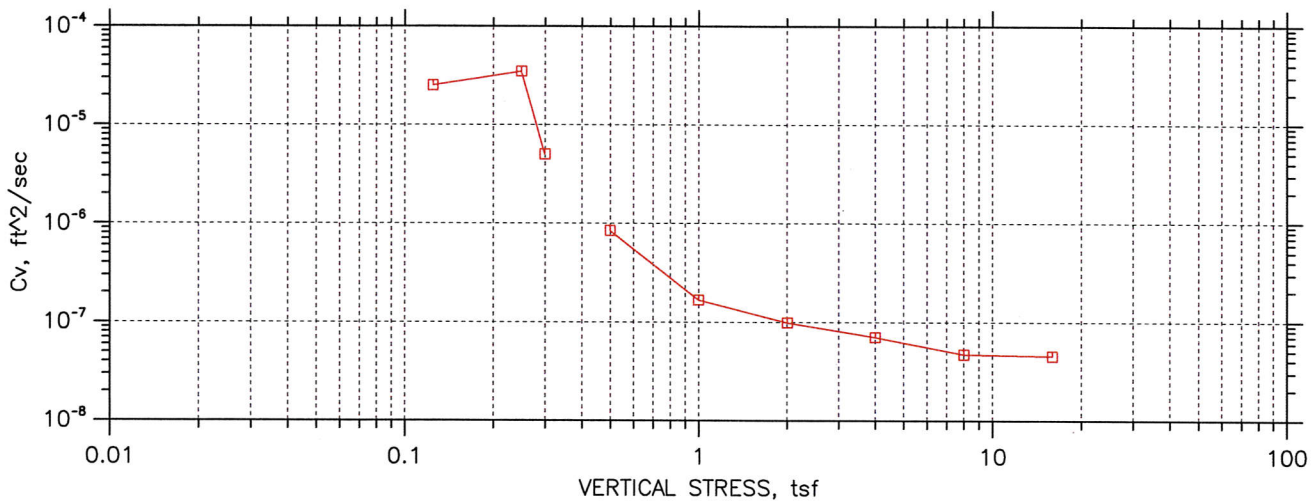
Soil Description: Moist; Black; Clay with silt
Remarks: Swell @ 0.3 tsf

	Applied Stress tsf	Final Displacement in	Void Ratio	Strain at End %	T50 Fitting Sq.Rt. min	T50 Fitting Log min	Coefficient of Consolidation Sq.Rt. ft^2/sec	Coefficient of Consolidation Log ft^2/sec	Coefficient of Consolidation Ave. ft^2/sec
1	0.0625	0.03566	1.461	3.57	0.0	0.0	0.00e+000	0.00e+000	0.00e+000
2	0.125	0.0381	1.454	3.81	0.3	0.2	2.00e-005	3.40e-005	2.52e-005
3	0.25	0.04303	1.442	4.30	0.2	0.1	2.89e-005	4.40e-005	3.49e-005
4	0.3	0.0461	1.434	4.61	1.0	0.0	5.03e-006	0.00e+000	5.03e-006
5	0.3	0.04475	1.437	4.48	0.0	0.0	0.00e+000	0.00e+000	0.00e+000
6	0.5	0.05486	1.412	5.49	6.1	0.0	8.46e-007	0.00e+000	8.46e-007
7	1	0.08731	1.329	8.73	29.4	0.0	1.67e-007	0.00e+000	1.67e-007
8	2	0.1299	1.220	12.99	45.9	0.0	9.89e-008	0.00e+000	9.89e-008
9	4	0.1812	1.089	18.12	57.7	0.0	7.05e-008	0.00e+000	7.05e-008
10	8	0.2398	0.940	23.98	75.3	0.0	4.72e-008	0.00e+000	4.72e-008
11	16	0.2854	0.823	28.54	68.1	0.0	4.56e-008	0.00e+000	4.56e-008
12	4	0.2697	0.863	26.97	15.9	0.0	1.87e-007	0.00e+000	1.87e-007
13	1	0.2458	0.924	24.58	56.4	0.0	5.57e-008	0.00e+000	5.57e-008
14	0.25	0.2038	1.031	20.38	276.7	0.0	1.24e-008	0.00e+000	1.24e-008

CONSOLIDATION TEST DATA

SUMMARY REPORT





	Project: Redhill Slope Repair	Location: 12-ORA-405-8.4	Project No.: 12-0N5401
	Boring No.: R-14-105	Tested By: jg	Checked By:
	Sample No.: 1-A	Test Date: 04/25/14	Depth: 25-29
	Test No.: 14-016-G4	Sample Type: tube	Elevation: GL 14-020
	Description: Moist; Black; Clay with silt		
	Remarks: Swell @ 0.3 tsf		

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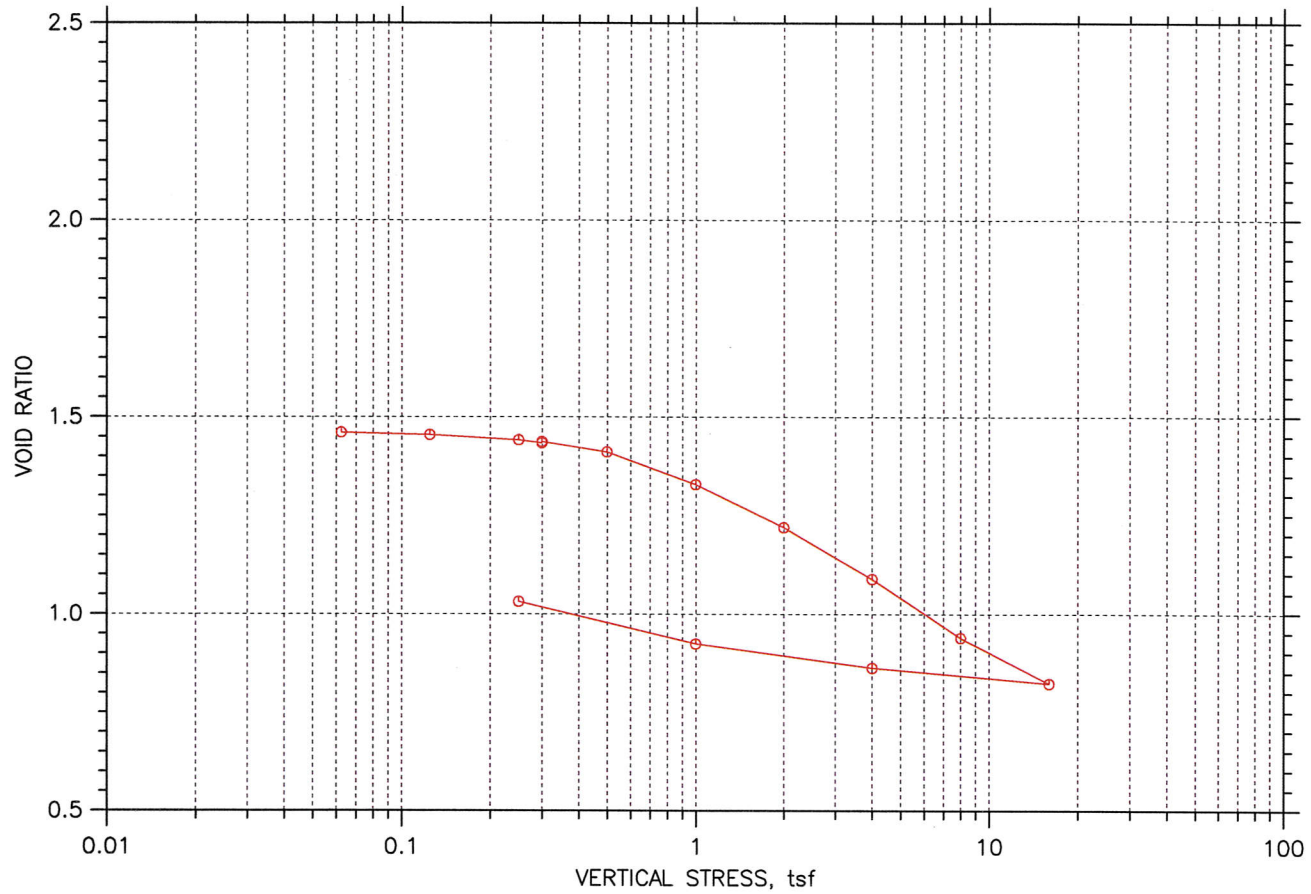
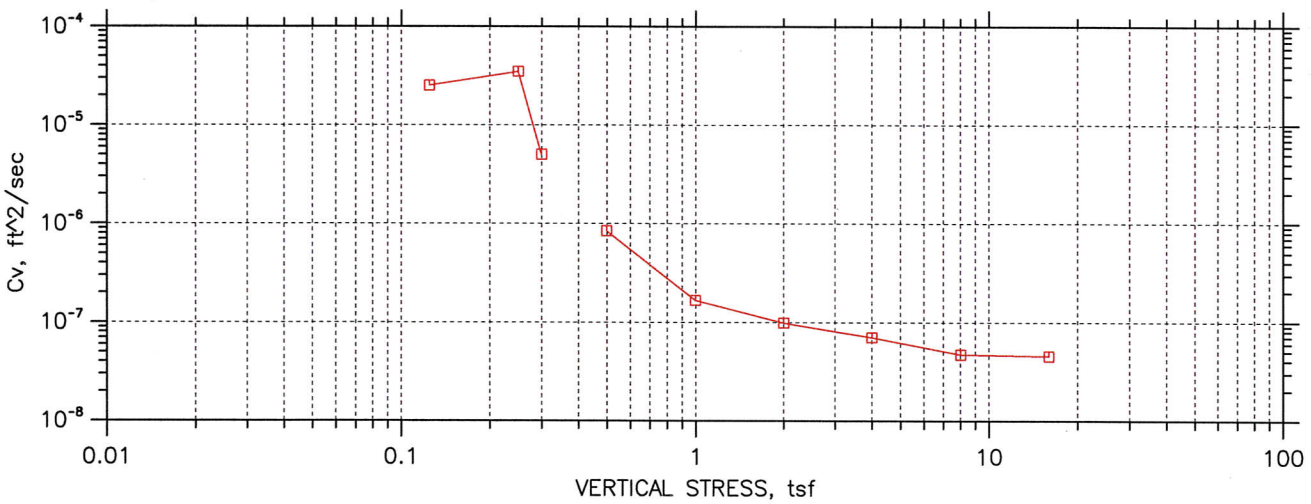
CONSOLIDATION TEST DATA

SUMMARY REPORT





	Project: Redhill Slope Repair	Location: 12-ORA-405-8.4	Project No.: 12-0N5401
	Boring No.: R-14-105	Tested By: jg	Checked By:
	Sample No.: 1-A	Test Date: 04/25/14	Depth: 25-29
	Test No.: 14-016-G4	Sample Type: tube	Elevation: GL 14-020
	Description: Moist; Black; Clay with silt		
	Remarks: Swell @ 0.3 tsf		

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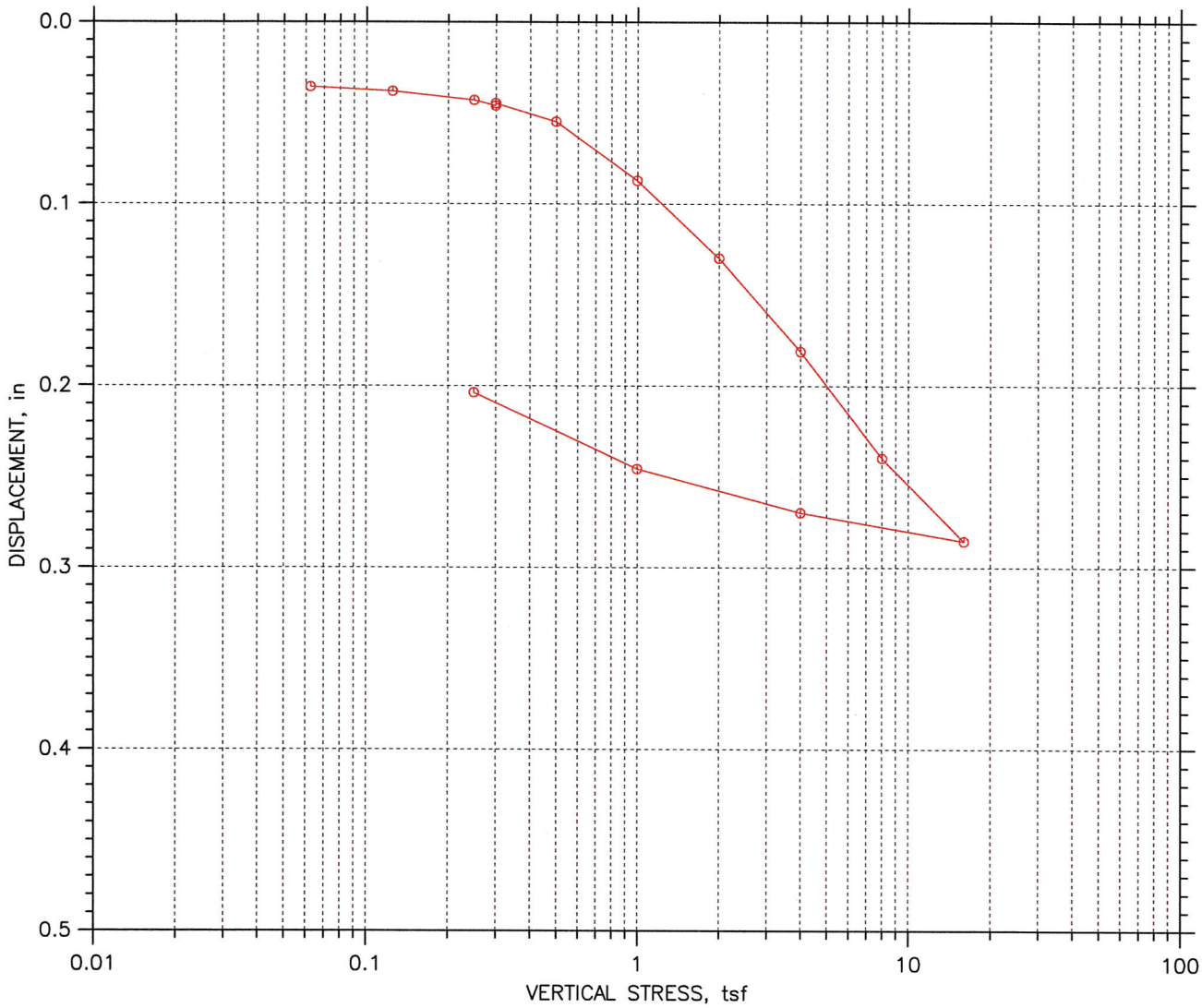
CONSOLIDATION TEST DATA

SUMMARY REPORT



				Before Test	After Test
Overburden Pressure: 0 tsf			Water Content, %	51.97	37.32
Preconsolidation Pressure: 0 tsf			Dry Unit Weight, pcf	67.5	84.79
Compression Index: 0			Saturation, %	92.42	99.84
Diameter: 2.375 in		Height: 1 in	Void Ratio	1.55	1.03
LL: ---	PL: ---	PI: ---	GS: 2.76		

	Project: Redhill Slope Repair	Location: 12-ORA-405-8.4	Project No.: 12-0N5401
	Boring No.: R-14-105	Tested By: jg	Checked By:
	Sample No.: 1-A	Test Date: 04/25/14	Depth: 25-29
	Test No.: 14-016-G4	Sample Type: tube	Elevation: GL 14-020
	Description: Moist; Black; Clay with silt		
	Remarks: Swell @ 0.3 tsf		

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One-Dimensional Consolidation by ASTM D 2435 - Method B

Project: Redhill Slope Repair
Boring No.: R-14-105
Sample No.: 1-B
Test No.: 14-017-G1

Location: 12-ORA-405-8.4
Tested By: jg
Test Date: 04/29/14
Sample Type: tube

Project No.: 12-0N5401
Checked By: KP 5/16
Depth: 25-29
Elevation: GL 14-020

Soil Description: Moist; Stiff; Black; Clay with silt
Remarks: Swell @ 1 tsf

Measured Specific Gravity: 2.77
Initial Void Ratio: 1.03
Final Void Ratio: 0.707

Liquid Limit: ---
Plastic Limit: ---
Plasticity Index: ---

Initial Height: 1.00 in
Specimen Diameter: 2.38 in

	Before Consolidation		After Consolidation	
	Trimmings	Specimen+Ring	Specimen+Ring	Trimmings
Container ID		RING		
Wt. Container + Wet Soil, gm	224.00	224.00	212.60	212.60
Wt. Container + Dry Soil, gm	187.30	187.30	187.30	187.30
Wt. Container, gm	87.900	87.900	87.900	87.900
Wt. Dry Soil, gm	99.400	99.400	99.400	99.400
Water Content, %	36.92	36.92	25.45	25.45
Void Ratio	---	1.03	0.707	---
Degree of Saturation, %	---	99.86	99.79	---
Dry Unit Weight, pcf	---	85.477	101.40	---

One-Dimensional Consolidation by ASTM D 2435 - Method B

Project: Redhill Slope Repair
Boring No.: R-14-105
Sample No.: 1-B
Test No.: 14-017-G1

Location: 12-ORA-405-8.4
Tested By: jg
Test Date: 04/29/14
Sample Type: tube

Project No.: 12-0N5401
Checked By:
Depth: 25-29
Elevation: GL 14-020

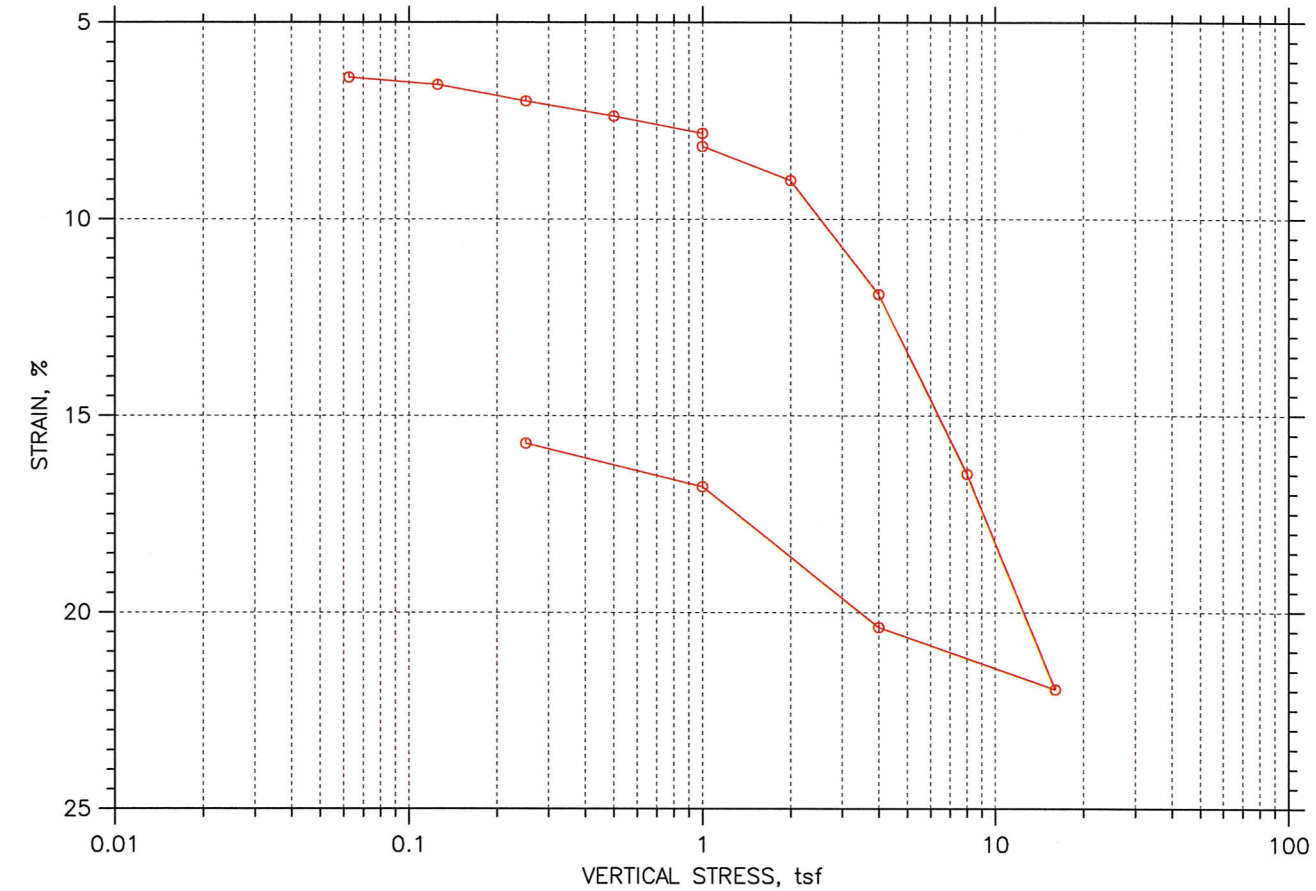
Soil Description: Moist; Stiff; Black; Clay with silt
Remarks: Swell @ 1 tsf
Displacement at End of Increment

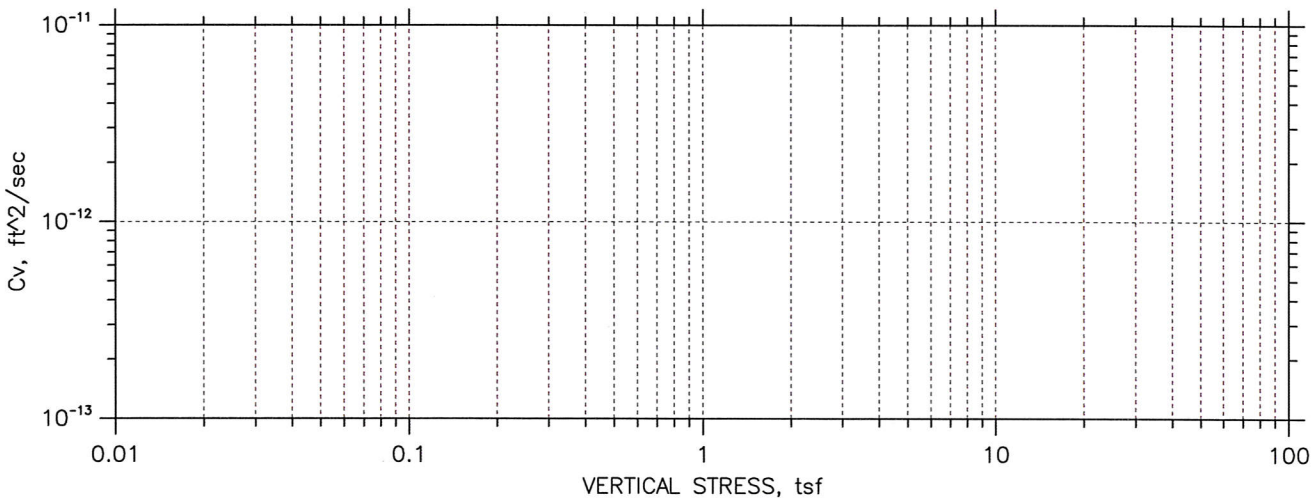
	Applied Stress tsf	Final Displacement in	Void Ratio	Strain at End %	Sq.Rt T90 min	Cv ft^2/sec	Mv 1/tsf	k ft/day
1	0.0625	0.06396	0.896	6.40	1.515	1.52e-005	1.02e+000	4.19e-002
2	0.125	0.06582	0.892	6.58	0.259	8.30e-005	2.98e-002	6.67e-003
3	0.250	0.06997	0.884	7.00	2.260	9.43e-006	3.32e-002	8.45e-004
4	0.500	0.07380	0.876	7.38	0.773	2.73e-005	1.53e-002	1.13e-003
5	1.00	0.07817	0.867	7.82	0.255	8.21e-005	8.73e-003	1.93e-003
6	1.00	0.08148	0.860	8.15	0.000	0.00e+000	1.#Je+000	-1.#Je+000
7	2.00	0.09013	0.843	9.01	99.276	2.07e-007	8.64e-003	4.82e-006
8	4.00	0.1191	0.784	11.9	207.795	9.47e-008	1.45e-002	3.70e-006
9	8.00	0.1648	0.692	16.5	316.972	5.70e-008	1.14e-002	1.76e-006
10	16.0	0.2196	0.581	22.0	326.752	4.90e-008	6.85e-003	9.05e-007
11	4.00	0.2038	0.613	20.4	119.691	1.27e-007	1.32e-003	4.53e-007
12	1.00	0.1680	0.685	16.8	656.031	2.48e-008	1.19e-002	7.97e-007
13	0.250	0.1570	0.707	15.7	0.000	0.00e+000	1.46e-002	0.00e+000

	Applied Stress tsf	Final Displacement in	Void Ratio	Strain at End %	Log T50 min	Cv ft^2/sec	Mv 1/tsf	k ft/day	Ca %
1	0.0625	0.06396	0.896	6.40	0.000	0.00e+000	1.02e+000	0.00e+000	0.00e+000
2	0.125	0.06582	0.892	6.58	0.000	0.00e+000	2.98e-002	0.00e+000	0.00e+000
3	0.250	0.06997	0.884	7.00	0.075	6.58e-005	3.32e-002	5.89e-003	0.00e+000
4	0.500	0.07380	0.876	7.38	0.116	4.24e-005	1.53e-002	1.75e-003	0.00e+000
5	1.00	0.07817	0.867	7.82	0.114	4.26e-005	8.73e-003	1.00e-003	0.00e+000
6	1.00	0.08148	0.860	8.15	0.000	0.00e+000	1.#Je+000	-1.#Je+000	0.00e+000
7	2.00	0.09013	0.843	9.01	16.156	2.95e-007	8.64e-003	6.87e-006	0.00e+000
8	4.00	0.1191	0.784	11.9	44.579	1.03e-007	1.45e-002	4.01e-006	0.00e+000
9	8.00	0.1648	0.692	16.5	72.016	5.83e-008	1.14e-002	1.79e-006	0.00e+000
10	16.0	0.2196	0.581	22.0	0.000	0.00e+000	6.85e-003	0.00e+000	0.00e+000
11	4.00	0.2038	0.613	20.4	0.000	0.00e+000	1.32e-003	0.00e+000	0.00e+000
12	1.00	0.1680	0.685	16.8	144.299	2.62e-008	1.19e-002	8.42e-007	0.00e+000
13	0.250	0.1570	0.707	15.7	0.000	0.00e+000	1.46e-002	0.00e+000	0.00e+000

One-Dimensional Consolidation by ASTM D 2435 ⇔ Method B

SUMMARY REPORT





	Project: Redhill Slope Repair	Location: 12-ORA-405-8.4	Project No.: 12-0N5401
	Boring No.: R-14-105	Tested By: jg	Checked By:
	Sample No.: 1-B	Test Date: 04/29/14	Test No.: 14-017-G1
	Depth: 25-29	Sample Type: tube	Elevation: GL 14-020
	Description: Moist; Stiff; Black; Clay with silt		
	Remarks: Swell @ 1 tsf		
	Displacement at End of Increment		

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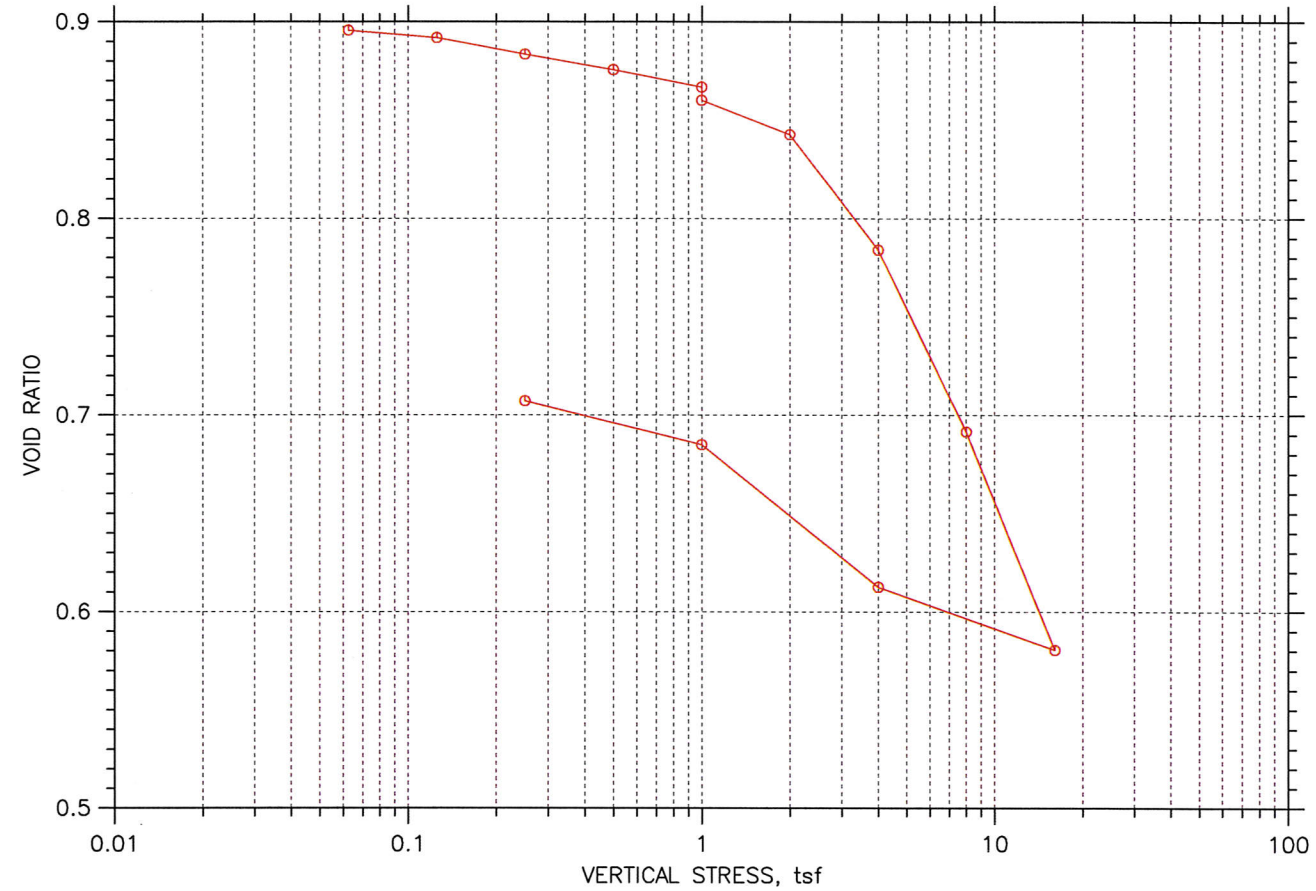
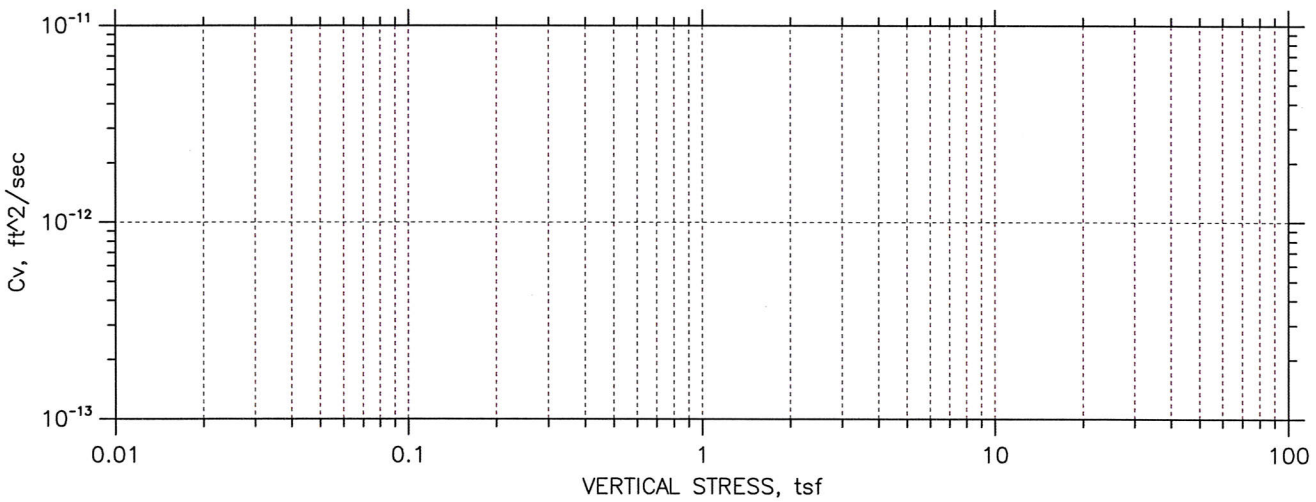
One-Dimensional Consolidation by ASTM D 2435 ↔ Method B

SUMMARY REPORT





	Project: Redhill Slope Repair	Location: 12-ORA-405-8.4	Project No.: 12-0N5401
	Boring No.: R-14-105	Tested By: jg	Checked By:
	Sample No.: 1-B	Test Date: 04/29/14	Test No.: 14-017-G1
	Depth: 25-29	Sample Type: tube	Elevation: GL 14-020
	Description: Moist; Stiff; Black; Clay with silt		
	Remarks: Swell @ 1 tsf		
	Displacement at End of Increment		

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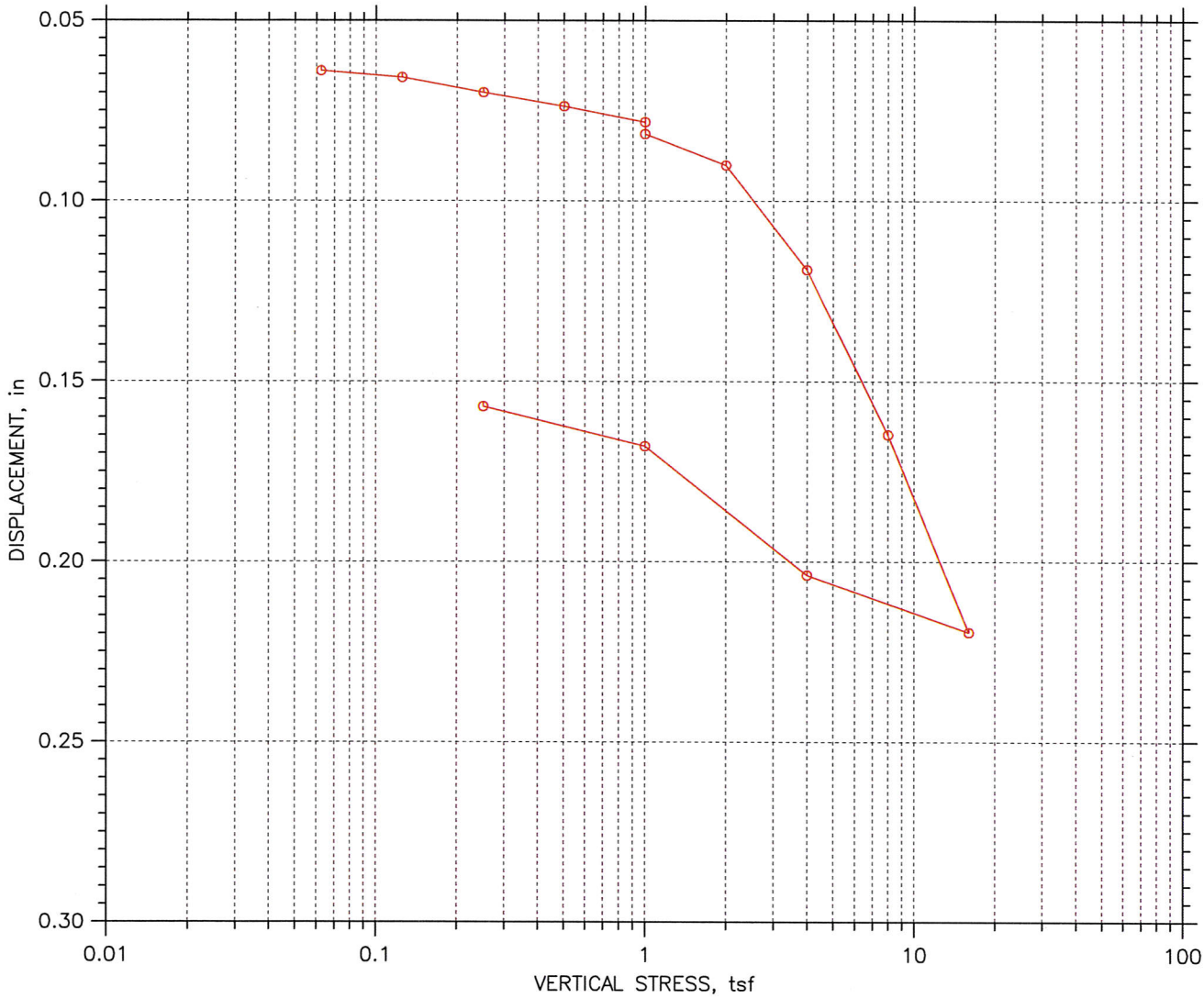
One-Dimensional Consolidation by ASTM D 2435 ↔ Method B

SUMMARY REPORT



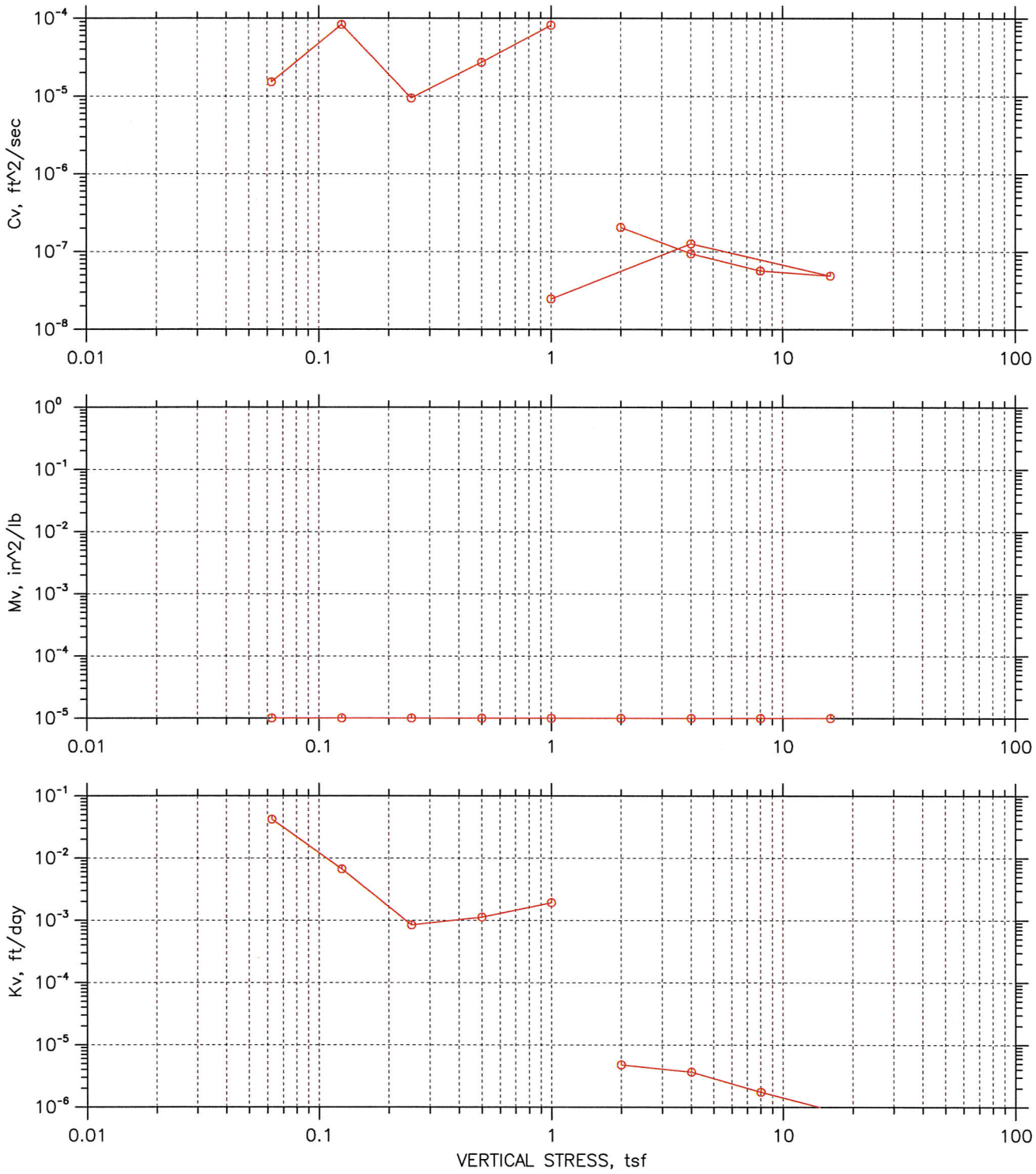
				Before Test	After Test
Overburden Pressure: 0 tsf			Water Content, %	36.92	25.45
Preconsolidation Pressure: 0 tsf			Dry Unit Weight, pcf	85.477	101.4
Compression Index: 0			Saturation, %	99.86	99.79
Diameter: 2.375 in		Height: 1 in	Void Ratio	1.03	0.71
LL: ---	PL: ---	PI: ---	GS: 2.77		

	Project: Redhill Slope Repair	Location: 12-ORA-405-8.4	Project No.: 12-0N5401
	Boring No.: R-14-105	Tested By: jg	Checked By:
	Sample No.: 1-B	Test Date: 04/29/14	Test No.: 14-017-G1
	Depth: 25-29	Sample Type: tube	Elevation: GL 14-020
	Description: Moist; Stiff; Black; Clay with silt		
	Remarks: Swell @ 1 tsf		
	Displacement at End of Increment		

Fri, 09-MAY-2014 09:49:16

One-Dimensional Consolidation by ASTM D 2435 ↔ Method B

ROOT of TIME COEFFICIENTS



	Project: Redhill Slope Repair	Location: 12-ORA-405-8.4	Project No.: 12-0N5401
	Boring No.: R-14-105	Tested By: jg	Checked By:
	Sample No.: 1-B	Test Date: 04/29/14	Test No.: 14-017-G1
	Depth: 25-29	Sample Type: tube	Elevation: GL 14-020
	Description: Moist; Stiff; Black; Clay with silt		
	Remarks: Swell @ 1 tsf		
	Displacement at End of Increment		

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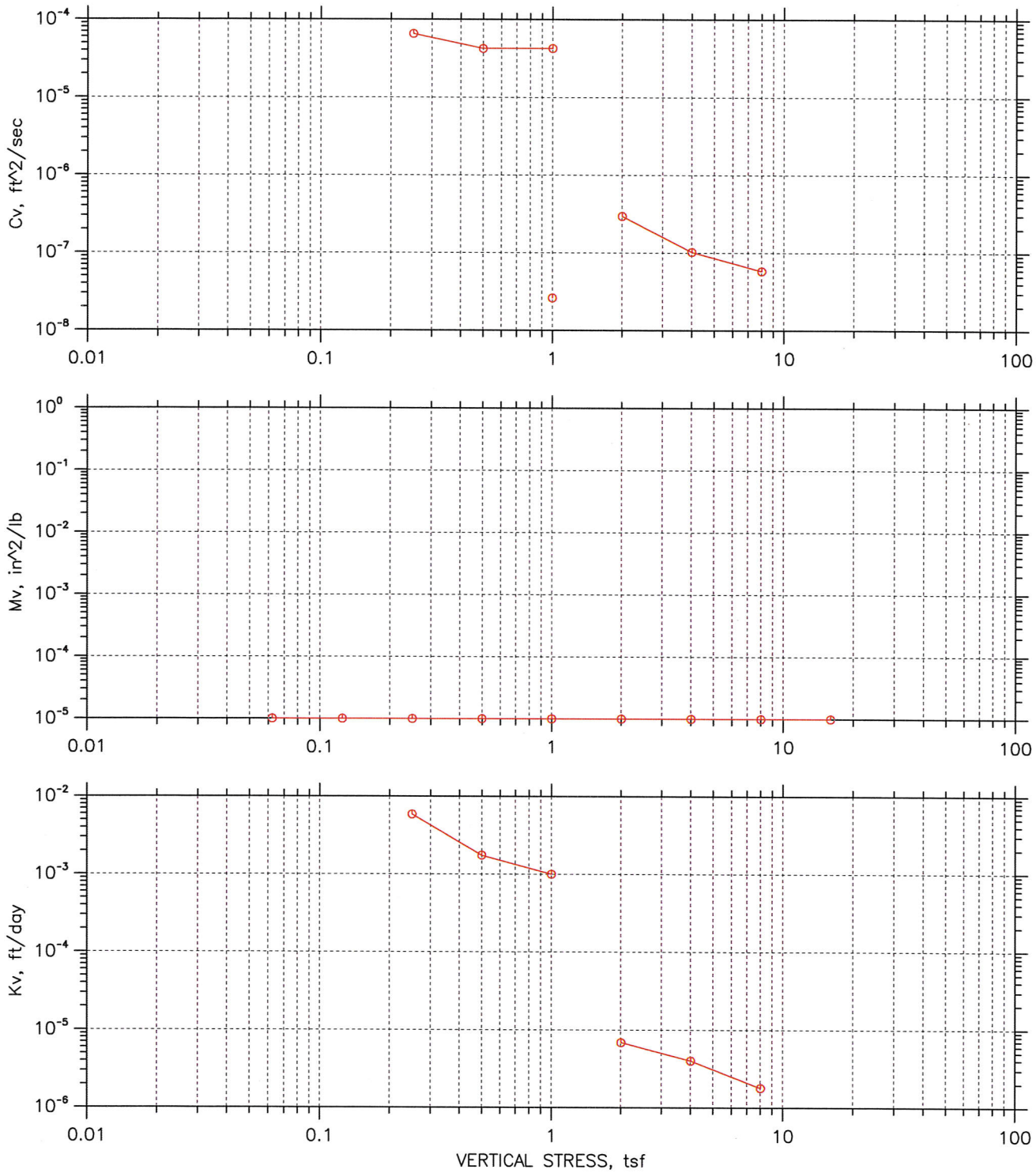
One-Dimensional Consolidation by ASTM D 2435 ⇔ Method B

LOG of TIME COEFFICIENTS



	Project: Redhill Slope Repair	Location: 12-ORA-405-8.4	Project No.: 12-0N5401
	Boring No.: R-14-105	Tested By: jg	Checked By:
	Sample No.: 1-B	Test Date: 04/29/14	Test No.: 14-017-G1
	Depth: 25-29	Sample Type: tube	Elevation: GL 14-020
	Description: Moist; Stiff; Black; Clay with silt		
	Remarks: Swell @ 1 tsf		
	Displacement at End of Increment		

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One-Dimensional Consolidation by ASTM D 2435 - Method B

Project: Redhill Slope Repair
Boring No.: R-14-105
Sample No.: 2
Test No.: 14-023-G1

Location: 12-ORA-405-8.4
Tested By: jg
Test Date: 05/19/14
Sample Type: tube

Project No.: 12-0N5401
Checked By: WP 5/22
Depth: 38-39.2
Elevation: GL 14-020

Soil Description: Moist; Soft; Gray; Sand
Remarks: 2nd test

Measured Specific Gravity: 2.70
Initial Void Ratio: 0.655
Final Void Ratio: 0.503

Liquid Limit: ---
Plastic Limit: ---
Plasticity Index: ---

Initial Height: 1.00 in
Specimen Diameter: 2.38 in

	Before Consolidation		After Consolidation	
	Trimmings	Specimen+Ring	Specimen+Ring	Trimmings
Container ID		RING		
Wt. Container + Wet Soil, gm	233.90	233.90	229.30	229.30
Wt. Container + Dry Soil, gm	207.30	207.30	207.30	207.30
Wt. Container, gm	88.800	88.800	88.800	88.800
Wt. Dry Soil, gm	118.50	118.50	118.50	118.50
Water Content, %	22.45	22.45	18.57	18.57
Void Ratio	---	0.655	0.503	---
Degree of Saturation, %	---	92.55	99.63	---
Dry Unit Weight, pcf	---	101.90	112.19	---

One-Dimensional Consolidation by ASTM D 2435 - Method B

Project: Redhill Slope Repair
Boring No.: R-14-105
Sample No.: 2
Test No.: 14-023-G1

Location: 12-ORA-405-8.4
Tested By: jg
Test Date: 05/19/14
Sample Type: tube

Project No.: 12-0N5401
Checked By:
Depth: 38-39.2
Elevation: GL 14-020

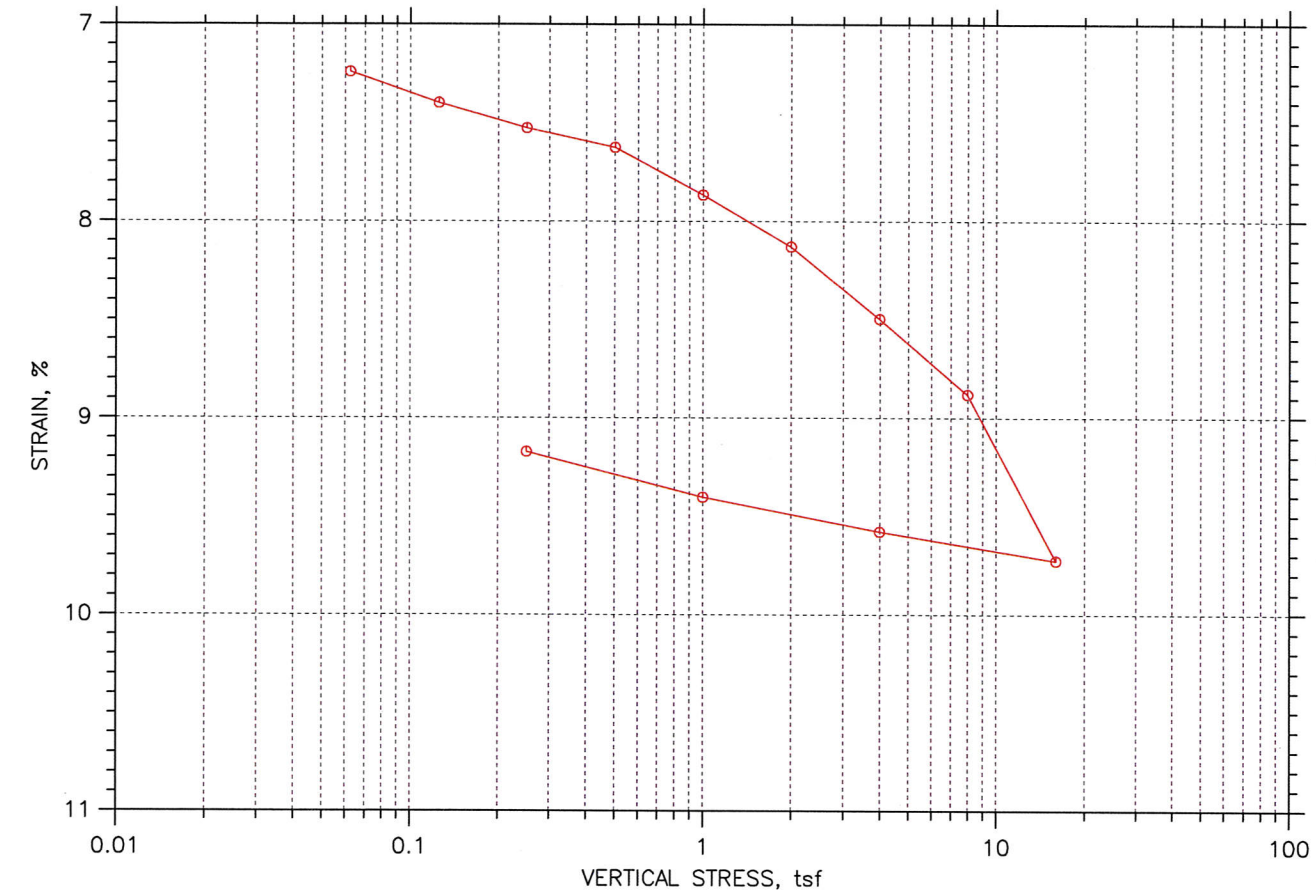
Soil Description: Moist; Soft; Gray; Sand
Remarks: 2nd test
Displacement at End of Increment

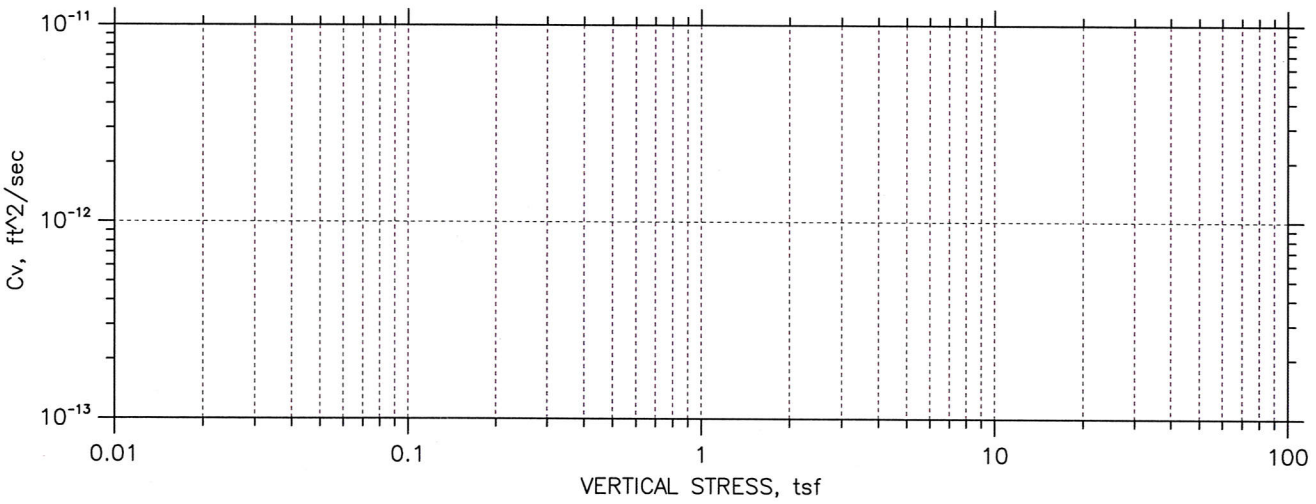
	Applied Stress tsf	Final Displacement in	Void Ratio	Strain at End %	Sq.Rt T90 min	Cv ft^2/sec	Mv 1/tsf	k ft/day
1	0.0625	0.07241	0.535	7.24	1.481	1.54e-005	1.16e+000	4.81e-002
2	0.125	0.07399	0.533	7.40	0.167	1.27e-004	2.53e-002	8.62e-003
3	0.250	0.07527	0.531	7.53	8.931	2.35e-006	1.02e-002	6.49e-005
4	0.500	0.07625	0.529	7.62	0.087	2.42e-004	3.92e-003	2.56e-003
5	1.00	0.07866	0.525	7.87	17.885	1.17e-006	4.83e-003	1.52e-005
6	2.00	0.08129	0.521	8.13	43.996	4.72e-007	2.62e-003	3.34e-006
7	4.00	0.08496	0.515	8.50	22.948	8.99e-007	1.83e-003	4.45e-006
8	8.00	0.08880	0.508	8.88	26.918	7.60e-007	9.60e-004	1.97e-006
9	16.0	0.09725	0.494	9.73	1.462	1.38e-005	1.06e-003	3.94e-005
10	4.00	0.09577	0.497	9.58	0.151	1.33e-004	1.23e-004	4.41e-005
11	1.00	0.09403	0.500	9.40	0.248	8.09e-005	5.83e-004	1.27e-004
12	0.250	0.09173	0.503	9.17	119.991	1.68e-007	3.07e-003	1.39e-006

	Applied Stress tsf	Final Displacement in	Void Ratio	Strain at End %	Log T50 min	Cv ft^2/sec	Mv 1/tsf	k ft/day	Ca %
1	0.0625	0.07241	0.535	7.24	0.793	6.68e-006	1.16e+000	2.09e-002	0.00e+000
2	0.125	0.07399	0.533	7.40	0.088	5.59e-005	2.53e-002	3.81e-003	0.00e+000
3	0.250	0.07527	0.531	7.53	0.000	0.00e+000	1.02e-002	0.00e+000	0.00e+000
4	0.500	0.07625	0.529	7.62	0.000	0.00e+000	3.92e-003	0.00e+000	0.00e+000
5	1.00	0.07866	0.525	7.87	0.000	0.00e+000	4.83e-003	0.00e+000	0.00e+000
6	2.00	0.08129	0.521	8.13	0.000	0.00e+000	2.62e-003	0.00e+000	0.00e+000
7	4.00	0.08496	0.515	8.50	0.000	0.00e+000	1.83e-003	0.00e+000	0.00e+000
8	8.00	0.08880	0.508	8.88	0.000	0.00e+000	9.60e-004	0.00e+000	0.00e+000
9	16.0	0.09725	0.494	9.73	0.000	0.00e+000	1.06e-003	0.00e+000	0.00e+000
10	4.00	0.09577	0.497	9.58	0.000	0.00e+000	1.23e-004	0.00e+000	0.00e+000
11	1.00	0.09403	0.500	9.40	0.000	0.00e+000	5.83e-004	0.00e+000	0.00e+000
12	0.250	0.09173	0.503	9.17	0.000	0.00e+000	3.07e-003	0.00e+000	0.00e+000

One-Dimensional Consolidation by ASTM D 2435 ⇔ Method B

SUMMARY REPORT

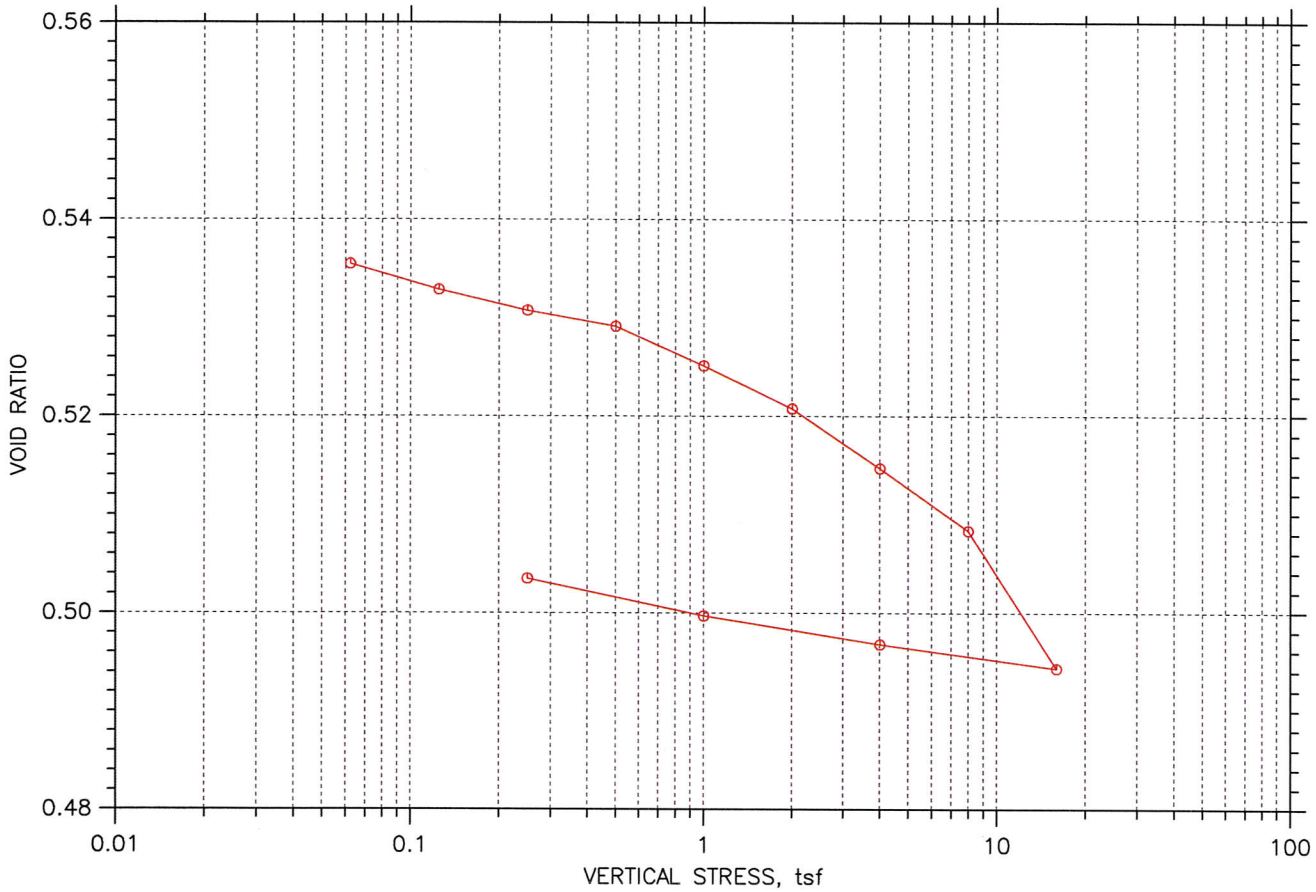


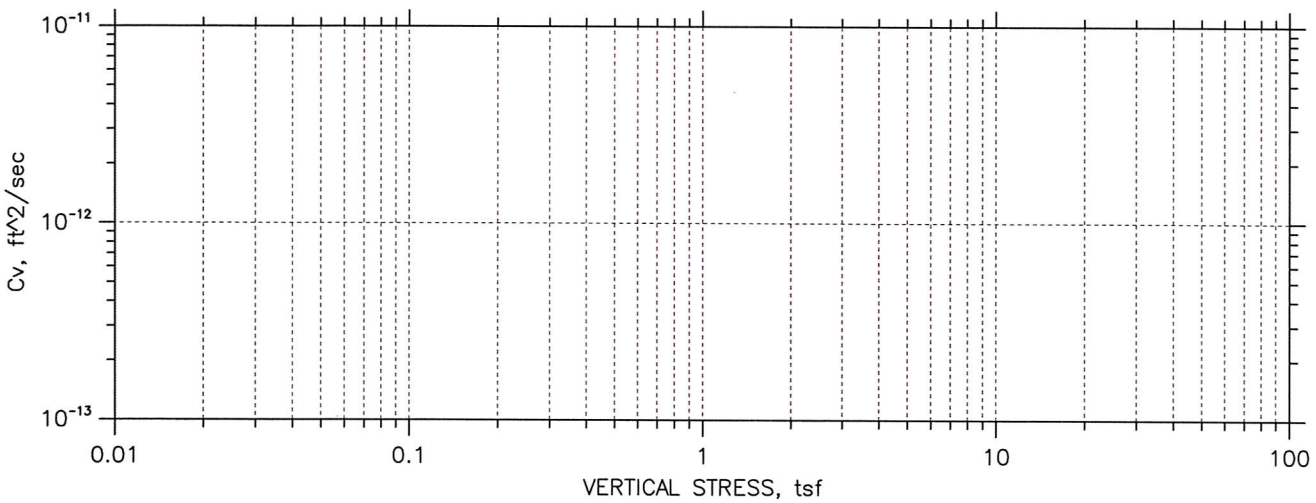


	Project: Redhill Slope Repair	Location: 12-ORA-405-8.4	Project No.: 12-0N5401
	Boring No.: R-14-105	Tested By: jg	Checked By:
	Sample No.: 2	Test Date: 05/19/14	Test No.: 14-023-G1
	Depth: 38-39.2	Sample Type: tube	Elevation: GL 14-020
	Description: Moist; Soft; Gray; Sand		
	Remarks: 2nd test		
	Displacement at End of Increment		

One-Dimensional Consolidation by ASTM D 2435 ⇔ Method B

SUMMARY REPORT



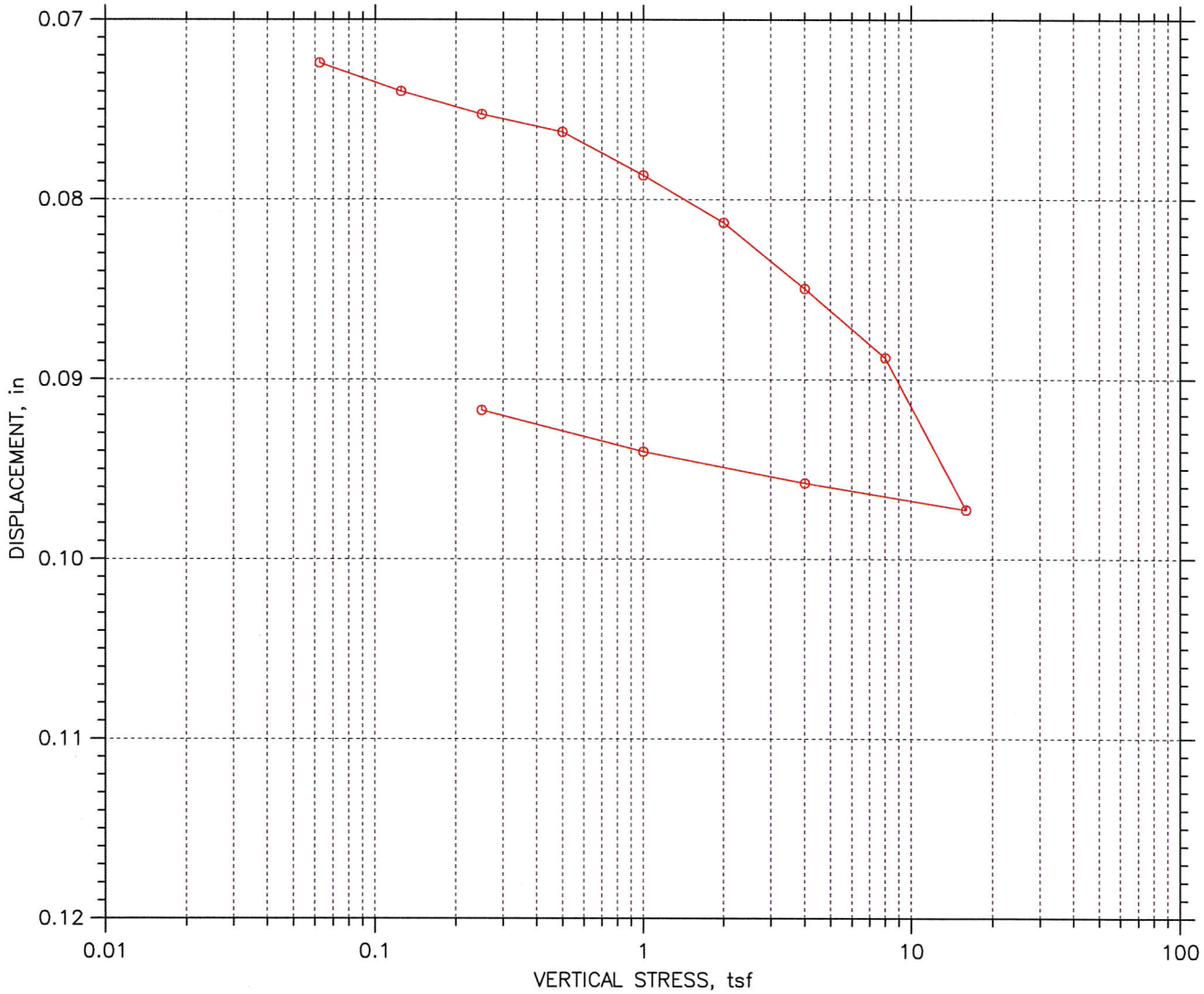


	Project: Redhill Slope Repair	Location: 12-ORA-405-8.4	Project No.: 12-0N5401
	Boring No.: R-14-105	Tested By: jg	Checked By:
	Sample No.: 2	Test Date: 05/19/14	Test No.: 14-023-G1
	Depth: 38-39.2	Sample Type: tube	Elevation: GL 14-020
	Description: Moist; Soft; Gray; Sand		
	Remarks: 2nd test		
	Displacement at End of Increment		

Thu, 22-MAY-2014 08:15:32

One-Dimensional Consolidation by ASTM D 2435 ⇔ Method B

SUMMARY REPORT



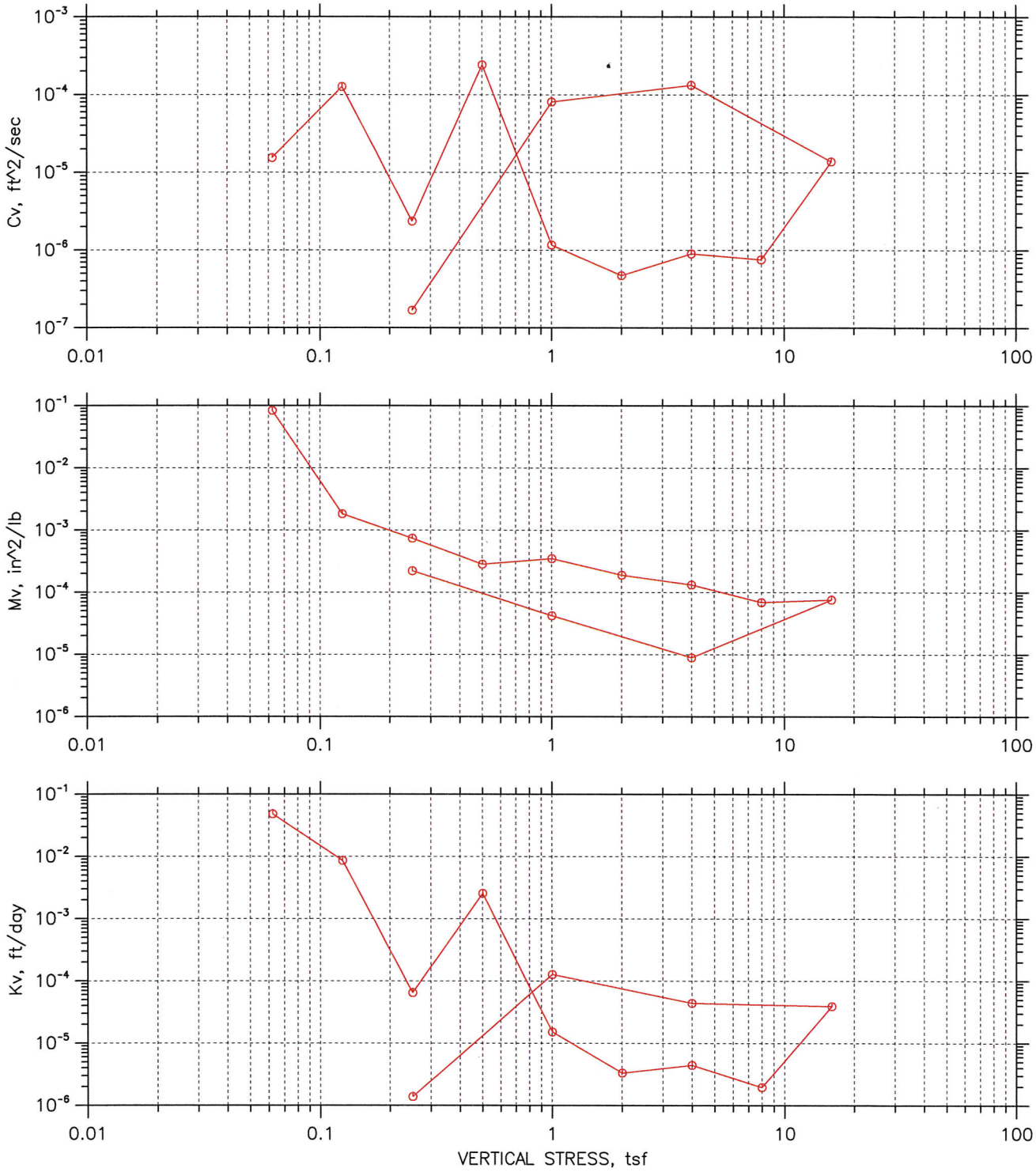
				Before Test	After Test
Overburden Pressure: 0 tsf			Water Content, %	22.45	18.57
Preconsolidation Pressure: 0 tsf			Dry Unit Weight, pcf	101.9	112.19
Compression Index: 0			Saturation, %	92.55	99.63
Diameter: 2.375 in		Height: 1 in	Void Ratio	0.66	0.50
LL: ---	PL: ---	PI: ---	GS: 2.70		

	Project: Redhill Slope Repair	Location: 12-ORA-405-8.4	Project No.: 12-0N5401
	Boring No.: R-14-105	Tested By: jg	Checked By:
	Sample No.: 2	Test Date: 05/19/14	Test No.: 14-023-G1
	Depth: 38-39.2	Sample Type: tube	Elevation: GL 14-020
	Description: Moist; Soft; Gray; Sand		
	Remarks: 2nd test		
	Displacement at End of Increment		

Thu, 22-MAY-2014 08:16:18

One-Dimensional Consolidation by ASTM D 2435 ⇔ Method B

ROOT of TIME COEFFICIENTS

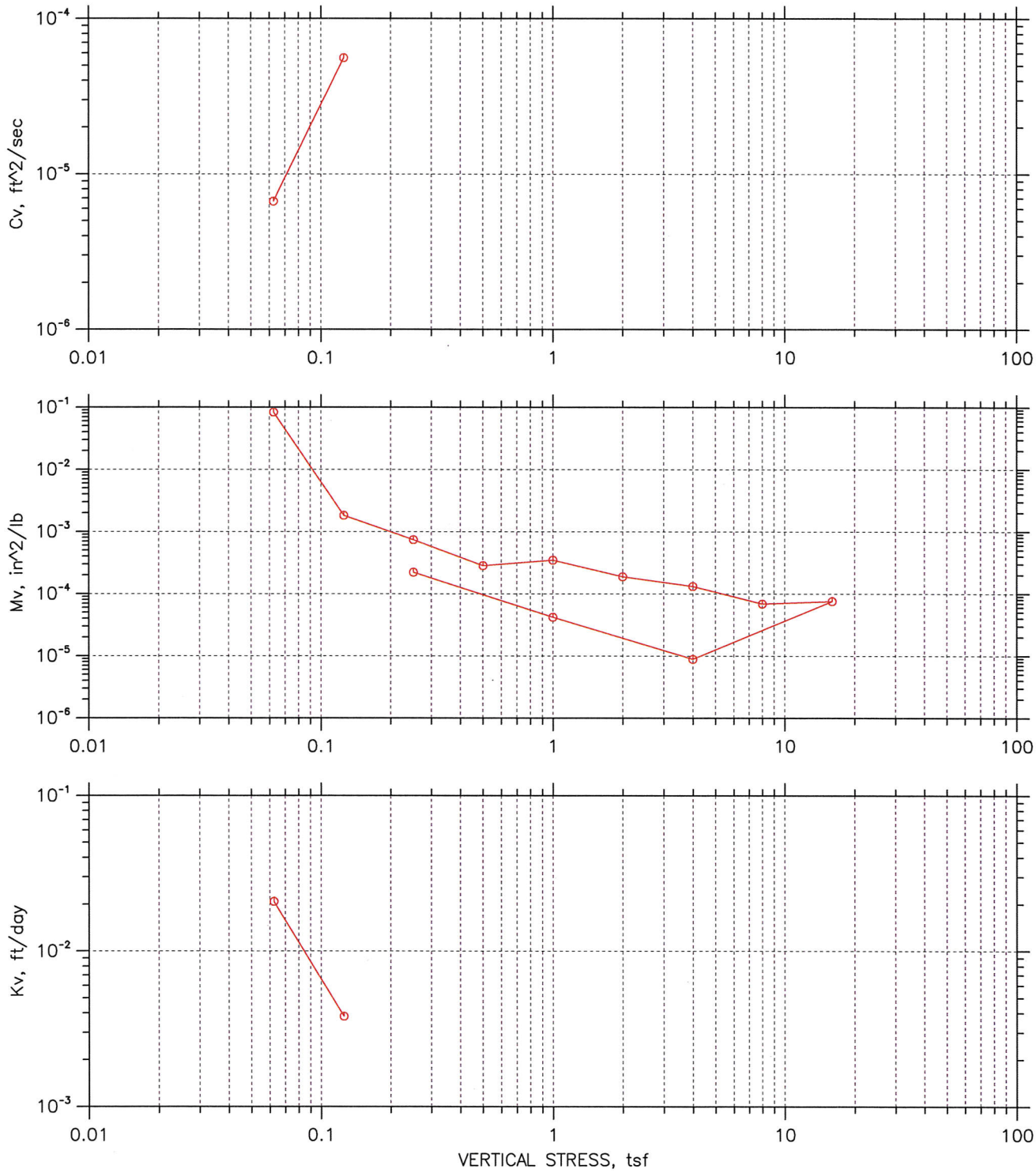


	Project: Redhill Slope Repair	Location: 12-ORA-405-8.4	Project No.: 12-0N5401
	Boring No.: R-14-105	Tested By: jg	Checked By:
	Sample No.: 2	Test Date: 05/19/14	Test No.: 14-023-G1
	Depth: 38-39.2	Sample Type: tube	Elevation: GL 14-020
	Description: Moist; Soft; Gray; Sand		
	Remarks: 2nd test		
	Displacement at End of Increment		

Thu, 22-MAY-2014 08:16:19

One-Dimensional Consolidation by ASTM D 2435 ⇔ Method B

LOG of TIME COEFFICIENTS



	Project: Redhill Slope Repair	Location: 12-ORA-405-8.4	Project No.: 12-0N5401
	Boring No.: R-14-105	Tested By: jg	Checked By:
	Sample No.: 2	Test Date: 05/19/14	Test No.: 14-023-G1
	Depth: 38-39.2	Sample Type: tube	Elevation: GL 14-020
	Description: Moist; Soft; Gray; Sand		
	Remarks: 2nd test		
	Displacement at End of Increment		

Thu, 22-MAY-2014 08:16:19

CONSOLIDATION TEST DATA

Project: Redhill Slope Repair
Boring No.: R-14-106
Sample No.: 1-A
Test No.: 14-018-G3

Location: 12-ORA-405-8.4
Tested By: jg
Test Date: 04/30/14
Sample Type: tube

Project No.: 12-0N5401
Checked By: MP 5/16
Depth: 18-20
Elevation: GL 14-020

Soil Description: Moist; Very Stiff; Black; Clay with gravel and silt
Remarks: Swell @ 0.3 tsf

Measured Specific Gravity: 2.74
Initial Void Ratio: 0.79
Final Void Ratio: 0.65

Liquid Limit: ---
Plastic Limit: ---
Plasticity Index: ---

Initial Height: 1.00 in
Specimen Diameter: 2.38 in

	Before Consolidation		After Consolidation	
	Trimmings	Specimen+Ring	Specimen+Ring	Trimmings
Container ID		RING		
Wt. Container + Wet Soil, gm	227.2	227.2	225.8	225.8
Wt. Container + Dry Soil, gm	199.6	199.6	199.6	199.6
Wt. Container, gm	88.2	88.2	88.2	88.2
Wt. Dry Soil, gm	111.4	111.4	111.4	111.4
Water Content, %	24.78	24.78	23.52	23.52
Void Ratio	---	0.79	0.65	---
Degree of Saturation, %	---	86.37	99.65	---
Dry Unit Weight, pcf	---	95.796	103.9	---

CONSOLIDATION TEST DATA

Project: Redhill Slope Repair
Boring No.: R-14-106
Sample No.: 1-A
Test No.: 14-018-G3

Location: 12-ORA-405-8.4
Tested By: jg
Test Date: 04/30/14
Sample Type: tube

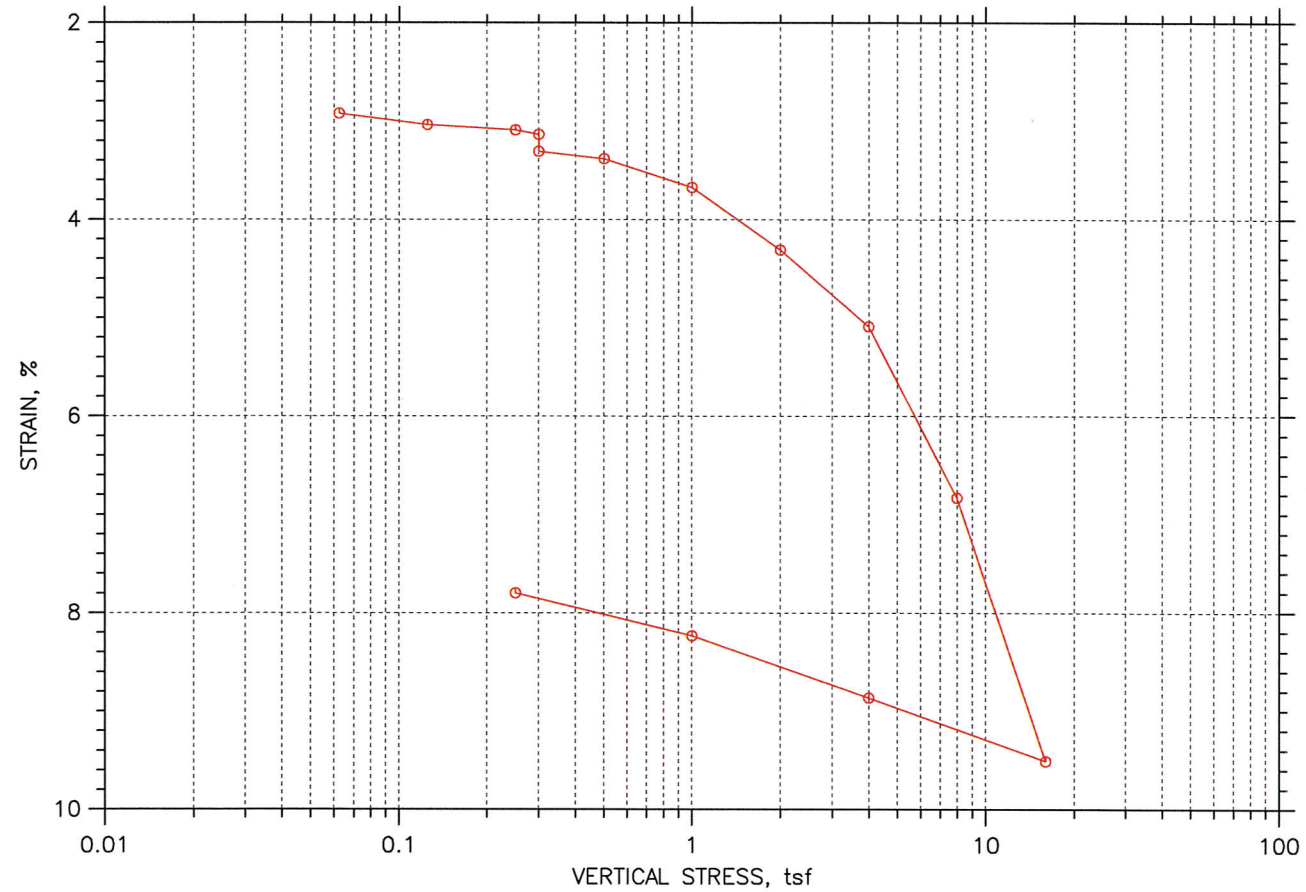
Project No.: 12-0N5401
Checked By:
Depth: 18-20
Elevation: GL 14-020

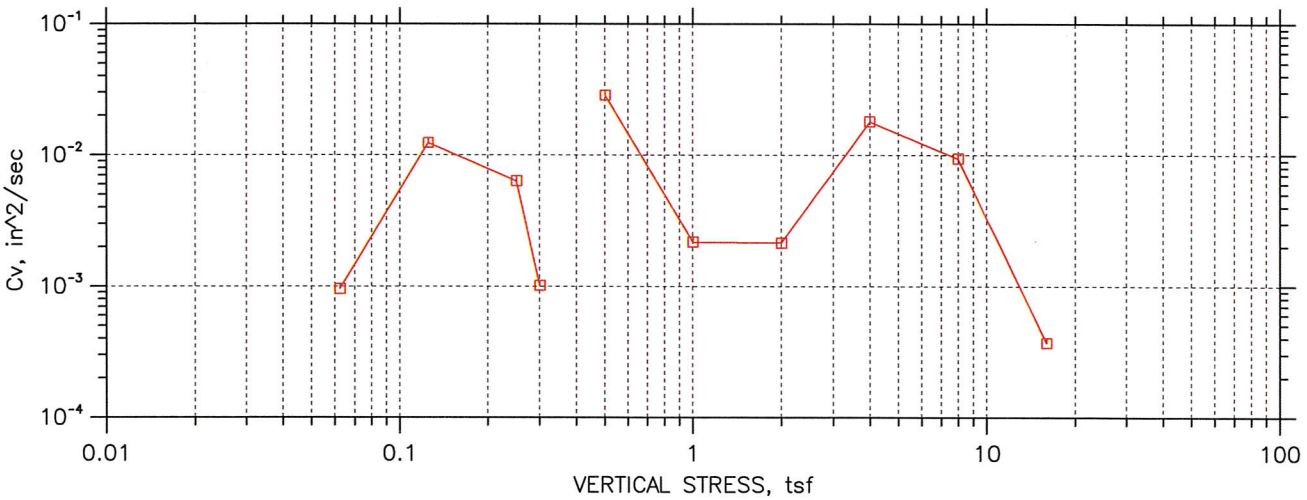
Soil Description: Moist; Very Stiff; Black; Clay with gravel and silt
Remarks: Swell @ 0.3 tsf

	Applied Stress tsf	Final Displacement in	Void Ratio	Strain at End %	T50 Fitting Sq.Rt. min	T50 Fitting Log min	Coefficient of Consolidation Sq.Rt. in^2/sec	Coefficient of Consolidation Log in^2/sec	Coefficient of Consolidation Ave. in^2/sec
1	0.0625	0.02921	0.734	2.92	0.9	0.7	8.60e-004	1.08e-003	9.58e-004
2	0.125	0.03038	0.732	3.04	0.1	0.0	1.24e-002	0.00e+000	1.24e-002
3	0.25	0.03091	0.731	3.09	0.1	0.0	6.35e-003	0.00e+000	6.35e-003
4	0.3	0.03136	0.730	3.14	0.8	0.0	1.01e-003	0.00e+000	1.01e-003
5	0.3	0.03307	0.727	3.31	0.0	0.0	0.00e+000	0.00e+000	0.00e+000
6	0.5	0.03382	0.726	3.38	0.0	0.0	2.86e-002	0.00e+000	2.86e-002
7	1	0.03673	0.721	3.67	0.4	0.0	2.18e-003	0.00e+000	2.18e-003
8	2	0.04308	0.709	4.31	0.4	0.0	2.14e-003	0.00e+000	2.14e-003
9	4	0.05087	0.695	5.09	0.1	0.0	1.21e-002	3.53e-002	1.80e-002
10	8	0.06827	0.664	6.83	0.1	0.0	6.83e-003	1.52e-002	9.43e-003
11	16	0.09507	0.616	9.51	1.9	0.0	3.72e-004	0.00e+000	3.72e-004
12	4	0.08863	0.628	8.86	0.0	0.0	4.71e-002	0.00e+000	4.71e-002
13	1	0.08233	0.639	8.23	0.0	0.0	4.64e-002	0.00e+000	4.64e-002
14	0.25	0.07799	0.647	7.80	8.1	0.8	8.55e-005	8.41e-004	1.55e-004

CONSOLIDATION TEST DATA

SUMMARY REPORT



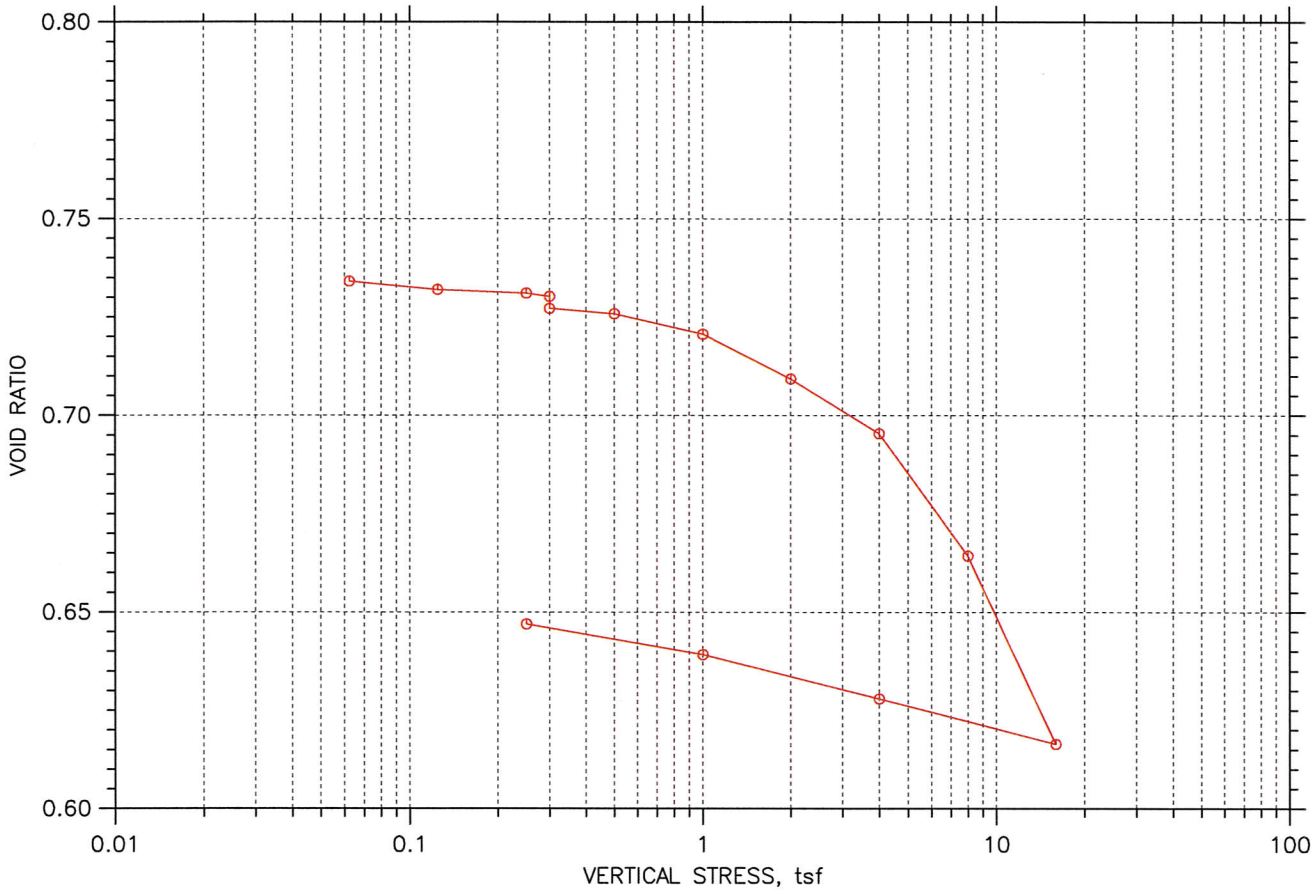


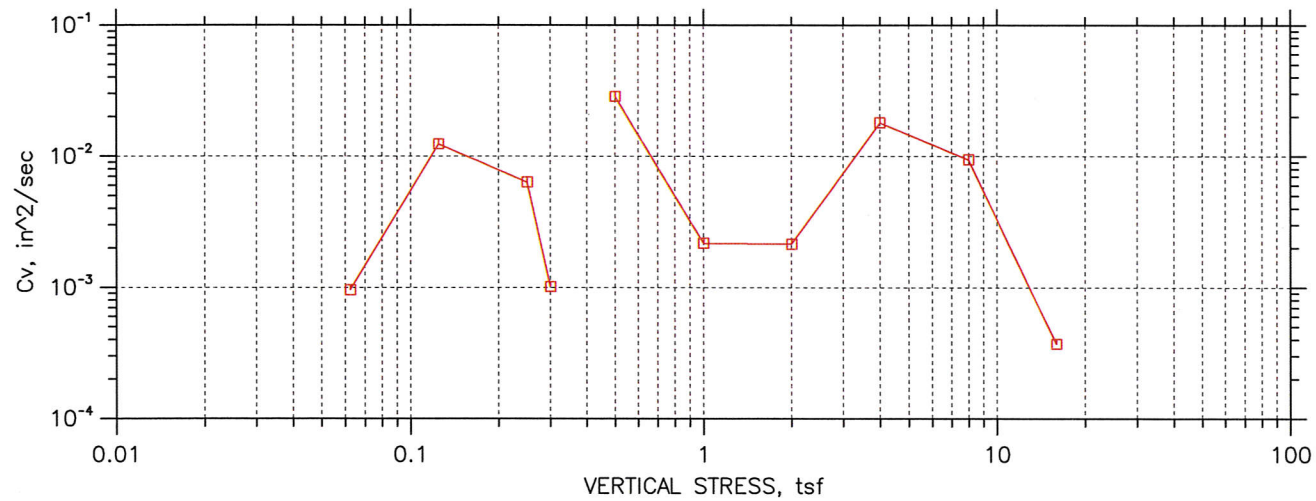
	Project: Redhill Slope Repair	Location: 12-ORA-405-8.4	Project No.: 12-0N5401
	Boring No.: R-14-106	Tested By: jg	Checked By:
	Sample No.: 1-A	Test Date: 04/30/14	Depth: 18-20
	Test No.: 14-018-G3	Sample Type: tube	Elevation: GL 14-020
	Description: Moist; Very Stiff; Black; Clay with gravel and silt		
	Remarks: Swell @ 0.3 tsf		

Fri, 09-MAY-2014 10:23:39

CONSOLIDATION TEST DATA

SUMMARY REPORT



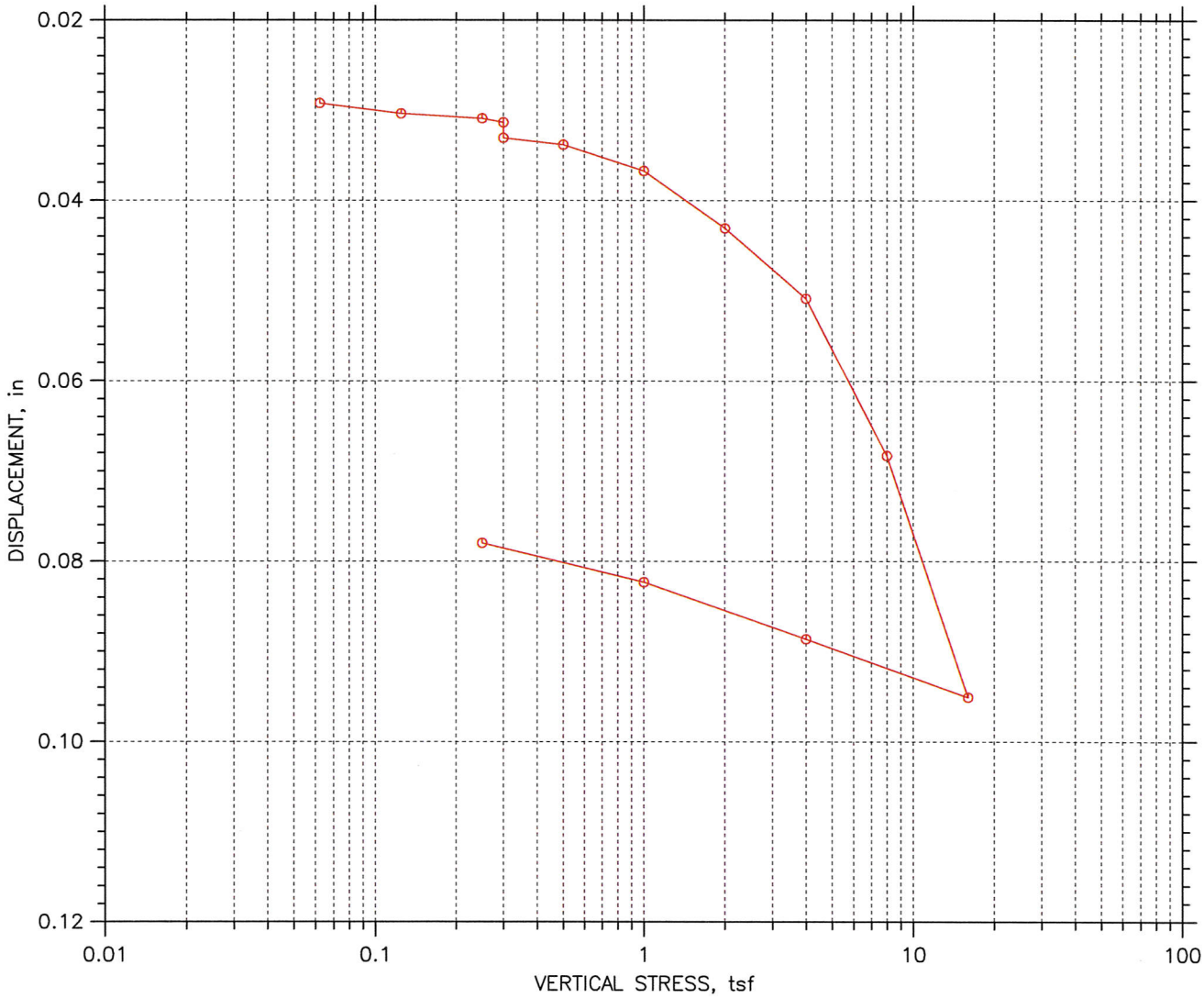


	Project: Redhill Slope Repair	Location: 12-ORA-405-8.4	Project No.: 12-0N5401
	Boring No.: R-14-106	Tested By: jg	Checked By:
	Sample No.: 1-A	Test Date: 04/30/14	Depth: 18-20
	Test No.: 14-018-G3	Sample Type: tube	Elevation: GL 14-020
	Description: Moist; Very Stiff; Black; Clay with gravel and silt		
	Remarks: Swell @ 0.3 tsf		

Fri, 09-MAY-2014 10:24:10

CONSOLIDATION TEST DATA

SUMMARY REPORT



				Before Test	After Test
Overburden Pressure: 0 tsf				Water Content, %	24.78	23.52
Preconsolidation Pressure: 0 tsf				Dry Unit Weight, pcf	95.8	103.9
Compression Index: 0				Saturation, %	86.37	99.65
Diameter: 2.375 in		Height: 1 in		Void Ratio	0.79	0.65
LL: ---	PL: ---	PI: ---	GS: 2.74			

	Project: Redhill Slope Repair	Location: 12-ORA-405-8.4	Project No.: 12-0N5401
	Boring No.: R-14-106	Tested By: jg	Checked By:
	Sample No.: 1-A	Test Date: 04/30/14	Depth: 18-20
	Test No.: 14-018-G3	Sample Type: tube	Elevation: GL 14-020
	Description: Moist; Very Stiff; Black; Clay with gravel and silt		
	Remarks: Swell @ 0.3 tsf		

Fri, 09-MAY-2014 10:24:36

CONSOLIDATION TEST DATA

Project: Redhill Slope Repair
Boring No.: R-14-106
Sample No.: 1-B
Test No.: 14-019-G4

Location: 12-ORA-405-8.4
Tested By: jg
Test Date: 05/01/14
Sample Type: tube

Project No.: 12-0N5401
Checked By: WP 5/16
Depth: 18-20
Elevation: GL 14-020

Soil Description: Moist; Stiff; Black; Clay with silt
Remarks: Swell @ 1.15 tsf

Measured Specific Gravity: 2.74
Initial Void Ratio: 1.01
Final Void Ratio: 0.66

Liquid Limit: ---
Plastic Limit: ---
Plasticity Index: ---

Initial Height: 1.00 in
Specimen Diameter: 2.38 in

	Before Consolidation		After Consolidation	
	Trimmings	Specimen+Ring	Specimen+Ring	Trimmings
Container ID		RING		
Wt. Container + Wet Soil, gm	221.9	221.9	210.8	210.8
Wt. Container + Dry Soil, gm	187.1	187.1	187.1	187.1
Wt. Container, gm	88.2	88.2	88.2	88.2
Wt. Dry Soil, gm	98.9	98.9	98.9	98.9
Water Content, %	35.19	35.19	23.96	23.96
Void Ratio	---	1.01	0.66	---
Degree of Saturation, %	---	95.41	99.98	---
Dry Unit Weight, pcf	---	85.047	103.2	---

CONSOLIDATION TEST DATA

Project: Redhill Slope Repair
Boring No.: R-14-106
Sample No.: 1-B
Test No.: 14-019-G4

Location: 12-ORA-405-8.4
Tested By: jg
Test Date: 05/01/14
Sample Type: tube

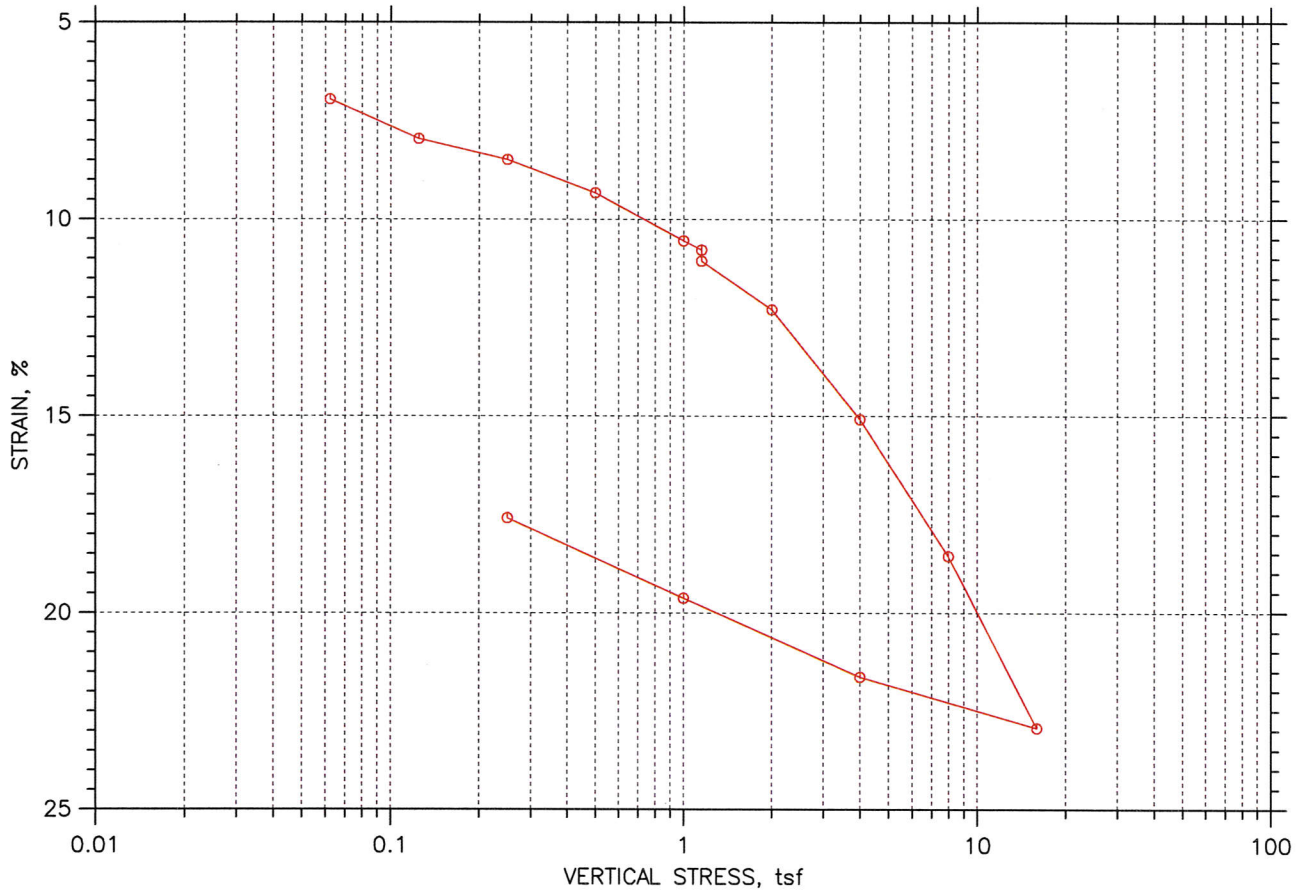
Project No.: 12-0N5401
Checked By:
Depth: 18-20
Elevation: GL 14-020

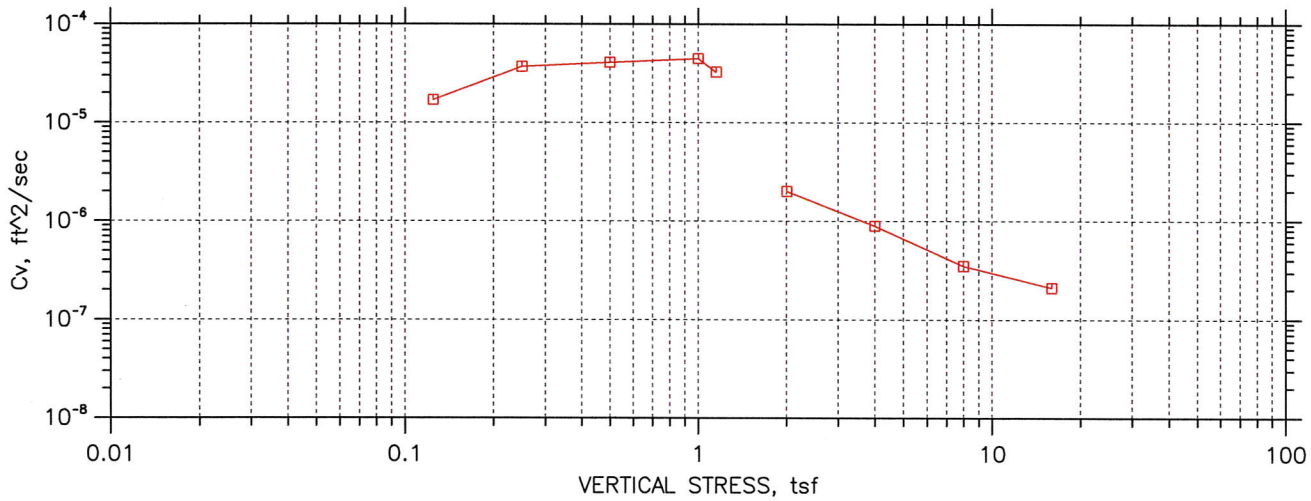
Soil Description: Moist; Stiff; Black; Clay with silt
Remarks: Swell @ 1.15 tsf

	Applied Stress tsf	Final Displacement in	Void Ratio	Strain at End %	T50 Fitting Sq.Rt. min	T50 Fitting Log min	Coefficient of Consolidation Sq.Rt. ft^2/sec	Coefficient of Consolidation Log ft^2/sec	Coefficient of Consolidation Ave. ft^2/sec
1	0.0625	0.06956	0.870	6.96	0.0	0.0	4.94e-324	4.94e-324	4.94e-324
2	0.125	0.0796	0.850	7.96	0.4	0.2	1.39e-005	2.16e-005	1.69e-005
3	0.25	0.08491	0.839	8.49	0.1	0.1	3.39e-005	4.05e-005	3.69e-005
4	0.5	0.09332	0.822	9.33	0.1	0.1	3.57e-005	4.77e-005	4.09e-005
5	1	0.1055	0.798	10.55	0.1	0.1	3.91e-005	5.19e-005	4.46e-005
6	1.15	0.1078	0.793	10.78	0.2	0.1	2.60e-005	4.40e-005	3.27e-005
7	1.15	0.1106	0.787	11.06	0.0	0.0	0.00e+000	0.00e+000	0.00e+000
8	2	0.123	0.763	12.30	2.2	0.0	2.01e-006	0.00e+000	2.01e-006
9	4	0.1508	0.707	15.08	4.7	0.0	8.96e-007	0.00e+000	8.96e-007
10	8	0.1855	0.637	18.55	11.9	10.6	3.32e-007	3.73e-007	3.52e-007
11	16	0.2293	0.549	22.93	16.7	17.3	2.15e-007	2.07e-007	2.11e-007
12	4	0.2162	0.575	21.62	3.6	0.0	9.54e-007	0.00e+000	9.54e-007
13	1	0.1962	0.615	19.62	20.6	20.8	1.75e-007	1.73e-007	1.74e-007
14	0.25	0.1759	0.656	17.59	48.0	0.0	7.88e-008	0.00e+000	7.88e-008

CONSOLIDATION TEST DATA

SUMMARY REPORT



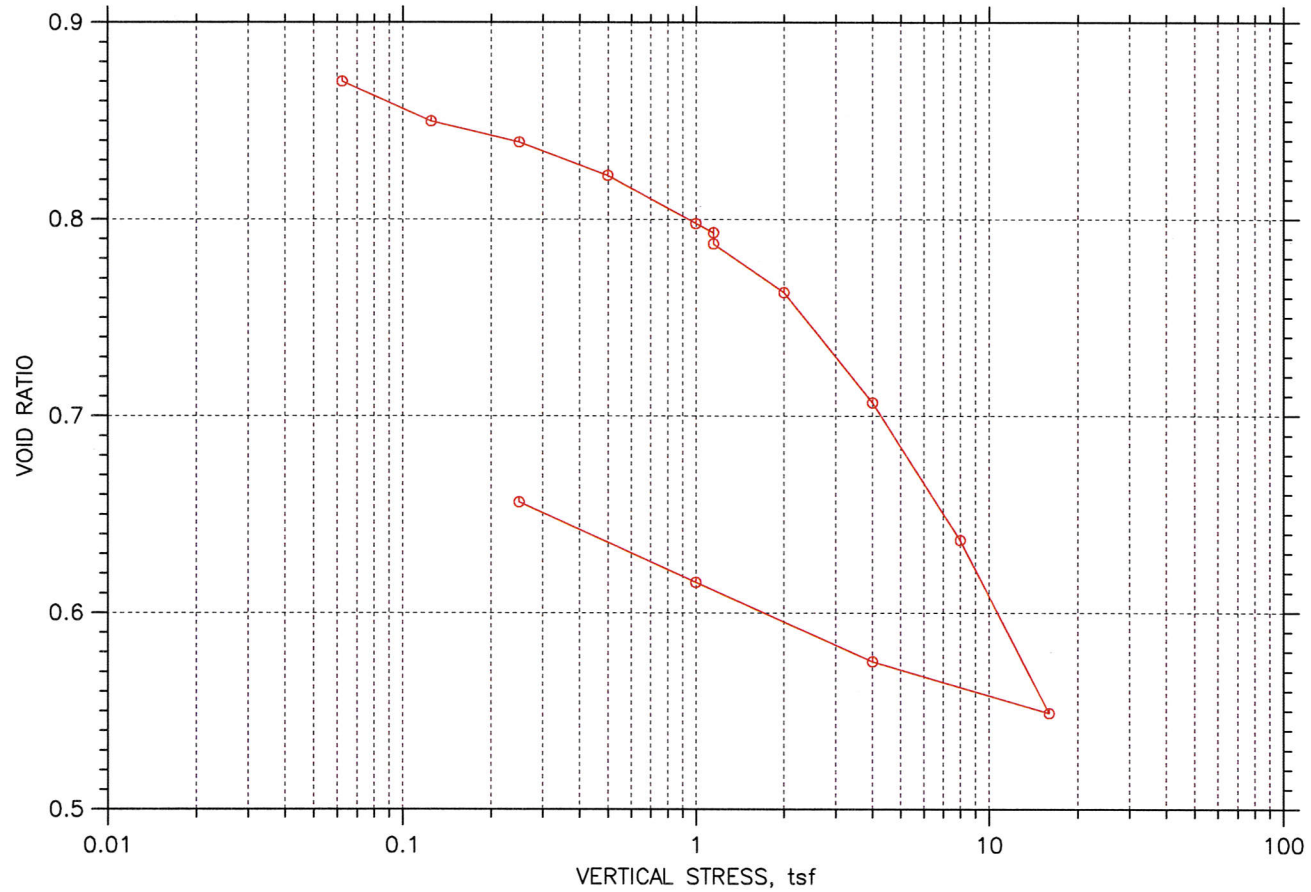


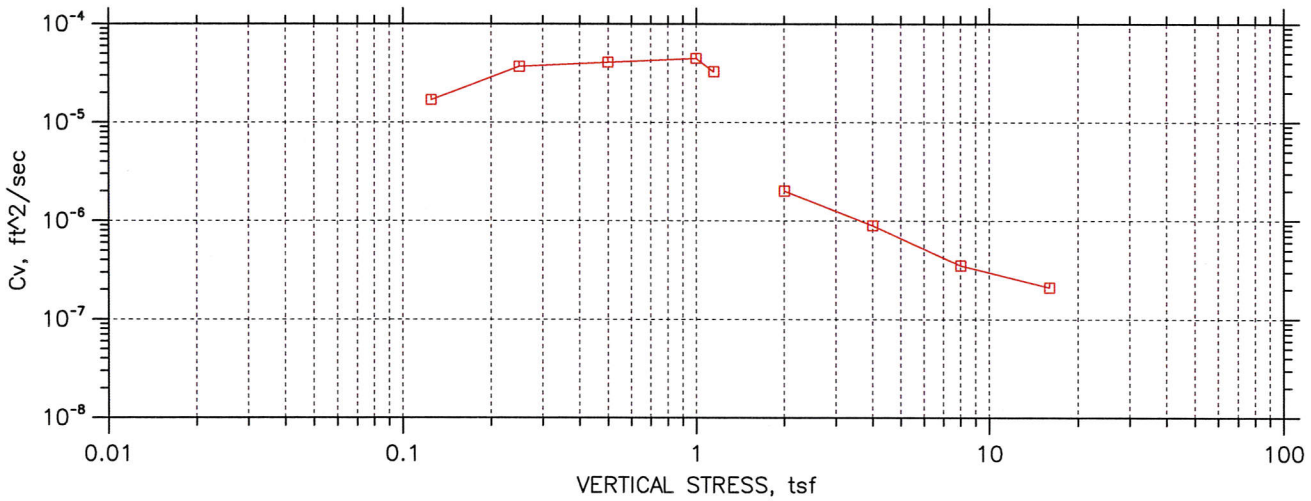
	Project: Redhill Slope Repair	Location: 12-ORA-405-8.4	Project No.: 12-0N5401
	Boring No.: R-14-106	Tested By: jg	Checked By:
	Sample No.: 1-B	Test Date: 05/01/14	Depth: 18-20
	Test No.: 14-019-G4	Sample Type: tube	Elevation: GL 14-020
	Description: Moist; Stiff; Black; Clay with silt		
	Remarks: Swell @ 1.15 tsf		

Fri, 09-MAY-2014 13:44:12

CONSOLIDATION TEST DATA

SUMMARY REPORT



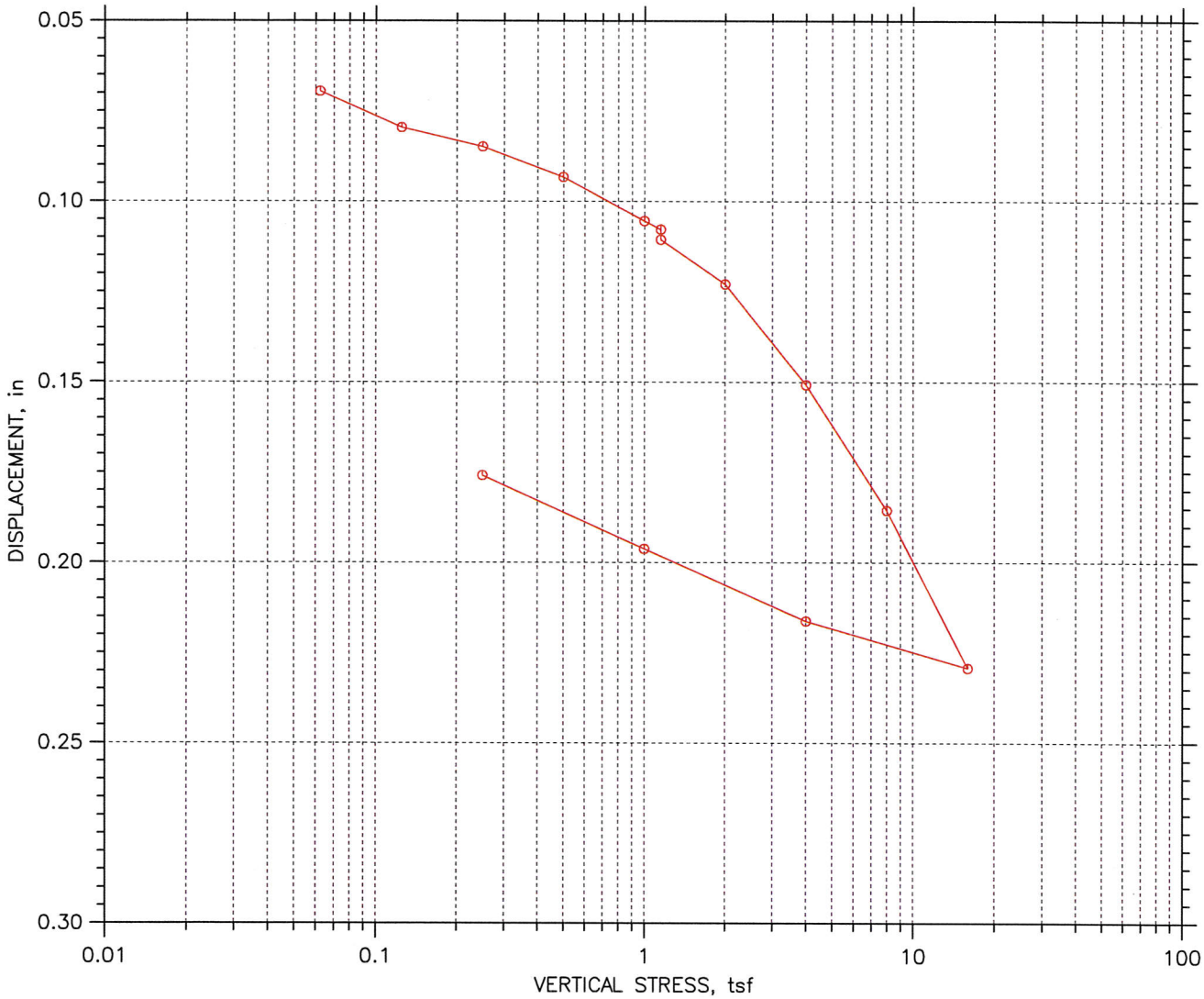


	Project: Redhill Slope Repair	Location: 12-ORA-405-8.4	Project No.: 12-0N5401
	Boring No.: R-14-106	Tested By: jg	Checked By:
	Sample No.: 1-B	Test Date: 05/01/14	Depth: 18-20
	Test No.: 14-019-G4	Sample Type: tube	Elevation: GL 14-020
	Description: Moist; Stiff; Black; Clay with silt		
	Remarks: Swell @ 1.15 tsf		

Fri, 09-MAY-2014 13:44:38

CONSOLIDATION TEST DATA

SUMMARY REPORT



				Before Test	After Test
Overburden Pressure: 0 tsf			Water Content, %	35.19	23.96
Preconsolidation Pressure: 0 tsf			Dry Unit Weight, pcf	85.05	103.2
Compression Index: 0			Saturation, %	95.41	99.98
Diameter: 2.375 in		Height: 1 in	Void Ratio	1.01	0.66
LL: ---	PL: ---	PI: ---	GS: 2.74		

	Project: Redhill Slope Repair	Location: 12-ORA-405-8.4	Project No.: 12-0N5401
	Boring No.: R-14-106	Tested By: jg	Checked By:
	Sample No.: 1-B	Test Date: 05/01/14	Depth: 18-20
	Test No.: 14-019-G4	Sample Type: tube	Elevation: GL 14-020
	Description: Moist; Stiff; Black; Clay with silt		
	Remarks: Swell @ 1.15 tsf		

One-Dimensional Consolidation by ASTM D 2435 - Method B

Project: Redhill Slope Repair
Boring No.: R-14-104
Sample No.: 2-A
Test No.: 14-020-G1

Location: 12-ORA-405-8.4
Tested By: jg
Test Date: 05/12/14
Sample Type: tube

Project No.: 12-0N5401
Checked By: WP 5/16
Depth: 28-30
Elevation: GL 14-020

Soil Description: Moist; Soft; Gray; Clay with silt and sand
Remarks:

Measured Specific Gravity: 2.74
Initial Void Ratio: 0.556
Final Void Ratio: 0.416

Liquid Limit: ---
Plastic Limit: ---
Plasticity Index: ---

Initial Height: 1.00 in
Specimen Diameter: 2.38 in

	Before Consolidation		After Consolidation	
	Trimmings	Specimen+Ring	Specimen+Ring	Trimmings
Container ID		RING		
Wt. Container + Wet Soil, gm	242.30	242.30	235.80	235.80
Wt. Container + Dry Soil, gm	216.40	216.40	216.40	216.40
Wt. Container, gm	88.400	88.400	88.400	88.400
Wt. Dry Soil, gm	128.00	128.00	128.00	128.00
Water Content, %	20.23	20.23	15.16	15.16
Void Ratio	---	0.556	0.416	---
Degree of Saturation, %	---	99.87	99.90	---
Dry Unit Weight, pcf	---	110.07	120.92	---

One-Dimensional Consolidation by ASTM D 2435 - Method B

Project: Redhill Slope Repair
Boring No.: R-14-104
Sample No.: 2-A
Test No.: 14-020-G1

Location: 12-ORA-405-8.4
Tested By: jg
Test Date: 05/12/14
Sample Type: tube

Project No.: 12-0N5401
Checked By:
Depth: 28-30
Elevation: GL 14-020

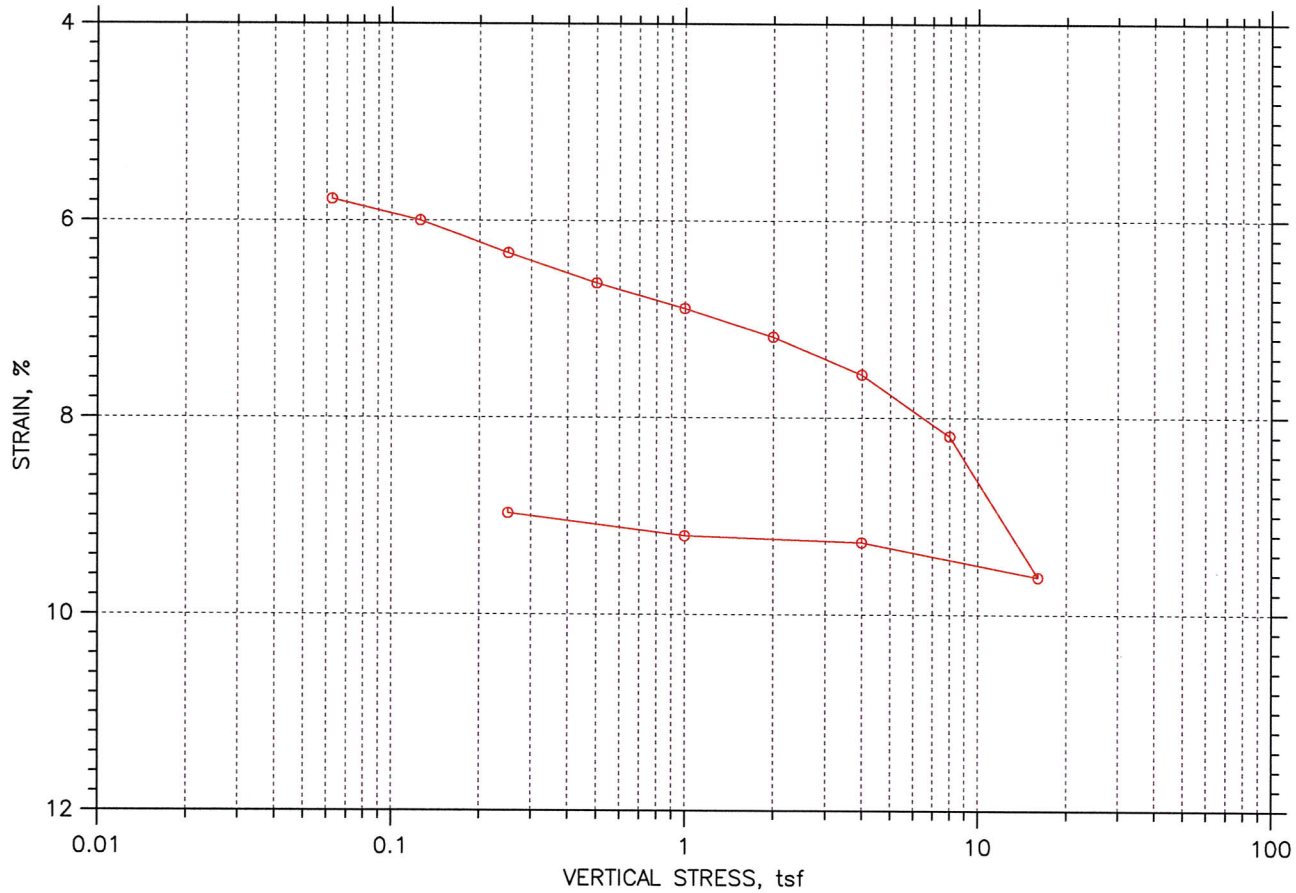
Soil Description: Moist; Soft; Gray; Clay with silt and sand
Remarks:
Displacement at End of Increment

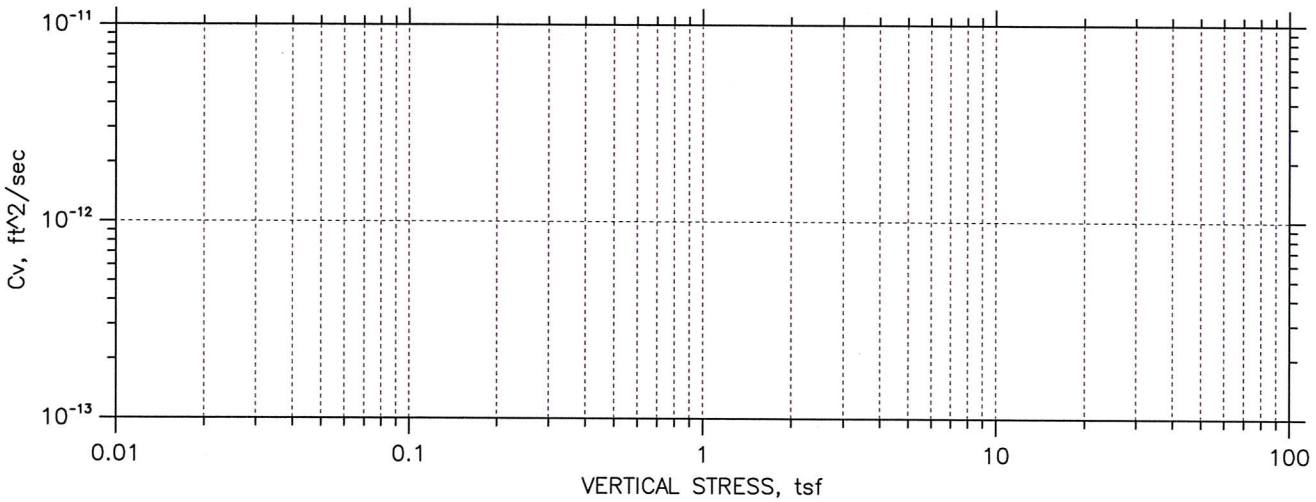
	Applied Stress tsf	Final Displacement in	Void Ratio	Strain at End %	Sq.Rt T90 min	Cv ft^2/sec	Mv 1/tsf	k ft/day
1	0.0625	0.05782	0.466	5.78	1.498	1.54e-005	9.25e-001	3.85e-002
2	0.125	0.06000	0.462	6.00	2.422	8.97e-006	3.49e-002	8.45e-004
3	0.250	0.06329	0.457	6.33	0.121	1.79e-004	2.63e-002	1.27e-002
4	0.500	0.06633	0.453	6.63	0.732	2.93e-005	1.22e-002	9.63e-004
5	1.00	0.06890	0.449	6.89	1.441	1.48e-005	5.14e-003	2.05e-004
6	2.00	0.07178	0.444	7.18	0.477	4.44e-005	2.87e-003	3.44e-004
7	4.00	0.07560	0.438	7.56	0.763	2.76e-005	1.91e-003	1.42e-004
8	8.00	0.08185	0.428	8.19	1.270	1.64e-005	1.56e-003	6.91e-005
9	16.0	0.09619	0.406	9.62	0.219	9.31e-005	1.79e-003	4.50e-004
10	4.00	0.09265	0.412	9.27	0.054	3.72e-004	2.95e-004	2.96e-004
11	1.00	0.09202	0.413	9.20	0.000	0.00e+000	2.13e-004	0.00e+000
12	0.250	0.08972	0.416	8.97	0.422	4.80e-005	3.06e-003	3.96e-004

	Applied Stress tsf	Final Displacement in	Void Ratio	Strain at End %	Log T50 min	Cv ft^2/sec	Mv 1/tsf	k ft/day	Ca %
1	0.0625	0.05782	0.466	5.78	0.797	6.74e-006	9.25e-001	1.68e-002	0.00e+000
2	0.125	0.06000	0.462	6.00	0.000	0.00e+000	3.49e-002	0.00e+000	0.00e+000
3	0.250	0.06329	0.457	6.33	0.000	0.00e+000	2.63e-002	0.00e+000	0.00e+000
4	0.500	0.06633	0.453	6.63	0.000	0.00e+000	1.22e-002	0.00e+000	0.00e+000
5	1.00	0.06890	0.449	6.89	0.000	0.00e+000	5.14e-003	0.00e+000	0.00e+000
6	2.00	0.07178	0.444	7.18	0.000	0.00e+000	2.87e-003	0.00e+000	0.00e+000
7	4.00	0.07560	0.438	7.56	0.000	0.00e+000	1.91e-003	0.00e+000	0.00e+000
8	8.00	0.08185	0.428	8.19	0.146	3.32e-005	1.56e-003	1.40e-004	0.00e+000
9	16.0	0.09619	0.406	9.62	0.032	1.50e-004	1.79e-003	7.24e-004	0.00e+000
10	4.00	0.09265	0.412	9.27	0.000	0.00e+000	2.95e-004	0.00e+000	0.00e+000
11	1.00	0.09202	0.413	9.20	0.000	0.00e+000	2.13e-004	0.00e+000	0.00e+000
12	0.250	0.08972	0.416	8.97	0.000	0.00e+000	3.06e-003	0.00e+000	0.00e+000

One-Dimensional Consolidation by ASTM D 2435 ⇔ Method B

SUMMARY REPORT



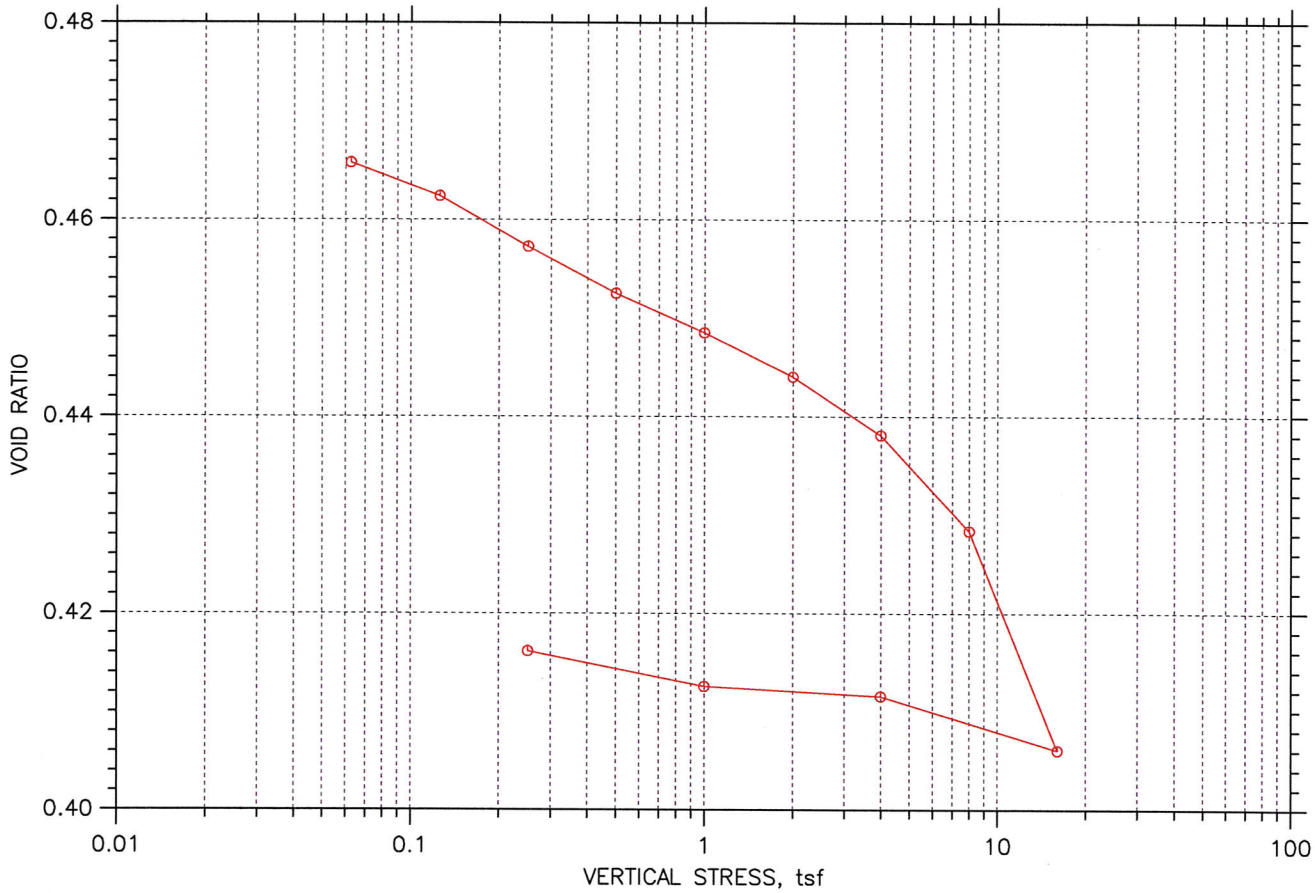


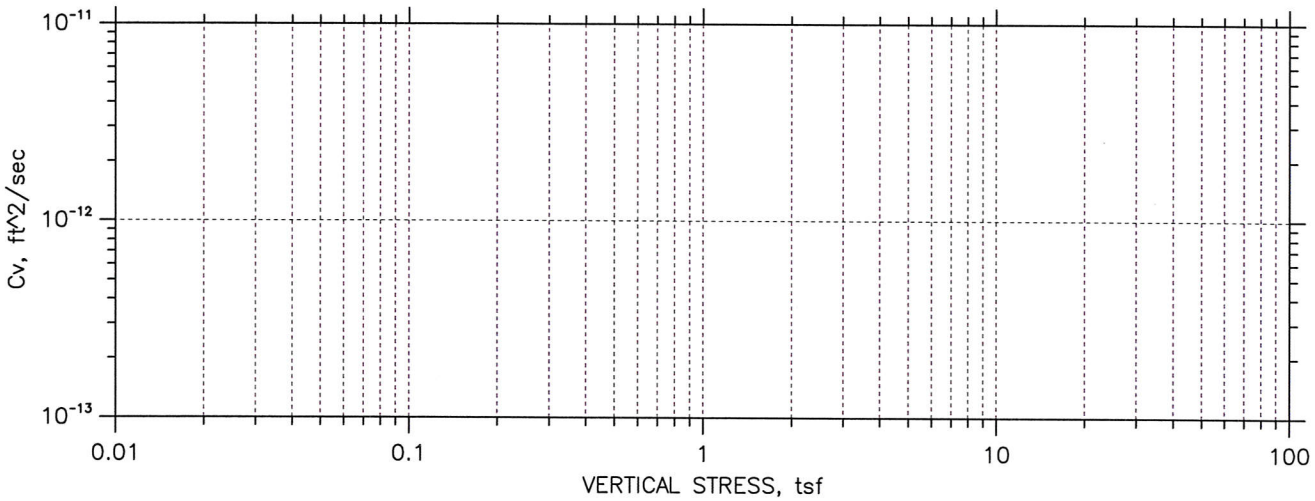
	Project: Redhill Slope Repair	Location: 12-ORA-405-8.4	Project No.: 12-0N5401
	Boring No.: R-14-104	Tested By: jg	Checked By:
	Sample No.: 2-A	Test Date: 05/12/14	Test No.: 14-020-G1
	Depth: 28-30	Sample Type: tube	Elevation: GL 14-020
	Description: Moist; Soft; Gray; Clay with silt and sand		
	Remarks:		
	Displacement at End of Increment		

Thu, 15-MAY-2014 09:26:00

One-Dimensional Consolidation by ASTM D 2435 ⇔ Method B

SUMMARY REPORT



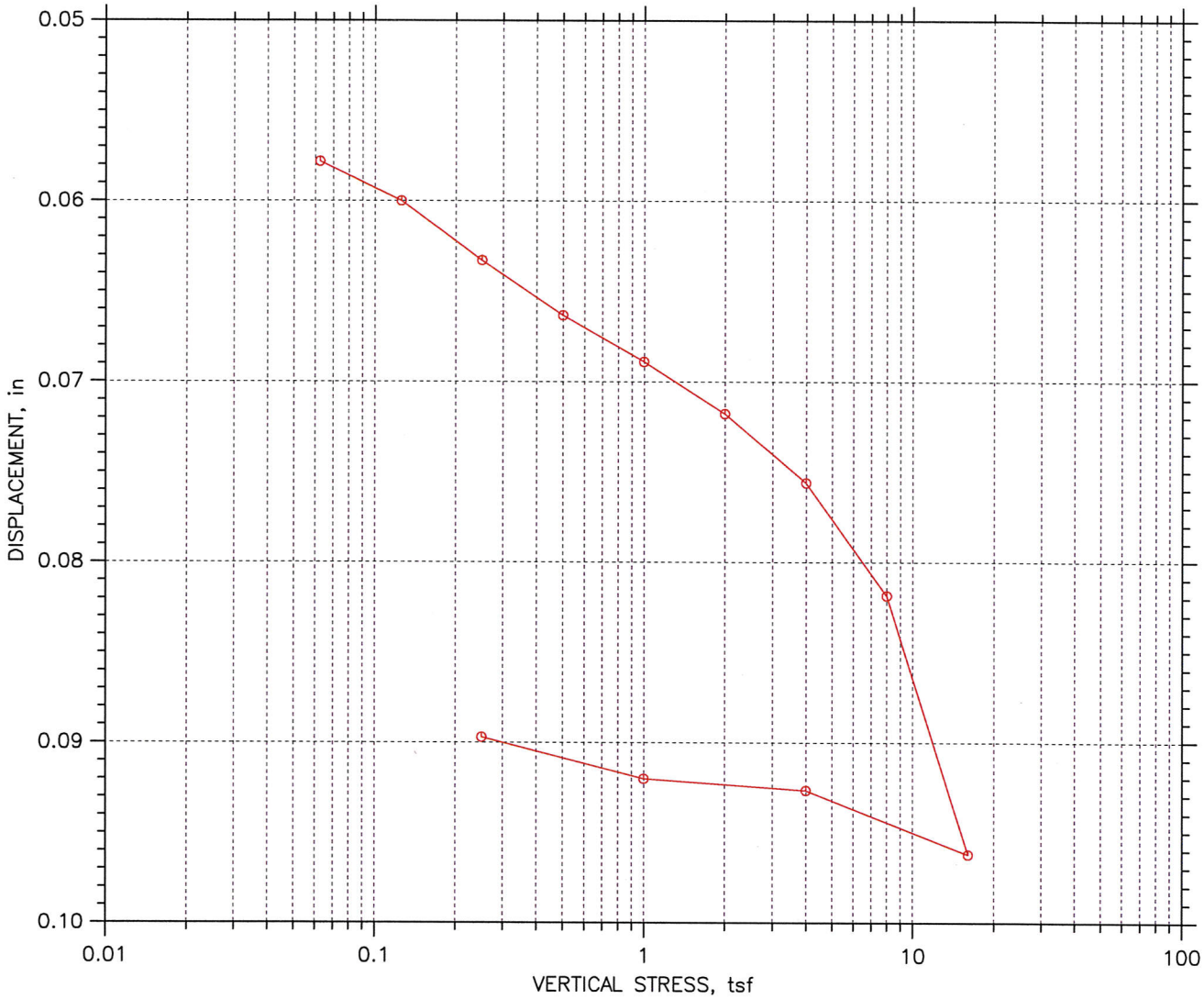


	Project: Redhill Slope Repair	Location: 12-ORA-405-8.4	Project No.: 12-0N5401
	Boring No.: R-14-104	Tested By: jg	Checked By:
	Sample No.: 2-A	Test Date: 05/12/14	Test No.: 14-020-G1
	Depth: 28-30	Sample Type: tube	Elevation: GL 14-020
	Description: Moist; Soft; Gray; Clay with silt and sand		
	Remarks:		
	Displacement at End of Increment		

Thu, 15-MAY-2014 09:26:38

One-Dimensional Consolidation by ASTM D 2435 ↔ Method B

SUMMARY REPORT



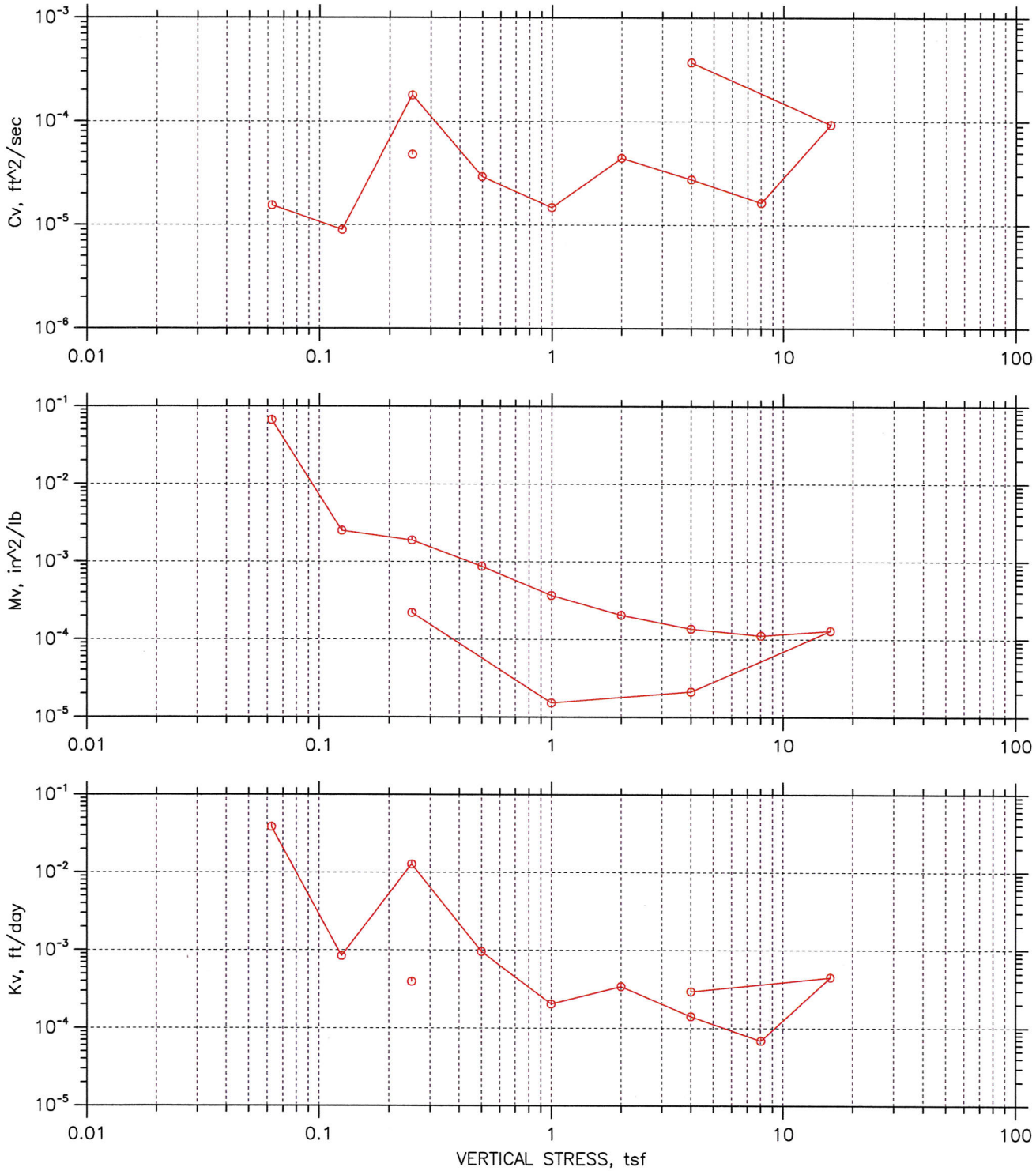
				Before Test	After Test
Overburden Pressure: 0 tsf			Water Content, %	20.23	15.16
Preconsolidation Pressure: 0 tsf			Dry Unit Weight, pcf	110.07	120.92
Compression Index: 0			Saturation, %	99.87	99.90
Diameter: 2.375 in		Height: 1 in	Void Ratio	0.56	0.42
LL: ---	PL: ---	PI: ---	GS: 2.74		

	Project: Redhill Slope Repair	Location: 12-ORA-405-8.4	Project No.: 12-0N5401
	Boring No.: R-14-104	Tested By: jg	Checked By:
	Sample No.: 2-A	Test Date: 05/12/14	Test No.: 14-020-G1
	Depth: 28-30	Sample Type: tube	Elevation: GL 14-020
	Description: Moist; Soft; Gray; Clay with silt and sand		
	Remarks:		
	Displacement at End of Increment		

Thu, 15-MAY-2014 09:27:12

One-Dimensional Consolidation by ASTM D 2435 ↔ Method B

ROOT of TIME COEFFICIENTS

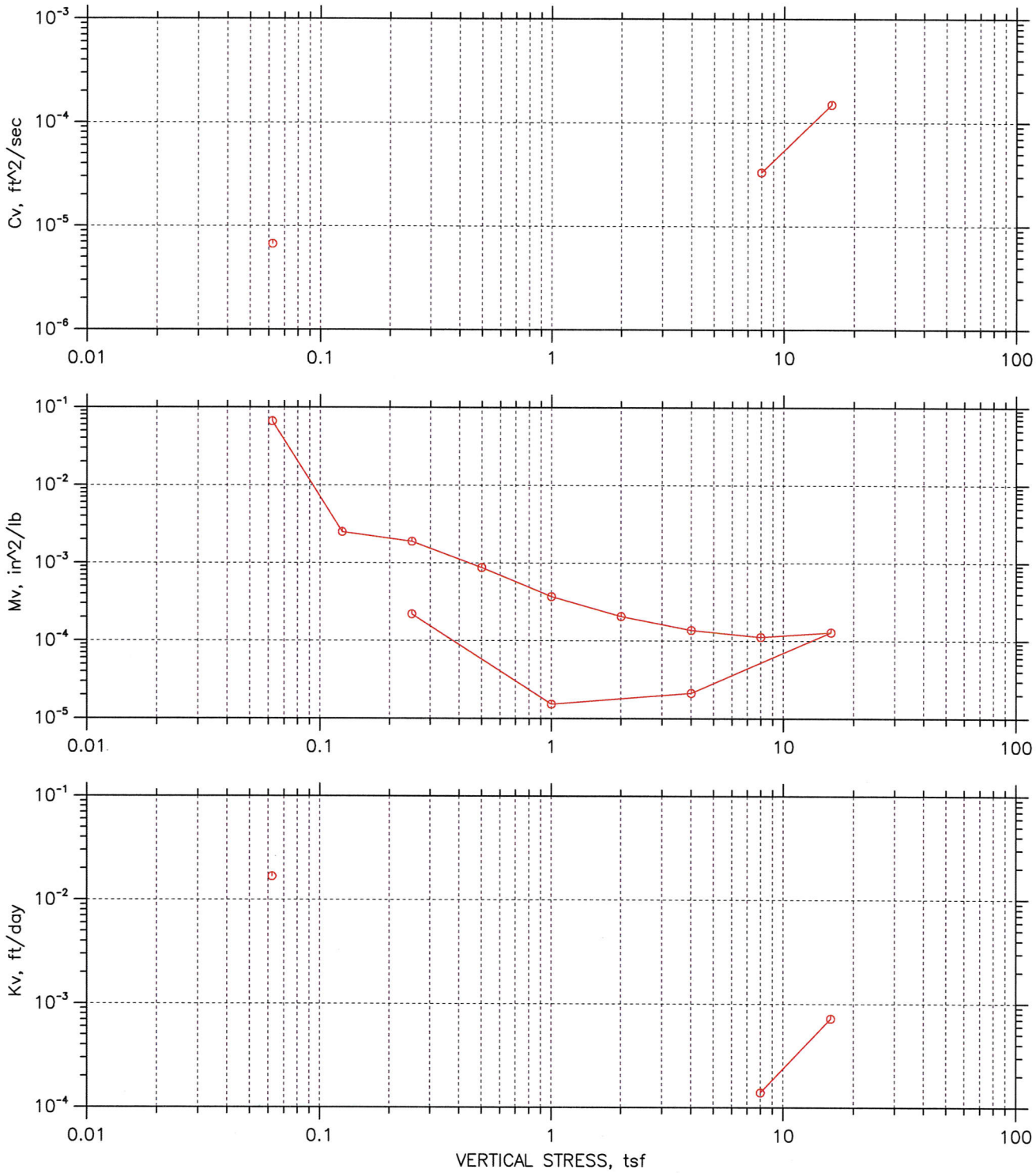


	Project: Redhill Slope Repair	Location: 12-ORA-405-8.4	Project No.: 12-0N5401
	Boring No.: R-14-104	Tested By: jg	Checked By:
	Sample No.: 2-A	Test Date: 05/12/14	Test No.: 14-020-G1
	Depth: 28-30	Sample Type: tube	Elevation: GL 14-020
	Description: Moist; Soft; Gray; Clay with silt and sand		
	Remarks:		
	Displacement at End of Increment		

Thu, 15-MAY-2014 09:27:12

One-Dimensional Consolidation by ASTM D 2435 ⇔ Method B

LOG of TIME COEFFICIENTS



	Project: Redhill Slope Repair	Location: 12-ORA-405-8.4	Project No.: 12-0N5401
	Boring No.: R-14-104	Tested By: jg	Checked By:
	Sample No.: 2-A	Test Date: 05/12/14	Test No.: 14-020-G1
	Depth: 28-30	Sample Type: tube	Elevation: GL 14-020
	Description: Moist; Soft; Gray; Clay with silt and sand		
	Remarks:		
	Displacement at End of Increment		

Thu, 15-MAY-2014 09:27:12

Geocon Project No. S9890-06-02
October 23, 2014

VIA EMAIL

Mr. David Yaghoubi
Caltrans – District 12
Office of Environmental Engineering & Corridor Studies
3347 Michaelson Drive, Suite 100
Irvine, CA 92612

Subject: AERIALLY DEPOSITED LEAD INVESTIGATION RESULTS
RED HILL AVENUE BETWEEN I-405 AND AIRPORT LOOP DRIVE
COSTA MESA, CALIFORNIA
CONTRACT 12A1535; EA 0N5401; TO 12-0N5401-02

Dear Mr. Yaghoubi:

In accordance with the California Department of Transportation's (Caltrans) Contract No. 12A1535 and Task Order No. 12-0N5401-02, dated August 18, 2014, we performed sampling and analytical testing to evaluate the potential presence of aerially deposited lead in soil within the north and southbound shoulders of Red Hill Avenue, between Interstate 405 (I-405) and Airport Loop Drive (the Site) in the City of Costa Mesa, California. This report summarizes the purpose of the project and the scope of services requested by Caltrans, and outlines procedures and methods employed by Geocon to complete the project. The location of the Site is depicted on Figure 1.

PURPOSE AND SCOPE OF SERVICES

Caltrans intends to perform repairs and restoration to Red Hill Avenue north of Airport Loop Drive and south of I-405. The proposed improvements will require excavation and management of the soil. The purpose of this investigation was to evaluate soil at the Site for the potential presence of hazardous concentrations of lead suspected due to impact from vehicle exhaust emissions when leaded gasoline was used. It is our understanding that Caltrans will use information obtained from the investigation to determine soil reuse and/or disposal options and potential worker health and safety concerns. Our scope of services included collection and laboratory analysis of soil samples, and preparation of this report to document results of the investigation.

SAMPLING AND ANALYTICAL TESTING

On September 5, 2014, Geocon collected 32 soil samples from 8 hand-auger borings advanced at locations chosen by Caltrans. Soil samples were collected from each boring at depths of 0 to 0.5 foot, 1.0 to 1.5 foot, 2.5 to 3.0 feet, and 3.5 to 4.0 feet. The approximate locations of the borings are shown on Figure 2.

The soil samples were collected by transferring the soil from the bottom end of the hand-auger bucket to laboratory-provided glass sample jars with Teflon–lined lids. Samples jars were labeled with a unique sample identification number, Geocon project number, date and time of collection. The samples were then placed in a portable cooler and transported to a certified laboratory for analyses under chain-of-custody procedures.

Sampling equipment was cleansed prior to each sampling effort using a non-phosphate detergent solution and two distilled/purified water rinses. Decontamination water was discharged to the ground surface away from areas potentially associated with surface water bodies or storm drain inlets. The hand-auger borings were backfilled with cuttings and surface soil from the immediate vicinity of the boring location.

The soil samples were submitted to Advanced Technology Laboratories (ATL), a State-certified laboratory located in Signal Hill, California following chain-of-custody procedures. The 32 soil samples were analyzed for total lead using U.S. Environmental Protection Agency (EPA) Test Method 6010B.

The borings were located utilizing a Global Positioning System (GPS) receiver. Data was recorded in the field and downloaded in the office using surveying TerraSync™ or similar software, in State Plane 83 coordinates. Boring latitude and longitudes coordinates in decimal degrees are provided in Table 1.

SAMPLE ANALYTICAL RESULTS

Analytical results are summarized below and in Table 1. Copies of laboratory reports and chain-of-custody documentations are attached.

Total lead was reported for the samples at concentrations ranging from 5.1 to 32 milligrams per kilogram (mg/kg).

None of the samples collected from Site exhibited total lead concentrations greater than the Total Threshold Limit Concentration (TTLC) of 1,000 mg/kg, or ten times the Soluble Threshold Limit Concentration (STLC) of 5.0 milligrams per liter (mg/l).

Based on these results further testing of the soil for soluble lead content was not necessary.

CONCLUSION AND RECOMMENDATION

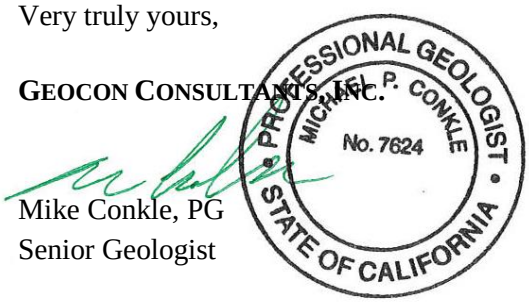
Based upon the reported total lead concentrations, the soil would be classified as non-hazardous with respect to lead content. Accordingly, the soil is suitable for onsite reuse without restriction (Caltrans Type X) with respect to lead content (see attached ADL Soil Management Table).

If the excess soil is to be transported off-site for disposal, it would be characterized as non-hazardous soil with respect to lead content. If the material is to be disposed of off-site, disposal should be done in accordance with the recommendations of SSP 7-1.02K.

Please call if you have any questions or desire additional information.

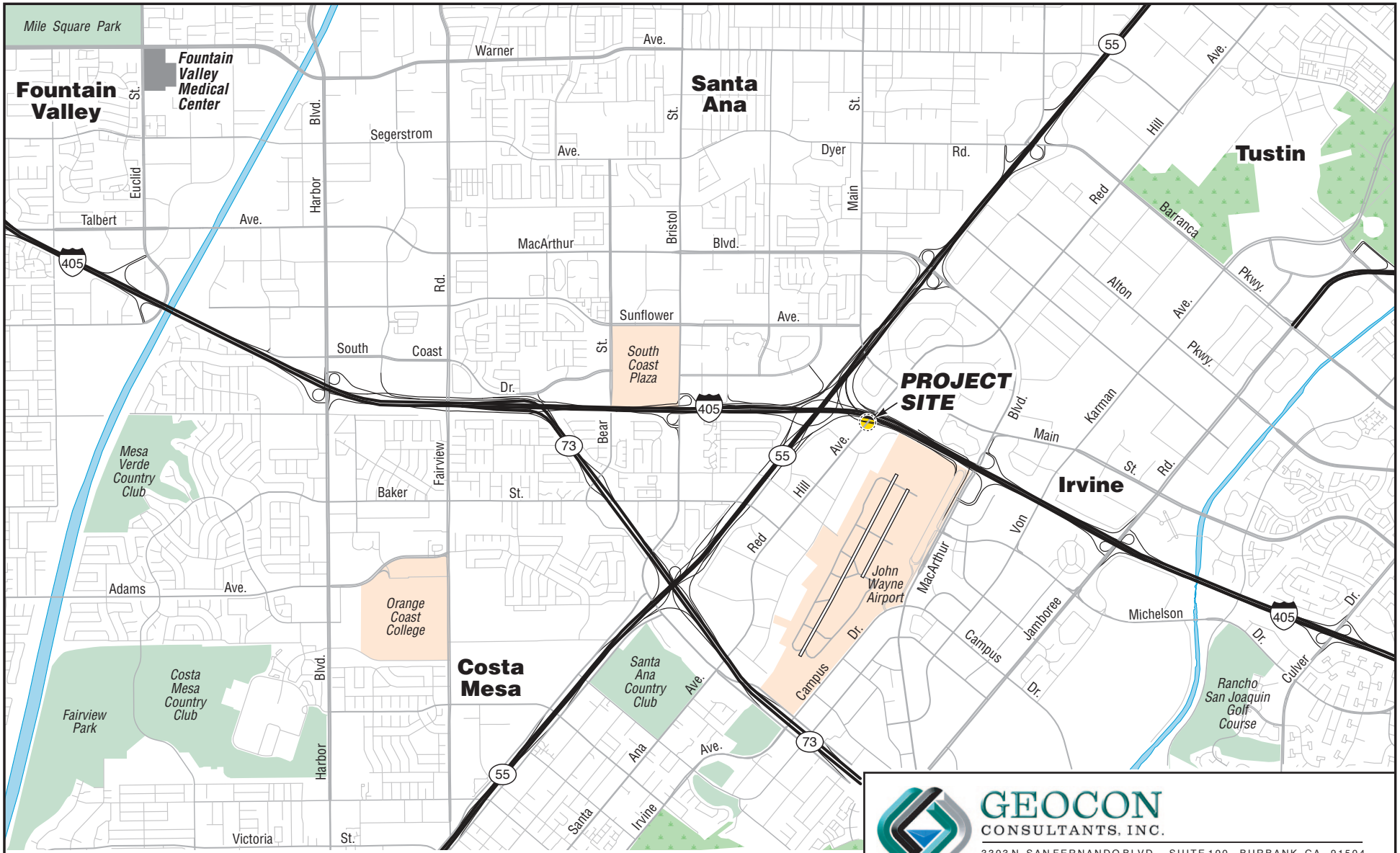
Very truly yours,

GEOCON CONSULTANTS, INC.



Mike Conkle, PG
Senior Geologist

Attachments: Figure 1: Vicinity Map
Figure 2: Sample Location Maps
Table 1 – Boring Coordinates and Summary of Analytical Results
Aerially Deposited Lead Soil Management Table
Laboratory Analytical Report and Chain-of-custody Documentation



N

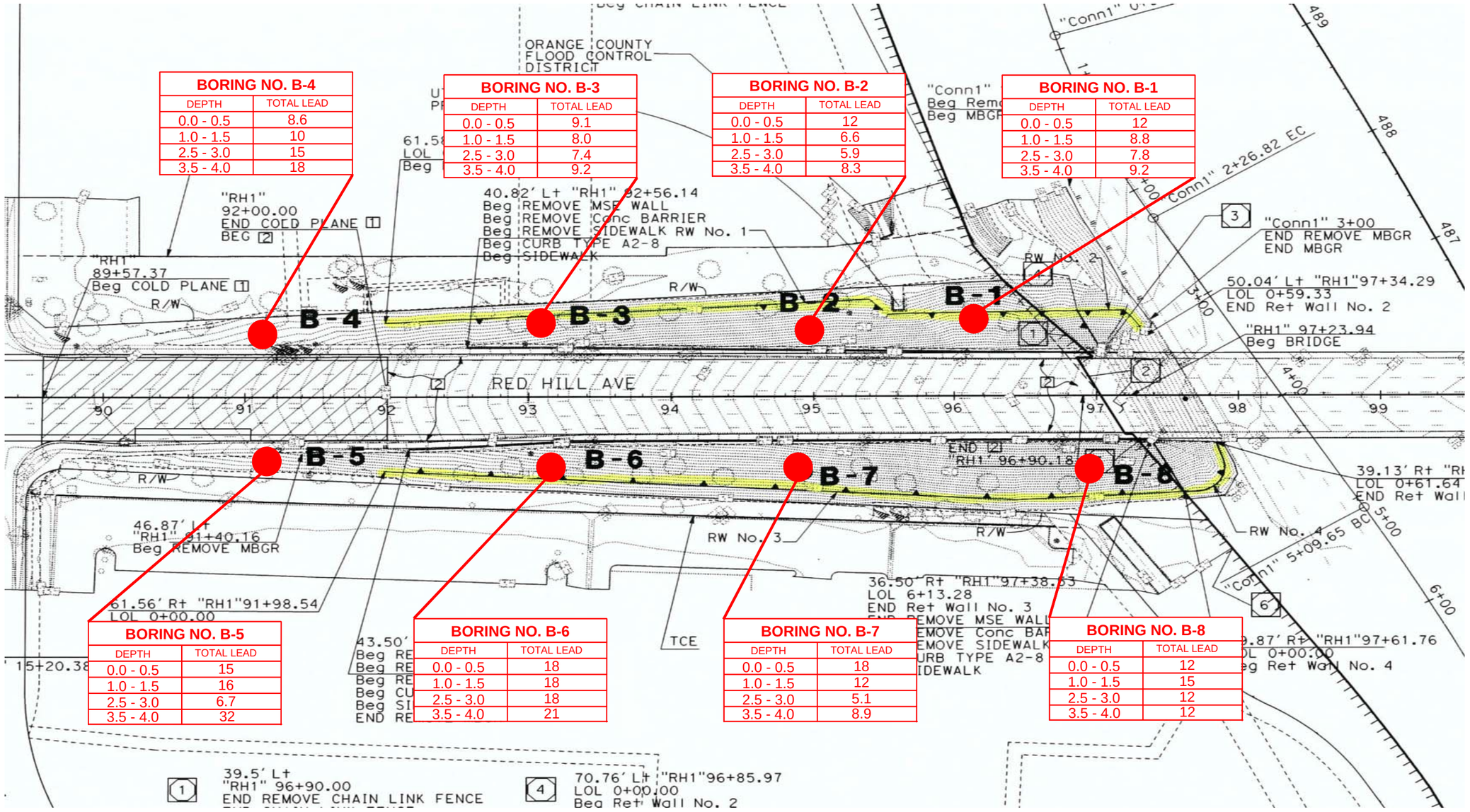
0 1

Scale in Miles

GEOCON
CONSULTANTS, INC.
3303 N. SAN FERNANDO BLVD. – SUITE 100 – BURBANK, CA. 91504
PHONE 818.841.8388 – FAX 818.841.1704

Redhill Avenue Between South of I-405 and Airport Loop Drive

Costa Mesa, California	**VICINITY MAP**	
GEOCON Proj. No. S9890-06-02		
Task Order No. 12-0N5401-2	October 2014	Figure 1



BORING NO. B-4	
DEPTH	TOTAL LEAD
0.0 - 0.5	8.6
1.0 - 1.5	10
2.5 - 3.0	15
3.5 - 4.0	18

BORING NO. B-3	
DEPTH	TOTAL LEAD
0.0 - 0.5	9.1
1.0 - 1.5	8.0
2.5 - 3.0	7.4
3.5 - 4.0	9.2

BORING NO. B-2	
DEPTH	TOTAL LEAD
0.0 - 0.5	12
1.0 - 1.5	6.6
2.5 - 3.0	5.9
3.5 - 4.0	8.3

BORING NO. B-1	
DEPTH	TOTAL LEAD
0.0 - 0.5	12
1.0 - 1.5	8.8
2.5 - 3.0	7.8
3.5 - 4.0	9.2

BORING NO. B-5	
DEPTH	TOTAL LEAD
0.0 - 0.5	15
1.0 - 1.5	16
2.5 - 3.0	6.7
3.5 - 4.0	32

BORING NO. B-6	
DEPTH	TOTAL LEAD
0.0 - 0.5	18
1.0 - 1.5	18
2.5 - 3.0	18
3.5 - 4.0	21

BORING NO. B-7	
DEPTH	TOTAL LEAD
0.0 - 0.5	18
1.0 - 1.5	12
2.5 - 3.0	5.1
3.5 - 4.0	8.9

BORING NO. B-8	
DEPTH	TOTAL LEAD
0.0 - 0.5	12
1.0 - 1.5	15
2.5 - 3.0	12
3.5 - 4.0	12

Plan by: Caltrans

LEGEND

Approximate Limit of Proposed Excavation

Approximate Sample Location

GEOCON

ENVIRONMENTAL GEOTECHNICAL MATERIALS
3303 N. SAN FERNANDO BLVD. - SUITE 100 - BURBANK, CA 91504
PHONE (818) 841-8388 - FAX (818) 841-1704

MKA		8000

SAMPLING LOCATION MAP

REDHILL AVE ADL INVESTIGATION
BETWEEN SOUTH OF I-405 AND AIRPORT LOOP DRIVE
COSTA MESA, CALIFORNIA

OCT. 2014	PROJECT NO. S9890-06-02	FIG. 2

TABLE 1
BORING COORDINATES AND SUMMARY OF LEAD ANALYTICAL RESULTS
RED HILL AVENUE BETWEEN I-405 AND AIRPORT LOOP DRIVE
COSTA MESA, CALIFORNIA

Sample ID	LATITUDE	LONGITUDE	Sample Depth (feet)	Total Lead[3] (mg/kg)	WET Lead[4] (mg/l)	WET-DI Lead[5] (mg/l)	TCLP Lead[6] (mg/l)	pH[7]
B-1-0.0	33.68618367	-117.8679668	0-0.5	12	--	--	--	--
B-1-1.0			1-1.5	8.8	--	--	--	--
B-1-2.5			2.5-3	7.8	--	--	--	--
B-1-3.5			3.5-4	9.2	--	--	--	--
B-2-0.0	33.68589832	-117.86827980	0-0.5	12	--	--	--	--
B-2-1.0			1-1.5	6.6	--	--	--	--
B-2-2.5			2.5-3	5.9	--	--	--	--
B-2-3.5			3.5-4	8.3	--	--	--	--
B-3-0.0	33.68569947	-117.8684702	0-0.5	9.1	--	--	--	--
B-3-1.0			1-1.5	8.0	--	--	--	--
B-3-2.5			2.5-3	7.4	--	--	--	--
B-3-3.5			3.5-4	9.2	--	--	--	--
B-4-0.0	33.68539117	-117.86876950	0-0.5	8.6	--	--	--	--
B-4-1.0			1-1.5	10	--	--	--	--
B-4-2.5			2.5-3	15	--	--	--	--
B-4-3.5			3.5-4	18	--	--	--	--
B-5-0.0	33.68508382	-117.8685875	0.0.5	15	--	--	--	--
B-5-1.0			1-1.5	16	--	--	--	--
B-5-2.5			2.5-3	6.7	--	--	--	--
B-5-3.5			3.5-4	32	--	--	--	--
B-6-0.0	33.68541795	-117.8682211	0-0.5	18	--	--	--	--
B-6-1.0			1-1.5	18	--	--	--	--
B-6-2.5			2.5-3	18	--	--	--	--
B-6-3.5			3.5-4	21	--	--	--	--
B-7-0.0	33.68577598	-117.86798000	0-0.5	18	--	--	--	--
B-7-1.0			1-1.5	12	--	--	--	--
B-7-2.5			2.5-3	5.1	--	--	--	--
B-7-3.5			3.5-4	8.9	--	--	--	--
B-8-0.0	33.68614062	-117.8675829	0-0.5	12	--	--	--	--
B-8-1.0			1-1.5	15	--	--	--	--
B-8-2.5			2.5-3	12	--	--	--	--
B-8-3.5			3.5-4	12	--	--	--	--
			Average Values:	12.4	--	--	--	--
			Regulatory Limits:	1,411[9]	5.0[10]	1.5[11]	5.0[12]	5.0[11]

Notes:

1. Samples analyzed by Advanced Technology Laboratories of Signal Hill, California.
2. Samples were collected using a hand auger; sample depths in feet below ground surface.
3. U.S. Environmental Protection Agency (EPA) Method 6010; concentrations in milligrams per kilogram (mg/kg).
4. Soluble lead using the Waste Extraction Test (WET) with citric acid as the extractant; concentrations in milligrams per liter (mg/l).
5. Soluble lead using the WET with deionized water as the extractant (WET-DI); concentrations in mg/l.
6. Soluble lead analyzed by the Toxicity Characteristic Leaching Procdure (TCLP); concentrations in mg/l.
7. U.S. EPA Method 9045.
8. -- = Not analyzed.
9. Limit specified in addendum to Variance issued by the Department of Toxic Substaces Control to Caltrans (DTSC Variance, September 22, 2000; Addendum, June 2014).
10. Soluble Threshold Limit Concentration (STLC) for California hazardous waste (California Code of Regulations [CCR] Title 22, Section 66261.24
11. Limit Specified in DTSC Variance.
12. Maximum concentration for the Toxicity Characteristic of Resource Conservation Recovery Act (RCRA) hazardous waste (CCR Title 22, Section 66261.24).

AERIALLY DEPOSITED LEAD SOIL MANAGEMENT

SOLUBLE LEAD (mg/l)	TOTAL LEAD (mg/kg)	SOIL TYPE	HANDLING
CALIFORNIA TESTING			
STLC <5.0	**TTLC** <1000	X	**Non-hazardous Waste**. Notify and require Lead Compliance Plan for worker safety.
	1000 – 1411 and DI WET < 1.5 mg/l	Y1	**Hazardous Waste. Variance applies** – cover with minimum 1 foot of clean soil.*
	1411 – 3397 and DI WET < 150 mg/l	Y2	**Hazardous Waste. Variance applies** – cover with pavement structure. *
	1000 – 3397 but Surplus	Z2	**Hazardous Waste** - Surplus. Dispose at Class 1 disposal site.
	> 3397 or 1000 – 3397 & DI WET > 150 mg/l	Z2	**Hazardous Waste** – not reusable under Variance. Dispose at Class 1 disposal site.
STLC >5.0	**TTLC** < 1411 and DI WET < 1.5 mg/l	Y1	**Hazardous Waste. Variance applies** – cover with minimum of 1 foot of clean soil.*
	1411 – 3397 and DI WET < 150 mg/l	Y2	**Hazardous Waste. Variance applies** – cover with pavement structure.*
	< 3397 and DI WET < 150 mg/l but Surplus	Z2	**Hazardous Waste** - Surplus. Dispose at Class 1 disposal site.
	> 3397 or DI WET > 150 mg/l	Z2	**Hazardous Waste** – not reusable under Variance. Dispose at Class 1 disposal site.
FEDERAL TESTING			
TCLP > 5.0 mg/l	N/A	Z3	**RCRA Hazardous Waste** Dispose at Class 1 disposal site as a RCRA waste regardless of TTLC and STLC results.

*Note: For hazardous waste levels of lead - if pH is less than 5.5 soil must be placed under a pavement structure. If pH is less than 5.0 variance can not be used and the soil must be disposed as Z-2 material.

ADVANCED TECHNOLOGY LABORATORIES

September 12, 2014

Mike Conkle
Geocon West, Inc.
3303 N. San Fernando Blvd., Suite 100
Burbank, CA 91504
Tel: (818) 841-8388
Fax:(818) 841-1704

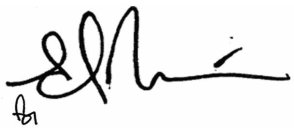
ELAP No.: 1838
CSDLAC No.: 10196
ORELAP No.: CA300003
TCEQ No. : T104704502

Re: ATL Work Order Number : 1402585
Client Reference : Redhill Ave ADL, S9890-06-02

Enclosed are the results for sample(s) received on September 05, 2014 by Advanced Technology Laboratories. The sample(s) are tested for the parameters as indicated on the enclosed chain of custody in accordance with applicable laboratory certifications. The laboratory results contained in this report specifically pertains to the sample(s) submitted.

Thank you for the opportunity to serve the needs of your company. If you have any questions, please feel free to contact me or your Project Manager.

Sincerely,



Eddie Rodriguez
Laboratory Director

Certificate of Analysis

Geocon West, Inc.	Project Number : Redhill Ave ADL, S9890-06-02
3303 N. San Fernando Blvd., Suite 100	Report To : Mike Conkle
Burbank , CA 91504	Reported : 09/12/2014

SUMMARY OF SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
B-1-0.0	1402585-01	Soil	9/05/14 8:21	9/05/14 14:50
B-1-1.0	1402585-02	Soil	9/05/14 8:28	9/05/14 14:50
B-1-2.5	1402585-03	Soil	9/05/14 9:11	9/05/14 14:50
B-1-3.5	1402585-04	Soil	9/05/14 9:18	9/05/14 14:50
B-2-0.0	1402585-05	Soil	9/05/14 9:32	9/05/14 14:50
B-2-1.0	1402585-06	Soil	9/05/14 9:51	9/05/14 14:50
B-2-2.5	1402585-07	Soil	9/05/14 10:00	9/05/14 14:50
B-2-3.5	1402585-08	Soil	9/05/14 10:09	9/05/14 14:50
B-3-0.0	1402585-09	Soil	9/05/14 10:19	9/05/14 14:50
B-3-1.0	1402585-10	Soil	9/05/14 10:37	9/05/14 14:50
B-3-2.5	1402585-11	Soil	9/05/14 10:58	9/05/14 14:50
B-3-3.5	1402585-12	Soil	9/05/14 11:15	9/05/14 14:50
B-4-0.0	1402585-13	Soil	9/05/14 11:19	9/05/14 14:50
B-4-1.0	1402585-14	Soil	9/05/14 11:23	9/05/14 14:50
B-4-2.5	1402585-15	Soil	9/05/14 11:30	9/05/14 14:50
B-4-3.5	1402585-16	Soil	9/05/14 11:33	9/05/14 14:50
B-5-0.0	1402585-17	Soil	9/05/14 11:51	9/05/14 14:50
B-5-1.0	1402585-18	Soil	9/05/14 11:55	9/05/14 14:50
B-5-2.5	1402585-19	Soil	9/05/14 12:00	9/05/14 14:50
B-5-3.5	1402585-20	Soil	9/05/14 12:03	9/05/14 14:50
B-6-0.0	1402585-21	Soil	9/05/14 12:14	9/05/14 14:50
B-6-1.0	1402585-22	Soil	9/05/14 12:15	9/05/14 14:50
B-6-2.5	1402585-23	Soil	9/05/14 12:26	9/05/14 14:50
B-6-3.5	1402585-24	Soil	9/05/14 12:31	9/05/14 14:50
B-7-0.0	1402585-25	Soil	9/05/14 12:51	9/05/14 14:50
B-7-1.0	1402585-26	Soil	9/05/14 12:54	9/05/14 14:50
B-7-2.5	1402585-27	Soil	9/05/14 13:06	9/05/14 14:50
B-7-3.5	1402585-28	Soil	9/05/14 13:15	9/05/14 14:50
B-8-0.0	1402585-29	Soil	9/05/14 12:24	9/05/14 14:50
B-8-1.0	1402585-30	Soil	9/05/14 13:30	9/05/14 14:50
B-8-2.5	1402585-31	Soil	9/05/14 13:38	9/05/14 14:50
B-8-3.5	1402585-32	Soil	9/05/14 13:48	9/05/14 14:50

Certificate of Analysis

Geocon West, Inc.		Project Number :	Redhill Ave ADL, S9890-06-02
3303 N. San Fernando Blvd., Suite 100		Report To :	Mike Conkle
Burbank , CA 91504		Reported :	09/12/2014

CASE NARRATIVE

Results were J-flagged. "J" is used to flag those results that are between the PQL (Practical Quantitation Limit) and the calculated MDL (Method Detection Limit). Results that are "J" flagged are estimated values since it becomes difficult to accurately quantitate the analyte near the MDL.

Certificate of Analysis

Geocon West, Inc.	Project Number : Redhill Ave ADL, S9890-06-02
3303 N. San Fernando Blvd., Suite 100	Report To : Mike Conkle
Burbank , CA 91504	Reported : 09/12/2014

Lead by ICP-AES EPA 6010B

Analyte: Lead **Analyst: CB**

Laboratory ID	Client Sample ID	Result	Units	PQL	MDL	Dilution	Batch	Prepared	Date/Time Analyzed	Notes
1402585-01	B-1-0.0	**12**	mg/kg	1.0	0.07	1	B4I0151	09/10/2014	09/11/14 12:17	
1402585-02	B-1-1.0	**8.8**	mg/kg	1.0	0.07	1	B4I0151	09/10/2014	09/11/14 12:17	
1402585-03	B-1-2.5	**7.8**	mg/kg	1.0	0.07	1	B4I0151	09/10/2014	09/11/14 12:18	
1402585-04	B-1-3.5	**9.2**	mg/kg	1.0	0.07	1	B4I0151	09/10/2014	09/11/14 12:19	
1402585-05	B-2-0.0	**12**	mg/kg	1.0	0.07	1	B4I0152	09/10/2014	09/11/14 12:27	
1402585-06	B-2-1.0	**6.6**	mg/kg	1.0	0.07	1	B4I0152	09/10/2014	09/11/14 12:28	
1402585-07	B-2-2.5	**5.9**	mg/kg	1.0	0.07	1	B4I0152	09/10/2014	09/11/14 12:29	
1402585-08	B-2-3.5	**8.3**	mg/kg	1.0	0.07	1	B4I0152	09/10/2014	09/11/14 12:29	
1402585-09	B-3-0.0	**9.1**	mg/kg	1.0	0.07	1	B4I0152	09/10/2014	09/11/14 12:30	
1402585-10	B-3-1.0	**8.0**	mg/kg	1.0	0.07	1	B4I0152	09/10/2014	09/11/14 12:31	
1402585-11	B-3-2.5	**7.4**	mg/kg	1.0	0.07	1	B4I0152	09/10/2014	09/11/14 12:32	
1402585-12	B-3-3.5	**9.2**	mg/kg	1.0	0.07	1	B4I0152	09/10/2014	09/11/14 12:32	
1402585-13	B-4-0.0	**8.6**	mg/kg	1.0	0.07	1	B4I0152	09/10/2014	09/11/14 12:33	
1402585-14	B-4-1.0	**10**	mg/kg	1.0	0.07	1	B4I0152	09/10/2014	09/11/14 12:36	
1402585-15	B-4-2.5	**15**	mg/kg	1.0	0.07	1	B4I0152	09/10/2014	09/11/14 12:38	
1402585-16	B-4-3.5	**18**	mg/kg	1.0	0.07	1	B4I0152	09/10/2014	09/11/14 12:39	
1402585-17	B-5-0.0	**15**	mg/kg	1.0	0.07	1	B4I0152	09/10/2014	09/11/14 12:40	
1402585-18	B-5-1.0	**16**	mg/kg	1.0	0.07	1	B4I0152	09/10/2014	09/11/14 12:41	
1402585-19	B-5-2.5	**6.7**	mg/kg	1.0	0.07	1	B4I0152	09/10/2014	09/11/14 12:41	
1402585-20	B-5-3.5	**32**	mg/kg	1.0	0.07	1	B4I0152	09/10/2014	09/11/14 12:42	
1402585-21	B-6-0.0	**18**	mg/kg	1.0	0.07	1	B4I0152	09/10/2014	09/11/14 12:43	
1402585-22	B-6-1.0	**18**	mg/kg	1.0	0.07	1	B4I0152	09/10/2014	09/11/14 12:46	
1402585-23	B-6-2.5	**18**	mg/kg	1.0	0.07	1	B4I0152	09/10/2014	09/11/14 12:46	
1402585-24	B-6-3.5	**21**	mg/kg	1.0	0.07	1	B4I0152	09/10/2014	09/11/14 12:47	
1402585-25	B-7-0.0	**18**	mg/kg	0.99	0.07	1	B4I0153	09/10/2014	09/11/14 12:53	
1402585-26	B-7-1.0	**12**	mg/kg	1.0	0.07	1	B4I0153	09/10/2014	09/11/14 12:56	
1402585-27	B-7-2.5	**5.1**	mg/kg	1.0	0.07	1	B4I0153	09/10/2014	09/11/14 12:57	
1402585-28	B-7-3.5	**8.9**	mg/kg	0.99	0.07	1	B4I0153	09/10/2014	09/11/14 12:58	
1402585-29	B-8-0.0	**12**	mg/kg	1.0	0.07	1	B4I0153	09/10/2014	09/11/14 12:58	
1402585-30	B-8-1.0	**15**	mg/kg	1.0	0.07	1	B4I0153	09/10/2014	09/11/14 12:59	

Certificate of Analysis

Geocon West, Inc.		Project Number :	Redhill Ave ADL, S9890-06-02
3303 N. San Fernando Blvd., Suite 100		Report To :	Mike Conkle
Burbank , CA 91504		Reported :	09/12/2014

Lead by ICP-AES EPA 6010B

Analyte: Lead **Analyst: CB**

Laboratory ID	Client Sample ID	Result	Units	PQL	MDL	Dilution	Batch	Prepared	Date/Time Analyzed	Notes
1402585-31	B-8-2.5	**12**	mg/kg	1.0	0.07	1	B4I0153	09/10/2014	09/11/14 13:00	
1402585-32	B-8-3.5	**12**	mg/kg	0.99	0.07	1	B4I0153	09/10/2014	09/11/14 13:01	

Certificate of Analysis

Geocon West, Inc.	Project Number : Redhill Ave ADL, S9890-06-02
3303 N. San Fernando Blvd., Suite 100	Report To : Mike Conkle
Burbank , CA 91504	Reported : 09/12/2014

QUALITY CONTROL SECTION

Lead by ICP-AES EPA 6010B - Quality Control

Analyte	Result (mg/kg)	PQL (mg/kg)	Spike Level	Source Result	% Rec	% Rec Limits	RPD	RPD Limit	Notes
Batch B4I0151 - EPA 3050 Modified									
Blank (B4I0151-BLK1)					Prepared: 9/10/2014 Analyzed: 9/11/2014				
Lead	ND	1.0			NR				
Blank (B4I0151-BLK2)					Prepared: 9/10/2014 Analyzed: 9/11/2014				
Lead	ND	1.0			NR				
LCS (B4I0151-BS1)					Prepared: 9/10/2014 Analyzed: 9/11/2014				
Lead	54.1144	1.0	50.0000		108	80 - 120			
Duplicate (B4I0151-DUP1)		**Source: 1402585-04**			Prepared: 9/10/2014 Analyzed: 9/11/2014				
Lead	8.33703	1.0		9.19914	NR		9.83	20	
Duplicate (B4I0151-DUP2)		**Source: 1402574-15**			Prepared: 9/10/2014 Analyzed: 9/11/2014				
Lead	29.1290	1.0		40.2392	NR		32.0	20	R
Matrix Spike (B4I0151-MS1)		**Source: 1402585-04**			Prepared: 9/10/2014 Analyzed: 9/11/2014				
Lead	225.432	1.0	250.000	9.19914	86.5	33 - 134			
Matrix Spike (B4I0151-MS2)		**Source: 1402574-15**			Prepared: 9/10/2014 Analyzed: 9/11/2014				
Lead	283.647	0.99	247.525	40.2392	98.3	33 - 134			
Matrix Spike Dup (B4I0151-MSD1)		**Source: 1402585-04**			Prepared: 9/10/2014 Analyzed: 9/11/2014				
Lead	238.921	1.0	250.000	9.19914	91.9	33 - 134	5.81	20	
Batch B4I0152 - EPA 3050 Modified									
Blank (B4I0152-BLK1)					Prepared: 9/10/2014 Analyzed: 9/11/2014				
Lead	ND	1.0			NR				
Blank (B4I0152-BLK2)					Prepared: 9/10/2014 Analyzed: 9/11/2014				
Lead	ND	1.0			NR				
LCS (B4I0152-BS1)					Prepared: 9/10/2014 Analyzed: 9/11/2014				
Lead	52.3112	1.0	50.0000		105	80 - 120			
Duplicate (B4I0152-DUP1)		**Source: 1402585-24**			Prepared: 9/10/2014 Analyzed: 9/11/2014				
Lead	17.1965	1.0		21.2899	NR		21.3	20	R
Duplicate (B4I0152-DUP2)		**Source: 1402585-14**			Prepared: 9/10/2014 Analyzed: 9/11/2014				
Lead	11.0402	1.0		10.4230	NR		5.75	20	
Matrix Spike (B4I0152-MS1)		**Source: 1402585-24**			Prepared: 9/10/2014 Analyzed: 9/11/2014				
Lead	253.329	1.0	250.000	21.2899	92.8	33 - 134			
Matrix Spike (B4I0152-MS2)		**Source: 1402585-14**			Prepared: 9/10/2014 Analyzed: 9/11/2014				
Lead	257.753	0.99	247.525	10.4230	99.9	33 - 134			

Certificate of Analysis

Geocon West, Inc.	Project Number : Redhill Ave ADL, S9890-06-02
3303 N. San Fernando Blvd., Suite 100	Report To : Mike Conkle
Burbank , CA 91504	Reported : 09/12/2014

Lead by ICP-AES EPA 6010B - Quality Control (cont'd)

Analyte	Result (mg/kg)	PQL (mg/kg)	Spike Level	Source Result	% Rec	% Rec Limits	RPD	RPD Limit	Notes
Batch B4I0152 - EPA 3050 Modified (continued)									
Matrix Spike Dup (B4I0152-MSD1)		**Source: 1402585-24**			Prepared: 9/10/2014 Analyzed: 9/11/2014				
Lead	260.408	1.0	250.000	21.2899	95.6	33 - 134	2.76	20	
Batch B4I0153 - EPA 3050 Modified									
Blank (B4I0153-BLK1)					Prepared: 9/10/2014 Analyzed: 9/11/2014				
Lead	ND	1.0			NR				
Blank (B4I0153-BLK2)					Prepared: 9/10/2014 Analyzed: 9/11/2014				
Lead	ND	1.0			NR				
LCS (B4I0153-BS1)					Prepared: 9/10/2014 Analyzed: 9/11/2014				
Lead	52.8782	1.0	50.0000		106	80 - 120			
Duplicate (B4I0153-DUP1)		**Source: 1402603-17**			Prepared: 9/10/2014 Analyzed: 9/11/2014				
Lead	42.5055	1.0		13.5437	NR		103	20	R
Duplicate (B4I0153-DUP2)		**Source: 1402603-03**			Prepared: 9/10/2014 Analyzed: 9/11/2014				
Lead	11.2515	1.0		11.5915	NR		2.98	20	
Matrix Spike (B4I0153-MS1)		**Source: 1402603-17**			Prepared: 9/10/2014 Analyzed: 9/11/2014				
Lead	227.535	1.0	250.000	13.5437	85.6	33 - 134			
Matrix Spike (B4I0153-MS2)		**Source: 1402603-03**			Prepared: 9/10/2014 Analyzed: 9/11/2014				
Lead	219.713	1.0	250.000	11.5915	83.2	33 - 134			
Matrix Spike Dup (B4I0153-MSD1)		**Source: 1402603-17**			Prepared: 9/10/2014 Analyzed: 9/11/2014				
Lead	229.120	1.0	250.000	13.5437	86.2	33 - 134	0.694	20	

Certificate of Analysis

Geocon West, Inc.		Project Number :	Redhill Ave ADL, S9890-06-02
3303 N. San Fernando Blvd., Suite 100		Report To :	Mike Conkle
Burbank , CA 91504		Reported :	09/12/2014

Notes and Definitions

R	RPD value outside acceptance criteria. Calculation is based on raw values.
ND	Analyte is not detected at or above the Practical Quantitation Limit (PQL). When client requests quantitation against MDL, analyte is not detected at or above the Method Detection Limit (MDL)
PQL	Practical Quantitation Limit
MDL	Method Detection Limit
NR	Not Reported
RPD	Relative Percent Difference
CA2	CA-ELAP (CDPH)
OR1	OR-NELAP (OSPHL)
TX1	TX-NELAP (TCEQ)

Notes:
(1) The reported MDL and PQL are based on prep ratio variation and analytical dilution.
(2) The suffix [2C] of specific analytes signifies that the reported result is taken from the instrument's second column.
(3) Results are wet unless otherwise specified.

CHAIN OF CUSTODY RECORD

Advanced Technology Laboratories
3275 Walnut Avenue
Signal Hill, CA 90755
Tel: (562) 989-4045 • Fax: (562) 989-4040

FOR LABORATORY USE ONLY

P.O. #: _____
Logged By: _____ Date: _____

Method of Transport: Client ☐ ATL ☐ CA OverN ☐ FedEx ☐ Other: _____

Sample Condition Upon Receipt:
1. CHILLED 5.9 Y ☑ N ☐ 4. SEALED Y ☐ N ☑
2. HEADSPACE (VOA) N/S Y ☐ N ☐ 5. # OF SPLS MATCH COC Y ☑ N ☐
3. CONTAINER INTACT Y ☑ N ☐ 6. PRESERVED Y ☐ N ☑

Client: Geocon
Attention: Mike Conkle
Address: 3303 North San Fernando Blvd Suite 100
City: Burbank State: CA Zip Code: 91504
Tel: 818-841-8388
Fax: 818-841-1704

Project Name: Redhill Ave
Project #: S9890-06-02
Sampler: Mike Alcott/Stephan Sasadias (Signature)

Relinquished by: (Signature and Printed Name)	Mike Alcott	Date: 9/5/14	Time: 1450	Received by: (Signature and Printed Name)	FEDEX	Date: 9/5/14	Time: 1450
Relinquished by: (Signature and Printed Name)		Date: 9/5/14	Time: 1559	Received by: (Signature and Printed Name)		Date: 9/5/14	Time: 1559
Relinquished by: (Signature and Printed Name)		Date:	Time:	Received by: (Signature and Printed Name)		Date:	Time:

I hereby authorize ATL to perform the work indicated below:
Project Mgr /Submitter: Mike Conkle 9/5/14
Print Name Date
Mike Conkle
Signature

Send Report To:
Attn: Mike Conkle
Co: Geocon Consultants Inc.
Addr: 3303 North San Fernando Blvd, Suite 100
City: Burbank State: CA Zip: 91504

Bill To:
Attn: Same as Report receiver
Co:
Addr:
City: State: Zip:

Special Instructions/Comments:
CT Contract 12A1535
Run samples with total lead greater than or equal to 50 mg/kg by WET. Run samples with WET results greater than or equal to 5.0 mg/l by DI-WET. Report MDL & PQL limits. Homogenize samples at the lab.

Sample/Records - Archival & Disposal
Unless otherwise requested by client, all samples will be disposed 45 days after receipt and records will be disposed 1 year after submittal of final report.

Storage Fees (applies when storage is requested):
- Sample :$2.00 / sample /mo (after 45 days)
- Records: $1 /ATL workorder /mo (after 1 year)

Circle or Add Analysis(es) Requested

SPECIFY APPROPRIATE MATRIX: SOIL / WATER / GROUND WATER / WASTEWATER

PRESERVATION: QA/QC RTNE ☐ CT ☐ SWRCB Logcode____ ☐ OTHER _____

ITEM	LAB USE ONLY: Lab No.	Sample Description: Sample ID / Location	Date	Time	Lead	TAT	Container(s) #	Container(s) Type	REMARKS
	1402545-1	B-1-0.0	9/5/14	0821	X	E	1	G	
	-2	B-1-1.0		0828	X	E	1	G	
	-3	B-1-2.5		0911	X	E	1	G	
	-4	B-1-3.5		0918	X	E	1	G	
	-5	B-2-0.0		0932	X	E	1	G	
	-6	B-2-1.0		0951	X	E	1	G	
	-7	B-2-2.5		1000	X	E	1	G	
	-8	B-2-3.5		1009	X	E	1	G	
	-9	B-3-0.0		1019	X	E	1	G	
	-10	B-3-1.0		1037	X	E	1	G	
	-11	B-3-2.5		1058	X	E	1	G	
	-12	B-3-3.5		1115	X	E	1	G	
	-13	B-4-0.0		1119	X	E	1	G	
	-14	B-4-1.0		1123	X	E	1	G	
	-15	B-4-2.5		1130	X	E	1	G	
	-16	B-4-3.5		1133	X	E	1	G	
	-17	B-5-0.0		1151	X	E	1	G	
	-18	B-5-1.0		1155	X	E	1	G	
	-19	B-5-2.5		1200	X	E	1	G	
	-20	B-5-3.5		1203	X	E	1	G	

■ TAT starts 8AM the following day if samples received after 3 PM

TAT: ☐ A = Overnight ≤ 24 hrs ☐ B = Emergency Next Workday ☐ C = Critical 2 Workdays ☐ D = Urgent 3 Workdays ☑ E = Routine 7 Workdays

Preservatives: H=HCl N=HNO_3 S=H_2SO_4 C=4°C Z=$Zn(AC)_2$ O=NaOH T=$Na_2S_2O_3$

VOA L=Liter P=Pint J=Jar B=Tedlar G=Glass P=Plastic M=Metal

CHAIN OF CUSTODY RECORD

Advanced Technology Laboratories
3275 Walnut Avenue
Signal Hill, CA 90755
Tel: (562) 989-4045 • Fax: (562) 989-4040

FOR LABORATORY USE ONLY

P.O. #: _____
Logged By: _____ Date: _____

Method of Transport: Client ☐ ATL ☐ CA OverN ☐ FedEx ☐ Other: _____

Sample Condition Upon Receipt:
1. CHILLED Y ☑ N ☐ 4. SEALED Y ☐ N ☑
2. HEADSPACE (VOA) Y ☐ N ☐ 5. # OF SPLS MATCH COC Y ☑ N ☐
3. CONTAINER INTACT Y ☑ N ☐ 6. PRESERVED Y ☐ N ☑

Client: Geocon
Attention: Mike Conkle
Address: 3303 North San Fernando Blvd Suite 100
City: Burbank State: CA Zip Code: 91504
Tel: 818-841-8388
Fax: 818-841-1704

Project Name: Redhill Ave
Project #: S9890-06-02
Sampler: Mike Alcott / Stephen Sarsadias (Signature)

Relinquished by: (Signature and Printed Name)	Mike Alcott	Date: 9/5/14	Time: 1450	Received by: (Signature and Printed Name)		Date: 9/5/14	Time: 1450
Relinquished by: (Signature and Printed Name)	Mike Alcott / Stephen Sarsadias	Date: 9/5/14	Time: 1558	Received by: (Signature and Printed Name)		Date: 9/5/14	Time: 1558
Relinquished by: (Signature and Printed Name)		Date:	Time:	Received by: (Signature and Printed Name)		Date:	Time:

I hereby authorize ATL to perform the work indicated below:
Project Mgr /Submitter: Mike Conkle (Print Name) 9/5/14 (Date)
Mike Conkle (Signature)

Send Report To:
Attn: Mike Conkle
Co: Geocon Consultants Inc.
Addr: 3303 North San Fernando Blvd, Suite 100
City: Burbank State: CA Zip: 91504

Bill To:
Attn: Same as Report receiver
Co:
Addr:
City: State: Zip:

Special Instructions/Comments:
CT Contract 12A1535
Run samples with total lead greater than or equal to 50 mg/kg by WET. Run samples with WET results greater than or equal to 5.0 mg/l by DI WET. Report MDL & PQL limits. Homogenize Samples at Lab.

Sample/Records - Archival & Disposal
Unless otherwise requested by client, all samples will be disposed 45 days after receipt and records will be disposed 1 year after submittal of final report.

Storage Fees (applies when storage is requested):
- Sample :$2.00 / sample /mo (after 45 days)
- Records: $1 /ATL workorder /mo (after 1 year)

Circle or Add Analysis(es) Requested

SPECIFY APPROPRIATE MATRIX: SOIL / WATER / GROUND WATER / WASTEWATER

PRESERVATION: QA/QC RTNE ☐ CT ☐ SWRCB ☐ Logcode____ OTHER ____

ITEM	LAB USE ONLY: Lab No.	Sample Description: Sample ID / Location	Date	Time	Lead	SOIL	WATER	GROUND WATER	WASTEWATER	TAT	Container(s) #	Container(s) Type	REMARKS
	1402585-21	B-6-0.0	9/5/14	1214	X	X				E	1	G	
	-22	B-6-1.0		1215	X	X				E	1	G	
	-23	B-6-2.5		1226	X	X				E	1	G	
	-24	B-6-3.5		1231	X	X				E	1	G	
	-25	B-7-0.0		1251	X	X				E	1	G	
	-26	B-7-1.0		1254	X	X				E	1	G	
	-27	B-7-2.5		1306	X	X				E	1	G	
	-28	B-7-3.5		1315	X	X				E	1	G	
	-29	B-8-0.0		1329	X	X				E	1	G	
	-30	B-8-1.0		1330	X	X				E	1	G	
	-31	B-8-2.5		1338	X	X				E	1	G	
	-32	B-8-3.5	↓	1348	X	X				E	1	G	
					X								

- TAT starts 8AM the following day if samples received after 3 PM

TAT: ☐ A = Overnight ≤ 24 hrs ☐ B = Emergency Next Workday ☐ C = Critical 2 Workdays ☐ D = Urgent 3 Workdays ☑ E = Routine 7 Workdays

OA L=Liter P=Pint J=Jar B=Tedlar G=Glass P=Plastic M=Metal

Preservatives:
H=HCl N=HNO_3 S=H_2SO_4 C=4°C
Z=$Zn(AC)_2$ O=NaOH T=$Na_2S_2O_3$

Memorandum

Serious drought.
Help Save Water!

To: **MATTHEW Q. CUGINI, P.E.**
Branch Chief
Design Branch C

Date: February 12, 2015

File: 12-ORA-405
PM 8.4
EA 0N5400
ID 12140000057
Final Materials
Letter Report

From: **MEHRDAD MAHDAVIAN, P.E.**
Transportation Engineer
Materials & Research Branch

Subject: **FINAL MATERIALS LETTER REPORT FOR RE-CONSTRUCTION OF SOUTHERN EMBANKMENT OF RED HILL AVENUE OVERCROSSSING BRIDGE IN CITY OF COSTA MESA, CALIFORNIA.**

In accordance with your request, Materials and Research (M&R) Branch has reviewed the Draft Geotechnical Design Report (GDR) for the above-referenced project in order to provide you with recommendations for pavement structural sections for the proposed improvements.

This report provides pavement design and materials recommendations in accordance with Topic 114 of Highway Design Manual (HDM 2010). There are other issues such as settlement/slope stability of embankment fills, groundwater elevations, etc. that will be addressed by the Draft GDR.

1.0 Introduction

Interstate 405 (I-405) is an interstate freeway that extends from Irvine to San Fernando, linking to Interstate 5 (I-5) at both ends. The District Program Advisor/Coordinator and their counterpart in Headquarters (HQ) have established that this project is needed and that it meets the qualifications for the Permanent Restoration Program (PRP).

2.0 Existing Facility

Red Hill Avenue OC was originally constructed in 1965 with three (3) bents (EA 07-031514), improved in early 1990s (EAs 12-0084U4 and 12-008604), rebuilt in 1999 with two (2) bents (EA 12-069514) and was reinforced with soil stabilization in 2007/09 (EA 12-0J1204). Red Hill Avenue OC (Bridge old# 55-439 and current # 55-959) is a reinforced concrete bridge supported by two (2) bents with two (2) columns each between the abutments. Figure 1 presents the project location.

Red Hill Avenue on the south side of I-405 was built on an initial fill and subsequently further elevated by the placement of additional fill and the erection of Mechanically Stabilized Embankment (MSE) walls. Soil nails were recently installed in an attempt to stabilize the sliding embankment.

3.0 Climatic Conditions

The climate in the project area is typical of coastal region in Southern California and classifies as Mediterranean because of characteristically warm, dry summers and mild winters, with moderate precipitation. The semi-arid Southern California coastal region receives most of its precipitation from moisture-laden air masses that originate in the northern Pacific Ocean, occurring predominantly during cool winter season, with an average annual rate of about 14 inches of rainfall per year (www.weather.com). Snowfall is rare in the project area, which may be considered frost-free. The project site considered to be within "South Coast" climate region based on Caltrans Pavement Climate Region Map (Figure 615.1 of HDM).

4.0 Proposed Project Improvement

The Draft Geotechnical Design Report (GDR) for the above-referenced project was prepared and submitted by Office of Geotechnical Design South-1, Branch C on August 22, 2014. Based on their findings and recommendations, the following improvements are proposed for the project:

- Construction of new pile supported retaining walls at the toe of existing slopes.
- Partial removal of existing clayey embankment fills while maintaining existing utilities in place.
- Complete removal of existing MSE walls,
- Construction of new embankment fill over the remaining existing embankment using non-plastic import borrows.
- Cold planing and replacement of 0.2' of the southern portion of existing pavement in areas where the existing pavement do not show any distress.
- Placement of new pavement section over the new embankment.

5.0 Terrain and Surface Drainage

The project site is located in an industrial area. The topography of the Red Hill Avenue alignment slopes down from north to south at about 6%. The elevation of roadway surface ranges from about 80 feet at the bridge to about 35 feet at Pullman Street.

6.0 Subsurface and Groundwater Conditions

Office of Geotechnical Design –South 1 conducted their field investigation at the site from January to March 2014. The information and recommendations provided here are based on the data presented in the GDR. The MSE wall structural backfill generally consisted of medium dense to dense silty sand and well graded sand. The embankment backfill behind the reinforced zone consisted of loose to medium dense sandy materials(SM/SW), high and low plastic clay (CH/CL), and silt (ML). Most sandy materials were encountered in the upper 7 feet. The embankment backfill under the MSE wall, which was placed during the original approach ramp construction in 1965, consisted of mostly soft to firm high plastic clay (CH) with various layers of low plastic clay (CL). The native soil underneath the ramp embankment backfill consisted of soft to medium stiff silt and clay and medium dense sand. For a more detailed

description of the encountered subsurface condition, please refer to the Draft GDR. Groundwater levels in the boreholes could not be measured during drilling because rotary wash method was used for drilling, however a piezometer was installed in Borehole R-14-105, which showed the groundwater to range in elevation from about 21 to 23.

7.0 Cut and Fill Construction

The proposed reconstruction of the embankment involves over excavation of clayey soils within the embankment and its slopes, leaving the central embankment fill in place to protect the existing utilities. Import materials consisting of structural backfill are required to replace the over-excavated clayey soils. ***All import fills material that is going to be placed within 4 feet of finished grade shall have an R-value of at least 40, a PI of less than 12, and an Expansion Index of less than 50***. It shall be non-corrosive to metals and concrete especially if any underground utilities or structures are planned to be constructed within the embankment.

8.0 Estimate of Settlement

Estimate of settlements for the roadway embankment fill and subsurface soils will be addressed by the GDR. ***All settlements have to be mitigated prior to placement of the pavement structural section.***

9.0 Seismic Considerations

The GDR provides recommendations for seismic design including liquefaction/seismic settlement and lateral spreading (as applicable).

10.0 Earthwork

10.1 General Earthwork Requirements

All earthworks shall conform to requirements of Section 19 of Caltrans 2010 edition of Standard Specifications, and project Special Provisions. Imported borrow may be required for construction of embankments. Source of imported borrow is unknown at this time. Therefore, earthwork factors cannot yet be determined. Compaction of soils shall be conducted in accordance with Section 19-5 of the Caltrans Standard Specifications. Fills placed against existing embankments shall be properly benched into the existing side slopes as described in Section 19-6.03 of the Caltrans Standard Specifications. Existing vegetation on slopes shall be removed and shall not be used as fill material. Any temporary sloping, sheeting and shoring shall be made the Contractor's responsibility. Appropriate measures shall be taken to prevent damage to adjacent structures and utilities. It should be noted that it is the responsibility of the Contractor to oversee the safety of the workers in the field during construction. The Contractor shall conform to all applicable occupational safety and health standards, rules, regulations, and orders established by the State of California.

10.2 Construction Observation and Testing

It is recommended that inspection and testing be performed during the following stages of construction:

- Grading operations, including over excavation and placement of compacted fill.
- Placement of Settlement Platforms.

- Removal of Existing MSE Wall.
- Removal of existing shoulders structural sections and Dicks.
- Preparation of pavement subgrade.
- Placement of Pavement sections.
- Excavations for utility trenches.
- When any unusual conditions are encountered.

11.0 Traffic Index

Since Red Hill Avenue is located in City of Costa Mesa (City), Caltrans does not have traffic data for it. The City had only ADT value for a different segment of Red Hill Avenue, which is about 17000 with a total truck percentage of 5%. A 20-year Traffic Index (TI) value of 10 is used for calculation of pavement sections.

12.0 Summary of Field Investigation and Existing Pavement Sections

Materials and Research Branch did not conduct any separate field investigation since Office of Geotechnical Design South-1; Branch C was planning to conduct their investigation at the same location. Soil samples from the upper 5 feet at two borehole locations R-14-103, and R-14-105 shown in Figure 2 were collected by M&R Branch and were sent to lab for testing. The existing pavement section consisted of about 8 inches of HMA over about 10 inches of Aggregate Base (AB) over aggregate subbase. Table 1 presents a summary of existing versus as-built pavement data, as well as recommended pavement sections.

13.0 Laboratory Testing

The following laboratory tests were performed on each sample collected from the boring:

- Sieve Analysis (CTM 202)
- Mechanical Analysis (CTM 203)
- Atterberg Limits (CTM 204)
- Sand Equivalent (CTM 216)
- R-Value (CTM 301)
- Expansion Index (UBC 29.2)
- Resistivity and pH (CTM 643)
- Sulfate Content (CTM 417)*
- Chloride Content (CTM 422)*

* These tests are done by HQ lab on samples having resistivity less than 1000 ohm-cm.

Table 2 presents summary of laboratory test results for each sample and its location (ramp).

13.1 Corrosion Testing

Caltrans Bridge Memo to Designers 3-1 (Caltrans, 2000), defines a corrosive environment as one where the soil has electrical resistivity of less than 1000 Ω-cm, sulfate content of greater than 2,000 ppm, chloride content of greater than 500 ppm, or pH of less than 5.5. Two Soil samples collected from borehole locations R-14-103 and R-14-105 were tested for corrosion. Results showed the existing

embankment fill soils to be non-corrosive to metals. However since the embankment is being reconstructed, it is recommended that the import soils used in construction are non-corrosive to metals and concrete.

14.0 Findings, Conclusions and Recommendations

The upper 15-17 feet of the embankment is planned to be removed and replaced with granular fill having an R-value of 40 in most areas with exception of the central part where the utility lines exist. The following pavement sections for the Red Hill Avenue pavements are designed based on a 20-year TI of 10 and an R-value of 40. We also recommend that **same structural section to be used for the shoulders:**

- **Recommended New Pavement Sections based on TI_{20}=*10, R=40***

Alternative 1: 0.2' RHMA-G over 0.95' HMA-Type A over 2.85' Class 3 AS

However to reduce the closure time and speed up the construction, Design Branch C wants to use the Full Depth HMA option and replace the AS with Class 2 AB, the following alternative can also be used:

Alternative 2: 0.2' RHMA-G over 0.95' HMA-Type A over 2.85' Class 2 AB (Full Depth Design over Aggregate Base)

15.0 Life Cycle Cost Analysis (LCCA)

LCCA is an analytical technique based on economic principals to evaluate long-term alternative investment options. LCCA studies the life cycle cost for various pavement strategies for new pavements or rehabilitation projects in order to evaluate the long-term alternative investment options for the pavement. LCCA accounts for relevant cost to the agency, owner, operator of the facility, and the roadway user, which will occur throughout the life of the pavement. After cost evaluation of various alternatives and based on discussions with HQ Pavement Program Branch, LCCA is not required for this project since the pavement work is short and the cost difference is not significant.

16.0 Materials Available

Imported borrow may be required for construction of embankments and replacement of unsuitable soils within the project limits. Local sources of construction materials were not investigated in this study. However, materials are available from several commercial suppliers throughout Orange, Los Angeles, Riverside and San Bernardino Counties. Furthermore, the Web Site of Department of Conservation on the Internet contains a current listing of mining operations eligible to sell materials to the State of California. The page can be accessed at: http://www.consrv.ca.gov/omr/index.htm

18.0 Limitations

This report is intended for the use of Caltrans for the proposed reconstruction of Red Hill Avenue in City Of Costa Mesa, California. This report is based on the project as described and the information obtained from the exploratory borings at the approximate locations indicated on the attached plans. The findings and recommendations contained in this report are based on the results of the field investigation, laboratory tests, and engineering analyses on soil samples obtained from the site. In addition, soils and subsurface conditions encountered in the exploratory borings are presumed to be representative of the project site. However, subsurface conditions and characteristics of soils between exploratory borings can vary. The findings reflect an interpretation of the direct evidence obtained. The recommendations

presented in this report are based on the assumption that an appropriate level of quality control and quality assurance (inspections and tests) will be provided during construction. District Materials and Research Branch should be notified of any pertinent changes in the project plans or if subsurface conditions are found to vary from those described herein. Such changes or variations may require a re-evaluation of the recommendations contained in this report.

The data, opinions, and recommendations contained in this report are applicable to the specific design element(s) and location(s), which is (are) the subject of this report. They have no applicability to any other design elements or to any other locations and any and all subsequent users accept any and all liability resulting from any use or reuse of the data, opinions, and recommendations without the prior written consent of the District Materials and Research Branch.

This report is prepared in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality under similar conditions. No other representation, expressed or implied, and no warranty or guarantee is included or intended.

19.0 Recommended Materials Specifications

The following requirements shall be included in the project specifications:

- Hot Mixed Asphalt shall be Type A-3/4 inch.
- Aggregate Base (AB) shall be Class 2 and Aggregate Subbase (AS) shall be Class 3 and follow requirements in sections 26 and 25 of Caltrans Standard Specifications respectively.
- Flexible pavement sections for the shoulder and ramps were designed using the Caltrans computer program "CALFP" (Caltrans, 2008), which was also based on the design method outlined in Chapter 600 of the Highway Design Manual (HDM).
- ***All import fills material that is going to be placed within 4 feet of finished grade shall have an R-value of at least 40, a PI of less than 12, and an Expansion Index of less than 50.*** It shall be non-corrosive to metals and concrete especially if any underground utilities or structures are planned to be constructed within the embankment. If the existing native soils within upper 4 feet of finished grade is determined not to meet the above requirements, the existing native soils shall be over-excavated and replaced with imported borrow to meet the imported fill recommendations herein. Borrow materials shall conform to Section 19-7 of Caltrans Standard Specifications (2010).
- Prior to the placement of pavement sections, the subgrade soils shall be compacted in accordance with Section 19-5.03 of Caltrans Standard Specification (2010).
- It is critical that construction and rehabilitation effort be coordinated such that a uniform superior product is delivered.
- All Standard Special Provisions (SSPs) to be included in the project shall be submitted the Materials and Research Branch for review and approval.
- Special attention is required to be given to the following sections of July 2010 Standard Specifications:
    - Section 19: Earthwork;
    - Section 25: Aggregate Subbases;
    - Section 26: Aggregate Bases;
    - Section 28: Concrete Bases;
    - Section 39 Hot Mixed Asphalt;
    - Section 61: Culvert and Drainage Pipe Joints;

- Section 64: Plastic Pipe;
- Section 65: Concrete Pipe;
- Section 66: Corrugated Metal Pipe;
- Section 68: Subsurface Drains;
- Section 92: Asphalts;
- Section 93: Liquid Asphalts;
- Section 94: Asphaltic Emulsion.

If you have any questions, please call Mehrdad Mahdavian at (949) 756-4927.

Prepared by:

Mehrdad Mahdavian, PE
Materials & Research Branch
Division of Project Delivery
RCE # 47566

Concurred by:

FOR :
Behdad Baseghi, PhD, PE, GE, PMP
Chief, Materials & Research Branch
Division of Project Delivery
RCE # 47051

Attachments: Table 1 & 2
Figure 1: Site Location Map
Figure 2: Boring Layout Sheet L-1
Summary of Laboratory Results

Cc: Tam Nguyen
David Lam
File

TABLES

TABLE 1-SUMMARY OF CORING VS AS-BUILT DATA

Route No.	Direction	Coring Location	Coring No.	Station	Offset (ft)	Lane No.	Existing Pavement (in)			As-Built Pavement (in)			Recommended Pavement Section for Mainline and Shoulder (ft)	
							HMA	AB	AS	HMA	AB	AS	HMA	AB
Red Hill Avenue	SB	Left Lane	R-14-103	95+86	9R	1	8	10	12+	7	9	14	1.15	2.85
	SB	Right Lane	R-14-105	93+62	25R	2	8	10	12+	7	9	14		

Notes:

1 Coring Data was obtained from core samples taken on March 11, 2014.
2 Mainline and its shoulder shall have the same structural section.
3 Acronyms:

HMA Hot Mix Asphalt Concrete, Type A - 3/4-inch Maximum, Coarse
AB Class 2 Aggregate Base (See Std. Spec. Section 26-1.02A)
AS Class 2 Aggregate Subbase (See Std. Spec. Section 25)

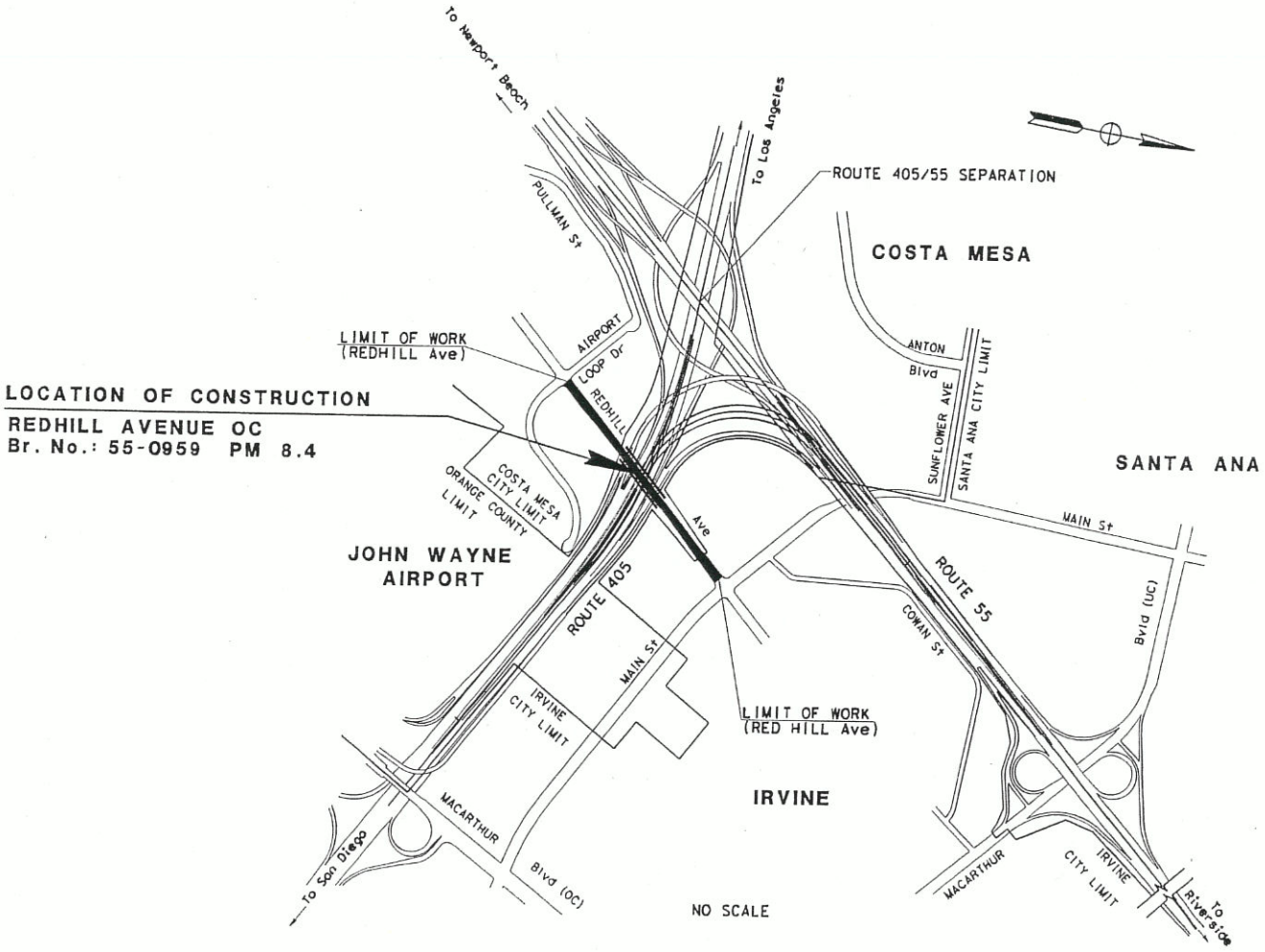
TABLE 2-SUMMARY OF LABORATORY TEST RESULTS

Route No.	Boring No.	Sample No.	Sample Depth (ft)	Percent Passing No. 200 Sieve	SE (%)	USCS	Expansion Index	Atterberg Limits (%)			R-Value	Corrosivity			
								LL	PL	PI		pH	Sulfate Content (ppm)	Chloride Content (ppm)	Resistivity (Ohm-cm)
Red Hill Avenue	R-14-103	1	2-5	28.2	18	SM	3	29	22	7	>40	9.88	1307	39	1365
	R-14-105	2	2-5	19.1	35	SM	1	N.P.	N.P.	N.P.	>40	10	682	32	1706

Notes: 1) NP Non Plastic

FIGURES

Figure 1: Site Location Map



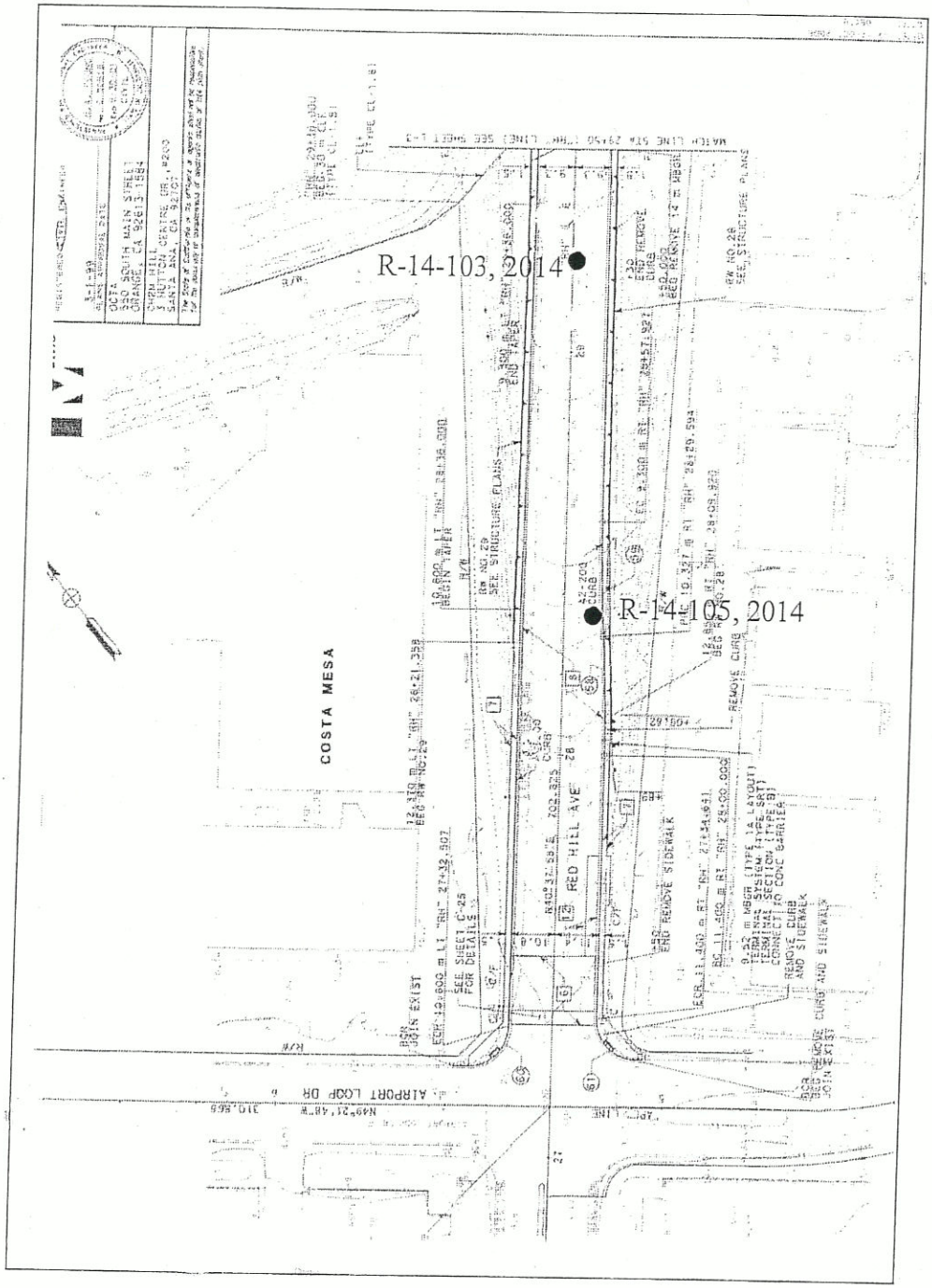


Figure 2: Boring Layout Sheet L-1

ORIGINAL LAB RESULTS

SRL SOIL & AGGREGATE TESTS

Sample of: Subsurface Soils, Depth 3-5' (1-1.5m)

Sampled from: Redhill Ave.

Material Source: Boring R-14-103

Owner / Mfr.: Caltrans

Date Sampled: 3/11/14

SRL Lab. Stamp

By _____ for

D. OZOWARA

SRL Materials Engineer

SOUTHERN REGIONAL LABORATORY
13970 Victoria Street
Fontana, CA 92336

Phone: (909) 350 9039

Fax: (909) 829 6294

R.E.: Mehrdad Mahdavian

Address: Caltrans - Distric 12

Phone No.: (949) 756-4927

Fax. No.: (949) 724-2519

1 2	0 N 5 4 0	1	4115B
	CONTRACT NO.	SAMPLE NO.	LAB. NO.

DATE RCV'D: 3/25/14

DATE OUT: 4/9/14

NUMBER OF CONTAINERS: 1 Bag

NORMAL ✓ PRIORITY DATE NEEDED:

By: FAX MAIL PHONE OTHER

GRADING ANALYSIS

Total Wt. 11664 g By: Date:

Wt. Ret.	Size (mm)	Acc. Wt. Ret.	% Ret.	% Pass	Comb. % Pass	SPEC.
	87.5					
	75					
	62.5					
	50					
	37.5					
0	25	0				
21	19	21	0		100	
370	12.5	391	3		97	
323	9.5	714	6		94	
743	4.75	1457	12		88	
10207		11664				

FINE GRADE / MECHANICAL ANALYSIS

Dry Wt. (g)						
			0	100	88	
	2.36 mm	47	9	91	80	
	1.18 mm	102	20	80	70	
515.0 g	600 µm	167	32	68	60	
	300 µm	239	46	54	48	
	150 µm	304	59	41	36	
	75 µm	348	68	32	28.2	

MECH. / HYDRO.		R	Corr.	C.R.	Mat In Sus	Comb % In Sus
1hr.	5M					
24hr.	1M					

SAND EQUIVALENT

MIN. SPEC.

Sand R2	2.2	2.2		Avg.
Clay R1	12.9	13.0		
S.E. Value	18	17		18

L.A.R.T.	Rev.	Wt.	Wt. Ret.	% Ret.	% Loss	% SPEC.
A B	100	5000g				
C D	500	5000g				

No. of spheres = Wt. of spheres =

DURABILITY INDEX

SPEC.

Dura-Coarse	Sed.Ht.=	
Dura-Fine	R2/R1 =	

R-VALUE BATCH

% Run	Size	Wt.
	25 mm	
100	19 mm	1200
97	12.5 mm	1164
94	9.5 mm	1128
88	4.75 mm	1056

R-VALUE

SPEC.

RESULT 65

SP. G. FINE (SSD)

(B) S.S. Dry	
(A) Ov. Dry	
ABS. %	
Wt. S+C+H2O	
Wt. S+C	
W=Wt. H2O	

$$Bulk = \frac{500}{500 - W} =$$

SP. GR. COARSE CT206/CT209, +4

(B) S.S. Dry	
(A) Ov. Dry	
ABS. %	
(C) Wt. S. in H2O	

$$App = \frac{A}{A - C} =$$

$$SSD = \frac{B}{B - C} =$$

$$OD = \frac{A}{B - C} =$$

% CRUSHED PARTICLES

SPEC.

%Ret.x(Wt.Cr./Tot.Wt.) = Prod.

			Wtd. Avg. % CP Ret. No.4 =
	% CP = P/R		

MOISTURE CONTENT

SPEC.

Gr. Wet	
Gr. Dry	
H2O	
Tare	
Net Dry	
% H2O	

PLASTICITY INDEX

L.L.	29
P.L.	22
P.I.	7

pH / RESISTIVITY

	Field	Lab.
Soil pH		9.88
H2O		8.04
Min. Resistivity		1365

Based on 18 gauge CMP.

Estimated life: 28 yrs.

CLEANNESS VALUE

NL	SED. HT.	RESULT

FILM STRIPPING	ORGANIC IMPURITIES
NM	Satisfactory
	Unsatisfactory

TEST(S) REQUESTED

			✓
■	Fine Grade	202	✓
■	Coarse Grade	202	✓
	Filler Material	202	
	Mech. Analysis	203	
■	Plasticity Index	204	✓
	% Crushed Particles	205	
	SpG. Coarse	206	
	SpG. Fine (SSD)	207	
	SpG. of Soils	209	
	L.A.R.T.	211	
	Unit Wt.	212	
	Organic Impurities	213	
	Soundness	214	
	Relative Compaction	216	
■	Sand Equivalent	217	✓
	Moisture Content	226	
	Cleaness Value	227	
	Durability Fine	229	
	Durability Coarse	229	
	Flat & Elongated	ASTM D 4791	
■	R-Value	301	✓
	Fine Agg Angularity	AASHTO T 304	
	Mortar Strength	515	
	pH (RC)	532	
	Resistivity (RC)	532	
■	pH (CMP)	643	✓
■	Resistivity (CMP)	643	✓
■	Expansion Index	UBC-29-2	✓
	Max. Dry Density/ Opt. Moist Content	ASTM-D1557	

SAMPLE TYPE

				✓
A.B.		PCC		
A.S.		Bk.Fill		
EMB.		MISC.		
O.G.		Sub-Grade		
A.C. Agg.		SOIL		✓

TL-101 S.I.C. NO.

Expansion Index

3.0

Very Low

Dry Density

105.20 pcf

Max. Dry Density (pcf)

Opt. Moist Content (%)

Laboratory Remarks:

Send samples to SAC for Chlorides and Sulfates.

SPECIFIC GRAVITY OF SOILS

Wt Oven Dry Soil (Wo)

Wt Pycnometer + H_2O (Wa)

Wt Pycnometer + H2O + Soil (Wb)

Wo / (Wo + Wa - Wb)

Wo

Wa

Wb

Spec. Grav.

CONTRACT NO. 12-0N540

LAB. NO. 4115B

SRL SOIL & AGGREGATE TESTS

Sample of: Subsurface Soils, Depth 3-5' (1-1.5m)

Sampled from: Redhill Ave.

Material Source: Boring R-14-105

Owner / Mfr.: Caltrans

Date Sampled: 3/11/14

SRL Lab. Stamp

By _____ for

D. OZOWARA

SRL Materials Engineer

1 2 0 N 5 4 0														4116B
CONTRACT NO.														LAB. NO.

SAMPLE NO.

DATE RCV'D: 3/25/14

DATE OUT: 4/9/14

NUMBER OF CONTAINERS: 1 Bag

By: FAX / MAIL / PHONE / OTHER

NORMAL ✓ PRIORITY

DATE NEEDED:

R.E.: Mehrdad Mahdavian

Address: Caltrans - Distric 12

Phone No.: (949) 756-4927

Fax. No.: (949) 724-2519

SOUTHERN REGIONAL LABORATORY
13970 Victoria Street
Fontana, CA 92336

Phone: (909) 350 9039

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GRADING ANALYSIS

Total Wt. 12901 g | By: | Date:

Wt. Ret.	Size (mm)	Acc. Wt. Ret.	% Ret.	% Pass	Comb. % Pass	SPEC.
	87.5					
	75					
0	62.5	0	0		100	
150	50	150	1		99	
0	37.5	150	1		99	
79	25	229	2		98	
54	19	283	2		98	
481	12.5	764	6		94	
406	9.5	1170	9		91	
1038	4.75	2208	17		83	
10693		12901				

FINE GRADE / MECHANICAL ANALYSIS

Dry Wt. (g)						
			0	100	83	
	2.36 mm	75	15	85	71	
	1.18 mm	151	30	70	58	
509.0 g	600 µm	221	43	57	47	
	300 µm	291	57	43	36	
	150 µm	351	69	31	26	
	75 µm	391	77	23	19.1	

MECH. / HYDRO.		R	Corr.	C.R.	Mat In Sus	Comb % In Sus
1hr.	5M					
24hr.	1M					

SAND EQUIVALENT

				MIN. SPEC.
Sand R2	2.6	2.6	Avg.	
Clay R1	7.8	7.6		
S.E. Value	34	35	35	

L.A.R.T.	Rev.	Wt.	Wt. Ret.	% Ret.	% Loss	% SPEC.
A B	100	5000g				
C D	500	5000g				

No. of spheres = Wt. of spheres =

DURABILITY INDEX

			SPEC.
Dura-Coarse	Sed.Ht.=		
Dura-Fine	R2/R1 =		

R-VALUE BATCH

% Run	Size	Wt.
	25 mm	
100	19 mm	1200
96	12.5 mm	1152
93	9.5 mm	1116
85	4.75 mm	1020

% CRUSHED PARTICLES — SPEC.

%Ret.x(Wt.Cr./Tot.Wt.) = Prod.

Wtd. Avg. % CP Ret. No.4 =

% CP = P/R

R-VALUE — SPEC.

RESULT 80

SP. G. FINE (SSD)

(B) S.S. Dry	
(A) Ov. Dry	
ABS. %	
Wt. S+C+H2O	
Wt. S+C	
W=Wt. H2O	
Bulk = 500 / (500 - W) =	

SP. GR. COARSE CT206/CT209, +4

(B) S.S. Dry	
(A) Ov. Dry	
ABS. %	
(C) Wt. S. in H2O	
App = A / (A - C) =	
SSD = B / (B - C) =	
OD = A / (B - C) =	

MOISTURE CONTENT — SPEC.

Gr. Wet	
Gr. Dry	
H2O	
Tare	
Net Dry	
% H2O	

PLASTICITY INDEX

L.L. N.P.

P.L. N.P.

P.I. N.P.

pH / RESISTIVITY

	Field	Lab.
Soil pH		10.00
H2O		8.04
Min. Resistivity		1706

Based on 18 gauge CMP.

Estimated life: 31 yrs.

CLEANNESS VALUE

NL	SED. HT.	RESULT

FILM STRIPPING

NM

ORGANIC IMPURITIES

Satisfactory

Unsatisfactory

TEST(S) REQUESTED			✓
■	Fine Grade	202	✓
■	Coarse Grade	202	✓
	Filler Material	202	
	Mech. Analysis	203	
■	Plasticity Index	204	✓
	% Crushed Particles	205	
	SpG. Coarse	206	
	SpG. Fine (SSD)	207	
	SpG. of Soils	209	
	L.A.R.T.	211	
	Unit Wt.	212	
	Organic Impurities	213	
	Soundness	214	
	Relative Compaction	216	
■	Sand Equivalent	217	✓
	Moisture Content	226	
	Cleaness Value	227	
	Durability Fine	229	
	Durability Coarse	229	
	Flat & Elongated	ASTM D 4791	
■	R-Value	301	✓
	Fine Agg Angularity	AASHTO T 304	
	Mortar Strength	515	
	pH (RC)	532	
	Resistivity (RC)	532	
■	pH (CMP)	643	✓
■	Resistivity (CMP)	643	✓
■	Expansion Index	UBC-29-2	✓
	Max. Dry Density/ Opt. Moist Content	ASTM-D1557	

SAMPLE TYPE			
A.B.		PCC	
A.S.		Bk.Fill	
EMB.		MISC.	
O.G.		Sub-Grade	
A.C. Agg.		SOIL	✓

TL-101 S.I.C. NO.

Expansion Index
1.0
Very Low

Dry Density
106.70 pcf

Max. Dry Density (pcf)	
Opt. Moist Content (%)	

Laboratory Remarks:
Send samples to SAC for Chlorides and Sulfates.

SPECIFIC GRAVITY OF SOILS

Wt Oven Dry Soil (Wo)

Wt Pycnometer + H_2O (Wa)

Wt Pycnometer + H2O + Soil (Wb)

Wo / (Wo + Wa - Wb)

Wo

Wa

Wb

Spec. Grav.

CONTRACT NO. 12-0N540

LAB. NO. 4116B

CORROSION ANALYSIS RESULTS

Results sent to: MEHRDAD MAHDAVIAN

Division of Engineering Services
Materials Engineering and Testing Services
Corrosion and Structural Concrete Field Investigation Branch

CORROSION TEST SUMMARY REPORT - SOIL

Report Date: 4/28/2014
Reported by Michael Mifkovic

EFIS: **1214000057**

Dist/Co/Rte/PM **12 / ORA /405/ / 8.4 PM**

CORROSION LAB #	TL101 #	BORE #	DEPTH (FT) START	DEPTH (FT) END	MINIMUM RESISTIVITY[1] (ohm-cm)	pH[1]	CHLORIDE CONTENT[2] (ppm)	SULFATE CONTENT[3] (ppm)	IS SAMPLE CORROSIVE?
SOIL SAMPLE FROM:									
CR20140128	**C080048**	R-14-103	0	5	1095	10	39	1307	NO
CR20140129	**C080049**	R-14-105	0	5	1706	10	32.5	681.9	NO

This site is not corrosive to foundation elements (see note below).

Note: For Structural Elements, the Department considers a site corrosive if one or more of the following conditions exist: pH is 5.5 or less, chloride concentration is 500 ppm or greater, sulfate concentration is 2000 ppm or greater. Resistivity is not considered for Structural Elements. MSE backfill shall conform to the requirements of section 47-2.02C Structure Backfill in the 2010 Standard Specifications.

[1]CT 643, [2]CT 422, [3]CT 417

5/1/2014